

PREMIER REFERENCE SOURCE

INFORMATION COMMUNICATION TECHNOLOGIES

CONCEPTS, METHODOLOGIES,
TOOLS AND APPLICATIONS



MEHDI KHOSROWI-POUR

VOLUME I

VOLUME I

VOLUME II

VOLUME III

VOLUME IV

VOLUME V

VOLUME VI

Reference
SERIALS

Reference
SERIALS

Reference
SERIALS

Reference
SERIALS

Reference
SERIALS

Reference
SERIALS

Information Communication Technologies: Concepts, Methodologies, Tools, and Applications

Craig Van Slyke
University of Central Florida, USA

Volume I



INFORMATION SCIENCE REFERENCE
Hershey • New York

Acquisitions Editor: Kristin Klinger
Development Editor: Kristin Roth
Senior Managing Editor: Jennifer Neidig
Managing Editor: Jamie Snavelly
Typesetter: Michael Brehm, Jeff Ash, Carole Coulson, Elizabeth Duke, Sara Reed, Sean Woznicki
Cover Design: Lisa Tosheff
Printed at: Yurchak Printing Inc.

Published in the United States of America by
Information Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue, Suite 200
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: <http://www.igi-global.com/reference>

and in the United Kingdom by
Information Science Reference (an imprint of IGI Global)
3 Henrietta Street
Covent Garden
London WC2E 8LU
Tel: 44 20 7240 0856
Fax: 44 20 7379 0609
Web site: <http://www.eurospanbookstore.com>

Copyright © 2008 by IGI Global. All rights reserved. No part of this publication may be reproduced, stored or distributed in any form or by any means, electronic or mechanical, including photocopying, without written permission from the publisher.

Product or company names used in this set are for identification purposes only. Inclusion of the names of the products or companies does not indicate a claim of ownership by IGI Global of the trademark or registered trademark.

Library of Congress Cataloging-in-Publication Data

Information communication technologies : concepts, methodologies, tools and applications / [compiled] by Craig Van Slyke.
p. cm.

Summary: "This collection meets these research challenges; compiling breaking research in the pivotal areas of social adaptation to information technology. It covers ad-hoc networks, collaborative environments, e-governance, and urban information systems, case studies, empirical analysis, and conceptual models. Over 300 chapters contributed by experts, this six-volume compendium will provide any library's collection with the definitive reference on ICTs"--Provided by publisher.

ISBN 978-1-59904-949-6 (hardcover) -- ISBN 978-1-59904-950-2 (e-book)

1. Information technology--Social aspects. 2. Information technology--Economic aspects. 3. Information technology--Political aspects. 4. Digital communications--Social aspects. 5. Information society. I. Van Slyke, Craig.

HM851.I5315 2008
303.48'33--dc22

2007052998

British Cataloguing in Publication Data

A Cataloguing in Publication record for this book is available from the British Library.

If a library purchased a print copy of this publication, please go to <http://www.igi-global.com/agreement> for information on activating the library's complimentary electronic access to this publication.

Editor-in-Chief

Mehdi Khosrow-Pour, DBA
Editor-in-Chief
Contemporary Research in Information Science and Technology, Book Series

Associate Editors

Steve Clarke
University of Hull, UK

Murray E. Jennex
San Diego State University, USA

Annie Becker
Florida Institute of Technology USA

Ari-Veikko Anttiroiko
University of Tampere, Finland

Editorial Advisory Board

Sherif Kamel
American University in Cairo, Egypt

In Lee
Western Illinois University, USA

Jerzy Kisielnicki
Warsaw University, Poland

Keng Siau
University of Nebraska-Lincoln, USA

Amar Gupta
Arizona University, USA

Craig van Slyke
University of Central Florida, USA

John Wang
Montclair State University, USA

Vishanth Weerakkody
Brunel University, UK

**Additional Research Collections found in the
“Contemporary Research in Information Science and Technology”
Book Series**

Data Mining and Warehousing: Concepts, Methodologies, Tools, and Applications
John Wang, Montclair University, USA • 6-volume set • ISBN 978-1-59904-951-9

Electronic Commerce: Concepts, Methodologies, Tools, and Applications
S. Ann Becker, Florida Institute of Technology, USA • 4-volume set • ISBN 978-1-59904-943-4

Electronic Government: Concepts, Methodologies, Tools, and Applications
Ari-Veikko Anttiroiko, University of Tampere, Finland • 6-volume set • ISBN 978-1-59904-947-2

End-User Computing: Concepts, Methodologies, Tools, and Applications
Steve Clarke, University of Hull, UK • 4-volume set • ISBN 978-1-59904-945-8

Global Information Technologies: Concepts, Methodologies, Tools, and Applications
Felix Tan, Auckland University of Technology, New Zealand • 6-volume set • ISBN 978-1-59904-939-7

Information Communication Technologies: Concepts, Methodologies, Tools, and Applications
Craig Van Slyke, University of Central Florida, USA • 6-volume set • ISBN 978-1-59904-949-6

Information Security and Ethics: Concepts, Methodologies, Tools, and Applications
Hamid Nemati, The University of North Carolina at Greensboro, USA • 6-volume set • ISBN 978-1-59904-937-3

Intelligent Information Technologies: Concepts, Methodologies, Tools, and Applications
Vijayan Sugumar, Oakland University, USA • 4-volume set • ISBN 978-1-59904-941-0

Knowledge Management: Concepts, Methodologies, Tools, and Applications
Murray E. Jennex, San Diego State University, USA • 6-volume set • ISBN 978-1-59904-933-5

Multimedia Technologies: Concepts, Methodologies, Tools, and Applications
Syad Mahbubur Rahman, Minnesota State University, USA • 3-volume set • ISBN 978-1-59904-953-3

Online and Distance Learning: Concepts, Methodologies, Tools, and Applications
Lawrence Tomei, Robert Morris University, USA • 6-volume set • ISBN 978-1-59904-935-9

Virtual Technologies: Concepts, Methodologies, Tools, and Applications
Jerzy Kisielnicki, Warsaw University, Poland • 3-volume set • ISBN 978-1-59904-955-7

Free institution-wide online access with the purchase of a print collection!



INFORMATION SCIENCE REFERENCE
Hershey • New York

Order online at www.igi-global.com or call 717-533-8845 ext.10
Mon–Fri 8:30am–5:00 pm (est) or fax 24 hours a day 717-533-8661

List of Contributors

| | |
|---|------------|
| Achterbergh, Jan / <i>University of Nijmegen, The Netherlands</i> | 617, 1445 |
| Adam, Alison / <i>University of Salford, UK</i> | 3460 |
| Adams, James / <i>Mississippi State University, USA</i> | 1143, 1190 |
| Agterberg, Bas / <i>Utrecht University, The Netherlands</i> | 1820 |
| Ajiferuke, Isola / <i>University of Western Ontario, Canada</i> | 1954 |
| Albert, Sylvie / <i>Laurentian University, Canada</i> | 323 |
| Alexander, Ian F. / <i>Scenario Plus, UK</i> | 679 |
| Altunbas, Derya / <i>Canakkale Onsekiz Mart University, Turkey</i> | 2771 |
| Amin, Narima / <i>Independent Consultant, USA</i> | 3658 |
| Amirian, Susan / <i>East Stroudsburg University, USA</i> | 1581 |
| Andrade, Stephen C. / <i>Johnson & Wales University, USA</i> | 1867 |
| Angeli, Charoula / <i>University of Cyprus, Cyprus</i> | 1590 |
| Antonacopoulou, Elena P. / <i>University of Manchester, UK</i> | 1066 |
| Arlt, Wolfgang George / <i>University of Applied Sciences, Germany</i> | 2877 |
| Arthur-Gray, Heather / <i>Griffith University, Australia</i> | 1995 |
| Aslam, Mohamed / <i>University of Malaysia, Malaysia</i> | 2659 |
| Averweg, Udo Richard / <i>eThekwini Municipality and</i> <i>University of KwaZulu-Natal, South Africa</i> | 2817 |
| Azarov, Serge S. / <i>Lucky Net Ltd., Ukraine</i> | 870 |
| Bala, Poline / <i>Universiti Malaysia Sarawak, Malaysia</i> | 826 |
| Balram, Shivanand / <i>Simon Fraser University, Canada</i> | 1254 |
| Baptista Nunes, J. Miguel / <i>University of Sheffield, UK</i> | 2297, 2311 |
| Baskin, Colin / <i>James Cook University, Australia</i> | 2084 |
| Bax, Samantha / <i>Murdoch University, Australia</i> | 2708 |
| Beardon, Hannah / <i>ActionAid, UK</i> | 2450 |
| Becerra-Fernandez, Irma / <i>Florida International University, USA</i> | 36 |
| Beedle, Jon / <i>University of Southern Mississippi, USA</i> | 1216 |
| Bellows, Ben / <i>University of California at Berkeley, USA</i> | 1002 |
| Berge, Zane L. / <i>UMBC, USA</i> | 1225 |
| Bhandari, Aman / <i>University of California at Berkeley, USA</i> | 1002 |
| Bhattacharjee, Anol / <i>University of South Florida, USA</i> | 2845 |
| Bhattarakosol, Pattarasinee / <i>Chulalongkorn University, Thailand</i> | 2637 |
| Birbaumer, Andrea / <i>Vienna University of Technology, Austria</i> | 472 |
| Björn, Michael / <i>Ericsson Consumer & Enterprise Lab, Sweden</i> | 1395 |

| | |
|--|-----------------------|
| Blind, Knut / <i>Fraunhofer Institute for Systems and Innovation Research, Germany & Berlin University of Technology, Germany</i> | 383 |
| Borbora, Saundarjya / <i>IIT Guwahati, India</i> | 66, 160 |
| Borge, Rosa / <i>Open University of Catalonia, Spain</i> | 582 |
| Bradley, Gunilla / <i>Royal Institute of Technology, Sweden</i> | 3273 |
| Braimah, Imoro / <i>Kwame Nkrumah University of Science and Technology, Ghana</i> | 1976 |
| Braun, Patrice / <i>University of Ballarat, Australia</i> | 2968, 3112 |
| Brock, Jürgen Kai-Uwe / <i>University of Strathclyde, UK</i> | 3158 |
| Bulchand, Jacques / <i>University of Las Palmas de Gran Canaria, Spain</i> | 1561 |
| Burmeister, Jay / <i>University of Queensland, Australia</i> | 1468 |
| Burtseva, Liudmila / <i>Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova</i> | 74, 2531 |
| Bygstad, Bendik / <i>Norwegian School of Information Technology, Norway</i> | 3057 |
| C. R., Ranjini / <i>Lancaster University, UK</i> | 2209 |
| Carayannis, Elias / <i>George Washington University, USA</i> | 304 |
| Carson, Dean / <i>Southern Cross University, Australia</i> | 911, 1889 |
| Cartelli, Antonio / <i>University of Cassino, Italy</i> | 456, 2350, 3338, 3368 |
| Cecchini, Simone / <i>United Nations Economic Commission for Latin America and the Caribbean (ECLAC), Chile</i> | 2566 |
| Changchit, Chuleeporn / <i>Texas A&M University, USA</i> | 1639 |
| Chen, Charlie C. / <i>Appalachian State University, USA</i> | 2398 |
| Chen, Sherry Y. / <i>Brunel University, UK</i> | 2143, 2728 |
| Chikowore-Kabwato, Shirley / <i>International Association of Physicians in AIDS Care, South Africa</i> | 1954 |
| Choi, Young B. / <i>James Madison University, USA</i> | 3259 |
| Cicciarelli, MarySue / <i>Duquesne University, USA</i> | 430 |
| Clarke, John A. / <i>Queensland University of Technology, Australia</i> | 405 |
| Clarke, Malcolm / <i>Brunel University, UK</i> | 1036 |
| Clayton, Kaylene / <i>Griffith University, Australia</i> | 3384 |
| Cojocar, Svetlana / <i>Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova</i> | 74, 2531 |
| Cole, Michele T. / <i>Robert Morris University, USA</i> | 3391 |
| Connolly, Patrick E. / <i>Purdue University, USA</i> | 2168 |
| Cooper, Malcolm / <i>Ritsumeikan Asian Pacific University, Japan</i> | 1896 |
| Coppock, Karen / <i>Stanford University, USA</i> | 3603 |
| Cosemans, Annalene / <i>Audiovisual Technologies, Informatics and Telecommunications, Belgium</i> | 1611 |
| Craddock, Patrick / <i>Multimedia and Distance Education, New Zealand</i> | 1506 |
| Culkin, Nigel / <i>University of Hertfordshire, UK</i> | 1832 |
| Cutshall, Robert / <i>Texas A&M University, USA</i> | 1639 |
| Dagdilelis, Vassilios / <i>University of Macedonia in Thessaloniki, Greece</i> | 2118 |
| Danenburg, James / <i>Western Michigan University, USA</i> | 1244 |
| Dark, Melissa / <i>Purdue University, USA</i> | 1179 |
| Dasgupta, Subhashish / <i>George Washington University, USA</i> | 304 |
| Day, Peter / <i>University of Brighton, UK & Central Queensland University, Australia</i> | 2282 |
| de Vries, Imar / <i>Utrecht University, The Netherlands</i> | 3475 |

| | |
|--|------------------|
| De Weaver, Lynne H. / <i>Southern Cross University, Australia</i> | 778, 183 |
| Demediuk, Peter / <i>Victoria University, Australia</i> | 3173 |
| Denison, Tom / <i>Monash University, Australia</i> | 2514 |
| Denoual, Etienne / <i>Spoken Language Communication Research Labs, Japan</i> | 751 |
| Diamond, Richard / <i>University of East Anglia, UK</i> | 3072 |
| DiMarco, John / <i>St. John's University, UK</i> | 1655 |
| Ding, Gang / <i>East China Normal University, China</i> | 1190 |
| Dixon, Michael / <i>Murdoch University, Australia</i> | 2718 |
| Docherty, Michael / <i>University of Queensland, Australia</i> | 1468 |
| Döös, Marianne / <i>VINNOVA, Sweden</i> | 2387 |
| Dragicevic, Suzana / <i>Simon Fraser University, Canada</i> | 1254 |
| Du, Jianxia / <i>Mississippi State University, USA</i> | 1143, 1153, 1190 |
| Dumas, J. Ann / <i>The Pennsylvania State University, USA</i> | 480, 496, 504 |
| Duncan, Peggy / <i>Health and Social Research Consultant, New Zealand</i> | 1506 |
| Dunham, Marlene D. / <i>Howard Everson & Associates, USA</i> | 2193 |
| Dunn, Leone / <i>University of Wollongong, Australia</i> | 2652 |
| Dutta, Dilip / <i>University of Sydney, Australia</i> | 115 |
| Dutta, Mrinal Kanti / <i>IIT Guwahati, India</i> | 66 |
| Dyson, Laurel Evelyn / <i>University of Technology, Australia</i> | 3190 |
| Eades, Jerry / <i>Ritsumeikan Asian Pacific University, Japan</i> | 1360 |
| Edmundson, Andrea L. / <i>eWorld Learning, USA</i> | 2252 |
| El Louadi, Mohamed / <i>University of Tunis, Tunisia</i> | 151 |
| Ellis, Allan H. / <i>Southern Cross University, Australia</i> | 778 |
| Elwood, Susan / <i>Texas A&M University, USA</i> | 1639 |
| Emurian, Henry H. / <i>University of Maryland, Baltimore County (UMBC), USA</i> | 1712 |
| Erwin, Geoff / <i>Cape Peninsula University of Technology, South Africa</i> | 2998 |
| Etter, Stephanie J. / <i>Mount Aloysius College, USA</i> | 3246 |
| Fähræus, Eva / <i>Stockholm University and Royal Institute of Technology, Sweden</i> | 2387 |
| Fairbank, James F. / <i>Penn State Erie, USA</i> | 3083 |
| Falch, Morten / <i>Technical University of Denmark, Denmark</i> | 882 |
| Fanning, Elizabeth / <i>The University of Virginia, USA</i> | 1647 |
| Ferguson, Maggie / <i>University of Central Lancashire, UK</i> | 1616 |
| Ferrier, Elizabeth / <i>University of Queensland, Australia</i> | 1379 |
| Finger, Glenn / <i>Griffith University, Australia</i> | 1047 |
| Finger, Paul / <i>Griffith University, Australia</i> | 1047 |
| Flanigan, Eleanor J. / <i>Montclair State University, USA</i> | 1581 |
| Fomin, Vladislav / <i>Delft University of Technology, The Netherlands</i> | 534 |
| Ford, Nigel / <i>University of Sheffield, UK</i> | 2297 |
| Foth, Marcus / <i>Queensland University of Technology, Australia</i> | 464 |
| Fraser, Simon / <i>The University of the West Indies, Trinidad and Tabago</i> | 1986 |
| Frempong, Godfred / <i>Science and Technology Policy Research Institute, Ghana</i> | 1976 |
| Gadish, David / <i>California State University - Los Angeles, USA</i> | 1688 |
| Gaindric, Constantin / <i>Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova</i> | 74, 2531 |
| Gallagher, Kevin / <i>Northern Kentucky University, USA</i> | 1083 |
| Garkavenko, Vladimir / <i>Waiariki Institute of Technology, New Zealand</i> | 2898 |

| | |
|---|------------------|
| George, Susan E. / <i>University of South Australia, Australia</i> | 3759 |
| Geri, Nitza / <i>The Open University of Israel, Israel</i> | 3566 |
| Gigler, Björn-Sören / <i>London School of Economics and Political Science, UK</i> | 2464 |
| Giner Minana, Victor / <i>UNESCO ICT4ID Programme, Spain</i> | 1951 |
| Giorgi, Chiara / <i>Università della Svizzera Italiana (USI), Switzerland</i> | 174 |
| Graham, John / <i>Robert Morris University, USA</i> | 1234 |
| Graham, Phil / <i>University of Queensland, Australia</i> | 1379 |
| Grimshaw, David J. / <i>Practical Action, UK</i> | 513 |
| Gunawardana, Kennedy D. / <i>University of Sri Jayewardenepura, Sri Lanka</i> | 2032 |
| Gururajan, Raj / <i>The University of Southern Queensland, Australia</i> | 2069 |
| Halpin, Edward / <i>School of Applied Global Ethics & the Praxis Centre, Leeds Metropolitan University, UK</i> | 2682 |
| Hansen, Raymond A. / <i>Purdue University, USA</i> | 1122 |
| Harris, Albert / <i>Appalachian State University, USA</i> | 2398 |
| Harris, Roger W. / <i>City University of Hong Kong, Hong Kong</i> | 826 |
| Hartsell, Taralynn / <i>The University of Southern Mississippi, USA</i> | 3529, 3540 |
| Havard, Byron / <i>The University of Southern Mississippi, USA</i> | 1143, 1153, 1190 |
| Hellsten, Sirkku Kristina / <i>University of Birmingham, UK</i> | 3299 |
| Henten, Anders / <i>Technical University of Denmark, Denmark</i> | 882 |
| Her, One-Soon / <i>National Chengchi University, Taiwan</i> | 3428 |
| Herman, Clem / <i>The Open University, UK</i> | 904 |
| Hohmann, Claus / <i>Bergische Universitaet Wuppertal, Germany</i> | 3417 |
| Hsu, Jeffrey / <i>Fairleigh Dickinson University, USA</i> | 1666 |
| Hubona, Geoffrey S. / <i>Georgia State University, USA</i> | 3578 |
| Humphreys, Sal / <i>Queensland University of Technology, Australia</i> | 2357 |
| Hynes, Briga / <i>University of Limerick, Ireland</i> | 3207 |
| Hynes, Deirdre / <i>Manchester Metropolitan University, UK</i> | 2341 |
| Ibbetson, Adrian / <i>University of Central Lancashire, UK</i> | 1616 |
| Ibrahim, Mahad / <i>University of California at Berkeley, USA</i> | 1002 |
| Iivari, Netta / <i>University of Oulu, Finland</i> | 2741 |
| Isaacs, Shafika / <i>SchoolNet Africa, South Africa</i> | 1284 |
| Isomäki, Hannakaisa / <i>University of Lapland, Finland</i> | 734 |
| Jakkilinki, Roopa / <i>Victoria University, Australia</i> | 920 |
| Jones, Ashley / <i>University of Queensland, Australia</i> | 1379 |
| Jones, Elizabeth / <i>Griffith University, Australia</i> | 3171 |
| Juntunen, Arla / <i>Helsinki School of Economics, Finland</i> | 3634 |
| Kakaletris, George / <i>University of Athens, Greece</i> | 951 |
| Karakurt Tosun, Elif / <i>Uludag University, Turkey</i> | 2771 |
| Kashmeery, Amin / <i>De Montfort University, UK</i> | 2232 |
| Katsianis, Dimitris / <i>University of Athens, Greece</i> | 951 |
| Keen, Chris / <i>University of Tasmania, Australia</i> | 54 |
| Keeris, Eva / <i>Utrecht University, The Netherlands</i> | 638 |
| Keil, Thomas / <i>Helsinki University of Technology, Finland</i> | 534 |
| Kennedy, Tracy L. M. / <i>University of Toronto, Canada</i> | 3229 |
| Keogh, Claire / <i>University of Salford, UK</i> | 3150 |
| Keso, Heidi / <i>Life Works Consulting Ltd. & University of Tampere, Finland</i> | 3142 |

| | |
|---|-----------------|
| Kettunen, Juha / <i>Turku Polytechnic, Finland</i> | 2104 |
| King, Kathleen P. / <i>Fordham University, USA</i> | 1102, 2194 |
| Klopper, Rembrandt / <i>University of Zululand, South Africa</i> | 3322 |
| Koivunen, Emma-Reetta / <i>University of Helsinki, Finland</i> | 2341 |
| Kovačić, Zlatko J. / <i>The Open Polytechnic of New Zealand, New Zealand</i> | 413 |
| Kruck, S. E. / <i>James Madison University, USA</i> | 3730 |
| Kuhndt, Michael / <i>Wuppertal Institute, Germany</i> | 3500 |
| Lajbcyier, Paul / <i>Monash University, Australia</i> | 1202 |
| Lannon, John / <i>AIB Centre for Information and Knowledge Management, Kemmy Business School, Ireland & the Praxis Centre, Leeds Metropolitan University, UK</i> | 268 |
| Latchem, Colin R. / <i>Open Learning Consultant, Australia</i> | 1554 |
| Lauría, Eitel J. M. / <i>Marist College, USA</i> | 2417 |
| LeBrasseur, Rolland / <i>Laurentian University, Canada</i> | 323 |
| Lee, David / <i>Goldsmiths College, University of London, UK</i> | 3807 |
| Leggett, Susan / <i>Queensland University of Technology, Australia</i> | 2434 |
| Lehtimäki, Hanna / <i>Life Works Consulting Ltd. & University of Tampere, Finland</i> | 3142 |
| Lekoko, Rebecca / <i>University of Botswana, Botswana</i> | 2617 |
| Leppanen, Jan-Eerik / <i>International Institute for Asian Studies (IIAS), The Netherlands</i> | 3681 |
| Lewis, Marilyn / <i>The University of the West Indies, Trinidad and Tobago</i> | 2008 |
| Li, Heng / <i>University of Toronto, Canada</i> | 1143 |
| Lie, Merete / <i>Norwegian University of Science and Technology (NTNU), Norway</i> | 3522 |
| Lin, Hong / <i>University of Houston-Downtown, USA</i> | 1130 |
| Lind, Mary R. / <i>North Carolina A&T State University, USA</i> | 3489 |
| Liu, Leping / <i>University of Nevada, USA</i> | 2154 |
| Lowe, Lucky / <i>Practical Action, USA</i> | 513 |
| Lubbe, Sam / <i>University of KwaZulu-Natal, South Africa</i> | 862, 3007, 3119 |
| Lyytinen, Kalle / <i>Case Western Reserve University, USA</i> | 534 |
| MacNeil, Neil / <i>Ritsumeikan Asian Pacific University, Japan</i> | 1896 |
| Madden, Andrew D. / <i>University of Sheffield, UK</i> | 2297, 2311 |
| Magariu, Galina / <i>Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova</i> | 74, 2531 |
| Maherry-Lubbe, Solitaire / <i>Dolphin Coast Enterprises, South Africa</i> | 2173 |
| Mariga, Julie R. / <i>Purdue University, USA</i> | 1122 |
| Márquez-Ramos, Laura / <i>Universitat Jaume I, Spain</i> | 284 |
| Martínez-Zarzoso, Inmaculada / <i>Universitat Jaume I, Spain</i> | 284 |
| Maru, Ajit / <i>Agricultural Informatics Consultant, India</i> | 1554 |
| Mason, Robert M. / <i>University of Washington, USA</i> | 11083 |
| Mason, Hilary / <i>Johnson & Wales University, USA</i> | 1867 |
| McCarthy, John / <i>University College Cork, Ireland</i> | 712 |
| McGill, Tanya / <i>Murdoch University, Australia</i> | 2708, 2718 |
| McGlasson, Maret / <i>Griffith University, Australia</i> | 1047 |
| McGrath, G. Michael / <i>Victoria University, Australia</i> | 2976 |
| McLean, Pamela / <i>Cawdnet (CAWD) and Dada McLean Ltd., UK</i> | 2003 |
| McMeel, Dermott / <i>University of Edinburgh, Scotland</i> | 1752 |
| McPherson, M.A. / <i>University of Leeds, UK</i> | 2297, 2311 |
| Medina, Ángela-Jo / <i>ConcienciAcción.org, USA</i> | 3784 |

| | |
|---|------------|
| Meekison, Lisa / <i>Anthropologist and Freelance Consultant, Canada</i> | 712 |
| Melia, Frank J. / <i>Fordham University, USA</i> | 2193 |
| Melkonyan, Gevorg / <i>Internet Users' Society of Shirak, Armenia</i> | 877 |
| Merhout, Jeffrey W. / <i>Miami University, USA</i> | 3246 |
| Merten, Patrick S. / <i>International Institute of Management in Technology, Switzerland</i> | 254 |
| Mezgár, István / <i>Budapest University of Technology, Hungary</i> | 1765 |
| Michael, Katina / <i>University of Wollongong, Australia</i> | 2652 |
| Michel-Verkerke, Margreet B. / <i>University of Twente, The Netherlands</i> | 1909 |
| Miller, Dave / <i>University of Sheffield, UK</i> | 2297, 2311 |
| Milne, Simon / <i>Auckland University of Technology, New Zealand</i> | 2898 |
| Mitchell, Matthew / <i>WSU Center to Bridge the Digital Divide, USA</i> | 2248 |
| Molodtsov, Olexandr / <i>National Academy of Public Administration, Ukraine</i> | 1352 |
| Moncrieff, Mike / <i>Cape Peninsula University of Technology, South Africa</i> | 2998 |
| Moodley, Sagren / <i>Human Sciences Research Council, South Africa</i> | 816, 2014 |
| Morawetz, Norbert / <i>University of Hertfordshire, UK</i> | 1832 |
| Morolong, Bantu / <i>University of Botswana, Botswana</i> | 2617 |
| Mulkeen, Aidan / <i>National University of Ireland, Ireland</i> | 3348 |
| Müller, Eggo / <i>Utrecht University, The Netherlands</i> | 1846 |
| Mutch, Alistair / <i>Nottingham Trent University, UK</i> | 3405 |
| Naicker, Inban / <i>University of KwaZulu-Natal, South Africa</i> | 1306 |
| Naidoo, Karna / <i>University of KwaZulu-Natal, South Africa</i> | 3036 |
| Nataatmadja, Indrawat / <i>University of Technology, Australia</i> | 3190 |
| Nel, Johan / <i>Brisbane Solution Centre, Australia</i> | 3021, 3129 |
| Neumann, Alf / <i>University of Cologne, Germany</i> | 574 |
| Ngubane, Buyile / <i>TransNET, South Africa</i> | 1328 |
| Nieborg, David B. / <i>University of Amsterdam, The Netherlands</i> | 3744 |
| Ogle, Alfred / <i>Edith Cowan University, Australia</i> | 988 |
| Olfman, Lorne / <i>Claremont Graduate University, USA</i> | 2398 |
| Olinzock, Anthony / <i>Mississippi State University, USA</i> | 1153 |
| Olla, Phillip / <i>Madonna University, USA</i> | 1513 |
| Onu, Godwin / <i>Nnamdi Azikiwe University, Nigeria</i> | 132 |
| Ooi, Pauline Hui Ying / <i>Intel Technology Penang, Malaysia</i> | 2656 |
| Osbourne, Janice A / <i>Brunel University, UK</i> | 1036 |
| Paakki, Minna-Kristiina / <i>University of Tampere, Finland</i> | 2341 |
| Papamichail, K. Nadia / <i>University of Manchester, UK</i> | 1066 |
| Papasratorn, Borworn / <i>King Mongkut's University of Technology Thonburi, Thailand</i> | 1109 |
| Paravastu, Narasimha / <i>Central State University, USA</i> | 3566 |
| Parchoma, Gale / <i>University of Saskatchewan, Canada</i> | 3695 |
| Patterson, Ian / <i>University of Queensland, Australia</i> | 3768 |
| Penn, Danielle / <i>Queensland University of Technology, Australia</i> | 2434 |
| Peters, Teresa / <i>Bridges.org, South Africa</i> | 3804 |
| Phala, Vanessa / <i>Link Centre, Research ICT Africa and University of the Witwatersrand, South Africa</i> | 144 |
| Pietiläinen, Tarja / <i>Life Works Consulting Ltd., Finland</i> | 3142 |
| Pillay, Hitendra / <i>Queensland University of Technology, Australia</i> | 405 |
| Ponnada, Mohan / <i>Victoria University, Australia</i> | 938 |

| | |
|--|------------------------------|
| Puffenbarger, Eric / <i>James Madison University, USA</i> | 3730 |
| Rabaey, Marc / <i>Royal Military Academy and Vrije Universiteit, Belgium</i> | 2918 |
| Ragazzi, Diego / <i>CEFRIEL—Politecnico di Milano, Italy</i> | 1758 |
| Rahman, Hakikur / <i>Sustainable Development Networking Programme (SDNP), Bangladesh</i> | 1, 104, 190, 443, 1482, 2076 |
| Rajasingham, Lalita / <i>Victoria University of Wellington, New Zealand</i> | 3716 |
| Rambaldi, Giacomo / <i>Technical Centre for Agriculture and Rural Co-Operation (CTA), The Netherlands</i> | 1925 |
| Ramesh, S. / <i>University Tenaga Nasional, Malaysia</i> | 1696 |
| Randle, Keith / <i>University of Hertfordshire, UK</i> | 1832 |
| Rennie, James J. / <i>Simon Fraser University, Canada</i> | 2495 |
| Rezaian, Bobak / <i>The World Bank, USA</i> | 2586 |
| Richardson, Ita / <i>University of Limerick, Ireland</i> | 3207 |
| Richardson, Helen / <i>University of Salford, UK</i> | 3150 |
| Rico, M. / <i>University of Sheffield, UK</i> | 2311 |
| Ridell, Seija / <i>University of Turku, Finland</i> | 840 |
| Rienzo, Thomas / <i>Western Michigan University, USA</i> | 1244 |
| Robinson, Alex / <i>University of Huddersfield, UK</i> | 2052 |
| Robinson, LeAnne K. / <i>Western Washington University, USA</i> | 2130 |
| Rodríguez, Jorge / <i>University of Las Palmas de Gran Canaria, Spain</i> | 1561 |
| Rogerson, Simon / <i>De Montfort University, UK</i> | 2232 |
| Roofe, Andrea J. A. / <i>Florida International University, USA</i> | 3623 |
| Rooney, David / <i>University of Queensland, Australia</i> | 1379 |
| Rowe, Michelle / <i>Edith Cowan University, Australia</i> | 988, 1551 |
| Ruzic, Fjodor / <i>Institute for Informatics, Croatia</i> | 3820 |
| Rydhagen, Birgitta / <i>Blekinge Institute of Technology, Sweden</i> | 46 |
| Sabherwal, Rajiv / <i>University of Missouri St. Louis, USA</i> | 36 |
| Sagi, John / <i>George Washington University, USA</i> | 304 |
| Sahay, Sundeep / <i>University of Oslo, Norway</i> | 2209 |
| Salazar, Juan Francisco / <i>University of Western Sydney, Australia</i> | 1966 |
| Salim, Baanda A. / <i>Sokoine University of Agriculture, Tanzania</i> | 1538 |
| Sandhu, Jaspal S. / <i>University of California at Berkeley, USA</i> | 1002 |
| Sanford, Clive / <i>Aalborg University, Denmark</i> | 2845 |
| Santos, Antonio / <i>Universidad de las Americas-Puebla, Mexico</i> | 889 |
| Sanzogni, Louis / <i>Griffith University, Australia</i> | 1995 |
| Sarkar, Nurul I. / <i>Auckland University of Technology, New Zealand</i> | 1726, 1741 |
| Saugstrup, Dan / <i>Technical University of Denmark, Denmark</i> | 656 |
| Saxena, Anupama / <i>Guru Ghasidas University Bilaspur, India</i> | 897 |
| Schelhowe, Heidi / <i>University of Bremen, Germany</i> | 1630 |
| Schell, Martin A. / <i>New York University, USA</i> | 793 |
| Schultz, Nette / <i>Technical University of Denmark, Denmark</i> | 656 |
| Schürch, Dieter / <i>Università della Svizzera Italiana (USI), Switzerland</i> | 174 |
| Schuring, Roel W. / <i>University of Twente, The Netherlands</i> | 1909 |
| Schwarz, Gavin M. / <i>University of New South Wales, Australia</i> | 3171 |
| Scime, Anthony / <i>State University of New York College at Brockport, USA</i> | 1270 |
| Selvanathan, N. / <i>University Malaya, Malaysia</i> | 1696 |

| | |
|--|------------|
| Semich, George W. / <i>Robert Morris University, USA</i> | 1234 |
| Sharda, Nalin / <i>Victoria University, Australia</i> | 438 |
| Sharma, Sushil K. / <i>Ball State University, USA</i> | 488 |
| Sharma, Pramod / <i>University of Queensland, Australia</i> | 1889 |
| Shaul, Matthew / <i>Kennesaw State University, USA</i> | 1459 |
| Shelley, Daniel J. / <i>Robert Morris University, USA</i> | 3391 |
| Shirah, Gregory W. / <i>National Aeronautics and Space Administration, USA</i> | 3578 |
| Sidhu, S. Manjit / <i>University Tenaga Nasional, Malaysia</i> | 1696 |
| Simpson, Matthew / <i>University of Queensland, Australia</i> | 1468 |
| Simpson, Lyn / <i>Queensland University of Technology, Australia</i> | 2434 |
| Singh, Kishore / <i>University of KwaZulu-Natal, South Africa</i> | 2791 |
| Slay, Jill / <i>University of South Australia, Australia</i> | 1530 |
| Smith, Anthony H. / <i>Purdue University, USA</i> | 1122 |
| Soininen, Aura / <i>Lappeenranta University of Technology and Attorneys-at-Law Borenius & Kempinen, Ltd., Finland</i> | 345 |
| Songan, Peter / <i>Universiti Malaysia Sarawak, Malaysia</i> | 826 |
| Sørensen, Lene / <i>Technical University of Denmark, Denmark</i> | 656 |
| Spedding, Paul / <i>University of Salford, UK</i> | 3460 |
| Sphicopoulos, Thomas / <i>University of Athens, Greece</i> | 951 |
| Spil, Ton A. M. / <i>University of Twente, The Netherlands</i> | 1909 |
| Spratt, Christine / <i>Monash University, Australia</i> | 1262 |
| Srivastava, Shirish C. / <i>National University of Singapore, Singapore</i> | 3101 |
| Stahl, Bernd Carsten / <i>De Montfort University, UK</i> | 2232 |
| Stanford, Ronnie / <i>University of Alabama, USA</i> | 1216 |
| Steer, Dean / <i>University of Tasmania, Australia</i> | 54, 1494 |
| Stevens, Ken / <i>Memorial University of Newfoundland, Canada</i> | 1934 |
| Stockwell, Melinda / <i>Queensland University of Technology, Australia</i> | 2434 |
| Suárez-Burguet, Celestino / <i>Universitat Jaume I, Spain</i> | 284 |
| Subramanian, Malathi / <i>University of Delhi, India</i> | 897 |
| Sutcliffe, Kate / <i>Gulf Savannah Development Inc., Australia</i> | 672 |
| Swartz, Louis B. / <i>Robert Morris University, USA</i> | 3391 |
| Takaya, Sadayoshi / <i>Kansai University, Japan</i> | 91, 226 |
| Talyarkhan, Surmaya / <i>Practical Action, USA</i> | 513 |
| Targowski, Andrew / <i>Western Michigan University, USA</i> | 238 |
| Tarkowski, Alek / <i>Polish Academy of Sciences, Poland</i> | 2372 |
| Tarn, J. Michael / <i>Western Michigan University, USA</i> | 1244 |
| Tattersall, Angela / <i>University of Salford, UK</i> | 3150 |
| Taylor, Peter G. / <i>Bond University, Australia</i> | 405 |
| Taylor, Andrew / <i>Southern Cross University, Australia</i> | 1889, 2022 |
| Teer, Harold B. / <i>James Madison University, USA</i> | 3259 |
| Teer, Faye P. / <i>James Madison University, USA</i> | 3259, 3730 |
| Tello, Steven F. / <i>University of Massachusetts Lowell, USA</i> | 1163 |
| Teo, Thompson S. H. / <i>National University of Singapore, Singapore</i> | 304, 3101 |
| Thomas, Gary / <i>Anne Arundel Community College, USA</i> | 304 |
| Thompson, Chris / <i>Elmbrook Schools, USA</i> | 1225 |
| Tiainen, Tarja / <i>University of Tampere, Finland</i> | 472, 2341 |

| | |
|---|-----------------------|
| Tolar, Marianne / <i>Vienna University of Technology, Austria</i> | 472 |
| Tom Lee, Sang-Yong / <i>Hanyang University, Korea</i> | 3285 |
| Trojer, Lena / <i>Blekinge Institute of Technology, Sweden</i> | 46 |
| Tromp, Herman / <i>Ghent University, Belgium</i> | 2918 |
| Türk, Volker / <i>Wuppertal Institute, Germany</i> | 3500 |
| Turner, Paul / <i>University of Tasmania, Australia</i> | 54, 1494 |
| Uden, Lorna / <i>Staffordshire University, UK</i> | 2268 |
| Valanides, Nicos / <i>University of Cyprus, Cyprus</i> | 1590 |
| van der Graaf, Shenja / <i>LSE, UK</i> | 628 |
| van der Kooij, Marco / <i>Hyperion Solutions, The Netherlands</i> | 2933 |
| van Staaden, Pieter / <i>Media 24 Ltd., South Africa</i> | 3042 |
| Vandenborre, Koenraad / <i>Hogeschool Gent and Ghent University, Belgium</i> | 2918 |
| Varoutas, Dimitris / <i>University of Athens, Greece</i> | 951 |
| Velibeyoglu, Koray / <i>Izmir Institute of Technolog, Turkey</i> | 2673 |
| Verheijden, Marieke W. / <i>TNO Quality of Life, The Netherlands</i> | 2323 |
| Verlan, Tatiana / <i>Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova</i> | 74, 2531 |
| Virborg Andersen, Kim / <i>Copenhagen Business School, Denmark</i> | 600 |
| von Geibler, Justus / <i>Wuppertal Institute, Germany</i> | 3500 |
| Vriens, Dirk / <i>University of Nijmegen, The Netherlands</i> | 614, 1414, 1437, 1445 |
| Wagner, Ina / <i>Vienna University of Technology, Austria</i> | 472 |
| Wangpipatwong, Thanakorn / <i>King Mongkut's University of Technology Thonburi, Thailand</i> | 1109 |
| Wania, Christine / <i>State University of New York College at Brockport, USA</i> | 1270 |
| Warner, Alfred G. / <i>Penn State Erie, USA</i> | 3083 |
| Wasburn, Mara H. / <i>Purdue University, USA</i> | 2863, 3552 |
| Washida, Yuichi / <i>Hakuhodo Inc. & The University of Tokyo, Japan</i> | 638, 1855 |
| Watson, Bernadette M. / <i>University of Queensland, Australia</i> | 3171 |
| Webb, Phyl / <i>University of Tasmania, Australia</i> | 3514 |
| White, Karen F. / <i>Purdue University, USA</i> | 2863 |
| Whybrow, Ellen / <i>University of Alberta, Canada</i> | 764 |
| Wiesner, Heike / <i>University of Bremen, Germany</i> | 1630 |
| Wiesner-Steiner, Andreas / <i>University of Bremen, Germany</i> | 1630 |
| Wildenbos, Gaby Anne / <i>Utrecht University, The Netherlands</i> | 1855 |
| Williamson, Andy / <i>Wairua Consulting Limited, New Zealand</i> | 2441 |
| Wilsdon, Thomas / <i>University of South Australia, Australia</i> | 1530 |
| Wojnar, Linda / <i>Duquesne University, USA</i> | 2268 |
| Wong, T. T. / <i>The Hong Kong Polytechnic University, Hong Kong</i> | 2950 |
| Wood, Leanne / <i>Queensland University of Technology, Australia</i> | 2434 |
| Wright, Peter / <i>University of York, UK</i> | 712 |
| Wright, Vivian H. / <i>University of Alabama, USA</i> | 1216 |
| Yang, Dazhi / <i>Purdue University, USA</i> | 1172 |
| Yonah, Zaipuna O. / <i>Tanzania Telecommunications Company Ltd., Tanzania</i> | 1538 |
| York, Cindy S. / <i>Purdue University, USA</i> | 1179 |
| Yoshikawa, Masataka / <i>Hakuhodo Inc., Japan</i> | 1809 |
| Young, Judy / <i>University of Tasmania, Australia</i> | 3514 |

| | |
|--|------|
| Yu, Wei -Chieh / <i>Mississippi State University, USA</i> | 1190 |
| Zhang, Juan Juan / <i>National University of Singapore, Singapore</i> | 3285 |
| Zinner Henriksen, Helle / <i>Copenhagen Business School, Denmark</i> | 600 |
| Zhou, Yu Josephine / <i>International University of Applied Science, Bad Honnef-Bonn, Germany</i> | 3158 |

Contents

by Volume

Volume I

Section 1. Fundamental Concepts and Theories in Information Communication Technologies

This section serves as the foundation for this exhaustive reference tool by addressing crucial theories essential to the understanding of information communication technology (ICT). Chapters found within these pages provide an excellent framework in which to position ICT within the field of information science and technology. Individual contributions provide insight into the critical incorporation of ICT into the global community and explore crucial stumbling blocks of the field. Within this introductory section, the reader can learn and choose from a compendium of expert research on the elemental theories underscoring the research and application of ICT.

| | |
|---|----|
| Chapter 1.1. An Overview on Strategic ICT Implementations Toward Developing Knowledge Societies / <i>Hakikur Rahman</i> | 1 |
| Chapter 1.2. The Role of Information and Communication Technologies in Knowledge Management: A Classification of Knowledge Management Systems / <i>Irma Becerra-Fernandez and Rajiv Sabherwal</i> | 36 |
| Chapter 1.3. Postcolonial ICT Challenges / <i>Birgitta Rydhagen and Lena Trojer</i> | 46 |
| Chapter 1.4. Holistic Evaluation of the Roles of ICTs in Regional Development / <i>Chris Keen, Dean Steer, and Paul Turner</i> | 54 |
| Chapter 1.5. ICT in Regional Development / <i>Saundaryya Borbora and Mrinal Kanti Dutta</i> | 66 |
| Chapter 1.6. Digital Divide: Introduction to the Problem / <i>Liudmila Burtseva, Svetlana Cojocar, Constantin Gaidric, Galina Magariu, and Tatiana Verlan</i> | 74 |
| Chapter 1.7. The Evolution of ICT, Economic Development, and the Digitally-Divided Society / <i>Sadayoshi Takaya</i> | 91 |

| | |
|---|-----|
| Chapter 1.8. Information Dynamics in Developing Countries / <i>Hakikur Rahman</i> | 104 |
| Chapter 1.9. Role of ICT in Development Process: A Review of Issues and Prospects in South Asia / <i>Dilip Dutta</i> | 115 |
| Chapter 1.10. Information and Communication Technology and Good Governance in Africa / <i>Godwin Onu</i> | 132 |
| Chapter 1.11. Telecommunications Sector and Internet Access in Africa / <i>Vanessa Phala</i> | 144 |
| Chapter 1.12. The Arab World, Culture, and Information Technology / <i>Mohamed El Louadi</i> | 151 |
| Chapter 1.13. ICT Growth and Diffusion: Concepts, Impacts, and Policy Issues in the Indian Experience with Reference to the International Digital Divide / <i>Saundarjya Borbora</i> | 160 |
| Chapter 1.14. ICT, Education, and Regional Development in Swiss Peripheral Areas / <i>Chiara Giorgi and Dieter Schürch</i> | 174 |
| Chapter 1.15. Applying for Government Grants for ICT in Australia / <i>Lynne H. De Weaver</i> | 183 |
| Chapter 1.16. Role of ICTs in Socioeconomic Development and Poverty Reduction / <i>Hakikur Rahman</i> | 190 |
| Chapter 1.17. Evolution of the Euro and Currency Competition in the Global ICT Age / <i>Sadayoshi Takaya</i> | 226 |
| Chapter 1.18. The Genesis, Political, and Economic Sides of the Internet / <i>Andrew Targowski</i> | 238 |
| Chapter 1.19. The Transformation of the Distribution Process in the Airline Industry Empowered by Information and Communication Technology / <i>Patrick S. Merten</i> | 254 |
| Chapter 1.20. Technological Innovation, Trade, and Development / <i>Laura Márquez-Ramos, Inmaculada Martínez-Zarzoso, and Celestino Suárez-Burguet</i> | 284 |
| Chapter 1.21. ICT and Business in the New Economy: Globalization and Attitudes Towards E-Commerce / <i>John Sagi, Elias Carayannis, Subhashish Dasgupta, and Gary Thomas</i> | 304 |
| Chapter 1.22. Collaboration Challenges in Community Telecommunication Networks / <i>Sylvie Albert and Rolland LeBrasseur</i> | 323 |
| Chapter 1.23. Patents and Standards in the ICT Sector: Are Submarine Patents a Substantive Problem or a Red Herring? / <i>Aura Soininen</i> | 345 |
| Chapter 1.24. Factors Influencing the Lifetime of Telecommunication and Information Technology Standards: Results of an Explorative Analysis of the PERINORM Database / <i>Knut Blind</i> | 383 |

| | |
|--|-----|
| Chapter 1.25. Some Insights into the Impact of ICTs on Learning Agency and Seamless Learning / <i>Hitendra Pillay, John A. Clarke, and Peter G. Taylor</i> | 405 |
| Chapter 1.26. Learning Styles and Adaptive ICT Based Learning Environment / <i>Zlatko J. Kovačić</i> | 413 |
| Chapter 1.27. Behavioral, Cognitive, and Humanistic Theories: Which Theories do Online Instructors Utilize? / <i>MarySue Ciccirelli</i> | 430 |
| Chapter 1.28. ICT-Based Learning: A Basic Ingredient for Socio-Economic Empowerment / <i>Hakikur Rahman</i> | 443 |
| Chapter 1.29. Between Tradition and Innovation in ICT and Teaching / <i>Antonio Cartelli</i> | 456 |
| Chapter 1.30. Sociocultural Animation / <i>Marcus Foth</i> | 464 |
| Chapter 1.31. Biographical Stories of European Women Working in ICT / <i>Andrea Birbaumer, Marianne Tolar, and Ina Wagner</i> | 472 |
| Chapter 1.32. The Beijing World Conference on Women, ICT Policy, and Gender / <i>J. Ann Dumas</i> | 480 |
| Chapter 1.33. Gender Inequalities for Use and Access of ICTs in Developing Countries / <i>Sushil K. Sharma</i> | 488 |
| Chapter 1.34. WSIS Gender and ICT Policy / <i>J. Ann Dumas</i> | 496 |
| Chapter 1.35. Gender ICT and Millennium Development Goals / <i>J. Ann Dumas</i> | 504 |

Section 2. Information Communication Technologies Development and Design Methodologies

This section provides in-depth coverage of conceptual architecture, enabling the reader to gain a comprehensive understanding of the emerging technological developments within the field of ICT. Research fundamentals imperative to the understanding of developmental processes within information management are offered. From broad examinations to specific discussions on electronic tools, the research found within this section spans the discipline while also offering detailed, specific discussions. Basic designs as well as abstract developments are explained within these chapters, and frameworks for implementing ICT in education, healthcare, and government are explored.

| | |
|---|-----|
| Chapter 2.1. Connecting the First Mile: A Best Practice Framework for ICT-Based Knowledge Sharing Initiatives / <i>Surmaya Talyarkhan, David J. Grimshaw, and Lucky Lowe</i> | 513 |
| Chapter 2.2. A Framework to Build Process Theories of Anticipatory Information and Communication Technology (ICT) Standardizing / <i>Kalle Lyytinen, Thomas Keil, and Vladislav Fomin</i> | 534 |

| | |
|---|-----|
| Chapter 2.3. How the National E-Strategy Shapes Competitiveness in the Information Economy / <i>Alf Neumann</i> | 574 |
| Chapter 2.4. An Explanatory Approach to the Political Uses of ICT Initiatives for Participation: Institutions, Context, and Characteristics of the Actors / <i>Rosa Borge</i> | 582 |
| Chapter 2.5. B2B E-Commerce Diffusion: The Efficacy of Institutional Discourse / <i>Kim Virborg Andersen and Helle Zinner Henriksen</i> | 600 |
| Chapter 2.6. Enabling Strategy Formulation by ICT: A Viable Systems Approach / <i>Dirk Vriens and Jan Achterbergh</i> | 617 |
| Volume II | |
| Chapter 2.7. Media Life Cycle and Consumer-Generated Innovation / <i>Yuichi Wasida, Shenja van der Graaf, Eva Keeris</i> | 638 |
| Chapter 2.8. Participatory Design and Creativity in Development of Information and Communication Technologies / <i>Nette Schultz, Lene Sørensen, and Dan Saugstrup</i> | 656 |
| Chapter 2.9. ICT and Developing Social Capital / <i>Kate Sutcliffe</i> | 672 |
| Chapter 2.10. A Taxonomy of Stakeholders: Human Roles in System Development / <i>Ian F. Alexander</i> | 679 |
| Chapter 2.11. A Practitioner-Centered Assessment of a User-Experience Framework / <i>John McCarthy, Peter Wright, and Lisa Meekison</i> | 712 |
| Chapter 2.12. Different Levels of Information Systems Designers' Forms of Thought and Potential for Human-Centered Design / <i>Hannakaisa Isomäki</i> | 734 |
| Chapter 2.13. A Method to Quantify Corpus Similarity and its Application to Quantifying the Degree of Literally in a Document / <i>Etienne Denoual</i> | 751 |
| Chapter 2.14. Digital Access, ICT Fluency, and the Economically Disadvantaged: Approaches to Minimize the Digital Divide / <i>Ellen Whybrow</i> | 764 |
| Chapter 2.15. Delivering More Effective Community Consultation and Support for Regional ICT Programs / <i>Lynne De Weaver and Allan H. Ellis</i> | 778 |
| Chapter 2.16. Developing a Global Perspective for Knowledge Management / <i>Martin A. Schell</i> | 793 |
| Chapter 2.17. Deconstructing the South African Government's ICT for Development Discourse / <i>Sagren Moodley</i> | 816 |

| | |
|---|------|
| Chapter 2.18. E Bario Project: In Search of a Methodology to Provide Access to Information Communication Technologies for Rural Communities in Malaysia / <i>Poline Bala, Roger W. Harris, and Peter Songan</i> | 826 |
| Chapter 2.19. ICTs and the Communicative Conditions for Democracy: A Local Experiment with Web-Mediated Civic Publicness / <i>Seija Ridell</i> | 840 |
| Chapter 2.20. The Creation of a Commercial Software Development Company in a Developing Country for Outsourcing Purposes / <i>Sam Lubbe</i> | 862 |
| Chapter 2.21. The Information Society in Ukraine / <i>Serge S. Azarov</i> | 870 |
| Chapter 2.22. Telecommunication Problems in Rural Areas of Armenia / <i>Gevorg Melkonyan</i> | 877 |
| Chapter 2.23. ICT as an Example of Industrial Policy in EU / <i>Morten Falch and Anders Henten</i> | 882 |
| Chapter 2.24. Information Literacy for Telecenter Users in Low-Income Regional Mexican Communities / <i>Antonio Santos</i> | 889 |
| Chapter 2.25. Gender and ICT Policies and Programmes in an Indian State / <i>Malathi Subramania and Anupama Saxena</i> | 897 |
| Chapter 2.26. Crossing the Digital Divide in a Women’s Community ICT Centre / <i>Clem Herman</i> | 904 |
| Chapter 2.27. Developing Regional Tourism Using Information Communications Technology / <i>Dean Carson</i> | 911 |
| Chapter 2.28. A Framework for Ontology-Based Tourism Application Generator / <i>Roopa Jakkilinki and Nalin Sharda</i> | 920 |
| Chapter 2.29. Developing Visual Tourism Recommender Systems / <i>Mohan Ponnada, Roopa Jakkilinki, and Nalin Sharda</i> | 938 |
| Chapter 2.30. Design and Implementation Approaches for Location-Based, Tourism-Related Services / <i>George Kakalettris, Dimitris Varoutas,</i> <i>Dimitris Katsianis, and Thomas Sphicopoulos</i> | 951 |
| Chapter 2.31. Collaborative Commerce and the Hotel Industry / <i>Michelle Rowe and Alfred Ogle</i> | 988 |
| Chapter 2.32. Peering into the Black Box: A Holistic Framework for Innovating at the Intersection of ICT & Health / <i>Ben Bellows, Aman Bhandar, Mahad Ibrahim, and</i> <i>Jaspal S. Sandhu</i> | 1002 |
| Chapter 2.33. Analysing a Rural Community’s Reception of ICT in Ghana / <i>Paula F. Saddler</i> | 1029 |

| | |
|---|------|
| Chapter 2.34. Factors Motivating the Acceptance of New Information and Communication Technologies in UK Healthcare: A Test of Three Models / <i>Janice A Osbourne and Malcolm Clarke</i> | 1036 |
| Chapter 2.35. Information and Communication Technologies: Towards a Mediated Learning Context / <i>Glenn Finger, Maret McGlasson, and Paul Finger</i> | 1047 |
| Chapter 2.36. Learning-Supported Decision-Making: ICTs as Feedback Systems / <i>Elena P. Antonacopoulou and K. Nadia Papamichail</i> | 1066 |
| Chapter 2.37. Reframing Information System Design as Learning Across Communities of Practice / <i>Kevin Gallagher and Robert M. Mason</i> | 1083 |
| Chapter 2.38. The Transformation Model / <i>Kathleen P. King</i> | 1102 |
| Chapter 2.39. The Influence of Constructivist E-Learning System on Student Learning Outcomes / <i>Thanakorn Wangpipatwong and Borworn Papasratorn</i> | 1109 |
| Chapter 2.40. A Wireless Networking Curriculum Model for Network Engineering Technology Programs / <i>Raymond A. Hansen, Anthony H. Smith, and Julie R. Mariga</i> | 1122 |
| Chapter 2.41. Agent-Based Architecture of a Distributed Laboratory System / <i>Hong Lin</i> | 1130 |
| Chapter 2.42. A Project-Based Learning Approach: Online Group Collaborative Learning / <i>Jianxia Du, Byron Havard, James Adams, and Heng Li</i> | 1143 |
| Chapter 2.43. Task-Oriented Online Discussion: A Practical Model for Student Learning / <i>Byron Havard, Jianxia Du, and Anthony Olinzock</i> | 1153 |
| Chapter 2.44. An Analysis of Student Persistence in Online Education / <i>Steven F. Tello</i> | 1163 |
| Chapter 2.45. Transitioning from Face-to-Face to Online Instruction: How to Increase Presence and Cognitive/Social Interaction in an Online Information Security Risk Assessment Class / <i>Cindy S. York, Dazhi Yang, and Melissa Dark</i> | 1179 |
| Chapter 2.46. Project-Based Online Group Collaborative Learning Characteristics / <i>Jianxia Du, Byron Havard, James Adams, Gang Ding, and Wei -Chieh Yu</i> | 1190 |
| Chapter 2.47. Using “Blended Learning” to Develop Tertiary Students’ Skills of Critique / <i>Paul Lajbcyier and Christine Spratt</i> | 1202 |
| Chapter 2.48. Using a Blended Model to Improve Delivery of Teacher Education Curriculum in Global Settings / <i>Vivian H. Wright, Ronnie Stanford, Jon Beedle</i> | 1216 |
| Chapter 2.49. Developing Staff Training in Virtual High Schools / <i>Chris Thompson and Zane L. Berge</i> | 1225 |

| | |
|--|------|
| Chapter 2.50. A Model for Effectively Integrating Technology Across the Curriculum: A Three-Step Staff Development Program for Transforming Practice / <i>John Graham and George W. Semich</i> | 1234 |
| Chapter 2.51. Putting Enterprise Systems in a Larger ICT Context: A Pedagogical Framework / <i>Thomas Rienzo, J. Michael Tarn, and James Danenburg</i> | 1244 |
| Chapter 2.52. An Embedded Collaborative Systems Model for Implementing ICT-Based Multimedia Cartography Teaching and Learning / <i>Shivanand Balram and Suzana Dragicevic</i> | 1254 |
| Chapter 2.53. Computing Curricula: A Comparison of Models / <i>Anthony Scime and Christine Wania</i> | 1270 |

Volume III

| | |
|--|------|
| Chapter 2.54. ICT-Enabled Education in Africa: A Sober Reflection on the Development Challenges / <i>Shafika Isaacs</i> | 1284 |
|--|------|

Section 3. Information Communication Technologies Tools and Technologies

This section presents extensive coverage of various ICT-related tools and technologies that researchers, practitioners, and students alike can implement in their daily lives. These chapters educate readers about fundamental tools such as the Internet and mobile technology, while also providing insight into new and upcoming technologies and instruments that will soon be commonplace. Within these rigorously researched chapters, readers are presented with countless examples of the tools and technologies essential to the field of ICT. In addition, the impact of these various tools, as well as the current issue of ensuring equal access to them, is discussed within this collection of chapters.

| | |
|---|------|
| Chapter 3.1. Internet: A Right to Use and Access Information, or a Utopia? / <i>Inban Naicker</i> | 1306 |
| Chapter 3.2. The Nearest Some of Us Will Ever Come to Information Heaven / <i>Buyile Ngubane</i> | 1328 |
| Chapter 3.3. Establishing a “Knowledge Network” of Local and Regional Development Subjects / <i>Olexandr Molodtsov</i> | 1352 |
| Chapter 3.4. Sex Tourism and the Internet: Information, Amplification, and Moral Panics / <i>Jerry Eades</i> | 1360 |
| Chapter 3.5. Cultural Knowledge Management and Broadband Content in Development: Open Content Platforms, Copyright and Archives / <i>David Rooney, Elizabeth Ferrier, Phil Graham, and Ashley Jones</i> | 1379 |
| Chapter 3.6. The Right of Interpretation: Who Decides the Success of Picture Mail? / <i>Michael Björn</i> | 1395 |

| | |
|--|------|
| Chapter 3.7. The Role of Information and Communication Technology in Competitive Intelligence / <i>Dirk Vriens</i> | 1414 |
| Chapter 3.8. Information and Communication Technology Tools for Competitive Intelligence / <i>Dirk Vriens</i> | 1437 |
| Chapter 3.9. It's All in the Game: How to Use Simulation-Games for Competitive Intelligence and How to Support Them by ICT / <i>Jan Achterbergh and Dirk Vriens</i> | 1445 |
| Chapter 3.10. Assessing Online Discussion Forum Participation / <i>Matthew Shaul</i> | 1459 |
| Chapter 3.11. E-News: Community Interaction through Journalism / <i>Matthew Simpson, Jay Burmeister, and Michael Docherty</i> | 1468 |
| Chapter 3.12. Role of ICT in Establishing E-Government System for Disadvantaged Communities / <i>Hakikur Rahman</i> | 1482 |
| Chapter 3.13. The Role of Place: Tasmanian Insights on ICT and Regional Development / <i>Dean Steer and Paul Turner</i> | 1494 |
| Chapter 3.14. Radio for Social Development / <i>Patrick Craddock and Peggy Duncan</i> | 1506 |
| Chapter 3.15. Digital Bridges: Extending ICT To Rural Communities Using Space Technologies / <i>Phillip Olla</i> | 1513 |
| Chapter 3.16. Voice Over IP for Rural Telecommunication Provision / <i>Thomas Wilsdon and Jill Slay</i> | 1530 |
| Chapter 3.17. ICTs as Tools for Poverty Reduction: The Tanzanian Experience / <i>Zaipuna O. Yonah and Baanda A. Salim</i> | 1538 |
| Chapter 3.18. Information Technology Standards in China / <i>Michelle Rowe</i> | 1551 |
| Chapter 3.19. ICT and Distance Learning for Agricultural Extension in Low Income Countries / <i>Colin R. Latchem and Ajit Maru</i> | 1554 |
| Chapter 3.20. ICT for Knowledge and Intellectual Capital Management in Organizations / <i>Jacques Bulchand and Jorge Rodríguez</i> | 1561 |
| Chapter 3.21. Digital Business Portfolios: Categories, Content, and Production / <i>Eleanor J. Flanigan and Susan Amirian</i> | 1581 |
| Chapter 3.22. A Socio-Technical Analysis of Factors Affecting the Integration of ICT in Primary and Secondary Education / <i>Charoula Angeli, Nicos Valanides</i> | 1590 |
| Chapter 3.23. Satellite Technology in Schools / <i>Anneleen Cosemans</i> | 1611 |

| | |
|--|------|
| Chapter 3.24. The Use of Online Technologies in the Teaching and Learning Process: WebCT-Communication or Technology Turn-Off? / <i>Maggie Ferguson and Adrian Ibbetson</i> | 1616 |
| Chapter 3.25. The Didactical Potential of Robotics for Education with Digital Media / <i>Andreas Wiesner-Steiner, Heidi Schelhowe, and Heike Wiesner</i> | 1630 |
| Chapter 3.26. Students' Perceptions of the Laptop Program: What Factors Should be Considered Before Implementing the Program? / <i>Chuleeporn Changchit, Robert Cutshall, and Susan Elwood</i> | 1639 |
| Chapter 3.27. Game Mods: Customizable Learning in a K16 Setting / <i>Elizabeth Fanning</i> | 1647 |
| Chapter 3.28. A Statewide Analysis of Student Web Portfolios in New York Colleges and Universities / <i>John DiMarco</i> | 1655 |
| Chapter 3.29. Innovative Technologies for Education and Learning: Education and Knowledge-Oriented Applications of Blogs, Wikis, Podcasts, and More / <i>Jeffrey Hsu</i> | 1666 |
| Chapter 3.30. Introducing GIS for Business in Higher Education / <i>David Gadish</i> | 1688 |
| Chapter 3.31. CAL Student Coaching Environment and Virtual Reality in Mechanical Engineering / <i>S. Manjit Sidhu, N. Selvanathan, and S. Ramesh</i> | 1696 |
| Chapter 3.32. Assessing the Effectiveness of Programmed Instruction and Collaborative Peer Tutoring in Teaching Java / <i>Henry H. Emurian</i> | 1712 |
| Chapter 3.33. An Interactive Tool for Teaching and Learning LAN Design / <i>Nurul I. Sarkar</i> | 1726 |
| Chapter 3.34. LAN-Designer: A Software Tool to Enhance Learning and Teaching Server-Based LAN Design / <i>Nurul I. Sarkar</i> | 1741 |
| Chapter 3.35. Mobile ICT / <i>Dermott McMeel</i> | 1752 |
| Chapter 3.36. Innovation in Wireless Technologies / <i>Diego Ragazzi</i> | 1758 |
| Chapter 3.37. New Challenges for Smart Organizations: Demands for Mobility—Wireless Communication Technologies / <i>István Mezgár</i> | 1765 |
| Chapter 3.38. Foreseeing the Future Lifestyle with Digital Music: A Comparative Study Between Mobile Phone Ring Tones and Hard-Disk Music Players Like iPod / <i>Masataka Yoshikawa</i> | 1809 |
| Chapter 3.39. Screening in High Standard: Innovating Film and Television in a Digital Age through High Definition / <i>Bas Agterberg</i> | 1820 |
| Chapter 3.40. Digital Cinema as Disruptive Technology: Exploring New Business Models in the Age of Digital Distribution / <i>Nigel Culkin, Keith Randle, and Norbert Morawetz</i> | 1832 |

| | |
|--|------|
| Chapter 3.41. Access to the Living Room: Triple Play and Interactive Television Reshaping the Producer/Consumer Relation / <i>Eggo Müller</i> | 1846 |
| Chapter 3.42. Beauty and the Nerd: Ethnographical Analyses in the Japanese Digitalization / <i>Gaby Anne Wildenbos and Yuichi Washida</i> | 1855 |
| Chapter 3.43. Digital Imaging Trek: A Practical Model for Managing the Demand of the Digitally Enabled Traveller / <i>Stephen C. Andrade and Hilary Mason</i> | 1867 |
| Chapter 3.44. Adaptive Use of ICT in Response to Disintermediation / <i>Pramod Sharma, Dean Carson, and Andrew Taylor</i> | 1889 |
| Chapter 3.45. Virtual Reality Mapping Revisited: IT Tools for the Divide Between Knowledge and Action in Tourism / <i>Malcolm Cooper and Neil MacNeil</i> | 1896 |
| Chapter 3.46. USE IT to Create Patient-Relation Management for Multiple Sclerosis Patients / <i>Margreet B. Michel-Verkerke, Roel W. Schuring, and Ton A. M. Spil</i> | 1909 |

Volume IV

| | |
|--|------|
| Chapter 3.47. Participatory 3D Modelling / <i>Giacomo Rambaldi</i> | 1925 |
|--|------|

Section 4. Utilization and Application of Information Communication Technologies

This section introduces and discusses a variety of the existing applications of ICT that have influenced government, culture, and education and also proposes new ways in which ICT can be implemented in society. Within these selections, particular issues related to ICT utilization, such as the existence of a cross-cultural digital divide and the existence of a gender barrier, are explored and debated. Contributions included in this section provide excellent coverage of today's IT community and insight into how ICT impacts the social fabric of our present-day global village.

| | |
|--|------|
| Chapter 4.1. A Dissemination Strategy for the Management of Knowledge in Rural Communities / <i>Ken Stevens</i> | 1934 |
| Chapter 4.2. ICTs for Intercultural Dialogue (ICT4ID) / <i>Victor Giner Minana</i> | 1951 |
| Chapter 4.3. Information and Communication Technologies Provision to Rural Communities: The Case of Gutu World Links Telecenter in Zimbabwe / <i>Shirley Chikowore-Kabwato and Isola Ajiferuke</i> | 1954 |
| Chapter 4.4. Indigenous Peoples and the Cultural Constructions of Information and Communication Technology (ICT) in Latin America / <i>Juan Francisco Salazar</i> | 1966 |
| Chapter 4.5. Assessing Universal Access to ICT in Ghana / <i>Godfred Frempong and Imoro Braimah</i> | 1976 |

| | |
|--|------|
| Chapter 4.6. Caribbean Companies and the Information Superhighway / <i>Simon Fraser</i> | 1986 |
| Chapter 4.7. Technology Leapfrogging in Thailand / <i>Louis Sanzogni and Heather Arthur-Gray</i> | 1995 |
| Chapter 4.8. An ICT Enabled “Community” in Rural Nigeria and the UK / <i>Pamela McLean</i> | 2003 |
| Chapter 4.9. ICT in Medical Education in Trinidad and Tobago / <i>Marilyn Lewis</i> | 2008 |
| Chapter 4.10. Clustering Dynamics of the ICT Sector in South Africa / <i>Sagren Moodley</i> | 2014 |
| Chapter 4.11. ICT and the Tourism Information Marketplace in Australia / <i>Andrew Taylor</i> | 2022 |
| Chapter 4.12. Potential Challenges of ICT Implementations in Sri Lanka / <i>Kennedy D. Gunawardana</i> | 2032 |
| Chapter 4.13. The E-Pabelan National ICT4PR Pilot Project: Experiences and Challenges of Implementation in an Indonesian Context / <i>Alex Robinson</i> | 2052 |
| Chapter 4.14. Determining Whether ICT Improves Social Interactions / <i>Raj Gururajan</i> | 2069 |
| Chapter 4.15. Formation of a Knowledge-Based Society through Utilization of Information Networking / <i>Hakikur Rahman</i> | 2076 |
| Chapter 4.16. Transforming the K-12 Classroom with ICT: Recognizing and Engaging new Configurations of Student Learning / <i>Colin Baskin</i> | 2084 |
| Chapter 4.17. Strategies for the Cooperation of Higher Education Institutions in ICT / <i>Juha Kettunen</i> | 2104 |
| Chapter 4.18. Integrating ICT in Universities: Some Actual Problems and Solutions / <i>Vassilios Dagdilelis</i> | 2118 |
| Chapter 4.19. Diffusion of Educational Technology and Education Reform: Examining Perceptual Barriers to Technology Integration / <i>LeAnne K. Robinson</i> | 2130 |
| Chapter 4.20. Evaluating the Learning Effectiveness of Using Web-Based Instruction: An Individual Differences Approach / <i>Sherry Y. Chen</i> | 2143 |
| Chapter 4.21. Quality of Online Learning Applications: Impact on Student Enjoyment, Motivation, and Anxiety / <i>Leping Liu</i> | 2154 |
| Chapter 4.22. Virtual Reality & Immersive Technology in Education / <i>Patrick E. Connolly</i> | 2168 |
| Chapter 4.23. E-Learning: An Investigation into Students’ Reactions to Investment into IT at Tertiary Institutions / <i>Solitaire Maherry-Lubbe</i> | 2173 |

| | |
|---|------|
| Chapter 4.24. Guiding Our Way: Needs and Motivations of Teachers in Online Learning Modeling Responsive Course Design / <i>Kathleen P. King, Frank J. Melia, and Marlene D. Dunham</i> | 2193 |
| Chapter 4.25. Computer-Based Health Information Systems: Projects for Computerization or Health Management? Empirical Experiences from India / <i>Ranjini C. R. and Sundeep Sahay</i> | 2209 |
| Chapter 4.26. Current and Future State of ICT Deployment and Utilization in Healthcare: An Analysis of Cross-Cultural Ethical Issues / <i>Bernd Carsten Stahl, Simon Rogerson, and Amin Kashmeery</i> | 2232 |

Section 5. Organizational and Social Implications of Information Communication Technologies

This section includes a wide range of research pertaining to the social and organizational impact of ICT around the world. Chapters introducing this section illustrate the intersection of ICT and culture and the impact this has upon individuals and entire communities. Other contributions discuss ICT's potential for empowerment among disenfranchised individuals and societies as well as the ways in which ICT can transform education and the modern workplace. Particular selections debate the use of ICT for web-based learning, while others discuss how ICT has been utilized in the field of tourism. The debates and inquires presented in this section offer research into the integration of global ICT as well as implementation of ethical considerations for all organizations.

| | |
|---|------|
| Chapter 5.1. Convergence of ICT and Culture / <i>Matthew Mitchell</i> | 2248 |
| Chapter 5.2. Addressing the Cultural Dimensions of E-Learning: Where to Begin? / <i>Andrea L. Edmundson</i> | 2252 |
| Chapter 5.3. Group Process and Trust in Group Discussion / <i>Lorna Uden and Linda Wojnar</i> | 2268 |
| Chapter 5.4. Community (Information and Communication) Technology: Policy, Partnership and Practice / <i>Peter Day</i> | 2282 |
| Chapter 5.5. Mind the Gap!: New ‘Literacies’ Create New Divides / <i>Andrew D. Madden, J. Miguel Baptista Nunes, M. A. McPherson, Nigel Ford, and Dave Miller</i> | 2297 |
| Chapter 5.6. A New Generation Gap? Some Thoughts on the Consequences of Early ICT First Contact / <i>Andrew D. Madden, J.Miguel Baptista Nunes, M. McPherson, Nigel Ford, David Miller, and M. Rico</i> | 2311 |
| Chapter 5.7. Behavior Change through ICT Use: Experiences from Relatively Healthy Populations / <i>Marieke W. Verheijden</i> | 2323 |
| Chapter 5.8. Articulating ICT Use Narratives in Everyday Life / <i>Deirdre Hynes, Tarja Tiainen, Emma-Reetta Koivunen, and Minna-Kristiina Paakki</i> | 2341 |
| Chapter 5.9. ICT, CoLs, CoPs, and Virtual Communities / <i>Antonio Cartelli</i> | 2350 |

| | |
|---|------|
| Chapter 5.10. “You’re in My World Now.” Ownership and Access in the Proprietary Community of an MMOG / <i>Sal Humphreys</i> | 2357 |
| Chapter 5.11. Digital Petri Dishes: LiveJournal User Icons as a Space and Medium of Popular Cultural Production / <i>Alek Tarkowski</i> | 2372 |
| Chapter 5.12. Competent Web Dialogue: Thoughts Linked in Digital Conversations / <i>Eva Fåhræus and Marianne Döös</i> | 2387 |
| Chapter 5.13. Differential Impacts of Social Presence on the Behavior Modeling Approach / <i>Charlie C. Chen, Lorne Olfman, and Albert Harris</i> | 2398 |
| Chapter 5.14. Exploring the Behavioral Dimension of Client/Server Technology Implementation: An Empirical Investigation / <i>Eitel J. M. Lauría</i> | 2417 |
| Chapter 5.15. A Capacity Building Approach to Health Literacy through ICTs / <i>Lyn Simpson, Melinda Stockwell, Susan Leggett, Leanne Wood, and Danielle Penn</i> | 2434 |
| Chapter 5.16. Transforming Democracy through ICT / <i>Andy Williamson</i> | 2441 |
| Chapter 5.17. ICTs, Empowerment, and Development: Articulating Grassroots Analysis Through Participatory Approaches / <i>Hannah Beardon</i> | 2450 |
| Chapter 5.18. Enacting and Interpreting Technology- From Usage to Well-Being: Experiences of Indigenous Peoples with ICTs / <i>Björn-Sören Gigler</i> | 2464 |
| Chapter 5.19. ICTs and Educational Benefits in Regional Development / <i>James J. Rennie</i> | 2495 |
| Chapter 5.20. Support Networks for Rural and Regional Communities / <i>Tom Denison</i> | 2514 |
| Chapter 5.21. Digital Divide: A Glance at the Problem in Moldova / <i>Liudmila Burtseva, Svetlana Cojocar, Constantin Gaidric, Galina Magariu, and Tatiana Verlan</i> | 2531 |

Volume V

| | |
|--|------|
| Chapter 5.22. Digital Opportunities, Equity, and Poverty in Latin America / <i>Simone Cecchini</i> | 2566 |
| Chapter 5.23. Integrating ICTs in African Development: Challenges and Opportunities in Sub-Saharan Africa / <i>Bobak Rezaian</i> | 2586 |
| Chapter 5.24. Poverty Reduction through Community-Compatible ICTs: Examples from Botswana and other African Countries / <i>Rebecca Lekoko and Bantu Morolong</i> | 2617 |
| Chapter 5.25. Interactions among Thai Culture, ICT, and IT Ethics / <i>Pattarasinee Bhattarakosol</i> | 2637 |

| | |
|---|------|
| Chapter 5.26. The Use of Information and Communication Technology for the Preservation of Aboriginal Culture: The Badimaya People of Western Australia / <i>Katina Michael and Leone Dunn</i> | 2652 |
| Chapter 5.27. ICT and the Orang Asli in Malaysia / <i>Pauline Hui Ying Ooi</i> | 2656 |
| Chapter 5.28. Information and Communication Technology and Economic Development in Malaysia / <i>Mohamed Aslam</i> | 2659 |
| Chapter 5.29. Urban Information Systems in Turkish Local Governments / <i>Koray Velibeyoglu</i> | 2673 |
| Chapter 5.30. Human Rights Movements and the Internet: From Local Contexts to Global Engagement / <i>John Lannon and Edward Halpin</i> | 2682 |
| Chapter 5.31. Learning IT: Where do Lectures Fit? / <i>Tanya McGill and Samantha Bax</i> | 2708 |
| Chapter 5.32. Information Technology Certification: A Student Perspective / <i>Tanya McGill and Michael Dixon</i> | 2718 |
| Chapter 5.33. The Effects of Human Factors on the Use of Web-Based Instruction / <i>Sherry Y. Chen</i> | 2728 |
| Chapter 5.34. Exploring the Rhetoric on Representing the User: Discourses on User Involvement in Academia and the IT Artifact Product Development Industry / <i>Netta Iivari</i> | 2741 |
| Chapter 5.35. E-Government Practices in Regional Context: Turkish Case / <i>Derya Altunbas and Elif Karakurt Tosun</i> | 2771 |
| Chapter 5.36. Information Security in Small Businesses / <i>Kishore Singh</i> | 2791 |
| Chapter 5.37. Impact of Organisational Intranets on Profitability in Organisations / <i>Udo Richard Averweg</i> | 2817 |
| Chapter 5.38. Training Sequences and their Effects on Task Performance and User Outcomes / <i>Clive Sanford and Anol Bhattacharjee</i> | 2845 |
| Chapter 5.39. CareerQuesting: Evaluating Web-Based Resources for Interesting Girls in STEM Careers / <i>Karen F. White and Mara H. Wasburn</i> | 2863 |
| Chapter 5.40. Feeling Welcome: Internet Tourism Marketing Across Cultures / <i>Wolfgang Georg Artl</i> | 2877 |
| Chapter 5.41. ICT and the Travel Industry: Opportunities and Challenges for New Zealand Travel Agents / <i>Vladimir Garkavenko and Simon Milne</i> | 2898 |

Section 6. Managerial Impact of Information Communication Technologies

This section presents contemporary coverage of the more formal implications of ICT, more specifically related to the corporate and managerial utilization of information sharing technologies and applications, and how these technologies can be facilitated within organizations. Core ideas such as IT-related training and continuing education as well as the efficiency and effectiveness of ICT in modern organizations are discussed throughout these chapters. Contributions within this section seek to answer the fundamental question of ICT implementation in organizations—how can particular technologies best be integrated into businesses and at what cost? Particular chapters provide methods for integrating ICT into the workforce and offer feedback from employees and employers regarding the future of ICT in the modern organizations.

| | |
|--|------|
| Chapter 6.1. Holistic Approach to Align ICT Capabilities with Business Integration / <i>Marc Rabaey, Herman Tromp, and Koenraad Vandenborre</i> | 2918 |
| Chapter 6.2. A Framework for Business Performance Management / <i>Marco van der Kooij</i> | 2933 |
| Chapter 6.3. Neural Data Mining System for Trust-Based Evaluation in Smart Organizations / <i>T. T. Wong</i> | 2950 |
| Chapter 6.4. E-Commerce and Small Tourism Firms / <i>Patrice Braun</i> | 2968 |
| Chapter 6.5. Towards Improved Business Planning Decision Support for Small-to-Medium Tourism Enterprise Operators / <i>G. Michael McGrath</i> | 2976 |
| Chapter 6.6. Investing in Online Privacy Policy for Small Business as Part of B2C Web Site Management: Issues and Challenges / <i>Geoff Erwin and Mike Moncrieff</i> | 2998 |
| Chapter 6.7. The Use of IT in Small Business: Efficiency and Effectiveness in South Africa / <i>Sam Lubbe</i> | 3007 |
| Chapter 6.8. Information Technology Investment Evaluation and Measurement Methodology: A Case Study and Action Research of the Dimensions and Measures of IT-Business-Value in Financial Institutions / <i>Johan Nel</i> | 3021 |
| Chapter 6.9. Examining the Approach Used for Information Technology Investment Decisions by Practitioners Responsible for IT Planning in Namibia / <i>Karna Naidoo</i> | 3036 |
| Chapter 6.10. A Case Study on the Selection and Evaluation of Software for an Internet Organisation / <i>Pieter van Staaden</i> | 3042 |
| Chapter 6.11. Managing Socio-Technical Integration in Iterative Information System Development Projects / <i>Bendik Bygstad</i> | 3057 |
| Chapter 6.12. Several Simple Shared Stable Decision Premises for Technochange / <i>Richard Diamond</i> | 3072 |

| | |
|--|------|
| Chapter 6.13. Integrating Real Option and Dynamic Capability Theories of Firm Boundaries: The Logic of Early Acquisition in the ICT Industry / <i>Alfred G. Warner and James F. Fairbank</i> | 3083 |
| Chapter 6.14. IT Training as a Strategy for Business Productivity in Developing Countries / <i>Shirish C. Srivastava and Thompson S. H. Teo</i> | 3101 |
| Chapter 6.15. Action Research Methods / <i>Patrice Braun</i> | 3112 |
| Chapter 6.16. The Impact of IT Investment in South African E-Commerce SME Organizations / <i>Sam Lubbe</i> | 3119 |
| Chapter 6.17. Organizational Performance and IT Investment Intensity of South African Companies / <i>Johan Nel</i> | 3129 |
| Chapter 6.18. Government Procurement ICT's Impact on the Sustainability of SMEs and Regional Communities / <i>Peter Demediuk</i> | 3137 |
| Chapter 6.19. Women Entrepreneurs in Finnish ICT Industry / <i>Tarja Pietiläinen, Hanna Lehtimäki, and Heidi Keso</i> | 3142 |
| Chapter 6.20. Directing Equal Pay in the UK ICT Labour Market / <i>Claire Keogh, Angela Tattersall, and Helen Richardson</i> | 3150 |
| Chapter 6.21. MNE Knowledge Management Across Borders and ICT / <i>Jürgen Kai-Uwe Brock and Yu Josephine Zhou</i> | 3158 |
| Chapter 6.22. Is Organizational e-Democracy Inevitable? The Impact of Information Technologies on Communication Effectiveness / <i>Bernadette M. Watson, Gavin M. Schwarz, and Elizabeth Jones</i> | 3171 |
| Chapter 6.23. The Role of Information and Communication Technology in Managing Cultural Diversity in the Modern Workforce: Challenges and Issues / <i>Indrawat Nataatmadja and Laurel Evelyn Dyson</i> | 3190 |

Volume VI

| | |
|---|------|
| Chapter 6.24. Creating an Entrepreneurial Mindset: Getting the Process Right for Information and Communication Technology Students / <i>Briga Hynes and Ita Richardson</i> | 3207 |
| Chapter 6.25. Working at Home: Negotiating Space and Place / <i>Tracy L. M. Kennedy</i> | 3229 |
| Chapter 6.26. Writing-Across-the-IT/MIS Curriculum / <i>Stephanie J. Etter and Jeffrey W. Merhout</i> | 3246 |

| | |
|---|------|
| Chapter 6.27. Management of Telecommunications Services: A Vital New Content Area and a Course Model for the College of Business / <i>Faye P. Teer, Young B. Choi, and Harold B. Teer</i> | 3259 |
|---|------|

Section 7. Critical Issues in Information Communication Technologies

This section addresses conceptual issues related to the field of ICT, such as the existence of a gender barrier and the potential of ICT for realizing social justice. Within these chapters, the reader is presented with an in-depth analysis of the most current and relevant conceptual inquiries within this growing field of study. Particular chapters address attitudes toward ICT in high schools, international ICT spillover, and ICT literacy among members of society. Overall, contributions within this section ask unique and often controversial questions related to ICT study and, more often than not, conclude that solutions are both numerous and contradictory.

| | |
|--|------|
| Chapter 7.1. ICT, Work Organisations, and Society / <i>Gunilla Bradley</i> | 3273 |
| Chapter 7.2. A Time Series Analysis of International ICT Spillover / <i>Juan Juan Zhang and Sang-Yong Tom Lee</i> | 3285 |
| Chapter 7.3. From Information Society to Global Village of Wisdom? The Role of ICT in Realizing Social Justice in the Developing World / <i>Sirkku Kristina Hellsten</i> | 3299 |
| Chapter 7.4. What Kinds of Organisations do We Want to Build in Africa with Information Communication Technology? / <i>Rembrandt Klopper</i> | 3322 |
| Chapter 7.5. Computing and ICT Literacy: From Students' Misconceptions and Mental Schemes to the Monitoring of the Teaching-Learning Process / <i>Antonio Cartelli</i> | 3338 |
| Chapter 7.6. ICT in Schools: What is of Educational Value? / <i>Aidan Mulkeen</i> | 3348 |
| Chapter 7.7. ICT, Knowledge Construction, and Evolution: Subject, Community, and Society / <i>Antonio Cartelli</i> | 3368 |
| Chapter 7.8. Attitudes Towards ICT in Australian High Schools / <i>Kaylene Clayton</i> | 3384 |
| Chapter 7.9. A Comparative Analysis of Online and Traditional Undergraduate Business Law Classes / <i>Daniel J. Shelley, Louis B. Swartz, and Michele T. Cole</i> | 3391 |
| Chapter 7.10. Concerns with "Mutual Constitution": A Critical Realist Commentary / <i>Alistair Mutch</i> | 3405 |
| Chapter 7.11. Emotional Digitalization as Technology of the Postmodern: A Reflexive Examination from the View of the Industry / <i>Claus Hohmann</i> | 3417 |
| Chapter 7.12. Optimality-Theoretic Lexical Mapping Theory: A Case Study of Locative Inversion / <i>One-Soon Her</i> | 3428 |

| | |
|---|------|
| Chapter 7.13. Trusting Computers Through Trusting Humans: Software Verification in a Safety-Critical Information System / <i>Alison Adam and Paul Spedding</i> | 3460 |
| Chapter 7.14. Propagating the Ideal: The Mobile Communication Paradox / <i>Imar de Vries</i> | 3475 |
| Chapter 7.15. A De-Construction of Wireless Device Usage / <i>Mary R. Lind</i> | 3489 |
| Chapter 7.16. Virtual Networking without a Backpack? Resource Consumption of Information Technologies / <i>Justus von Geibler, Michael Kuhndt, and Volker Türk</i> | 3500 |
| Chapter 7.17. Cultural Factors and Collective Identity of Women in ICT / <i>Phyl Webb and Judy Young</i> | 3514 |
| Chapter 7.18. A Cultural Studies Approach to Gender and ICT / <i>Merete Lie</i> | 3522 |
| Chapter 7.19. Who's Talking Online? A Descriptive Analysis of Gender & Online Communication / <i>Taralynn Hartsell</i> | 3529 |
| Chapter 7.20. Who's Talking Online II: Revisiting Gender and Online Communications / <i>Taralynn Hartsell</i> | 3540 |
| Chapter 7.21. Cultivating Greater Acceptance of Women in Technology: A Pilot Study / <i>Mara H. Wasburn</i> | 3552 |
| Chapter 7.22. Are Cross-Gender Conversations in Threaded Discussions Reminiscent of Communicating Across Cultural Boundaries? / <i>David Gefen, Nitza Geri, and Narasimha Paravastu</i> | 3566 |
| Chapter 7.23. The Paleolithic Stone Age Effect? Gender Differences Performing Specific Computer-Generated Spatial Tasks / <i>Geoffrey S. Hubona and Gregory W. Shirah</i> | 3578 |

Section 8. Emerging Trends in Information Communication Technologies

This section highlights research potential within the field of ICT while exploring uncharted areas of study for the advancement of the discipline. Introducing this section are chapters that set the stage for future research directions and topical suggestions for continued debate. Discussions exploring RFID, virtual religion in the 21st century, and new ICTs for conflict management provide insight into forthcoming issues in ICT study. Authors within this section look past the digital divide to a time when ICT is ubiquitous and divisions no longer exist. These contributions, which conclude this exhaustive, multi-volume set provide emerging trends and suggestions for future research within this rapidly expanding discipline.

| | |
|---|------|
| Chapter 8.1. Bringing on the Next Billion Online: Cooperative Strategies to Create Internet Demand in Emerging Markets / <i>Karen Coppock</i> | 3603 |
| Chapter 8.2. ICT and the Efficient Markets Hypothesis / <i>Andrea J. A. Roofe</i> | 3623 |

| | |
|--|------|
| Chapter 8.3. Creating Competitive Advantage: The Emergence of a New Business through Collaborative Networks—An Empirical Case Study in the ICT Sector / <i>Arla Juntunen</i> | 3634 |
| Chapter 8.4. Enabling the Expansion of Microfinance Using Information and Communication Technologies / <i>Narima Amin</i> | 3658 |
| Chapter 8.5. Management of New Genetic Knowledge for Economic and Regional Development of Ethnic Minorities in China / <i>Jan-Eerik Leppanen</i> | 3681 |
| Chapter 8.6. Visualizing ICT Change in the Academy / <i>Gale Parchoma</i> | 3695 |
| Chapter 8.7. Perspectives on 21st Century E-Learning in Higher Education / <i>Lalita Rajasingham</i> | 3716 |
| Chapter 8.8. RFID: New Technology on the Horizon for IT Majors / <i>Eric Puffenbarger, Faye P. Teer, and S. E. Kruck</i> | 3730 |
| Chapter 8.9. Games and Advertisement: Beyond Banners and Billboards / <i>David B. Nieborg</i> | 3744 |
| Chapter 8.10. Believe It or Not: Virtual Religion in the 21st Century / <i>Susan E. George</i> | 3759 |
| Chapter 8.11. Changing Technological Trends in the Travel Behaviour of Older Tourists / <i>Ian Patterson</i> | 3768 |
| Chapter 8.12. New ICTs for Conflict Prevention and Management / <i>Ángela-Jo Medina</i> | 3784 |
| Chapter 8.13. Crossing the Digital Divide and Putting ICT to Work to Improve People’s Lives / <i>Teresa Peters</i> | 3804 |
| Chapter 8.14. Creative London? Investigating New Modalities of Work in the Cultural Industries / <i>David Lee</i> | 3807 |
| Chapter 8.15. Information-Communications Systems Convergence Paradigm: Invisible E-Culture and E-Technologies / <i>Fjodor Ruzic</i> | 3820 |

Preface

The development, advancement, and implementation of Information Communication Technologies (ICT) within today's ever-changing society profoundly impacts the way we lead our lives. With its rapid growth and continual evolution, this field has provided the impetus for economic innovation, cultural revolution, and social reform. Consequently, the effects of these pervasive technologies present both a challenge and an opportunity for researchers, educators, and students worldwide.

As applications of ICT have grown in both number and popularity, researchers and educators have devised a variety of techniques, methodologies, and measurement tools to develop, deliver, and, at the same time, evaluate the effectiveness of their use. The explosion of these methodologies in this new field of ICT study has created an abundance of new, state-of-the-art literature related to all aspects of this expanding discipline. This body of work allows researchers to learn about the fundamental theories, latest discoveries, and forthcoming trends in the field of ICT.

Constant technological innovation challenges researchers in ICT to stay abreast of and continue to develop and deliver methodologies and techniques utilizing the latest advancements in ICT. In order to provide the most comprehensive, in-depth, and current coverage of all topics related to ICT and its application, as well as to offer a single reference source on all conceptual, methodological, technical, and managerial issues, *Information Science Reference* is pleased to offer a six-volume reference collection on this rapidly growing discipline. This collection aims to empower researchers, students, and practitioners by facilitating their comprehensive understanding of the most critical areas within this field of study.

This collection, entitled ***Information Communication Technologies: Concepts, Methodologies, Tools, and Applications*** is organized in eight distinct sections, which are as follows: (1) Fundamental Concepts and Theories; (2) Development and Design Methodologies; (3) Tools and Technologies; (4) Utilization and Application; (5) Organizational and Social Implications; (6) Managerial Impact; (7) Critical Issues; and (8) Emerging Trends. The following paragraphs provide a summary of what is covered in each section of this multi-volume reference collection.

Section One, ***Fundamental Concepts and Theories***, serves as a foundation for this exhaustive reference tool by addressing crucial theories essential to the understanding of ICT. Chapters such as "An Overview on Strategic ICT Implementations Toward Developing Knowledge Societies" by Hakikur Rahman and "ICT and Business in the New Economy: Globalization and Attitudes Towards eCommerce" by John Sagi, Elias Carayannis, and Subhashish Dasgupta, provide an excellent framework for discussing the fundamental relationship between ICT and societal growth. Sadayoshi Takaya's, "The Evolution of ICT, Economic Development, and the Digitally-Divided Society" offers insight into some of the critical issues resulting from ICT development, which include the emergence of a digital divide and the social, political, and economic impact this may have. Another chapter, "Between Tradition and Innovation in ICT and Teaching" by Antonio Cartelli, addresses how ICT has changed the face of modern education. The contributions within this foundational section enable readers to learn from expert research on the elemental theories underscoring the discipline of ICT.

Section Two, *Development and Design Methodologies*, contains in-depth coverage of conceptual architectures and frameworks, providing the reader with a comprehensive understanding of emerging technological developments within the field of ICT. “Connecting the First Mile: A Best Practice Framework for ICT-Based Knowledge Sharing Initiatives” by Surmaya Talyarkhan, David J. Grimshaw, and Lucky Lowe offers a method for introducing knowledge sharing in developing countries through ICT. Rosa Borge’s contribution, “An Explanatory Approach to the Political Uses of ICT Initiatives for Participation,” demonstrates that ICT also extends into the political sphere, since politicians use ICT to bridge the gap between themselves and the voting public. From basic designs to abstract development, chapters such as “Developing Regional Tourism Using Information Communications Technology” by Dean Carson and “Peering into the Black Box: A Holistic Framework for Innovating at the Intersection of ICT & Health” by Ben Bellow, Aman Bhandar, and Mahad Ibrahim serve to expand the reaches of development and design technologies within the field of ICT.

Section Three, *Tools and Technologies*, presents extensive coverage of various tools and technologies available in the field of ICT that researchers, educators, and professionals alike use to streamline and enhance their daily tasks. Chapters such as “Internet: A Right to Use and Access Information, or a Utopia?” by Inban Naicker and “Radio for Social Development” by Patrick Craddock and Peggy Duncan emphasize the widespread impact that particular technologies have upon entire communities. Similarly, contributions such as “Innovations in Wireless Technologies” by Diego Ragazzi and “Satellite Technology in Schools” by Anneleen Cosemans provide overviews of revolutions in ICT while also discussing the potential effects of these technologies. These rigorously researched chapters provide insight into the tools and technologies that ICT has spawned and how these tools and technologies are incorporated into education, business, and society at large.

Section Four, *Utilization and Application*, provides an in-depth investigation into the ways in which ICT has been adopted and implemented in society. This section includes contributions such as “Formation of a Knowledge-Based Society through Utilization of Information Networking” by Hakikur Rahman, which explains how ICT can empower and enable developing communities. Conversely, Kennedy D. Gunawardana’s “Potential Challenges of ICT Implementations in Sri Lanka” reveals possible barriers to ICT utilization and application. ICT’s application to other diverse fields is mentioned in chapters such as “Implementation of a Health Information Systems Programme” by Zubeeda Banu Quraishy and “Virtual Reality Applications in Tourism” by Călin Gurău. Research in this section provides excellent coverage of today’s global community and demonstrates how ICT impacts the social, economic, and political fabric of our present-day global village.

Section Five, *Organizational and Social Implications*, includes a wide range of research pertaining to the cultural and organizational impact of ICT around the world. Introducing this section is Matthew Mitchell’s “Convergence of ICT and Culture,” which analyzes the impact that ICT utilization and development has upon culture. Additional chapters included in this section, such as “Mind the Gap!: New ‘Literacies’ Create New Divides” by Andrew D. Madden, J. Miguel Baptista Nunes, and M. A. McPherson, emphasize one of the most contested issues regarding access to technology—the digital divide. This unique problem, in which a veritable wall between the technology “haves” and “have nots” is constructed, is also examined in “Digital Opportunities, Equity, and Poverty in Latin America” by Simone Cecchini, as well as in Pattarasinee Bhattarakosol’s contribution, “Interactions among Thai Culture, ICT, and IT Ethics.” The discussions presented in this section offer insight into the integration of technology in society regardless of socioeconomic status—arguably the most important social and organizational barrier that this field of study has yet to overcome.

Section Six, *Managerial Impact*, presents contemporary coverage of the social implications of ICT, which are, more specifically, related to the corporate and managerial utilization of ICT within organiza-

tions. Core ideas such as integration, training, and potential strategies for increasing the effectiveness of modern organizations are discussed in this collection. “A Framework for Business Performance Management,” by Marco van der Kooij emphasizes ICT’s role in fostering successful predictions about the future of a business. Equally essential to this examination of managerial impact is evaluating the effectiveness of already-implemented ICT programs, which is examined at length in chapters such as “The Use of IT in Small Business: Efficiency and Effectiveness in South Africa” by Sam Lubbe. A contribution by Indrawat Nataatmadja and Laurel Evelyn Dyson, “The Role of Information and Communication Technology in Managing Cultural Diversity in the Modern Workforce: Challenges and Issues” explores how managers can make the utilization of ICT in a culturally diverse workplace more successful. As a result of their research, the authors of this chapter conclude that since no individual ICT application works best in existing social and cultural contexts, managers must provide flexibility in their ICT integration.

Section Seven, *Critical Issues*, presents readers with an in-depth analysis of the most current and relevant issues within this growing field of study by addressing topics such as the existence of a gender barrier, social justice, and the relationship between technology and humanity. Sirkku Kristina Hellsten’s “From Information Society to Global Village of Wisdom? The Role of ICT in Realizing Social Justice in the Developing World” advocates the theory that ICT can, potentially, allow us to enhance our well-being, realize our capabilities, and, ultimately, promote better standards of living and social justice. Other chapters discuss the role of gender in ICT from a number of distinct angles. Within Taralynn Hartsell’s “Who’s Talking Online? A Descriptive Analysis of Gender & Online Communication” and the successive publication “Who’s Talking Online II: Revisiting Gender and Online Communications,” the difference between men and women’s online communication styles is illustrated and analyzed, while in “Cultivating Greater Acceptance of Women in Technology: A Pilot Study,” author Mara H. Wasburn attempts to account for the shortage of women pursuing careers in ICT, as well as devise strategies for attracting more women to the field.

The concluding section of this authoritative reference tool, *Emerging Trends*, highlights research potential within the field of ICT while exploring uncharted areas of study for the advancement of the discipline. New trends in ICT implementation discussed in this section include virtual religion, which is defined in “Believe It or Not: Virtual Religion in the 21st Century” by Susan E. George, the use of RFID technology, which is considered in “RFID: New Technology on the Horizon for its Majors” by Eric Puffenbarger, Faye P. Teer, and S. E. Kruck and the use of ICT in managing and preventing conflict, which is examined in “New ICTs for Conflict Prevention and Management” by Ángela-Jo Medina. Other topics, such as ICT’s future role in education, are envisioned in selections such as Gale Parchoma’s “Visualizing ICT Change in the Academy” and “Perspectives on 21st Century E-Learning in Higher Education” by Lalita Rajasingham. The future trends and research examined in this final section demonstrate that the always-changing field of ICT promises to transform every aspect of our technological lives.

Although the contents of this multi-volume book are organized within the preceding eight sections, which offer a progression of coverage of the important concepts, methodologies, technologies, applications, social issues, and emerging trends, the reader can also identify specific contents by utilizing the extensive indexing system listed at the end of each volume. Furthermore, to ensure that the scholar, researcher, and educator have access to the entire contents of this multi-volume set, as well as additional coverage that could not be included in the print version of this publication, the publisher will provide unlimited, multi-user electronic access to the online aggregated database of this collection for the life of the edition, free of charge when a library purchases a print copy. In addition to providing content not included within the print version, this aggregated database is also continually updated to ensure that the most current research is available to those interested in ICT.

The diverse and comprehensive coverage of ICT in this six-volume, authoritative publication will contribute to a better understanding of all topics, research, and discoveries in this developing, significant field of study. Furthermore, the contributions included in this multi-volume collection series will be instrumental in the expansion of the body of knowledge in this enormous field, resulting in a greater understanding of the fundamentals while also fueling the research initiatives in emerging fields. We at *Information Science Reference*, along with the editor of this collection, hope that this multi-volume collection will become instrumental in the expansion of the discipline and will promote the continued growth of ICT.

Introductory Chapter

A Brief Introduction to the Field of Information Communication Technologies

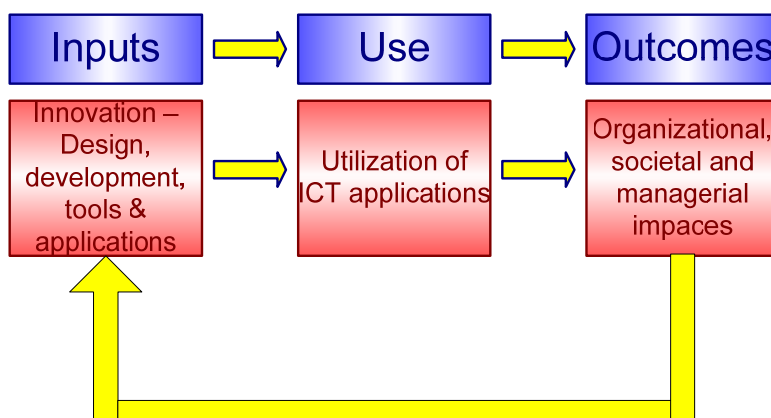
Craig Van Slyke
University of Central Florida, USA

INTRODUCTION

Information and communication technologies (ICT) have evolved from back-office, workhorse devices to become central to our daily work and personal lives. ICT research has evolved along with the technologies. ICT research now involves on personal, organizational, societal and economic topics and utilizes theories from a wide range of research traditions. In this chapter, we try to give a sense of the breadth of ICT research by providing a broad overview of many of the topics covered throughout the six-volume reference set. To do this, we discuss a variety of topics related to the creation, use and impacts of ICT.

This chapter is organized around a concise, yet useful framework, which is shown in Figure 1. After discussing some core concepts and theories, the chapter follows a flow model that originates with activities centered on innovation—the creation of new information technologies and the modification of extant ICTs. These innovations, in essence, provide the “inputs” into the system of ICT concepts. The discussion of innovations or inputs is broken down into two areas. Development and design methods

Figure 1. Organizing framework



pertain to the methods and theories related to the creation of new ICT. This topic is taken rather broadly to include such subjects as end-user development, and community development. The second area under the innovation/inputs area concerns the tools and applications themselves. Applications such as enterprise systems, supply chain management, and social computing are discussed.

After discussing innovations and inputs, we turn attention to the utilization of the innovations discussed previously. The focus here is on issues related to how and why individuals and organizations use ICT. These are fundamental questions for without use, there can be no outcomes, which brings us to the third component of our framework—outcomes of ICT use.

Outcomes are discussed at three levels, societal impacts, organizational impacts, and managerial impacts. Subsumed within the societal impacts are impacts on the individual. ICT have had and continue to have substantial impacts on all levels of society. Topics such as globalization, e-government, and environmental impacts are among the organizational and societal impacts discussed. ICT also impact how leaders manage their organizations and workers. Topics include outsourcing (and the reverse, back-sourcing), and managing a global workforce. After discussing outcomes, we describe a number of critical issues and emerging trends that are important to ICT research.

FUNDAMENTAL CONCEPTS AND THEORIES

ICT research has used a vast array of theories, borrowing from reference disciplines ranging from sociology to computer science. As might be expected, the theory applied relies on the level of analysis and research questions being pursued. Psychology and sociology-based theories seem to dominate individual-level studies, although communication and economic theories are also widely used. In this section, we provide a brief discussion of some of the more widely used theories, and describe their core concepts and how they have been applied to ICT research. This list is not intended to be exhaustive, but rather is meant to provide a sense of the range of theories used in ICT research. Table # lists the theories introduced in this section and provides key references for each.

Table 1. Fundamental theories

| Theory | Focus | Key References |
|-----------------------------|---|--------------------------|
| Technology acceptance model | Individual behavior | Davis, 1989 |
| Theory of reasoned action | Individual behavior | Fishbein & Ajzen, 1975 |
| Diffusion of innovation | Individual behavior, social interaction | Rogers, 1995 |
| Task-technology fit | Individual behavior | Goodhue & Thompson, 1995 |
| Social cognitive theory | Social interaction | Bandura, 1986 |
| Social exchange theory | Social interaction | Homans, 1958 |
| Social identity theory | Social interaction | Tajfel & Turner, 1986 |
| Social network theory | Social interaction | Granovetter, 1973 |
| Actor-network theory | Social interaction | Latour, 1986 |
| Agency theory | Economic behavior | Eisenhardt, 1989 |
| System theory | General theory | Von Bertalanffy, 1962 |

The technology acceptance model (TAM) (Davis, 1989) is among the most widely-applied theories in ICT research. This theory posits that two beliefs, perceived usefulness and perceived ease of use, influence use intentions, which impact actual use. Attitude towards use is sometimes included as a mediating variable between the beliefs and intentions (e.g. Davis, Bagozzi & Warshaw, 1989), although most researchers omit attitudes. The theory of reasoned action (TRA) (Fishbein & Ajzen, 1975) is the theoretical foundation of TAM. TRA is a general model of human behavior, while TAM is an adaptation of TRA specifically intended for explaining and predicting use of ICT. TAM has generally enjoyed reasonable empirical support, although the significance of perceived ease of use is sometimes unsupported. TAM-based studies typically take one of two approaches, either applying TAM in a new context (such as electronic commerce), or adding new variables to TAM (such as trust).

Diffusion of innovation theory (Rogers, 1995) is also widely used in ICT research. Broadly speaking there have been two major ways in which this theory has been applied. The first way is similar to TAM in that these studies seek to understand factors that lead to the adoption or rejection of ICT-based innovations. These studies often use perceived innovation characteristics (or the perceived characteristics of innovating) as the main factors that influence adoption. Beliefs regarding these characteristics are expected to impact decisions to adopt or reject an innovation. Widely-studied beliefs include relative advantage, compatibility and complexity. Perceptions of result demonstrability, visibility, and trialability are also included in many studies of ICT adoption (e.g. Van Slyke, Lou & Day, 2002; Ilie, Van Slyke, Green & Lou, 2005; Plouffe, Hulland, & Vandenbosch, 2001). The second manner in which diffusion theory has been applied to ICT research concerns how the use of an innovation spreads throughout a social system (this is the definition of diffusion). These studies are not concerned with an individual user's or organization's adoption, but are instead concerned with how the use of the innovation spreads. Some studies within this category are focused on understanding what leads to adoption at various points along the diffusion curve.

The task-technology fit model is another approach to understanding individual use of ICT, although it is directed at understanding what leads to productive use of an ICT (although utilization is also a dependent variable in the model). Task-technology fit theory proposes that a technology is more likely to positively impact individual productivity if the characteristics of the technology fit the characteristics of the task (Goodhue & Thompson, 1995). In addition, the technology is more likely to be utilized when the task and technology fit well. Important task-technology fit dimensions include quality, locatability, authorization, compatibility, ease of use, timeliness, and reliability.

Theories of social interaction have also been important to ICT use. The use of ICT requires interaction between an individual and the ICT. People are fundamentally social creatures, so a complete understanding of ICT requires understanding the social aspects of ICT use. Researchers who are interested in this area often apply social theories in their studies. Examples include social-cognitive theory, social exchange theory, social identity theory and social network theory. (Other theories, such as diffusion theory, also include social components.) Social-cognitive theory (Bandura, 1986) seeks to explain human behavior through understanding how people, their behaviors, and their environments interact. Further, learning can occur through the process of observing others in the context of social interactions and personal experiences. Social-cognitive theory is closely linked to self-efficacy theory. Social exchange theory views social interactions as exchanges where the parties contribute on the expectation of gaining rewarding reactions from the other party in the exchange. People contribute to the relationship in order to gain through social reciprocity. In contrast, social identity theory posits that people gain "social identities" through their association with various groups. Some propose that social identity theory may be more applicable to the study of group-oriented ICT, such as knowledge management systems (Jarvenpaa & Staples, 2001). Social network theory views relationships in terms individuals and the connections

among them. In the view of social network theory, the connections among individuals are as important as characteristics of an individual (if not more important).

Another network-oriented theory is actor-network theory, which extends the idea of social networks to include non-human elements, such as ICT. Networks, therefore, contain both social and technical elements. Actor-network theory is concerned with how the networks come together (and fall apart), rather than why the network might exist.

Economic theories have also been widely applied to ICT research. For example, agency theory (Eisenhardt, 1989) has been applied to studies of outsourcing (as well as other areas) (e.g. Choudhury & Sabherwal, 2003). Agency theory is concerned with the principal-agent problem, which occurs under conditions of asymmetric and imperfect information when a principal hires an agent to act on the principal's behalf. The problem of asymmetric information is also important to trust-oriented studies because the asymmetric information leads to increased risk, which increases the importance of trust. Resource-oriented theories from economics have also been used in ICT research (e.g. Oh & Pensonneault, 2007).

The final fundamental theory we discuss is perhaps the most fundamental of all, general systems theory (Von Bertalanffy, 1962). The basic idea behind general systems theory is that one cannot understand an entity through the study of each component individually. Understanding an entity requires understanding how the various components fit together; one must understand the arrangements of and connections between the components that make up the whole. This basic concept is at the very core of ICT research, whether or not this is explicitly acknowledged. General systems theory is used to understand ICT and the environments in which they are applied. Further, it has spawned other important theories and approaches to understanding ICT, not the least of which is the concept of systems thinking. It may be time to return to our roots and take the ideas of systems theory more to heart. This is apparent from the growing interest in considering the role of context in ICT studies. Just as the components of a system interact with their environment (for open systems), so do ICT interact with the various elements that make up the context in which the ICT is used. This inescapable fact should be considered more explicitly in ICT research.

Clearly, there are many other important theories and concepts that have been used in ICT research. A complete discussion is beyond the scope of this section. However, we hope that our brief treatment provides some insights as to the breadth of theories that ICT researchers employ. Throughout the remainder of this chapter we will refer to these and other fundamental ICT theories.

INPUTS

In this section, we discuss the innovation or inputs phase of our framework. Here we are concerned with theories and research related to methods for designing and developing ICT, and with the tools and applications that result from design and development efforts. Development and design methods are included in this section because they provide the means by which ICT are created. The actual ICT that are created (the tools and applications) are also inputs in our framework because they are the artifacts that are employed in the next stage of our framework (use).

Development and Design Methods

Development and design methods form the basis for the creation of ICT applications. While a plethora of such methods exist, this section focuses on two fundamental areas, design science and end-user de-

velopment. Design science is a broad area that has been employed since the early days of ICT research. Such core concepts and methods as database design and modeling, the systems development life cycle, and decision support systems have all been profoundly impacted by design science. Further, there has been a recent resurgence in interest in the application of design science in ICT research (Gregor & Jones, 2007). End-user development is the other topic discussed in this section. As development tools become increasingly sophisticated and easy-to-use, it is likely that the prevalence of end-user development will increase. As a result, it becomes increasingly important to understand end-user development and its impacts.

Design Science

While ICT research seems dominated by behaviorally-oriented studies, there is also a need for research and theories related to the design and creation of ICT artifacts. Design science and design theories address take the latter approach to understanding ICT. Fundamentally, design science seeks to understand ICT by designing and building artifacts, which are applied to problems of interest (Hevner, March, Park and Ram, 2004). The newly-created artifact is also evaluated. Theory can be refined on the basis of application and evaluation. The term “artifact” should be taken in a rather broad sense; it does not imply that a computer program is written or new hardware is created. Artifacts may include constructs, models, methods and instantiations (Hevner et al., 2004). Behavioral science and design science are not at odds with one another. Design science may use theories and knowledge generated from behavioral science to inform the design and creation of artifacts. In addition, behavioral science studies may identify the problem space and environment to which the artifacts are applied.

Design science spawns and uses design theories. Design theories focus on how to do something; they are directed at design and action. This is in contrast to other classes of theories, which may be directed at analyzing, explaining and/or predicting (Gregor & Jones, 2007). Design theories may be directed at understanding or creating a methodology or a product. As Hevner et al. (2004) point out, design is both a noun and a verb. Design can refer to the artifact itself, or to a set of activities. Design theories may address three different phenomena: instantiations (physical artifacts or a set of actions with physical existence), (2) theories or artificial artifacts (artifacts without a physical existence, and (3) human understanding of artifacts (Gregor & Jones, 2007). At a minimum specifying a design theory requires addressing five areas, (1) purpose and scope, (2) constructs of interest, (3) principles of form and function, (4) artifact mutability, and (5) testable propositions. Full specification should also include principles of implementation and expository instantiation (Gregor & Jones, 2007).

There seems to be an ongoing debate as to the relevance of design science as an appropriate paradigm for the study of ICT. Recently, strong arguments have been made in favor of design science (e.g. Hevner et al., 2004; Ball, 2001). Ball (2001), using Whetten’s (1989) definition of contributions of theory, demonstrates how design science research can satisfy all of Whetten’s criteria for “contributions of theory.” For example, design science satisfies the “what” requirement of contributions of theory by studying the effects that the artifact has on other elements in the environment in which the artifact is implemented. Using the example of e-commerce research, Ball (2001) provides several example of how design science could be used to build theories related to e-commerce research.

Information systems design science has made contributions to ICT research and practice. One excellent example of such a contribution is the system development life cycle (SDLC) (Gregor & Jones, 2007). While many SDLC variations exist, the concept of an SDLC can be considered the object of a design theory; this is an example of a methods artifact. Other examples of how design science has been applied to ICT research include decision support systems (DSS), research, the entity-relationship model, executive information systems and group support systems (Hevner et al., 2004).

Usability research represents an interesting application of design science. Design science can be used to develop methods for including usability into current design and development methodologies or for developing new methods for evaluating usability. For example, Zhang Cary, Te-eni, Termaine, 2005) propose a method for integrating usability into the modern SDLC. Such an integration may help fill the gap between systems that satisfy organizational needs and systems that are satisfying to individual users. Design science can be used to test the actual ICT developed using these methods. Given the increasingly central nature of ICT in our lives, enhancing usability is of critical importance. Design science holds considerable promise for helping ICT researchers and practitioners better understand how to improve ICT usability.

The further emergence of design science and the development of design theories holds considerable promise for extending our knowledge of development and design methods. Existing methods can be extended, and new methods can be created. Because the world of ICT is constantly changing, we frequently need new methods and tools for creating and applying ICT. Studies that utilize design science methods are particularly useful for addressing these needs.

End-User Development

Over time, application development tools and environments have become increasingly sophisticated. End users have also become increasingly knowledgeable. Software publishers have, at the same time, begun to offer software that allows for increasing amounts of customization (Hansen-Asand & Morch, 2006). The confluence of these events brought about a growing tendency for end users to engage in activities that were once the purview of dedicated application developers. This trend towards end user development raises a number of interesting theoretical and practical issues. Interestingly, some of these same issues were studied in the earlier days of ICT research in the context of spreadsheet development.

There is a continuum of actors in software development and use, ranging from “regular users” who do not engage in any customization or other tailoring of a system, through “local developers” who have more computer and development skills than even super-users, to professional developers (Hansen-Asand & Morch, 2006). This range of actors leads to opportunities to apply a variety of social theories to understand the motivations of the various parties involved. For example, Hansen-Asand and Morch (2006) applied activity theory to the study of end user application development in a Scandinavian accounting firm. Their findings revealed interesting insights into the roles played by the various actors.

A major area of interest concerns the risks associated with end-user development. These risks range from a lack of accuracy (in part, due to a lack of proper testing), to failure to properly back up data (McGill & Klisc, 2006). A particularly interesting aspect of this research concerns the IT auditing implications of end-user development. Verifying that systems analysis and development methodologies are sound and are followed is one aspect of IS assurance. End user development is often undisciplined and ad hoc; in such cases an organization’s prescribed methodologies are unlikely to be followed. Even the existence of end user-developed systems may be difficult for auditors to uncover. Reports of covert end user development projects are not unheard of (Ferneley, 2007). This leads to a number of questions that are interesting from both theoretical and practical perspectives. For example, can methods be developed for uncovering the existence of such systems? It might also be interesting to develop theoretically-sound interventions for helping end users understand the need to follow the organization’s methodologies. In a similar vein, developing methodologies specifically intended for less formal end user development may be in order. An example of such a methodology comes from Costabile Fogli, Lanzilotti & Mussio (2006) who developed a methodology specifically intended for end-user development. In developing this methodology, Constabile et al. (2006) considered the fact that end users are the ones who possess domain knowledge; or as they put it are “owners of the problem.”

TOOLS AND APPLICATIONS

Given the pervasiveness of ICT, it is not surprising that many interesting and important ICT-based tools and applications have emerged. These applications range from enterprise systems to socially-oriented ICT. In this section, we examine a number of these applications and discuss the theories that have been used in related research. Of course there are many tools and applications that could be discussed here. We focus on several that we believe will have a growing impact. Specifically, we discuss knowledge management systems, open source software, health care ICT and education-oriented applications. Admittedly, the choice of these particular tools and applications is based primarily on personal interest, but we believe that they demonstrate the breadth of tools and applications that utilize ICT.

Knowledge Management Systems

Knowledge is a critical organizational and societal resource, so the management of knowledge continues to be an area of interest to researchers and practitioners. While organizations have always been engaged in managing knowledge, the application of ICT to knowledge management brings some interesting issues to light. Technology offers considerable promise in helping organizations manage knowledge. Thus, knowledge management systems have emerged as important applications of ICT.

To be complete, a knowledge management system must not simply be a repository for storing and retrieving knowledge-based resources. At a minimum, a comprehensive approach to knowledge management should include the following processes: knowledge creation, knowledge storage and retrieval, knowledge transfer, and knowledge application (Alavi and Leidner, 2001). ICT can be applied to all of these processes. For example, business intelligence tools, such as data warehouses and data mining applications can be used to uncover information that can be applied, thus becoming knowledge. Collaboration systems, such as groupware, and directories of experts may facilitate the storage and retrieval of knowledge, as can query and search technologies, databases, and other ICT (Alavi and Leidner, 2001; Smith & McKeen, 2003). Communication-oriented ICT, such as groupware, electronic mail and forums, help facilitate knowledge transfer.

Knowledge transfer is a particularly thorny issue that can only be partially addressed by ICT. Two parties must cooperate in order for knowledge transfer to occur. The knowledge creator (or possessor) must be willing and able to share the knowledge. The knowledge consumer must be willing to apply the shared knowledge. Typically, much of an organization's knowledge resides in and is controlled by individuals (Jarvenpaa and Staples, 2001). Because of this, sharing of knowledge is not influenced by organizational norms of ownership, but rather is driven by some sense of personal benefit. Motivating individuals to share knowledge, whether directly with another individual or through an ICT-based knowledge repository, requires understanding the gains and losses that might result from such sharing. These perceptions must then be manipulated so that the individual possessing the knowledge sees the gains of sharing as offsetting the potential losses of sharing. Successful knowledge management requires identifying incentives for and consequences of knowledge sharing (Massey, Montoya-Weiss & O'Driscoll, 2003); these must be considered from the perspective of the individual, not the organization as a whole.

While there are many benefits to knowledge management, potential losses also exist. Consider, for example, the issue of knowledge as a source of power. Possession of knowledge is a source of power within an organization, because knowledge is a scarce resource. Sharing that resource dilutes its scarcity and thus also dilutes the organizational power of the individual. In to induce sharing, the gain from sharing knowledge must be sufficient to offset the loss of power. Otherwise, individuals may hoard knowledge (Jarvenpaa and Staples, 2001). Social theories, such as social exchange theory and social

identity theory have been applied in attempts to gain an understanding of the social aspects of knowledge sharing (Jarvenpaa and Staples, 2001). The use of these theories serve as reminders that knowledge management can be assisted by ICT, but proper ICT alone is not adequate for ensuring the success of a knowledge management system.

OPEN SOURCE SOFTWARE

Although the concept of open source software goes back to the early days of computing, there has been a resurgence of interest in open source software following the success of open source applications such as Apache. In fact, there is so much interest in open source software that there are now references to the open source “movement” and a “sea change” in the migration to open source software on the server and the desktop (Hardaway, 2007). In this section we use the term “open source software” to refer to software that can be freely distributed and modified by anyone.

Open source software differs from commercial software in a number of important ways. First is the obvious difference in the initial cost of the software. Typically, there is some initial cost associated with acquiring commercial software; in contrast there are no acquisition costs for open source software. (It is worth noting that some claim that the total cost of ownership of open source software actually exceeds that of commercial software. While this is a matter of debate, it would be inaccurate to say that open source software has a total cost of ownership of zero.) Open source software also differs in how it is created and maintained. Typically the development of open source software is a community effort, as is the ongoing maintenance. This community is made up of volunteers, rather than paid employees of a software company. Finally, support for open source software often comes from the community of developers and users, rather than from the software publisher. However, in some cases commercial enterprises package (with drivers, etc.) and offer support for open source software. An example of this is Red Hat, which distributes and supports Linux.

There are four components to open source software, the license, the community, the development process and the software itself (AlMarzouq, Zheng & Grover, 2005). The community and the development process are of primary interest here. The community surrounding an open source software package consists of developers and users. Both are critical to the success of the software (Jin, Robey & Boudreau, 2007). These communities have several salient characteristics. First, they are typically made up of volunteers. In addition, the members of the community are dispersed both in terms of time and location. Because of this dispersion, members of the community typically use network-based collaborative tools, such as the Internet, forums and the like to interact.

Community members contribute for a variety of reasons. Some are motivated by a desire to see the open source movement succeed, while others contribute as a way to further their careers by demonstrating expertise. Different motivations may lead to different levels of participation. Those driven by career concerns tend to exhibit low levels of participation, while those motivated by a desire to integrate their own code into the products source code tend to have higher levels of participation (Shah, 2006). Interestingly, enjoyment seeking tends to lead to quite high levels of involvement (Shah, 2006). This is not completely surprising; prior research indicates that both cognitive and affective factors motivate membership and involvement in virtual communities (Gupta & Kim, 2007).

The structure of an open source development community has been compared to an onion; with core developers at the center and passive users at the outermost layer. Core developers contribute most of the code (both in terms of original creation and ongoing maintenance). Co-developers report bugs and request feature. They may also contribute code and bug fixes from time to time. Active users also report

bugs and request new features, but do not contribute code. They may assist other users in community forums. Passive users are the “freeloaders” of the community, making little or no contribution (AlMarzoug et al., 2005).

One interesting area of future research is to apply design theories and design science methods to the context of open source. Extant theories could be tested in open source communities, then modified if necessary. This could lead to interesting insights and enhancements to our current theory base.

HEALTH CARE ICT

The use of ICT in health care represents a critical application area. While diagnostic ICT tools, such as MRI machines represent cutting-edge ICT applications, the use of ICT tools for records management and other administrative uses lags other industries. Some have gone so far as to claim that the use of ICT in the health care industry is a decade behind other industries (Burke & Menachemi, 2004). Applications such as electronic medical records (EMR) and computerized physician order entry (CPOE) hold considerable potential for improving both the efficiency and quality of health care. Unfortunately, relatively few hospitals are taking full advantage of these ICT.

EMR systems have multiple benefits to the practice of health care. These ICT provide an integrated, structured approach to the management of patient data. They also provide ready access to up-to-the-minute data, as opposed to paper charts, which often take hours to update with new lab test results and the like. EMR systems also provide a single point of access for all patient data, which may help reduce medical errors. Potential efficiency gains are also a major benefit of EMR; the United States Department of Health and Human Services estimates that the use of ICT in health care has the potential to cut health care costs by as much as 10%, which is a staggering sum considering the amount of money consumed by health care costs.

There are many ways in which ICT can be applied to health care. Records-oriented systems such as EMR systems are directed at improving the organization of and access to medical records. Taken a step further, COPE systems add decision support and knowledge management functions to help health care professionals with diagnostic decision making. Telemedicine systems are directed at accessing health-related information and expertise at a distance. For example, a Peruvian telemedicine system allows remote access of medical knowledge, and consultation with non-co-located specialists, among other functions (Miscione, 2007). Public health information systems make health-related information available to the general population. These systems target consumers rather than providers; the focus is on prevention, not treatment (LeRouge and Niederman, 2006).

Various theories have been applied to the study of health care-related ICT, which is not surprising given the vast array of health care ICT applications. Health care has been studied at various levels of analysis, including country-level, organizational level, and individual level. Interestingly, the individual-level studies investigate impacts on various health care professionals (such as doctors and nurses) as well as patients.

Theories of behavior seem to dominate individual-level studies. For example, Hennington and Janz (2007) used the Universal Theory of Acceptance and Use of Technology (Venkatesh et al., 2003) to study physician adoption of EMR. More general behavioral theories have also been used. The theory of planned behavior (TPB) was used in an empirical investigation of medical residents’ adoption and use of EMR (Ilie et al., 2007). More studies are needed in this area, especially those directed at understanding the use of ICT to support physicians’ clinical decision making.

Institutional, economic and diffusion-oriented theories may be more appropriate for the study of organization- and country-level studies. Institutional theory would be helpful in understanding the various

pressures that impact organizational health care ICT adoption. Using this theoretical foundation allows health care ICT researchers to better understand how the nuances of the health care industry impact ICT use by hospitals and other health care institutions.

Country-based studies of health care ICT can take different focuses, depending on whether the interest is on governmental efforts to promote health care ICT or how these ICT impact local health care practices. A good example of the latter comes from Miscione's (2007) study of the introduction of telemedicine in the upper Amazon area of Peru. This study used new institutional theory as the lens through which to examine the interplay between telemedicine and local, traditional health care practices. (New institutional theory focuses on what actors in an arena consider to be normal, and on the various constraints on human activity.)

Although the bulk of the research into health care ICT is performed in the context of developed countries, there is a growing need to better understand these applications in the context of developing countries. Many of these countries face challenges that are not found in the developed world. In many cases, the technological and social infrastructures taken for granted in developed countries are not present in the developing world. Even the stable availability of electricity is not a given in many less developed countries. Interestingly, it may be necessary to alter our theories when doing research in less developed countries. Most of our theories were created and refined in the context of developed countries. It is not clear whether these theories hold when studying ICT in the developing world.

EDUCATION-ORIENTED APPLICATIONS

The application of ICT to education is an area of growing importance. Since the early days of the personal computer, educators and technologists alike have touted the potential of ICT to revolutionize education. There are a number of ways in which ICT can be applied to education. One of the most popular education-oriented ICT applications is in technology-mediated learning. An important subtype of technology-mediated learning, distance education, is an area of particular interest to researchers and practitioners. Distance education is growing at a rapid pace; both educational institutions and non-education organizations are increasingly turning to ICT-based distance learning as a way to improve the efficiency and/or effectiveness of education.

As is the case with electronic commerce, ICT can be applied to education to extend reach. Universities can use Web-based systems to deliver courses to individuals who are outside the immediate geographic vicinity of the institution. ICT can also be used to provide education to individuals who find it inconvenient or impractical to attend traditional class sessions. Distance learning technologies can be used to deliver either synchronous or asynchronous learning. Synchronous distance learning is similar to teleconferencing in that the teacher and learner are not co-located, but are online at the same time. Asynchronous distance learning does not have this requirement, but rather allows the learner to access course materials at any time s/he finds convenient.

Despite the many advantages of distance learning, there are a number of challenges both pedagogically and institutionally. Cost and funding concerns are among the many challenges educational institutions face when implementing distance learning. Other challenges include adapting to market changes and new types of students, and providing an adequate infrastructure (Folkers, 2005). Pedagogical concerns also arise when implementing ICT-based distance learning. Teaching online is very different from teaching face-to-face. The absence of visual cues, loss of control over the learning environment, and learning how to interact with students online are only a few of the challenges faced by instructors who teach distance learning courses. Students also face challenges when learning online. A much higher degree

of self-regulation is required in online courses. Gone is the imposed discipline of a regularly-scheduled class meeting. Some students may have weak ICT skills, which can hinder online learning.

In order for distance learning to be successful, there must be a proper fit among the institution, course, instructor and student. If any one of these elements does not fit, success is unlikely (Van Slyke, Belanger & Kittner, 1998). Theory can help us understand how various elements must come together in order for distance learning to be successful. For example, the task-technology fit model has been applied to distance learning (Van Slyke, et al., 1998). Studies of individual elements may use a variety of theories. For example, studies of student or instructor adoption may appropriately use theories of individual behavior, while organizational-level studies may find institutional and economic theories more applicable.

One particularly interesting area related to distance learning borrows from theories surrounding object-oriented programming languages. The basic concepts and theories from object-oriented programming have been adapted to develop the concept of reusable learning objects. Reusable learning objects are learning modules that are designed so they can be redeployed in different contexts. This is similar to the way in which a C++ object can be reused in multiple applications. These modules are particularly useful when coupled with a learning management system. This allows an entire curriculum to be customized to the learning goals of each individual learner (Dick, Case, Rhulman, Van Slyke & Winston, 2006). These ICT are already being applied to organizational learning contexts, and may soon become more widely used in higher education (Dick et al., 2006).

Use

In order for an ICT to have an impact, it must be used. Understanding the utilization and application of ICT is a topic of enduring interest to ICT researchers. In this section, we discuss some of the more important theories and research directed at understanding issues related to ICT use. We begin by providing an overview of theories related to the adoption, diffusion and acceptance of ICT. Then, we dig deeper by discussing factors that impact ICT use (which we call antecedents to use) and factors that may moderate the influence of these antecedents. This is followed by the discussion of two areas that may be of growing interest in the future, hedonic (non-utilitarian) motivations for use, and the grassroots diffusion of ICT within organizations. The section closes with a brief discussion of institutional theories, which help explain how the use of particular ICT spread across organizations.

UTILIZATION AND APPLICATION

Adoption/Acceptance/Diffusion

Many theories have been applied in attempts to understand ICT use, including the elaboration-likelihood model (Bhattacharjee & Sanford, 2006), the technology acceptance model (Davis, 1989), innovation diffusion theory (Rogers, 1995), the unified theory of acceptance and use of technology (Venkatesh, et al., 2003) among many others. Inherent in these theoretical approaches is the notion of adoption, acceptance or use. However, understanding at a precise level what these constructs mean is a critical hurdle that must be overcome if the research is to move forward. An interesting development related to this issue is the increasingly sophisticated, theoretically-grounded perspectives on what “use” means.

On the surface, this may seem like a trivial issue. However, use is much more complex than it first seems. Does using an ICT once qualify as prior use? Is the frequency of use what is important? Even

what is meant by frequency may vary from study to study. Frequency may be the number of times in a period one uses an ICT, or it may mean the amount of time one is logged into a system. Do we care only about whether or not the ICT is used (or how much it is used), or are we more concerned with *how* the ICT is used?

In the past, most research has used rather cursory methods for measuring the use of an ICT. Self-reported use is often employed by asking users about their frequency of use, either directly (such as number of hours per day), or through Likert-type scales (e.g. never ... daily). Binary views of use (use/don't use) are also common. When actual use is measured, system logs are often used to measure number of log-ins per day, number of hours logged in, and the like. While these measures are expedient, they do not measure the nuances of types of use, quality of use or depth of use. At the least granular end of the spectrum is the binary view (which I must admit to using in my own research). This view makes no distinction between a one-time user and a heavy, several hours per day user, which is an obvious weakness of this particular approach.

A variety of more comprehensive measures of use have also been employed. These range from duration and frequency of use to dependence of use (Burton-Jones and Straub, 2006). Unfortunately, these, more fine-grained self-reported use measures, while preferred to the binary view, also suffer from some weaknesses. Burton-Jones and Straub (2006) delineate some of the weaknesses of traditional use measures. One of the major problems concerns the fact that most of these measures are developed without solid theoretical grounding, and often seem to be chosen simply because they have been used in prior research.

Various approaches to addressing the weaknesses in traditional use measures are emerging. Boudreau & Seligman (2005) approach use from a quality perspective, basing their work on that of Bevan (1995), who views quality of use as the effectiveness, efficiency and satisfaction with which users can achieve specific goals in a specific context. This is an interesting perspective in that it looks at what can be accomplished by using the system rather than looking at quantity of use. If the point of use is to accomplish some task, then considering how well the system helps the user accomplish the task seems to be a reasonable way of viewing use.

Burton-Jones and Straub (2006) offer a detailed two-stage approach for defining system use and selecting (or developing) appropriate use measures. The first stage in this method is to define the characteristics of system use that are appropriate for the study context, and to also state any assumptions that are made with respect to these characteristics. The second stage involves choosing the best measures for the type of use that is of interest.

It is important for ICT research to refine its understanding and measurements of use, whether one is interested in the antecedents or consequences of use. If we want to understand what leads to use, we must understand exactly what we mean by use, and we must be able to measure use. (Of course, this is a positivist view, but even more interpretive research approaches gain from a better understanding of what we mean by use, even if no quantitative measures are employed.) A number of theoretical perspectives of ICT acceptance and use could benefit from refined views and measures of use.

Antecedents to Use

There is considerable continuing interest in antecedents of ICT use/adoption. Briefly, we can divide these efforts into three groups (1) investigations of new antecedents, (2) refined conceptualizations of widely-used antecedents, and (3) studies aimed at "opening the black box" of well-established antecedents such as perceived usefulness.

The first category includes studies that investigate new applications of ICT. For example, there are numerous studies of new antecedents that influence the use of electronic commerce. Among these are studies of trust (e.g. Gefen, Karahanna & Straub, 2003; Van Slyke, Belanger & Comunale, 2004) and information privacy concerns (Kimery & McCord, 2002; Malhotra, Kim & Agarwal, 2004; Van Slyke, Shim, Johnson & Jiang, 2006). Together these works have helped refine our theoretical and practical understanding of consumer-oriented e-commerce. Other examples of emerging use antecedents come from studies of instant messaging. The concept of critical mass was introduced to ICT research by Markus (1987), who proposed that the diffusion of interactive communication innovations that reach a certain level of adoption will seem to explode. In contrast, those innovations that fail to reach this critical mass will fall into disuse. Unfortunately, the exact point at which critical mass is reached is difficult to predict, and is only evident in retrospect. Lou, Luo and Strong, (2000) addressed this limitation by proposing the concept of perceived critical mass, which is the degree to which potential adopters' believe that an innovation has attracted a critical mass of users. The original conceptualization of perceived critical mass investigated the construct in the context of groupware adoption. Subsequent research has refined and further demonstrated the efficacy of this construct in predicting the adoption of instant messaging (Li, Chau & Lou, 2005, Ilie, et al., 2005; Van Slyke, Ilie, Lou & Stafford, 2007). As new ICT and new applications of existing ICT continue to emerge, it is likely that we will continue to see the theoretical development of new constructs that may influence ICT use.

Karahanna, Agarwal & Angst's (2006) study represents a significant effort to refine the conceptualization and measurement of a widely-used construct related to ICT adoption. Perceived compatibility is a core construct in the innovation-decision process of Rogers' (1995) diffusion of innovation theory. Perceived compatibility has received considerable empirical support in studies of innovation adoption. Tornatzky and Klein (1982) found perceptions of compatibility to be among the most consistently supported innovation characteristics impacting adoption. A number of ICT-based adoption studies have found similar results (e.g. Moore & Benbasat, 1991, Eastlick, 1993; Van Slyke, et al., 2002; Ilie et al., 2005). Unfortunately, the most widely-used measure of perceived compatibility in the ICT literature (developed by Moore & Benbasat, 1991), suffers from discriminant validity problems. A number of empirical studies have reported a lack of discriminant validity between Moore and Benbasat's (1991) perceived compatibility and relative advantage scales. Karahanna et al. (2006) addressed this problem by engaging in a careful theoretical analysis of the compatibility construct, and determined that compatibility is actually a multi-dimensional construct consisting of four dimensions, compatibility with prior experience, compatibility with existing work practices, compatibility with preferred work practices and compatibility with values. After drawing these theoretical conclusions, Karahanna et al. (2006) developed and tested scales for each of the compatibility dimensions. Other core concepts of adoption and acceptance theories may also benefit from such theoretical scrutiny.

MODERATION EFFECTS

Another area of considerable theoretical interest is the investigation of more complex relationships, particularly moderating relationships. Studies that examine moderating effects often add one or more moderating variable to existing theoretical models. The typical pattern is to develop a theoretically-based rationale for the moderating variable, then to test the effects empirically. For example, Ilie et al. (2005) investigated whether gender moderates the impact of beliefs about the use of instant messaging on intentions to use the technology. The core theory was Rogers' diffusion of innovation theory (Rogers, 1995). Prior literature on gender, communication and technology was used to propose hypothesis, which were

then empirically tested. Results confirmed that beliefs have differential effects according to gender (Ilie, et al., 2005). Other research has also investigated gender as a moderators in studies of ICT use intentions (Gefen & Straub, 1997; Venkatesh & Morris, 2000; Venkatesh, Morris & Ackerman, 2000).

One of the more significant theoretical and empirical efforts in this area comes from Venkatesh et al. (2003), who included a number of moderating effects in their UTAUT model. Three of these moderating variables were based on characteristics of the individual user, including age, gender, and experience. A fourth moderator, voluntariness of use, is a belief-based construct rather than an individual characteristic. Empirical results indicated general support for these moderating effects.

As research into ICT adoption and use continues to mature, researchers are well advised to further consider moderating effects. A particularly interesting avenue of research would be to investigate whether or not moderating effects can account for inconsistent findings in previous research. For example, the gender or experience profile of a sample of subjects may account for the significance or non-significance of perceived ease of use as a predictor of use intentions.

Grassroots Diffusion (Appropriation from Personal to Organizational Use)

One of the interesting recent phenomena in ICT use is the appropriation of personal technologies for work purposes. For example, instant messaging, which was originally intended primarily for recreational communication found its way into organizations. Surprisingly, much of the communication that occurred over instant messaging was business-oriented rather than personal in nature. Instant messaging is just the latest example of ICTs that have migrated to personal use. As ICTs become increasingly ingrained in our personal, day-to-day lives, it is quite possible that the rate of organizational appropriation of personal ICTs will increase.

The migration of personal ICT into organizations presents a number of interesting theoretical questions. When personal ICT are introduced into the organization, their use often spreads throughout an organization through informal means and without organizational sanction or support. This sort of diffusion has been called grassroots diffusion (Van Slyke, Ilie & Stafford, 2004). One fundamental question concerns how the grassroots diffusion differs from organizationally-sanctioned and sponsored diffusion. Traditional diffusion-assisting practices such as organized training sessions, mandatory use, etc. are absent in grassroots diffusion; other influence practices must substitute for organizational diffusion efforts. For example, rather than formal change agents, proponents of a new ICT must take it upon themselves to build awareness of the existence and advantages of the new ICT. Further, influence processes must be more subtle since the proponents may lack the ability to mandate use (or provide extrinsic rewards for use). Training may be informal as well, with early adopters providing education and perhaps technical support for later users.

Grassroots diffusion is only one interesting area of potential research related to the use of personal-level ICT in organizations. Theories should be developed related to how organizations take advantage of these technologies. Both the providing organization and the user organization should be studied. How user organizations react to control and take advantage of (or restrict the use of) these ICT is an interesting research question. Equally interesting is how the organizations that developed the ICT react to its use in organizations. For example, do such organizations introduce “enterprise-class” versions of the technology?

Hedonic Motivations

Originally ICTs were primarily utilitarian technologies directed at improving the efficiency and/or effectiveness of work. However, with the emergence of lower cost, more ubiquitous ICT, a transformation

occurred as the technologies became part of our non-work lives. Although personal ICT use certainly existed long before the Internet and Web became household words, the emergence of low-cost, readily-available Internet access seems to ignite the transition of ICT from the work world into our personal lives. Hedonic outcomes refer to the pleasure or enjoyment received from using an ICT, as opposed to utilitarian outcomes, which refer to how well an ICT enhances the efficiency or effectiveness of some task (Venkatesh & Brown, 2001).

Hedonic motivations are the desire to achieve enjoyment from using an ICT. In the home, hedonic motivations are partially responsible for ICT adoption in households (along with the desire for social and utilitarian outcomes) (Venkatesh & Brown, 2001). Households acquire ICT not just to accomplish tasks such as paying bills and banking online, but also to have fun by surfing the Web, listening to music and playing games. In terms of theory, these and similar findings mean that we need to expand our theories to consider non-utilitarian factors that may influence ICT adoption and use. Interestingly, theories that have been expanded to include hedonic motivations have been applied in research in a variety of contexts, including ICT adoption in developing countries (Dwivedi, Khoubati, Williams, Lal, Gharavi, 2007).

On the surface it may seem that hedonic motivations would be of little interest to researchers interested in work-related ICT use. However, this is not the case. As discussed earlier, use is not either/or; different levels and different types of use exist. One perspective theorizes that individuals may use a technology for exploitation or exploration (March, 1991). Exploitation occurs when the ICT is applied to tasks in a routine manner. In contrast, exploratory use of ICT involves seeking out new ways in which to use the ICT. Such use may be driven primarily by the desire for utilitarian outcomes, but there is an undercurrent of enjoyment as well. When users derive more pleasure from ICT use, they may be more likely to “play” with the technology and discover new uses. The beneficial aspect of “playing” with an ICT has been noted. Webster & Martocchio (1991) pioneered this avenue of thought by developing the concept of microcomputer playfulness, which they define as the “degree of cognitive spontaneity in microcomputer interactions.” More recently, Belanger and Van Slyke (2000; 2002) posit that playful (non-work-related) use of ICT applications may result in learning that is beneficial for more utilitarian applications. They use an example of email implementation in a small business to demonstrate how hedonic and social motivations for email use lead to email communication becoming ingrained in work practices. While there is still much work to be done in this area, it seems that examining the interplay between hedonic motivations and utilitarian outcomes may be a fruitful and interesting avenue of inquiry.

INSTITUTIONAL THEORIES

There continues to be considerable interest in what motivates organizations to innovate through the adoption of ICT. A variety of theories have been applied to the study of organizational ICT adoption. One of the more enduring of these is institutional theory (DiMaggio & Powell, 1983). Institutional theory posits that three forms of influence facilitate the spread of an innovation through the companies within an industry through the pressure to conform to organizational forms and practices that are viewed as “legitimate.” Mimetic pressures concern the pressure to conform to the ways in which other organizations practice. Coercive pressures are exerted by governments or other regulatory agencies to bring about the adoption of practices and technologies that are seen as desirable. Finally, normative pressures result from attempts to professionalize an industry.

A number of studies have used institutional theory to examine ICT diffusion and adoption at an organizational level (e.g. Orlikowski & Barley, 2001; Chatterjee, Grewal & Sambamurthy, 2002). A

recent application of institutional theory to the study of ICT comes from Liang, Saaf, Hu & Xue (2007). This study investigates the influence of normative, mimetic and coercive pressures on the assimilation of enterprise systems. The authors posit that top management beliefs and top management participation mediate the impacts of institutional pressures. Interestingly, institutional pressures influence enterprise system assimilation when there is a prolonged integration process and outcomes are dynamic and uncertain. Liang et al.'s (2007) results indicate that mimetic and normative pressures also exert a direct influence on enterprise system assimilation. Accordingly, the authors suggest that there may be additional mediating influences. This may well be an interesting avenue for future research.

OUTCOMES

Having discussed the first two components of our framework, we now turn attention to the third, the outcomes of ICT use. As ICT become increasingly ubiquitous in our work and personal lives, an interesting phenomenon occurs. To an extent, the more ubiquitous something becomes, the less noticeable it is. However, this does not mean that its impacts are lessened; they simply become less apparent. In turn, this sometimes makes teasing out the exact impacts of a particular technology a bit more difficult. Fortunately, we have at our disposal a variety of useful theories that can be applied to investigations of the outcomes of ICT use.

In this section, we discuss how ICT impact four broad areas. First, we discuss impacts on the individual. Next, we examine organizational impacts. This is followed by a discussion of managerial impacts. We close the section with an overview of the broad social impacts of ICT.

ORGANIZATIONAL IMPACTS

The degree to which ICT impacts organizational operations and outcomes continues to be of considerable interest to ICT researchers and practitioners alike. One area of particular and enduring interest concerns how ICT can be employed strategically to gain competitive advantage. A more fundamental question is whether gaining sustained competitive advantage is even possible. Although studies of the value of ICT are hardly new, there seems to be a renewed interest that was touched off by Carr's (2003) controversial article "IT Doesn't Matter." It is possible that the commoditization of ICT has progressed to the point that long-term, strategic advantage can no longer be gained from ICT. Of course, this position is not universally held, and much research energy has gone into refuting this thesis, either directly or indirectly.

Because ICT are so pervasive in organizations, exactly how ICT impact organizations becomes a knotty question. One way to untangle this knot is to consider the intent of the ICT application. A deeper understanding of this helps researchers choose the appropriate theoretical perspectives from which to investigate the value of ICT investments. To this end, Oh et al., (2007) compare two approaches to assessing the strategic value of ICT. Their work reveals that a contingency-based view is more appropriate for explaining the impact of ICT applications that are directed at cost reduction. In contrast, a resource-centered view does a better job of explaining ICT investments that are directed at increasing revenue and profitability. Further, their results indicate that investments in growth-oriented ICT applications have a direct impact on improving an organization's revenue.

There is also research being done to refine theories related to organizational impacts by developing new constructs. An interesting work in this area introduces the construct of IT leveraging competence

(Pavlou & El Sawy, 2006). IT leveraging competence is the ability to effectively use the functionality offered by IT to support IT-related activities. These authors also propose that two capabilities mediate the impact of IT leveraging competence on competitive advantage. The first of these is functional competence, which is the ability to execute operational activities effectively. The second is dynamic capability, which is the ability to “integrate, build, and reconfigure existing functional competencies to address turbulent environments” (p. 199). Empirical results show support for the notion that IT leveraging competence can be used for competitive advantage, but that this impact is fully mediated by functional and dynamic competencies. The Pavlou and El Sawy (2006) study used the context of new product development to develop the theory surrounding their new constructs and to test their empirical efficacy. Other researchers may further test and possibly refine the new theory in other contexts.

A number of recent studies have investigated the impact of specific ICT applications. Some of these studies are directed at more micro-level impacts (which we discuss later), and others examine more macro-level impacts. In one example of a broader-based study, Ranganathan & Brown (2006) used an organizational integration theoretical lens to investigate how different types of ERP projects impact shareholder values. ERP projects that are broader in functional scope (involving modules that impact two or more value-chain components) or physical scope (involving multiple sites) lead to higher shareholder returns than do lesser-scope projects. Projects that have broad functional and physical scopes bring about the highest returns.

Some studies take an indirect approach at demonstrating the value of ICT. These works show the value of ICT by investigating how particular applications impact operations. By extension, one may conclude that if operations are improved, then there is an overall improvement in firm performance. (Whether this improvement gains the company a sustainable competitive advantage is another question.) For example, Mishra et al. (2007) used a resource-based theoretical view to investigate antecedents and consequences of the use of the Internet to support procurement activities. These authors took a holistic perspective by considering the firm, the technology, the organization, and the environment. Their results indicate that some resources impact Internet use in only one stage of the procurement process, while others impact multiple stages. In addition, their work indicates that Internet use in the order initiation and completion stage of the procurement process has the strongest positive influence on performance. Using the Internet in the search stage has a lesser impact.

Other studies have also examined the ability of ICT to improve supply-chain operations. For example, Grant’s (1996) theory of higher-order capabilities serves as the foundation for arguing that organizations that use supply-chain management systems to create higher-order supply-chain integration capabilities generate significant and sustainable performance improvements (Rai & Patnayakuni & Seth, 2006). Providing the infrastructure integration necessary to support supply-chain management allows firms to integrate supply-chain-related information flows with their trading partners. This, in turn, leads to performance gains in both operations and revenue growth. Rai et al.’s (2006) study formalizes a number of theoretical constructs and relationships related to integration capabilities that might be applicable to studying the impacts of other ICT applications.

Enterprise systems are also the subject of numerous studies concerned with understanding how ICT impact operational performance. Cotteleer and Bendoly (2006) used a case study approach to investigate how enterprise systems impact operational performance. In this study, not only did enterprise systems impact order fulfillment lead time, it also brought about performance improvement on an ongoing basis.

Given the amount of interest in the organizational impacts of ICT, it is not surprising that attempts have been made to synthesize the literature in this area. One example of this comes from Piccoli and Ives (2006), who provide a comprehensive review of the literature on sustained competitive advantage. They use a theoretically-derived framework to organize their review, which is focused on understanding

factors that create barriers to the erosion of ICT-enabled competitive advantage. These factors are further organized into four groups. IT resource barriers include IT assets, such as the IT infrastructure, and IT capabilities, including technical skills and IT management skills. Complementary non-ICT resources create the second barrier. Examples of complementary resources include distribution channels, slack resources, and brand image. The third group of factors comprises the IT project barrier. These factors include technology characteristics (such as complexity and uniqueness) and the implementation process (such as the complexity of the implementation process, and the extent of change required in an organization's processes to fully utilize the ICT). The final barrier is the preemption barrier, which concerns whether the leader's competitive advantage can be threatened, even after successful implementation has taken place. Switching costs and value-system structural characteristics (such as relationship exclusivity) form the preemption barrier. Taken together, the studies reviewed by Piccoli and Ives (2006) offer support for the belief that ICT can, in fact, lead to sustainable competitive advantage.

SOCIETAL IMPACTS

ICT have also had considerable impacts at the societal level. The increasingly pervasive presence of ICT make these impacts almost inescapable. From automated check-out aisles at the grocery store, to personal entertainment devices such as MP3 players and digital video recorders, ICT seem to touch most aspects of day-to-day life.

DIGITAL DIVIDES

While there are many benefits to ICT use by individuals, not all are able to fully participate in the information society. As a result, there is much interest in studying various digital divides. A digital divide exists when there is a separation between "haves" and "have nots" with respect to access to digital information and ICT (Dewan & Riggins, 2005). Identifying divides, their underlying causes and potential solutions are all topics of interest to researchers and policy makers.

There are actually a number of digital divides, including those based on age, gender, socio-economic status, and location. In addition to understanding digital divides at the individual level, there is also a need to understand community- and nationality-based divides.

Developing and less-developed countries may benefit greatly from ICT. Unfortunately, in many cases, these nations suffer from a digital divide in that they lack the necessary infrastructure to provide ICT access to their citizens. Even in rapidly developing countries such as India, there may be significant infrastructure issues, especially in poorer or rural areas. These conditions may have a detrimental impact on ICT applications, such as e-commerce. For example, there is evidence that perceptions of e-commerce are more negative among Indian consumers than American consumers (Van Slyke, Belanger & Sridhar, 2005). These differences may be due to less favorable local conditions in India. The digital divide is even more pronounced in less developed areas, such as sub-Saharan Africa.

Some claim that an age-based digital divide exists, even within developed countries. The elderly face a number of challenges when attempting to use ICT. A number of studies in this area use human-computer interaction studies to examine how various aspects of common ICT interfaces impact older users. For example, Wu and Van Slyke (2005) use a synthesis of the technology acceptance model and cognitive theories to posit that the increasing functionality of modern software applications may be more detrimental than beneficial to older computer users.

Location may lead to variations in access to digital resources, even within a given country. For example, there may be considerable differences in Internet access quality between urban and rural areas. High-speed cable and DSL connections may not be available in rural areas, which significantly limits the utility of accessing multimedia content.

One of the more interesting areas of digital divide research concerns second-order digital divides. A second-order divide exists when an individual or organization has access to the requisite ICT, but lacks the necessary expertise to make use of the ICT (Dewan & Riggins, 2005). Some individuals may lack early-life exposure to ICT, and thus may fail to develop ICT skills. Lack of skills may further lead to a lack of confidence in using ICT, which may hinder use.

Reducing the digital divides becomes especially important when governments pursue electronic government (e-government) initiatives. When e-government is implemented, ICT access inequities may lead to inequitable access to governmental services and representation. Even something as basic as renewing a driver's license is much more difficult when one does not have access to online resources. Governments may need to pay particular attention to this matter if online voting is seriously considered. This brings us to our next topic, electronic government.

ELECTRONIC GOVERNMENT

The use of ICT by governmental entities goes back to the very beginning of computing. In fact, ENIAC I was developed for the government (specifically for the United States military). However, the term "electronic government" seems to have emerged towards the end of the 1990s. In contrast to earlier governmental ICT applications, which were primarily internal applications, e-government applications are directed at making information more accessible to stakeholders and at making stakeholder interactions more efficient and effective. Applications range from simple directories of governmental offices and representatives, to tax-roll databases, and license applications and renewals. Such diverse ICT applications in a critically-important area lead to many interesting research issues. These run the gamut from appropriate research methods and instruments, to trust and privacy issues (Gronlund & Horan, 2004). Some believe that the emergence of e-government is not simply a matter of automation, but is a fundamental change in the way governments operate (Tan, Pan & Lin, 2007).

E-government applications bring many potential benefits. Operations may be made more efficient through automation and process transformation. This may lead to financial benefits through the reduction of staff and infrastructure necessary to carry out basic operations. In addition, making representatives and governmental services more available bring about obvious benefits to constituents. However, there are also a number of challenges, including redesigning processes, change management, and coordination among stakeholders. It is also possible that e-government transformation may shift some transaction costs to citizens, which may be burdensome to some (Tan et al., 2007).

Given the range of individuals and organizations who are affected by e-government, it is not surprising that stakeholder analysis has been applied to the study of e-government (Flak & Rose, 2005; Tan et al., 2007). As Tan et al. (2007) point out, a stakeholder perspective allows addressing several critical aspects of e-government, including identifying stakeholders, recognizing differences in stakeholder interests, and how governments can address these differences. As ICT continue to become more ubiquitous and universally available, it is likely that the scope of e-government applications will increase. Because of this it is critically important that ICT researchers continue work in this area.

MANAGERIAL IMPACTS

ICT have considerable impact on management. These impacts run the gamut from individual issues, such as managing technical workers, to strategic issues, such as gaining strategic advantage from ICT. In this section, we discuss a number of the more interesting theoretical developments related to the managerial impacts of ICT.

Sourcing Arrangements

Since the early 1990s, ICT researchers have been interested in gaining a better understanding of sourcing ICT functions (e.g. Loh & Venkatraman, 1992). A number of theory-based models of the outsourcing decision process have been proposed, including Chaudhury, Nam & Rao (1995) and Lacity and Willcocks' (2000), both of whom proposed six-stage processes to explain the outsourcing decision. (It should be noted that the stages differ across the two models.)

Outsourcing is a complex phenomenon, which leads to corresponding complexity when attempting to understand the totality of prior outsourcing research. Thus, alternative approaches have been used to review the outsourcing literature. Ilie and Parikh (2004) offer an interesting synthesis of the outsourcing literature using a process model of outsourcing. Their model consists of seven phases, (1) decision to outsource, (2) vendor selection, (3) outsourcing contract, (4) implementation, (5) operations/relationship, (6) evaluation, and (7) decision to renew (or not renew). Research can investigate single phases, multiple phases or links between phases.

Dibbern et al. (2004) also offer a stage model in their extensive review of the outsourcing literature. They begin with Simon's four-stage model of decision making (intelligence gathering, decision design, choice, and implementation). This is adapted to be more specific to the outsourcing decision. The first three stages (why, what and which) make up the decision process phase. In the "why" stage, organizations consider the arguments for and against outsourcing. The "what" stage is directed at determining which specific sourcing arrangements are to be considered. In the "which" stage, the organization makes the choice among the alternatives considered earlier. The last two stages (how and outcome) together form the implementation phase. The "how" stage includes activities such as selecting the specific vendor, contract negotiation, and relationship management. Finally, the "outcome" stage reflects the consequences of the chosen sourcing arrangement.

Quite an array of theoretical perspectives has been used to study sourcing arrangements, ranging from economic theories to social theories. Some studies have used multiple disparate theories in attempts to understand the range of processes and factors that are important to outsourcing. Whitten and Leidner (2006), for example, used transaction cost theory (an economic theory) and social exchange theory in a study of backsourcing (returning previously outsourced operations to the organization). Others have also studied the backsourcing phenomenon (e.g. Veltri & Saunders, (2006), which seems to be an area of increasing interest.

Theories from economics are often used in studies of outsourcing (even when financial factors are not the focus of the work). Dibbern et al. (2004) offer an excellent discussion of the theories that have been applied to the study of outsourcing. (The remainder of this paragraph is derived from their discussion.) Agency theory, game theory, transaction cost theory and resource-based theories have all been applied to outsourcing. Agency theory considers the divergent interests of principals (e.g. the client company) and agents (vendor). Contracts and other mechanisms are required to ensure that the information asymmetries and different risk perceptions do not lead to opportunistic behavior on the part of the agent. Game theory tries to explain the different actions a party will take, based on its understanding of what

actions the other party might take. The parties (players in game theory) interact to produce outcomes based on the players' preferences. Players attempt to anticipate the actions and preferences of the other player and act accordingly. Transaction cost theory attempts to explain the transaction conditions that lead to certain governance arrangements. Resource-based theories consider the resources an organization possesses (or does not possess) form the basis for the organization's strategy. Basically an organization is seen as a collection of resources that can be used to produce outputs. Other theories that have been applied to outsourcing include strategic management theories, social exchange theories, diffusion theories, political theories and relationship theories.

Outsourcing arrangements involve interactions among parties with differing interests and motivations. In essence, these arrangements are relationships between the client and vendor organizations. It seems appropriate, then, to consider relationship factors as being worthy of additional study. Although most outsourcing studies seem to use cost-oriented economic theories (Ilie & Parikh, 2004), there are notable exceptions. Choudhury and Sabherwal (2004) used both agency and organizational theories to study control mechanisms in outsourced software development projects. Based on these theories, Choudhury and Sabherwal (2004) proposed that organizations used a portfolio of different control modes and mechanisms to bring about desired behaviors from the outsourcing vendors. These portfolios might include both formal and informal controls. Formal controls use performance evaluation and rewards/sanctions to bring about the desired behavior. Formal controls can be divided into two types. Behavior controls focus on the process by which desired outcomes can be achieved. Outcome controls specify desired outcomes and the rewards for achieving those outcomes (or sanctions for failing to achieve them); the means by which the outcomes are achieved are not considered.

In contrast to formal, informal controls use social and relationship strategies to control the vendor's behavior. Choudhury and Sabherwal (2004) also divide informal controls into two types, clan controls and self-controls. Clan controls seek to close the gap between the client's and vendor's preferences through promoting common beliefs and philosophies. Self controls involve the vendor establishing standards for its own behaviors; these standards are hopefully in line with the client's interests. In their empirical work, Choudhury and Sabherwal (2004) found that outcome controls dominated outsourcing arrangements, particularly in the earlier stages of the outsourcing relationships. Later in the project, behavior controls are added. This work illustrates how theories from reference disciplines can be used to study a specific aspect of outsourcing.

There has also been considerable research into factors affecting the outsourcing decision (as opposed to the process by which the decision is made). Most of these studies are based on economic theories, which has led to a corresponding focus on economic drivers of outsourcing, including cost savings and other financial drivers. However, technological and strategic drivers have also been investigated. Technological drivers include lack of internal technical capabilities, access to new technologies, increasing flexibility and reducing technology-related risk. Focusing on an organization's core business, restructuring and improving the management of the ICT operation are among the strategic outsourcing drivers (Ilie & Parikh, 2004).

Despite the amount of research on outsourcing, as Ilie and Parikh (2004) point out, there are a number of gaps in outsourcing research. Unfortunately, there seems to be a lack of research using institutional and political theories. The vendor side of the outsourcing equation needs to be better understood. Examining how vendor practices, reputation and other characteristics influence vendor selection may help us better understand the totality of outsourcing. Other gaps identified by Ilie and Parikh (2004) include:

- How the complexity of the outsourcing contract influences the outsourcing relationship and its ultimate success or failure.

- What conditions facilitate or hinder the implementation process.
- How the outsourcing arrangement evolves from an “arms-length” relationship to a strategic partnership.
- Development of comprehensive measures and methods for assessing outsourcing performance.
- The impact of client lock-ins such as asset specificity on the decision to continue or terminate the outsourcing arrangement.

MANAGING A GLOBAL WORKFORCE

The increasing globalization of ICT has led to a more global workforce. In today’s environment, teams may be distributed around the world, spanning national boundaries, time zones and cultures. Managing in such an environment is challenging; managers must understand how to manage workers that are not collocated and who may not be influenced by the same cultural norms.

Managing workers from different cultures can be particularly challenging. This challenge is not reduced by the fact that ICT may mediate much of the communication among geographically dispersed workers. Beyond the obvious logistical challenges, there are also difficulties brought about by different norms and practices in the various cultures. These differences potentially lead to unproductive conflict in culturally diverse teams. We know from the literature on teams and teamwork that certain types of team conflict are productive, while others are not. Substantive (or task-related) conflict often improves the work output of a team. Such conflict comes about from different perspectives on the task at hand. This conflict is a positive byproduct of one of the main strengths of teamwork, diversity of perspectives. Affective conflict also results from diversity, but does not result in positive outcomes. Affective conflict is typically thought to be caused by visible demographic diversity, such as differences in age, race, and gender. Affective conflict hinders team processes; teams must spend time and energy resolving the conflict. However, unlike substantive conflict, there is no offsetting improvement in output quality (Pelled, 1996; Pelled & Alder, 1994.)

An interesting related theoretical and practical question is how the notion of visible demographic diversity translates into the context of virtual teams (teams that interact using ICT rather than face-to-face). Since visible differences are not apparent when teams do not meet face-to-face, it is possible that other cues to differences lead to affective conflict. For example, differences in language usage, interaction norms and the like may substitute for visible cues. One particularly interesting cultural difference that may lead to affective conflict is the notion of culturally-based time visions (Saunders, Van Slyke & Vogel, 2004). A time vision is how an individual or culture perceives the nature of time. Time is an extremely complex concept, and different cultures have differing views of time. Time visions vary across a number of dimensions, including subjectivity, continuity, linearity and homogeneity, among others (Saunders et al., 2004). Americans, for example, tend to view time as linear, unidirectional, and homogenous. Time is viewed as a scarce resource that must be managed wisely. In contrast, individuals from regions where Hinduism or Buddhism predominate may view time as being without a discrete beginning or end. The concept of “wasting” time, which is common in many western cultures, has little or no meaning to those with a timeless view of the nature of time. One can easily see how these differences might lead to conflict in a team. Deadlines have very different levels of importance to those with different culturally-based notions of time. As workforces become increasingly global, managers will have to deal with this and many other cultural differences.

CRITICAL ISSUES AND EMERGING TRENDS

A number of critical issues face the ICT research community. In this section we discuss a number of these, starting with the importance of more explicitly considering the context in which our studies are conducted.

Context

As ICT research matures, it becomes important to more explicitly consider the role of context. The context of a study may influence the findings and/or the proper application of theory. For example, it may be inappropriate to apply individual-level theories to group- or organizational-level studies. Because research is cumulative, lack of consideration of context may lead to misconceptions that carry through to later studies. Explicitly and carefully considering the impact of context not only avoids this issue, it may also help explain equivocal results. Four aspects of context should be considered and explicitly described in ICT studies; the users, the environment, the task, and the technology. Doing so may bring about a number of benefits to ICT research. More thorough consideration of context encourages researchers to dig more deeply into the theories that they employ. Thinking about how context may alter or impact the suppositions of a theory may lead to better understanding of the nuances of our core theories. Deeper consideration of context may also lead to more cohesive research streams. In addition, better integration of context may help researchers avoid inappropriately adopting findings of prior research. Finally, research that better integrates context will provide a more solid foundation for future research.

Globalization

Globalization brings about opportunities and challenges for ICT researchers. As we just discussed, context is important to well-done ICT research. One aspect of context is the country or culture in which a study takes place. Most of our theories were developed and tested in the context of western countries, particularly North America. It is not clear whether our extant theories will hold in non-western contexts. Theoretical relationships that are found in individualistic western countries may not hold in more collective societies. For example, perceived relative advantage (and the similar concept of perceived usefulness) has enjoyed wide support as a predictor of use intentions. However, this construct did not have a significant relationship with e-commerce use intentions among Indian consumers (Van Slyke, et al., 2005). Theories may need to be modified or extended as we look beyond western countries. There is an increasing amount of research being conducted in Asian countries. This is a good opportunity to more completely understand our fundamental theories.

We must also carefully examine our measurement instruments to see if they are valid outside the countries in which they were developed. Simple translation-back-translation strategies are helpful, but they do not go far enough. We should perform more rigorous tests of the content validity and factor invariance of our widely-used instruments when applying them globally.

Social Software

The emergence of social software may be a fruitful area for ICT researchers. Although an exact definition of social software seems to be missing from the literature, the basic idea is that individuals jointly contribute to an effort, such as a wiki. The end product is not the output of any single individual, but

rather is a community effort. (Interestingly, in some cases, no “end product” exists; the product is under ongoing evolution as more and more individuals add their contributions.)

In the absence of a widely accepted definition of social software, it is useful to examine common characteristics of such applications. Parameswaran & Whinston (2007a) offer a list of traits of social computing (which is analogous to social software). Social computing has a decentralized organization, a transient membership, and a loosely defined structure. Further, the scope of the system is rather fluid. Content is dynamic and quality control is unstructured, occurring primarily through peer feedback.

Social computing applications/platforms are quite varied. Blogs (Web logs), which are basically public online journals are an example. Typically, authors allow others to comment on blog entries, which increases the social nature of the platform. Wikis are another example of social computing. A wiki is an online information compendium, such as Wikipedia, which is an online, open source, user-created encyclopedia. Social bookmarking services, which enable different users to share their Web bookmarks, are another example, as are YouTube, Flickr, MySpace, and the like (Parameswaran & Whinston, 2007b). These applications may be directed at both personal and work-related uses. For example, it may be that social networking systems are an important new element in knowledge management systems (Smith & McKeen, 2007).

There are many interesting theoretical questions related to social software. Understanding what motivates individuals to contribute may lead to systems that lead to even greater levels of participation. (As noted earlier, this same question is of interest to open source software researchers.) Individual-level motivational theories are the most applicable to this question; theories from sociology and anthropology may also be appropriate. Social capital and social learning theories may be interesting to apply to the study of reputation mechanisms, which are key to some social computing platforms. Organizational theories may be applied to understanding the governance structures and organizational forms that social computing communities take. For example, Ouchi's (1980) theory of the clan organizational form may be an appropriate lens through which to study social computing (Parameswaran & Whinston, 2007a).

An interesting question related to social computing is what role critical mass plays in the development of a particular social computing platform or application. Markus (1983) contends that interactive communication technologies must either reach a critical mass of users, or its diffusion will stall, and the technology will fall into disuse. It would be interesting to see if the same rule applies to social computing communities. If a community fails to reach a critical mass, does it die out, or is a small core of dedicated contributors sufficient to ensure the communities survival? Similarly, it would be interesting to determine if perceptions of critical mass are important to individuals' decisions to join a community.

CONCLUSION

As the evolution of ICT continues, so must our research. New theories must be developed to fit new circumstances, existing theories must be re-tested and, if found lacking, must be revised. None of us know what the future of ICT will be, what we do know is that new technologies will emerge, new uses will be found for existing technologies, and new classes of users will take advantage of ICT. Our research must keep pace if we are to continue to build our understanding of ICT and how they affect our world.

REFERENCES

- Alavi, M. and Leidner, D. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues, *MIS Quarterly*, 25(1), 107-136.
- AlMarzouq, M., Zheng, L., Grover, V. (2005). Open source: Concepts, benefits, and challenges, *Communications of the Association for Information Systems*, 18, 756-784.
- Ball, N. (2001). Design science II: The impact of design science on e-commerce research and practice, *Communications of the Association for Information Systems*, 7, 1-21.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*, Prentice-Hall: Englewood Cliffs, NJ.
- Belanger, F., and Van Slyke, C. (2002). Abuse or Learning?, *Communications of the ACM*, 45(1), 64.
- Belanger, F., and Van Slyke, C. (2000). From Employee Shirking to Organizational Learning: The Role of Application Play, *Information Technology, Learning and Performance Journal*, 18(1), 61-70.
- Bevan, N. (1995). Measuring usability as quality of use, *Software Quality Journal*, 4(2), 192-201.
- Bhattacharjee, A. and Sanford, C., (2006). Influence strategies for information technology usage: An elaboration-likelihood model, *MIS Quarterly*, 30(4), 805-825.
- Boudreau, M.C. and Seligman, L. (2005). Quality of use of a complex technology: A learning-based model, *Journal of Organizational and End User Computing*, 17(4), 1-22.
- Burke, D. and Menachemi, N. (2004). Opening the black box: Measuring hospital information technology capability, *Health Care Management Review* 29(3), 207-217.
- Burton-Jones, A. and Straub, D. (2006). Reconceptualizing system usage: An approach and empirical test, *Information Systems Research*, 17(3), 228-246.
- Carr, N. (2003). IT doesn't matter, *Harvard Business Review*, 81(5), 41-49.
- Chatterjee, D., Grewal, R., & Sambamurthy, V. (2002). Shaping up for E-commerce: Institutional enablers of the organizational assimilation of web technologies. *MIS Quarterly*, 26(2), 65.
- Chaudhury, A., Nam, K., and Rao, H. (1995). Management information systems outsourcing: A bidding perspective. *Journal of Management Information Systems*, 12(2), 131-159.
- Choudhury, V. and Sabherwal, R. (2003). Portfolios of control in outsourced software development projects, *Information Systems Research*, 14(3), 291-314.
- Costabile, M., Fogli, D., Lanzilotti, R., Mussio, A. (2006). Supporting work practice through end-user development environments, *Journal of Organizational and End User Computing*, 18(4), 43-65.
- Cotteleer, M. and Bendoly, E. (2006). Order lead-time improvement following enterprise information technology implementation: An empirical study, *MIS Quarterly*, 30(3), 643-660.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Quarterly*, 13(3), 319-339.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models, *Management Science*, 35(8), 982-1003.
- Dewan, S. and Riggins, F. (2005). The digital divide: Current and future research directions, *Journal of the Association for Information Systems*, 6(12), 298-337.
- Dibbern, J., Goles, T., Hirschheim, R. and Jayatilaka, B. (2004). Information systems outsourcing: A survey and analysis of the literature, *Database for Advances in Information Systems*, 35(4), 6-102.
- Dick, G., Case, T., Rhulman, P., Van Slyke, C., and Winston, M., (2006). Online learning in the business environment, *Communications of the Association for Information Systems*, 17, 895-904.
- DiMaggio, P. and Powell, W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review* 48(2), 147-160.

- Dwivedi, Y., Khoubati, K., Williams, M., Lal, B., Gharavi, H. (2007). Examining role of attitudinal, normative and control factors influencing behavioural intention to adoption broadband in Pakistan, *Proceedings of e-DIGIT 2007*, retrieved from <http://www.sigadit.org/edigit07papers/ECIS2007-edgit.pdf>.
- Eastlick, M.A. (1993) Predictors of videotex adoption. *Journal of Direct Marketing*, 7(3), 66-74.
- Eisenhardt, M. (1989). Agency theory: An assessment and review, *Academy of Management Review*, 14(1), 57-74.
- Ferneley, E. (2007). Covert end user development: A study of success, *Journal of Organizational and End User Computing*, 19(1), 62-71.
- Fishbein, M. and Ajzen, I. (1975) *Belief, attitude, intention and behavior: An introduction to theory and research*. Addison-Wesley, Reading, MA.
- Flak, L.S. and Rose, J. (2005). Stakeholder governance: Adapting stakeholder theory to e-government, *Communications of the Association for Information Systems*, 16, 642-664.
- Folkers, D. (2005). Competing in the marketplace: Incorporating online education into higher education – An organizational perspective, *Information Resources Management Journal*, 18(1), 61-77.
- Gefen, D., Karahanna, E. and Straub, D. (2003) Trust and TAM in online shopping: An integrated model. *MIS Quarterly* 27(1), 51-90.
- Gefen, D. and Straub, D.W. (1997). Gender differences in the perception and use of e-mail: an extension of the technology acceptance model. *MIS Quarterly* 21 (4) 389-400.
- Goodhue, D. and Thompson, R. (1995). Task-technology fit and individual performance, *MIS Quarterly*, 19(2), 213-236.
- Grant, R. (1996). Prospering in dynamically-competitive environments: Organizational capability as knowledge integration, *Organizational Science*, 7(4), 375-387.
- Gregor, S. and Jones, D. (2007). The anatomy of a design theory, *Journal of the Association for Information Systems*, 8(5), 312-355.
- Grolund, A. and Horan, T. (2004). Introducing e-gov: History, definitions, and issues, *Communication of the Association for Information Systems*, 15, 713-729.
- Granovetter, M. (1973). The strength of weak ties, *The American Journal of Sociology*, 78(6), 1360-1380.
- Gupta, S. and Kim, H.W. (2007). Developing the commitment to virtual community: The balanced effects of cognition and affect, *Information Resources Management Journal*, 20(1), 28-45.
- Hansen-Asand H. and Morch, A. (2006). Super users and local developers: The organization of end-user development in an accounting company, *Journal of Organizational and End User Computing*, 18(4), 1-21.
- Hardaway, D. (2007). Replacing proprietary software on the desktop, *IEEE Computer*, 40(3), 96-97.
- Hennington, A. and Janz, B. (2007). Information systems and healthcare XVI: Physician adoption of electronic medical records: Applying the UTAUT model in a healthcare context, *Communications of the Association for Information Systems*, 19, 60-80.
- Hevner, A., March, S., Park, J. and Ram, S. (2004). Design science in information systems research, *MIS Quarterly*, 28(1), 75-105.
- Homans, G. (1958). Social behavior as exchange, *American Journal of Sociology*, 63(6), 597-606.
- Ilie, V., Parikh, M. (2004). A process view of information systems outsourcing research: Conceptual gaps and future research directions, *Proceedings of the Tenth Americas Conference on Information Systems*, August, New York.

- Ilie, V., Courtney, J. and Van Slyke, C. (2007). Paper versus Electronic: Challenges associated with Physicians' Usage of Electronic Medical Records, *Proceedings of the Hawai'i International Conference on System Sciences*, January, Waikoloa, HI, USA.
- Ilie, V., Van Slyke, C., Green, G. and Lou, H. (2005). Gender differences in perceptions and use of communication technologies: A diffusion of innovation approach. *Information Resources Management Journal*, 18(3), 16-31.
- Jarvenpaa, S. and Staples, D.S. (2001). Exploring perceptions of organizational ownership of information and expertise, *Journal of Management Information Systems*, 18(1), 151-183.
- Jin, L., Robey, D. and Boudreau, M.C. (2007). Beyond development: A research agenda for investigating open source software user communities, *Information Resources Management Journal*, 20(1), 68-80.
- Karahanna, E., Agarwal, R., Angst, C. (2006). Reconceptualizing compatibility beliefs in technology acceptance research, *MIS Quarterly*, 30(4), 781-804.
- Kimrey, K. and McCord, M. (2002). Third-party assurances: Mapping the road to trust in e-retailing, *Journal of Information Technology Theory and Application*, 4(2), 63-82.
- Lacity, M. C., & Willcocks, L. P. (2000). Relationships in IT Outsourcing: A Stakeholder Perspective. In R. W. Zmud (Ed.), *Framing the Domains of IT management: Projecting the Future through the Past* (pp. 355-384). Cincinnati, OH: Pinnaflex Education Resources.
- Latour, B. (1986). The powers of association, in J. Law, (Ed.) *Power, Action and Belief: A New Sociology of Knowledge? Sociological Review* monograph 32. Routledge & Kegan Paul, London: 264-280.
- LeRouge, C. and Niederman, F. (2006). Information systems and health care XI: Public health knowledge management architecture design: A case study, *Communications of the Association for Information Systems*, 18, 176-204.
- Li, D., Chau, P.Y.K., and Lou, H. (2005). Understanding Individual Adoption of Instant Messaging: An Empirical Investigation, *Journal of the Association for Information Systems*, 6(4), 102-129.
- Liang, H., Saraf, N., Hu, Q. and Xue, Y. (2007). Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management, *MIS Quarterly*, 31(1), 59-87.
- Loh, L., and Venkatraman, N. (1992). Determinants of information technology outsourcing: A cross-sectional analysis. *Journal of Management Information Systems*, 9(1), 7-24.
- Lou, H., Luo, W. & Strong D. (2000). Perceived critical mass effect on groupware acceptance. *European Journal of Information Systems*, 9, 91-103.
- Malhotra, N. K., S. S. Kim, and J. Agarwal (2004). Internet users' information privacy concerns (IUIPC): The construct, the scale and a causal model, *Information Systems Research* 15(4), 336-355.
- March, J. (1991). Exploration and exploitation in organizational learning, *Organizational Science*, 2(1), 71-87.
- Markus, M.L. (1987). Toward a "critical mass" theory of interactive media, *Communication Research*, 14(5), 491-511.
- Massy, A., Montoya-Weiss, M., and O-Driscoll, T. (2003). Knowledge management in pursuit of performance: Insights from Nortel Networks, *MIS Quarterly*, 26(3), 269-289.
- McGill, T. and Klisc, C. (2006). End-user perceptions of the benefits and risks of end-user Web development, *Journal of Organizational and End User Computing*, 18(4), 22-42.
- Miscione, G. (2007). Telemedicine in the upper Amazon: Interplay with local health care practices, *MIS Quarterly*, 31(2), 403-425.
- Mishra, A., Konana, P., Baura, A. (2007). Antecedents and consequences of Internet use in procurement: An empirical investigation of U.S. manufacturing firms, *Information Systems Research*, 18(1), 103-122.

- Moore, G. C. & Benbasat, I. (1991) Development of an instrument to measure the perceptions of adopting an information technology innovation, *Information Systems Research*, 2(3), 192-222.
- Oh, W. and Pinsonneault, A. (2007). On the assessment of the strategic value of information technologies; Conceptual and analytical approaches, *MIS Quarterly*, 31(2), 239-265.
- Orlikowski, W., & Barley, S. (2001). Technology and institutions: What can research on information technology and research on organizations learn from each other? *MIS Quarterly*, 25(2), 145-165.
- Ouchi, W. (1980). Markets, bureaucracies, and clans, *Administrative Science Quarterly*, 25, 124-141.
- Parameswaran, M. and Whinston, A. (2007). Social computing: An overview, *Communications of the Association for Information Systems*, 19, 762-780.
- Parameswaran, M. and Whinston, A. (2007). Research issues in social computing, *Journal of the Association for Information Systems*, 8(6), 336-350.
- Pavlou, P., and El Sawy, O. (2006). From IT leveraging competence to competitive advantage in turbulent environments: The case of new product development, *Information Systems Research*, 17(3), 198-227.
- Pelled, L.(1996). Demographic diversity, conflict, and work group outcomes: An intervening process theory,” *Organization Science*, 7(6), 615 - 631.
- Pelled, L. and Adler, P. (1994). Antecedents of intergroup conflict in multifunctional product development teams: A conceptual model,” *IEEE Transactions on Engineering Management*, 41(1), 21 - 28.
- Piccoli, G. and Ives, B. (2006). IT-dependent strategic initiatives and sustained competitive advantage: A review and synthesis of the literature, *MIS Quarterly*, 29(4), 747-776.
- Plouffe, C., Hulland, J. and Vandenbosch, M. (2001). Research report: Richness versus parsimony in modeling technology adoption decisions – understanding merchant adoption of a smart card-based payment system. *Information Systems Research* 12(2), 208-222.
- Ranganathan, C., and Brown, C. (2006). ERP investments and the market value of firms: Toward an understanding of ERP project variables, *Information Systems Research*, 17(2), 145-161.
- Rai, A., Patnayakuni, R. and Seth, N. (2006). Firm performance impacts of digitally enabled supply chain integration capabilities, *MIS Quarterly*, 30(2), 225-246.
- Rogers, E. M. (1995) *Diffusion of Innovations*, The Free Press, New York.
- Saunders, C., Van Slyke, C. and Vogel, D. (2004). My time or yours?: Managing time visions in global virtual teams, *Academy of Management Executive*, 18(1), 19-31.
- Shah, S. (2006). Motivation, governance, and the viability of hybrid forms in open source software development, *Management Science*, 52(7), 1000-1014.
- Smith, H. and McKeen, J. (2007). Developments in practice XXVI: Social networks: Knowledge management’s “killer app,” *Communications of the Association for Information Systems*, 19, 611-621.
- Smith, H. and McKeen, J. (2003). Developments in practice IX: The evolution of the KM function, *Communications of the Association for Information System*, 12, 69-79.
- Stewart, K.J. and Gosain, S. (2006). The impact of ideology on effectiveness in open source software development teams, *MIS Quarterly*, 30(2), 291-314.
- Tan, C.W., Pan, S., and Lim, E. (2007). Managing stakeholder interests in e-government implementation: Lessons learned from a Singapore e-government project, *International Journal of Electronic Government Research*, 3(1), 61-84.
- Tajfel, H. and Turner, J. (1986). The social identity theory of inter-group behavior. In S. Worchel and L. W. Austin (eds.), *Psychology of Intergroup Relations*. Chicago: Nelson-Hall.

- Tornatzky, L. and Klein, K. (1982). Innovation characteristics and innovation adoption-implementation: A meta analysis of findings, *IEEE Transactions on Engineering Management*, 29(1), 28-45.
- Van Slyke, C., Belanger, F. and Comunale, C. (2004). Factors influencing the adoption of web-based shopping: The impact of trust, *Database for Advances in Information Systems* 35(2), 32-49.
- Van Slyke, C., Belanger, F. and Sridhar, V. (2005). A comparison of American and Indian consumers' perceptions of electronic commerce, *Information Resources Management Journal*, 18(2), 24-40.
- Van Slyke, C., Ilie, V., Lou H., and Stafford, T. (2007). Perceived critical mass and the adoption of a communication technology, *European Journal of Information Systems*, 16, 270-283.
- Van Slyke, C., Ilie, V. and Stafford, T. (2004). Grassroots diffusion: A research agenda and propositional inventory. In *Diffusion of Innovation Interest Group in Information Technology Annual Meeting*, Washington, D.C.
- Van Slyke, C., Belanger, F., and Kittner, M. (1998). Distance Education: A Telecommuting Perspective, *Proceedings of the Fourth Americas Conference on Information Systems*.
- Van Slyke, C., Lou, H. and Day, J. (2002). The impact of perceived innovation characteristics on intention to use groupware. *Information Resource Management Journal* 15(1), 5-12.
- Van Slyke, C., Shim, J.T., Johnson, R. and Jiang, J., (2006). Concern for Information Privacy, Risk Perception and Online Consumer Purchasing, *Journal of the Association for Information Systems*, 7(6), 415-444.
- Veltri, N. and Saunders, C. (2006). Antecedents of information systems backsourcing. In R. Hirschheim, A. Heinzl & J. Dibbern (Eds.), *Information systems outsourcing: Enduring themes, new perspectives and global challenges*. Berlin: Springer, 83-102
- Venkatesh, V. and Brown, S.A. (2001). A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges. *MIS Quarterly* 25(1), 71-102.
- Venkatesh, V., Morris, M.G., Davis, G. and Davis, F. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly* 27(3), 425-478.
- Venkatesh, V. and Morris, M.G. (2000). Why don't men ever stop to ask for directions? Gender, social influence and their role in technology acceptance and user behavior. *MIS Quarterly* 24 (1) 115-139.
- Venkatesh, V., Morris, M.G. and Ackerman, P. (2000). A longitudinal field investigation of gender differences in individual adoption and usage of technology. *Organizational Behavior and Human Decision Processes* 83 (1) 33-60.
- Von Bertalanffy, L. (1962). General system theory - A Critical Review, *General Systems*, 7, 1-20.
- Webster, J. and Martocchio, J. (1992), Microcomputer playfulness: Development of a measure with workplace implications, *MIS Quarterly*, 16(2), 201-226.
- Whetten, D. (1989). What constitutes a theoretical contribution? *Academy of Management Review*, 14(4), 490-495.
- Whitten, D. and Leidner, D. (2006). Bringing IT back: An analysis of application development backsourcing and switching, *Decision Sciences Journal*, 37(4), 605-621.
- Wu, Y. and Van Slyke, C. (2005). Interface complexity and elderly users: Revisited, *Proceedings of the 2005 Southern Association for Information Systems*.
- Zhang, P., Cary, J., Te-eni, D., Termaine, M. (2005). Integrating human-computer interaction development into the systems development life cycle: A methodology, *Communications of the Association for Information Systems*, 15, 512-534.

Section 1

Fundamental Concepts and Theories in Information Communication Technologies

This section serves as the foundation for this exhaustive reference tool by addressing crucial theories essential to the understanding of information communication technology (ICT). Chapters found within these pages provide an excellent framework in which to position ICT within the field of information science and technology. Individual contributions provide insight into the critical incorporation of ICT into the global community and explore crucial stumbling blocks of the field. Within this introductory section, the reader can learn and choose from a compendium of expert research on the elemental theories underscoring the research and application of ICT.

Chapter 1.1

An Overview on Strategic ICT Implementations Toward Developing Knowledge Societies

Hakikur Rahman

Sustainable Development Networking Programme (SDNP), Bangladesh

ABSTRACT

As nations continue to conceptualize, adopt, implement, and monitor their respective information and communications technologies (ICTs) policies and e-strategies, it is vital that a critical assessment is undertaken on their effective progress. This includes analysis of strategies, methodologies, and best practices while weighing the impact, effectiveness, and efficiency of these policies and strategies. However, the demands, motivations, and incentives of various governments for adopting, adapting, and initiating ICTs varies from country to country, with diverse economic, social, cultural, and political environments. Researches in this aspect recognized the necessity of a cohesive ICT policy and strategic framework in each country for socio-economic development at their grass roots. The execution of these policies and strategies should include concrete national commitment and strong political will at

the highest levels of government, and an enabling environment that promotes stakeholder involvement in setting agendas and implementing plans and programs. This chapter provides insights into various national implementations in promoting related activities, tries to establish an analytical approach that would assist in formulating ICT policies and strategies by identifying different ICT indicators. Furthermore, this chapter focuses on critical aspects of different strategic national level policies with short-medium-long term visions that targeted both the immediate needs of the populace and long-term needs of nations by integrating ICTs. Finally, this chapter has recommended that via coherent and complimentary policies that engage both the private sector and civil society organizations, nations can move forward towards creating a knowledge society and at the same time by leveraging capabilities of ICT can address the social, economic and political issues on the ground.

INTRODUCTION

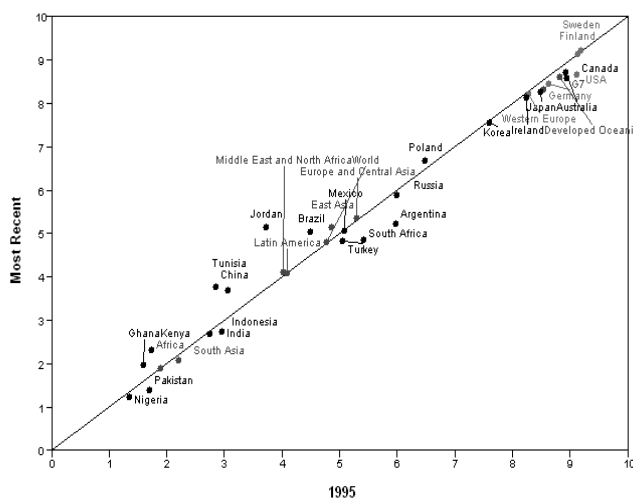
During 1970 to 2000, the largest users of foreign direct investment (FDI) flows were generally in Asia (China alone had 33.2%), while portfolio flows were more concentrated in Latin America (Brazil, Mexico, and Argentina added up to 26.9%, Singapore and Malaysia obtained 10%, and rest of the developing world had 29.9%). An important point can be noted that, despite low FDI, Singapore and Malaysia have successes in economic development due to the implementation of successful ICT strategies in their countries.

In essence in many countries, ICTs provide the means to accelerate their progress or even leapfrog into the new phase of development and to enable their integration into the global economy. Particularly, in developed countries the knowledge-based economy allows further specialization, improvements in productivity, and the achievement of sustainable growth. By virtue knowledge capital is the only asset that can grow without limits; and new knowledge increases the efficient use of resources that are in finite supply

(Léautier, 2005). Figure 1 gives a global view on how knowledge-based economy has been adopted in many countries, since 1995. It also shows that a few countries have been achieved almost highest ranking in terms of knowledge economy index (KEI) in recent years¹.

With an estimated span of about 50 years of Information Age (1950-2010)², the world has been passing through revolution of changes and witnessing astounding development in ICTs. Today, the Second World³ has about 30% of the world's population and about 20% of its wealth. The Third World⁴ accounts for some 60% of the population but enjoys less than 10% of its wealth. These classifications relate primarily to economic indicators such as GDP, but they can also be equated to the differing rates of adoption of industrial technologies. In this context, information technology presents an opportunity to the Second and Third World countries to improve their economies. However, the First World⁵ countries were among the leading developers and early adopters of Information Age technologies. Therefore, Second and Third World countries

Figure 1. Global view: Knowledge economy index by countries and regions (Adapted from Dahlman, Routti, & Ylä-Anttila, 2005)



have an opportunity by embracing ICT to equal these information economies (UN, 2003).

This chapter has analytically observed some of the ICT indicators in a few countries of the world, synthesized their approaches of overall development, tried to find out any synergy among them that can be replicated elsewhere, and endeavored on critical assessment of potential ICT parameters that are being used to represent a nation's digital presence, including status of their economic development. It has been observed that a few countries in Europe and Asia have reached an acceptable level of development through implementation of strategic ICT policies. Keeping this in mind, brief review on transformation of digital governance in Finland and Ireland have been incorporated, while Turkey has been discussed due to its transitional nature in the European Union that may be treated as a success case among many nations. In Asia, Japan, Singapore, and Thailand are leading in many parameters of digital access index (DAI)⁶, and at the same time, a few countries of Africa have been included in the synthesis with specific focus to Kenya.

BACKGROUND

Technology planning is the process of strategically deciding what technologically should be implemented to best poise a nation's vision, mission, strategy, activities, outputs, and outcome. It involves a candid assessment of the current scenario and an analysis of what can be improved upon with technology tools to enhance their effectiveness. It is also useful in identifying innovative program delivery opportunities that could be available through technology. Where most nations employ technology in a reactive fashion, responding to current short-term measures, strategic technology planning encourages a more long-term focus, making a realistic assessment of both the economic value and the cost of implementing technology. Although technology planning is a process, at

the same time it also results in a document—the Strategic Technology Plan, which serves as a snapshot of current technology adoption and a roadmap for integrating technology more effectively (Uganda-Africa, 2005).

Strategy is to be defined as a plan to reach the goals in terms of systematic actions to be taken by different actors at all levels. In addition, an action plan goes beyond by clarifying measures to be taken—what should be accomplished, by whom, and when?⁷ Currently, all strategic planning on ICTs emphasizes on building knowledge societies apart from establishing networks, contents, and learning. Knowledge is fueling economic growth and social development in all regions of the world. Along the way, the forces of globalization such as migration, travel, trade, foreign investment, and communications are speeding the dissemination and utilization of information across boundaries. Novel ideas and innovation are spreading faster than ever. Furthermore, knowledge-based growth and development offer opportunities for both developed and developing economies, and advancement in ICTs has been a necessary precondition for these new developments in the global economy (Léautier, 2005).

The world has seen remarkable achievement in terms of Internet penetration and broadband penetration as many countries have adopted successful ICT strategies in their policies and economies. Table 1 shows the top five countries of the world with highest Internet penetration⁸ in 2005, Table 2 shows the top five countries with highest broadband penetration in 2005, Table 3 shows the top five countries with highest technology achievement index (TAI) in 2001⁹ (UNDP, 2001), and Table 4 shows the top five countries with highest ICT diffusion index (ICTDI) in 2004.

From Table 1 it can be noted that top 30 countries (with 13.74% of world population) have 66.2% penetration in terms of their percentage of population, while the rest of the world has a penetration rate of 8.8%. At the same time from Tables 1, 2, 3, and 4 it has been found that Hong

An Overview on Strategic ICT Implementations Toward Developing Knowledge Societies

Table 1. Top 5 countries with the highest Internet penetration rate

| # | Country or Region | Penetration (% Population) | Internet Users Latest Data | Population (2006 Est.) | Source and Date of Latest Data |
|-----------------------|-------------------|----------------------------|----------------------------|------------------------|--------------------------------|
| 1 | New Zealand | 76.3 % | 3,200,000 | 4,195,729 | ITU - Sept/05 |
| 2 | Iceland | 75.9 % | 225,600 | 297,072 | ITU - Sept/05 |
| 3 | Sweden | 74.9 % | 6,800,000 | 9,076,757 | ITU - Oct/05 |
| 4 | Denmark | 69.4 % | 3,762,500 | 5,425,373 | ITU - Sept/05 |
| 5 | Hong Kong | 69.2 % | 4,878,713 | 7,054,867 | Nielsen//NR Feb./05 |
| TOP 30 in Penetration | | 66.2 % | 519,461,313 | 785,179,437 | IWS - Mar/06 |
| Rest of the World | | 8.8 % | 503,401,994 | 5,714,517,623 | IWS - Mar/06 |
| World Total Users | | 15.7 % | 1,022,863,307 | 6,499,697,060 | IWS - Mar/06 |

Table 2. Top 5 economies by broadband penetration (Source: ITU statistics)

| Year | Country | Per 100 inhabitants | Country | Per 100 inhabitants | Country | Per 100 inhabitants | Country | Per 100 inhabitants | Country | Per 100 inhabitants |
|------|--------------|---------------------|------------------|---------------------|-------------|---------------------|---------------|---------------------|---------------|---------------------|
| 2002 | Korea (Rep.) | 21.3 | Hong Kong, China | 14.6 | Canada | 11.5 | Taiwan, China | 9.4 | Iceland | 8.6 |
| 2003 | Korea (Rep.) | 23.3 | Hong Kong, China | 18.0 | Canada | 14.8 | Iceland | 14.5 | Taiwan, China | 13.4 |
| 2004 | Korea (Rep.) | 24.8 | Hong Kong, China | 22.0 | Netherlands | 19.8 | Denmark | 19.1 | Iceland | 18.8 |
| 2005 | Iceland | 25.0 | Korea (Rep.) | 23.6 | Netherlands | 23.5 | Denmark | 23.4 | Liechtenstein | 23.3 |

Table 3. Top 5 countries with technology achievement index (TAI) in 2001 (Source: UNDP, 2004)

| Country | TAI Value |
|------------|-----------|
| Finland | 0.744 |
| USA | 0.733 |
| Sweden | 0.703 |
| Japan | 0.698 |
| Korea (R.) | 0.666 |

Table 4. Top 5 countries with ICT diffusion index (ICTDI) in 2004 (Source: UN, 2006)

| Rank | Country | Access Index | Connectivity Index | ICT Diffusion Index ¹⁰ |
|------|------------|--------------|--------------------|-----------------------------------|
| 1 | Luxembourg | 0.928 | 0.703 | 0.815 |
| 2 | USA | 0.833 | 0.754 | 0.794 |
| 3 | Iceland | 0.854 | 0.706 | 0.780 |
| 4 | Sweden | 0.836 | 0.700 | 0.768 |
| 5 | Denmark | 0.828 | 0.667 | 0.748 |

Kong, Korea (R.), Iceland, Sweden, and USA have accomplished as such in developing their ICT sector to remain at the top in terms of Internet penetration, broadband penetration, TAI, or ICTDI.

In terms of Internet penetration, the European Union is leading the world with 49.8% of penetration rate, comprising 230,396,996 users with a growth rate of 147% between 2000 and 2005. Though growth rate in Africa rises to 424% between 2000 and 2005, the Internet penetration rate is only 2.6% of its population. Similarly, Asia has shown a growth rate of 219% with 9.9% penetration and America has a growth rate of 143%, but Internet penetration rate is much higher at 34.7%. Tables 5, 6, 7, and 8 show other parameters in Europe, Africa, Asia, and America.

To show the trend on settling down of Internet penetration in the developed world, a survey conducted by the Oxford Internet Institution (OII) can be highlighted. OII has been found that Internet penetration is growing slowly in UK with 3% between 2003 and 2005. However, Internet users are skeptical about the Internet's ability to help develop social relations. Sixty-five percent disagree ('disagree strongly' and 'disagree') that it is easier to meet people online than in person, while 73% agree ('agree' and 'agree strongly') that the Internet is a toll of benefit in a time-starved world that saves time; and 63% agree ('agree and 'agree strongly') that technology is making things better for people (OII, 2005).

Subsequently, case of a small country, Macedonia is being highlighted that is thriving for ICT development. ICT Assessment Report of Municipalities in FYR Macedonia 2004 and Recommendations and E-model of Municipalities summarizes that the 6.75% of budget spent on ICT and its development is graded very low, with 1.73% of the total budget being spent on IT infrastructure and 5.02% on communications. It follows that municipalities do not assign sufficient importance to ICT usage and do not recognize the work-related benefits of the new

technologies. The existing municipality profile is without a strategy for development of ICT usage. Nearly all municipality decision-making persons know little of ICT and no ICT initiatives are implemented, with the exception of a few sponsored projects and donations. The level of computer literacy of employees and members of the municipality council is graded very low, with a quality measure of 0.75 on a scale from 0 to 4, where value 1 signifies basic IT skills and value 2 moderate IT skills, which scores very low in comparison to the surprisingly high educational level (UNDP, 2004).

More importantly, in recent years many researchers, including world reputed agencies have been showing particular interest in ICTs. According to the Committee on Science and Technology at the Service of Development, ICTs "will become crucially important for sustainable development in developing countries." (Credé & Mansell 1998: ix) For the past two decades, most developed countries have witnessed significant changes that can be traced to ICTs. These multidimensional changes (technical, financial and economic, cultural, social, and political) have been observed in almost all facets of life: economics; education; health; communications; leisure; and travel (Thioune, 2003). The World Summit on Sustainable Development in 2002 and subsequent sessions of the Commission of Sustainable Development (CSD) encouraged further work on indicators for sustainable development by countries in line with national conditions and priorities and invited the international community to support these efforts (UN, 2005). Therefore, a number of areas, including sustainable tourism, marine environment, national strategies for sustainable development, and good governance, require further work to identify appropriate indicators. In the next section, various ICT indicators have been critically analyzed and appropriate measures at national levels have been closely followed, that have created positive environment in formulating successful ICT strategies.

An Overview on Strategic ICT Implementations Toward Developing Knowledge Societies

Table 5. Internet usage in Europe (Source: <http://www.internetworldstats.com/stats4.htm>)

| EUROPE | Population (2006 Est.) | % Pop. of World | Internet Users, Latest Data | Penetration (% Population) | % Usage of World | Use Growth (2000-2005) |
|------------------------|------------------------|-----------------|-----------------------------|----------------------------|------------------|------------------------|
| European Union | 462,371,237 | 7.1 % | 230,396,996 | 49.8 % | 22.5 % | 147.3 % |
| EU Candidate Countries | 110,206,019 | 1.7 % | 19,055,671 | 17.3 % | 1.9 % | 450.7 % |
| Rest of Europe | 234,711,764 | 3.6 % | 42,148,231 | 18.0 % | 4.1 % | 397.5 % |
| TOTAL EUROPE | 807,289,020 | 12.4 % | 291,600,898 | 36.1 % | 28.5 % | 177.5 % |
| Rest of World | 5,692,408,040 | 87.6 % | 730,462,384 | 12.8 % | 71.5 % | 185.5 % |
| TOTAL WORLD | 6,499,697,060 | 100.0 % | 1,022,063,282 | 15.7 % | 100.0 % | 183.1 % |

Table 6. Internet users and population statistics for Africa (Source: <http://www.internetworldstats.com/stats1.htm>)

| AFRICA REGION | Population (2006 Est.) | Pop. % in World | Internet Users, Latest Data | Penetration (% Population) | % Users in World | Use Growth (2000-2005) |
|------------------|------------------------|-----------------|-----------------------------|----------------------------|------------------|------------------------|
| Total for Africa | 915,210,928 | 14.1 % | 23,649,000 | 2.6 % | 2.3 % | 423.9 % |
| Rest of World | 5,584,486,132 | 85.9 % | 999,214,307 | 17.9 % | 97.7 % | 180.3 % |
| WORLD TOTAL | 6,499,697,060 | 100.0 % | 1,022,863,307 | 15.7 % | 100.0 % | 183.4 % |

Table 7. Internet users and population statistics for Asia (Source: <http://www.internetworldstats.com/stats3.htm>)

| ASIA REGION | Population (2006 Est.) | % Pop. of World | Internet Users, Latest Data | Penetration (% Population) | % Usage of World | Use Growth (2000-2005) |
|-------------------|------------------------|-----------------|-----------------------------|----------------------------|------------------|------------------------|
| Asia Only | 3,667,774,066 | 56.4 % | 364,270,713 | 9.9 % | 35.8 % | 218.7 % |
| Rest of the World | 2,831,922,994 | 43.6 % | 653,786,676 | 23.1 % | 64.2 % | 165.0 % |
| WORLD TOTAL | 6,499,697,060 | 100.0 % | 1,018,057,389 | 15.7 % | 100.0 % | 182.0 % |

Table 8. Internet users and population statistics for the Americas (Source: <http://www.internetworldstats.com/stats2.htm>)

| AMERICA | Population (2006 Est.) | % Pop. America | Internet Users, Latest Data | % Population (Penetration) | % Usage America | Use Growth (2000-2005) |
|-----------------|------------------------|----------------|-----------------------------|----------------------------|-----------------|------------------------|
| Central America | 144,550,714 | 16.3 % | 20,021,900 | 13.9 % | 6.5 % | 522.3 % |
| South America | 370,118,282 | 41.8 % | 55,629,500 | 15.0 % | 18.1 % | 289.2 % |
| The Caribbean | 39,239,636 | 4.4 % | 4,298,409 | 11.0 % | 1.4 % | 670.7 % |
| SUB-TOTAL | 553,908,632 | 62.6 % | 79,962,809 | 14.4 % | 26.0 % | 342.5 % |
| North America | 331,473,276 | 37.4 % | 227,303,680 | 68.6 % | 74.0 % | 110.3 % |
| TOTAL AMERICAS | 885,381,908 | 100.0 % | 307,266,489 | 34.7 % | 100.0 % | 143.5 % |

Furthermore, the changes observed in these countries have led to what is now referred to as “the knowledge society.” ICTs have made it possible to find fast access to, and distribution of, information as well as new ways of communication in real time at a cheaper cost. However, still a considerable gap exists between developing countries and developed ones in terms of the contribution of ICTs to the creation of wealth. The gap has tended to widen among developed countries, the technology suppliers, and the receiving developing countries. At the same time, the gap between the privileged and the grassroots communities within these developing countries is also expanding in terms of their access to ICTs. If measures are not taken to make ICTs both affordable and usable, mere access to them will be insignificant (Thioune, 2003).

Finally, technologies can play a crucial role in determining how networks can be used, whether they will be centralized or decentralized, who can own them, who can set them up, and whether they can be adapted to specific needs of individuals and communities. Certain technological developments and choices can decentralize networks and offer local communities a role in shaping the services and applications that are achievable. Conversely, any restricted choices and configurations may leave entire communities completely outside of the networks (Siochru & Girard, 2005).

MAIN THRUST: ANALYSIS OF ICT INDICATORS

This section has tried to identify some leading countries across the globe that have developed in terms of ICTs indicators, successful implementations of their ICT strategies in achieving human development, and have transformed into knowledge societies. Firstly, a few of ICT indicators have been discussed with specific focus on their developments, and consequently some of the parameters have been critically analyzed to build some form of inference. Secondly, a few of ICT parameters have been highlighted to observe their follow up in different economies, and finally ICT strategies in a few countries have been closely monitored, focusing their regional contribution.

For this purpose, one of the ICT indicators, the penetration of main telephone lines in top five countries during 2002 to 2005 have been highlighted in Tables 9 to 12. Penetration of main telephone lines per 100 inhabitants has been considered and it has been found that Bermuda remains at the top. This gives the indication of Bermuda’s growth of basic information infrastructure and dependency on communication media.

In 2005, Vietnam had the highest CAGR¹¹ of 42.5% per 100 inhabitants from 2000-2005 (ITU, 2006). The lowest CAGR was -16.6 in D.R. Congo. In 2004 Somalia had the highest CAGR of 46.6%

Table 9. Penetration of main telephone lines in order of per 100 inhabitants – 2005

| Country | CAGR (%) 2000-2005 | Per 100 inhabitants | CAGR (%) per 100 inhabitants |
|----------------|---------------------------|----------------------------|-------------------------------------|
| Bermuda | -1.4 | 86.15 | -0.5 |
| Luxembourg | 2.8 | 79.75 | 1.8 |
| Sweden | -1.1 | 71.54 | -1.4 |
| Switzerland | -0.4 | 68.66 | -1.1 |
| Germany | 1.9 | 66.57 | 1.7 |

Table 10. Penetration of main telephone lines in order of per 100 inhabitants – 2004

| Country | CAGR (%) 1999-2004 | Per 100 inhabitants | CAGR (%) per 100 inhabitants |
|-------------|--------------------|---------------------|------------------------------|
| Bermuda | 0.6 | 86.15 | 0.2 |
| Luxembourg | 3.7 | 79.75 | 2.6 |
| Sweden | -0.2 | 71.54 | 0.1 |
| Switzerland | 0.8 | 70.97 | 0.1 |
| Germany | 2.5 | 66.15 | 2.4 |

Table 11. Penetration of main telephone lines in order of per 100 inhabitants – 2003

| Country | CAGR (%) 1998-2003 | Per 100 inhabitants | CAGR (%) per 100 inhabitants |
|-------------|--------------------|---------------------|------------------------------|
| Bermuda | 1.0 | 86.15 (2002) | 0.6 |
| Luxembourg | -5.8 | 79.75 | -4.5 |
| Sweden | 0.5 | 72.89 | 0.2 |
| Switzerland | 1.7 | 72.74 | 1.2 |
| Germany | 3.1 | 65.71 | 3.0 |

Table 12. Penetration of main telephone lines in order of per 100 inhabitants – 2002 (Source: ITU statistics)

| Country | CAGR (%) 1997-2002 | Per 100 inhabitants | CAGR (%) per 100 inhabitants |
|-------------|--------------------|---------------------|------------------------------|
| Bermuda | 1.6 | 86.15 | 1.2 |
| Luxembourg | 4.9 | 79.68 | 3.7 |
| Switzerland | 2.8 | 73.99 | 2.3 |
| Sweden | 1.0 | 73.57 | 0.8 |
| Denmark | 2.1 | 68.86 | 1.7 |

per 100 inhabitants from 1999-2004, and the lowest CAGR was -14.0 in D.R. Congo, while Vietnam maintained CAGR of 35.6. In 2003 Sudan had the highest CAGR of 38.5% per 100 inhabitants from 1998-2003, with the lowest CAGR of -24.0 in D.R. Congo, and Vietnam kept the CAGR at 19.2. In 2002 Sudan had the highest CAGR of 39.0% per 100 inhabitants from 1997-2002, while the lowest CAGR was -5.7 in Solomon Island, but Vietnam had a CAGR of 22.7.

Main Telephone Lines

Due to non-availability of continuous data, two small countries in Europe, Guernsey, and Jersey could not be put in the table, but Guernsey had over 90 main telephone lines per 100 inhabitants in 2002 and 2003, while Jersey had over 80 main telephone lines per 100 inhabitants in 2002 and 2003. At the same time, a country can be put into focus, which is Vietnam. That country has been consistently increasing its number of land telephone per 100 inhabitants throughout the period. This has been possible due to Vietnam's

An Overview on Strategic ICT Implementations Toward Developing Knowledge Societies

recent ICT reformations. Table 13 shows various stages of ICT strategies that have been taken in Vietnam.

Vietnam will boost its digital content industry through streamlining its legal environment and upgrading its broadband network by 2006. In this context, a master plan on digital content industry drafted by MPT will be submitted to the government later in 2006. The country hopes that this industry will generate USD400 million by 2010 with an annual growth rate of 50%. Meanwhile, Vietnam will provide skills development training to around 300,000 digital content industry experts. Digital content industry will include e-learning, games for computer, online game, interactive game, game for mobile handset, Internet e-content (online newspaper, Web sites, searching, library), and value-added services for mobile (logo, ring tones, digital movies, television, and cartoon). Furthermore, Vietnam's ICT develop-

ment strategy aims to reach annual ICT revenue of USD6-7 billion by 2010 including USD3 billion in the computer hardware industry, USD2 billion in electronics production, and USD1.2 billion in the software/outsourcing¹².

Next, compound annual growth rate of cellular phones have been considered in Tables 14 to 17 and found that Hong Kong, Italy, Luxembourg, and Sweden remain at the top, though Lithuania had the highest CAGR of with 127.10 per 100 inhabitants and highest percent of total telephone subscriber in 2005. It has also been found that Nigeria had the highest CAGR of 261.8% between 2000 and 2005. Furthermore, D.R. Congo had the highest percent of total cell phone subscribers as indicated in Table 18. Previously it was observed that D.R. Congo had the lowest CAGR in main telephone lines (Tables 9 to 12) and this reflect their dependency on the cellular phone, in lack of any robust information infrastructure. It is also

Table 13. Actions taken by the Vietnam's Government for the improvement of ICT (Source: Thanh, 2003; Soan, 2006; ThuHue, 2005; MPT, 2003; World Bank, 2005)

| Action Taken | Year | Remarks |
|---|---------------|--|
| National Program on IT (NPIT) initiated | 1996-2000 | Implementing major application projects in state management and in some socio-economic areas |
| Directive No. 58-CT/TW | 2000 | Articulated the national strategy plan and policies for ICT development, and pushed IT towards the forefront of the country's industrialization drive for the period 2000-2010 |
| Decision No. 81/2001/QD-TTg | May 2001 | Approval of the Action Program to implement Directive No. 58-CT/TW |
| Internet Policies initiated | 2001 | Amended in 2003-2004 |
| | February 2002 | Ordinance on Posts and Telecommunications adopted |
| Decision No. 95/2002/QD-TTg | July 2002 | Approval of the IT Application and Development Master Plan in Vietnam by 2005 |
| Decree No. 90/2002/ND-CP | November 2002 | A new Ministry of Posts and Telematics (MPT) created to develop ICT Strategy along with other ministries |
| ICT Strategy initiated | January 2003 | The Vietnam ICT development strategy to 2010 and forward to 2020 approved |
| ICT Strategy approved | 2005 | |
| e-transaction law drafted | 2005 | |
| ICT Law | 2006 | Drafted by MPT and to be approved by end of 2006 |

Table 14. Compound annual growth rate of cellular phone 2002-2005 in order of per 100 inhabitants

| Country | CAGR (%) 2000-2005 | Per 100 inhabitants | As % of total telephone subscribers |
|------------------|-----------------------|---------------------|--|
| Lithuania | 52.7 | 127.10 | 84.5 |
| Italy | 11.1 | 123.14 | 74.1 |
| Hong Kong, China | 9.7 | 122.65 | 69.5 |
| Macao, China | 30.4 | 115.82 | 75.3 |
| Czech Republic | 22.1 | 115.22 | 78.5 |

Table 15. Compound annual growth rate of cellular phone 1999-2004 in order of per 100 inhabitants

| Country | CAGR (%) 1999-2004 | Per 100 inhabitants | As % of total telephone subscribers |
|------------------|-----------------------|---------------------|--|
| Luxembourg | 24.8 | 138.17 | 63.8 |
| Hong Kong, China | 14.0 | 118.77 | 68.6 |
| Sweden | 13.8 | 108.47 | 60.3 |
| Italy | 15.7 | 108.19 | 70.7 |
| Czech Republic | 40.9 | 105.64 | 75.9 |

Table 16. Compound annual growth rate of cellular phone 1998-2003 in order of per 100 inhabitants

| Country | CAGR (%) 1998-2003 | Per 100 inhabitants | As % of total telephone subscribers |
|------------------|-----------------------|---------------------|--|
| Luxembourg | 32.8 | 119.38 | 60.0 |
| Taiwan, China | 40.4 | 114.14 | 65.9 |
| Hong Kong, China | 18.3 | 107.92 | 65.9 |
| Italy | 22.6 | 98.07 | 68.1 |
| Sweden | 16.5 | 98.05 | 57.4 |

to be noted that Nigeria had the highest CAGR of 261.8% from 2000-2005 in terms of cellular phone subscribers.

Cellular Subscriber

Afterwards, Internet penetration has been considered and found that USA remains at the top consequently in 2002, 2003, and 2004 (see Tables 17 to 19), with the highest Internet hosts per 10,000 inhabitants. But, Iceland and Korea (R.) took the lead in terms of Internet users per 100 inhabitants. This supports towards their efforts in implement-

ing successful ICT strategies in those countries for creating enabling environments.

Information Technology

Lastly, before performing a critical analysis of an ICT indicator, basic indicators of ICT during 2002 to 2005 have been portrayed in Tables 22 to 25. It has been found that, despite high population density of over 6,500 per Km² Hong Kong has maintained to keep higher number of total telephone subscriber per 100 inhabitants, with over 23,000 USD per capita. This reflects the

An Overview on Strategic ICT Implementations Toward Developing Knowledge Societies

Table 17. Compound annual growth rate of cellular phone 1997-2002 in order of per 100 inhabitants

| Country | CAGR (%) 1997-2002 | Per 100 inhabitants | As % of total telephone subscribers |
|------------------|-----------------------|---------------------|-------------------------------------|
| Taiwan, China | 74.9 | 108.30 | 65.1 |
| Luxembourg | 47.7 | 106.05 | 57.1 |
| Italy | 35.8 | 95.99 | 66.6 |
| Israel | 30.5 | 95.45 | 67.8 |
| Hong Kong, China | 23.5 | 94.25 | 62.5 |

Table 18. Highest and lowest growth rate of total cell phone subscribers 2002-2005 (Source: ITU statistics www.itu.int/ITU-D/ict/statistics.htm)

| 2002 | | 2003 | | 2004 | | 2005 | |
|--------------|------|--------------|------|--------------|------|--------------|------|
| Country | % | Country | % | Country | % | Country | % |
| D.R. Congo | 98.2 | D.R. Congo | 99.0 | D.R. Congo | 99.5 | D.R. Congo | 97.3 |
| Turkmenistan | 2.1 | Turkmenistan | 2.4 | Turkmenistan | 11.8 | Turkmenistan | 11.8 |

Table 19. Internet hosts per 10,000 inhabitants of top 5 countries in 2004

| Country | Internet hosts per 10,000 inhabitants | Internet users per 100 inhabitants | PCs per 100 inhabitants | Country | Internet users per 100 inhabitants |
|-------------|--|---------------------------------------|----------------------------|------------|---------------------------------------|
| USA | 6645.16 | 63.00 | 76.22 | Iceland | 77.00 |
| Iceland | 4758.60 | 77.00 | 48.22 | Greenland | 66.32 |
| Netherlands | 3334.42 | 61.63 | 68.47 | Korea (R.) | 65.68 |
| Denmark | 2681.94 | 60.41 | 65.48 | Australia | 65.28 |
| Finland | 2215.16 | 63.00 | 48.22 | Guernsey | 64.52 |

Table 20. Internet hosts per 10,000 inhabitants of top 5 countries in 2003

| Country | Internet hosts per 10,000 inhabitants | Internet users per 100 inhabitants | PCs per 100 inhabitants | Country | Internet users per 100 inhabitants |
|-------------|--|---------------------------------------|----------------------------|--------------|---------------------------------------|
| USA | 5577.84 | 55.58 | 62.44 | Iceland | 67.47 |
| Iceland | 3789.65 | 67.47 | 46.37 | Sweden | 63.00 |
| Finland | 2436.55 | 49.05 | 46.08 | Korea (R.) | 61.07 |
| Denmark | 2312.67 | 56.21 | 61.40 | Guernsey | 59.14 |
| Netherlands | 2162.66 | 52.19 | 50.83 | Faroe Island | 58.74 |

Table 21. Internet hosts per 10,000 inhabitants of top 5 countries in 2002 (Source: ITU statistics www.itu.int/ITU-D/ict/statistics.htm)

| Country | Internet hosts per 10,000 inhabitants | Internet users per 100 inhabitants | PCs per 100 inhabitants | Country | Internet users per 100 inhabitants |
|-------------|--|---------------------------------------|----------------------------|--------------|---------------------------------------|
| USA | 4004.25 | 50.10 | 62.44 | Iceland | 64.79 |
| Iceland | 2370.17 | 64.79 | 45.14 | Sweden | 57.31 |
| Finland | 2343.12 | 48.57 | 44.17 | Korea (R.) | 55.17 |
| Tonga | 1964.21 | 2.92 | 2.02 | Guernsey | 53.57 |
| Netherlands | 1937.14 | 50.63 | 46.66 | Faroe Island | 53.23 |

An Overview on Strategic ICT Implementations Toward Developing Knowledge Societies

Table 22. Basic ICT indicators in 2005 in order of total telephone subscribers per 100 inhabitants

| Country | Total telephone subscribers per 100 inhabitants | Per capita USD (2004) | Population density (per Km ²) |
|------------------|---|-----------------------|---|
| Luxembourg | 199.13 | 69,027 | 180 |
| Sweden | 180.02 | 38,850 | 20 |
| Hong Kong, China | 176.54 | 23,960 | 6,630 |
| Iceland | 169.34 | 41,765 | 3 |
| Denmark | 162.39 | 45,059 | 126 |

Table 23. Basic ICT indicators in 2004 in order of total telephone subscribers per 100 inhabitants

| Country | Total telephone subscribers per 100 inhabitants | Per capita USD (2003) | Population density (per Km ²) |
|------------------|---|-----------------------|---|
| Luxembourg | 199.13 | 59,626 | 177 |
| Sweden | 180.02 | 36,738 | 20 |
| Guernsey | 177.31 | 32,428 | 858 |
| Hong Kong, China | 173.19 | 23,245 | 6,512 |
| Iceland | 164.01 | 35,973 | 3 |

Table 24. Basic ICT indicators in 2003 in order of total telephone subscribers per 100 inhabitants

| Country | Total telephone subscribers per 100 inhabitants | Per capita USD (2002) | Population density (per Km ²) |
|------------------|---|-----------------------|---|
| Luxembourg | 199.13 | 47,255 | 175 |
| Guernsey | 173.79 | 32,428 | 858 |
| Taiwan, China | 173.22 | 12,453 | 628 |
| Sweden | 170.94 | 26,864 | 20 |
| Hong Kong, China | 163.81 | 23,566 | 6,413 |

Table 25. Basic ICT indicators in 2002 in order of total telephone subscribers per 100 inhabitant (Source: ITU statistics www.itu.int/ITU-D/ict/statistics.htm)

| Country | Total telephone subscribers per 100 inhabitants | Per capita USD (2001) | Population density (per Km ²) |
|---------------|---|-----------------------|---|
| Luxembourg | 185.74 | 44,857 | 172 |
| Taiwan, China | 166.47 | 12,553 | 626 |
| Guernsey | 164.82 | 32,428 | 862 |
| Sweden | 162.45 | 24,626 | 20 |
| Iceland | 155.71 | 26,687 | 57 |

national commitment in implementing successful ICT strategies for their economy.

Basic Indicators

All these indicators are providing with facts that countries/communities will emerge as successful if and only if, successful ICT strategies can be implemented properly through longer-term strate-

gies. Else, the ultimate result will not be visible in terms of their outcomes. Table 26 shows a critical analysis on one of ICT indicators (number of Internet users per 100 populations):

In this context, to make pragmatic steps, indicators on national sustainable development strategy and implementation of ratified global agreements have been modified to establish good global governance. At the same time, indicator

Table 26. A critical analysis on one of ICT indicators (Adapted from UN, 2005)

| |
|---|
| <p>Parameter: Number of Internet users per 100 populations</p> <p>Purpose: The number of Internet users is a measure of Internet access and its use</p> <p>Relevance to building knowledge society: As an information distribution system, the Internet and its usage provide opportunities for bringing education and information within the reach of all. It can significantly shorten time lags as well as opening up a new range of information resources and creating a knowledge society by enabling them to take informed decisions.</p> <p>Relevance to Sustainable/Unsustainable Development: Telecommunications and social, economic, and institutional development are closely linked. Modern communications is considered to be relatively favorable to the development processes. There is unlikely to be sustainable development without a well-developed communications infrastructure. Communication is critical to support sustainable development.</p> <p>International conventions and agreements: The four-year strategic Istanbul Action Plan adopted by the ITU World Telecommunication Development Conference in 2002 provides a six-point action plan that address the key elements needed to bridge the digital divide. Similarly G8 Okinawa charter on Global Information Society in 2000; two phases of World Summit on the Information Society (WSIS), first phase in Geneva from December 10-12, 2003 and second phase in Tunis from November 16-18, 2005 endorsed by the UN General Assembly Resolution 56/183 ¹³ (December 21, 2001); and WSSD in Johannesburg August 26-September 4, 2002, including many follow up meetings are providing dynamic guidance to the global communities.</p> <p>International targets/ Recommended standards: The benefits of new technologies, especially ICTs should be available to all, UN Millennium Declaration #55/2.</p> <p>Linkages to Other Indicators: There are also other variables (e.g., Internet hosts and subscribers), which provide a measure of how many people are accessing the Internet. This indicator is also related to other telecommunication indicators (e.g., main telephone lines, mobile cellular subscribers), as well as income and education indicators.</p> |
|---|

#47¹⁴ and 48¹⁵ of MDGs have been made less dense by extending to 1000 inhabitants, instead of 100 (Table 27). They seem realistic in sense, that many countries will not be able to achieve MDGs by 2015, unless they keep forcing on improving indicators on knowledge building and increase expenditures on research and development as a percent of their GDP.

Before proceeding further, ICT strategies of a few countries in regional aspect have been highlighted. They are Finland, Ireland, and Turkey from European Union; Japan, Singapore, and Thailand from Asia Pacific and Kenya from Africa.

European Union

An international cooperation dimension integrated with the activities of each of the thematic priority fields of these specific programmes, “Integrating and strengthening the European Research Area,” “Specific activities covering a wider field of research,” and “Structuring the European Research Area” allowed the European research community to benefit from the knowledge and expertise of third countries and institutions through the participation of researchers, teams, and institutions from those countries. The general objective under the 6th Framework programme

is to help open up the European research area to the world focusing mutual benefits of the community. The overall objective is, therefore, for the European Union to develop strong scientific partnerships with developing countries in order to contribute to their sustainable development (EC, 2004), by means of human capital development, mobility, and institution-building (EC, 2005, 2006). It is thus important that the ownership of the knowledge and technology developed in partnership under this activity be equitably shared. The results will be used to contribute to improved regional cooperation strategies, the elaborations of concepts aimed at sustainable development, and societal innovation.

It has been observed that, over a quarter of EU GDP growth and around 50% of productivity growth is due to improvement in ICT. In recent years ICT services, skills development, media and content services, and their usage in other economic sectors, are growing fast within the economy and society. However, many Europeans are yet to reap a few benefits from ICT. As such, 57% of individuals living in the EU did not regularly use the Internet in 2005; only 10% of persons over 65 used Internet against 68% of those with age between 16 and 24; only 24% of persons with low education used the Internet against 73% of those with high education; and only 32% of unemployed

Table 27. Modified MDG indicators (Adapted from UN, 2005)

| CSD ¹⁶ Indicators | MDG Indicators | New Indicators |
|---|--|----------------------------|
| National Sustainable Development Strategy | | |
| Implementation of Ratified Global Agreements | | Good governance indicators |
| Number of Internet Subscribers per 1000 inhabitants | 48. Personal computers in use per 100 population and Internet users per 100 population | |
| Main Telephone Lines per 1000 inhabitants | 47. Telephone lines and cellular subscribers per 100 population | |
| Expenditure on R&D as a percent of GDP | | |

persons used the Internet against 54% of those with employment (ICT Riga, 2006).

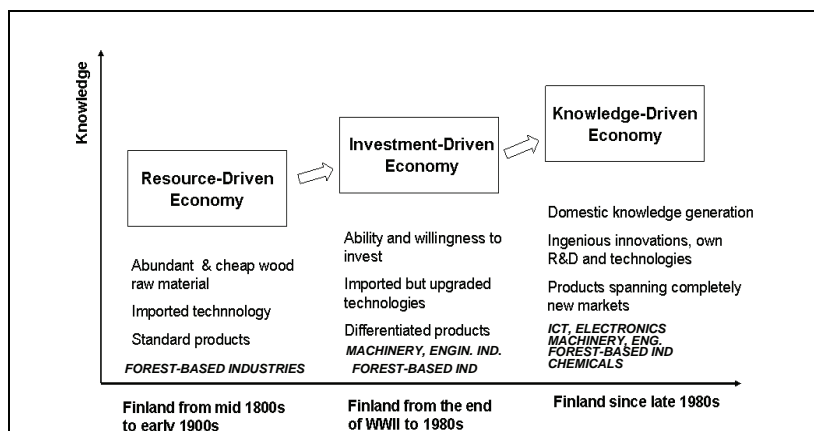
Finland

Finland is a unique example of how a country can rapidly transform itself from a resource-based economy into one based on innovative and intellectual technologies. In Finland, the specialization of production, trade, and R&D in more knowledge-intensive products and services coincided with the gradual opening of the economy and deregulation of capital flows. A peculiarity of the Finnish case is the atypical pattern of industrial renewal from essentially natural-resource-based industries toward machinery, engineering, electronics, and ICT. However, there are a few other examples of natural-resource-abundant countries that have managed to transform their industrial structures toward higher knowledge intensity and value added so rapidly and successfully as Finland. The origins of the Finnish knowledge economy can be traced back to user-producer linkages between the forest-based industries as early users of high technology, and the emerging

engineering, electronics, and ICT industries in the 1960s and 1970s (see Figure 2).

The Finnish experience in the 1990s is an example of how knowledge becomes the driving force in economic transformation and growth. Although as recently as in the 1970s Finland was relying mainly on resource-intensive industries, it has transformed to be the most ICT specialized economy in the world. In this aspect, rapid structural transformation beginning in the mid nineties coincided with equally rapid improvements in macro balances, and by the end of the decade the country's macroeconomic implementation was one of the strongest in Europe. Although Finland has many characteristics that cannot easily be replicated by other countries, much of its experience in designing knowledge-based economic and social strategies are highly relevant. However, a key lesson is the importance of flexibility in responding to change and the critical role of a responsive education system. Finland's experience also highlights the importance of developing a vision, a process for consensus building and accomplishment (Léautier, 2005).

Figure 2. Finland's stages of industrial and economic development (Adapted from Dahlman, Routti, & Ylä-Anttila, 2005)



Ireland

ICTs lead a transition in the Irish economy to get away from low-end manufacturing to hardware manufacturer and software developer. Over the past decade, Ireland has become one of the strongest growing partners in the EU and ranked nineteenth in the Networked Readiness Index¹⁷. Heavy government spending on technical and tertiary institutions

in the early 1980s gave the country to provide steady supply of highly skilled manpower and at the same time creation of tax and trade regulators gave it a better environment for ICT investors.

The Irish economy escalated during the 1990s, with GDP per capita growing by an annual average of 7.1% between 1990 and 2000, compared to an OECD average of 2.6%¹⁸. A few of the strategies are being illustrated in Table 28.

Table 28. Various steps taken by the Irish government to promote ICT for knowledge development^{19;20;21}

| Country | Policies taken | Date of implementation | DAI Ranking in 2002 |
|---------|---|------------------------|---------------------|
| Ireland | Higher Education Authority Act | 1971 | 0.69 (upper access) |
| | Strategy for Education Technology | October 1997 | |
| | The Education Act | 1998 | |
| | Government Action Plan on the Information Society | January 1999 | |
| | Policy for the Acceptable use of the Internet in Schools | 1999 | |
| | Classroom 2000 | 2000 | |
| | Establishment of Information Society Commission | 2000 | |
| | Information Society Fund | 2000 | |
| | Establishment of Media Lab Europe | 2000-2005 | |
| | Inclusion of Research Technological Development and Innovation Priority (RTDI) in the National Development Plan 2000-2006 | 2000 | |
| | Establishment of Technology Foresight Fund | February 2000 | |
| | Establishment of Irish Research Council for Science, Engineering and Technology | 2001 | |
| | Establishment of Cabinet Committee on the Information Society | December 2001 | |
| | New Connections- A Strategy to Realise the Potential of the Information Society | March 2002 | |
| | Inclusion of Programme for research in Third Level Institutions (PRTLII) | March 2002 | |
| | New Connections: the Second Government Action Plan | April 2002 | |
| | Establishment of Cabinet Committee on the Information Society | | |
| | The Empowering Schools Strategy | 2003 | |
| | Strategic Innovation Fund | 2006 | |
| | Institutes of technology Act | 2006 | |
| | New Government Action Plan for 2006-2008 ²² | 2006 | |

Turkey

Since the founding by Mustafa Ataturk in 1923, the government of the Republic of Turkey has been moving to integrate the country into Europe. To achieve this long term aim the country in recent years has been investing aggressively in networked readiness. Turkey ranks forty-first in overall Networked Readiness²³. Digital access index (DAI) of Turkey in 2002 was 0.48, that falls under medium access (under a category of high access, upper access, medium access, and low access, respectively)²⁴. Table 29 shows the broadband subscribers per 100 inhabitants, by technology in December 2005.

Asia Pacific

The world economy is in the midst of a profound transformation spurred by globalization and sustained by the rapid development of ICT that is

accelerating the transmission of information and knowledge in every part of the globe, including the countries and regions in the Asia Pacific. ICT has a great potential to facilitate the achievement of the UN Millennium Development Goals, particularly to combat poverty, hunger, disease, illiteracy, environmental degradation, and gender inequality (Hak-Su, 2003).

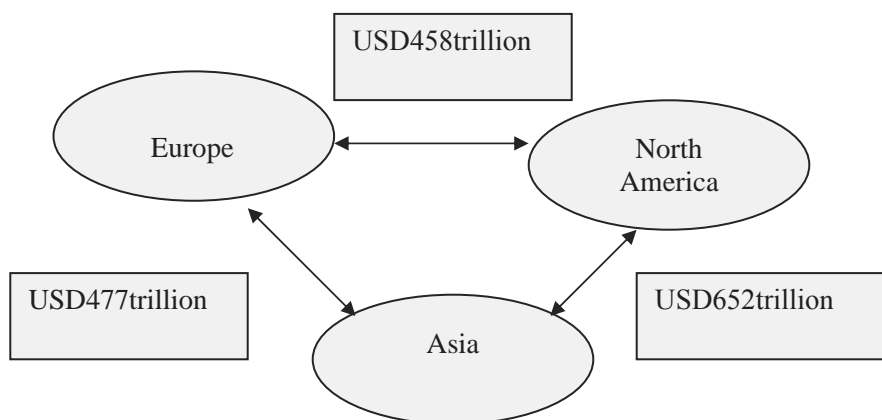
At the same time, the Asia Pacific region is also the most dynamic and fastest growing region of the world and it is expected to account for more than half of the world trade in the twenty-first century. Current trade estimates among the three continents is given in Figure 3, and it has been observed that it is highest between Asia and North America.

Particularly, the economic and technological levels in East Asian countries are not uniform, and the bases and environments for network economic development are also diverse. However, the growth tendency for the network economy in East Asia as

Table 29. Broadband subscribers per 100 inhabitants of Turkey (Source: www.oecd.org/ict/broadband accessed on August 16, 2006)

| DSL | Cable | Other | Total | Rank | Total subscribers |
|-----|-------|-------|-------|------|-------------------|
| 2.1 | 0.0 | 0.0 | 2.1 | 29 | 1,530,000 |

Figure 3. Amount of trade estimates in three continents (Adapted from UN, 2003)



a whole is very noticeable. For the average growth rate of Internet users, in 2000, it was 150% in the East Asia region, higher than 130% in Europe and 51% in North America. Similarly, network economy is becoming the new motive force for the development of Asian economy²⁵.

Asia Pacific homes more than 60% of the world's population, among them more than 75% are below the poverty line, despite being the most dynamic and fastest growing region of the world. However, due to its diverse nature of characteristics comprising the world's richest and the poorest nations, it represents more than half of the world trade. At the same time, it establishes a unique feature in this region to promote growth of ICT, as the region dwells orient cultures that have been centers of learning and have created huge intellectual property in several languages. GDP per capita grew from USD120 in the 1900s to USD1600+ in the 2000s (Japan has the highest GDP per capita of US \$37890 in 2005)²⁶ despite the fact that only 11 economies in this region has over 25% of teledensity and Internet penetration rate ranges between 10 and 50 (UN, 2003; ITU, 2005)²⁷. Currently, Japan has 21,304,292 (2005) Internet hosts and 86.3 million (2005) Internet users²⁸ that shows their ICT development, and at the same time, Japan's KDDI has launched an unlimited access mobile Internet tariff at a price equivalent to entry-level digital subscriber line (DSL) that gives their competency in establishing local knowledge repository²⁹. Another country, with more than 95% of internal content, Korea (R.) is currently ranked highest in the world in terms of the development of information infrastructure³⁰. Korea (R.) also enjoys the highest penetration of broadband Internet with over 70% of total households and all schools of that country have broadband Internet. Korea (R.) ranked fourth in DAI 2002 with high access of 0.82³¹.

Japan

Initially, at the first meeting of the IT Strategic Headquarters in January 2001 "e-Japan Strategy" was launched to establish the goal for Japan 'to become the world's most advanced IT nation within 5 years (by the end of 2005). To achieve this goal the public and private sectors together have been expending great efforts in implementing various measures, such as the development of communications infrastructure, promotion of e-government, and e-commerce. As a result, stunning achievements have been made in the area of ICT. For example, Internet service in Japan is the fastest and cheapest in the world, e-government instrument is expanding (online procedures operate 24 hours a day for 365 days and handle more than 100,000 applications annually) and its e-commerce market is growing in scale to become the second largest in the world after the United States (the United States ranked at the top with 9.0%, followed by Japan with 7.1%) (ECOM, 2003). At the 29th meeting of the IT Strategic Headquarters, the "IT Policy Package 2005: Towards the Realization of the World's Most Advanced IT Nation" was announced. It is desired that the "IT Policy Package 2005" will further enhance measures mainly in the areas closely related to the peoples' daily lives, including administrative service, medical care, and education. The IT Strategic Headquarters will work to realize a knowledge society in which people can experience the change and enjoy the benefits brought upon by ICT (Government of Japan, 2005).

If observed closely, one will comment that these have been achieved not just in a few days or months, but years of relentless efforts and endeavors to fulfill the mission of a nation. Table 30 shows a chronological overview of various steps taken by the Japan government along this prospect.

Table 31 provides a comparison on e-strategies of Singapore and emerging Thailand who may

Table 30. Various steps taken by the Japan government to promote a knowledge society

| Country | Policies taken | Period of implementation | DAI Ranking in 2002 |
|----------------------------|--|--------------------------|-----------------------|
| Japan (MIC, 2004; 2005) | National ICT Policy | 1994-1999 | 0.75 (high access) |
| | Formation of the Advanced Information and telecommunications Society Promotion Headquarters | 2000-2001 | |
| | Strategic Headquarters for the Promotion of an Advanced Information and telecommunications Network Society | 2001-2002 | |
| | e-Japan Strategy-I | 2001-2003 | |
| | e-Japan Priority Policy Program (e-Japan Strategy-II) | 2003-2005 | |
| | u-Japan Initiative | 2004-> | |

Table 31. E-strategies of Singapore and Thailand

| Country | Policies taken | Period of implementation | DAI Ranking in 2002 |
|-----------|-------------------------------------|--------------------------|-----------------------|
| Singapore | National Computerization Plan | 1980-1985 | 0.75 (high access) |
| | National IT Plan | 1986-1991 | |
| | IT 2000 | 1992-1999 | |
| | InfoComm 21 | 1999-2003 | |
| | Connected Singapore | 2003-onwards | |
| | | | |
| | | | |
| Thailand | National Science and Technology Act | 1991 | 0.48 (medium access) |
| | National IT Committee | 1992 | |
| | National IT Policy: IT 2000 | 1996-2000 | |
| | e-Thailand initiative | 2000 | |
| | IT 2010 Policy | 2001-2010 | |
| | National ICT Master Plan | 2002-2006 | |

take a leading role in South East Asia within a few years.

Africa

Africa is confronted with numerous challenges. But, one of the most important of these challenges is to integrate the continent into the information

society. Furthermore, reducing the digital divide and facilitating the continent's absorption into the global information society could overcome Africa's isolation. In an avant-garde approach, concerned authorities have been convinced that research through the production of learning and applicable knowledge could contribute significantly to a better development. For this purpose, the International

Development Research Centre (IDRC) launched a program known as Acacia to contribute to the production of an essentially African body of knowledge on the role of ICTs in the economic and social development process. This focus on learning and the production and sharing of knowledge is reflected in the systematic documentation and evaluation of Acacia's experiences in sub-Saharan Africa (Olu-koshi & O'Neil, 2003).

For the past few decades, the international community has noted a growing digital gap between developed countries and Africa, on the one hand, and within African countries, between the elites and the poorer and underprivileged populations, on the other hand. New information and communication technologies can serve as a development lever to speed up the economic development of Africa and its poor communities. However, the details of these transformations and the degree and pace of such changes in poor communities have yet to be fully grasped. Equally, the ways in which ICTs might best serve development are still relatively unknown.

Therefore, it is critical to determine the implications that these changes will have on the poor

communities that ICTs are supposed to transform. Studies and investigations are needed to generate new hypotheses that can be tested. The results of such research must also be shared rapidly and effectively to keep up with the pace at which ICTs evolve (Adera & Camara, 2003). To illustrate on how ICT strategies have been implemented in Africa and how indicators of ICT are being developed, Tables 32-35 are showing the basic ICT indicators for the five top countries, in terms of total telephone subscribers. From these tables, it has been observed that Reunion, Seychelles, and Mauritius are at the top with robust information infrastructure, while South Africa and Botswana have been driving towards the achievement with increased GDP per capita.

Basic Indicators

Kenya

Despite advances in private sector initiatives, the government has been found to be reluctant to embrace ICTs for social and economic development for some time³². However, Kenya's e-strategies

Table 32. Basic ICT indicators in 2005

| Country | Total telephone subscribers per 100 inhabitants | Per capita USD (2004) | Population density (per Km ²) |
|------------|---|-----------------------|---|
| Reunion | 98.65 | - | 313 |
| Seychelles | 96.80 | 8,348 | 200 |
| Mauritius | 86.13 | 5,146 | 668 |
| Tunisia | 69.06 | 2,821 | 61 |
| Botswana | 54.11 | 4,957 | 3 |

Table 33. Basic ICT indicators in 2004

| Country | Total telephone subscribers per 100 inhabitants | Per capita USD (2003) | Population density (per Km ²) |
|--------------|---|-----------------------|---|
| Reunion | 98.65 | 1,893 | 306 |
| Seychelles | 86.94 | 8,348 | 200 |
| Mauritius | 70.06 | 4,606 | 661 |
| Tunisia | 47.97 | 2,527 | 61 |
| South Africa | 46.76 | 2,293 | 38 |

Table 34. Basic ICT indicators in 2003

| Country | Total telephone subscribers per 100 inhabitants | Per capita USD (2002) | Population density (per Km ²) |
|--------------|---|-----------------------|---|
| Reunion | 98.65 | 1,893 | 301 |
| Seychelles | 85.07 | 8,348 | 205 |
| Mauritius | 55.22 | 3,957 | 655 |
| South Africa | 46.76 | 2,293 | 39 |
| Botswana | 37.19 | 2,939 | 3 |

Table 35. Basic ICT indicators in 2002 (Source: ITU statistics (www.itu.int/ITU-D/ict/statistics.htm))

| Country | Total telephone subscribers per 100 inhabitants | Per capita USD (2001) | Population density (per Km ²) |
|--------------|---|-----------------------|---|
| Reunion | 98.65 | 1,893 | 296 |
| Seychelles | 78.81 | 7,603 | 207 |
| Mauritius | 55.79 | 3,771 | 649 |
| South Africa | 40.80 | 2,562 | 38 |
| Botswana | 33.57 | 2,921 | 3 |

have been best poised through the approval of its national ICT policy by the Ministry of Information and Communication in January 2006. Table 36 shows the steps of the Kenyan government towards establishment of a knowledge society through initiating relevant ICT strategies:

The next section puts forward a few recommendations for successful implementation of ICT strategies by upholding the concept of creating knowledge societies.

RECOMMENDATIONS

Creation of knowledge societies demand high initial investment in sectors that are seemingly looked as unproductive at the beginning, commitment at all levels of the policy initiations, and mass awareness at the end users level. Furthermore, increasing investments in R&D during these periods of high unemployment demand great political wisdom and courage, when an easier

path may seem to generate immediate employment rather than build up longer-term strengths. At the same time, increasing R&D must be supported by national industrial and innovation strategies, which should be properly communicated by governments. These national strategies should focus on consensus building; such as, by organizing economic policy programs attended by practically all members of the Parliament and other decision makers from the public and private sectors, media, and labor market organizations (Dahlman, Routti & Ylä-Anttila, 2005).

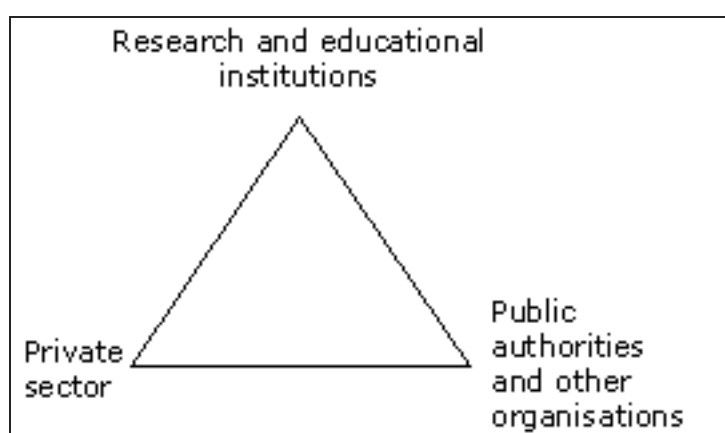
There should be a triangular incorporation of partnerships, as shown in Figure 4³³.

Consequently, it is almost impossible to identify the embedded ICT component due to non-availability of the financial data, and for that reason the aggregate figure cannot be calculated. However, figures for ICT-specific projects/programmes are easier to produce and some reported figures (including some non-ODA) have been highlighted, and it also shows various approaches taken by governments across the globe through

Table 36. Various steps taken by the Kenyan government to promote ICT

| Country | Policies taken | Period of implementation | DAI Ranking in 2002 |
|---------|--|--------------------------|---------------------|
| Kenya | The Kenya Information and Communications Bill 2006 | February 2006 | 0.19 (low access) |
| | National ICT Policy | January 2006 | |
| | Freedom of Information Act 2005 | 2005 | |
| | The Kenya Communication Act, 1998 | October 1998 | |
| | The Science and Technology Act | 1980 | |

Figure 4. Transformation to knowledge society demands tri-partite involvements



their direct commitments in establishing knowledge societies:

- Canada estimates a minimum expenditure of \$33 million per annum
- European Commission has a commitment of €250 million for multi-year ICT-specific programmes in addition to €110 million from the European Development Fund and €750 million from the European Investment Bank (1999–2003)
- France committed about €40 million (2002–2005) to global programmes over and above its country programmes and other facilities
- Germany supports at present ICT applications with approximately €180 million;
- Japan launched its Comprehensive Cooperation Package for bridging the “digital divide”
- —Japan’s commitment for ICT support, announced at the G8 Kyushyu-Okinawa Summit in 2000—which consists of non-ODA and ODA funding with a total of \$15 billion over 5 years (2000–2005)
- Sweden spent approximately \$18 million in 2003
- the United Kingdom currently has multi-year ICT-specific programmes and projects, mounting to approximately a total of \$83 million
- the United States estimates its spending of ICTs for development at more than \$200 million in 2003, and through leveraged or matching outside resources a further \$240 million was mobilized (OECD, 2005).

Taking all these facts into consideration, the following recommendations may be adopted for

successful implementation of ICT strategies in each country:

- Formulation of appropriate policies for promoting investment in ICT sector and establishing a transparent and consistent legal and regulatory framework to foster ICT development
- Ensure investment to improve access and network infrastructure, establish investment friendly climate by setting up policy, regulatory, and legal framework and by providing fiscal incentives, induction of new less expensive and cost-effective broadband wireless technology, and optical fiber communication transport backbone infrastructure (UN, 2003)
- Provide a framework for establishing national, regional, and international partnerships and help in coordinating programmes and activities aimed at specific ICT application areas with well defined objectives, milestones, and outcomes
- Formulate action plan for implementation at national and regional levels aimed at achieving the MDGs by mainstreaming ICTs
- Supporting national actions aimed at harnessing the potential of ICT for development through providing necessary assistance
- Serving as a common global forum to accelerate and promote universal access to knowledge and information, contribute to the development of norms and standards in a transparent, meaningful, and participatory way, taking into account development priorities and incentives for innovations and contribute to addressing issues like cultural diversity, information ethics, information rights, intellectual property rights, privacy, security, and cyber crime
- Contributing to a more systematic approach, review, and dissemination of ICT expertise, distance learning programmes, information and reliable data on ICT, case studies,

best practices and successful models, thus becoming an important 'knowledge bank' in this field

- Emphasizing universal access to knowledge and information for promoting grass roots development
- Taking actions in bridging the digital divide and promoting digital opportunities and adopting a coherent ICT strategy that would ensure cooperation and synergy among programmes and activities of the involved organizations or agencies so as to transform into a knowledge based society (UN, 2003)

The author feels that many nations are yet to cross the boundaries of implanting ICTs for fostering their economic outgrowths, despite substantive themes were addressed by various agencies including the Commission of Sustainable Development (CSD) since 1995. The box shows the themes of CSD with years as a ready reference and it can be observed that, including 2001 (focus was on biotechnology), all the themes were on capacity development or related to it.

- Technology for small-scale economic activities to address the basic needs of low-income populations; the gender implications of science and technology; and the contributions of science and technology to an integrated approach to land management (1995)
- Information and communication technologies for development (1997)
- Science and technology partnerships and networking for national capacity building (1999)
- National capacity-building in biotechnology (2001)
- Technology development and capacity building for competitiveness in a digital society (2003)
- Promoting the application of science and technology to meet the development goals

- contained in the United Nations Millennium Declaration (2004)
- Science and technology promotion, advice and application for the achievement of the internationally agreed development goals contained in the United Nations Millennium Declaration (2005)
- Bridging the technology gap between and within nations (2006)

Furthermore, nations can endorse a two-prong approach to promote successful ICT strategies. One may be in the technology context and the other one in the management perspective. The box (Figure 5) shows different action plans; a nation can take in these aspects.

An integrated approach is desirable in the implementation process along with the design and development phases, including critical assessment of the implementation strategies. Notwithstanding technologies are dynamically adjustable and varied in nature, but countries with success cases can easily be adopted without much duplication. This would save time, effort, and resources for many economies. Rather, efforts can be concen-

trated to localize the technology, content, and the change management processes through recursive simplifications. A circular modality can be followed as shown in Figure 6.

Finally, a context diagram is being developed that may be adopted in implementing national ICT strategies (see Figure 7).

WAY AHEAD AND CONCLUSION

National regulators, financial institutions, and market participants have shown that the global financial system can continue to function smoothly even under a difficult and totally unanticipated form of extreme constraints. Globalization of the world economy has been driven by a variety of forces: rising trade in goods, increasing international capital flows, enhanced technological spillovers, and emergent labor mobility.

A second channel has evolved in recent years through which capital account liberalization can have a positive impact is technology spillovers. These spillovers are most noticeable in the case of foreign direct investment (FDI), especially

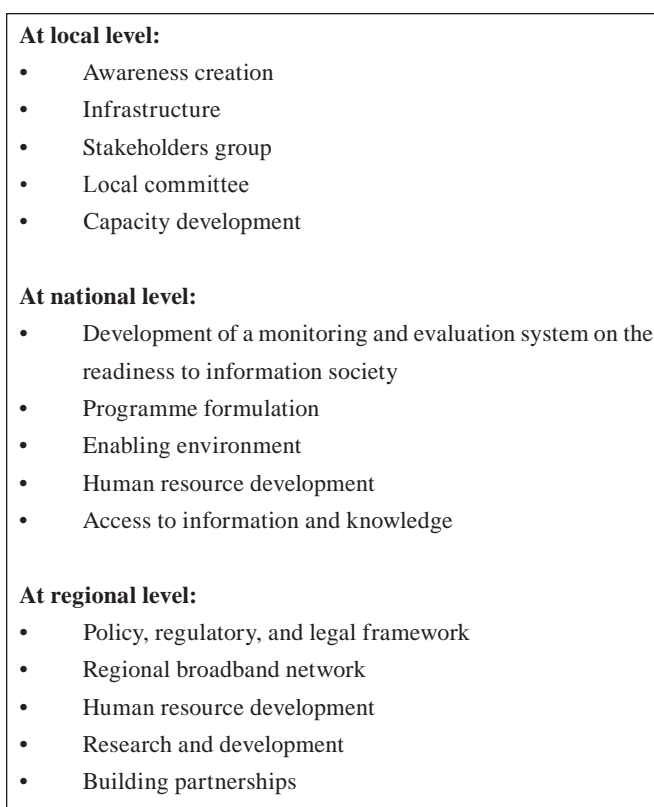
Figure 5. Parameters of the two-prong approach

| |
|---|
| <u>Technology parameters</u> |
| Initiation of Strategic Implementation Plan |
| Uniform Network Deployment |
| Adoption of Definitive Economic Indicators |
| Implementation of Recursive Algorithm for Content Management |
| Implementation of Adaptive Algorithm for Bandwidth Management |
| Establishment of Tools for Monitoring and Evaluation |
| Taking Corrective Measures |
| <u>Management parameters</u> |
| Development of Strategies |
| Transformation of Strategies into Plans and Actions |
| Correlations among Implementing Partners |
| Coherence among Stakeholders |

Figure 6. An ideal strategic implementation process



Figure 7. Context Diagram of activities for a knowledge society



through foreign firms incorporating new technologies in their subsidiaries. As novel technologies are generally developed and adapted by firms in industrial countries, FDI may be the most efficient way for developing economies to gain access to them. In addition, this knowledge may become more widely available in the country over a longer time, as employees with experience in the techniques used in foreign companies switch to other firms. Furthermore, foreign investment could increase competition in the host-country industry, and hence force local firms to become more productive by adopting more efficient methods or by investing in human and or physical resources (IMF, 2001).

Many countries have already released various strategic plans over the last decade. The worldwide technology revolution makes such strategies much more imperative. However, unlike the industrial revolution, the knowledge revolution encompasses all aspects of society, so e-strategies must go beyond technical goals in addressing the challenge of universal access to, and the usage of ICTs. The responsibility for adopting appropriate e-strategies rests not just with government, but also with civil society and the private sector. Moreover, much depends on how open governments want to be with their people in formulating and implementing such policies (Ulrich, Chacko & Says, 2004).

Along this aspect, the UN regional roadmap adopts the common vision and the key principles consistent with the WSIS Inter-sessional meeting recommendations that envisage the Information Society as a new and higher form of social organization, where highly-developed ICT networks, equitable and ubiquitous access to information, appropriate content in accessible formats, and effective communication must enable all the people to achieve their full potential, promote sustainable economic and social development, improve quality of life and therefore, alleviate poverty and hunger (UN, 2003).

Similarly, the UNESCO declaration urged the governments, parliaments, and other agencies to establish the legislative and political framework for reform and further development of higher education, taking into account of the fact that education and research are two closely related elements in establishing knowledge economy. Innovation schemes of collaboration among education institutions and different sectors of society might ensure that education and research programs effectively contribute to local, national, regional, and global development (Rossman, 2005).

Furthermore, the World Summit on the Information Society (WSIS) held in Tunis in November 2005 requested ECOSOC³⁴ to oversee the system-wide follow-up of its Geneva and Tunis outcomes. To this end, it requested ECOSOC, at its substantive session of 2006, to appraise the mandate, agenda, and composition of the Commission on Science and Technology for Development (CSTD), including considering the strengthening of the Commission, taking into account the multi-stakeholder approach. This mandate was immediately endorsed by the General Assembly in its resolution (A/60/252) adopted by consensus on March 27, 2006 (ECOSOC, 2006).

In these contexts, if the Internet penetration rate were taken as an indicator of successful implementation of ICT strategies, then it has been observed that during 1994-2000 it reaches to about 7%, while till 2003 the rate has increased to about 11%. However, mobile penetration rate was around 13% in 2000 and in 2003 it was about 23%. Hence, it can be seen that during 2000-2003 Internet penetration rate has increased by 4%, while mobile penetration rate has increased by 10%. If Internet growth is to recover, it is important to reach out to the growing number of users who have a mobile phone but no fixed-line telephone. Handheld Internet enabled devices could open up the information gateway in a new and exciting manner—through that one could help further the goals of universal access while challenging manufactures and service providers

to meet different users' need across the globe. Table 37 synthesizes the growth rate of Internet penetration and mobile penetration across the globe during 1994 to 2003.

Technologies, such as Bluetooth, ZigBee, and RFID allow low-power—short-distance connectivity within a range of 30 meters. Medium-range technologies can communicate at least 150 meters from a hotspot (e.g., Wi-Fi or IEEE 802.11b) and up to several kilometers, depending on environmental, geographical, and regulatory factors. Similarly, long-range technologies such as WiMAX (IEEE 802.16) and IMT-2000 (3G) have ranges that may extend up to 50 kilometers from a base station, and to near-nationwide coverage through a networked service. Furthermore, in this category fit solutions based on high or low-altitude platform stations (HAPS/LAPS), LMDS, and MMDS that can serve a whole town or city, and finally satellite that can serve a whole region (ITU, 2004).

Academic institutions can play greater role in helping design and evaluate ICT projects that may involve technically challenging research. In addition, their corporate research counterparts could become active in developing standards that are revolutionizing the spread and use of ICT: from open source software and the next-generation Internet IPv6, to wireless LAN (IEEE 802.11b or 'Wi-Fi'), the longer-reaching standard of IEEE802.16 (or Wi-Max'), and the IEEE802.20

(or 'Wi-Mobile'). At the one end of the academic spectrum are scholars involved in cutting-edge innovations designed at leading research institutions and higher education institutions (HEIs); at the other are those toiling on the front lines of basic education. Each stage of the continuum has a stake in national e-strategies and input to provide into their own design.

Developing a cadre of digitally literate workers is necessary for a country to participate in the ICT revolution. However, such a process takes time—in fact, education and the investment in human capital can have a longer horizon for payback than almost any other investments. In 1980, when Singapore first began looking at computerization, the island city-state had just 850 computer professionals among its three million people. In 2004 it reaches to over 100,000. Similarly, India's policy of putting resources into tertiary ICT education took over two decades to bear fruit in creating global centers for outsourcing software development and business processes for multinational firms (call centers, etc.).

North American Companies' outsourcing of software development, processing of health-insurance claims, and maintenance of customer databases has generated 3000 jobs long back in 1998 in the Barbados, which was the same number of people employed in sugar cane farming³⁵. After about 8 years in the age of ICT, still those sectors deserve the same attention from many

Table 37. Internet and mobile penetration rates (Source: ITU World Telecommunication Indicator Database)

| Year | Internet penetration rate | Mobile penetration rate |
|------|---------------------------|-------------------------|
| 1994 | 0 | 0 |
| 1996 | 3 | 5 |
| 1998 | 4 | 7 |
| 2000 | 7 | 13 |
| 2002 | 9 | 19 |
| 2003 | 11 | 23 |

nations who need to adopt ICT in their knowledge economy.

Mexico's GDP per capita in 1960 was about 2.5 times higher than that of Korea (R.), but by 2003 Korea (R.)'s GDP per capita was more than double than Mexico's. Without the contribution of knowledge, Korea (R.)'s actual GDP per capita would have been lower than Mexico (World Bank, 2006).

No matter how undeveloped they are, virtually all countries recognize that ICT development is the key to future prosperity, and ICT has to be embedded into the daily life with an enabling environment (Capacity dot org, 2004). Furthermore, without knowledge workers, nations cannot move up to higher rank of GDP, and more remunerative links in the global value chain. Hence, in a few countries (some indicated in this chapter) and elsewhere, digital literacy has become the highest priority, emphasizing math, basic science, technical skills, and for better or worse, English, as the prevailing lingua franca of international business and the Internet (Ulrich, Chacko & Says, 2004).

FUTURE ICT STRATEGIES

National development strategies calls for the creation of a high-skill, high-value added economy to increase the GDP and help bridge the wealth gap among cities and between country and the rest of the world. Skills development can be seen as moving a country eventually into the knowledge-based economy. Hence, the vision of the strategy should be dynamic, inclusive, and sustainable depending on world-class competitive business and skilled motivated people (National Assembly for Wales, 2001). From these aspects, national ICT strategies of a country should act as catalytic agents in reinforcing the overall development through innovative application of technologies and promotion of ubiquitous access to information.

Development of ICT needs assessment and strategic planning; policy development and implementation; information management; project development and implementation for e-services in health, education, environment, and other economic sectors; private sector entrepreneurship; awareness, education, and capacity building; e-government strategic planning; information infrastructure improvement; enterprise information resources integration; information systems design and deployment; business process reengineering and optimization; grass-roots and national institutional reforms and change management; and foremost improved regulatory environment.

For successful strategic ICT development, the following steps may be initiated at national level:

- Formulation and realization of ICT-enabling policy, institutional and regulatory framework and its incorporation into the overall strategy of the national social and economic development
- Formulation and implementation of sectoral ICT strategies and policies in health, education, environment, SMEs, and other economic sectors
- Advisory services to central and local governments on policies to raise awareness and encourage application of ICT to strengthen the economic and social position of the poor masses and ensure their enhanced participation in decision-making processes
- Advisory services on e-governance including strengthening of e-government road-map, strategies and policies, and implementation framework, e-government systems architecture improvement, strategic planning for information integration, e-service planning and research, information security strategies, knowledge, and content management
- Advisory services on ICT infrastructure advancement, ICT manpower development,

- institutional restructuring, change management and business process re-engineering
- Sponsor training courses, capacity building and awareness creation workshops on ICT policy, institutional and legislative issues, e-government, ICT standards, information security, and data protection (UNESCAP, 2006)

Figure 8 shows the various steps needed to develop strategic ICT implementations in a country.

As described earlier, in recent years many governments have undertaken, as part of the Millennium Declaration, to develop and put into effect strategies to give common people a real change to find decent and productive work. The Heads of State and governments have also resolved to 'ensure that the benefits of new technologies, especially information and communication technologies are available to all' (UN General Assembly, 2000). Furthermore, as developing countries join the global information infrastructure, each country will need to find competent ways of maximizing the benefits and reducing the risks from ICTs. This will involve synchronized action

through national ICT strategies encompassing the technologies and services as well as many aspects of the institutional settings. Strategies are needed to build the necessary scientific, technical, and engineering knowledge as well as the management techniques so that the social and economic institutions that are consistent with creativity using ICTs may reap the potential social and economic benefits. Eventually, effective national ICT strategies are most likely to materialize through creatively combining competencies in scientific, technological, and management fields related to ICTs in each country and recombining these strengths with externally available technologies, information, and knowledge resources (Mansell, R. & When, U., 1998).

Figure 9 illustrates an ideal environment to develop successful ICT strategies. The core parameters are hardware, software and access to ICT services, and the basic preconditions are to improve appropriate infrastructure, enhance human capacity, incorporate supportive public policy, establish supportive framework for enterprises, and strengthen local content and applications.

In terms of hardware, ICT refers to a wide range of products and service activities. These include

Figure 8. Steps towards successful ICT strategy implementation

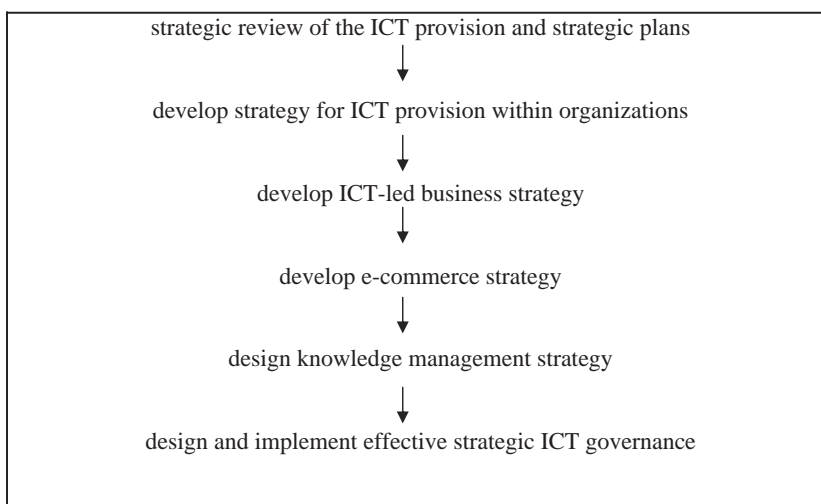
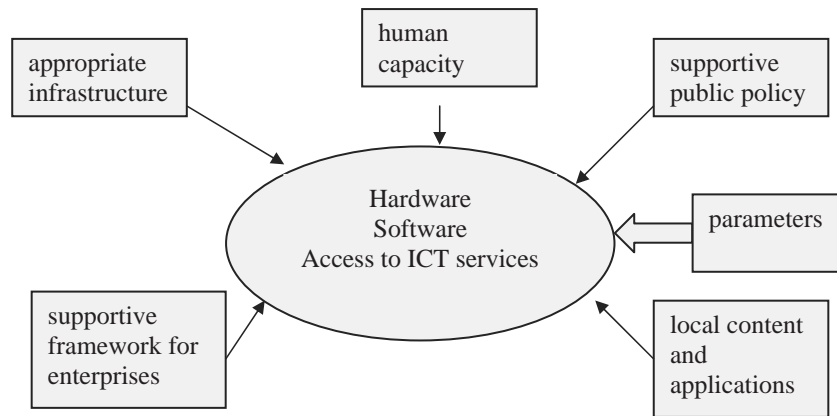


Figure 9. Preconditions for a successful ICT strategy



computers, related equipment, and accessories. In recent years, it also includes the fiber optics, satellites, sub-marine cables, voice over internet protocol, cellular phones (3Gs, 4Gs), high speed communication equipment, high definition television, and wifi/wimax equipment. ICT strategy should also encompass the software and related services industries, as such computer programming services, pre-packaged software, wholesale trade of software, retail trade of software, computer-integrated system design, computer processing, data generation, data security and information retrieval services, computer application and services management, computer rental and leasing, as well as computer maintenance and repair (Curtin, 2001).

REFERENCES

Adera, E., & Camara, A. (2003). Opportunities and Challenges for Community Development. Preface. In Ramata Malo Thioune (Ed.), *Information and Communication Technologies for Development in Africa: Vol. 1*. International Development Research Centre, Canada, 2003. ISBN 2-86978-114-8.

Capacity dot org (2004). *Embedding ICT in development*, Issue 23, October 2004, ISSN 1566-6603.

Crede, A., & Mansell, R. (1998). *Knowledge Societies in a Nutshell*. Information Technologies for Sustainable Development. IDRC, Ottawa, Canada.

Curtin, R. (2001). *Promoting youth employment through information and communication technologies (ICT): Best practices examples in Asia and the Pacific*. Report prepared for ILO/Japan Tripartite Regional Meeting on Youth Employment in Asia and the Pacific, Bangkok.

Dahlman, C.J., Routti, J., & Ylä-Anttila, P. (Eds.). (2005). A prepublication version of the Overview of the book *Finland as a Knowledge Economy: Elements of Success and Lessons Learned*, published in January 2006. The International Bank for Reconstruction and Development / The World Bank, Washington, 2005.

ECOMInternational Relations Group announced its 2002 Survey on the State of E-commerce in Other Countries. (2003). ECOM Newsletter, 34. Retrieved from http://www.ecom.jp/ecom_e/latest/newsletter_no34.htm

- EC (2004). *Specific programme for research, technological development and demonstration: Integrating and strengthening the European research Area*. 2004 Work Programme (SP1-10), European Commission, 2004.
- EC (2005). *Specific programme for research, technological development and demonstration: Integrating and strengthening the European research Area*. 2005 Work Programme (SP1-10), European Commission, 2005.
- EC (2006). *Specific programme for research, technological development and demonstration: Integrating and strengthening the European research Area*. 2006 Work Programme (SP1-10), European Commission, 2006.
- ECOSOC (2006). Informal background note on possible options for consideration by ECOSOC in the reform of the CSTD.
- Government of Japan (2005, February). *IT Policy Package 2005: Towards the Realization of the World's Most Advanced IT Nation*. The 29th Meeting of the IT Strategic Headquarters.
- Hak-Su, K. (2003). Forward. *Regional Road Map towards an Information Society in Asia and the Pacific, Economic and Social Commission for Asia and the Pacific*. United Nations, New York.
- ICT Riga (2006, June). *Ministerial Declaration*. Latvia.
- IMF (2001, October). *World Economic and Financial Surveys, World Economic Outlook: The Information Technology Revolution*. International Monetary Fund, Washington, ISBN 1-58906-073-3.
- ITU (2004, September). *The Portable Internet*. ITU Internet Reports 2004, Switzerland. ISBN 92-61-10741-9.
- ITU (2005). *World Telecommunications Development Report 2005*, ITU, Geneva.
- ITU (2006). *World Telecommunication/ICT Indicators*, ITU, Geneva.
- Léautier, F.A. (2005). Forward. In Dahlman, C.J., Routti, J., & Ylä-Anttila, P. (Eds.) A prepublication version of the Overview of the book *Finland as a Knowledge Economy: Elements of Success and Lessons Learned*, published in January 2006. The International Bank for Reconstruction and Development / The World Bank, Washington, 2005.
- Mansell, R., & When, U. (Eds.). (1998). *Information Technology for Sustainable Development*. Oxford: Oxford University Press.
- MIC (2004). Ministry of Internal Affairs and Communications. *MIC Communications News*. 15,12.
- MIC (2005). Ministry of Internal Affairs and Communications, *MIC Communications News*. 16,1.
- MPT (2003, December). *Info-Communication Country Report in Vietnam, Ministry of Posts and Telematics (MPT)*. The 29th Asian Info-communication Council conference, Tokyo, Japan.
- National Assembly for Wales (2001). *Information and Communication Technology for Education*. Education and Life-Long Learning Committee. Final Report, Cardiff, UK.
- OECD (2005). *Financing ICTs for Development: Efforts of DAC Members*,
Review of Recent Trends of ODA and its Contribution, Report to the UN Task Force on Financial Mechanisms for ICT for Development (TFFM), OECD Publications, France, 2005.
- OII (2005, May). *The Internet in Britain*. The Oxford Internet Survey (OxIS), Oxford Internet Institute, University of Oxford, Oxford.
- Olukoshi, A., & O'Neil, M. (2003). In Ramata Malo Thioune (Ed.), *INFORMATION AND COMMUNICATION TECHNOLOGIES FOR DEVELOPMENT IN AFRICA: Vol.1., Opportuni-*

ties and Challenges for Community Development. International Development Research Centre, Canada. ISBN 2-86978-114-8.

Rossmann, P. (2005). *TRANSFORMING HUMAN SOCIETY: The Future of Higher (Lifelong) Education: A Vision of Job Training and Education for Everyone on the Planet during this Century, Planning For all Worldwide, a Holistic View*. Retrieved June 12, 2006, from <http://ecolecon.missouri.edu/globalresearch/>

Siochru, Sean O., & Girard, Bruce (2005). *Community-based Networks and Innovative Technologies: New models serve and empower the poor*. UNDP, New York, 2005.

Soan (2006). *Digital sector comes into sharp focus*. Retrieved July 12, 2006, from <http://english.vietnamnet.vn/tech/2006/06/582289/>

ThuHue, N. (2005, July). *Internet governance for socio-economic development*. Case study from Vietnam, a case study in GIPI, Geneva.

Thanh, P.X. (2003, March). *ICT Policy Report*. Vietnam, Paper presented at the Interregional Seminar and Regional Demonstration Workshop on Accessible Information and Communications Technologies and Persons with Disabilities, Manila, Philippines.

Thioune, R.M. (Ed.) (2003). *Information and Communication Technologies for Development in Africa, Volume 1*. Opportunities and Challenges for Community Development, IDRC, Ottawa, Canada, 2003.

UN General Assembly (2000). *United Nations Millennium Declaration 55/2*, available at <http://www.un.org/millennium/declaration/ares552e.htm>, para. 20.

UN (2003). *Regional Road Map towards an Information Society in Asia and the Pacific, Economic and Social Commission for Asia and the Pacific*, United Nations, New York.

UN (2005). *United Nations for Sustainable Development, Expert Group Meeting on Indicators of Sustainable Development*, New York.

UN (2006). *The Digital Divide Report: ICT Diffusion Index 2005*, United Nations Conference on Trade and Development, United Nations, New York and Geneva.

UNDP (2001). *Human Development Report 2001: Making New technologies Work for Human Development*, Oxford University Press, New York.

UNDP (2004, May). *Local e-Government in FYR Macedonia 2004*. ICT Assessment Report of Municipalities, Skopje, UNDP FYR Macedonia.

UNESCAP (2006). Retrieved February 15, 2007, from http://www.unescap.org/pmd/03_tc/pmd_dp_tc_ra_ictps.asp

Ulrich, P., Chacko, J.G., & Says, P. (2004). Overview of ICT Policies and e-strategies in the Asia-Pacific Region. In Sayo, P., Chacko, J.G., & Pradhan, G. (Eds.), *ICT Policies and e-Strategies in the Asia-Pacific: A critical assessment of the way forward*, Elsevier, New Delhi. ISBN: 81-8147-513-5.

Uganda-Africa (2005). Retrieved June 06, 2006 from http://www.ungana-afrika.org/resources/techplanning/tech_planning_guide.pdf

World Bank (2005). *Project Appraisal Document and Project Information Document*, World Bank, Retrieved July 12, 2006, from <http://web.worldbank.org/external/projects/main?pagePK=104231&.htm>

World Bank (2006). *Korea as a Knowledge Economy: Evolutionary Process and Lessons Learned*, The World Bank, Washington, 2006.

Additional Readings

Ang, J., & Pavri, F. (1994). A survey and critique of impacts of information technology, *International Journal of Information Management*, 14, 122-133.

Balzan, R., & Vella, G. (1997). *A review of the National Strategy for Information Technology*. Office of the Prime Minister, Government of Malta.

Bennett, I. (May 9, 1995). *National industrial policy information technology sector*. (Draft Report), Planning Institute of Jamaica.

Bessette, G. (1996). *Empowering people through information and communication technology: Lessons from experience*. Paper submitted to the International Development Research Centre, Ottawa, Canada.

Bourdeal, J., Vazquez-Abad, J., & Winer, L. (January, 1996). *Information and communication technologies for generating and disseminating know-how*. (Draft report). Department of Scientific and Technological Affairs, Organization of American States.

Byron, L., & Gagliardi, R. (1996). *Communities and the information society: The role of information and communication technologies in education*. Report prepared for International Development Research Centre, Ottawa, UNESCO International Bureau of Education (IBE).

Camilleri, J. (October, 1994). *A national strategy for information technology for Malta*. Office of the National Strategy for Information technology, University of Malta.

Chataway, B., & Cooke, A. (1996). *Measuring the impact of information on development: Related literature: 1993-1995*. Available at <http://www.idrc.ca/books/focus/783/chataway.htm>

Cooper, C. (1998). An outline for policy analysis on access to information technology. In C. Cooper (Ed.), *Information technology policy and national economic development*. London: Routledge and Tokyo: UNU Press.

Correa, C.M. (1996). Strategies for software exports from developing countries. *World Development*, 24(1), 171-182.

Curtain, R. (2000). *Identifying the basis for a youth employment strategy aimed at transitional and developing countries*. United Nations Social Development Division. Available at <http://www.un.org/esa/socdev/youthemployment/research.html>

D'Orville, H. (April 30, 1996). *Technology revolution study: Communications and knowledge-based technologies for sustainable human development*. Final report, United Nations Development Programme, New York.

Drake, W.J. (Ed.). (1995). *The new information infrastructure: Strategies for US policy*. New York: Twentieth Century Fund Press.

Dutton, W.H. (Ed.). (1997). *Information and communication technologies: Vision and realities*. Oxford: Oxford University Press.

Eliasson, G. (1990). *The knowledge-based information economy*. Stockholm: Almqvist & Wiksell International.

Friedman, A.L. (1990). Four phases of information technology: Implications for forecasting IT work. *Future*, 22(8), 787-800.

Hafkin, N., & Taggart, N. (2001, June). *Gender, information technology and developing countries: An analytic study*. For the Office of Women in Development, Bureau for Global Programs, Field Support and Research, United States Agency for International Development. Available at <http://www.usaid.gov/wid/pubs/it01.htm>

Institute on Governance (1996). *Information and communication technologies (ICTs) and governance: Linkages and challenges*. International Development Research Centre, Ottawa, Canada.

Kahin, B., & Wilson III, E.J. (1997). *National information infrastructure Initiatives: Vision and policy design*. Cambridge MA: MIT Press.

Kenyon, P., & White, S. (2001). *Enterprise-based youth employment policies, strategies and programmes*. International Labour Office, Geneva. Available at <http://www.ilo.org/public/english/employment/skills/youth/publ/>

Lundvall, B.A. (1996). Information technology in the learning economy—challenges for development strategy. In a background paper for the *UNCSTD Working Group on IT and Development*.

Mahan, A.K., & Melody, W.H. (2005). *Stimulating investment in network development: Roles for regulators*. Case studies and research from World Dialogue on Regulation Cycle 2, Technical University of Denmark, Lyngby.

National Computerization Agency (2003). *Informatization: White Paper*. e-Korea, National Computerization Agency, Seoul, Rep. of Korea.

OECD (1997). *Information infrastructure: Their impact and regulatory requirements*. Committee for Information, Computer and Communications Policy, Paris, OECD/GD(97)18.

Surman, M., & Reilly, K. (2003). Appropriating the Internet for social change: Towards the strategic use of networked technologies by transnational civil society organizations. A report for Social Sciences research Council.

The Digital Opportunity Task Force (DOT Force) (2001). Digital opportunities for all: Meeting the challenge: Including a proposal for a Genoa Plan of Action, May 11, Genoa. Available at <http://www.dotforce.org/reports/>

Valantin, R. (1995). Information and communication technologies for development: Some principles and lessons from IDRC experience. *Information Technology for Development*, 10, 540-544.

ENDNOTES

- ¹ Source: World Bank–Knowledge Assessment Methodology. www.worldbank.org/kam. Note: The Knowledge Economy Index (KEI) comprises of 80 structural or qualitative variables with benchmark performance from more than 128 countries. KEI is an aggregate of all variables normalized from 0 (worst) to 10 (best).
- ² J. Bradford De Long. <http://econ161.berkeley.edu>
- ³ Eastern Europe, South America, and more developed parts of Asia
- ⁴ Rural Asia, Central America, and Africa
- ⁵ North America, Western Europe, Japan, Australia, and New Zealand
- ⁶ DAI measures the overall ability of individuals in a country to access and use new ICTs. The DAI is built around four fundamental vectors that impact a country's ability to access ICTs: infrastructure, affordability, knowledge and quality, and actual usage of ICTs. http://www.ictlogy.net/wiki/index.php?title=Digital_Access_Index accessed on August 02, 2006.
- ⁷ Retrieved June 15, 2006 from <http://www.barents2010.net/default.asp?ML=2663>
- ⁸ Retrieved July 14, 2006, from <http://www.internetworldstats.com/top25.htm>
- ⁹ TAI is a measure of how a country is creating and diffusing technology and building a human skill base, reflecting capacity to participate in the technological innovations at the network age.
- ¹⁰ ICTDI: Scores are derived as an index relative to the maximum and minimum achieved

- by countries in any indicator, as such; Index score= (Value – Minimum)/(Maximum – Minimum).
- 11 The compound annual growth rate (CAGR) is computed by the formula:
12 $[(P_v/P_0)^{(1/n)}]-1$, where P_v = Present value, P_0 = Beginning value and n = Number of periods. The result is multiplied by 100 to obtain a percentage.
- 13 <http://english.vietnamnet.vn/tech/2006/06/582289> accessed July 12, 2006
- 14 http://www.itu.int/wsis/docs/background/resolutions/56_183_unga_2002.pdf
- 15 47: MDG- Telephone lines and cellular subscribers per 100 population
- 16 48: MDG- Personal computers in use per 100 population and Internet users per 100 population
- 17 Commission on Sustainable Development The Global Information Technology Report 2001-2002: Readiness for the Networked World, Center for International Development, Harvard University, Oxford University Press, Oxford, 2002.
- 18 Country Note: Ireland, OECD Review of Career Guidance Policies, OECD, April 2002.
- 19 http://insight.eun.org/ww/en/pub/insight/misc/country_report.cfm accessed on August 16, 2006
- 20 <http://www.american.edu/initeb/ty5746a/policies.htm> accessed on August 08, 2006
- 21 <http://www.taoiseach.gov.ie/index.asp?docID=764; 229; 557> accessed on August 08, 2006
- 22 Knowledge Society News, Issue 1, August 03, 2006 available online from <http://news-weaver.ie/>
- 23 The Global Information Technology Report 2001-2002: Readiness for the Networked World, Center for International Development, Harvard University, Oxford University Press, Oxford, 2002.
- 24 ITU Digital Access Index: World's First Global ICT Ranking, ITU 2002.
- 25 http://www.ecdc.net.cn/newindex/chinese/page/sitemap/reports/IT_report/english/02/03.htm, accessed on June 12, 2006.
- 26 <http://www.mfat.govt.nz/foreign/regions/northasia/country/japanpaper.html>, accessed on June 14, 2006 <http://www.mfat.govt.nz/foreign/regions/northasia/country/japanpaper.html>, accessed on June 14, 2006
- 27 http://www.ecom.jp/ecom_e/latest/newsletter_no34.htm, accessed on June 12, 2006
- 28 <http://www.cia.gov/cia/publications/factbook/geos/ja.html>, accessed on June 14, 2006
- 29 <http://reports.tmgtelecom.com/apmmo/TMG%20APMMO%20datasheet.pdf> accessed on June 20, 2006
- 30 http://www.digital-review.org/03_Korea.htm; http://www.digital-review.org/05_Korea.htm accessed on August 16, 2006
- 31 ITU Digital Access Index: World's First Global ICT Ranking, ITU 2002
- 32 <http://www.uneca.org/aisi/NICI/Kenya/kenya.htm>, accessed on August 01, 2006
- 33 Adapted from Strategy and action plan for the Barents Region until 2010, Retrieved June 15, 2006 from <http://www.barents2010.net/files/lloRhbb.pdf>
- 34 Economic and Social Council: United Nations organ facilitating international cooperation on standards- making and problem-solving in economic and social issues
- 35 http://www.idrc.ca/en/ev-28856-201-1-DO_TOPIC.htm accessed on August 05, 2006

Chapter 1.2

The Role of Information and Communication Technologies in Knowledge Management: A Classification of Knowledge Management Systems¹

Irma Becerra-Fernandez

Florida International University, USA

Rajiv Sabherwal

University of Missouri-St. Louis, USA

INTRODUCTION

Rapid changes in the field of knowledge management (KM) have to a great extent resulted from the dramatic progress we have witnessed in the field of information and communication technology. ICT allows the movement of information at increasing speeds and efficiencies, and thus facilitates sharing as well as accelerated growth of knowledge. For example, computers capture data from measurements of natural phenomena, and then quickly manipulate the data to better understand the phenomena they represent. Increased computer power at lower prices enables the measurement of increasingly complex processes, which we possibly could only imagine

before. Thus, ICT has provided a major impetus for enabling the implementation of KM applications. Moreover, as learning has accrued over time in the area of social and structural mechanisms, such as through mentoring and retreats that enable effective knowledge sharing, it has made it possible to develop KM applications that best leverage these improved mechanisms by deploying sophisticated technologies.

In this article we focus on the applications that result from the use of the latest technologies used to support KM mechanisms. Knowledge management mechanisms are organizational or structural means used to promote KM (Becerra-Fernandez, Gonzalez, & Sabherwal, 2004). The use of leading-edge ICT (e.g., Web-based conferencing)

to support KM mechanisms in ways not earlier possible (e.g., interactive conversations along with the instantaneous exchange of voluminous documents among individuals located at remote locations) enables dramatic improvement in KM. We call the applications resulting from such synergy between the latest technologies and social or structural mechanisms knowledge management systems. We discuss the topic of KM systems in detail in the next sections.

BACKGROUND

We describe the variety of possible activities involved in KM as broadly intending to (a) discover new knowledge, (b) capture existing knowledge, (c) share knowledge with others, or (d) apply knowledge. Thus, KM relies on four kinds of KM processes as depicted in Figure 1 (Becerra-Fernandez et al., 2004). These include the processes through which knowledge is discovered or captured, and the processes through which this knowledge is shared and applied. These four KM processes are supported by a set of seven KM subprocesses as shown in Figure 1, with one subprocess, socialization, supporting two KM processes (discovery and sharing).

Polyani's (1967) distinction between explicit and tacit is at the heart of most KM papers. These constructs follow in that explicit knowledge is knowledge about things, and tacit knowledge is associated with experience. Nonaka (1994) identified four ways of managing knowledge: combination, socialization, externalization, and internalization. Of the seven KM subprocesses presented in Figure 1, four are based on Nonaka, focusing on the ways in which knowledge is shared through the interaction between tacit and explicit knowledge. New explicit knowledge is discovered through combination, wherein the multiple bodies of explicit knowledge (and/or data and/or information) are synthesized to create new, more complex sets of explicit knowledge. Therefore, by

combining, reconfiguring, recategorizing, and recontextualizing existing explicit knowledge, data, and information, new explicit knowledge is produced. In the case of tacit knowledge, the integration of multiple streams for the creation of new knowledge occurs through the mechanism of socialization. Socialization is the synthesis of tacit knowledge across individuals, usually through joint activities rather than written or verbal instructions. Externalization involves converting tacit knowledge into explicit forms such as words, concepts, visuals, or figurative language (e.g., metaphors, analogies, and narratives; Nonaka & Takeuchi, 1995). It helps translate individuals' tacit knowledge into explicit forms that can be more easily understood by the rest of their group. Finally, internalization is the conversion of explicit knowledge into tacit knowledge. It represents the traditional notion of learning.

The other three KM subprocesses—exchange, direction, and routines—are largely based on Grant (1996a, 1996b) and Nahapiet and Ghoshal (1998). Exchange focuses on the sharing of explicit knowledge and it is used to communicate or transfer explicit knowledge between individuals, groups, and organizations (Grant, 1996b). Direction refers to the process through which the individual possessing the knowledge directs the action of another individual without transferring to him or her the knowledge underlying the direction. This preserves the advantages of specialization and avoids the difficulties inherent in the transfer of tacit knowledge. Finally, routines involve the utilization of knowledge embedded in procedures, rules, and norms that guide future behavior. Routines economize on communication more than direction as they are embedded in procedures or technologies. However, they take time to develop, relying on constant repetition (Grant, 1996a).

Other KM system characterizations present similar models to describe KM systems. For example, the acquire, organize, and distribute (AOD) model (Schwartz, Divitini, & Brasethvik, 2000)

uses a similar characterization to describe organizational memories. Comparing the two models, the acquisition process relates to how we collect knowledge from members of the organization or other resources, and it is related to the processes of knowledge discovery and knowledge capture. The organizing process refers to structuring, indexing, and formatting the acquired knowledge, and it is related to the process of knowledge sharing. Finally, the process of distribution relates to the ability to get the relevant knowledge to the person who needs it at the right time, and it is related to the process of knowledge application.

Knowledge management systems utilize a variety of KM mechanisms and technologies to support the knowledge management processes. Depending on the KM process most directly supported, KM systems can be classified into four types: knowledge-discovery systems, knowledge-capture systems, knowledge-sharing systems, and knowledge-application systems (Becerra-Fernandez et al., 2004). In the next sections, we provide a brief overview of these four kinds of

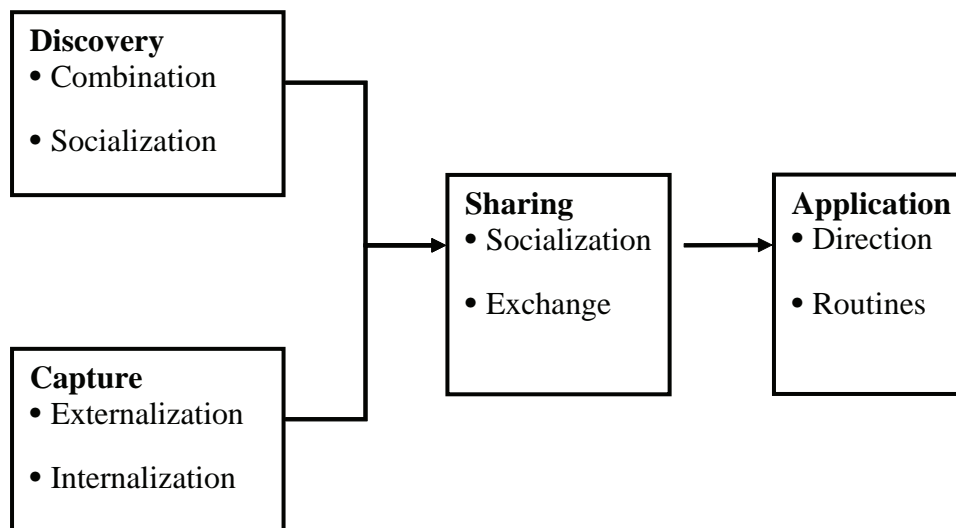
systems and examine how they benefit from KM mechanisms and technologies.

Types of Knowledge Management Systems

Knowledge-discovery systems support the process of developing new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge. These systems support two KM subprocesses associated with knowledge discovery: combination, enabling the discovery of new explicit knowledge, and socialization, enabling the discovery of new tacit knowledge. Thus, mechanisms and technologies can support knowledge-discovery systems by facilitating a combination and/or socialization.

KM mechanisms that facilitate combination include collaborative problem solving, joint decision making, and the collaborative creation of documents. For example, at the senior-management level, new explicit knowledge is created by sharing documents and information related

Figure 1. KM processes



to mid-range concepts (e.g., product concepts) augmented with grand concepts (e.g., corporate vision) to produce new knowledge about both areas. This newly created knowledge could be, for example, a better understanding of the products and corporate vision (Nonaka & Takeuchi, 1995). Mechanisms that facilitate socialization include apprenticeships, employee rotation across areas, conferences, brainstorming retreats, cooperative projects across departments, and initiation processes for new employees. For example, Honda “set up ‘brainstorming camps’ (*tama dashi kai*)—informal meetings for detailed discussions to solve difficult problems in development projects” (Nonaka & Takeuchi, p. 63).

Technologies facilitating combination include knowledge-discovery or data-mining systems, databases, and Web-based access to data. According to Nonaka and Takeuchi (1995, p. 67), the “reconfiguration of existing information through sorting, adding, combining, and categorizing of explicit knowledge (as conducted in computer databases) can lead to new knowledge.” Repositories of information, best practices, and lessons learned also facilitate combination. Technologies can also facilitate socialization, albeit to less extent than they can facilitate combination. Some of the technologies for facilitating socialization include videoconferencing, electronic discussion groups, and e-mail.

Knowledge-capture systems support the process of retrieving either explicit or tacit knowledge that resides within people, artifacts, or organizational entities. These systems can help capture knowledge that resides within or outside organizational boundaries, including within consultants, competitors, customers, suppliers, and prior employers of the organization’s new employees. Knowledge-capture systems rely on mechanisms and technologies that support externalization and internalization.

KM mechanisms can enable knowledge capture by facilitating externalization, that is, the conversion of tacit knowledge into explicit form,

or internalization, that is, the conversion of explicit knowledge into tacit form. The development of models or prototypes and the articulation of best practices or lessons learned are some examples of mechanisms that enable externalization.

Learning by doing, on-the-job training, learning by observation, and face-to-face meetings are some of the mechanisms that facilitate internalization. For example, at one firm, “the product divisions also frequently send their new-product development people to the Answer Center to chat with the telephone operators or the 12 specialists, thereby ‘re-experiencing’ their experiences” (Nonaka & Takeuchi, 1995, p. 69).

Technologies can also support knowledge-capture systems by facilitating externalization and internalization. Externalization through knowledge engineering is necessary for the implementation of intelligent technologies such as expert systems, case-based reasoning systems, and knowledge-acquisition systems. Technologies that facilitate internalization include computer-based communication. Using such communication facilities, an individual can internalize knowledge from a message or attachment thereof sent by another expert, from an AI- (artificial intelligence) based knowledge-acquisition system, or from computer-based simulations.

Knowledge-sharing systems support the process through which explicit or implicit knowledge is communicated to other individuals. They do so by supporting exchange (i.e., the sharing of explicit knowledge) and socialization (which promotes the sharing of tacit knowledge). Mechanisms and technologies supporting socialization also play an important role in knowledge-sharing systems. Discussion groups or chat groups facilitate knowledge sharing by enabling an individual to explain his or her knowledge to the rest of the group. In addition, knowledge-sharing systems also utilize mechanisms and technologies that facilitate exchange. Some of the mechanisms that facilitate exchange are memos, manuals, progress reports, letters, and presentations. Technologies facilitat-

ing exchange include groupware and other team collaboration mechanisms, Web-based access to data, databases, and repositories of information, including best-practice databases, lessons-learned systems, and expertise-locator systems.

Knowledge-application systems support the process through which some individuals utilize knowledge possessed by other individuals without actually acquiring or learning that knowledge. Mechanisms and technologies support knowledge-application systems by facilitating routines and direction.

Mechanisms facilitating direction include traditional hierarchical relationships in organizations, help desks, and support centers. On the other hand, mechanisms supporting routines include organi-

zational policies, work practices, and standards. In the case of both direction and routines, these mechanisms may be either within an organization (e.g., organizational hierarchies) or across organizations (e.g., software-support help desks).

Technologies supporting direction include experts' knowledge embedded in expert systems and decision-support systems, as well as troubleshooting systems based on the use of technologies like case-based reasoning. On the other hand, some of the technologies that facilitate routines are expert systems, enterprise resource-planning systems (ERPs), and traditional management-information systems. As mentioned for KM mechanisms, these technologies can also facilitate directions and routines within or across organizations.

Table 1. KM systems, subprocesses, mechanisms, and technologies

| KM Processes | KM Systems | KM Subprocesses | Illustrative KM Mechanisms | Illustrative KM Technologies |
|-----------------------|-------------------------------|-----------------|---|--|
| Knowledge Discovery | Knowledge-Discovery Systems | Combination | Meetings, telephone conversations, and documents, collaborative creation of documents | Databases, Web-based access to data, data mining, repositories of information, Web portals, best practices, and lessons learned |
| | | Socialization | Employee rotation across departments, conferences, brainstorming retreats, cooperative projects, initiation | Videoconferencing, electronic discussion groups, e-mail |
| Knowledge Capture | Knowledge-Capture Systems | Externalization | Models, prototypes, best practices, lessons learned | Expert systems, chat groups, best practices, and lessons-learned databases. |
| | | Internalization | Learning by doing, on-the-job training, learning by observation, and face-to-face meetings | Computer-based communication, AI-based knowledge acquisition, computer-based simulations |
| Knowledge Sharing | Knowledge-Sharing Systems | Socialization | See above | See above |
| | | Exchange | Memos, manuals, letters, presentations | Team collaboration tools, Web-based access to data, databases, and repositories of information, best-practices databases, lessons-learned systems, and expertise-locator systems |
| Knowledge Application | Knowledge-Application Systems | Direction | Traditional hierarchical relationships in organizations, help desks, and support centers | Capture and transfer of experts' knowledge, troubleshooting systems, and case-based reasoning systems, decision-support systems |
| | | Routines | Organizational policies, work practices, and standards | Expert systems, enterprise resource-planning systems, management-information systems |

Table 1 summarizes the above discussion of KM processes and KM systems, and also indicates some of the mechanisms and technologies that might facilitate them. As may be seen from this table, the same tool or technology can be used to support more than one KM process.

Information and Communication Technology Infrastructure in Knowledge Management Systems

The knowledge management infrastructure is the foundation on which knowledge management resides. It includes five main components: organization culture, organization structure, communities of practice, information technology infrastructure, and common knowledge. In this section, we concentrate on the role of ICT infrastructure on KM systems.

Knowledge management is facilitated by the organization's ICT infrastructure. While certain information technologies and systems are directly developed to pursue knowledge management, the organization's overall ICT, developed to support the organization's information-processing needs, also facilitates knowledge management. The ICT infrastructure includes data processing, storage, and communication technologies and systems. It comprises the entire spectrum of the organization's information systems, including transaction-processing systems and management-information systems. It consists of databases and data warehouses, as well as enterprise resource-planning systems. One possible way of systematically viewing the IT infrastructure is to consider the capabilities it provides in four important aspects: reach, depth, richness, and aggregation (Daft & Lengel, 1986; Evans & Wurster, 1999).

Reach pertains to access and connection, and the efficiency of such access. Within the context of a network, reach reflects the number and geographical locations of the nodes that can be efficiently accessed. Keen (1991) also uses the term reach to refer to the locations an ICT plat-

form is capable of linking, with the ideal being able to connect to anyone, anywhere. Much of the power of the Internet is attributed to its reach and the fact that most people can access it quite inexpensively (Evans & Wurster, 1999). Reach is enhanced not just by advances in hardware, but also by progress in software. For instance, the standardization of cross-firm communication standards and languages such as XML (extensible markup language) make it easier for firms to communicate with a wider array of trading partners, including those with whom they do not have long-term relationships.

Depth, in contrast, focuses on the detail and amount of information that can be effectively communicated over a medium. This dimension closely corresponds to the aspects of bandwidth and customization included by Evans and Wurster (1999) in their definition of richness. Communicating deep and detailed information requires high bandwidth. At the same time, it is the availability of deep and detailed information about customers that enables customization. Recent technological progress, for instance, in channel bandwidth, has enabled considerable improvement in depth.

Communication channels can be arranged along a continuum representing their relative richness (Carlson & Zmud, 1999). The richness of a medium is based on its ability to (a) provide multiple cues (e.g., body language, facial expression, tone of voice) simultaneously, (b) provide quick feedback, (c) personalize messages, and (d) use natural language to convey subtleties (Daft & Lengel, 1984). ICT has traditionally been viewed as a lean communication medium. However, given the progress in information technology, we are witnessing a significant increase in its ability to support rich communication.

Finally, rapid advances in ICT have significantly enhanced the ability to store and quickly process information (Evans & Wurster, 1999). This enables the aggregation of large volumes of information drawn from multiple sources. For instance, data mining and data warehousing to-

gether enable the synthesis of diverse information from multiple sources, potentially to produce new insights. Enterprise resource-planning systems also present a natural platform for aggregating knowledge across different parts of an organization. A senior IS executive at Price Waterhouse Coopers, for example, remarks, “We’re moving quite quickly on to an intranet platform, and that’s giving us a greater chance to integrate everything instead of saying to people, ‘use this database and that database and another database.’ Now it all looks—and is—much more coordinated” (Thomson, 2000, p. 24).

To summarize, the above four ICT capabilities enable knowledge management by enhancing common knowledge or by facilitating the four KM processes. For example, an expertise-locator system (also called knowledge yellow pages or a people-finder system) is a special type of knowledge repository that pinpoints individuals having specific knowledge within the organization (Becerra-Fernandez, 2000, 2001). These systems rely on the reach and depth capabilities of ICT by enabling individuals to contact remotely located experts and seek detailed solutions to complicated problems. Another KM solution attempts to capture as much of the knowledge in an individual’s head as possible and archive it in a searchable database (Armbrecht et al., 2001). This is primarily the aim of projects in artificial intelligence, which capture the expert’s knowledge in systems based on various technologies, including rule-based systems and case-based reasoning, among others (Wong & Radcliffe, 2000). But the most sophisticated systems for eliciting and cataloging experts’ knowledge in models that can easily be understood and applied by others in the organization (see, for example, Ford, Coffey, Cañas, Andrews, & Turner, 1996) require strong knowledge-engineering processes to develop. Such sophisticated KM systems are typically not advocated for use in mainstream business environments primarily because of the

high cost involved in the knowledge-engineering effort.

FUTURE TRENDS

The future of knowledge management will be highlighted by three continuing trends: (a) KM will benefit from progress in ICT, (b) KM will continue the shift toward integrating knowledge from a variety of different perspectives, and (c) KM will continue to make trade-offs in numerous important areas.

First, in the future, KM will benefit from continual, and even more dynamic, progress in ICT. Improvements in cost and performance ratios of ICT have caused the cost of digitizing information to approach zero, and the cost of coordinating across individuals, organizational subunits, and organizations to approach zero as well (Grover & Segars, 1996). ICT progress also includes developments in autonomous software-based agents. Thus, the future of KM will be dramatically different due to the inevitable and unpredictable over any long period of time, and quantum changes in ICT and underpinning technologies such as artificial intelligence.

Second, in the future, KM will continue the shift toward bringing together, and effectively integrating, knowledge from a variety of different perspectives. Knowledge management originated at the individual level, focusing on the training and learning of individuals. Over time, the emphasis of knowledge management shifted to groups and entire organizations, and now examples of interorganizational impacts of knowledge management are becoming increasingly common. This trend in the impact of KM is expected to continue with its use across networks of organizations and across governments, enabling collaborations across historical adversaries and integrating knowledge across highly diverse perspectives and disciplines.

Finally, in the future, knowledge management will continue to make trade-offs in numerous important areas. One such trade-off pertains to the use of ICT for sharing. The same communication technologies that support the sharing of knowledge within an organization also enable the knowledge to leak outside the organization to its competing firms. Another trade-off concerns the balance between technology and people. It is essential to maintain a balance between using technology as substitutes for people (e.g., software agents) and using technology to enable collaboration from a wider range of people within and across organizations.

In conclusion, the future of knowledge management is one where people and advanced technologies will continue to work together, enabling knowledge integration across diverse domains with considerably higher payoffs. However, the new opportunities and greater benefits will require the careful management of people and technologies, a synthesis of multiple perspectives, and effectively dealing with a variety of trade-offs. The future of knowledge management will clearly be exciting due to the new opportunities and options, but interesting challenges definitely lay ahead for knowledge managers.

CONCLUSION

We have described the key aspects of knowledge management in this article. We have provided a working definition of knowledge management systems and presented the four types of KM systems: knowledge-discovery systems, knowledge-capture systems, knowledge-sharing systems, and knowledge-application systems. We also discussed how KM systems serve to support KM processes based on the integration of KM mechanisms, technologies, and infrastructure.

REFERENCES

- Armbrecht, F. M. R., Chapas, R. B., Chappelow, C. C., Farris, G. F., Friga, P. N., Hartz, C. A., et al. (2001). Knowledge management in research and development. *Research Technology Management*, 44(4), 28-48.
- Becerra-Fernandez, I. (2000). The role of artificial intelligence technologies in the implementation of people-finder knowledge management systems. *Knowledge Based Systems*, 13(5), 315-320.
- Becerra-Fernandez, I. (2001). Locating expertise at NASA: Developing a tool to leverage human capital. *Knowledge Management Review*, 4(4), 34-37.
- Becerra-Fernandez, I., Gonzalez, A., & Sabherwal, R. (2004). *Knowledge management: Challenges, solutions and technologies*. Upper Saddle River, NJ: Prentice Hall.
- Becerra-Fernandez, I., & Stevenson, J. M. (2001). Knowledge management systems and solutions for the school principal as chief learning officer. *Education*, 121(3), 508-518.
- Carlson, J. R., & Zmud, R. W. (1999). Channel expansion theory and the experiential nature of media richness perceptions. *Academy of Management Journal*, 42(2), 153-170.
- Daft, R. L., & Lengel, R. H. (1986). Organization information requirements, media richness, and structural design. *Management Science*, 32(5), 554-571.
- Evans, P., & Wurster, T. S. (1999). Getting real about virtual commerce. *Harvard Business Review*, 85-94.
- Ford, K. M., Coffey, J. W., Cañas, A. J., Andrews, E. J., & Turner, C. W. (1996). Diagnosis and explanation by a nuclear cardiology expert system. *International Journal of Expert Systems*, 9, 499-506.

Grant, R. M. (1996a). Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. *Organization Science*, 7(4), 375-387.

Grant, R. M. (1996b). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17, 109-122.

Keen, P. (1991). *Shaping the future: Business design through information technology*. Boston: Harvard Business School Press.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23(2), 242-266.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14-37.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford University Press.

Polyani, M. (1967). *The tacit dimension*. Garden City, NY: Anchor Books.

Schwartz, D. G., Divitini, M., & Brasethvik, T. (2000). On knowledge management in the Internet age. In D. G. Schwartz, M. Divitini, & T. Brasethvik (Eds.), *Internet-based knowledge management and organizational memory* (pp. 1-23). Hershey, PA: IGP.

Thomson, S. (2000). Focus: Keeping pace with knowledge. *Information World Review*, 155, 23-24.

Wong, W., & Radcliffe, D. (2000). The tacit nature of design knowledge. *Technology Analysis and Strategic Management*, 12(4), 493-512.

KEY TERMS

Artificial Intelligence: The branch of computer science concerned with making computers behave like humans. John McCarthy coined the term in 1956 while at the Massachusetts Institute of Technology. It refers to the science that provides computers with the ability to solve problems not easily solved through algorithmic models.

Common Knowledge: An organization's cumulative experiences in comprehending a category of knowledge and activities, and the organizing principles that support communication and coordination.

Knowledge Capture: The process of eliciting knowledge (either explicit or tacit) that resides within people, artifacts, or organizational entities, and representing it in an electronic form such as a knowledge-based system for later reuse or retrieval.

Knowledge Discovery: The development of new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge.

Knowledge Engineering: The process of eliciting an expert's knowledge in order to construct a knowledge-based system or organizational memory.

Knowledge Management: They perform the activities involved in discovering, capturing, sharing, and applying knowledge in terms of resources, documents, and people skills so as to enhance, in a cost-effective fashion, the impact of knowledge on the unit's goal achievement.

Knowledge Management Infrastructure: The long-term foundation on which knowledge management resides. It includes five main components: organization culture, organization structure, communities of practice, information technology infrastructure, and common knowledge.

Knowledge Management Mechanisms:

Organizational or structural means used to promote knowledge management. They may (or may not) utilize technology, but they do involve some kind of organizational arrangement or social or structural means of facilitating KM.

Knowledge Management Processes:

The broad processes that help in discovering, capturing, sharing, and applying knowledge.

Knowledge Management Systems:

They integrate technologies and mechanisms to support KM processes.

Knowledge Sharing:

The process through which explicit or tacit knowledge is communicated and appropriated to other individuals.

This work was previously published in Encyclopedia of Knowledge Management, edited by D. Schwartz, pp. 230-236, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.3

Postcolonial ICT Challenges

Birgitta Rydhagen

Blekinge Institute of Technology, Sweden

Lena Trojer

Blekinge Institute of Technology, Sweden

INTRODUCTION

This article has a particular interest in the introduction of ICT in the postcolonial parts of the world. The fundamental arguments for investing in ICT all over the world rest on the view of ICT as a necessity for successful integration into the world economy. ICTs are regarded as having great potential to promote development in key social and economic areas where a shortage of capital, knowledge and local capacity obstructs progress. However, “information itself does not feed, clothe or house the world” (Main, 2001, p. 96), and it remains to be seen whether ICTs in developing countries will create wealth among the poor in those countries or among the already wealthy.

In the promotion of ICTs for development, the introduction of these technologies is mainly discussed in technical terms, considering the problems of electricity, telephone access, and expensive computers. The argument for introduction is also rather instrumental, expecting income generation and economic improvement.

At the same time, ICTs are sometimes referred to as revolutionary, but they will travel on existing technologies, modes of communication and (post) colonial relationships.

The introduction of new technologies will not only be regarded as a technical issue. It may also be politically sensitive, if the technology shows signs of disrespect for the local culture, if it promotes only specific groups and ways of life in the local society, or if it bypasses the local society when reaching out for a specific target like a company (see e.g., Redfield, 2002). As for example Weckert and Adeney (1997) argue, the spread of ICTs in diverse cultural settings might very well be regarded as cultural imperialism, given the unequal access to resources for alternative technologies or content. The directions that ICTs lead towards, for example distant communication, may be interpreted as unifying and networking on a global scale between interest groups to their own and society’s benefit. ICTs may also lead to an increased spread of (androcentric) American and western ideals and commercial products,

increasing the global dominance of the U.S. and other western nations. These examples show the impossibility in treating technologies as neutral tools.

The aim of this article is to develop postcolonial and feminist technoscience requests for context sensitive and distributed ICT processes in relation to the development of ICTs for Tanzania at the University of Dar es Salaam.

BACKGROUND

The position of “having never as much” (Redfield, 2002, p. 810) will for a long time be the position from which people in the Third World will receive ICTs. In his study, Redfield showed what reactions and tensions this position may create. Are ICTs yet another way of imposing control, of deciding what is important to know and to have, of showing who is in charge of globalisation? Are they yet another demand on transfer from national to private and commercialisation of common goods? A tool “to make the poor dream the same dreams as the rich” (Martín-Barbero, 1993, p. 165)?

Mörtberg (2000) raises the issue of equal access to ICT in a time when we see less of arguments for “technology in a democratic society” and more of arguments for “democracy in an information society”. Equal access, referring to gender, class, race, religion, language etc. is by no means inherent in the ICTs. The gender dimension in the case of ICT in the postcolonial context relates to a double burden of men’s supposed supremacy in technological matters, and women’s specific barriers in the developing world, including illiteracy, unfamiliarity with English (that dominates the Internet), domestic work load, lack of valuable information on the Internet, and lack of connectivity in rural areas where women primarily live (Gurumurthy, 2004).

The links between equal-level¹ participation and ICT development or ICT policy development are created by means of hard work and tedious

dialogues, multidimensional partnership co-evolution with developed and working sensitivity and awareness of diverse interests, gender dimensions and cultural—ethnic pluralism, among other components in an increasingly complex world.

Suchman (2002) argues that the *design from nowhere* is a result of the idea that technical systems could be constructed with a minimal cultural connection “as commodities that can be stabilized and cut loose from the sites of their production long enough to be exported en masse to the sites of their use” (p. 140). Suchman also points out that the distinction between designer and user is not straight forward. The designers are users of their own products, and that invisible design-in-use often takes place without rigorous documentation. “Even to keep things going on ‘in the same way’ in practice requires continuous, mundane forms of active appropriation and adaptation of available resources” (p. 143).

Requests for access to communication (not only information; Colby, 2001), relevant material (e.g., Morley & Robins, 1995) and appropriate modes of communication practices (oral/literal, face-to-face or over distance; Mejias, 2001) highlights the borderline between ICTs supporting imperialism or pluralism. “Our challenge lies in theorizing exactly this interstitial space between agency and the lack thereof, between being constructed within structures of domination and finding spaces of exerting agency” (Shome & Hegde, 2002, p. 266).

These issues make it necessary to investigate and de-naturalise the discussion of former colonies as nations in need of ICT *transfer*. As Rwandan ICT expert Albert Nsengiyumva has stated², all electronic technologies have been brought into the African countries from outside. The new ICTs are often referred to as a sign of the jump from the modern into a postmodern age. Hess (1995) is very critical of the reference to a global postmodern age,

before claiming that “we” are living in a post-modern age, it is worth remembering that not everyone is included in that we. Cyberspace is an elite space ... There is a glass ceiling, and for many in the world a large part of postmodern technoculture lies well above it. (p. 116)

THE ROLE OF THE UNIVERSITY IN TANZANIAN ICT DEVELOPMENT

Feminist technoscience with emphasis on ICT is certainly motivated by transformation goals. The needs for transformation are not only seen in the ongoing difficulties of achieving appropriate ICT system solutions especially in low income countries, but also in a more general process of knowledge and technology development (Gibbons et al., 1994; Nowotny, Scott, & Gibbons, 2001). The latter urge for transformation not the least within academy and technical faculties (Etzkowitz & Leydesdorff, 1997). Feminist technoscience within technical faculties is a driving force for the transformation processes required (Trojer, 2002). The transformation on a deeper level is vital to address appropriateness, access and utilisation not only for women within the academia, but for the majority of women in the local society (Gurumurthy, 2004).

In order to be able to understand and learn about distributed knowledge and technology production you have to be situated in a very concrete, day to day practice as well as achieve broad contextual knowledges. The postcolonial situation carries the potential for distributed knowledge production that are of particular interest in this sense. Experiences from Tanzania and the role of the main university of the country will be used to elaborate on these negotiation processes.

Relevance and Transformation

The University of Dar es Salaam (UDSM) is the main university out of five in the country and the

only university holding a technical faculty. The challenge for the university as an actor in societal development is huge. High expectations are placed on the implementation of ICT, which can be recognised in strategic documents of UDSM:

As part of the ongoing transformation programme, the UDSM has initiated a number of reforms aimed at improving its main outputs (teaching, research and services to the society) through ICT. The improvement of ICT aims to suit the needs of the students and staff, the working environment and establish linkages with both industry and government. The new ICT developments are also expected to contribute to income generation in order to complement government and other funding sources to ensure sustainable academic programmes. (University of Dar es Salaam, n.d., para. 1)

The vice chancellor emphasizes that within the larger transformation activities of the university the issue of *relevance* becomes central. As far as possible a public university in a very poor country must aim to be relevant to the developmental aspiration of the people in all knowledge areas.

The transformation should go deeper in the academic organisation culture, the vice chancellor argues.

I must say it is not easy. If you want to bend a fish you bend it while it is still alive, before it is dry. If dry you crack it. We have come to learn that it is a bit difficult. We are still struggling with it. (vice chancellor, interview September 12, 2003)

Resource for Society and Government

The experience of approving ICT at the university started in 1993. Responsible people at UDSM put in a 2 MBite wireless line to the university main campus. UDSM even brought Internet to the Tanzania telephone company (TTCL) and

not the other way around. Now, twelve years later, Tanzania has Internet backbone in every region. In order to reduce the costs and ensure connection for the ministries, the university also connected eight government ministries to the wireless internet line at UDSM. As a result of this process, expert people from UDSM are now managers at TTCL.

Today, when the university competes with several other Internet service providers (ISP), a number of governmental bodies are still connected through the university link. The impact of the initiative coming from the university was an increased motivation for the university staff to keep on with ICT development, as the university staff members were the only ICT experts within Tanzania at that time. For the content development for the government (eGov) the process is both ways. The government as well as the university are looking to find the easiest way to implement the government's own processes and demands, which are monitoring, evaluation and easy communication. UDSM is trying to provide that kind of solutions.

ICT Politics and Borders in Question

The University of Dar es Salaam (UDSM) played a key role in the national ICT policy process. The policy draft was developed in a very broad and open process to reduce the dominance of the academy. The role of UDSM in the policy process can be viewed as part of a sensitive technopolitical agreement between the university and the government. We have to keep in mind that the knowledge experts of ICT in Tanzania were and are mostly located at UDSM or trained at the same place as the only institution having a technical faculty in the country.

The national ICT policy gives a substantial understanding of the status of ICT in Tanzania as well as strategic areas for ICT and development. One of the central statements concerns the needs for Tanzania to move from being mere

consumers of technology to being the designers and manufacturers of ICT.

At UDSM, the issue of how to achieve the dreams like poverty reduction, more education, gender equality and so forth is on the agenda. ICT can provide tools for this, but how much is really Tanzanian? The academic staff regards ICT as more promising than other technological fields in this sense:

We have a kind of technology where we can provide significant content of products, more than 60% as equal partners in the provision of products and services. This is mainly knowledge based. We have an opportunity to do that (provision) much more than in for example nuclear physics. (interview with academic staff, September 2003)

A department director at Tanzania Commission for Science and Technology (COSTECH) stressed that,

it is very unfortunate that computers came to Africa as prestigious tools, as elite, sophisticated tools and not as non rocket signs. This is a myth that came with them. Computers are just ordinary technology, much easier than automobile and more powerful than automobiles, because they are all knowledge based. Knowledge based technologies transform individuals. Many have a lot of interest in them. The West pushed computers as tools for private sector. That this is not true was not understood by the government ... It all depends on how you look at things within your own country ... This element of articulation is what we need to do.

FUTURE TRENDS

Experiences from international feminist research closely linked to dominant areas of technology (information technology, biotechnology, and material engineering) imply recognition of techno- and

research politics deeply rooted in understandings of knowledge and technology production as processes which occur in distributed systems. In other words, knowledge creation today takes place on the boundaries between universities, private sector, public sector and the political spheres.

We can recognize ICT as one of the technological science fields most evidently challenging the borders between academic research and politics/society (Gulbrandsen, 2000) and experience how the negotiations (Aas, 2000) about the character of academic research take place in society. Academic ICT and its applications in society and every day life force our attention towards the relation between dominating actors, of which the university is one. It stresses relevant knowledge about its prerequisites, which in turn results in transformation challenges within the traditional universities. One model explored for these processes has been the *triple helix model* stating that the three institutional bodies university, industry and government are increasingly working together (Uhlin & Johansen, 2001). The triple helix model focuses more on the outer frame for the processes. The actual knowledge and development processes are more explicitly discussed within the concept sphere of *mode 2* (Nowotny, Scott, & Gibbons, 2001). Mode 2 knowledge is created in a broad and transdisciplinary social and economic context involving varying actors and participants in the research process. This is seen in contrast with the traditional scientific knowledge, produced in separate, academic institutions with efforts to *reduce* influence from the society.

In a developing country like Tanzania in particular, the process of mode 2 knowledge production in a triple helix formation will present an example for the traditional academic institutions in the industrialised parts of the world. We see that the ICT development in Tanzania and other postcolonial countries will have an advantage in this sense of intensive interaction between different actors in society.

However, as already stated, equal access for people in rural areas, women in particular, and disadvantaged groups, will require active participation also from local organisations and NGOs with feminist agendas (see Gurumurthy, 2004, p. 42ff).

CONCLUSION

From our perspective, the situation at UDSM carries potentials of a contextual awareness that opens for a benign triple helix knowledge and technology production. A more broadly defined group of stakeholders in the early phases of ICT development may increase the robustness of the choices that are made along the road.

At UDSM in Tanzania, the priority of collaboration with institutions outside the university shows a potential for an ICT development drawing from a more conscious technopolitical work in a postcolonial situation. The recognition of the necessary efforts to enter into technology *development* has a potential to bring about a more domestic and context aware ICT development process. Feminist technoscience perspectives are supporting these processes.

If the ICT priorities of African nations shall become directed towards the population, internal expertise needs to develop the technologies and to utilise them. As the quotation from the department director at COSTECH indicates, the way ICT was introduced by foreign companies and nations can be criticised for attempting to retain an unnecessary control, carrying colonial marks, over the use of technology in the postcolonial context. The people at UDSM and COSTECH, however, have made conscious efforts to change the situation of “having never as much” into a situation where the control over the ICTs lies with the domestic expertise. As the interviewed academic staff member acknowledged, this is easier to achieve with ICT, which is knowledge

based, than in other technological fields which are more technology based.

The issues of software and content have not been addressed as thoroughly as the technical infrastructure. What we here regard as knowledge production within a triple helix or mode 2 system involves the technical expertise at the Tanzanian universities and in the Tanzanian society. Continuous efforts to address equality issues and access to ICT for diverse user groups, including women and men, rural and urban and so forth are needed.

ACKNOWLEDGMENT

The authors wish to acknowledge support from the Swedish International Development Cooperation Agency.

REFERENCES

- Aas, G. H. (2000). Kvinneforskningens samfunnskontrakt. In L. Trojer, M. Eduards, M. Glass, E. Gulbrandsen, B. Gustafsson, S. Björling, et al. (Eds.), *Genusforskningens relevans (The relevance of gender research)*. Report from the expert group of the Swedish Research Councils for Integration of Gender Research, Stockholm. Retrieved October 15, 2005, from <http://www.bth.se/tks/teknovet.nsf>
- Colby, D. (2001). Conceptualizing the “digital divide”: Closing the “gap” by creating a post-modern network that distributes the productive power of speech. *Communication Law and Policy*, 6(1), 123-173.
- Etzkowitz, H., & Leydesdorff, L. (1997). *Universities in the global knowledge economy. A triple helix of university–industry–government relations*. London: Pinter.
- Gibbons, M., Limoge, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The new production of knowledge*. London; Thousand Oaks, CA; New Delhi: SAGE Publications.
- Gulbrandsen, E. (2000). Integrering av kvinne- og kjønnsforskning i Norges forskningsråd. *Genusforskningens Relevans*, Stockholm.
- Gurumurthy, A. (2004). *Gender and ICTs. Overview report*. Brighton: Institute of Development Studies.
- Hess, D. (1995). *Science and technology in a multicultural world: The cultural politics of facts and artifacts*. New York: Columbia University Press.
- Main, L. (2001). The global information infrastructure: Empowerment or imperialism? *Third World Quarterly*, 22(1), 83-97.
- Martín-Barbero, J. (1993). *Culture and hegemony. From the media to mediations*. London; Newbury Park, CA; New Delhi: SAGE Publications.
- Mejias, U. (2001). Sustainable communicational realities in the age of virtuality. *Critical Studies in Media Communication*, 18(2), 211-228.
- Morley, D., & Robins, K. (1995). *Spaces of identity. Global media, electronic landscapes and cultural boundaries*. London; New York: Routledge.
- Mörtberg, C. (2000, April 14). *Information technology and gender challenges in a new millennium*. Paper presented at the Women and the Information Society Conference, Reykjavik. Retrieved from http://www.simnet.is/konur/erindi/christina_iceland2.htm
- Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science. Knowledge and the public in an age of uncertainty*. Cambridge, UK: Polity.
- Redfield, P. (2002). The half-life of empire in outer space. *Social Studies of Science*, 32(5-6), 791-825.

Shome, R., & Hegde, R. (2002). Postcolonial approaches to communication: Charting the terrain, engaging the intersections. *Communication Theory, 12*(3), 249-270.

Suchman, L. (2002). Practice-based design of information systems: Notes from the hyperdeveloped world. *The Information Society, 18*(2), 139-144.

Trojer, L. (2002). *Gender research within technoscience* (Genusforskning inom Teknikvetenskap—en drivbänk för forskningsförändring). Stockholm: Högskoleverket.

Uhlin, Å., & Johansen R. (2001, May). *Innovation and the post-academic condition*. Paper presented at the 2nd Research Conference on University and Society Co-operation (HSS01), Halmstad University, Sweden.

University of Dar es Salaam. (n.d.). *Sida-Sarec ICT Cooperation*. Retrieved February 15, 2005 from <http://www.sida-sarec.udsm.ac.tz>

Weckert, J., & Adeney, D. (1997, June 20-21). Cultural imperialism and the Internet. Technology and society at a time of sweeping change. In *Proceedings of the International Symposium on Technology and Society*, IEEE, University of Strathclyde, Glasgow (pp. 288-295).

KEY TERMS

Cyberspace: A world-wide computer network that allows people to communicate with each other.

eGov: The government's information and communication with citizens via the use of the Internet.

Internet Backbone: A larger transmission line that carries data gathered from smaller lines that interconnect with it. On the Internet or other wide area network, a backbone is a set of paths

that local or regional networks connect to for long-distance interconnection. The connection points are known as network *nodes* or telecommunication data switching exchanges (DSEs).

Mode 2 Knowledge Production: Some characteristics of mode 2 knowledge productions are situated in the context of application; distributed knowledge processes; development of robust knowledge; subject to multiple accountabilities.

Postcolonial: The period after the independence for colonized states in Africa, Latin America and Asia. Postcolonial also refers to a discursive space that has opened up for diverse positionings, discussions and practices after independence.

Technoscience: In the new fields of ICT, biotechnology and material sciences in particular, science and technology are so intimately related that they have merged into one. The concept of technoscience signals that the boundaries between science, technology, politics and society are about to weaken.

Triple Helix: Knowledge production taking place in the collaboration between the university, the government and the industry.

Wireless Technology: Wireless is a term used to describe telecommunications in which electromagnetic waves (rather than some form of wire) carry the signal over part or the entire communication path. Wireless technology is rapidly evolving, and is playing an increasing role in the lives of people throughout the world. In addition, ever-larger numbers of people are relying on the technology directly or indirectly.

ENDNOTES

¹ The authors have borrowed Jan Åhlander's concept of the equal-level perspective in order to overcome the dichotomy of the

Postcolonial ICT Challenges

top-down / bottom-up perspective (lecture notes, Jämshög folk high school, 1991).

²

Workshop held at Blekinge Institute of Technology October 23, 2003.

This work was previously published in Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 1012-1017, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.4

Holistic Evaluation of the Roles of ICTs in Regional Development

Chris Keen

University of Tasmania, Australia

Dean Steer

University of Tasmania, Australia

Paul Turner

University of Tasmania, Australia

ABSTRACT

Regional Australia continues to be the recipient of public programs premised on assumptions about the benefits of Information and Communications Technologies (ICTs) related development, at the same time as it is experiencing a reduction in basic services and problems associated with the digital divide. From a research perspective, these circumstances pose challenges on how to evaluate meaningfully the impacts of ICTs on regional development. These challenges are compounded by the considerable confusion that exists over what is meant by regional development, how it can be achieved, and how to measure and evalu-

ate the role ICTs play in reviving and sustaining regional communities. The exploratory research reported in this chapter examines the issues surrounding what is meant by ICT-related development in a regional context. It also explores the usefulness of multiple measures, as opposed to single measures, to describe what in reality is a very complex process. In this context, the chapter outlines the preliminary development of, and the rationale behind, a holistic approach for evaluating the role of ICTs in regional development, based on insights generated from ongoing research in Tasmania.

INTRODUCTION

The role of ICT ... in economic growth and social change has received considerable attention in recent years [but] ... reliable and comprehensive indicators are needed to track developments in new information technologies and understand their impacts on our economies and societies. (OECD, 2002, p. 3)

Community informatics researchers are well aware of the huge volume of literature on the impact of ICTs on economic (particularly urban) development. This discourse often relies on a simplistic assumption that “what is good for the economy is good for the community.” Too frequently their attempts to assess the impact of technology adoption on the social fabric of communities have been marginalized by the prevalence of this “dominant discourse.” While it is clearly problematic to marginalize questions relating to the influence of ICTs on the social framework of communities, particularly in regional areas, it does highlight the challenges that need to be overcome if more effective ICT-related interventions are to be designed, initiated and implemented.

In examining the role of ICTs on regional areas it is easy to be in support of the need for a recalibration from purely economic indicators to an aggregation of indicators encapsulating social and community dimensions. It is however, considerably more difficult to identify those indicators and the mechanisms for their meaningful aggregation. This is the case in regional Australia, where even obtaining an official and consistent definition of “regional” is fraught with difficulties. Indeed, while linking economic, social, and community factors together is an important and worthy step, it has not led to the identification of mechanisms for achieving such a meaningful aggregation (Steer & Turner, 2004).

The exploratory research reported in this chapter aims to contribute to an understanding of the issues surrounding what is meant by ICT-related

development in a regional context. It outlines the development of a holistic approach for evaluating the role of ICTs in regional development, based on insights generated from ongoing research into the impact of ICT-based projects in Tasmania.

ICTs and Regional Development

Despite the difficulties of defining “regional” that have been considered elsewhere (Steer & Turner, 2004), it is evident that the overall trends of slower industrial growth, decreasing rural populations, and the emergence of issues associated with the adequacy and/or affordability of telecommunications are very much a part of the everyday experience of the information economy for many Australians in regional areas, outside of the main metro area (DCITA, 2002).

In this context, it is not surprising that there has been considerable support for the deployment of ICTs as a mechanism to revitalise regional Australia. However, while ICTs clearly have the potential to connect regional Australia to the world, their impacts have been far from uniform and not always beneficial. ICTs and in particular e-commerce “raises the possible outcome of increased market share and dominance of large urban based companies in regional areas rather than the promised expansion of regionally based companies outside their regions” (Coulthard, 2001, p. 420).

The lack of uniformity of benefits is indicative of the fact that the implementation of ICTs are highly differential, depending on existing local regulatory, economic, and social infrastructure context, and that in turn re-emphasizes the importance of an assessment of the unique characteristics and circumstances of individual regional areas (Hearn, Kimber, Linnie & Simpson, 2005). From a different but complementary perspective, Lloyd and Hellwig (2000) have highlighted how socio-demographic factors are also extremely influential in relation to determining the extent to which Australians use ICTs and participate

in the information economy. Both perspectives highlight how both regional and individual differences are central to determining the outcomes of the development of ICTs infrastructure.

More broadly, it is interesting to consider the perspective of Hicks and Nivin (2000) who, in examining the huge U.S. investment in ICTs during the 1980s, researched the difficulty of finding consistent evidence of measurable impacts of these investments on overall U.S. economic performance. Hicks and Nivin found that when this ICT investment was assessed in isolation there was “no evidence of IT-induced income gains” (2000, p. 115), rather there was significant evidence to suggest that a “marked geographical concentration of IT investment” underscored the existence of the strong localization effects of ICT impacts. Simpson (2001) also noted that the majority of ICT-related economic growth in the U.S. was centralized in the relatively small locations of Silicon Valley and Seattle (Microsoft’s and Amazon.com’s headquarters).

The ICT-related investment and the deployment of ICTs has, and is having an impact on regional development. While ICTs can connect a region to the global economy, they also expose the region to global competition and the associated socioeconomic uncertainties of globalisation. What remains unclear is the extent to which this net impact will be positive (Coulthard, 2001; Wilde, Swatman & Castleman, 2000). More seriously, within the current conceptualization of the issues there is no way of meaningfully assessing whether the introduction of ICTs will mitigate, exacerbate, or simply replicate the pre-existing urban/regional divide (Steer & Turner, 2004).

EFFORTS AND INSIGHTS TO DATE

In recent years the provision of telecommunications, and especially broadband services, to rural and remote Australia has become a hot political topic. Not surprisingly this has resulted in a

large number of ICT-related policies, projects and schemes aimed at issues such as maintaining equity of access to ICT services, bridging the digital divide, providing regional economic growth, and empowering local communities. It has also given rise to an increasing number of theories and models on best practice. Unfortunately, what is often missing from these endeavors is a clear articulation of the specific goals of the projects in relation to how their impact will be measured, what outcomes are anticipated, and over what time frame.

At the Australian national level this can be seen in the HealthConnect project, estimated to cost \$AU300 million (Dearne, 2005), which is the Australian National, State and Territories Governments’ planned nationwide electronic health record system “to improve the flow of information across the healthcare system through the electronic collection, storage and exchange of consumer health information” (Productivity Commission, 2005, p. 260).

A report by the Australian Government’s Productivity Commission notes, “Overall, the approach taken in assessing the costs and benefits of HealthConnect has been disjointed” and that “the fact that so many unresolved issues remain after seven years of research and development suggests that there have been gaps in the planning and evaluation of the project and/or how these have been acted upon” (Productivity Commission, 2005, p. 260).

In Tasmania, expectations were high for significant change in economic and social terms, based on the promises of several multi-million dollar ICT-based development projects. One of these projects, the AU\$30 million Telstra Broadband-eLab, setup in the State’s north, is a test and development site for broadband and multimedia applications (Mitchell, 2003). However, according to industry groups in Tasmania the Telstra Broadband-eLab had “not delivered on its promises to either Launceston or the Tasmanian IT industry” (Mitchell, 2006, p. 33).

At the broadest level, this highlights the problem that if the goals of ICT-related regional development are vague, it remains very difficult to be able to assess whether they have been achieved. Indeed, without clarity any project is open to interpretation of success and/or failure depending on an evaluator's perspective and priorities.

This is more than just of academic interest; there can be serious consequences if effective evaluations of such projects are not conducted. If the impact of ICTs is identified overall as positive when in fact it has been negative, this may lead to either a continuation of the same policies that are in reality having a negative effect, or the scaling down or the withdrawal of the initiatives due to the perception that they have accomplished their aim. Conversely, if the impact of ICTs is identified overall as negative when in fact it has been positive again this may lead to undesirable policy changes where successful programmes are reduced or stopped to the detriment of the region (Chester, 2003).

Meaningless Measurement

It is easy to argue that single measures seldom present a meaningful indicator of the state and focus of any individual project, community, or regional economy. For example, the Federal Government's advisory body on broadband development in Australia, the Broadband Advisory Group (BAG) recently called on the Federal Government to "encourage the OECD to introduce mechanisms that measure the effective use of broadband and not merely take-up" (NOIE, 2003, p. 4), without offering any substantial suggestions as to how this would be achieved and how it would be used.

By using multiple, disparate measures the complexity of interpretation of any situation is dramatically increased. This is particularly the case, if there is no consensus amongst researchers on what multiple measures to use or how best to integrate/aggregate the results (Henderson-Montero, Julian, & Yen, 2003). Of course, the

accuracy of the measures themselves is also an essential element and relies on tailoring them to the specific situation under examination.

Moreover, despite the vast amount of data collected, Papadakis (2001) implies that in the main, most of the measures used to date have missed the point – the true significance of ICTs is not in the technology itself, but rather in its use and the consequences of its use.

Similarly, Sorensen (2000) questions the use of a "single picture" representation of regional Australia, insisting that this flawed depiction masks a diverse and complex range of economic and social conditions which are multifaceted, complex, interrelated and dynamic. Further, Sorensen (2000, p. 17) concludes that there is a "need to understand better how Australia's regional economies operate and are evolving," and that "the measurement and analysis of regional economic and social well-being in Australia requires in-depth clarification, focusing especially on the more intangible lifestyle, wealth, taxation, demographic and cost of living aspects."

It can be seen in the literature that scholars have been debating for almost 20 years about the return on investment from large scale ICT projects, without coming to a consensus as to whether the economy as a whole has benefited for this expenditure (Peslak, 2003). A study of data by Peslak (2003) that related to the ten year period from 1989 through to 1999, using both financial and market based productivity measures in the U.S. at the firm level, rather than at the industry or national level, concluded that despite popular rhetoric "the overall results do not show clear consistent positive results for the relationship between information technology spending and firm level productivity" (Peslak, 2003, p. 80).

These discussions reveal the difficulty in developing and utilizing individual measures and aggregating multiple measures. The dependent variables have not been identified, let alone characterisation of the independent variables in the evaluation of these programs. They also point to

the difficulty of being able to accurately compare results across regions.

The more geographically specific and sophisticated the tailoring of measurements is to a specific ICT or region, the more difficult it becomes to compare it with other regions. More than this, the outcomes of any regional development initiatives can carry different values in different regions, for example, creating 10 new jobs in a large regional city is always welcomed, but those same jobs created in smaller, struggling regional centers may have a much greater significant impact on the local economy and community.

New Alternatives

From an international perspective, recent work in the United Nations (UN) provides some insights that might assist in refining tools and techniques for measuring the impact of ICTs on regional Australia. The United Nations Development Program's Human Development Index (HDI) and the Genuine Progress Indicator (GPI) are two emerging major alternative measurement processes that are gaining some international support and credibility (ABS, 2002).

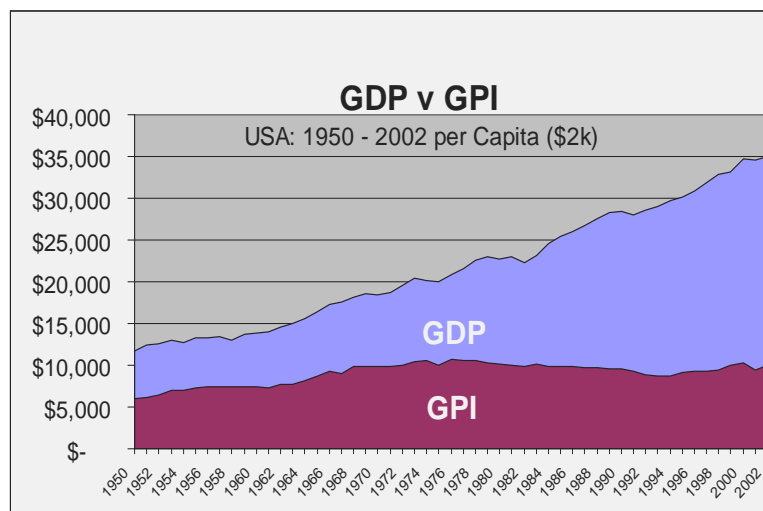
The Human Development Index (HDI) "was created to re-emphasize that people and their lives should be the ultimate criteria for assessing the development of a country, not economic growth" (UNDP, 2003). The HDI summarises three basic dimensions of human development: "living a long and healthy life, being educated and having a decent standard of living" (UNDP, 2003, p. 2). This is achieved by combining measures of life expectancy, school enrolments, adult literacy rates, and per-capita income rates. However, the United Nations Development Program (UNDP) acknowledges that the HDI is only a "useful starting point" as it "omits several vital aspects of human development, notably the ability to participate in the decisions that affect one's life" (UNDP, 2003, p. 60). Further, the UNDP recognizes that more complete pictures of human

development require the analysis of "other human development indicators and information" (UNDP, 2003, p. 60).

According to Colman (2001, p. 70), growth in Gross Domestic Product (GDP) "is simply a quantitative increase in the physical scale of the economy, and tells us nothing about our actual well-being." Colman's solution is to use an alternative measuring system, the Genuine Progress Indicator (GPI), which was developed by redefining progress to measure "the real state of our economy, our environment, and social justice" and to "indicate genuine progress in people's quality of life" (RP, 2000, p. 1). The GPI builds upon the personal consumption component of the GDP, and includes capital investment, government spending, and net exports. However it also includes quality of life measures that are not typically measured in monetary terms; for example, the contributions of volunteer work in the community, crime, and family breakdown (Colman, 2001; RP, 2000). When GDP and GPI are compared for the period 1950 to 2002 in the U.S., the distinction is marked. During this period the GDP rose at a relatively steadily rate, while at the same time the GPI, after a peak in the late 1970s, has remained relatively flat (Figure 1).

Yet another model for aggregating multiple measures is the Wealth of Nations Triangle Index for emerging economies, developed by the Money Matters Institute, Inc. This model uses economic environment, social environment, and information exchange variables to comprise legs of an equilateral triangle, and is built on the premise that sustainable growth is dependent on balance between these three areas (Sullivan, 2002). "Each leg contains 21 variables, chosen for both their relevancy and consistency over the years. Each variable is given equal weighting, based on a desire for simplicity, transparency, and balance among the three legs" (Sullivan, 2002, p. 4). The Index includes 70 nations that are considered to be "emerging economies" by the international investment community, and "measures the sustainable

Figure 1. Gross production vs. genuine progress for USA, 1950 to 2002 (Adapted from RP, 2004)



economic and social development potential of a nation and related risks, against those of other nations” (Sullivan, 2002, p. 4).

The Australian Bureau of Statistics also recognises that “public interest in the interrelationships between economic, social and environmental aspects of life” is growing (ABS, 2004, p. v), and that their statistical publications have tended to treat these issues as discontinuous. In recognising the current debate, the ABS is periodically publishing a series of discussion chapters called “Australia Now: Measures of Australia’s Progress.”

It is evident, even from this brief overview of just a few of the many attempts to capture and aggregate multiple measures of development of social progress that accurately measuring the impact and role of ICTs in regional development is likely to be fraught with difficulty. Nonetheless, it is also clear that if meaningful interventions have to be shaped by using ICTs in regional areas, meaningful measures must be obtained that present a more holistic picture of what is occurring.

DEVELOPING A HOLISTIC APPROACH

While numerous measures for economic, social, and community dimensions exist, it is a very difficult in any individual measure to clearly isolate the role of ICTs from other factors that may be at play and to develop a meaningful aggregation of these different measures. This is due to the fact that they often rely on different conceptual and methodological bases. However, despite these difficulties, the development of sophisticated holistic measures is not just of research significance but critical in accurately evaluating ICT-related regional development.

Purposeful Measurement

Ryan and Hess (1999, p. 3) assert that the “the choice of the measurement instruments to be employed is the most important step in the entire [assessment] process.” Winter (2001, p. 7) suggests that there are six sets of critical questions that should be considered when deciding what measures to use:

- What are the primary purposes for collecting information about ICT-related development in regions? What information is needed to fulfil the purposes?
- How will the information be used? What decisions will be made based on the assessment of ICT-related regional development?
- Do the measures adequately reflect the breadth and depth of ICT-related regional development? Do they provide information at each potential area of impact? That is, do they align with expectations?
- Do the measures provide reliable information about the ICT-related regional development process?
- Are there differences between the information needed from the key regional policy stakeholders and what the measures provide?
- Do the various measures, as a whole, serve their intended purpose? (Adapted from Winter, 2001, p. 7)

Winter also suggests that “some of the questions can be answered during the development or selection of the measures.” However, “some can be answered only by trying out various techniques for combining data and analysing the characteristics of the measures and how they contribute” to the assessment process (Winter, 2001, p. 7).

Chester (2003) cautions that multiple measures do not necessarily provide a clearer understanding of the underlying issues, but rather it is the reasoning behind the choosing and combining of the measures that determine their accuracy and appropriateness. Further, he states that the way multiple measures are combined is as “important as the measures themselves” (Chester, 2003, p. 9).

Disparate Measurement

However, from ongoing research in Launceston, a regional city in Tasmania, Australia, it is pos-

sible to outline the beginnings of an approach to accommodate a diverse range of measures. Launceston, with a population of around 70,000 people, is 200 km north of the State’s capital city of Hobart (with a population of 200,000), and is the second largest city in Tasmania.

In his work, which in part assessed the use and implications of ICTs in the household sector, Papadakis’ (2001) uses three areas of assessment: the socio-demographics of access and adoption, patterns of IT use, and research on impacts. A preliminary structured approach to evaluate the different measures based on Papadakis’ work has been developed. This preliminary structured approach will allow the development of a holistic picture to emerge of the impact of ICT-based projects on regional development in Launceston.

So far within this preliminary structured framework two major types of data are being collected: quantitative data from multiple statistical sources, such as the Australian Bureau of Statistics and the Tasmanian Department of Economic Development (see Table 1); and qualitative data obtained using a combination of semi-structured interviews and surveys of approximately 40 key regional policy stakeholders. The aim of the qualitative data collection is to interpret the assumptions, attitudes, and understandings of issues with regard to ICT-related regional development and associated economic sustainability (see Table 2).

Multiple Measurement

As has been discussed above, the principal difficulty in using diverse measures is how to aggregate these data. The approach being developed in this research program draws on the work of Henderson-Montero, Julian, and Yen (2003, p. 9), who list four possible approaches for meaningfully combining multiple and diverse measures: conjunctive, compensatory, mixed conjunctive-compensatory, and confirmatory:

Holistic Evaluation of the Roles of ICTs in Regional Development

Table 1. Quantitative data

| Sources: | Data sought: (current and changes over past 5 years) |
|---|--|
| <ul style="list-style-type: none"> ▪ Australian Bureau of Statistics (ABS) ▪ Major Australian banks ▪ Tasmanian Department of Economic Development. ▪ Tasmanian Department of Education. ▪ Tasmanian Chamber of Commerce and Industry ▪ Launceston City Council ▪ Service Tasmania (A Tasmanian Government agency) ▪ Tasmania Business Online ▪ Tasmanian Communities Online ▪ Tasmanian Electronic Commerce Centre | <p>Home PC ownership / Internet connection and use</p> <ul style="list-style-type: none"> • Number of people with home PCs • Hours of home PC / Internet use per user • Primary areas of use? • Hours connected to the Internet per user • Type of connection (Dialup, ISDN, ADSL) <p>Business PC ownership / Internet connection and use</p> <ul style="list-style-type: none"> • Number of Businesses connected • Type of connection (Dialup, ISDN, ADSL) • Primary areas of use • Percent / value of business using ICTs <p>Educational PC access and Internet use</p> <ul style="list-style-type: none"> • Number of Students per computer in Schools • Number of Students per Internet enabled computer in Schools <p>Online Government Services</p> <ul style="list-style-type: none"> • Number and percentage of Local, State, and Federal Government services online • Number and percentage of people using online Government services |

Table 2. Qualitative information: Semi-structured interviews

| Sources: | Information sought: |
|--|---|
| <ul style="list-style-type: none"> ▪ General Businesses – local, state wide, national and international ▪ ICT-related businesses ▪ Recipients of ICT-related development funding ▪ Community Groups ▪ Schools – Teachers, students, and parents ▪ Home PC and Internet users and non-users ▪ Online Access Centre staff and users ▪ Politicians and Community leaders ▪ Telecommunications providers ▪ IT Industry representative groups | <p>Businesses</p> <ul style="list-style-type: none"> • How have ICTs impacted on the business? • What are the barriers to the adoption or further utilisation of ICTs? <p>Educational Institutions</p> <ul style="list-style-type: none"> • How are ICTs used in education? • What are the barriers to the adoption or further utilisation of ICTs in the education process? <p>Politicians and Community leaders</p> <ul style="list-style-type: none"> • Have the actual impacts matched original goals? <p>Home PC and Internet users and non-users</p> <ul style="list-style-type: none"> • What are (would be) the benefits of home PC / Internet use? • Who is (would) using the PC / Internet? • How did (would) you do previously spend your time now spent using the PC / Internet? • What are the barriers to the adoption / further adoption of ICTs? |

- Conjunctive approach requires the demonstration of a minimum level of performance across all measures;
- Compensatory approach allows for the poor performance in one or more measures to be counterbalanced by higher performance in another measure;
- Mixed conjunctive-compensatory approach requires a minimum level of performance across the different measures; however, poorer performances measures can be counterbalanced by better performing measures;
- Confirmatory approach uses information from one measure to confirm or evaluate information from another independent measure. (Henderson-Montero, Julian & Yen, 2003, p. 9)

Preliminary research to date indicates that the mixed conjunctive-compensatory approach is providing the best holistic assessment in the Launceston region. However, mixed conjunctive-compensatory is not new and has been used for many years and in many different settings. What is new is its adaptation to the area of assessing ICT-related regional development.

Mixed conjunctive-compensatory techniques have been applied in diverse areas, such as marketing, teamwork evaluation and surveys of community cohesion. A potential application of this technique in the area of ICT adoption may be the development of a longitudinal analysis of the uptake of broadband communication technology. A survey of distinct technologies, such as high bandwidth cable connection, low to medium ADSL connections, and a variety of satellite connections can employ compensatory techniques to accommodate the differential uptake, degree of uptake, and extent of satisfaction with such a range of technologies. The conjunctive element of the analysis arises through the combination of data on different providers, technologies and pricing strategies, both geographically and over

time, so that the combination of several factors, including speed of access, price of service provision, download limits, and availability of distinct technologies can be accommodated in the one study.

ANALYSIS AND FINDINGS

Return on investment has been identified as the dependent variable for ICT development in regional areas, where this return encompasses both economic outcomes and social outcomes. A complete triple bottom line approach was not considered appropriate since the projects under consideration had negligible relationship to environmental outcomes. Preliminary analysis of the data collected, using the mixed conjunctive-compensatory approach, has identified the following independent variables as being relevant to the determination of the return on investment in large scale ICT development for the region of Tasmania under consideration:

- Clarity of formulation of project objectives.
- Extent of effective communication of these project objectives to stakeholders and participants.
- Extent of alignment with declared project objectives that is evident in the decision making by the project management team during the project planning and administration phases.
- Extent of communication of project outcomes to stakeholders, especially key interested parties in local government and the community, during and after the project.
- Extent of linkage of these project outcomes with other regional activities, projects and infrastructure.

In comparison with ICT projects, other infrastructure works, such as the construction of new

roads and highways, have clearly defined and communicable objectives of providing transport linkages between two or more points. The decision making during such a project is focused on civil construction and engineering. The key interested parties can relatively comprehend the outcomes that will eventuate when the road or highway is completed, and the linkages with economic and social development, and with other regional activities, projects and infrastructure become readily apparent once the road or highway is completed. Despite the widespread adoption of the metaphor of the information superhighway, ICT projects lack transparency of objectives and outcomes, and are far more difficult to comprehend. In particular, the strategic outcomes of a large scale ICT project are very difficult for many communities to envisage and to realize.

The determination of the dependent variable that characterises success in ICT projects has been identified as problematic (Milis, Meulders, & Mercken, 2003). The lack of comparable and statistically consistent data over a long time periods is also exacerbated by the rate of change of the underlying technologies and factors influencing its adoption, such as government policies and competitive pricing structures. Much more research in this field is needed to develop reliable, generalisable statistical frameworks to strengthen and support future investigation.

CONCLUSION

Evaluating the impact of ICTs on regional development is a complex process. It has been seen from the above discussion that much has been promised of ICT-focused developments, in terms of delivering benefits to regional areas including economic sustainability and connectivity to the global community. Clearly, if community informatics researchers are to assist in ensuring that the ICTs do impact positively on regional areas it is essential that more adequate measures are

introduced so that a better picture of the diverse range of impacts (positive and negative) are considered in shaping future interventions.

This chapter has promoted a more holistic view of ICT-related development that includes assessments specifically designed to capture the value of ICTs for social and community development as well as economic, and has outlined an initial approach to doing this based on insights generated from ongoing research in Tasmania.

REFERENCES

- ABS. (2002). *Measuring Australia's progress*. Catalogue No. 1370.0_2002. Retrieved June 25, 2006 from http://www.ausstats.abs.gov.au/ausstats/1370-0_2002.pdf.
- ABS. (2004). *Measures of Australia's progress*. Catalogue No. 1370.0_2004. Canberra: Australian Bureau of Statistics.
- Chester, M.D. (2003). Multiple measures and high-stakes decisions: A framework for combining measures. *Educational Measurement: Issues and Practice*, 22(2), 32-41.
- Colman, R. (2001). Measuring real progress. *Journal of Innovative Management*, 7(1), 69-77.
- Coulthard, D. (2001). eCommerce and the region: Not necessarily an unequivocal good. In *Proceedings of the Fourteenth Bled Electronic Commerce Conference* (pp. 419-443), University of Maribor, Bled, Slovenia.
- DCITA. (2002). *Connecting regional Australia: The report of the Regional Telecommunications Inquiry*, Commonwealth Department of Communications, Information Technology and the Arts. Retrieved June 25, 2006, from http://www.telinqury.gov.au/rti-report/rti_report_text_f-a_18.pdf
- Dearne, K. (2005, October 27). E-health ailing, says watchdog. *The Australian*, p. 31.

- Hearn, G., Kimber, M., Lennie, J., & Simpson, L. (2005). A way forward: Sustainable ICTs and regional sustainability. *The Journal of Community Informatics*, 1(2), 18-31.
- Henderson-Montero, D., Julian, M.W., & Yen, W.M. (2003). Multiple measures: Alternative design and analysis models. *Educational Measurement: Issues and Practice*, 22(2), 7-12.
- Hicks, D.A., & Nivin, S.R. (2000). Beyond globalization: Localized returns to IT infrastructure investments. *Regional Studies*, 34(2), 115-127.
- Lloyd, R., & Hellwig, O. (2000). *Barriers to take-up of new technology*. Discussion Paper No. 53. Canberra: National Centre for Social and Economic Modelling (NATSEM).
- Milis, K., Meulders, M., & Mercken, R. (2003). A quasi-experimental approach to determining success criteria for ICT projects. In *Proceedings of the 36th Hawaii International Conference on System Sciences* (p. 260.1), Hawaii.
- Mitchell, S. (2003, May 13). Harradine deal a dud: Industry. *The Australian*, (p. 33).
- NOIE (2003). *Australia's broadband connectivity: The Broadband Advisory Group's Report to Government*. Retrieved June 25, 2006, from National Office for the Information Economy, http://www.noie.gov.au/publications/NOIE/BAG/report/326_BAG_report_setting_2.pdf
- OECD. (2002). *Measuring the information economy*. Retrieved June 25, 2006, from <http://www.oecd.org/dataoecd/16/14/1835738.pdf>
- Papadakis, M.C. (2001). *The application and implications of information technologies in the home: Where are the data and what do they say?* Arlington: National Science Foundation.
- Peslak, A.R. (2003). A firm level study of information technology productivity using financial and market based measures. *The Journal of Computer Information Systems*, 43(4), 72-80.
- Productivity Commission. (2005). *Impacts of advances in medical technology in Australia* (Research Report). Melbourne.
- RP. (2000). *Blazing sun overhead and clouds on the horizon: The genuine progress report for 1999*. Retrieved June 25, 2006, from <http://www.rprogress.org/projects/gpi/gpi1999.pdf>
- RP. (2004). *The genuine progress indicator 1950-2002 (2004 Update)*. Retrieved June 25, 2006, from http://www.rprogress.org/newpubs/2004/gpi_march_2004update.pdf
- Ryan, J.M., & Hess, R.K. (1999). Issues, strategies, and procedures for combining data from multiple measures. Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada. In P.C. Winter (2001). *Combining information from multiple measures of student achievement for school-level decision-making*. Council of chief state school officers. Washington, DC. Retrieved June 25, 2006, from <http://www.ccsso.org/Publications/Download.cfm?Filename=CASWinter.pdf>
- Sorensen, T. (2000). *Regional development: Some issues for policy makers*. Research paper: 26 1999_2000. Retrieved June 25, 2006, from <http://www.aph.gov.au/library/pubs/rp/1999-2000/2000rp26.htm>
- Simpson, R. (2001). *The Internet and regional Australia: How rural communities can address the impact of the Internet*. Report for Rural Industries Research and Development Corporation (RIRDC). Publication No. 01/087. Retrieved June 25, 2006, from <http://www.rirdc.gov.au/reports/HCC/01-087.pdf>
- Steer, D.R., & Turner, P.A. (2004). The role of place: Tasmanian insights on ICT and regional development. In S. Marshall, W. Taylor, & X. Yu (Eds.), *Using community informatics to transform regions* (pp. 67-81). Hershey, PA: Idea Group Publishing.

Holistic Evaluation of the Roles of ICTs in Regional Development

Sullivan, N.P. (Ed.). (2002). *Wealth of nations triangle index: Statistical GPS to emerging economies*. Retrieved June 25, 2006, from Money Matters Institute, <http://www.moneymattersinstitute.org/wni.pdf>

UNDP. (2003). *Human development report 2003*. United Nations Development Programme. Retrieved June 25, 2006, from <http://www.undp.org/hdr2003/>

Wilde, W.D., Swatman, P.A., & Castleman, T. (2000). Investigating the impact of IT&T on rural,

regional and remote Australia. In *Proceedings of COLLECTeR (USA)2000*, Colorado. Retrieved June 25, 2006, from <http://www.collector.org/col-IUSA/Wilde.pdf>

Winter, P.C. (2001). *Combining information from multiple measures of student achievement for school-level decision-making*. Washington, DC: Council of Chief State School Officers. Retrieved June 25, 2006, from <http://www.ccsso.org/Publications/Download.cfm?Filename=CASWinter.pdf>

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 166-179, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.5

ICT in Regional Development

Saundarjya Borbora
IIT Guwahati, India

Mrinal Kanti Dutta
IIT Guwahati, India

INTRODUCTION

Economic development and information and communication technology (ICT) are found to move together in the present day era of globalization. ICT can contribute significantly in economic development of a region by providing adequate information at the minimum of time and cost, thereby enhancing productivity in different sectors of an economy. This fact is substantiated by several studies (Kraemer & Dedrick, 2001; Pohjola, 2001). Some country specific studies like that of Singapore (Wong, 2001) also highlighted similar results. ICT diffusion in the world has been quite rapid since the mid 1990s. While the developed countries have benefited substantially from the ICT growth, the developing countries could not reap similar benefits out of it which has resulted in emergence of a digital divide across the countries (Economist, 2000; Nkrumah, 2000; Norris, 2001). This divide is noticed not only across countries but also within a country and this is more prominent in developing economies

like India. ICT diffusion is another area which needs more attention in India as it will lead to ICT access and application of ICT in real sectors to increase productivity and output. During the past one decade India has made rapid advances in ICT growth as reflected in the increase in the number of Internet connections and users. The growth of Internet connections and users in the country is shown in Table 1.

Thus, Internet growth in India during the second half of 1990s has been phenomenal. However, the country is lagging behind other countries in ICT diffusion. The comparative position of India with some selected Asian countries in terms of Internet growth and usage is shown in Table 2.

The table clearly indicates that there is appreciable growth in Internet use in India over the period 2000-2004, but the penetration is abysmally low at 1.7% of the population whereas in China it is 6.0%. Some other small Asian countries like Japan, South Korea, Singapore, Taiwan have made substantial progress in terms of penetration which is evident from the table. Digital divide is glaringly

Table 1. Internet growth in India (Source: Adopted from Globalization, Inequality and the internet in India by Elizabeth C. Hansen [<http://www.isanet.org/archive/hanson.html>])

| Date | Number of Internet Connections | Number of Internet Users |
|-----------------|--------------------------------|--------------------------|
| 1 | 2 | 3 |
| August 15, 1995 | 2000 | 10,000 |
| March 31, 1996 | 50,000 | 250,000 |
| March 31, 1997 | 90,000 | 450,000 |
| March 31, 1998 | 140,000 | 700,000 |
| March 31, 1999 | 280,000 | 1,400,000 |
| March 31, 2000 | 900,000 | 2,800,000 |
| August 31, 2000 | 1,600,000 | 4,800,000 |
| January, 2001 | 1,800,000 | 5,500,000 |

obvious across different regions of the country. For example, while many states in Western and Southern region of India have witnessed rapid ICT growth and diffusion, states in regions like East and North East are found to lag behind. Out of 28 states and six union territories in India, only five states namely, Karnataka, Delhi, Tamil Nadu, Andhra Pradesh and Maharashtra accounted for

1.4 million Internet connections out of a total of 1.5 million connections in the country in 2000 (Prabhakaran, 2003). Increasing participation of non-governmental organizations (NGO) and private sector is important for bridging the digital divide. Efforts are already going on to achieve this objective by involving private sector companies in many parts of the country¹. However, infrastructural bottlenecks in the backward regions of the country are found to be a major obstacle in effective participation of the private sector in providing benefits of ICT diffusion to different sections of the society. Hence, the government sector has a crucial role to play in this area. In view of this, the Government of India has initiated efforts to provide the benefits of the ICT revolution to the rural masses through disseminating information and to enhance productive capacity of the rural sector. In line with the stated objectives of ICT diffusion, the Community Information Centres (CICs) Project was conceived and implemented by the Ministry of Communications and Information Technology, Government of India in the North Eastern Region of the country. In terms of providing benefits of ICT, CICs is the first initiative by the government to provide ICT access to

Table 2. Internet growth and usage in selected Asian countries (Source: www.internetworldstats.com)

| Countries | Internet users (2000) | Internet users (2004) | Use growth (%) (2000-04) | % population penetration |
|-------------|-----------------------|-----------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 |
| China | 22,500,000 | 79,500,000 | 253.3 | 6.0 |
| India | 5,000,000 | 18,481,000 | 269.6 | 1.7 |
| Japan | 47,080,000 | 64,537,437 | 37.1 | 50.4 |
| South Korea | 19,040,000 | 29,220,000 | 53.5 | 62.0 |
| Malaysia | 3,700,000 | 8,692,100 | 134.9 | 35.3 |
| Pakistan | 133,900 | 1,500,000 | 1,020.2 | 1.0 |
| Singapore | 1,200,000 | 2,100,000 | 75.0 | 60.0 |
| Sri Lanka | 121,500 | 200,000 | 64.6 | 1.0 |
| Taiwan | 6,260,000 | 11,602,523 | 85.3 | 50.3 |
| Thailand | 2,300,000 | 6,031,300 | 162.2 | 9.4 |
| Vietnam | 200,000 | 3,500,000 | 1,650.0 | 4.2 |

the people living in remote areas. Such an initiative may have an impact on the socio-economic development of the region and bring the region closer to the national mainstream.

North Eastern Region of India consists of the eight states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura with a total population of 39,125,582 in 2001 (Government of India, 2002). The CICs project was launched with a pilot project covering 30 blocks in the region including 15 in Assam and was inaugurated in August 2000. By August 2002, CICs were established in all the blocks in the region, including 219 CICs in Assam covering all the 23 districts. These CICs were expected to help the region avail the benefits of global connectivity through the Internet as well as other local benefits.

A year after the establishment of CICs in North Eastern India, including Assam, it was felt necessary to assess the functioning of the CICs in Assam and its role on regional economic development. It was also necessary at this point to find out the expectations of the rural people from these centers. Keeping these twin objectives in mind, the present study was undertaken to examine the achievements of the CICs in Assam taking into account the aspirations of the rural people of the state. An attempt was also made to record the expectations of the users from the CICs in terms of information dissemination and its catalytic role in increasing productivity in the rural sector. This type of study offered promise to provide valuable guidelines to the government and as a result provide different services to the society through diffusion of ICT. It also provided the opportunity for the users to communicate their requirements/local content to the service providers. Such studies also bring out information on the stages of ICT infrastructure and acceptance of ICT as a tool of development by the users which may act as a guide to the private sector, NGOs, etc. in the process of ICT diffusion.

The following were the specific objectives of the study:

- To examine the functioning of CICs in relation to their stated objectives.
- To find out the socio-economic aspirations of the people at the block level and how CICs could help fulfill their expectations.
- To put forward recommendations for better functioning of the CICs in order to generate ICT awareness among rural people, to narrow the digital divide and achieve regional development.

CICS IN ASSAM AS A TOOL TO BRIDGE THE DIGITAL DIVIDE

Assam is the gateway to the North Eastern region of India. Because of its prominence in economic activities, contribution of a larger share to the national income and a larger population in the region it was felt to provide a good base for a sample case in relation to ICT diffusion and impact of ICT in regional development.

The case was considered to be reflective to the region as a whole. CICs in the state were set up in order to establish ICT infrastructure, to create ICT awareness amongst the local populace, to provide computer education and training, to provide government to community (G2C) services and to use ICT for sustainable regional development.

To achieve these objectives, each CICs was well equipped with infrastructure including one server machine, five client systems, VSAT, Laser Printer, Dot Matrix Printer, Modem, LAN, TV, Web cam, UPS, generator, telephone, air conditioner etc. The project was jointly implemented by Department of Information Technology under the Ministry of Communications and Information Technology, National Informatics Centre (NIC) and state governments.

The present study was based on primary data, which were collected through field work with the

help of structured questionnaires. For collection of data, a procedure of multi-stage sampling was adopted.

In the first stage, nine out of 23 districts belonging to different climatic, geographical conditions and socio-economic groups of people were selected. The districts selected for the study were Kamrup, Nagaon, Jorhat, Dibrugarh, Lakhimpur, Sonitpur, Goalpara, Bongaigaon and Cachar.

In the second stage, two CICs from each of the districts were chosen keeping in mind the intra-district variations in socio-economic conditions. The CICs covered under the study were: Rani and Kamalpur from Kamrup; Raha and Kaliabor from Nagaon; Dhekergorah and Titabor from Jorhat; Khowang and Barbaruah from Dibrugarh; Lakhimpur and Bihpuria from Lakhimpur; Dhekiajuli and Biswanath Chariali from Sonitpur; Balijana and Rongjuli from Goalpara; Dangtol and Borobazar from Bongaigaon and Borjalenga and Silchar from Cachar.

This was followed by selection of five villages from each CICs using simple random sampling procedure. Finally, about 10% of the beneficiaries were selected at random from each of these villages. Thus, total number of samples for the present study was 900. This included both users and non-users of the facilities provided by the CICs. Effort was made to include at least 75% users among the beneficiaries.

Further information were collected from the CICs operators of the CICs used in the samples with the help of structured questionnaires to elicit their opinions about the functioning of the CICs.

The data thus collected were tabulated and analysed using appropriate statistical tools.

SUMMARY OF THE FINDINGS

Some of the findings from the study are summarized below.

Participation of women in accessing information through CICs was very low. Only about 9% of users were found to be women, which clearly shows that gender participation of the sample was skewed towards male.

Students were found to be the dominant group among the users. While about 67% of the users were students, farmers and housewives constituted only 6% and 1.2% of the sample respectively. Again, about 85.11% of the sample, which comprises mostly the youth, were found to be aware about the CICs. Awareness about the facilities provided by CICs among the farming community, businessmen and other sections of the society was not spreading in desired manner. However, about 76.4% of the users were found to use the services provided by the CICs.

Some of the services provided by the CICs in Assam are:

- Training on computer application and advanced training in computers
- Word processing and printing
- Internet browsing and e-mail
- Examination results
- Health/Medical information
- Information on career opportunities
- Information on government schemes
- Information on banks' schemes
- Information on Public Distribution System (PDS)
- Downloading of application form for different government certificates
- Agricultural commodity prices
- Entertainment facility

Of all these services provided by CICs, the computer training programme was the most used (72.40%) by the users.

Providing G2C services was one of the prime objectives of establishing the CICs in the state. However, the spread of G2C services through the CICs was not very impressive. Only about 33% of the beneficiaries were found to avail themselves

of these services. The G2C services currently provided by the CICs were limited to providing information only. However, some of the information provided was found to be not current and not relevant to the rural people. Moreover, the rural people were not getting further benefits, such as getting birth certificates, death certificates, records of rights etc. at the village as was initially intended by establishing the CICs.

Among the users of other services, 49.39% were accessing information on employment opportunities followed by information on banks' schemes (37.29%) and downloading of various application forms (13.32%). The severity of unemployment problem in the state especially among the educated youth was reflected in the type of information sought by the users. In addition to these, the entertainment facility was also used by the participants in the CICs. It was found that about 51% of the sample were using the entertainment facility which was provided mostly through television broadcasting.

All the users were found to pay a user fee for various services used by them. Variation in user fee was observed depending on the type of facility used.

Location of the CICs was found to be an important parameter in accessing the services of CICs. About 82.70% of the users were found to reside within 5 kilometers from CICs. 33.28% of the users resided within 2 kilometers of the CICs. Only 0.73% of the users were found to travel a distance of more than 10 kilometres. This reflects an inverse relationship between distance from residence and the number of users.

About 36% of the users reported facing difficulties in accessing the facilities of the CICs. Most of these problems were related to the infrastructure of the CICs. Irregular supply of electricity, lack of sufficient space and furniture, non-availability of sufficient computers, delay in providing maintenance services, etc. were found to be the hindrances in exploiting the facilities of CICs. However, all the users found the services provided

by the CICs in the present form useful.

Some of the specific expectations of the beneficiaries about the services that should be provided by CICs are as follows:

- Distance education
- Information on banks' schemes
- List of beneficiaries of government schemes
- Information on career opportunities
- Redressing Public grievances online
- Information on government holidays
- Land patta and records of rights
- Matrimonial issues
- Tender notice
- Government certificates
- Information on agricultural commodity prices in neighbouring markets
- Information on health and medical services
- Information on Public Distribution System
- Downloading of application forms

Some of these expected services are being currently provided by some of the CICs in Assam, but in a low key.

SUGGESTIONS

The following suggestions are offered as easy ways of improving the effectiveness of CICs in the state.

Generating awareness among the rural people about the services that can be provided by the CICs needs to be taken up rigorously. At present, awareness about the services provided by CICs is found to be mostly among the educated youth. It should be extended to the rural masses in order to achieve the objectives for which CICs were established. Emphasis should be given to make females more aware about the services provided by the CICs. This is required as women can play

an active role in enhancing productivity in rural sector.

The limited spread of G2C services is mainly because of non-computerization of information and data at the district level, poor connectivity as well as lack of initiative from the state government. Initiative on the part of state government is necessary to make the CICs more vibrant and useful.

Some interactive services like online public grievances, providing records of rights of land, issuing of different certificates, residence certificates, caste certificates, birth and death certificates etc. will be taken up immediately in coordination with district administration. These types of services should be able to attract more rural people to use the services of CICs.

Efforts should be made to provide innovative services that cater for specific needs of the people. As for example, farmers could be provided with information on latest technology and specific problems such as raising alternative crops in the event of natural calamities like flood, etc. and agricultural experts may be involved online to provide advice. This has to be done within an acceptable time frame. These types of services may also be extended to school children, youth and other sections of the rural people.

Updated and relevant information should be provided by the CICs. As for example, in case of agricultural commodity prices, the figures may be updated at least weekly and the prices should be relevant to the area that a CICs serves.

Distance education programmes can be popularized through the CICs. Different universities and educational institutions providing specialized courses should be involved in this endeavour. Such programmes may be region specific and rural need based.

In order to bring transparency in government functioning, additional services may be brought under the purview of CICs. As for example, official information could be posted at different health centres in the villages and official information

on rural development etc. should also be made available.

The location of the CICs needs to be reviewed. Presently, most of the CICs are found to be located either in block development offices or schools. It was observed that some of the CICs located at block development offices were too far away from the centres of the villages they serve. This affects the use and the popularity of the CICs.

In order to make the CICs sustainable in the long run, it is necessary to provide their services effectively and efficiently. The role of CICs operators in this respect is most important. They have to keep abreast of the village environment and the requirements and expectations of the rural people under changing circumstances.

CONCLUSION

Establishment of CICs was an innovative step by the Government of India to minimize the digital divide. It has been found that CICs in Assam are providing various services to rural people in a limited way both in terms of providing relevant information and G2C services. The CICs have been able to achieve some of the stated objectives such as providing ICT infrastructure at the block level, providing e-mail and internet services and conducting computer based training programmes. But they have only been partially successful in facilitating distance education and G2C services. The objective of using CICs as a tool for sustainable regional development has not been satisfactorily achieved as they are providing mostly limited information and services which are not directly augmenting the rural productivity in a desired manner. To achieve some of the stated objectives of the CICs, a stronger coordination between the state government and the CICs is required. In order to make the CICs more viable and effective in achieving regional economic development there is a necessity for wider coverage of G2C services, a better awareness campaign and

region-specific innovative services. Involvement of the private sector for economic sustainability of the CICs in future may also be a necessity. Further research is needed to verify the scope and viability of involvement of NGOs, the private sector and corporate bodies. Such an effort has already taken place in some states of India. Evaluative studies incorporating the requirements in changing circumstances in the rural areas may need to be undertaken. Such an effort should provide future guidance to the service providers so that relevant ICT services can be provided to the rural population.

NOTE

The case study of CICs in Assam is based on a consultancy project by the authors funded by the National Informatics Centre, Ministry of Communications and Information Technology, Government of India, March 2004.

REFERENCES

- Economist (2000, September 21). *Falling through the Net?* (Print ed.)
- Government of India (2002). *Basic statistics of North Eastern Region*. Shillong: North Eastern Council.
- Hansen, E.C. (2001). *Globalisation, inequality and the Internet in India*. Retrieved April 6, 2003, from www.isanet.org/archive/hanson.html
- Kraemer, K.L. & Dedrick, J. (2001). Information technology and economic development: Results and policy implications of cross country studies. In M. Pohjola (Ed.), *Information technology, productivity and economic growth*. Oxford: Oxford University Press.
- Nkrumah, G. (2000, July 27-August 2). Digital divide. *Al-Ahram Weekly*. Retrieved August 25,

2000, from www.weekly.ahram.org.eg/2000/492/in3.htm

- Norris, P. (2001). *Digital divide: Civic engagement, information poverty and Internet worldwide*. Cambridge: Cambridge University Press.
- Pohjola, M. (2001). Information technology and economic growth: A cross country analysis. In M. Pohjola (Ed.), *Information technology, productivity and economic growth*. Oxford: Oxford University Press.
- Prabhakaran, A (2003). Digital divide: The Neo Indian stratification. Paper presented at the *summer workshop 2003* at Karlstad University, Sweden.
- Wong, P.K. (2001). The contribution of information technology to the rapid economic growth of Singapore. In M. Pohjola (Ed.), *Information technology, productivity and economic growth*. Oxford: Oxford University Press.

KEY TERMS

Block: An administrative unit in India which occupies fourth place after centre, state and district.

CICs (Community Information Centres): Information Centres set up by the Government of India in the north eastern region of the country to provide IT related services with internet access to the rural population.

Digital Divide: The gap in accessibility of ICT and its related services.

G2C (Government to Citizen) Services: Different citizen centric services provided by the government for the benefits of the citizen. These include providing birth and death certificates, records of rights of land, information on govt. schemes and so on.

ICT Diffusion: Spread of ICT benefits to the majority of the population for using ICT to increase productivity and regional development.

NGOs (Non-Governmental Organizations): Associations of like-minded people serving the society specially the downtrodden and vulnerable sections on their own or supplementing the organized effort.

Sustainability: A situation in which a particular mechanism is viable for a longer period.

Transparency in Government Services: A mechanism by which citizens know and understand the different activities of the government. Information on functioning of different government machineries is made available to the citizens.

UPS (Uninterrupted Power Supply): A mechanical/electronic device used to provide power supply without any disruption at the time

of power failure. This is mainly used in computers as a power back up.

VSAT (Very Small Aperture Terminal): An earthbound station used in satellite communications of data, voice and video signals, excluding broadcast television.

ENDNOTE

- ¹ The instances of Andhra Pradesh State Wide Area Network (APSWAN) in Andhra Pradesh, Keltron Information Kiosks (KIKs) in Kerala, Gyandoot Dotcom Project in Dhar District of Madhya Pradesh, Development of Humane Action Network (DHAN) in Tamil Nadu, M. S. Swaminathan Foundation, Drishtee, etc. reflect the success of involving government, NGOs and private sectors in bridging the digital divide in some Indian states.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 387-392, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.6

Digital Divide: Introduction to the Problem

Liudmila Burtseva

Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova

Svetlana Cojocaru

Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova

Constantin Gaidric

Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova

Galina Magariu

Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova

Tatiana Verlan

Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova

ABSTRACT

In this chapter the authors introduce the digital-divide concept to the reader, bring its different definitions, and describe the short history of the problem. The basic figures and facts, which characterize the information and communication technologies' usage in different countries and regions, are given as well. Also, basic indicators that allow the monitoring of the country's advancement on the way to bridging the digital divide are stated.

The main purpose for the authors was to show that the digital divide is not only (and not as much) a technical problem, but rather a social and political one. Hence, the approaches to this problem decision, both in the world community as a whole and in separate countries, are described.

INTRODUCTION

“The future belongs not so much to those peoples who have achieved today a high standard of well-being, as to those ones which can induce new ideas

in the field of high technologies and in their relations with the Nature. The erudition is necessary for this purpose, and not of separate people, but of the nation as a whole. And this circumstance imposes the special responsibility on a governing body of the state and on the intelligentsia.” (N. N. Moiseev, “Universum. Information. Society.” Moscow, 2001)

“It is not the gap that divides, but the difference of levels.” (Stanislaw J. Lec, “Unkempt Thoughts”)

The problem of the digital divide has probably only now begun to be perceived as it deserves. Practically any society can face it. Its manifestations are so various in different countries that it is actually impossible to offer common recipes for its solution. As the problem is basically social rather than technological, the ways of its overcoming depend on the degree of the democratization of a society, on the standard of living of a population, on the level of population erudition, and on cultural and ethnic features of the specific community of people. Certainly, the presence of an ICT infrastructure is necessary, but this is only the necessary condition. This chapter contains a brief history of the problem and various relevant definitions. On the basis of statistical data, the state of the art in the world is shown, the various countries are compared, and some basic ideas of the Genoa action plan are stated.

The necessary steps, without which the solution of the digital-divide problem is impossible, are brought. Positive experiences of the European Union (EU) and other countries are confirmed by examples. Basic indicators of the digital divide that allow the monitoring of the problem solution are brought as well.

A SHORT HISTORY OF THE PROBLEM

The end of the 20th century and the beginning of the 21st were marked by the rapid development of information and communication technologies, which has led to the avalanche growth of digital information. However, any progressive phenomenon, as a rule, is accompanied also by negative by-products. In this case, alongside the overcoming of existing temporal, spatial, and social borders when using information, society has also received a new problem, the so-called digital divide. There are a lot of definitions of this term, which as a matter of fact are reduced to the following: “the term ‘digital divide’ describes the fact that the world can be divided into people who do and people who don’t have access to—and the capability to use—modern information and communication technology” (*Digital Divide*, 1999).

The world community started talking about the problem of the digital divide and the “have-nots” at the end of the last century (Brown, Barram, & Irving, 1995). The *Oxford English Dictionary Online* (2004) considers that the term digital divide was used for the first time in 1995 in an article of Ohio’s daily newspaper *Columbus Dispatch* and gives the following explanation as the commonly accepted meaning of this term: “the gulf between those who have ready access to current digital technology (esp. computers and the Internet) and those who do not; (also) the perceived social or educational inequality resulting from this.” At that time, many people refused to take this problem seriously and even spoke about it as a far-fetched problem that promoted further enrichment of computer and telecommunication corporations. By the end of the ’90s, the stable concept of the digital divide appeared as the serious, recognized problem that is regularly being studied and periodically being discussed by people all over the world today.

In 1999, in its third survey *Falling Through the Net: Defining the Digital Divide*, the USA

National Telecommunications and Information Administration (NTIA) noted that the digital divide became “one of America’s leading economic and civil rights issues” (1999, p. xiii).

With time, many international organizations and agencies (United Nations [UN], European Union, World Bank, United Nations Development Program [UNDP], Organization for Economic Cooperation and Development [OECD], International Telecommunications Union [ITU], United Nations Educational, Scientific, and Cultural Organization [UNESCO], Economic and Social Council [ECOSOC]) began to express growing concern that the deepening of the digital divide problem may leave many nations far behind, producing growing disparities between advanced, industrialized countries and developing societies. Therefore, they give a lot of attention, force, and means for studying decisions regarding this problem. The international community carries out international conferences and summits (the Digital Divide Summit by the United States Department of Commerce in 1999, and the World Summit on the Information Society [WSIS] in Geneva in 2003 to Tunis in 2005), organizes various forums, creates specialized sites on the digital-divide problem (<http://www.pbs.org/digitaldivide/>, <http://www.digitaldivide.net>, <http://cbdd.wsu.edu/>, http://europa.eu.int/information_society/eeurope/i2010/digital_divide/index_en.htm), and launches various programs and initiatives. They study the experiences of various countries in overcoming this problem. Their discussions have come to a level of development on which practical recommendations are giving for bridging digital inequality both within an international scope and between separate states as well.

DEFINING THE CONCEPT OF DIGITAL DIVIDE

There are a lot of terms to describe the concept of digital divide—digital gap, digital inequality,

and rarely, information inequality—but all of them reflect the inequality of access to digital or information technologies.

However, before speaking about the problem of digital inequality, and for easier understanding of its essence and origin, it is necessary to pay attention to inequality in general. The following discussion is widespread and absolutely true. Inequality takes place in all spheres of social life from the moment of the beginning of a society. This is the inequality in access to vital resources (food, raw power, and now to information as well), workplaces, education, medical services, and cultural heritage. The distinctions of people regarding social status, the amount of available money resources, level of education, age, residence, and so forth lay in the basis of inequality. Inequality is the reason for conflicts and social cataclysms of various scales. Therefore, the world community, first of all the advanced countries, makes efforts for the neutralization of threats to global and local stability caused by various sorts of inequality.

In this way, the ensuring of equal access to social, economic, cultural, educational, and technological opportunities is offered for all people and for all states. Thus, they get the potential opportunity to reach an equal social status. However, it is an opportunity only, not the solution of the problem. In fact, certain limited resources (financial and especially human resources), even in the presence of political will, cannot be the sole determining factor as they do not allow the removal of inequality. If the opportunities exist already, then it is the will and efforts of people that will determine whether the actual inequality will proceed or will be eliminated. The consciousness of the person influences his or her will. The comprehension of inequality is already a powerful stimulus for social transformations, and for the development of separate people, social groups, and states as a whole. Therefore, discussion of the problem and the popularization of the necessity of overcoming inequality at all levels—internation-

Digital Divide

ally, nationally, and in governmental circles and various social groups—are very important.

Now let us turn to the digital-inequality problem, or as it is put more often, the digital-divide problem.

The attention of researchers of the problem at first was usually focused on the inequality in access to technical equipment. Even the definition given in the UN review (UN, 2003) fixes this position: The digital divide is “the fact that poor people in the industrialized world and almost all in the developing world are excluded from modern (information and communication) technologies” (p. 25).

However, this definition is too elementary to characterize the problem, which, actually, is much deeper and extensive. For today, we may consider, among others, the following aspects of the digital divide as basic ones:

- Property
- Age
- Education
- Territory
- Gender
- Culture

In addition, all these aspects are manifested differently in various countries, irrespective of their well-being and ICT infrastructure development level. From practical experience it becomes obvious that the idea “the more computers, the less digital divide” is narrow.

Irvine M. Warschauer (2002), a professor at California University, analyzed three examples of projects concerning ICT promotion. The conclusion was that providing access to ICT is not enough for bridging the digital divide. Analogously, taking into account each of the factors of the digital division (social factors, age, etc.) separately does not determine the problem. The problem needs to be considered in a complex way, taking into account all relevant factors.

For an illustration, let us examine these projects.

- **Example 1. (Warschauer, 2002, “A Slum ‘Hole in the Wall’”):** This project was established in 2000 by the New Delhi government in collaboration with an information-technology corporation. A computer kiosk was set up in one of New Delhi’s poorest slums. Five computers were inside a booth, and monitors were placed in holes in the walls. Specially designed joysticks and buttons were provided instead of computer mice and keyboards. Dial-up, 24-hour Internet access was available. There were no teachers in accordance to the concept of minimally invasive education. The idea was to allow children to learn by their own desire and capabilities.

Researchers and government officials appreciated this project as it was one that offered a model for how to bring India’s and the world’s urban poor into the computer age. However, as M. Warschauer (2002) noted, visits to the computer kiosk indicated a rather different reality. Internet access was of little use since it seldom functioned. There were no special educational programs and no special content in Hindi, the only language the children knew. Children did learn to manipulate the joystick and buttons, but almost all their time was spent drawing with paint programs or playing computer games.

Parents had ambivalent feelings. Some saw the kiosk as a welcome initiative, but most expressed concern that the lack of organized instruction took away from its value. In short, the community came to realize that minimally invasive education was, in practice, minimally effective education.

- **Example 2. (Warschauer, 2002, “An Information Age Town”):** In 1997, Ireland’s national telecommunications company held a national competition “Information Age

Town.” Towns of 5,000 people and more across Ireland were invited to compete by submitting proposals detailing their vision of an information-age town and how they could become one. Four towns were chosen as finalists, and then Ennis, a small, remote town of 15,000 people, was selected as the winner. The prize consisted of over \$1,200 per resident, a huge sum for a struggling Irish town.

The proposal planned for the following:

- An Internet-ready personal computer (PC) for every family
- An ISDN (integrated services digital network) line for every business
- A Web site for every business that wanted one
- Smart-card readers for every business, and smart cards for every family

Ennis was strongly encouraged to implement these plans as quickly as possible.

Meanwhile, each of three other towns received consolation prizes of about \$1.5 million. These towns were not limited by time.

Three years later, Ennis had little to show for its money. Training programs had been run, but they were not sufficiently accompanied by awareness programs. People were not prepared to use advanced technology. In some cases, well-functioning social systems were broken.

The unemployed had received computers and Internet connections at home so that they could sign in and receive electronic payments via the Internet, thus the necessity to visit the labor registry office fell away. However, these people lost the important social function to overcome isolation. More over, they could not use the equipment, and most others saw no reason to do so. Thus, a good number of those computers were sold.

Meanwhile, the other three towns with far fewer resources were forced to carefully plan

the usage of their funds rather than spend them for massive amounts of equipment. Community groups, small businesses, and labor unions participated in the planning process. Much greater effort and money were spent on developing awareness, planning and implementing effective training, and setting up processes for sustainable change. The towns built on already existing networks among workers, educators, and businesspeople to support basic uses of technology. As a result, these three towns actually achieved more success than the winner.

- **Example 3. (Warschauer, 2002, “A Model Computer Lab”):** An international donor project funded by the United States Agency for International Development decided to donate a computer laboratory to the College of Education at a major Egyptian university. The purpose was to establish a model teacher-training program using computer-assisted learning in one of the departments of the college. State-of-the-art equipment was selected, including more than 40 computers, an expensive video projection system, several printers and scanners, and expensive educational software. To guarantee that the project would be sustainable, the Egyptian university would be required to manage all the ongoing expenses and operations, including paying for Internet access, maintaining the local area network (LAN), and operating the computer laboratory.

Before the equipment was installed, it became clear that the college would have difficulty in making use of such a huge and expensive donation. Other departments within the college became envious because of the fact that a single department would have such modern and expensive equipment. The college and university could not easily justify spending the money. No money was available to engage an outside LAN manager or provide Internet access at the proper level. Due to

Digital Divide

all these difficulties, the expensive state-of-the-art computers sat in boxes in a locked room for more than a year before they were even installed, thus losing about one third of their economic value.

These experiences confirm the idea expressed by Bridges.org that states:

providing access to technology is critical, but it must be about more than just physical access. Computers and connections are insufficient if the technology is not used effectively because it is not affordable; people do not understand how to put it to use, or they are discouraged from using it; or the local economy cannot sustain its use. (“Spanning the Digital Divide,” 2001, p. 5)

Thus, we come to the wider definition: “digital inequality is a going deep inequality in access to social, economic, educational, cultural and other opportunities owing to unequal access to information and communication technologies” (Baranov, 2003).

FIGURES AND FACTS

A lot of analysis and research was carried out to compare the state of the art in the world. The results allow for the assessment of disparities existing in the access to and use of ICT between different countries (international digital divide) and groups within countries (domestic digital divide).

The existence of the digital-divide problem is recognized already by one and all. However, to compare the problem in different countries and at various times, it is necessary to measure it somehow. There are three basic parameters that are frequently used for measuring the digital divide: the number of ICT users, number of computer users, and number of Internet users.

According to data from the Digital Opportunity Task Force (DOT Force, 2001), 70% of the world’s poor live in rural and remote areas, and very often they have scarce access even to

a telephone, not speaking about ICT in general. Thus, one third of the world population has never made a telephone call.

In its *Human Development Report* of 1998, the UNDP drew attention to the fact that 109 million primary-school-age children (22% of those in the world) were out of school, 885 million adults (age 15 and above) were illiterate, and 4 copies of daily newspapers were circulated per 100 people in developing countries, in contrast to 26 in industrial countries.

Other impressive comparative statistics include the following:

- On the entire continent of Africa, there are only 14 million phone lines—less than the number in either Manhattan or Tokyo (Nkrumah, 2000).
- Wealthy nations make up only 16% of the world population but possess 90% of Internet host computers (Nkrumah, 2000).
- Sixty percent of world Internet users reside in North America, but only 5% of the world population reside there (Nkrumah, 2000).
- One in two Americans is online as opposed to 1 in 250 Africans (“Falling through the Net?” 2000).

In digital-divide studies, Internet-usage numbers are most often cited to describe the divide. Nua Internet Surveys (“How Many Online?,” 2002) offers an estimate of the global Internet-user population based on an extensive examination of surveys and reports from around the world. Nua’s data on how many people have used the Internet show a clear division. In 2001 in the world as a whole, there were 407.1 million Internet users; by 2002, the online users numbered 605.6 million. The leading regions were Europe (190.91 million), Asia and the Pacific (187.24 million), and Canada and the USA (182.67 million). A comparison with similar data on Latin America (33.35 million), Africa (6.31 million), and the Middle East (5.12 million) impresses.

Internet World Stats (2005), an International Web site, shows up-to-date 2005 worldwide Internet-usage and population statistics for over 233 countries and world regions. See Table 1 for world-regions data. These data as well as Nua's ("How Many Online?," 2002) show the identical world tendency: Asia, Europe, and North America remain leaders in Internet usage.

However, one can notice that in 2002, Europe was the leader by the absolute amount of Internet users (though its population makes up only 11.4% of the world's population); in 2005, Asia was the leader in the world (see Figure 1). Nevertheless, speaking about the percent of the country's population using the Internet (see Internet penetration in Figure 1), Asia, the population of which makes up 56.4% of the world's population, is still far behind (8.9%), and Northern America is the absolute leader (68%), though its population makes up only 5.1% of the world's population. By examining the dynamics of Internet users' growth inside each region for 2000 to 2005, one can see that the largest progress during these 5 years was made by the nonmembers of the EU (377.6%);

the Middle East follows with 311.9%. However, penetration inside these regions remains at only 17.5% and 8.3%, accordingly. The tendency is characteristic for countries of Latin America and the Caribbean (277.1%), Africa (258.3%), and Asia (183.2%) as well, where the penetration parameter is equal to 12.5%, 1.8%, and 8.9%, respectively. Let us compare the same parameters for North America, with a penetration rate of 68%. In this region for the same period, Internet users' growth was only 106.7%.

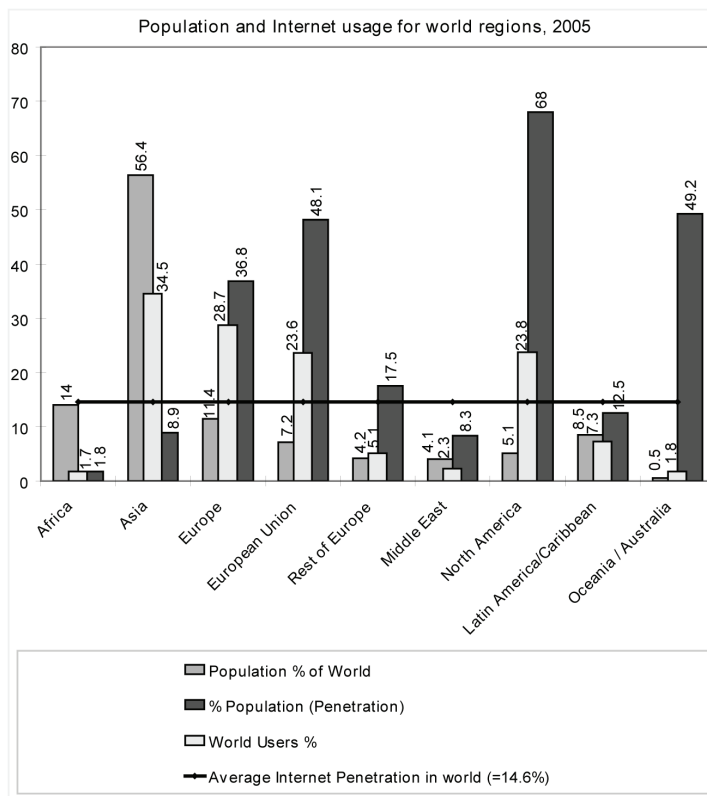
That is, during the last several years, less developed countries of the Middle East, East Europe, the Asian-Pacific region, and Latin America showed a constant increase in the active Internet audience, but not the USA, Japan, and countries of Western Europe. Insignificant growth of the number of Internet users in countries where penetration is already high is quite clear. Additionally, it is not only saturation, but probably an insuperable part of the digital divide that will remain in each society, at least in the near future.

According to the statistics in Table 1, on July 23, 2005, only 14.6% of the world population

Table 1. World Internet usage and population statistics for July 23, 2005 (Source: The table is made according to the data taken from Internet World Stats, 2005).

| World regions | Population (million; 2005 est.) | Population % of world | Internet usage (million; latest data) | Usage growth 2000-2005 | % population (penetration) | % world users |
|--------------------------|---------------------------------|-----------------------|---------------------------------------|------------------------|----------------------------|---------------|
| Africa | 896.72 | 14.0 | 16.17 | 258.3 | 1.8 | 1.7 |
| Asia | 3622.99 | 56.4 | 323.76 | 183.2 | 8.9 | 34.5 |
| Europe | 731.02 | 11.4 | 269.04 | 161.0 | 36.8 | 28.7 |
| European Union | 460.27 | 7.2 | 221.60 | 137.9 | 48.1 | 23.6 |
| Rest of Europe | 270.75 | 4.2 | 47.44 | 377.6 | 17.5 | 5.1 |
| Middle East | 260.81 | 4.1 | 21.77 | 311.9 | 8.3 | 2.3 |
| North America | 328.39 | 5.1 | 223.39 | 106.7 | 68 | 23.8 |
| Latin America/ Caribbean | 546.72 | 8.5 | 68.13 | 277.1 | 12.5 | 7.3 |
| Oceania/ Australia | 33.44 | 0.5 | 16.45 | 115.9 | 49.2 | 1.8 |
| World total | 6420.10 | 100 | 938.71 | 160 | 14.6 | 100 |

Figure 1. Comparison of population and Internet usage for different world regions (Source: Diagram is made by the authors of this chapter using data taken from Internet World Stats, 2005)



used the Internet. The reasons for which the other 85.4% are nonusers are interesting. Numerous reviews specify the following reasons: poverty, a badly advanced ICT infrastructure, a lack of education, a misunderstanding of the benefits of ICT usage, bad content, the absence of interesting e-services, and so forth. However, the factor of motivation in using or not using ICT, the Internet in particular, is not less important. The report (Kalkun & Kalvet, 2002) prepared at the order of the Estonia state chancellery contains an analysis of motivation regarding Internet nonuse. Some ideas of this analysis are appropriate for the discussion below.

This report indicates that Internet nonusers constitute about 58% of the Estonian population in the age group of 15 to 74 (February 2002). Every second nonuser acknowledges one or many

benefits of computers or the Internet, while one half of the nonusers cannot point out any benefits of Internet.

One third of Internet nonusers are motivated to use the Internet. They have access to the Internet due to ongoing projects. This is because they have a more open attitude to learning new skills on the one hand, and an ability to overcome any barriers to Internet use that may arise on the other hand.

New projects should pay special attention to those two thirds of Internet nonusers who do not associate the possibilities of Internet use with their lives. There are two distinct categories in this group: retired persons and workers, or, as they are called in this report, “passive people” and “blue collars.”

- **Passive people** (28% of nonusers)
 - About 60% of people in this group are of 50 or older.
 - They have relatively little interest in matters outside their daily life.
 - They have a very weak relation to the Internet or computers; they see no benefits in the Internet and have no need to use it.
 - They prefer to use traditional media (even if the Internet were cheaper and more convenient); besides a lack of interest, they have a language barrier and are incapable of handling the user interfaces of computers. They are also relatively less able to learn and memorize new things, and are unwilling to change their habits.
- **Blue collars** (27% of nonusers)
 - They are mainly unskilled and skilled workers who do not use computers in their work.
 - About half of people in this group see no benefits in the Internet and would not very willingly change their daily routines as the Internet is unattractive for them.
 - A personal monetary gain would make the Internet attractive for them.
 - There are social and psychological barriers (fear of new technologies, no perception of the need for lifelong learning, a fear of demonstrating their lack of skills to others), skill barriers (lack of computer and ignorance of foreign languages), and economic barriers (income per family member is low).

These groups have not realized a relation between their lives and the Internet yet. That is why the important task is to motivate them, to introduce Internet services adjusted to the habits of these target groups, and to develop suitable Internet services where necessary. It is also important to

pay attention to the Internet-skills and Internet-access problems of the passive people and blue collars groups. The rest of the nonusers already have the motivation to use the Internet.

It may be said with fair certainty that the sociodemographic characteristics of the population segments that do not use information technologies are similar to those of other countries. The problem of motivation regarding ICT use arises in many countries, both in the developing and advanced. For example, in Scotland, where the technical base exists and is at a high-enough level, the question about the necessity of projects for the motivation to use ICT arises for those who do not use them (nonusers). Viviane Reding, member of the European Commission, states the same idea. She notes that governments need to encourage the use of new technologies, saying that the public will find new technologies “beneficial but guidance will be needed. The infrastructure exists but is underused: broadband is available on 80% of the European network but has been taken up by only 7% of users” (Raven, 2004).

The authors of the Estonian review fairly remark that if the problems of nonusers are ignored, a part of the population would effectively be excluded from actively participating in economic activities. This implies a decrease in the number of consumers, lower labor quality for the private sector, and, in the worst case scenario, the generation of an army of unemployed for the public sector, which in turn may cause extensive social problems (Kalkun & Kalvet, 2002).

SOLUTIONS FOR THE DIGITAL DIVIDE PROBLEM

In July 2000, the summit of the Great 8 (G8) was held in Kyushu-Okinawa, Japan. At this summit, the leaders from G8 countries adopted the *Okinawa Charter on Global Information Society* (2000). This charter established the DOT Force to integrate “efforts into a broader international

Digital Divide

approach” (p. 5). The DOT Force presented the report *Digital Opportunities for All: Meeting the Challenge* (2001) at the G8 summit held in Genoa in 2001. In that report, a nine-point action plan (Genoa Plan of Action) was proposed as well as a theory of ICT utilization to activate social and economic development.

Since then, the recipes for overcoming the digital inequality in and among countries have found reflection also in a lot of other world community documents (“Spanning the Digital Divide,” 2001; UNECOSOC, 2000). Today, the European Union is aimed to become the most dynamic knowledge-based economy and considers closing the digital divide as a key goal. This idea is reflected in such fundamental EU documents as the conclusion of the European Council in Lisbon 2000 (Lisbon European Council, 2000), the *eEurope 2002 Action Plan* (Council of the European Union & Commission of the European Communities [CEU & CEC], 2000), the *eEurope Benchmarking Report* (CEC, 2002b), and the *eEurope 2005 Action Plan* (CEC, 2002a).

There are many initiatives in the world directed to the digital-divide reduction.

However, it is necessary to understand the idea (“Spanning the Digital Divide,” 2001) that solutions that are successful in developed countries cannot simply be copied in the environments of developing countries. The solutions must take into consideration the local needs and conditions. As UN review (UN, 2003) stated, “The UN Millennium Declaration mentions the digital divide issue as one of the symbols of deepening developmental inequality in the world and indeed, finding a comprehensive solution to it belongs to world-making efforts” (p. 26).

Also, the analysis of relevant documents allows drawing a conclusion that the solution to the digital-inequality problem demands a balanced, nationwide-system approach that concentrates on the following basic directions: (a) policy, (b) access, (c) services, (d) content, (e) knowledge and skills, and (f) motivation.

In the Genoa Plan of Action (DOT Force, 2001), special attention is given to the coordination of strategies produced by less developed countries, as well as to involving in the work representatives of both private and state sectors. The states should produce these strategies by themselves, and the strategies’ presence in itself is already important for less developed countries. With that, it is necessary to formulate the strategy in strict conformity with national interests.

The many areas of human activity where ICTs can be applied and the many reasons for the digital divide assume many directions to operate and many various forces to involve for its overcoming. In what proportion, when, and what should be preferred depends on features of the specific country. The problem should be solved in a complex way, taking into account and coordinating the actions directed on the elimination of the separate reasons and overcoming any separate barrier. To embrace the basic aspects of the digital divide and to take into account the fact that each society has its own economical, political, social, and historical peculiarities, the following level of reality is necessary to be achieved.

- Physical access (infrastructure, computers, availability of necessary information in the language required on the Net)
- Comprehension of necessity and desire for ICT advantages
- Sufficient degree of society democratization
- Certain literacy level and opportunity for training
- Legislative base (electronic signatures, electronic documents, rights of access to information and protection of confidential information)
- Commercial-structures participation
- Sufficient financing
- State support (political will)

Having in view the objective of achieving this level, experts emphasize the following steps for overcoming the digital divide that are necessary to undertake in the directions listed previously.

1. Formation of national strategy, international and internal policy, and a favorable legislative, public, and economic atmosphere in the fields of informatisation and of ICT use
2. Maintenance of the potential opportunity for the population to access ICT everywhere due to the association of efforts of the state and private sectors of the economy on the development of an information infrastructure
3. Assistance to increase the variety and amount of services for the population and business by means of ICT
4. Concentration of efforts of the state and society for the creation of public electronic information resources (content) on the basis of national, world, political, economic, cultural, religious, and other types of aspects of development
5. Ensuring the possibility to get knowledge and skills in ICT use while getting basic special and higher education, and also the creation of conditions for obtaining initial knowledge and skills in this area for all layers of the population
6. Creation of a system of motivations for ICT application and use, aimed at the formation of wide demand for the use of such technologies in all spheres of society life

In these directions, a variety of avenues have been taken to bridge the digital divide in the world in general and in the EU particularly. Primarily, there have been efforts to promote e-government, encourage technological innovation and the use of existing technologies, guarantee more people Internet access, and advocate media pluralism and creativity. Many of these plans are interest-

ing and noteworthy, but it will take a great deal of political will to accomplish them.

Lately, many high-ranking officials in the EU in their statements express their readiness to undertake the necessary actions to bridge the digital divide. British prime minister Tony Blair, in his speech to the Labour Party Conference in Brighton (Blair, 2004), promised a broadband Britain by 2008. Also, member of European parliament and former French minister of culture and communication Catherine Trautman stated, "Europe must allocate resources for equity of access but also in equipment and in education" (as cited in Raven, 2004). These intentions of high-ranking officials agree with the *eEurope 2005 Action Plan* (CEC, 2002a), which is based on two complementary groups of actions: "On the one hand, it aims to stimulate services, applications and content, covering both online public services and e-business; on the other hand it addresses the underlying broadband infrastructure and security matters" (p. 3).

According to information presented in *People's Daily Online* ("280 Mln U.S Dollars Spent to Eliminate Digital Divide in HK," 2001), the Hong Kong secretary for information technology and broadcasting, Carrie Yau, emphasized that in spite of the fact that the digital-divide problem is not so sharp for Hong Kong as for other countries, the government had formulated clear policies in tackling the issue. She outlined a series of measures taken to bridge the gap or avoid the emergence of a potential gap between various sectors of the community. These include providing education and training, creating a favorable environment for technology diffusion in the community, enhancing knowledge and awareness, and developing e-government. By 2001, the Hong Kong government already expended \$282 million to strengthen the community for the exploitation of opportunities in the digital world. Yau noted that a substantial proportion of the local population already had the opportunity to access ICT and the Internet. Half of the households have installed computers.

Digital Divide

One third of the population are Internet users. The mobile-phone penetration rate has reached nearly 80%.

The new-coming technologies of information transmission are currently applied to bridge the technology and media clusters of the digital divide. The EU's action plan for 2005 includes a thesis for carrying out a cost-benefit analysis of various technological options including space-based ones (CEC, 2002a). In the summer of 2004, the eEurope Advisory Group published *Work Group No.1: Digital Divide and Broadband Territorial Coverage*. The main idea of this paper is that fast data exchange can supply citizens with e-services and help in bridging technological and other clusters of the digital divide. The paper presents recommendations to public authorities for selecting proper and effective technologies that correspond to local conditions. Satellite technologies are proposed for low-density rural areas because of "service costs dependent on the average bit rate usage, and investment costs dependent on peak bit rates" (p. 7). WiFi (wireless fidelity), DSL (digital subscriber line), and fibre technologies are recommended in the case of a medium-density village. High-density rural and urban areas are supposed to be covered by ADSL/VDSL and fibre or cable. The eEurope Advisory Group has examined other alternative technologies such as third-generation mobile/UMTS, power-line communications, broadband wireless access, and digital terrestrial TV, but found out that these technologies are more expensive or offer insufficient bit rates and interactivity as compared with other solutions.

According to these recommendations, "public authorities could also encourage the creation of Public Access Points (libraries, community centres, schools) in order to extend broadband access as much as possible into rural areas" (p. 10).

In particular, WiFi is currently widespread. Several projects based on this technology started during the last 3 years. Both inter-European projects, for example, TWISTER (Terrestrial

Wireless Infrastructure Integrated with Satellite Telecommunications for E-Rural; European Space Policy, 2004), and national projects, for example, the Spanish program Rural Public Access Points (Diputacion de Badajoz, 2005), have begun.

Included in the framework of the EU action plan of 2005 was the forum on the digital divide (<http://www.techsoup.org/fb>). Through this forum, any concerned person can exchange opinions, ask about possible solutions to a problem, or share a solution.

Although the digital-divide problem has become apparent all over the world, it has its own manifestations in each country because of different experiences according to the situation in the respective country.

ABOUT BASIC INDICATORS CHARACTERIZING THE DIGITAL DIVIDE PROBLEM

The sets of indicators for digital-divide assessment differ when mentioned by different organizations. These sets sometimes have some common elements, and sometimes they differ in their composition; however, they are not contradicting in essence, but supplement each other. Even in the evolution of these sets, we can track some consecution and regularity. Thus, at the first stages of studying the digital-divide problem, more attention was paid to the technological aspects. In the course of time, the world community became conscious that this problem is also of human and social character, and that is why the indicators characterizing this problem began to reflect these parts of human activity as well.

Thus, inasmuch as the digital divide was in the first place directly connected with ICT penetration into society life, for digital-divide monitoring and assessment it will be efficient to evaluate ICT development using a range of indicators to benchmark connectivity, access, ICT policy, and overall ICT diffusion. In the Geneva *Plan of Ac-*

tion (WSIS, 2003), in the section “Action Lines,” it is stated, “In the context of national e-strategies, devise appropriate universal access policies and strategies, and their means of implementation, in line with the indicative targets, and develop ICT connectivity indicators.” In the section “Follow-Up and Evaluation,” the following is stipulated:

Appropriate indicators and benchmarking, including community connectivity indicators, should clarify the magnitude of the digital divide, in both its domestic and international dimensions, and keep it under regular assessment, and tracking global progress in the use of ICTs to achieve internationally agreed development goals, including those of the Millennium Declaration...

All countries and regions should develop tools so as to provide statistical information on the Information Society, with basic indicators and analysis of its key dimensions. Priority should be given to setting up coherent and internationally comparable indicator systems, taking into account different levels of development.

So, each country should develop its own basic indicators to characterize the state of the art of ICT development in it, and to be able to evaluate the development or reduction of the digital divide. Nevertheless, there is a core list of ICT indicators that was developed and is adopted by international organs; it is recommended to be followed, not excluding the indicators elaborated to stress the specific country’s peculiarities. Thus, the WSIS Thematic Meeting on “Measuring the Information Society,” held in Geneva in February 2005, published the recommended core list of ICT indicators and its broad evolution (“Final Conclusions,” 2005). So, not to overload the space in this chapter but to give an idea of their details, we give the core list of ICT indicators and only some of its subindicators given in the document.

Core List of ICT indicators:

- Infrastructure and access core indicators (CIs)
- CI on access and ICT use by households and individuals
- CI on access and ICT use by businesses

Infrastructure and access CIs (basic core):

- Fixed telephone lines per 100 inhabitants
- Mobile cellular subscribers per 100 inhabitants
- Computers per 100 inhabitants
- Internet subscribers per 100 inhabitants
- Broadband Internet subscribers per 100 inhabitants (fixed and mobile)
- International Internet bandwidth per inhabitant
- Population percentage covered by mobile cellular telephony
- Internet-access tariffs
- Mobile-cellular tariffs
- Percentage of localities with public Internet-access centres by number of inhabitants (rural/urban)

Certainly, the problem of digital-divide evolution is a rather specific one. This problem differs to some extent from the problems of ICT evolution and of information-society evolution. Perhaps it should take into account some specific trends, but these basic trends are useful for assessment, too. Therefore, the indicators mentioned above are taken as the components for the calculation of more complex indicators that take into account the human factor as well. These are e-readiness, e-government, and e-ranking. They were calculated in analytical UN reports during last decade to estimate the level of society informatisation.

For example, we show the structure of the e-government indicator according to its explanation presented in the UN report (American Society for Public Administration & United Nations Division for Public Economics and Public Administration [ASPA & UNDPEPA], 2002).

Digital Divide

- a. **Presence on the Internet**
- b. **Infrastructure of telecommunications**
 - Number of PCs per 100 persons
 - Number of Internet hosts per 10,000 persons
 - Percentage of population using Internet
 - Number of telephone lines per 100 persons
 - Number of mobile telephones per 100 persons
 - Number of TV sets per 1,000 persons
- c. **Human resources**
 - Human-development index
 - Index of access to information
 - Ratio between urban and rural population

Tracking all of these indicators is useful for digital-divide monitoring and comparative analysis. These indicators' are indicative for every country, too.

The mentioned indicators for any range of countries or population groups allow carrying out comparative analysis, but do not allow expressing numerically the unevenness of the researched resource distribution between these groups. In the UN report *The Digital Divide: ICT Development Indices 2004* (2005), the authors propose to use Gini coefficients and Lorenz curves in the fields of telephone main lines, mobile subscribers, Internet hosts, PCs, and Internet users for the measurement of digital-divide unevenness.

The Gini coefficient is a measure of inequality. It is usually used to measure income inequality, but can be used to measure any form of uneven distribution. The Lorenz curve was developed as a graphical representation of income distribution and is used to calculate the Gini coefficient. These tools are very visual and can be calculated simply enough, having the values of the researched indicators for the chosen set of countries or groups of population.

In the same report, the calculated Gini coefficients are presented (UN, 2005). These data show changes that occurred during the period from 1995 until 2002 in the fields of telephone main lines, mobile subscribers, Internet hosts, PCs, and Internet users. For example, for telephone main lines, the value of the Gini coefficient in 1995 was equal to 0.688 for 200 measured countries, and it became equal to 0.551 in 2002 for 188 measured countries. For mobile subscribers, these values were 0.822 (195 countries) and 0.609 (194 countries), correspondingly. In other words, the inequality of these resources' distribution between countries had decreased. The same tendency was seen for PCs and Internet users. However, for Internet hosts, the picture is different: In 1995, the value was 0.910 (199 countries), and in 2002, it was 0.913 (204 countries). In this field, the inequality had increased instead of decreased. Perhaps this can be explained by the fact that this resource is the most expensive and requires a strategic approach.

Summarizing all discussed above about digital-divide estimation, we can recommend the use of the simple and complex (e-readiness, e-government) indicators as well as Gini coefficients for digital-divide monitoring and assessment.

In this chapter, the authors described the history of the problem, showed the situation in the world and the large-scale and magnitude of the problem, and set out the traditional, generally accepted views and trends for its solution. Every time, before giving a thesis, the authors endeavored to choose demonstrative examples from the world practice and then, on their basis, to make generalizations and conclusions.

Now, when benchmarking is made, it would be logical and useful to show the application of these judgments and recommendations for specific situations in the example of a typical, average country that is not distinguished by anything. The authors examine the application of these judgments for a specific country in the next chapter of this book. Being an agrarian country with a transition

economy (from planned to market), in which the digital-divide problem is especially manifested, Moldova was chosen as such a country.

CONCLUSION

The analysis of the situations in some countries, made in this chapter, shows that the digital-divide problem has a set of common aspects irrespective of country's development level or other (geographical, demographical, etc.) characteristics. Moreover, this problem is not so much technological as it is even more social and political. Therefore, its solution needs not only technological measures, but social and political ones as well.

- Creation of a system of motivation for ICT usage in everyday life
- Creation by the state and society of national electronic, informational resources, available for the population
- Elaboration of national strategy for information-society development, supported by a system of laws that provide (ensure) the creation of a favorable climate for nondiscriminated access to information for all citizens, for economic activity, and for social progress

REFERENCES

280 mln U.S dollars spent to eliminate digital divide in HK. (2001). *People's Daily Online*. Retrieved July 8, 2005, from http://english.people-daily.com.cn/english/200106/07/eng20010607_71990.html

American Society for Public Administration & United Nations Division for Public Economics and Public Administration (ASPA & UNDPEPA). (2002). *Benchmarking e-government: A global perspective*. Retrieved February 29, 2004, from

http://www.itpolicy.gov.il/topics_egov/docs/benchmarking.pdf

Baranov, A. (2003). Nad "tsifrovoi propast'yu." *Zerkalo Nedeli*, 2(427). Retrieved July 8, 2005, from <http://www.zerkalo-nedeli.com/nn/show/427/37343/>

Blair, T. (2004). *Full text of Blair's speech*. Retrieved July 15, 2005, from http://news.bbc.co.uk/1/hi/uk_politics/3697434.stm

Brown, R. H., Barram, D. J., & Irving, L. (1995). *Falling through the Net: A survey of the "have nots" in rural and urban America*. Retrieved July 1, 2005, from <http://www.ntia.doc.gov/ntiahome/fallingthru.html>

Commission of the European Communities (CEC). (2002a). *eEurope 2005: An information society for all. Action plan*. Retrieved August 5, 2005, from http://europa.eu.int/information_society/eeurope/2002/news_library/documents/eeurope2005/eeurope2005_en.pdf

Commission of the European Communities (CEC). (2002b). *eEurope benchmarking report*. Retrieved August 5, 2005, from http://europa.eu.int/eur-lex/en/com/cnc/2002/com2002_0062en01.pdf

Council of the European Union & Commission of the European Communities (CEU & CEC). (2000). *eEurope 2002 action plan*. Retrieved August 5, 2005, from http://europa.eu.int/information_society/eeurope/2002/action_plan/pdf/actionplan_en.pdf

Digital divide. (1999). Retrieved April 20, 2005, from http://searchsmb.techtarget.com/sDefinition/0,290660,sid44_gci214062,00.html

Digital Opportunity Task (DOT) Force. (2001). *Digital opportunities for all: Meeting the challenge*. Retrieved March 25, 2005, from http://www.labi-berlin.nubb.dfn.de/bibliothek/positionspapier/dot_force.htm

Digital Divide

- Diputacion de Badajoz. (2005). *Convocatoria publica para la participacion de los entes locales de la diputacion de Badajoz en el programa "Puntos de Acceso Publico a Internet Ii" (Telecentros. Es)*. Retrieved August 2, 2005, from http://www.dip-badajoz.es/municipios/internet_rural/inet_rural_convocatoria2005_diputacion.pdf
- eEurope Advisory Group. (2004). *Work Group No.1: Digital divide and broadband territorial coverage*. Retrieved August 2, 2005, from http://europa.eu.int/information_society/eeurope/2005/doc/wgl_digi_divide_written_recs_290904.pdf
- European Space Policy. (2004). *TWISTER: New project moves to close "digital divide."* Retrieved August 2, 2005, from http://europa.eu.int/comm/space/news/article_730_en.html
- Falling through the Net? (2000). *The Economist*. Retrieved April 12, 2005, from http://www.economist.com/surveys/displayStory.cfm?Story_id=375645
- Final conclusions. (2005). *WSIS Thematic Meeting on "Measuring the Information Society."* Retrieved November 28, 2005, from <http://www.itu.int/wsis/docs2/thematic/unctad/final-conclusions.pdf>
- Internet World Stats*. (2005). Retrieved July 25, 2005, from <http://www.internetworldstats.com/stats.htm>
- Kalkun, M., & Kalvet, T. (2002). *Digital divide in Estonia and how to bridge it*. Retrieved July 1, 2005, from <http://unpan1.un.org/intradoc/groups/public/documents/UNTC/UNPAN018532.pdf>
- Lisbon European Council. (2000). *Presidency conclusions*. Retrieved August 4, 2005, from http://ue.eu.int/ueDocs/cms_Data/docs/pressData/en/ec/00100-rl.en0.htm
- National Telecommunications and Information Administration (NTIA). (1999). *Falling through the Net: Defining the digital divide*. Retrieved July 18, 2005, from <http://www.ntia.doc.gov/ntia-home/fttn99/contents.html>
- Nkrumah, G. (2000). Digital divide. *Al-Ahram Weekly*, 492. Retrieved April 12, 2005, from <http://www.ahram.org.eg/weekly/2000/492/in3.htm>
- How many online? (2002). *Nua Internet Surveys*. Retrieved March 18, 2005, from http://www.nua.com/surveys/how_many_online/index.html
- Okinawa charter on global information society*. (2000). Retrieved July 20, 2005, from <http://lacnet.unictaskforce.org/Docs/Dot%20Force/Okinawa%20Charter%20on%20Global%20Information%20Society.pdf>
- Oxford English dictionary online*. (2004). Retrieved June 14, 2005, from <http://dictionary.oed.com>
- Raven, F. (2004). *The European Union on the digital divide*. Retrieved July 15, 2005, from <http://www.digitaldivide.net/articles/view.php?ArticleID=41>
- Spanning the digital divide: Understanding and tackling the issues*. (2001). Retrieved April 3, 2005, from <http://www.bridges.org/spanning/download.html>
- United Nations (UN). (2003). *World public sector report 2003: E-government at the crossroads*. Retrieved March 25, 2004, from http://www.unpan.org/dpepa_worldpareport.asp
- United Nations (UN). (2005). *The digital divide: ICT development indices 2004*. Retrieved November 26, 2005, from http://www.unctad.org/en/docs/iteipc20054_en.pdf
- United Nations Development Program (UNDP). (1998). *Human development report 1998: Consumption for human development*. Retrieved March 17, 2005, from <http://hdr.undp.org/reports/global/1998/en/>
- United Nations Economic and Social Council (UN ECOSOC). (2000). *Development and inter-*

national cooperation in the twenty-first century: The role of information technology in the context of a knowledge-based global economy. Retrieved July 13, 2005, from <http://www.un.org/documents/ecosoc/docs/2000/e2000-19.pdf>

Warschauer, M. (2002). Reconceptualizing the digital divide. *First Monday*, 7(7). Retrieved July 19, 2005, from http://firstmonday.org/issues/issue7_7/warschauer/index.html

World Summit on the Information Society (WSIS). (2003). *Plan of action*. Retrieved February 4, 2005, from http://www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=1160|0

ENDNOTE

- ¹ Here and further on, the most recent data available at the moment of this chapter's writing are presented. For example, the data for year 2004 for Moldova are taken when possible from a preliminary report issued in 2005 by the National Bureau for Statistics. If the table or diagram lacks some data for year 2004 for Moldova, it means that the data were not presented in 2004's report and in the preliminary 2005 report. Also, it may be that corresponding data from the preliminary 2005 report were calculated by a different method and disagree with similar data for previous years from the 2004 report.

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, and M. Acevedo-Ruiz, pp. 57-76, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.7

The Evolution of ICT, Economic Development, and the Digitally–Divided Society

Sadayoshi Takaya
Kansai University, Japan

ABSTRACT

In this chapter, we mention that a digital divide could bring about an income divide both within a country and between countries. The more the uses of the Internet diffuse, the more the divide may introduce serious concerns. From a macroeconomic point of view, the increase in the digital divide diminishes ICT investments and delays the innovation of ICT. As a result, we propose that the public policies of each government provide the devices of ICT as social capital and infrastructure. On the global stage, the digital divide exists between developed and developing countries. Therefore, international provision of the digital devices should be achieved through a cooperative effort between developed countries and international organizations.

INTRODUCTION

Currently, the global information society achieves progress by the development of information and communication technology. ICT offers the global society several conveniences, such as communication measures among countries and/or local areas, Web systems for businesses, online trading of securities, and distance learning.

ICT has the characteristics of a general-purpose technology (GPT); that is, it has the two qualities of compatibility and applicable innovation as identified by Helpman and Trajtenberg (1994). A GPT has broad compatibility across many industrial fields, for example, the steam engines of the 18th century. Furthermore, a GPT encourages the creation of new technologies based on its own core technology. Through such movements, the core technology diffuses across many

industries. Presently, in what is known as the IT revolution, ICTs are widely used by citizens, firms, and governments across the world. At the same time, ICTs create applied technologies in many fields. Looking back at this age from the future, one might well regard the ICT as being a GPT.

Figure 1 presents the contributions of ICT investment to gross domestic product (GDP) growth in Organization for Economic Cooperation and Development (OECD) countries during 1990 to 1995 and 1995 to 2003. From this figure, we can observe that ICT could contribute to increasing the growth rate in developed countries. Because ICT investment includes two aspects—increase in demand and technological change in the supply side—this contribution may not stem solely from innovations by ICT. Nevertheless, ICT may be one of the factors in growth engines.

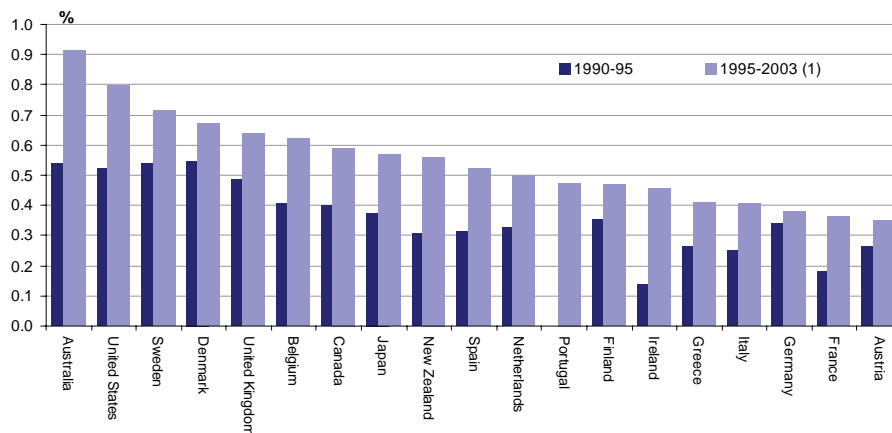
We would like to suggest that there are two perspectives on ICT. One is the perspective of ICT as development infrastructure; the other is that of ICTs as communication measures. From the first perspective, networks provide the production factor and nurture human capital. This perspective is based on the view that ICT is an infrastructure

of economic development that is related to the supply side of economies, not the demand side. Developments of ICT provide new information, knowledge, and education to nurture highly qualified human capital. This argument is based on the endogenous growth theory,¹ which suggests that economic growth is driven by the accumulation of knowledge. Since this theory regards knowledge as capital, economic development progresses if the development of ICT contributes to the diffusion and deepening of knowledge.

On the other hand, the perspective of ICTs as communication measures is related to the demand side of the economy. Horrigan (2002) suggests that the notion of social capital is linked to the concept of measures as reducing transactions costs by access to ICT. ICT is, then, proposed to be social capital. The Internet provides facilities of the network of information exchange that can promote businesses and consumptions.

When, however, people use tools innovated by ICT, a burden is imposed on them. Their ability to use the devices, therefore, depends on whether or not they can bear the burden. Furthermore, their ability to use the devices depends on where

Figure 1. Contribution of ICT investment to GDP growth 1990-1995 and 1995-2003. Source: OECD Productivity Database, September 2005 (www.oecd.org/statistics/productivity)



Note: (1) 1995-2002 for Australia, France, Japan, New Zealand, and Spain.

they reside because regional differences exist with regard to the uses of the devices, such as the Internet. Due to these reasons, the uses of digital devices depend on incomes and areas of residence. As a result, the digital divide, which causes the difference with regard to the uses of digital devices, may become an issue in both the global and local society.

The concept of the digital divide was first used in a 1999 report entitled *Falling through the Net: Defining the Digital Divide* by the Department of Commerce in the United States. This concept includes the difference in the availability of the Internet and/or broadband Internet as well as the disparity of information literacy by region, country, and/or individual.

For our purposes, we use the concept of the digital divide to imply the disparity of information literacy and availability. Furthermore, a person under a digitally divided society faces some challenges in accessing the private and public services supplied through the Internet.²

In former studies of economic effect by ICT, Jorgenson and Stiroh (2000) estimated that average labor productivity in the United States grew at 2.4% annually during 1995 to 1998. They concluded that there was little evidence of ICT's effect on production. Gordon (2000) found that ICT led to price-induced substitution and rapid investment in ICT devices. He concluded, therefore, that ICT capital was deepening in the 1990s. Bailey and Lawrence (2001) found empirical evidence for the effect of ICT development on higher productivity in service industries. These empirical works implicate that access to ICT products is important for development, and ICTs also reduce the real costs of ICT equipment to increase the economic welfare of persons who can easily access ICT devices.

Casselli and Coleman (2001) found that computer skill is positively related to the level of human capital. Openness of trade, high rates of investment, and low share of agriculture in GDP had a positive relationship to computer use. Their

findings are important because human capital is complementary to computers

On the other hand, there are only a few effects of the digital divide on economic growth or development. Sidorenko and Findlay (2001) discussed the concept of digital divide in a global economic context, related to the economic growth theory and the evolution of technology in East Asia. They suggested that an appropriate policy for bridging the digital divide could bring about considerable gain in East Asia through openness in trading ICT products and through policy cooperation.

Wong (2002) estimated the scope of the economic effect of the divide in East Asia, despite the region having captured a high share of the global production of ICT goods. He found that a significant digital divide exists between the five leading countries in East Asia and the other seven developing countries.

Antonelli (2003) examined the composition effects stemming from the interaction between the direction of technological change and relative factor prices. He also suggested that these effects are necessary in order to understand the economics of new ICT in the global economy because of the significance of the digital divide.

Mariscal (2005) investigated the appropriate policy to address the digital divide. He classified different policy trajectories recommended by the literature on telecommunications development. He investigated the case of a developing country to use it as an analytical framework.

Most of these previous studies are empirical, not theoretical. Our work involves a mathematically theoretical approach through the construction of a simple economic growth model. The purpose of this chapter is to clarify the macroeconomic effects of the digital divide. If the digital divide in a digital economy progresses, the divide may result in a decrease in the aggregate economic demand. If this is the case, the divide should be resolved using political initiatives.

The remainder of this chapter is divided as follows. First, ICT diffusion and division in the

global economy is explained. Then we illustrate a static economic model to clarify the macro-economic effects of digital divides. Next, the implementation of public policies is suggested. Finally we conclude the chapter.

ICT DIFFUSION AND DIVISION IN THE GLOBAL ECONOMY

Since the late 1990s, the Internet has come to be widely used, particularly in the industrialized societies. The Internet has provided not only useful services of communication among individuals, but also new business opportunities for many private companies. For instance, a worker who gains access to a personal computer (PC) and the Internet will find it easy to secure a higher paying job. Moreover, many companies can get opportunities to tackle new businesses in ICT fields.

Table 1 charts the current aspects of ICT diffusion in leading ICT countries. With regard to the number of computers per 100 persons, the United States is the highest, followed by Korea. However, with regard to the diffusion rate of the Internet, Korea ranks first, with the United States being second. With regard to the number of contracts for broadband Internet, the country with the highest diffusion is the United States with Japan being second. Diffusions of the PC, the Internet, and broadband Internet vary even among the leading countries.

Furthermore, Table 2 indicates the regional differences in the diffusion of the Internet and PC; it displays the Internet usage indicator by the International Telecommunication Union (ITU).

This table indicates the disparity in Internet usage among country groups categorized according to income level. People in low-income countries do not have easy access to PCs, the Internet, and/or broadband. This condition creates a divide between people in the high- and low-income groups with regard to their current income and their potential to earn higher incomes in the future.

For example, the highest average number of hosts for Internet networks is in North America; this is followed by the industrial economies in Asia, including Malaysia, Korea, Hong Kong, Japan, Singapore, and Taiwan. The number of network hosts is an important indicator because the data indicate the degree of ICT as well as the degree of dependence on hosts in the home country that is needed in order to connect to the Internet. In the case of the average number of PC users, North America ranks the highest, followed by the industrial countries in Asia and subsequently by the EU (European Union) countries. The average numbers of Internet hosts and users, and PC users in developing Asian and African countries are very low; this is in conjunction with the fact that the per capita GDP of these countries is also low.

These data imply that the digital divide exists in the global society and it is caused by the disparity in income. Since the infrastructure of the Internet—that is, the hosts and the network of the Internet—and personal computers place an enormous expense on individuals, companies, and even governments, low-income countries are unable to afford the costs and shoulder the burden. For this reason, the diffusion of the Internet in low-income countries is low, which may make it difficult to boost the growth of these economies.

Table 1. Basic data on ICT diffusion. Source: International Telecommunication Union, “The Portable Internet 2004”

| | Japan | the United States | United Kingdom | Germany | France | Korea |
|---|--------|-------------------|----------------|---------|--------|--------|
| volume of computer per 100 | 38.2 | 65.9 | 40.6 | 43.1 | 34.7 | 55.8 |
| diffusion rate of internet(%) | 48.3 | 55.1 | 42.3 | 53.6 | 36.6 | 61 |
| quantity of contracts of broadband(million) | 1491.7 | 2715.1 | 182.1 | 456 | 336.1 | 1117.9 |

Table 2. Differences in ICT use among country groups. Data source) ITU <http://www.itu.int/ITU-D/ict/statistics/index.html>. Access August 1, 2006.

| | | Internet | | PC |
|------------------------------|---------|----------------------|-----------------------|-----------------------|
| | | Hosts per million | Users per 100inhab | Users per 100inhab |
| Africa | average | 6.56 | 3.51 | 3.42 |
| | high | 77.52 | 26.08 | 36.31 |
| | low | 0.01 | 0.09 | 0.07 |
| Latin America | average | 118.62 | 17.72 | 11.72 |
| | high | 1837.90 | 62.90 | 52.31 |
| | low | 0.05 | 1.32 | 1.57 |
| North America | average | 3878.01 | 62.68 | 73.02 |
| | high | 6645.16 | 63.00 | 76.22 |
| | low | 1110.85 | 62.36 | 69.82 |
| Middle East | average | 66.48 | 12.41 | 13.95 |
| | high | 789.56 | 46.63 | 73.40 |
| | low | 0.01 | 0.14 | 0.83 |
| Industrial economies in Asia | average | 879.96 | 49.57 | 47.48 |
| | high | 1389.65 | 65.68 | 62.20 |
| | low | 1.74 | 32.24 | 19.16 |
| Developing Asia | average | 7.78 | 3.49 | 2.60 |
| | high | 58.13 | 11.25 | 11.86 |
| | low | 0.05 | 0.08 | 0.26 |
| EU countries | average | 760.14 | 45.62 | 39.36 |
| | high | 3334.42 | 75.46 | 76.14 |
| | low | 70.50 | 17.81 | 8.98 |
| Non- EU Euroepan countries | average | 451.94 | 25.85 | 18.06 |
| | high | 4758.60 | 77.00 | 82.33 |
| | low | 0.03 | 0.10 | 1.17 |
| Oceania countries | average | 436.81 | 17.95 | 16.56 |
| | high | 1978.27 | 65.28 | 68.90 |
| | low | 1.05 | 0.61 | 0.67 |

If the digital divide exists, it may create an income divide on a global scale.

Table 3 shows the aspects of the digital divide in Japan, which has local differences with regard to the use and the diffusion of the Internet. Although Japan is one of the leading countries in ICT fields, the disparity of the Internet environment exists in this country. From this example, we infer similar conditions in other countries. In developing countries, these conditions may be cause for more serious concern.

In order to clearly highlight the digital divide, we estimated a cross-country relationship between the diffusion of PC use and per capita income in 2004. The sample consists of 160 countries and the method used is the ordinary least squares method. The estimated equation is as follows:

$$\log(PC_i) = c_1 + \alpha_1 \log(GDP2004_i) + u_1, \quad (1)$$

where i country's PC_i denotes PC users per 100 inhabitants, $GDP2004_i$ is i country's per capita GDP in 2004, and u_1 is the error term. Furthermore, we estimated the cross-country relationship between the diffusion of the use of the Internet and per capita GDP. The estimated equation is as follows:

$$\log(Internet_i) = c_2 + \alpha_2 \log(GDP2004_i) + u_2, \quad (2)$$

where $Internet_i$ denotes i country's Internet users per 100 inhabitants and u_2 stands for the error term. Tables 4-1 and 4-2 display the results. The per capita GDP significantly affects the use of the PC and the Internet in 160 countries. Therefore,

Table 3. Regional ICT indicator of Japan in 2005. Data (source), white paper information and communications in Japan, 2005. Ministry of Internal Affairs & Communications.

| | Diffusion rate of Internet 1) | Ratio of volume of broadband contract to total households 2) | Diffusion rate of mobile Internet 3) | Ratio of occupied person in ICT industry 4) |
|-----------|-------------------------------|--|--------------------------------------|---|
| Hokkaido | 46.0 | 17.6 | 36.9 | 1.9 |
| Aomori | 26.8 | 16.8 | 23.6 | 0.8 |
| Iwate | 31.6 | 17.6 | 27.9 | 1.0 |
| Miyagi | 43.6 | 24.7 | 32.9 | 2.1 |
| Akita | 36.4 | 19.9 | 20.7 | 0.8 |
| Yamagata | 44.2 | 24.2 | 30.6 | 1.1 |
| Fukushima | 39.0 | 17.2 | 36.0 | 1.0 |
| Ibaraki | 44.0 | 23.9 | 36.3 | 1.8 |
| Tochigi | 48.8 | 26.2 | 43.0 | 1.2 |
| Gunma | 46.1 | 24.0 | 37.3 | 1.7 |
| Saitama | 63.6 | 32.0 | 43.9 | 3.6 |
| Chiba | 63.6 | 31.1 | 41.8 | 4.4 |
| Tokyo | 62.2 | 37.7 | 49.8 | 6.8 |
| Kanagawa | 63.7 | 36.7 | 44.0 | 6.6 |
| Yamanashi | 43.4 | 27.2 | 36.7 | 1.6 |
| Niigata | 63.0 | 22.3 | 39.1 | 1.3 |
| Nagano | 43.8 | 26.6 | 31.6 | 1.6 |
| Tohoku | 39.0 | 32.8 | 30.0 | 1.4 |
| Ishikawa | 38.0 | 26.6 | 34.0 | 2.0 |
| Fukui | 38.0 | 33.3 | 31.6 | 1.6 |
| Gifu | 42.9 | 24.6 | 36.3 | 1.2 |
| Shizuoka | 60.9 | 33.6 | 33.8 | 1.6 |
| Aichi | 49.6 | 32.4 | 40.0 | 2.0 |
| Mie | 60.9 | 33.3 | 36.8 | 1.2 |
| Shiga | 49.6 | 24.1 | 38.0 | 1.1 |
| Kyoto | 62.7 | 26.6 | 40.6 | 1.8 |
| Osaka | 66.6 | 30.8 | 41.9 | 2.7 |
| Hyogo | 62.3 | 28.9 | 39.6 | 2.0 |
| Nara | 67.6 | 29.8 | 40.8 | 2.3 |
| Yamaguchi | 46.6 | 20.4 | 36.9 | 1.1 |
| Tottori | 46.8 | 20.4 | 37.7 | 1.0 |
| Simane | 48.3 | 17.4 | 41.9 | 1.0 |
| Chugoku | 60.3 | 24.4 | 34.8 | 1.6 |
| Hiroshima | 63.0 | 21.2 | 43.1 | 2.0 |
| Yamaguchi | 44.8 | 19.6 | 36.0 | 0.8 |
| Tokushima | 38.0 | 21.8 | 32.0 | 1.1 |
| Kagawa | 71.7 | 24.3 | 46.3 | 1.2 |
| Ehime | 42.6 | 20.6 | 31.7 | 1.4 |
| Kochi | 41.6 | 14.3 | 34.6 | 1.1 |
| Fukuoka | 61.6 | 22.9 | 39.1 | 2.6 |
| Saga | 34.7 | 18.6 | 32.0 | 0.9 |
| Nagasaki | 36.4 | 17.7 | 27.3 | 0.9 |
| Kumamoto | 41.6 | 26.6 | 36.9 | 1.6 |
| Oita | 40.7 | 20.6 | 31.3 | 1.1 |
| Yamaguchi | 43.6 | 16.9 | 31.3 | 1.0 |
| Kanagawa | 31.8 | 10.4 | 26.7 | 0.7 |
| Chikuma | 31.3 | 18.3 | 22.8 | 1.8 |
| Average | 46.6 | 24.2 | 36.8 | 1.7 |
| variance | 9.0 | 6.2 | 6.6 | 1.2 |

unit: percentage

the higher the income, the greater the diffusion of the PC and the Internet. Such results show that the diffusion of ICT implies the burden of a large amount of expense because people should pay more in order to catch up in using the new digital devices. In addition, we chart the graphs of the relationship between per capita GDP and the diffusion of the PC, as well as between per capita

GDP and the diffusion of the Internet. From these figures, we can easily infer that these diffusions are positively correlated with per capita GDP.

However, if the diffusion divide is transitory, the so-called digital divide poses no problem. For instance, advanced technologies such as ICT have a tendency to be more developed in a few industrial countries. Thereafter, other developed

Table 4-1. Estimation results of diffusion of the PC

| Dependent Variable: LOG(PC) | | | | |
|-----------------------------|-------------|--------------------|-------------|----------|
| Included observations: 160 | | | | |
| | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| | | | | |
| C ₁ | 0.7046 | 0.0716 | 9.8408 | 0.0000 |
| α ₁ | 0.9084 | 0.0361 | 25.111 | 0.0000 |
| | | | | |
| Adjusted R-squared | 0.7984 | S.D. dependent var | | 1.6737 |
| Log likelihood | -180.3214 | F-statistic | | 630.5789 |
| Durbin-Watson stat | 1.9086 | Prob(F-statistic) | | 0.000000 |
| | | | | |

Table 4-2. Estimation results of diffusion of the Internet

| Dependent Variable: LOG(INTERNET) | | | | |
|-----------------------------------|-------------|--------------------|-------------|----------|
| Included observations: 160 | | | | |
| | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| | | | | |
| C ₂ | 0.9456 | 0.0779 | 12.137 | 0.0000 |
| α ₂ | 0.8831 | 0.0400 | 22.065 | 0.0000 |
| | | | | |
| Adjusted R-squared | 0.7275 | S.D. dependent var | | 1.72887 |
| Log likelihood | -239.8867 | F-statistic | | 486.8850 |
| Durbin-Watson stat | 1.9749 | Prob(F-statistic) | | 0.000000 |
| | | | | |

and developing countries obtain those advanced technologies, which subsequently results in high levels of growth in those countries, similar to the leading industrial countries. This is known as the flying-geese pattern of development. If the pattern is applied at the current stage, the digital divide will be merely a transitory problem. Therefore, there is no need for governments or industrial organizations to reach a solution to the divide problem.

Until now, the trend was unclear; however, we estimated the relationship between the diffusion of the PC and the Internet and income disparity from the average value. The estimated equations are as follows:

$$\log(std_GDP2004_i) = c_3 + \alpha_3 \log(PC_i) + u_3 \tag{3}$$

$$\log(std_GDP2004_i) = c_4 + \alpha_4 \log(Internet_i) + u_4 \tag{4}$$

where $std_GDP2004_i$ denotes i country's deviation of GDP from the average of 160 countries in 2004. Equation (3) suggests that the diffusion of the PC may cause deviation of GDP from the global average value, and equation (4) suggests that the diffusion of the Internet may bring about the deviation. Therefore, coefficients c_3 and c_4 are supposed to be positive.

Table 5-1 presents an estimation result of equation (3). According to Table 5-1, the diffusion of the PC may contribute to the disparity of GDP in the global society. Table 5-2 also presents an estimation result of equation (4). According to Table 5-2, the diffusion of the Internet may also lead to gaps in GDP.

Since we can easily anticipate the progress of PC and Internet uses, the gaps of GDP may also expand further. However, simple market mechanisms, which remain unaccounted for in the global economy, are not the panacea for the digital divide. Consequently, should the divide be narrowed regardless of the efforts involved?

If not, should it be permitted to exist even if it may be serious? Our response is that the divide should be resolved because GDP gaps by the divide may cause a decrease in the aggregate demands in the global economy. Because ICT has the distinct feature of progressing rapidly, some persons, companies, or countries will be unable to keep pace with the progress pertaining to the usage and the developments. As a result, the rapid progress may bring about an impoverishment in the case of a majority of people or countries. If this scenario actualizes, the global economy will shrink. The next section illustrates this scenario more clearly using a simple static model.

Table 5-1. Estimation results of Income Divides 1

| Dependent Variable: (STD_GDP) | | | | |
|-------------------------------|-------------|--------------------|-------------|----------|
| Included observations: 160 | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| C ₃ | -17.963 | 1.1294 | -15.905 | 0.0000 |
| α ₃ | 5.8156 | 0.4776 | 12.176 | 0.0000 |
| Adjusted R-squared | 0.4746 | S.D. dependent var | | 14.0134 |
| Log likelihood | -611.8865 | F-statistic | | 148.2445 |
| Durbin-Watson stat | 1.9673 | Prob(F-statistic) | | 0.000000 |

Table 5-2. Estimation results of Income Divides 2

| Dependent Variable: (STD_GDP) | | | | |
|-------------------------------|-------------|--------------------|-------------|----------|
| Included observations: 160 | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| C ₄ | -21.084 | 1.8064 | -11.672 | 0.0000 |
| α ₄ | 6.5234 | 0.6371 | 10.239 | 0.0000 |
| Adjusted R-squared | 0.5352 | S.D. dependent var | | 15.2848 |
| Log likelihood | -702.6269 | F-statistic | | 215.1598 |
| Durbin-Watson stat | 1.9484 | Prob(F-statistic) | | 0.000000 |

THEORETICAL MODEL

In this section, we theoretically examine the effects of ICT diffusion and divisions on economic development as this chapter represents effects of economic activity by evolution of technology because there could be a positive relationship between technological developments and economic progress. For the purpose of the investigation, we construct a simple static economic model.

Our model is composed of the demand and supply sides. The demand side consists of two strata: well-trained persons who easily access ICT, and less-trained persons who rarely access ICT.

$$m + n = 1 \quad (5)$$

In equation (5), m denotes the population of less-trained persons and n that of well-trained persons. The total population is assumed to be fixed as one. The population of well-trained persons is assumed to be a decreasing function of technology. The development of technology leads users to obtain advanced training for new digital devices and computer applications, and higher information literacy. Consequently, in accordance with the development of technology, well-trained persons n are assumed to decrease:

$$n = \theta(T), \quad (6)$$

$$\theta'_T < 0, \theta''_{TT} < 0$$

Equation 11.

$$\frac{\partial D}{\partial T} = n(\alpha_n - \alpha_m) + \alpha_m - \{(1-n)l_m + nl_n\}T + \theta'_T \{(\alpha_n - \alpha_m)T - (l_n - l_m)\} \equiv D_T \geq 0$$

Equation 12.

$$\frac{\partial^2 D}{\partial T^2} = -\{(1-n)l_m + nl_n\} + \theta'_T(\alpha_n - \alpha_m) + \theta''_{TT} \{(\alpha_n - \alpha_m)T - (l_n - l_m)\} \equiv D_{TT} \sim 0$$

where T is the accumulation of technology. Aggregate demand D is the sum of the incomes of less-trained and well-trained persons.

$$D = mY_m + nY_n \quad (7)$$

In equation (7), Y_m denotes the income of less-trained persons and Y_n that of well-trained persons. Furthermore, both incomes depend on the accumulation of technology as follows:

$$Y_m = \alpha_m T - l_m T^2 \quad (8)$$

and

$$Y_n = \alpha_n T - l_n T^2. \quad (9)$$

Equation (8) represents the income function of less-trained persons, which is a positive coefficient function α_m of T and a negative square function with coefficient l_m . The former term represents the contribution of T to income. In other words, α_m is the income multiplier of technology. The latter term denotes the marginal cost of training or education, which we assume to be the square function of T .

Equation (9) is the income function of well-trained persons, whose components are similar to those in equation (8), with the exception of the coefficient. In addition, we assume the magnitude of coefficient α_n, α_m as follows:

$$\alpha_n > \alpha_m. \quad (10)$$

Equation (10) implies that the contribution of T to well-trained persons' income is higher than that of the less-trained persons. Since a well-trained person can achieve a higher income, he or she has an incentive to obtain training for ICT by paying its marginal cost.

We do not assume the magnitude of marginal cost,

$$l_n - l_m \sim 0.$$

Here, we show effects of technology on aggregate demand as follows, see equations (11) and (12).

Next, we present the supply side of our model. A representative firm infinitely maximizes its profit by investment, subject to technology innovation dynamics; that is:

$$\text{Max } \pi \quad (13)$$

$$\text{s.t. } \pi = D - \frac{cI^2}{2} \quad (14)$$

Here, π denotes the profit function in equation (13). The profit function is defined in equation (14), in which the second term represents the adjustment function of investment, which is supposed to be a quadratic form function. In addition, we assume the innovation function caused by investments I as follows:

$$T = \beta I. \quad (15)$$

Equation (15) indicates that increases of private investments induce developments in information and communication technology; therefore, it is assumed that $\beta > 0$.

From equations (13), (14), and (15), we can easily obtain the FOC as follows:

$$\frac{\partial \pi}{\partial I} = D_T \beta - cI = 0. \quad (16)$$

We can rewrite equation (16) as the following:

$$I^* = \frac{\beta}{c} D_T, \quad (17)$$

where the asterisk denotes the equilibrium value. By using equation (17), we can obtain equilibrium technology and equilibrium aggregate demand as follows:

$$T^* = \frac{\beta^2}{c} D_T \quad (18)$$

and

$$D^* = \left[m \left(\alpha_m - \frac{l_m \beta^2}{c} D_T \right) + n \left(\alpha_n - \frac{l_n \beta^2}{c} D_T \right) \right] \frac{\beta^2}{c} D_T \quad (19)$$

From the above equations, the equilibrium investments, equilibrium technology, and equilibrium aggregate demand depend on the marginal demand of change of technology. If D_T is zero, due to an enlargement of the disparity between less-trained and well-trained persons, the development of technology is zero; therefore, the aggregate demand is also zero.

The implications of our economic model are that the regional digital divide causes decreases of aggregate demands in the domestic dimension, and the international digital divide causes decreases of global demands in the international dimension. If ICT develops further, it is possible to diminish local and global demands, which in turn would bring about stagnancy to ICT innovation itself.

IMPLICATIONS FOR GLOBAL ECONOMY AND DOMESTIC SOCIAL DYNAMICS

In the previous sections, we mentioned that the digital divide exists in the global economy, and it may induce a blockage in the development of technologies. Consequently, in this chapter, we

argue for a policy analysis that would address this digital divide. From the perspective of the market economy, the digital divide is resolved through market mechanisms. That is to say, the market forces should drive the deployment of ICT. A competitive force will encourage technological innovation, and the prices of information and communication will decrease for many people (Moschella & Atkinson, 1998). Therefore, public policy should be used to promote competition in the fields of Internet and communication, for example, in order to promote universal access services and to liberalize the regulations of the Internet and communications. Active competition causes redistribution between digitally divided people.

However, ICT is a GPT whose versatility is considerably high among many industries. This technology has externality in economies. From the perspective of economic theory, the market mechanism does not function effectively to bring about sufficient redistribution. Furthermore, the externality of ICT has two aspects, namely, economic developments and communication measures. The former indicates that ICT contributes directly to economic development by the creation of new businesses and a decrease of transaction costs. The latter indicates that ICT promotes individual and corporate communications at less cost to promote economic growth. With regard to the former aspect, ICT is the infrastructure for development. On the other hand, with regard to the latter aspect, ICT is a social capital for communication.

From the perspective of ICT as infrastructure for development, public policies promote ICT by, for example, supporting the consumption of information and communication services, and/or investing in ICT infrastructure such as LAN (local area network) and public access points. From this perspective, public policies are needed to promote the growth of the entire spectrum of ICT networks, equipment, and infrastructure.

On the other hand, the perspective of ICT as communication measures and social capital is related to the demand side of the economy. From this perspective, public policies must provide the networks in order to activate communication in the community.³ These promote the consumption of digital devices such as mobile phones and PCs, and create investments in digital equipment for offices and factories, such as LANs, mobile PCs, and online systems of orders via the Internet. ICT as social capital, therefore, contributes to economic growth through the enlargement of aggregate demands.

Although the supply side is an important factor for growth in the long run, the demand side is a crucial factor for economic stability in the short run. Both sides interact in each time definitively. Public policies should promote the diffusion of communication methods of ICT in order to provide easy access to them by many users, regardless of their income and/or regional differences. Thus, not only will each government cope with digital divides as a local problem, but international cooperation by the governments and international organizations will also tackle digital divides as a global problem. All governments can support the public provision of information and communication infrastructures by their respective public budgets. While cooperating internationally, developed countries should act as leaders to finance the ICT infrastructures in developing countries in order to bridge the gap in the uses of digital devices. These policies may improve digital circumstances not only in developing countries, but also in developed countries through a global increase in the demand for digital devices.⁴

CONCLUSION

In this chapter, we stated that a digital divide could cause an income divide within a country and between countries. The more the uses of the Internet diffuse, the more serious concerns the divide may

introduce. From a macroeconomic point of view, the increase in the digital divide diminishes ICT investments and delays the innovation of ICT. As a result, we propose that the public policies of each government provide the devices of ICT as social capital and infrastructure. On the global stage, the digital divide exists between developed and developing countries. Therefore, international provision of the digital devices must be achieved through a cooperative effort between developed countries and international organizations.

REFERENCES

- Antonelli, C. (2003). The digital divide: Understanding the economics of new information and communication technology in the global economy. *Information Economics and Policy*, 15, 173-199.
- Bailey, M. H., & Lawrence, R. Z. (2001). Do we have a new economy? *American Economic Review*, 91, 308-312.
- Collier, P. (1998). *Social capital and poverty: Social capital initiative* (Working paper No. 4). Washington, DC: The World Bank.
- Gordon, R. J. (2000). Does the “new economy” measure up to the great inventions of the past? *Journal of Economic Perspectives*, 14, 49-74.
- Helpman, E., & Trajtenberg, M. (1994). *A time to sow and a time to reap: Growth based on general purpose technologies* (NBER Working Paper Series No. 4854).
- Horrigan, J. (2002). Online communities: Networks that nurture long-distance relationships and local ties. *Pew Internet and American Life Project*. Retrieved September 1, 2006, from http://207.21.232.103/pdfs/PIP_Communities_Report.pdf
- Jorgenson, D. W., & Stiroh, K. J. (2000). Raising the speed limit: US economic growth in the information age. *Brookings Papers on Economic Activity*, 1, 125-235.
- Mariscal, J. (2005). Digital divide in a developing country. *Telecommunications Policy*, 29, 409-428.
- Moschella, D., & Atkinson, R. D. (1998). *The Internet and society: Universal access, not universal service*. Washington, DC: Progressive Policy Institute.
- Romer, P. (1986). Increasing returns and long run growth. *Journal of Political Economy*, 94, 1002-1037.
- Sidorenko, A., & Findlay, C. (2001). The digital divide in East Asia. *Asia-Pacific Economic Literature*, 15, 18-30.
- Wong, P. K. (2002). ICT production and diffusion in Asia: Digital dividends or digital divide? *Information Economics and Policy*, 14, 167-187.

ADDITIONAL READING

- Helpman, E. (Ed.). (1998). *General purpose technologies and economic growth*. Cambridge, MA: MIT Press.
- Katz, M., & Shapiro, C. (1985). Network externalities, competition, and compatibility. *American Economic Review*, 75, 424-440.
- Lenhart, A., & Horrigan, J. B. (2003). Re-visualizing the digital divide as a digital spectrum. *IT & Society*, 1, 23-39.
- Liu, M.-c., & San, G. (2006). Social learning and digital divides: A case study of Internet technology diffusion. *Kyklos*, 59(2), 307-321.
- Quibria, M. G., Ahmed, S. N., Tschang, T., & Reyes-Macasaquit, M. L. (2003). Digital divide: Determinants and policies with special reference to Asia. *Journal of Asian Economics*, 13, 811-825.

Robinson, J. P., Dimaggio, P., & Hargittai, E. (2003). New social survey perspectives on the digital divide. *IT & Society, 1*, 1-22.

Shapiro, C., & Varian, H. R. (1999). *Information rules: A strategic guide to the network economy*. Boston: Harvard Business School Press.

ENDNOTES

¹ This theory was mainly proposed by Romer (1986).

² The divide includes two phases: an international divide between developed and developing countries, and a domestic phase where the divide exists between highly diffused areas and lesser ones. As we discuss, our investigation sheds light on these phases through the simple economic model.

³ Collier (1998) conducted an empirical study on telephone networks that would activate the requisite social interaction in the community.

⁴ This was pointed out in our model.

This work was previously published in Information Technology and Economic Development, edited by Y. Kurihara, S. Takaya, H. Harui, and H. Kamae, pp. 1-13, copyright 2008 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.8

Information Dynamics in Developing Countries

Hakikur Rahman

Sustainable Development Networking Programme (SDNP), Bangladesh

ABSTRACT

Revolutionary advancement in information and communication technology (ICT) with strengthening of economic and social aspects is transforming the global communities. A new kind of dynamism—the information dynamics—is emerging where communities are not restricted within boundaries and becoming competent with information, knowledge, networking, and versatility on a global basis. A new society is emerging with pervasive information capabilities, creativity other than the conventional learning system, substantially different from an industrial society; more competitive, better able to address individual needs, and steady to the ever-changing environment. The information revolution creates both the challenge and the means for the developing world to adjust to the newly developed strategic issues and action plans of the New World by accommodating the needful infrastructure of telecommunications and information systems. The information revolution has also opened up opportunities to tackle the problems of poverty,

inequality, illiteracy, and environmental degradation.

INTRODUCTION

Information is the lifeblood of every economy. In more traditional economies, information may be less codified, more often conveyed in personal interaction, but it is vital nonetheless. The ways people get information, and the incentives they have to gather and provide it, are affected by the way society is organized: legal rules and social conventions, institutions and governments, all determine how much information people have and the quality (that is, the accuracy and completeness) of that information (World Bank, 1998).

Information technology is changing throughout the world. Information and communication technologies (ICTs) are generating a new industrial revolution already as significant and far-reaching as those of the past century. This revolution is based on information dynamics, and within itself the human knowledge content.

Recent years have seen rapid progress in science and technology related to the generation, processing, transmission, accumulation, storage, and utilization of information—a field known collectively as information science and technology (Council for Science & Technology, 1999). Advancement in ICT offers unprecedented promise for social and economic development on a global perspective. As the primary means of communication and performance in the networked society, ICT has become a fundamental instrument for both the developed and developing countries.

ICT can contribute to fostering empowerment and participation and making government processes more efficient and transparent by encouraging communication and information sharing among people and organizations, and within government. ICT connects individuals and local communities with information and resources beyond their geographic boundaries, encouraging information dissemination, information exchange, and communication (DOI, 2001).

Wolfensohn (1998) stated in his forwarding for the World Bank WRD1998 report, that the information revolution makes understanding knowledge and development more urgent than ever before. New communications technologies and plummeting computing costs are shrinking distance and eroding borders and time. The remotest village has the possibility of tapping a global store of knowledge beyond the dreams of anyone living a century ago, and more quickly and cheaply than anyone imagined possible only a few decades ago.

Information infrastructure comprised of the cross-country telecommunications network, the user-friendly computing tools, and easy-access information warehouses. Information backbone has the characteristics of easier transportation, manipulation, storage, and dissemination by creating the “knowledge tank” an essential element for the management of the new economy. And because the new economic development is about knowledge networking, the information revolu-

tion holds inestimable promise for downtrodden population in the developing countries.

BACKGROUND

Information can be seen as any communication or representation of knowledge, such as facts, data, or opinions in any medium or form, including textual, numerical, graphic, cartographic, narrative, or audiovisual forms. It is the knowledge acquired through study or experience or instruction. Information is data and facts that have been organized and communicated in a coherent and meaningful manner (Google definition search). Dynamics is that part of the field of mechanics that studies objects in motion, and here it is taken as a representation of movement of entities (human, society, or community). By developing countries, it meant a country that is poor by world standards in terms of real GDP per capita. They are the countries with low- and medium-income in which most of the population have a lower standard of living with access to fewer goods and services.

Then information dynamics can be treated as an integrated knowledge movement of the society or community. Depending on the penetration of various applications on information and communication technologies, information dynamics in low-income countries have potential impact on the community development processes.

Information technology revolution should not be treated as innovation and just advancement, but as “general purpose technology” (Bresnahan & Trajtenberg, 1995) to adopt and improve the livelihood of the general people. This general-purpose technology has surpassed the rapidity and mobilization in many perspectives, and substantially improved the quality of life in the marginal community by simply multiplying the state of applications in everyday usage.

The striving forces behind the so-called information revolution are the sharp decline in the

prices of information processing, the convergence in communication and computing technologies, and the rapid growth in network computing. Communication networks and interactive multimedia applications are providing the foundation for the transformation of existing social and economic relations into an “information society” (OECD, 1997). It is, indeed, widely believed that modern information technology will change the world, but how can such a change be measured and its impacts assessed (Pohjola, 1998)? A question that needs to be addressed properly for successful implementation of the processes before launching it.

Information technology presents the attractive possibility of bypassing older technologies (“leapfrogging”). For example, countries with old-fashioned mechanical telephone systems can skip the analog electronic era and go straight to advanced digital technologies, and that certainly is happening. Leapfrogging is also made possible in a more radical developmental sense (IMF, 2001).

An information system provides a societal capability based on the use of information that encompasses its full context of people, institutions, policies, processes, incentives, data, information technology, and infrastructure. A strategic information system provides a fundamental capability of such importance that it can enhance the scope and efficiency of an entire sector and economy (Talero & Gandette, 1996).

Radical advancement in ICT information technology reinforced economic and social changes by transforming community and society. From this advancement emerges a new kind of economy, the information economy, where information is the critical essence. Traditional ways of doing business has been drastically modified and sometimes, the old ways have been replaced by new means and methods. Technological progress now enables us to process, store, retrieve, and communicate information in whatever form it may take, unconstrained by distance, time, and volume. This revolution adds huge new capacities

to human intelligence and constitutes a resource, which changes the way we work together and the way we live together (Bangemann et al., 1994).

Developing countries and especially the least developed countries (LDCs), have yet to attain measurable socio-economic benefits out of ICT. Development of this sector has often been hindered by a combination of outdated infrastructure, relatively high telecommunication costs, inappropriate technology policies, absence of skilled professionals, and the intricate culture of information interchange. With these views and practices, many of these nations could not able to be the forerunner in the global market and compete with their more fortunate neighbors (Rahman, 2004).

In developing countries, access to information infrastructure always remains inadequate, and progress on telecommunications policy reforms are lagging behind. Yet there is an opportunity for leapfrogging the new technology can provide better, cheaper links to the grass root level stakeholders, while competing global operators can provide low-cost long distance communications. Adopting new technologies, developing countries can deploy telecommunications for lower costs per capita than the industrial world and rapidify poverty alleviation processes.

To create appropriate information dynamics in developing countries, the following issues need to be resolved with greater context; issues of accessibility, intellectual property protection, fair competition, content regulation, and cultural preservation. However, due to many unintended factors, the access to the global information infrastructure by developing countries remains inadequate and dependent on major telecommunications policy reforms yet to be implemented.

KEY FACTORS TO UPHOLD THE INFORMATION DYNAMICS: ISSUES AND PROBLEMS

Information technology has become a potent force in transforming social, economic, and political life globally. There is little chance for countries or regions to develop without their incorporation into the information age. More and more, development strategies see the need for developing countries to embrace information technology both as a way to avoid further economic and social mobilization as well as to offer opportunities for both growth and diversification of their economies (Hafkin & Taggart, 2001).

Communication is no longer focusing on a single issue, but on a range of livelihoods issues and using several channels. Communication theory has not quite come to grips yet with the complexities of participatory communication. What is certain is that implies a change in roles for the main stakeholders, some of whom may be more willing to change than in roles for the main stakeholders, some of whom may be more willing to change than others (Lowe, 2001).

Poor men and women living in urban informal settlements do need knowledge and information to cope with risks and improve their livelihoods, but the urban poor obtain information hard to access (Schilderman, 2002a). Science and technology development is the fundamental driving force in pushing forward the entire process of social evolution while the creation of more advanced tools is the kernel engine of the development (Zhong, 2003).

Therefore, to harness information and communication technology for its mission of poverty alleviation and sustainable economic development, the following objectives to be set at the national level:

- Easy access to communication and information services through accelerated deployment of national information infrastructure

and integration into international communication and information backbone.

- Systemic improvements in the functioning and competitiveness of key sectors of the national economy through strategic policies and implementation plans.
- New ways to use ICT to assist in solving the most prevailing problems of human and economic development—education, health, poverty alleviation, rural development, and reinforced environmental awareness.
- Increased motivation at the national level for economic development through inclusion of information contexts in each level of administration hierarchy.

EVOLVING PARAMETERS: SOLUTIONS AND RECOMMENDATIONS

Information technology can offer significant opportunities in developing countries for virtually all societies, including marginalized communities in rural areas. In considering diversified entrepreneurial ventures associated with information technology, the following parameters need in-depth study to ensure equitable participation of all societies in the information age.

- **Concept of society needs to be re-thinked:** Societal control based on closely-held information is no longer possible when information is ubiquitous and inexpensive. Uncontrolled and easy flows of information increase create opportunities for social manipulation.
- **Environmental awareness to be raised:** Due to faster information dissemination and knowledge development, the preservation of the environment has become a prime concern of a well-informed public society. Economic growth cannot be pursued at the expense of the environment, lest such growth become

unsustainable and threaten the environment of the entire globe, though environment has significantly different connotations in developed and developing countries.

- **Definition of developing countries needs to be adjusted:** With the rapid advancement of the developed world, and unbalanced participation of the developing world in the global economy, developing world is in the competitiveness of their goods and services. They are threatened with a new form of information poverty that could further extend the “digital divide” and widen the gap in economic status and competitive issues. Necessary fine-tuning is essential, though extremely complex, for total diffusion of information technology, which may result in social fragmentation.
- **Information revolution:** In real sense, to keep up with the developed world, the term “information revolution” needs to be retorted. This will assist to create new paradigm to encounter problems of poverty, inequality, and environmental degradation with the potential to achieve unprecedented gains in social and human development.
- **Developing world need rapid transformation:** Information and communication technology in developing countries need transformation to overcome the dynamic challenges and create unprecedented possibilities for sustainable economic development.
- **Strategies for information dynamics to be recapitulated:** Strategic information systems for developing countries should primarily include sector-wise information systems for education, health, governance, and communication at the first phase. E-commerce, knowledge networks, e-business, environmental awareness, disaster prevention and management, and national statistical databank may be treated as the next phase strategic systems.
- **Sectoral information networks need to be developed:** Social networks based on computer-based communications are needed to improvise to connect institutions working in diversified sectors, like, agriculture, education, health, banking, industry, and others. Interconnected networks offer multi-dimensional opportunities in technical cooperation, research, coordination, information, and resource sharing.
- **Social and technical aspects are needed to be simplified:** Design, development, and deployment of information systems and telecommunications capabilities are socially and technically complicated, even in the face of technological advancement and sometime not completely understandable to developing communities. Countries need to depend on the substantial resources, often from abroad, to accomplish this task. They need to establish means and management schemes to facilitate adoption and effective utilization of new systems through adaptive methodologies.
- **State patronization:** Government action is a pre-requisite, but epoch making adjustments are required at the state level in the developing countries to participate in the newly emerged global economy. Governments should establish broad partnerships with the private and corporate sectors, local communities, small and medium enterprises, non-governmental agencies, international and development partners. Government intervention to harness information for development is necessary on several fronts: as policy makers, as major users of information technology, and as compensating influences against market failures. Also, governments must supervise and coordinate education—the key to human and economic development (Talero & Gandette, 1996).
- **Telecommunications reformation is a**

- must:** Reformation in the telecommunications sector are a primary requisite to increase the efficiency and availability of services. Policies and regulations are needed to create the conditions for faster private sector entry, for national integration into global information infrastructure, and for efficient use of the existent infrastructure.
- **ICT policies need to be revisited:** National information strategies and action plans need to be deployed by identifying the parameters leading to based an information-based economy. The policy, institutional, legal, and regulatory changes need to be utilized to create an information-friendly environment. Performance, competitiveness, and governance of all sectors of the economy can be improved through de-regulated information policies and systems.
 - **Priorities needed to be identified:** Information systems with important and catalytic capacity to national economic activity should be considered strategic and put forward as part of national information infrastructure. Sector-wise information systems for education, health, financial management, communication, and transportation fall in this category. Similarly, some other generic value-added information facilities, like e-commerce, environmental awareness, disaster prevention, and poverty alleviation can be added to the priority categories. Each country should define its own set of guideline as part of the national information strategy.

Nation-wide networks can also accommodate:

- Network of the financial institutions, and the information industries
- Cross-country studies on ICTs and e-readiness

- Accumulation and dissemination of best practices
- Establishment of a national databank

Similarly, strategies need to be taken to mobilize financial sector for development:

- Of national information infrastructure projects
- In project financing guarantees
- With technical cooperation

To implement these strategies in actions, nations need to form information dynamics as depicted in Figure 1. From this figure, it is evident that IT revolution is the core of social uplift through proper resource mobilization. Similarly, Figure 2 illustrates how information and content creates dynamics in the society for its uplift and skill development, creating demand at the local level. The entire information process can create a global knowledge network in a three tires context, as shown in Figure 3. Fed with balanced content in repositories and connected through information links community knowledge networks can form a knowledge pyramid.

Derived from these perspectives, the concept of creating an information dynamics at the national level is shown in Figure 4. Proper policy initiation, partnership, and recognition of key players would lead to the development and implementation of information dynamics by bridging the digital divide inside a country. This information dynamics can grow top-down-top fashion according to the information hierarchy as depicted in Figure 5. By pushing forward a balanced information policy to be implemented in modular form at strategic locations, and utilizing the existing infrastructure, in addition to the newly built one can create demands at the local level. Thorough understanding of local level demand and accommodation of content will enhance incremental expansion of the dynamics at the national level. Eventually, these

Figure 1. Information dynamics in social uplift

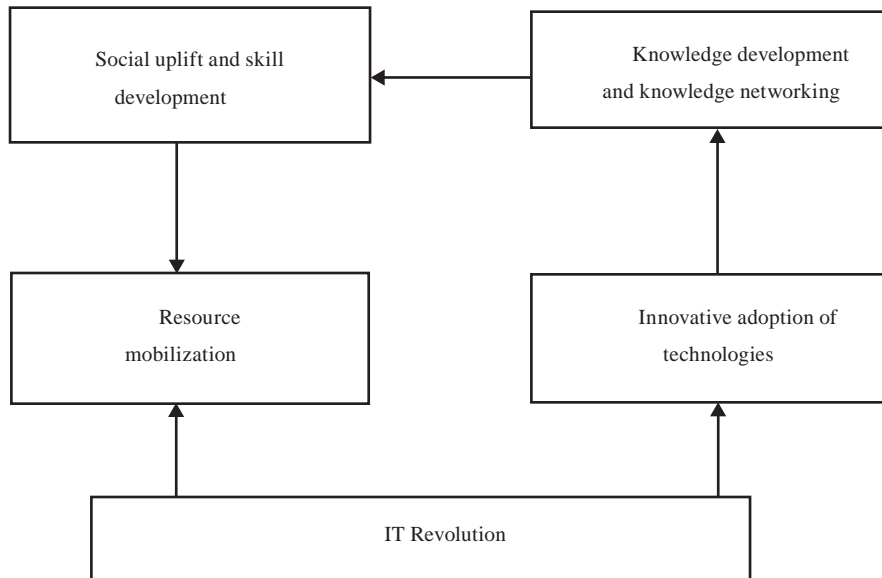
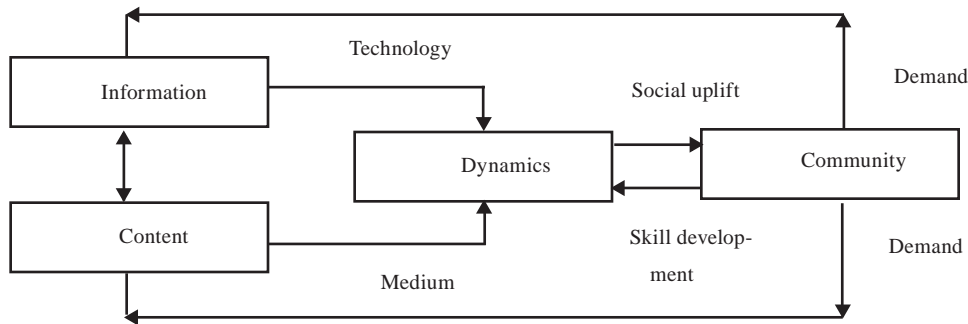


Figure 2. Information dynamics creates demand at the local level



national networks can be interlinked to form a global information backbone.

GLOBAL CHALLENGES AND FUTURE DIMENSIONS

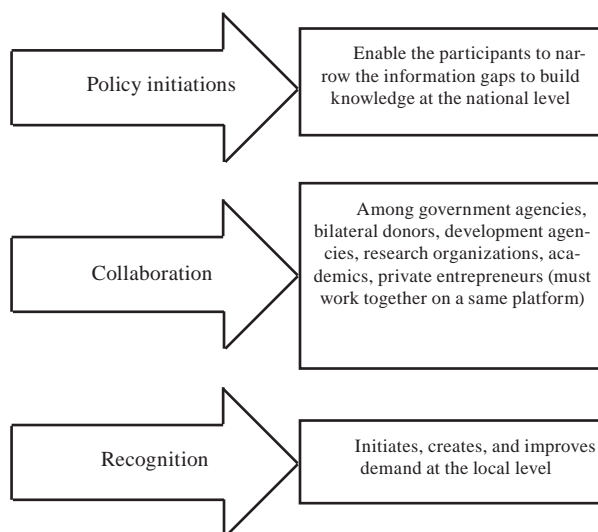
The challenge of communication technologies is not only to transmit pure information but, above all, to enable a real communication between people and communities. The transmission of information is certainly important, but it is far from sufficient. Real, effective, interpersonal

communication is, first of all, based upon the exchange of different kinds of messages, postures, gestures, and intonations that physical co-presence can transmit. It is also important to focus on the fact that communication follows different rhythms of interaction (Casalegno & McWilliam, 2004). To implement a successful ICT application for the development of a society, the ideologies of ICTs in social change, empirical research studies on ICTs and organizational change, changes in everyday life, or larger scale societal changes must be understood. Furthermore, relationships between conceptions of ICTs (tools, media, envi-

Figure 3. Global knowledge pyramid



Figure 4. Concept of information dynamics at the national level

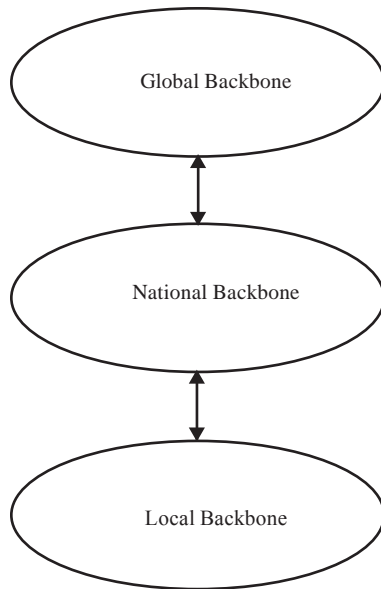


ronments, socio-technical networks), theories of social change, workable evidence, and research methods need to be examined in depth (Kling, 2001). The future of information dynamics in developing countries needs to understand principles of information infrastructure, technologies, architecture, and scaleable use of the information (MIT Report, 1995-96).

The development of new media and the progressive spreading of the emerging and rapidly

growing phenomenon of remote collaboration pave the way for interesting research in several fields, from teaching to communication, from design to architecture, from ergonomics to studying interfaces. Remote collaborative environments represent a very good opportunity to design communication spaces that allow for social interaction between people and between distant communities, supporting different forms of communication, work, and creativity in various domains. Further-

Figure 5. Information hierarchy backbone



more, technological progress makes interactive media progressively more efficient, easier to use and destined to a wider public (Casalegno et al., 2004), through participatory communication.

Participatory communication not only helps to empower communities, it also does allow them to influence development. Impact assessment should therefore also consider whether two-way communication has been established, and whether local knowledge and demands have been taken into account, for instance, in policies and programmes targeted at the urban poor (Schilderman, 2002b). Therefore, understanding of principles of information technologies, pursuing these technologies to create acceptable information architecture, and using these infrastructures on highly scaleable state (MIT Report, 1995-96) at marginal to organizational to national to global level are important.

Nowadays, concept of sustainable development has arisen in the emerging societies. It is the process of achieving a standard of living and a quality of life with a degree of dignity and a measure

of control over their lives, including respect for the environment and the natural resources. This process demands investment, in infrastructure, in human capital, and in productive capacity. In this context, achieving the Millennium Development Goals remains another challenge in reducing poverty and improving livelihoods that world leaders have agreed on at the Millennium Summit in 2000 (<http://www.undp.org/mdg/>).

CONCLUSION

The tremendous opportunities offered by the emerging information technology often come in packages with remarkably high payoff potential and at the same time impart high risk. However, these sort of projects should not divert resources from efforts to address the basic needs of common communities and should be driven to be well-established, low-risk, and easily adaptable.

Poor countries and poor people differ from rich ones not only because they have less capital but because they have less knowledge. Knowledge is often costly to create, and that is why much of it is created in industrial countries. But developing countries can acquire knowledge overseas as well as create their own at home (World Bank, 1998).

The urban poor are often deprived by a lack of knowledge and information. The public sector often discriminates against the poor when they seek access to information, or is simply inefficient. To overcome these problems, development agencies should seek to improve their communication with the poor, reduce exclusion, support communities in building their knowledge and information assets, improve the attitudes and performance of information suppliers and invest in sustainable ICTs that are of use to the poor (ITDG, 2002).

As a starter, community information centers are a good fit. This multisectoral concept can help common citizens, non-governmental organizations, and businesses in poor rural and urban

areas with economical, easy, and ready access to needed information. The centers could be a powerful engine of rural development and a preferred instrument in the fight against poverty. They could be the hub, at the community level, through which a large number of information services can be dispensed--telephone and fax, local bulletins, document searches on demand, video libraries for entertainment, and knowledge development, health and nutrition training, government utility services, market prices, self-paced learning, and more. The centers would be multisectoral facilities and eventually self-sustaining through fees and contracts (VITA, 1995).

At the social context, a new society is emerging with pervasive information capabilities, thus making it substantially different from an industrial society. It is more competitive, able to address individual needs, and environment friendly, dictating a major agenda of structural adjustment. The adjustment, therefore, is needed within the information arena to tackle uncontrolled information flows, global competition, trade unbalance, and investment opportunities.

REFERENCES

- Bangemann, M., et. al. (1994, May 26). *Europe and the global information society*. Unpublished recommendations to the European Council.
- Bresnahan, T. F., & Trajtenberg, M. (1995). General purpose technologies: Engines of growth? *Journal of Econometrics*, 65(1), 83-108.
- Casalegno, F., & McWilliam, I. M. (2004). Communication dynamics in technological mediated learning environments. *ITDL Journal*, 1(11), 15-34.
- Council for Science & Technology. (1999). *Measures for the strategic promotion of information science and technology pioneering the future*. Retrieved February 7, 2005, from <http://www.mext.go.jp/english/kagaku/science06.htm>
- DOI. (2001, July). *Creating a development dynamic*. Final report of the Digital Opportunity Initiative.
- Hafkin, N., & Taggart, N. (2001, June). *Gender, information technology, and developing countries: An analytic study*. Academy for Educational Development (AED).
- IMF. (2001, October). The information technology revolution. In *World Economic Outlook* (p. 135).
- ITDG. (2002). *Strengthening the knowledge and information systems of the urban poor*. A project report of ITDG, 2002. Retrieved December 25, 2004, from http://www.itdg.org/?id=kis_urban_poor
- Kling, R. (2001). *Information technologies and social change*. Retrieved February 7, 2005, from <http://www.indiana.edu/Kling>
- Lowe, L. (2001). *Modeling demand in order to meet it: Can the information and knowledge management systems of the urban poor be understood and strengthened?* A paper to the DSA Conference, Manchester, 2001.
- MIT Reports. (1995-96). *MIT reports to the president 1995-96*. Retrieved February 7, 2005, from <http://web.mit.edu/annualreports/pres96/10.16.html>
- OECD. (1997). *Towards a global information society*. Paris: OECD.
- Pohjola, M. (1998). *An introduction to the research issues* (UNU/WIDER Working Paper No. 153).
- Rahman, H. (2004, July 6-9). *Utilizing ICT for sustainable development in developing countries*. Presented at the 18th European Conference on Modern South Asian Studies Network (SASNET), Lund, Sweden.

Schilderman, T. (2002a). *How do the urban poor obtain information and develop knowledge?* Retrieved December 25, 2004, from <http://www.eldis.org/static/DOC10072.htm>

Schilderman, T. (2002b). *Strengthening the knowledge and information systems of the urban poor.* A project report of ITDG, 2002.

Talero, E., & Gandette, P. (1996, March). *Harnessing information for development.* A proposal for a world bank group strategy. The World Bank.

VITA. (1995, January). *Volunteers in Technical Assistance (VITA), Arlington VA, USA. Com-*

munity information centers. Unpublished topic paper prepared for the VITA project.

Wolfensohn, J. D. (1998). *World development report 1998.* World Bank.

World Bank. (1998). *Knowledge for development. World Development Report 1998, World Bank,* pp. iii, 72.

Zhong, Y. X. (2003, October 14-16). *Information age and information engineering.* Presented at the Digital Divide World Congress, World Federation of Engineering Organization, Tunis.

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 79-93, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.9

Role of ICT in Development Process: A Review of Issues and Prospects in South Asia

Dilip Dutta

University of Sydney, Australia

ABSTRACT

Empirical studies that focus on impact of ICT for development usually make a distinction between ICT as a production sector and ICT as an enabler of socioeconomic development. Although the developed countries are reaping very high benefits from the ICT, its diffusion in developing countries has been limited. It is often argued that for developing countries benefits from ICTs are more likely to accrue from consumption rather than production. In the context of the selected five South Asian countries, the ICT penetration is relatively very low, although there have been some success stories in software production sector and IT-enabled service sector in the region. Generally speaking, the author argues that the developing countries need to integrate ICT policies more closely into economic strategies, which can be done by strengthening the links between

development and technology agencies via the organizational structure of policy-making bodies.

INTRODUCTION

Capacity to use conventional technologies varies from country to country and often tends to be location or industry specific. This limitation has been more prominent in developing countries due to a number of reasons. First, imported technologies may not always be appropriate to their endowments of labor or technical skills, or to their scales of operation. Second, limited scope for diffusion of knowledge and imperfect market competition restrict assimilation of these technologies in these countries. Third, inability to upgrade the technologies they utilize into new technologies to suit in new conditions. Finally, many other circumstantial situations play important role in hindering the transition that may

or may not be visible. Technological capabilities (technical, managerial, and institutional) in the industrial sector, therefore, become more often enterprise specific accumulated skills with a tendency for their technical efficiency to lag behind world technological frontiers. As a result, many developing countries may have stayed at, what Lall (1993, p. 20) calls, “low value added end of the industrial spectrum, falling behind world technological frontiers as others forge ahead.”

Over the past two decades or so, the application of new technologies especially, information and communication technology (ICT),¹ has been credited for its positive role in economic growth and development. Although the developed countries are reaping very high benefits from the ICT, its diffusion in developing countries is still very limited. The role of ICT as a means for accelerating development in underdeveloped and developing societies has been lately questioned especially in terms of their social capacity to process and use the growing volume of information for the society as a whole. While assessing the potential development impacts of ICT many pertinent issues are often raised that include (Morales-Gomez & Melesse, 1998, p. 2):

- who benefits and who loses from the introduction of these technologies;
- how can ICT be made useful and meaningful to the developing countries’ poor majority who are struggling to meet their basic needs;
- what are the social and cultural opportunities and risks they present;
- how can developing countries meaningfully adopt these technologies while lessening their undesirable social and cultural consequences?

ICT AND ECONOMIC GLOBALIZATION: EMERGING TRENDS

The new technologies such as information and communication technology (ICT), biotechnology, nanotechnology, and so forth, have been contributing to the rapid transformation particularly of the developed societies. The ICT is, however, singled out as the most pervasive technical innovation of the post Second World War era in the sense that it gives rise to a wide range of new products and services, its applications affect almost all sectors of an economy, it generates strong industrial interest as a means for profitability and competitive advantage, and it gains widespread social acceptance (Avgerou, 1998). ICT is classified as a “general purpose technology” and, therefore, it is a form of drastic technological innovation that can be applied to a wide range of sectors with dramatic change in their existing modes of operations (Helpman, 1998). As Prakash (2002) further elaborates, ICT has wide applicability in various manufacturing and services sectors. It has strong spread effects and extensive linkages with the rest of the economy. However, its potential forward linkages extend to custom made configuration while its backward linkages extend to material sciences.

ICT includes a heterogeneous series of products and services including semiconductors, voice telephony technologies, and technologies supporting high speed data and audio visual systems, as well as computers and packaged and customized software (Mansell, 1999). Starting from the birth of the Internet in the late 1960s, advents of e-mail in the late 1970s, domain name system in the 1980s, the World Wide Web in the 1990s, and repository/portal concepts in the 2000s are the popular applications of ICT, which have emerged as powerful tools for business and development. Afterwards, ICT has integrated computing, communications, and graphics through digitalization. It has thrived on Web sites with the use of broad-

Role of ICT in Development Process

band optical-fiber lines and made headway into wireless mode. It is becoming more and more personalized with greater use of personal digital aids (PDAs) (Prakash, 2002).

Although there are differences in the definitions of ICT, there is general consensus that the main ICT components (already in existence and expected to be added in the near future) such as sensors and detectors, control and display systems, and so forth, are all interconnected with computers and knowledge-based systems, and do function interdependently and, thereby, form an intelligent communication network. This network becomes the main force behind a national information infrastructure and is linked to its global counterpart. Along with globalizing forces of the world economy, today's progress in ICT has been creating a new paradigm of network age with clear advantage over the industrial age. The implication of this historic shift, as has been summarized in *Human Development Report* (2001), is as follows:

Structures of production and other activities have been reorganized into networks that span the world. In the industrial age—with its high costs of information access, communications and transportation—businesses and organizations were vertically integrated. In the network age, with the costs of communications and information down to almost zero, horizontal networks make sense. Production is increasingly organized among separate players—subcontractors, suppliers, laboratories, management consultants, education and research institutes, marketing research firms, distributors. Their complex interactions, with each playing a niche role, create the value chains that drive the technology-based global economy. (p. 31)

Since the early 1980s, there have been two major trends visible in the globalizing world:

- A strong interaction between market & technology related factors.

- Shifting of the determining factors of competitiveness towards social and economic institutional characteristics of a country.

Technology related factors, such as componentization of production, facilitated by advancement in both manufacturing technologies and ICT have led to lowering costs and making geographical distances irrelevant (ESCAP, 1999). Market related factors such as increased competition for resources in the production of the same products, greater engagement in international trade, enhanced effort to attract foreign direct investments, etc., have been greatly influenced by technological as well as information-related innovations. Along this process, the multi-national corporations (MNCs) in both production and service sectors have been exerting competitive pressures on domestic firms and, thereby, leading to some pattern of technological specialization in their favor. For instance, the multi-national retail giants such as Wal-Mart, Metro, Target, and Tesco have recently issued directives to the Indian suppliers to replace bar codes with radio frequency identification (RFID) technology. To the retail giants, RFID is fast emerging as the best option for keeping costs low. Embedded in plastic product tags, RFID chips can track goods, signal the need for restocking, and thus boost supply efficiency. This has caused domestic companies' sleepless nights simply because the cost of RFID labels will squeeze their profit margins. In fact, the cost of one RFID tag results in a loss of about 30 U.S. cents (Jayeswal & Verma, 2005).

Regarding other major trends in the globalizing world, the physical infrastructure, the rules and regulations (applied to business and individuals), the degree of transparency, perception of fairness (or lack of corruption), the investment climate and functioning of the legal system, and so forth, have lately become important elements for inducing investments in the production of goods and services. Technology and skilled labor can move easily as usual, but ability of a country to

be competitive in the contemporary globalizing world depends more and more on the above infrastructural, as well as social, legal and various institutional factors.

ICT and its impact on Economic Growth

OECD (1989) and ESCAP (1999) reiterate at least four dimensions of the positive contribution of ICT to economic growth in the globalizing world:

- **ICT allows process innovation (new ways of doing old things).** Smaller, faster, and cheaper ICT helps to reduce the cost-to-performance (output) ratio of its application and, thereby increases productivity level. Use of ICT could also promote more efficient utilization of inputs such as raw materials, energy and land. Some new applications of ICT may not only make products economical, but also help to customize them. Drawing closer attention to customer's tastes and preferences with the help of ICT, producers could increase the value added (usefulness and appeal) to their products and, thereby improve their quality. The adoption and dissemination of ICT could also contribute to the formation of networks which, in turn, likely to lead to innovation.
- **ICT helps to generate innovative economic activities (new ways of doing new things).** Various new applications of ICT do now allow some small scale production and service activities to be carried out efficiently both within a country and across borders. These have assisted the creation of new opportunities for regional and global subcontracting, and the decentralization and globalization forces have greatly enhanced the speed of this process. Through organizational changes made possible by ICT, developing countries may plan for better spatial distribution of economic activities, especially those industrial and service operations centralized in large cities.
- **ICT can lead to economic restructuring through being a new factor of production (in addition to the conventional factors of land, labor and capital).** With the help of new and varied applications of ICT, a rapid integration of markets across countries has been taking place through the transmission of market signals and consumer/producer responses. As a result, market horizons are becoming broader, with more information available on the nature of various markets, retail outlets, electronic linkages to clients and distributors, and so forth. More and more producers with computer-assisted design are now capable of responding to market signals with greater flexibility and speed. Their capability to provide consumers with tailor-made products and services and to create market niches has, therefore, been increasing. Built-in software and "intelligence" in many products, automatic diagnosis of malfunctions, and electronically assisted after-sales service help to increase their adaptability and substitutability, which, in turn, increases competition. The resulting competition and the pressures of market integration in the globalizing world have compelled most large-scale manufacturers to go global in terms of sources of inputs, markets and competitors.
- **ICT adds a new means of organizing various activities through its synergies with other technologies.** ICT has revolutionized the marketing systems for commodities on international markets due to producers' instantaneous access to the prices of their products on a real time basis through mobile phones, the Internet, facsimile machine, and so on. The nature and structure of the services sector have also undergone drastic changes as a result of various ICT enabled improvements made in the speed, reliability

and cost of processing vast quantities of information related to financial, inventory and sales. Generally speaking, flexible automation technologies and organizational innovations are being combined into new best practice manufacturing systems and service providers. All the above potential contributions of ICT could directly increase a nation's economic growth and indirectly influence (through multiplier effect) its price and income structures.

ICT as a Tool for Socioeconomic Development of the Developing Countries

Several studies including reports by the United Nations Development Program (*Human Development Report*, 2001), the United Nations Educational, Scientific and Cultural Organisation (UNESCO, 2004), the World Bank (*World Development Report*, 1998/99), the Organisation for Economic Cooperation and Development (OECD, 2004) have identified specific socioeconomic areas within developing countries where ICT can have potential impact. Among these, poverty alleviation, empowerment of socially and economically disadvantaged, agricultural and rural development, population and human resource development, and infrastructural development are important. Lopez and Vilaseca (1996) and Mansell (1999), among others, have listed several sector specific impact of ICT application in developing countries:

- **Industrial sector:** Creation of new industries (in the form of microelectronics and software-based products) or the integration of IT with other technologies (biotechnology) has enabled some developing countries to modernize traditionally "low tech" and labor intensive industries by taking significant steps towards closing the technology gap. Many Asian and Pacific developing economies have been successful in this direction in the areas of ICT industry's hardware production, particularly personal computer (PC), as well as software development and services. The success of South Korea and Taiwan lies in their supply of ICT products and components to the world market, while that of Hong Kong and Singapore is in ICT related trading and manufacturing. Subsequently, Malaysia, Thailand and recently China have all followed suit in ICT related manufacturing and packaging. India has emerged as a world leader in software development since the mid 1990s.
- **Service sector:** Adoption of technologies and changes in service sector technologies has major implications for developing countries. This is due to their impact on fundamental process and organizational changes in different areas including product distribution, financial services, engineering, insurance, marketing, transports, and so forth. This impact is, however, not restricted only on economies, it has certainly spillover effects on education, consumer behavior, and quality of life. Many developing countries which have relatively large pool of skilled or semiskilled labour force with some knowledge of English language are found to excel in the IT enabled service activities. These activities include various types of services such as handling of large volumes of marketing and post sale service related telephone communications with existing or potential customers (call centers); data entry, transcription or digitalization, insurance claim processing, compilation of abstracts, and typesetting for publishing companies, design and maintenance of Web sites (business process centers); preparation and collation of research materials (technical support centers), and so forth.
- **Public sector:** Because this sector is highly information dependent, ICT has a very far

reaching impact on it. ICT is being increasingly applied to different processes used by governments in developing countries. These processes include policy making, planning and budgeting, debt management, macro-economic analysis, community participation, monitoring the quality of provided services, implementing new services, and overall, financial accountability and control. "Given the developmental potential of ICTs, there is," as Morales-Gomez and Melesse (1998, p. 2) argue, "a growing trend among industrialized countries, governments, large transnational corporations, donor agencies, and international organizations to see these technologies as a panacea to underdevelopment."

Avgerou (1998) warned that, the developing countries may face several problems in introducing ICTs in different sectors with the adoption of economic and organizational forms that have been transferred from the industrialized countries. There is no unique proven "best practice" or best policy that could be locally effective for achieving socioeconomic benefits from ICT diffusion. Here comes the notion of "appropriate technology" that is also relevant in this context.² Among many of its comparative advantages, availability of local managerial and technical skills, cultural proximity of producers to intended customers, existence of institutionalized user producer networks, and accumulated tacit knowledge are notable. However, adoption of economic mechanisms and organizational practices from the "postindustrial" world may connect organizations of developing countries to the global business, but it may not guarantee them a competitive position in the global economy.

In the following section on impact of ICT in South Asia, the author will draw some attention to how the policy makers are making efforts to ensure the co-ordination of ICT policies could maximize the spillover effects across the society.

ICT RELATED POLICY INITIATIVES AND THEIR DEVELOPMENTAL IMPACT IN SOUTH ASIA

Empirical studies that focus on impact of ICT for development usually make a distinction between ICT as a *production sector* and ICT as an *enabler of socioeconomic development*. ICT as a production element (including ICT enabled production services) for commercial use requires huge capital (physical and human) investments in information infrastructures (including telecommunications), hardware and software. At the same time, ICT as an *enabler of socioeconomic development* requires increased ICT consumption (public and private). However, as preconditions private consumption in developing countries depends largely on public investment in ICT infrastructure, and type of ICT strategy adopted for harnessing wider development objectives. For these reasons, Pigato (2001) argued that "for developing countries benefits from ICTs are more likely to accrue from consumption rather than production" (p. 4).

This section focuses on ICT policy initiatives in the developing nations. To make it more realistic and reach out the largest base of low-income communities, the region of South Asia has been selected. Though in terms of ICT development, a few Asian countries emerge as giants, but South Asia is yet to remain as one of the two poorest regions (with very high incidence of absolute poverty) of the world, the other one being Sub-Saharan Africa. To compare the ICT development in South Asian region, several indicators have been chosen. As shown in Table 1 below, this region has very low intensity of ICT consumption per 1000 inhabitants. Sri Lanka leads ahead in its overall ICT consumption intensity among the five selected South Asian countries, although recently India and Pakistan tend to move ahead of others in Internet users per 1,000 inhabitants and Internet hosts per 1,000 inhabitants, respectively.

On the production front of the information technology (IT) industry,³ India has early success

Table 1. ICT at a glance in selected South Asian countries

| | Bangladesh | | | India | | | Nepal | | | Pakistan | | | Sri Lanka | | |
|---|------------|------|------|--------|-------|------|-------|-------|------|----------|-------|-------|-----------|-------|-------|
| | 1997 | 2001 | 2004 | 1997 | 2001 | 2004 | 1997 | 2001 | 2004 | 1997 | 2001 | 2004 | 1997 | 2001 | 2004 |
| Telephone main lines (per 1,000 inhabitants) | 3.0 | 4.3 | 5.5 | 19.0 | 37.5 | 40.7 | 8.0 | 13.1 | 15.6 | 19.0 | 22.8 | 31.0 | 17.0 | 44.2 | 51.4 |
| Telephone subscribers (per 1,000 inhabitants) | n.a. | 8.3 | 34.4 | n.a. | 43.8 | 84.4 | n.a. | 13.9 | 22.5 | n.a. | 28.5 | 62.7 | n.a. | 79.8 | 166.2 |
| Cellular mobile subscribers (per 1,000 inhabitants) | 0 | 4.0 | 28.9 | 1 | 6.3 | 43.7 | 0 | 0.8 | 7 | 1 | 5.7 | 31.9 | 6 | 35.6 | 114.7 |
| Personal computers (per 1,000 inhabitants) | n.a. | 1.9 | 11 | 2.1 | 5.8 | 12.1 | n.a. | 3.5 | 4.6 | n.a. | 4.2 | n.a. | 4.1 | 9.3 | 27.5 |
| Internet hosts* (per 1,000 inhabitants) | n.a. | n.a. | n.a. | 0.013† | 0.081 | 0.13 | 0.00† | 0.067 | 0.11 | 0.023† | 0.079 | 0.165 | 0.029† | 0.122 | 0.107 |
| Internet users (per 1,000 inhabitants) | n.a. | 1.42 | 2 | n.a. | 6.82 | 32.4 | n.a. | 2.64 | 6.8 | n.a. | 3.51 | 13.2 | n.a. | 8.01 | 14.5 |

in software sector since the mid 1990s, and then in IT enabled service sector since the beginning of the new millennium. Some of the other South Asian countries have either made similar attempt or have been following the transition. However, before analyzing India’s success story, a brief information on recent ICT profile for each of the other four selected South Asian countries (Bangladesh, Nepal, Pakistan, and Sri Lanka) will be given first.

Bangladesh

Although sales of ICT related consumer products such as mobile phones, desktop computers, modems, networking equipment, and so forth, have been increasing fast, the use of ICT has remained confined mainly to entertainment, voice commu-

nication, and basic Internet access for browsing and e-mail. The Bangladesh Telecommunications Regulatory Commission (BTRC) has reported that there were 150 registered Internet Service Provider (ISP) licence holders (not necessarily operational) at the end of 2003. Among these licensees, 14 were registered as “nationwide service providers.” Apart from ISPs, four registered Very Small Aperture Terminal (VSAT) hub operators had planned to provide satellite terminal and gateway services in December 2003, but a year later only one of them was open for business providing services to financial institutions (Haque, 2005/2006).

As Islam (2005) writes, Bangladesh seems to be waiting for a take off in ICT. Bangladesh’s skilled labor force with expertise in ICT is growing. Training centers, computer institutes, and

both private and public universities are all increasingly contributing to this pool of technical labor force. The present government had approved the National ICT policy in October 2002 with the objective of building an ICT driven knowledge based society. An ICT Task Force with the Prime Minister as its chairperson has also been created for making policy decisions related to various ICT activities. It is expected that the recently established Incubation Center at Kawranbazar in the capital, Dhaka, with data transmission facility and uninterrupted electric supply, will attract companies involved in software and IT enabled services. Establishment of a planned high-tech park with all modern infrastructural facilities at Kaliakair near Dhaka will certainly boost ICT industry and ICT related developmental impacts in Bangladesh.

There seems to have a general feeling that the overall growth of the ICT industry in Bangladesh had been hampered during 2003-2004 due to lack of coordination and cooperation between private and public sector agencies (Haque, 2005/2006). However a recent Springboard Research study⁴ on the Bangladesh IT market finds that its domestic IT spending amounted to US\$235 million, an increase of 9% over the previous year, despite various obstacles such as natural disasters, economic setbacks, political instability, and social unrest. The IT market in Bangladesh is largely dependent on hardware, which represents more than 75% of total IT spending. The software market is stifled by the early state of market development and prevalent piracy, which exceeds 90% in the consumer market. The government sector accounts for over 40% of total spending, and the investment by non governmental organizations (NGOs) such as World Bank, Asian Development Bank, and so forth, is a major driver for market expansion. Apart from these two key market segments, the finance and telecommunications industries also play vital role. These four segments together represent over 70% of total ICT spending in the country.

Nepal

After the launching of IT Policy 2000, Nepal's progress in its implementation has been slow. "However, some of the key national initiatives to develop the ICT infrastructure, such as the construction of the first IT park and the information superhighway, are," as Pandey and Shrestha (2005/2006, p. 1) note, "on the verge of completion." Among the recent efforts taken by the government include establishment of telecenters, licensing of private rural telecommunications operators, liberalization of the telecommunications market, enactment of the long-awaited Electronic Transactions Act in 2004, and so forth. One of the important initiatives taken by the Ministry of Science and Technology in line with the IT Policy 2000 was on human resource development (HRD). Accordingly, the ministry was determined to make sure that sufficient number of people trained at the semiskilled, skilled, and advanced levels could be made available for employment in ICT sector. A long term ambitious program with the slogan "Computer education to all by 2010 A.D." has also been formulated. Five Nepalese universities are offering IT related courses. The total number of private firms engaged in IT sector exceeds 1,000. The majority of these firms are concentrated in Kathmandu Valley and more than half provide various types of training in ICTs. There are about 15 software development companies. Five or six of these companies are export oriented, while the rest cater to the limited demand of the local market (APDIP, 2005).

The number of Internet users has increased sharply in the recent years (see Table 1), due to the private sector's leading role in introducing Internet services. The private sector first connected Nepal to the Internet in 1995. Since then, 12 ISPs have begun their operations in the country, 5 of them are VSAT providers. Although all of the 12 municipalities in Nepal are served by ISPs, but most of the subscribers and users are concentrated in capital Kathmandu. The state

Role of ICT in Development Process

owned Nepal Telecommunications Corporation had been attempting to set up 1,000 VSAT connections for rural telephony with the aim of providing at least two telephones to each Village Development Committee by 2004. The United Nations Development Program (UNDP) and the Nepalese government have recently signed an agreement to run a US\$625,000 two-year pilot project in ICTs (APDIP, 2005).

Pakistan

As a continuation of the IT Policy 2000, the new government of Pakistan which took office in November 2002 has taken a number of initiatives for ICT development. Masood (2005/2006) notes that the current government has been supporting ICT development with a two-pronged strategy. The first part of the strategy aims at generating work for the local ICT industry which is still reeling from the 2001-2002 economic downturn. The second part is designed to assist the small and medium enterprises (SMEs) so that they can embrace ICT to enhance their performance and competitiveness. The Telecom Deregulation Policy approved in 2003 has been taking effect in recent years in terms of the opening up of the telecommunication sector to major investors. Two new cellular licenses have been awarded in April 2004 resulting in an accelerating growth of cellular networks (Table 1).

Pakistan Telecommunication Company Limited (PTCL), the exclusive provider of telecommunication services, is the major Internet backbone in the country. National Telecommunication Corporation (NTC) is the organization entrusted with the responsibility of providing telecommunication services to government agencies and designated users. NTC is deploying a countrywide automatic teller machine (ATM) based multiservices data network capable of carrying voice, video, and multimedia traffic. In addition to public sector operators, there are 80 private sector ISPs and nationwide data communication network opera-

tors who provide Internet access in all major cities of Pakistan. Already, more than 1,800 cities and towns have been connected to the Internet and plans to expand this service are progressing. The use of broadband services has also started to grow in households and offices mainly located in major cities (APDIP, 2005).

Following Masood (2005/2006), an overall state of Pakistan's ICT development and related issues in the recent past has been summarized here. As he mentioned, the ICT sector appeared to have shrunk during the first half of 2004 when a number of ICT companies had closed their operation. This seemed to be partly due to the spillover effect of the global dotcom crash and partly due to geopolitical insecurity. Also, the *e-commerce* and *e-government* initiatives, which were the core of the ICT industry development strategy during 2000-2001, could not achieve much success apparently due to low inertia in government's own system. Meanwhile, the human resource development (HRD) initiative has achieved mixed results. Universities and other educational institutions have been upgraded, and a critical mass of people has been trained in various facets of ICT. However, the pilot programs adopted in these critical areas started to act as agents of change during the second half of 2004 and saw some revival of the ICT industry, especially the outsourcing segment. The companies that survived the downturn during 2001-2002 have emerged to be more focused in terms of their strategies. New firms have also sprouted to capitalize the new opportunities of outsourcing. A number of companies have set up call center operations to provide back office services to foreign-based companies. It is expected that this segment of the ICT services market will grow in the years to come because of favorable business climate.

Sri Lanka

As could be seen from Table 1, Sri Lanka has the highest tele-density (both land line and mobile)

and ownership of personal computers in the region. About 70% of the country's communication infrastructure is, however, concentrated in the Western Province where the country's capital, Colombo, is located. ICT proliferation outside Greater Colombo is still limited. In the case of Internet density, India seems to have overtaken Sri Lanka in 2004 (Table 1). Sri Lanka, which ranks first in South Asia on the Human Development Index (HDI), has a large pool of skilled labor force, as well as an open business culture to global partners and investors. Low cost offshore data entry operations have thrived in Sri Lanka since the early 1980s. The Sri Lankan Government has actively encouraged the spread of computer literacy by providing custom duty concessions on hardware imports and introducing appropriate data transmission systems. Also, in many cases, a large Sri Lankan Diaspora has brought in their knowledge, contacts, and capital back to help integrate companies into the global market of software and tele-services (SLICTA, 2004).

Seven universities in Sri Lanka produce graduates in engineering, electronics, and computer science. In addition, four institutes provide training in electronics. Sri Lanka has recently gained recognition as a competitive choice for top quality ICT outsourcing and call centers in the region of South Asia. Currently, Sri Lanka's ICT industry has an estimated export earning of U.S. \$100 million and has a potential for growth in both ICT and ICT-enabled service industry. About 80 software development companies are in operation. Most of them started their operation since 1996, when the Board of Investment (BOI) offered special incentives in the form of tax holidays and duty free imports for software exporters. Sri Lanka also acts as an offshore development center for companies in USA, UK, Ireland, Australia, and so forth, and joint venture development center for those in Sweden, Norway, USA, Japan, and so forth.

As noted in MAIT (2005), "Open Source" software⁵ presents an opportunity to revolutionize

the ICT industry of Sri-Lanka. Among the 800 committed participators involved in open source projects worldwide, 30 are based in Sri Lanka. The Lanka Software Foundation, a nonprofit organization, has been formed to assist Sri Lanka utilize the opportunities offered by the open source projects. These participators currently operate open source related development laboratories at the Universities of Colombo and Moratuwa, and the Sri Lanka Institute of Information Technology. Among the other significant ICT related initiatives taken in Sri Lanka is the Government's launching of an ICT program in 2003 for the societywide development widely known as *e-Sri Lanka*. Its principal objectives are to foster the local ICT industry, transform the way Government works, improve the quality of life and create opportunities for all Sri Lankans. The first phase of the program focuses on rural connectivity and re-engineering the government. The priority projects for the latter include e-Monitoring, e-Pensions, e-HRM (Human Resource Management), and e-Foreign Employment (MAIT, 2005). As Sri Lanka seems to be gradually recovering from a prolonged civil war, the strategic use of ICT can play a key role to rebuild the country.

India

Significant progress in electronics and computer technology and, therefore, the growth of IT industry has been a major success story in India's economy since the mid 1990s.⁶ From 1996-1997 to 2001-2002 the industry's production grew substantially from Rs. 26,640 crore (US\$7,504 million) to Rs. 80,884 crore (US\$17,324 million).⁷ While the share of hardware products and nonsoftware services (such as system integration including packaged application implementation and custom application development) in the IT sector has declined in the recent past, the share of software services in electronics and IT sector has gone up from 38.7% in 1998-99 to 61.8% in 2003-04. Recently, however, there has been some

Role of ICT in Development Process

acceleration in the growth of hardware sector. Output of computers in value terms has, for example, increased by 36.0%, 19.7%, and 57.6% in 2000-2001, 2002-2003, and 2003-2004, respectively (Economic Survey 2004-2005, p. 147).

During 1990s, the software sector of India's information technology services (ITS) industry has developed as one of the fastest growing sectors in its economy at the compound annual growth rate (CAGR) of 50%, although India's share in the global IT software and services markets was only 2.4% during 2003-2004. A unique feature of India's IT software industry has been its export orientation. Exports of computer software and IT enabled services⁸ have become important sources of India's export earnings in the recent period. The value of India's IT software and services export is estimated to have increased by 30% to US\$12.5 billion in 2003-04 (Economic Survey 2004-2005, pp. 147-148). The general thrusts behind the success of the ICT industry have been highly competitive private sector, public investment in human capital, government's support in IT policies in general, and recent telecommunication policy in particular.

Since the beginning of 2001, India's traditional ITS companies have been focusing more on the IT enabled services (ITeS) including business process outsourcing (BPO) components. The ITeS segment provides people-intensive services that are delivered over telecom networks or Internet to a range of business works and verticals. Services included in this segment are telemarketing, help-desk support, medical transcription, back-office accounting, payroll management, legal database maintenance, insurance claim, and credit card processing. ITeS businesses are operating in India under two categories: *outlocation* services and *outsourcing* services. While the former services are for captive use mainly by foreign companies, the latter ones are through a third-party service provider (Dataquest, 2002). Multinational companies such as *General Electric* (GE) that invested in remote services as captive facilities for world-

wide group operations have adopted a primarily outlocation focus. But Wipro's *Spectramind*, for example, operates as a pure outsourcing service provider, which is funded by banks and venture capital finance, and operates as a niche of contact centre services for Fortune 200 companies. In fact, the ITeS-BPO segment has quickly emerged as a key source of export growth for India's ITS industry.

Following Karnik (2004), major specific factors (external and internal), responsible for high growth rate of India's ITeS-BPO market can be summarized as follows:

External

- Worldwide advancement in technology and infrastructure maturity, which has allowed more complex processes to be off-shored.
- Rapidly improving communications infrastructure for data and voice has enabled this trend to gain pace.
- Competitive pressures faced by global organizations which have been forced to cut costs by outsourcing their non-critical processes.
- Success stories of the BPO route have encouraged other global organizations to opt for the same.

Internal

- Efficiency and productivity improvements achieved by the major Indian outsourcing companies have helped them speed up operations and provide 24x7 customer services.
- Indian IT companies' access to skilled manpower with specific domain knowledge including English-language ability at relatively lower costs is also another advantage.
- Indian IT industry's accelerated pace of consolidation and service convergence has helped stabilize the ITeS-BPO market.
- Success stories of Indian IT companies that have been able to focus on their core business and optimize existing processes by taking

the BPO route have been an inspiration to other Indian organizations to follow suit as well.

However, at the same time, the success of the Indian ITeS-BPO sector due to above factors is also creating challenges in order to maintain its current momentum. Again, following Karnik (2004), some of the major challenges can be noted as follows:

- Because of inadequate ICT infrastructure support, a number of small and medium sized BPO companies have not yet achieved the world class status in terms of communication and other physical infrastructure, which could create shortfalls in this sector's overall service level.
- Performance gap between the top-of-the-line and mediocre suppliers needs to be closely looked into, especially when the lower-rung vendors are also achieving scales, quality levels and portfolio of services by matching to those of the more reputed providers.
- A significant challenge facing Indian BPO vendors today is to cope and successfully combat the backlash against outsourcing, which is creating a negative sentiment for the activity, particularly in the U.S.
- Human resource issues are arising especially in the case of high attrition level, lack of relevant manpower availability and also maintaining the satisfactory level of work environment.
- The Indian ITeS-BPO sector's profit margin seems to be shrinking due to the emergence of competitors especially from China, the Philippines, Vietnam, Ghana, Czechoslovakia, Poland, Romania, Bulgaria, Slovakia, and others.

The increasing importance and growth of ITeS-BPO activities in India have led to specific policy initiatives for this particular segment. These

include measures, to name a few, for adjusting the regulatory and legal framework, rationalizing tax provisions, and improving communication infrastructure. The government is also actively involved in a proper settlement of the backlash against outsourcing through General Agreement of Trade in Services (GATS) negotiations at the World Trade Organization (WTO) level.

In order to meet the challenge of zero custom duty regime in 2005 under the Information Technology Agreement (ITA-1), a number of initiatives have recently been taken by the Indian government. Tariffs on raw materials, parts, other inputs and capital goods have been rationalized to make domestic hardware manufacturing viable and competitive. For example, customs duty on computer parts, static converters for automatic data processing machines and parts thereof has been fully exempted during 2004-2005. Also, computers have been exempted from excise duty (Economic Survey: 2004-2005, pp. 148-49).

Regarding initiatives on ICT as an *enabler* of socioeconomic development, the Department of Information Technology has taken up the following steps:

- An ambitious program of PC and Internet penetration to the rural and underserved urban areas has been launched.
- A program to establish State Wide Area Network (SWAN) up to the block level to provide connectivity for e-governance has been announced.
- Community Information Centers (CICs) have been set up in hilly, far-flung areas of the North-East and Jammu and Kashmir to facilitate the spread of ICT related benefits.
- setting up of CICs in other hilly, far-flung areas of Uttaranchal, Andaman, and Nicobar and Lakshadweep has also been proposed (Indian Economic Survey: 2004-2005, pp. 148-49).

ROLE OF NETWORKING PROCESS⁹

Like most of the developed countries, the developing countries need to integrate ICT policies more closely into societal development strategies. This can be done by strengthening the links between, for example, economic development and technology agencies via the organizational structure of policy-making bodies. Here comes the importance of appropriate networking process at national, regional, and international levels. In the context of South Asia, the countries belonging to the *South Asian Association for Regional Cooperation* (SAARC), a regional institution called the SAARC Agricultural Information Centre (SAIC), has been functioning in Dhaka since January 1989. Because the problems and prospects of agriculture and ecology of the SAARC countries are more or less the same, its main objective is sharing information mutually for the advancement of agriculture, livestock, fisheries, forestry, and allied disciplines. Recently, the SAARC Governing Board has prioritized a program called “SAICNet” with its following specific objectives (SAIC, 2004):

1. Develop Web-based information network that will bring in the synergy of the potential collaborators of SAIC.
2. Establish a gateway mechanism to improve access to agricultural information, which is relevant for researchers, extensionists, policy makers, educationists, students and agribusiness entrepreneurs and through them to the end user, the farmers in the SAARC region.
3. Capture, organize, and disseminate information, wherever it is available, that is relevant for agricultural development in SAARC region.
4. Design and introduce value added services that are based on the ever-changing information needs of the users.
5. Improve use-friendly access to SAIC’s

information services on the Web site that will lead to increased relevance and use of information.

6. Expose and train SAIC staff on the tools and technologies related to Web development and networking.
7. Enhance network activities with the participation of collaborative institutions in sharing information and knowledge resources.

Effectiveness of similar objectives as the above also depends on appropriate networking process among various country specific governmental and non-governmental institutions on the one hand, and the national and regional ICT networks on the other hand. Many non-governmental institutions which have been engaged in introducing ICT for the benefit of rural/urban masses include, among others, *Sustainable Development Networking Program* (SDNP) in Bangladesh, *M.S. Swaminathan Research Foundation* in India, *International Centre for Integrated Mountain Development* (ICIMOD) in Nepal, *All Pakistan Women Association* (APWA) in Pakistan and *Sarvodaya Shramadana Movement* in Sri Lanka. Similarly, various national/regional ICT network agencies have helped different institutions in the South Asian countries to adopt ICT as a means to address their developmental activities. The national ICT networks in the South Asian region include *Bangladesh Advanced Education Research & Information Network* (BAERIN), *Bangladesh Research and Educational Network* (BERNET), *ERNET-India*—India’s education and research network, *Pakistan Educational Research Network* (PERN), *Lanka Educational And Research Network* (LEARN) of Sri Lanka. Among the regional ICT network agencies, important ones are *South Asian Network Operators Group* (SANOG)—a regional forum, *Pan Asia Networking* (PAN)—a program initiative of the International Development Research Center of Canada, *Asia-Pacific Advanced Networks* (APAN)—a non-profit high-performance network for research and develop-

ment on advanced next generation applications and services, *Asia Pacific Network Information Centre* (APNIC)—responsible for addressing the challenges of Internet resource distribution in the Asia Pacific region.

Because of a variety of country specific socioeconomic needs and challenges, namely in the areas of health, education, livelihoods, and governance of the South Asian countries in particular or developing countries in general, it is very crucial that the economic development and technological policy making agencies must not only make sure to select the most appropriate ICT available (of course subject to financial constraint), but also try to gather information on the recent technological changes, especially in the area of ICT networks.

CONCLUSION

Developing countries have different levels of socioeconomic development depending on the structural, institutional and infrastructural constraints at their economic, political, and social levels. In fact, efforts undertaken in a coordinated way with systemic approach seem to have a greater chance for faster socioeconomic development than otherwise. In most cases, level of socioeconomic development has a direct bearing on a country's level of technological development. The recently published UNCTAD's *Information Economy Report 2005* illustrates that many developing countries are undertaking vigorous efforts to catch up with their more developed partners in the dissemination and use of ICT; it also shows that the gaps are still far too wide and the catching-up far too uneven.

It is true that the ICT as a *production sector* or as an *enabler of socio-economic development* has potential for economic growth and development. Because of the availability of surplus skilled labor force in many developing countries

including those in South Asia, there is some prospect for them to participate in the production of the IT services related to ITeS-BPO segment. However, unless the fundamentals as required by the globalizing world are made favorable for this segment, there is little hope for this to happen. Similarly, to take advantage of the ICT as an *enabler of socio-economic development*, the country's strategies and actions must make sure that its marginalized social and economic groups are not left out, otherwise the *digital divide* within the country will choke its overall socio-economic development.

The ICT penetration in five countries selected from the poverty stricken South Asian region can easily be seen to be very low in comparison to the newly industrializing countries (NICs) in other part of Asia. This low ICT penetration also indicates the existence of *digital divide* within each of these countries. What is needed to combat with digital divide that exists both across various developing regions and within developing countries is "the sustained engagement of national governments, the business sector, and civil society, and the tangible solidarity of the international community" (UNCTAD, 2005, p. xv).

REFERENCES

- APDIP. (2005). *Asia-Pacific development information program*. UNDP. Retrieved June 26, 2006, from <http://www.apdip.net>
- Avgerou, C. (1998). How can IT enable economic growth in developing countries? *Information Technology for Development*, 8(1), 15-28.
- Chakraborty, C., & Dutta, D. (2003). Indian software industry: Growth patterns, constraints and government initiatives. In R. Jha (Ed.), *Indian Economic Reforms* (pp. 317-333). New York: Palgrave Macmillan.

Role of ICT in Development Process

- Dataquest. (2002, July 29). *IT-enabled services: Indian IT's lone crusader*.
- Dutta, D. (2005). Role of science & technology in development process: A review of major historical perspectives and issues. *Ritsumeikan Journal of Asia Pacific Studies*, 15, 11-24.
- Dutta, D., & Sekhar, A. (2005). Major Indian ICT firms and their approaches towards achieving quality. In R. Jha (Ed.), *Economic growth, economic performance and welfare in South Asia* (pp. 225-248). New York: Palgrave-Macmillan.
- Economic Survey*. (2002-2003). New Delhi: Government of India.
- Economic Survey*. (2004-2005). New Delhi: Government of India.
- ESCAP. (1999). *Economic and social survey of Asia and the Pacific 1999*. Economic and Social Commission for Asia and the Pacific, United Nations.
- Haque, S.E. (2005/2006). *Digital review of Asia Pacific*. Retrieved June 26, 2006, from http://www.digital-review.org/05_Bangladesh.htm
- Helpman, E. (Ed.). (1998). *Introduction: General purpose technologies and economic growth*. Cambridge, MA: MIT Press.
- Human Development Report. (2001). *Today's technological transformations—creating the network age* (Ch. 2). UNDP.
- International Telecommunication Union*. Retrieved June 26, 2006, from <http://www.itu.int/ITU-D/ict/statistics>
- Islam, M.A. (2005, February 15). ICT in Bangladesh: Waiting for a take-off? *The Daily Star*.
- Jayaswal, R., & Verma, P. (2005, May 21). Local retailers hit hard by big bros' demand for RFID code. *The Economic Times*.
- Karnik, K. (2004, February). *Editorial. BPO Newslines*. National Association of Software and Services Companies (NASSCOM).
- Lall, S. (1993). *Understanding technology development*. *Development and Change*, 24, (pp. 719-753).
- Lopez, E., & Vilaseca, M. (1996). IT as a global economic development tool. In E.M. Roche & M.J. Blaine (Eds.), *Information technology, development and policy*. (99. 57-75). England: Avebury.
- Manufacturers' Association for Information Technology (MAIT). (2005, July). Sri Lanka ICT Industry. *Country Intelligence*, 49.
- Mansell, R. (1999). Information and communication technologies for development: Assessing the potential and the risks. *Telecommunications Policy*, 23, 35-50.
- Masood, J. (2005/2006). *Digital review of Asia Pacific*. Retrieved June 26, 2006, from http://www.digital-review.org/05_Pakistan.htm
- Morales-Gomez, D., & Melesse, M. (1998). Utilising information and communication technologies for development: *The social dimensions*. *Information Technology for Development*, 8(1), 3-14.
- OECD. (1989). *Information technology and new growth opportunities*. Paris: Author.
- OECD. (2004). *Information technology outlook 2004*. Paris: Author.
- Pandey, S., & Shrestha, B. (2005/2006). *Digital review of Asia Pacific*. Retrieved June 26, 2006, from http://www.digital-review.org/05_Nepal.htm
- Pigato, M. (2001). *Information and communication technology, poverty, and development in sub-Saharan Africa and South Asia*. Africa Region: World Bank.

Prakash, B. (2002). *Information and communication technology in developing countries of Asia. Technology and poverty reduction in Asia and the Pacific*. Manila: Asian Development Bank.

SAIC. (2004). *SAICNet project*. Retrieved June 26, 2006, from <http://www.saic-dhaka.org/AnnualReport2004.htm>

SLICTA. (2004). *Sri Lanka IT industry. World Information Technology and Services Alliance*. Retrieved June 26, 2006, from <http://www.witsa.org/profiles/slicta.htm>

UNCTAD. (2005). *Information economy report 2005. United Nations Conference on Trade and Development*, Geneva.

UNESCO. (2004). *ICT innovations for poverty reduction*. United Nations Educational, Scientific and Cultural Organisation.

World Development Report. (1998/1999). *Knowledge for development*. World Bank/Oxford University Press.

World Development Report. (1999/2000). *Entering the 21st century*. World Bank/Oxford University Press.

ENDNOTES

¹ Following OECD (2004, p. 63), the term “information and communication technology” (ICT) is broadly used to refer the family of related technologies that process, store, and transmit information by electronic means. The term “information technology” (IT) is narrower and is used to denote computer, software, and related technologies not including communications and network technologies. The boundary between the two is, however, getting increasingly blurred.

² The author (Dutta, 2005, pp. 15-16) has

recently summarized the “appropriate technology” movement in the context of earlier industrial technology.

³ The term “information technology (IT) industry” generally covers development, production, and services related to IT products. Hence, it contains three basic sub sectors: hardware, software, and services. IT services include those services which result from the use of any IT software over a system of IT products for realizing value addition. There are three broad categories of the entire IT services (ITS) industry: (1) system integration, which includes packaged application implementation, custom application development and integration; (2) application outsourcing, which includes support and maintenance services; and (3) IT consulting, which includes strategic consulting, business process consulting and change management (Retrieved June 26, 2006, from www.expressindia.com/full-story.php?newsid=29232&spf=true).

⁴ <http://economictimes.indiatimes.com/articleshow/1214281.cms> (Retrieved June 26, 2006)

⁵ “Open Source” software is a method of software creation, distribution, and licensing, which permits accessibility of its source code. In contrast, for the proprietary companies such as Microsoft, IBM, Oracle, and so forth, the source code is a closely guarded secret.

⁶ Some detailed analysis of India’s software industry and major Indian ICT firms’ quality achievement process can be found, respectively, in Chakraborty and Dutta (2003), and Dutta and Sekhar (2005).

⁷ Note that 1 crore = 10 million. The rupee figures are from Economic Survey: 2002-2003, p. 143. Exchange rates used are: US\$1.00 = Rs 35.50 in 1996-1997 and US\$1.00 = Rs. 46.69 in 2001-2002.

Role of ICT in Development Process

⁸ The IT enabled service industry in India began to evolve in the early 1990s, when companies such as American Express, British Airways, General Electric and Swissair set up their offshore operations in India. A large number of foreign affiliates now

operate IT-enabled services in India (Ibid., p. 148).

⁹ The author is grateful to Dr. H. Rahman who has provided the names of most of the national and regional ICT networks included in this section.

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 240-258, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.10

Information and Communication Technology and Good Governance in Africa

Godwin Onu

Nnamdi Azikiwe University, Nigeria

INTRODUCTION

The 20th and 21st centuries have witnessed major paradigm shifts in the conceptualization of development and governance. These phenomena are aided and propelled by a new “network intelligence” consummated in the introduction of information and communication technology (ICT). The world has also witnessed a reinvention of the whole process of governance that has impacted society in various ways. Through the Internet and digital connectivity, today’s world has come to be closer than ever before. Efficiency and processes of governance have been improved through faster information flow in the governance chain. Bottlenecks and cost of labor have been reduced across the world. Furthermore, ICT has opened new possibilities, improved transparency and access to information as well as partnership and collaboration, leading to improved relationships between the citizen and state. While Europe and North America, as well as some countries of Asia and the Pacific, have taken advantage of

this development to improve their economies and governance process, Ningo (1999) observes that sub-Saharan Africa has remained either passive or in the periphery, often reduced to a consumer for reasons related to its history or its system of governance—or lack of one. This has led to a yawning digital divide (especially between Africa and developed states of the world).

What led to this divide and how can Africa, then, benefit from this revolution? What are the obstacles?

BACKGROUND

Such historical factors as colonialism and associated exploitative orientations and, more recently, military dictatorship and neo-liberalism have dominated the literature of Africa’s political economy as explanatory framework for underdevelopment. Little has been blamed on the problems of state interventionism that characterized the post-independence period and that appear to

have exposed the weakness of the state in Africa to manage its resources and deliver services, thereby leading to underdevelopment and poverty. Even at that, the prognosis and taxonomy of the post-cold war developments in Africa still lean on such templates. In fact, African scholarship has continued to heap blames for underdevelopment on doors of liberalism, mercantilism and their “center-peripheral” characters. According to Bathily (Nnoli, Ed., 2000, p.49), “It appears clearly that the crisis of the post-colonial state is not directly caused by state intervention in the economy.” To that extent, Bathily contends that the solution to this crisis cannot be generated by the mere restoration of the so-called macro-economic equilibrium.

The current Africa’s problems have also been traced to corruption and bad governance (World Bank, 1989). Identification of these problems and their impediments to political and economic development have led experts, scholars, organizations and agencies to show concerted interests towards paradigm shift and reinventing governance. The move is borne out of the genuine conviction that there is a correlation between bad governance as witnessed in Africa and other parts of the world and over-centralization. This correlation also extends to governance and problems of war, poverty, corruption and human security. Consequently, these have led to various dimensions of inequality and growth below the world’s minimum standards for economic development. According to Adedeji (2002), African performance in 1960-1975 was substantially below all the targets set by the United Nations (UN) Second Development Decade. Its GDP annual growth was 4.5% instead of the 6.0%; its export was 2.8% instead of 7.00%; its agricultural growth rate was 1.6% instead of 4.00%; while manufacturing grew at 6.0% instead of 8.00%. Import was 10.0% instead of 7.0%. This, according to Adedeji, reveals that Africa was faced with development crisis. Unfortunately, performance during the one-quarter of the 20th century (1975-2000) was more abysmal than that

achieved during the first 15 years of independent Africa (1960-1975). It is postulated that if Africa has to exit from poverty and develop, it needs a growth rate of 7.0% per annum (Adedeji, 2002). The following data demonstrate Africa’s growth rate and prospects from 2002 to 2006.

It is the contention of scholarship also that this bad governance could be averted if there is culture of accountability, transparency, as well as commitment of political leadership to deliver services to the governed.

STEPS TAKEN TO ACHIEVE GOOD GOVERNANCE

Various steps have been taken at the national, regional and global levels to address the problems of bad governance in Africa. At the global level, there is a general call for democratization and economic reforms that could entrench a regime of accountability, transparency and culture of trust. Institutions, such as the World Bank, International Monetary Fund (IMF) and donor nations, have not minced words on these virtues as conditions for granting any form of aid to Africa. They have even extended their definition of governance to include a redefinition of the state, the de-politization of public administration and involvement of non-governmental organizations.

At the regional level, there have been concerted efforts at political and economic integration as well as such programs as the New Partnership for Africa’s Development (NEPAD), which is designed to use its Peer Review Mechanism and ICT as tracking tools against bad governance. Through this process, NEPAD will help eradicate poverty and empower African states to develop.

At national levels, states of Africa have various provisions in their constitutions and have introduced various institutional measures and anti-corruption agencies to check bad governance. In spite of these efforts, corruption and bad governance continue to ravage the continent,

Table 1. Real GDP growth rate of developing countries (International Development Economic Associates, 2005)

| | 2002 | 2003 | 2004 | 2005 | 2006 |
|----------------------------------|------------|------------|------------|------------|------------|
| East Asia and Pacific | 6.7 | 7.9 | 7.8 | 7.1 | 6.6 |
| Europe and Central Asia | 4.6 | 5.9 | 7.0 | 5.6 | 5.0 |
| Latin America and the Caribbean | 0.6 | 1.6 | 4.7 | 3.7 | 3.7 |
| Middle East and North Africa | 3.2 | 5.7 | 4.7 | 4.7 | 4.5 |
| South Asia | 4.6 | 7.5 | 6.0 | 6.3 | 6.0 |
| Sub-Saharan Africa | 3.1 | 3.0 | 3.2 | 3.6 | 3.7 |
| All Developing Countries | 3.4 | 5.2 | 6.1 | 5.4 | 5.1 |
| - excluding transition Countries | 3.2 | 5.1 | 5.9 | 5.4 | 5.1 |
| - excluding China & India | 2.1 | 3.8 | 5.4 | 4.6 | 4.3 |

Table 2. Actual and projected long-term growth of per capita GDP (in percent) (International Development Economic Associates, 2005)

| | 1980s | 1990s | 2000-06 | 2006-15 |
|---------------------------------|-------|-------|---------|---------|
| World Total | 1.3 | 1.1 | 1.6 | 2.1 |
| High Income Countries | 2.5 | 1.8 | 1.7 | 2.4 |
| Developing Countries | 0.6 | 1.5 | 3.4 | 3.5 |
| East Asia and the Pacific | 5.8 | 6.3 | 6.0 | 5.3 |
| Europe and Central Asia | 1.0 | -1.8 | 5.2 | 3.5 |
| Latin America and the Caribbean | -0.9 | 1.5 | 0.8 | 2.4 |

Table 3. Percentage of population living on less than \$1.08 per day (Chen & Revallion, 2004)

| REGIONS | 1981 | 1984 | 1987 | 1990 | 1993 | 1996 | 1999 | 2001 |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| East Asia | 57.7 | 38.9 | 28.0 | 29.6 | 24.9 | 16.6 | 15.7 | 14.9 |
| Eastern Europe and Central Asia | 0.7 | 0.5 | 0.4 | 0.5 | 3.7 | 4.3 | 6.3 | 3.6 |
| Latin America and Caribbean | 9.7 | 11.8 | 10.9 | 11.3 | 11.3 | 10.7 | 10.5 | 9.5 |
| Middle East and North Africa | 5.1 | 3.8 | 3.2 | 2.3 | 1.6 | 2.0 | 2.6 | 2.4 |
| South Asia | 51.5 | 46.8 | 45.0 | 41.3 | 40.1 | 36.6 | 32.2 | 31.3 |
| Sub-Saharan Africa | 41.6 | 46.3 | 46.8 | 44.6 | 44.1 | 45.6 | 45.7 | 46.4 |
| Total | 40.4 | 32.8 | 28.4 | 27.9 | 26.3 | 22.8 | 21.8 | 21.1 |

leading to abject poverty. The main thrust of this article, therefore, is to establish how ICT can help achieve good governance in Africa and bridge the divide in overall development (but also the digital divide) between the advanced industrial countries and Africa.

ICT AS A ROAD MAP TO GOOD GOVERNANCE IN AFRICA

While good governance could be achieved through efficient management of the nation's resources,

entrenching a culture of trust, accountability and transparency, we argue that ICT could be a veritable tool of making the above factors possible. ICT in governance has been defined as "the use of Information and Communication Technology to support the act and process of governance through the provision of improved administrative systems within and without government" (Duncobe, 1999) in Emadoye (2002, p. 1). On the other hand, governance is an exercise of political, economic and administrative authority to manage a nation's affairs (UNDP, 1997). It is the complex mechanisms, processes, relationships and institutions

through which citizens and groups articulate their interests, exercise their rights and obligations, and mediate their differences. This poses the concept of governance in two dimensions (good and bad). But we are concerned with good governance. This, the United Nations Development Program (UNDP) argues, has to do with effective management of public resources in response to the critical needs of the society. According to Cloete (2001, p. 4), good governance is “the achievement by a democratic government of the most appropriate developmental policy objectives to sustainably develop its society, by mobilizing, applying and coordinating all available resources in the public, private and voluntary sectors, domestically and internationally, in the most effective, efficient and democratic way”. According to Cloete, this latter definition contains both empirical and normative utilitarian approach. It is also a reflection of the current academic state of public administration/management.

Having said this, it is important to note that no matter how defined, good governance must take care of the principles of responsibility, accountability, transparency, trust and efficient service delivery – all channeled towards the improvement of the welfare of the governed. It is being emphasized, because good governance provides an enabling environment for economic development, political participation, social inclusion, equity and quality of life of citizens. These issues generate broad consensus in society and reduce the problems of war and violence; it reduces poverty by creating employment opportunities through investment and guarantees human security. It creates an atmosphere of freedom, develops talent and ingenuity, reduces fear and throws open windows of opportunity to both domestic and foreign investors.

The above background suggests one basic question. In what ways can ICT be used to achieve this good governance? In other words, what is the instrumental utility of ICT to improve peoples’

welfare, hold government accountable and achieve a responsible, efficient and transparent public administration that could deliver services?

Backus (2001) writes that ICT can be involved in governance in two major dimensions: internally and externally. Internally, it facilitates speedy, transparent, accountable, efficient and effective process for performing government administration activities. Externally, it facilitates speedy, transparent, accountable, efficient and effective interaction with the public, citizens, business and other agencies.

Duivenboden (2002) agrees that ICT could create new ways of service delivery through multi-challenging information supplies. It could equally influence the behavior of governments in their relations with citizens to a certain extent. Duivenboden admits that electronic governance (e-governance) could lead to increased access of citizens to government information and increase the process of transparency. E-governance also saves time and money for both citizens and the state.

Cloete (2001) emphasized the importance of electronic management assessment tools and their use to improve policy outcomes and service delivery. He observed that the poor state of these tools have led to policy failures and poor policy implementation in most developing states. ICT, according to Uma (2004), enables the government to reinvent itself, get closer to the citizenry and forge closer alliances and partnerships with diverse communities of interest, practice, expertise, conviction and inter-dependence within the context of national agendas. Backus (2001) writes further that the objective of e-governance is similar to the objectives of good governance: Good governance is the exercise of economic, political and administrative authority to better manage affairs of a country at all levels, national and local. Many other ways have also been identified as roadmaps to good governance via ICT:

Citizen Participation

The introduction of ICT (including the widespread use of the Internet across the world and its increasing use in Africa) has proven to be a major way of increasing public participation in the governance process. E-governance through ICT is a major roadmap towards defining a society's vision and priorities for e-government. ICT facilitates electronic democracy—voting; public opinion polls; policy inputs; campaigns; payment of taxes; political contacts, especially with elected leaders; networking; as well as advocacy. According to the Pacific Council on International Policy (2002), participation requires collaboration, especially between the private sector and civil society groups that may possess the much-needed expertise and resources. Participation makes it possible for citizens to evaluate government services openly. This enables the government to make improvements in its services and policy process. Good governance in Africa could be facilitated through this process of participation, as it would enable the average African to make input into policy process and generate confidence and trust in the political system. The overall consequence may be political stability and economic development. Experiences from across the world reveal that ICT can be instrumental to community development, improved access to information and public-private partnership, and all of these can also be of tremendous benefit to Africa.

Community Development

ICT in Africa could lead to information sharing, local administration, healthcare service delivery, and accessing information needed at localities without traveling to the state or nation's capitals. In Africa also, ICT could be used by civil society organizations to inform people in the localities about their rights and privileges, and so forth. The effect of this is the empowerment of the civil societies to checkmate their governments and hold

them accountable for their responsibilities. This is a major way of guaranteeing transparency and good governance.

Access

ICT in Africa can create access to information about the entire political process, services and choices available. Government agencies can equally use ICT facilities to advertise their activities, programs and plans, as well as achievements. It can also be used to announce jobs and opportunities on Web sites. Citizens can submit applications online and fill out forms. Though this access still follows the digital divide between developed and developing states, among African states as well as in their urban and rural centers, its benefits are numerous if made possible. The divide also has its gender dimension, since speculations are that women have less access to ICT worldwide.

Partnership

Through ICT in Africa, a feeling of ownership of policy process, legitimacy, and sense of efficacy and patriotism will be generated. As states in transition, it can help in forging a closer and stronger partnership between public and private sectors.

It can also be possible to transact business and send messages faster than ever before in Africa. Though connectivity is still abysmal, such facilities as e-mail, fax and cellular telephones, digital television and radio have been of immense benefits. Cost-effective administration (through microelectronics, fiber optics, video compression, fast-packet switching and high-density storage technology, reduction in the volume of files and of the cost of labor) has been enhanced.

Finally, ICT in Africa, like in other parts of the world, has led to information gathering for intelligence, national security and ecological monitoring, not only to manage natural disasters but also for improvement of agriculture.

Having outlined how ICT can benefit Africa and improve governance, it is noteworthy to state that ICT is like the theory of the hammer, which the carpenter can use for good, bad and ugly. This understanding informs part of its special constraints. Ningo (1999) suggests that Africa should take advantage of the development of ICT, since it offers a dramatic opportunity to leap-frog into the future and break out of decades of stagnation and decline. In this regard, Hegener (1996) warned that if Africa cannot take advantage of the information revolution and surf this great wave of technological change, it may be crushed by it. This, he argues, will lead to greater marginalized and economic stagnancy in the future. Ronfeldt (1992) also suggested that governments that succeed in using the information revolution and its associated technologies to develop advanced information and communication infrastructures may leap ahead of others in terms of their capacity to deal with current issues, assert their presence, build cooperative networks and partnerships, and cope with competition and conflict at home and abroad.

THE FUTURE OF ICT IN AFRICA: PROBLEMS AND CONSTRAINTS

The introduction of ICT at least brings the hope that if adopted and properly implemented, African states can transform from a culture of distrust, dishonesty and mismanagement to that of transparency and accountability that will encourage an efficient and cost-effective public administration and good governance. It will also enable the continent benefit from the present UN Millennium Development Goals.

While this is admissible, it is important to note that peculiar environmental factors may constrain the extent ICT will determine the roadmap to good governance in Africa. Though these factors are not peculiar to Africa, their presence is widely engrossed and their effect severe. The following factors could

hinder Africa's dream and disrupt this roadmap to political and economic development.

Problems

Lack of Infrastructure

Infrastructure is essential to successful ICT procurement and sustenance. These include legal recognition and acknowledgement of electronic data as legal documents, electronic signatures, issues of piracy and intellectual property rights, and procurement policies. These require legal reforms and broad policy frameworks that are yet to be developed in most African states.

Telecommunication

Most African states are still below the world minimum in accessibility to telecommunications. It was found out that Africa has only a 13% share of the world population. Out of this number, only 1% has total global telephone lines, 1% Internet users, 1.2% of total world Internet sites, and almost 0% of global ICT production. With an estimated 274,742 hosts in 2001, Africa has 0.19% of the total global Internet hosts, while its share of personal computers stood at 7,558,000, representing 1.53% of the world total (United States Internet Council, 2001). There is no gainsaying that without this facility, electronic governance, democracy and commerce will be hampered. While in many African states the telecommunication industry has been liberalized, still, the cost of access to these facilities are yet to be within the reach of majority, especially when telecommunication companies are constituting themselves into new monopolies, thereby defeating the essence of liberalization. Even at that, the distribution of the telephone is not only skewed in favor of urban residents, especially the urban elites, but the digital divide continues to increase between the urban and rural dwellers. This divide has also proven to be generational. While African youths appear to be

more ICT literate, a greater percentage of elders appear to be behind this new technology.

Lack of Knowledge Jobs

There is still a gross lack of technical manpower in the field of information technology (IT). This affects not only software maintenance, but also development of new ones and manufacturing of accompanying hardware. IT facilities need to be properly set up, computers repaired and serviced. To a large extent, trained manpower for these services are in short supply. In some offices, where computers are available, they serve the purpose of decoration. Even at homes, generational gaps also exist in their use. Older people feel it is not their business. Younger ones get more interested. Unfortunately, it is the older people that occupy most sensitive positions in the public and private offices.

Poverty/Cost

Poverty is still a major handicap in access to ICT. Most Africans cannot access the Internet or own telephones or other digital receivers, because they are unaffordable. Because of this lack of access, most cannot benefit from various online facilities, such as information, education, e-commerce and so forth. This could endanger the future of ICT benefits for good governance in Africa. Computers are very expensive and, in many cases, unaffordable to the average person.

Another major effect of this poverty in Africa is the use of IT to achieve an inter-generational shift in corruption. The few cyber-cafes that are available are owned by private persons and are often filled with young men and women scamming to defraud – a technique unknown to the older generation and a more sophisticated form of corruption. Employing such people in government offices will offer opportunity for new forms of fraud in the future.

Civil Wars

Available statistics show that many states in Africa are deeply engrossed in civil wars and political instability. The report of the UN Secretary General (April, 1998) shows that since 1970, more than 30 wars have been fought in Africa, most of them intra-state in origin. In 1996, 14 out of 53 countries in Africa were experiencing armed conflicts that accounted for more than half of all war-related deaths globally. This creates environmental problems that are hardly ideal for the development of ICT. Mostly, these states are more committed to basic survival, containing insurgency and fundamentalism than development of ICT infrastructure.

Electricity

In such countries as Nigeria, electricity supply is grossly irregular. In many cases, electricity supply is erratic. It comes on and off. This not only slows progress and development, but also inflicts serious damage to computers and their software. The future of IT development in Africa could be endangered by the poor energy sector existent in many states of Africa, coupled with the fact that many rural communities have no electricity.

Then, there is the lack of most governments' willingness to set up public information centers for cheaper and easy access to information and business transaction. This is not because the government policy makers do not acknowledge the benefits of these; but, lack of patriotism and corruption stand in their way, disposing them to be unwilling to invest where there are no direct cash rewards.

Lack of Space for Open Comments

This might look minor or ignorable, but it is very important. In designing Web sites, most agencies and organizations hardly create open space for exchange of information and comments on

government policies. What government and its agencies do is tell people what they want them to know. This channel is closed for the fear of criticisms arising from the public as well as challenge of policy options. The future of ICT in Africa faces an uphill task in the challenge of the above constraints.

Policy Dichotomization

In some African countries, ministries of communications are separated from those of technology. This keeps IT and communication technologies as separate issues. In Nigeria, for instance, ICT understanding is narrowed down generally to just computers and Internet. There are three separate policies on IT. IT and Broadcasting have different regulatory bodies (Ya'u, 2001). According to Ya'u, this not only creates problems in terms of coordination between the various agencies and resulting duplication of efforts, but also does not allow the countries to tackle the issues of convergence that ICT represents. This dichotomous stance was exemplified when ministers responsible for economic planning were meeting with the Economic Commission for Africa (ECA) in May 1996 to conceptualize the African Information Society Initiative (AISI). That same month, the Ministers responsible for telecommunications were meeting in Abidjan to agree on the green paper outlining the Telecommunication Policies for Africa (Apeworkin, 2001). Again in Nigeria, while the Minister for African Integration was representing Nigeria in the African Development Forum (ADF'99), the Minister for Telecommunications was releasing the National Policy on Telecommunication in Abuja with no reference to what was going on in Addis Ababa (Ya'u, 2002).

PROSPECTS OF ICT IN AFRICA

Leaderships have at least demonstrated some

desires to embrace ICT. For instance, there have been numerous initiatives to embrace ICT and bridge the yawing gap at both international and domestic levels. The World Bank, UNDP and even the Group of Eight initiate some. These have led to modest improvement in connectivity in most African states. By 1995, only six African states had the Internet, but by 2002, virtually all had access to the Internet (Ya'u, 2002).

In spite of these modest improvements, the reports of the Organization for Economic Cooperation and Development (OECD, 2001) and the US Internet Council (UIC, 2000) showed that the divide between Africa and other developed parts of the world is still on the increase. This position leaves us with one major, disturbing question. Will Africa ever catch up and bridge the divide in IT? Mansell and Wehn (1998:25) said it will take at least a century. Cogburn and Adeya (1999, p. 12) sounded even more pessimistic. According to them, "it is an illusion to think that ICT-poor countries can 'catch up' or keep pace with advances in the most technologically advanced countries." Even the efforts through NEPAD did not seem to win the confidence of some scholars. According to Ya'u (2005, p. 8), "NEPAD is symptomatic. There is nowhere in the document in which the ways ICTs are reinforcing existing global inequalities or how the challenges e-commerce is posing to developing countries are factored in the discussion on bridging the development gap." He blamed Africa for taking the matter on its surface level without taking into consideration its historical roots and for thinking that the gap can be bridged just by promoting access for foreign investors in ICT industry by removing for them import duties, taxes and breaks as well as holidays, and reducing itself to consumerist status. The extent to which Africa can catch up therefore, will depend on the level of its leadership commitment to achieving good governance that will enshrine principles of transparency, accountability and service delivery. It is in realization of these virtues that words could be matched by action that could bring Africa

nearer to actualization of digital technology and bridge its consequent divide.

CONCLUSION

The World Bank (1994) had noted that the future of economic development and good governance are hinged on ICT. Africa needs to translate this prediction from mere expression of interest to concrete efforts at bridging the digital divide, not only between the continent and the rest of the world, but within Africa itself, between rural and urban dwellers. For instance, while 29 members of the OECD share 97% of Internet hosts, 92% of the market in production and consumption of computer hardware and software services and 86% of all Internet users, the whole of Africa contain only 2.5% Internet users, or less than 1% of the world's online community (Norris, 2000). This calls for indigenous investment in the ICT sector, with the hope that it will positively impact on governance process. This is a major way of getting through the center-periphery model of development that has beset Africa since the period of colonization. It is equally important to note that the problem of governance does not solely lie in lack of technology. Effective use of technology calls for improvement in various governance infrastructures that will not only enable this technological acquisition but its productive usage. This, therefore, calls for the ICT knowledge society. It is observed that one of the fundamental reasons for the absence of good governance in post-colonial Africa is the sheer incapacity of its bureaucracy to discharge its duties (Chabal, 1992). With creation of a knowledge society and the positive use of IT, the bureaucracy may be better positioned to discharge its roles and deliver services. If Africans can see ICT as an innovation for the common good and adjust from the current culture of greed to that of using the new technology to track bad governance, then the benefits will be tremendous and the future bright. The problem

of ownership of ICT may not even constitute an impediment.

REFERENCES

- Apeworkin, M.K. (2001, April). *The challenges, constraints and opportunities of Telecommunications reforms in West Africa: A national service provider perspective*. Paper presented at the ABANTU Workshop on Gender and ICTs Policies in Africa, Ghana, Accra.
- Bathily, A. (2000). The West Africa in historical perspective. In Nnoli, O. (Ed., 2000). *Government and politics in Africa*. Harare, Zimbabwe: AAPS Books.
- Budhiraja, R. (2003). Electronic governance—A key issue in the 21st century. Electronic governance division, Ministry of Information Technology, Government of India. Retrieved January 19, 2004, from <http://www.digitalgovernance.org>
- Cees, H. (1999, October). ICTs and social development: The global policy context. *UNRISD discussion paper* (No. 116).
- Chabal, P. (1992). *Power in Africa: An essay in political interpretation*. New York: St. Martins Press.
- Chen, S., & Revallion, M. (2004). How did the world's poorest fare since the early 1980s? *The World Bank's Research Observer*, 19(2).
- CIPE. (2004). Democratic governance: The key to political and economic reform. *Issue Paper* (No. 0405), January 22.
- Cloete, F. (2001). *Improving good governance with electronic policy management assessment tools*. Public Futures 2nd Annual Conference, London. Retrieved May 9, 2006, from <http://www.emergence.nu/events/brussels/pubfutures.pdf>
- Cogburn, D. L., & Adeya, C. N. (1999, October). *Globalization and the information economy:*

Challenges and opportunities for Africa. Paper presented at the African Development Forum.

Duivenboden, H.V. (2002, March 11-12). *Responsive e-government services: Citizen participation in public administration—The impact of citizen oriented public services on government and citizens*. Organization for Economic Cooperation and Development (OECD): Vision, Responsiveness, and Measurement Seminar, Paris.

Hegener, M. (1996). Internet unwired. *IICD E-Journal documentation*. Retrieved from www.iicd.org

Kwesi, B. (1995, November 22-24). *Recent development in the theory and practice of governance in Africa*. Paper presented at the Good Governance for Africa: Whose governance?, Maastricht.

Mansell, R., & Uta, W. (1998). *Knowledge societies: Information technology for sustainable development*. New York: Oxford University Press.

Manuel, C. (1999). *Information technology, globalization and social development*.

Ndou, V. (2004). E-government for developing countries: Opportunities and challenges. *Electronic Journal on Information Systems in Developing Countries*. Retrieved October 25, 2005, from www.ejisdc.org

Ningo, N. N. (1999). *ICT and sustainable good governance in sub-Saharan Africa: Countering the hegemonic drive for power. A study for the world bank*, University of Duala, Duala, Cameroon.

Norris, P. (2000). *The world digital divide*. Retrieved from www.Pippanorris.com

Pacific Council on International Policy. (2002). *Roadmap for e-government in the developing world*. Retrieved from www.pacificcouncil.org

Richard, D. (1999, October 24). *Information, ICT and small enterprise: Findings from Botswana*.

Paper presented at the Workshop and Exhibition on Window of Investment Opportunities in the Petroleum (Oil and Gas) Power and Telecommunication Sectors of Delta State of Nigeria. Retrieved May 9, 2006, from <http://unpan1.un.org/intradoc/groups/public/documents/NISPAcee/UNPANO15541.pdf>

Ronfeldt, D. (1992). Cyberocracy is coming. *The Information Society Journal*, 8(4). 243-296. Retrieved from www.cyberocracy.org

UNRISD Discussion Paper. No. 14. September.

Ya'u, Y.Z. (2002). *Globalization, ICTs and the new imperialism: Perspectives on Africa in the global electronic village*. Paper presented at the 10th General Assembly of CODESRIA, Kampala,

KEY TERMS

Bureaucracy: This refers to the personnel and administrative structure of an organization. Business, labor, religious, educational and governmental systems depend on a large workforce arranged in a hierarchy to carry out specialized tasks based on internal rules and procedures. The term is used mostly in referring to government administration, especially regarding officials in government and civil services. It is often used pejoratively to suggest waste, inefficiency and red tape (Encarta, 2003). In sociological theories, bureaucracy is an organizational structure characterized by regularized procedure, division of responsibility, hierarchy and impersonal relationships. The term can characterize either governmental or nongovernmental organizations.

Cyber Café: “Cyber” is anything related computers or networking. Cyber Café, though, used in exchange with Internet café, is expected to be a coffee shop that offers computer terminals for customers to browse the Internet while sipping coffee. It is a colloquial concept that is fast becoming an accepted formal language.

Globalization: The process by which markets and production in different countries are becoming increasingly independent due to the dynamics of trade in goods and services and flows of capital and technology (European Commission, 1997). Globalization involves much more than economic transaction and spans into political, social and cultural issues. Economic globalization has to do with a borderless global economy, in which the principal agents are the multi-nationals, which are disembodied from any national base. Political globalization refers to the withering away of the state. Cultural globalizing refers to the present global village that watches more or less the same television serials and videos, consumes or aspires to consume the same products. Social globalization refers to the homogenization of today's mode of life, which is based on an individualist and consumerist culture. As a result of globalization, social geography gains a planetary dimension. "Place" comes to involve more than local, provincial, country, regional and continental realms. With globalization, the world as a whole also becomes a social space in its own right (Encarta, 2003).

Governance: The term governance has not received any universal fit-all definition. The best we have are working definitions by international organizations, which in most cases lack underlying theories. The UNDP defines governance as "the exercise of political authority to manage a nation's affairs. It is the complex mechanisms, processes, relationships and institutions through which citizens and groups articulate their interests, exercise their rights and obligations and mediate their differences." In keeping with this, it defines sound governance as effective and efficient management of public resources and an adequate response to critical societal needs. It also denotes democratic forms of relationships between the governed and the governors, relationships that have in-built mechanisms for public participation, accountability and transparency.

It is contended that systems that incorporate the above elements have been better able to satisfy broad societal needs, including sustainable human development (Economic Commission for Africa, 1988). It can also represent decision-making processes in the administration of an organization. Governance also refers to the process whereby elements in society wield power and authority, and influence and enact policies and decisions concerning public life, as well as economic and social development.

Human Security: Human security has been looked at from two primary perspectives. From the narrow perspective, it has to do with protection of individuals and communities from violent threats and internal conflicts. The broad perspective defines it to include threats of hunger, poverty, exclusion and natural disasters.

Internet: Internet is a collection of computer networks that operate to common standards and enable the computers and the programs they run to communicate directly. There are many small-scale, controlled-access "enterprise Internets," but the term is usually applied to the global, publicly accessible network, called simply the Internet or Net. By the end of 2002, more than 100,000 networks and around 120 million users were connected via the Internet. According to Encarta Encyclopedia (2003), Internet connection is usually accomplished using international standards collectively called Transmission Control Protocol/Internet Protocol (TCP/IP), which are issued by an organization called the Internet Engineering Task Force, combined with a network registration process and with the aid of public providers of Internet access services, known as Internet service providers (ISPs). This global communications network consisting of thousands of networks typically interconnected by fiber-optic cabling had two parent networks whose joining began the ongoing evolution.

- U.S. Military (tactical communication in the event of telephone downtime during war-time)
- Academics (shared information between researchers).

Poverty: Poverty is an economic condition in which people lack sufficient income to obtain certain minimal levels of health services, food, housing, clothing and education, generally recognized as necessary to ensure an adequate standard of living. What is considered adequate, however,

depends on the average standard of living in a particular society. Poverty could be relative or absolute. Relative poverty is that experienced by those whose income falls considerably below the average for their particular society. Absolute poverty is that experienced by those who do not have enough food to remain healthy. However, estimating poverty on an income basis may not measure essential elements that also contribute to a healthy life. People without access to education or health services should be considered poor even if they have adequate food (Encarta, 2003).

This work was previously published in Encyclopedia of Digital Government, edited by A. Anttiroiko and M. Malkia, pp. 1026-1034, copyright 2007 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.11

Telecommunications Sector and Internet Access in Africa

Vanessa Phala

LINK Centre, Research ICT Africa, and University of the Witwatersrand, South Africa

INTRODUCTION

The “information revolution” has not only transformed the world as we know it, but also its future potential. Information and Communication Technologies (ICT), with their major technological advances, have affected the lives and lifestyles of people across the globe, as well as the way institutions and organizations do business. However, not all outcomes of the spread of information technologies have been positive. A majority of the world’s population, especially those who live in poverty, have been largely bypassed by this revolution. The gap between them and the rest of the world has expanded precisely as a result of the facilitation capacity of these technologies for those who have access to them (Figueres, 2003). The majority of these people are situated in the African continent and other developing countries.

According to Jensen,³ from the study he conducted on the current status of information and communication technologies in Africa, the use of ICT has grown relatively rapidly in most urban areas in Africa. Five years ago, only a few countries had local Internet access, and now it is

available in every capital city. In the same five-year period, more mobile cell phones were deployed on the continent than the number of fixed lines laid in the entire previous century. Hundreds of new local and community radio stations have been licensed, and satellite TV is now also widely available. However, the digital divide is still at its most extreme in Africa, where the use of ICT is still at a very early stage of development compared to other regions of the world (Okpaku, 2003).

The history of the development and spread of computers in Africa can be traced back to the 1960’s when Ethiopia first introduced computers. This was followed in 1961 in Zimbabwe and Zambia and 1962 in Kenya and Nigeria. The spread of computers and related technologies raised broad a wave of fear about important social and economical issues concerning the loss of jobs. Regardless of this fear, computers became and are the vital tool for economic development of all countries. The spread of these technologies demanded effective legislations which to govern their usage and contributed to the formulation of national information and informatics policies in the 1970’ and 80’s (Adam, 2004).

In addition to this, during 1992-1996 Africans were introduced to the Internet and this further highlighted the importance of regulation. Most countries adopted policies which favored the promotion of privatization and competition. The period between 1996-2000 saw the birth of broad-based policy formulation around health, education and business. Many African countries adopted policies which allowed people to make use of the ICT to better their economic standard and increase their social status. The incorporation of Communications into Information Technology reinforced the importance of using Information and Communications Technology for development (i.e., e-education, e-health, e-commerce, e-democracy and so forth).

Currently, many African countries are racing towards achieving the Millennium Development Goals by using ICT as part of their development strategy. In addition, the spread of ICT has increased digital opportunities for some and a “digital divide” for the rest, especially in developing countries. It has also given rise to other important development challenges such as achieving real access to telecommunications, incorporating gender equity into ICT programmes, the importance and relevance of Intellectual Property Rights, the need to license VoIP (Voice over Internet Protocol) and VSAT, especially in poor nations, the need for Internet governance, and the right to communicate. Most of these issues were discussed during the first phase of the World Summit on Information Society in Geneva December 2003 and will be further discussed during the second phase in Tunis 2005.

According to the Fair Access to Internet Report (FAIR) produced by the Research ICT Africa (RIA) network⁴ concludes that Africa is the continent with the lowest diffusion of the Internet in the world. It has an average of only 111 users per 10,000 people and only three Internet hosts per 10,000 inhabitants (RIA, 2004). This is attributed primarily to the limited penetration, unreliable connections and high costs of usage of typical

of the communications infrastructure across the continent. The limited network roll-out and high prices are often attributed to the restrictive policy and regulatory environment and monopoly market structures that persist in many African communications sectors, which have contributed to low levels of competition.

The Research ICT Africa network has recently produced two research reports. The first was the FAIR analysis of Internet access that covered 13 African countries (i.e., Algeria, Cameroon, Ethiopia, Ghana, Cote D’Ivoire, Kenya, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Uganda and Zambia). The second research report (Sector Performance Review) reviewed the performance of seven African countries’ (Cameroon, Ethiopia, Kenya, Rwanda, South Africa, Uganda and Zambia) telecommunications sector at the national level against their stated policy objectives and strategies. The main thrust was to determine which reform strategies are contributing positively to the realization and achievement of development objectives, and which ones are failing.

FINDINGS

Sector Performance Reviews

Though only seven case studies are reviewed in this paper, they reveal that development of the ICT sector continues to be highly uneven within countries and across the continent. What these studies also demonstrate is the lack of availability of statistical data, even from the major government departments and international reporting archives such as the International Telecommunication Union World Development Report Indicators. Further, where indicators did exist, they were often not appropriate to a developing-country context (Gillwald, 2004).

In addition, the report revealed that the primary objective of all countries reviewed was the improvement of access to telephony services, with

added commitment not only to network extension but also to modernization of the network in order to meet the needs of the modern economy.

Ironically, at least one of the regulatory regimes that has proven to be effective, has achieved its success as a result of a policy and regulatory vacuum that left the regulator neglected or ignored by central government. Uganda's regulator has emerged as a well-resourced, autonomous body, at least partially because mechanisms were not put in place to provide for its funding or accountability. The regulator set about resourcing itself through levies on the sector, which allowed it to attract and train personnel who could competently deliver on the regulator's legislated mandate (RIA, 2004).

In other cases, regulatory weakness has been a key dynamic. The weak Zambian regulatory regime has been identified as one of the factors contributing to the government's inability to privatize the incumbent PSTN. This, together with high license fees, has impacted on the emergence and sustainability of ISPs (Internet Service Providers) and the penetration of the Internet. Like other jurisdictions that have to date protected the rights and revenue streams of current incumbents (such as Cameroon, Ethiopia, Rwanda and South Africa), Zambia does not permit the deployment of cost-effective technologies such as Voice over IP (VoIP) outside of the existing incumbent.

In Ethiopia, which has seen some institutional reform since the 1996, legislation separated operations from regulation—through the creation of the Ethiopian Telecommunications Company and Ethiopian Telecommunications Agency. This provides one of the purest examples of state-provisioning, with a strict monopoly on fixed, cellular, Internet services and international gateways. With a regulatory agency that lacks political independence and human and financial resources, the likelihood of Ethiopia's monopoly PSTN being regulated to more effectively meet national needs seems remote. Unlike Uganda, where the loss-earning incumbent provider was

viewed as “a yoke around the government's neck” that had to be gotten rid of, the provider in Ethiopia is one of the few revenue streams for the government. As a result, by 2004 the government remained unconvinced that privatization would sufficiently compensate it for any loss of income. For the same reason, the Ethiopian government, like many other governments that have pursued monopolistic models, remained unconvinced of the benefits of liberalization in 2004.

A key area of difficulty in regulating incumbent PSTNs is interconnection. Generally, the problems around interconnection are caused by incumbent providers not being used to operating in a competitive environment or from them being regulated. In South Africa, despite a relatively sophisticated interconnection and facilities-leasing frameworks, the principle (drawn from international best practice) that new entrants or competitors are required by law to acquire their facilities from the incumbent provider and to enter into commercial agreements prior to regulatory intervention, have resulted in protracted negotiations, competition disputes and lengthy legal reviews. Generally, the incumbent monopoly providers have the financial resources to draw out negotiations so that new entrants are forced into agreement or forced out of business. Or incumbent monopoly providers can use their superior resources to tie up the regulator in the courts for years on end, challenging what they regard as unfavourable regulatory intervention. This has been the case in South Africa. In fact, in South Africa, it was a complaint brought by the VANS providers—including Internet Service Providers—to the Competition Commission that resulted in the commission recommending to the Competition Tribunal that the incumbent provider be fined 10 percent of total annual earnings for competition breaches.

The issue of interconnection highlights the need for appropriate regulatory models for developing countries, where regulators often have restricted human and financial resources. An

“access regulation” paradigm has developed globally in response to the emergence of a competitive environment. But under the highly imperfect market conditions that exist in many developing nations—where there are legacies of the “natural monopoly”—this form of regulation is overly resource-intensive and complex. Often the incumbent monopoly provider’s position is inherently anti-competitive, either because of the vertically-integrated market structure that inevitably exists or because of formal protection of certain of its activities.

What emerges starkly from the different country studies is the pattern of political, social and economic legacies that determine the ability of a country to respond to the challenges of globalization and, in particular, the so called “digital divide.” Each study unveils the impact of a country’s unique history. So that, whilst facing the already-stark global challenges of new technologies and liberalization, each country has, in addition, to confront the impact of its own history. This includes such events as apartheid in South Africa and Namibia, genocide in Rwanda, years of civil war in Ethiopia, ongoing violent dissent in Uganda, strong neo-colonial tendencies in Cameroon, and the collapse of the “mono-crop” copper economy in Zambia (www.researchICTafrica.net/homepage).

Fair Access to Internet Report (FAIR)

The purpose of this study was to understand the relationship between the market structure and regulatory frameworks, the cost of Internet connectivity and the levels of Internet penetration. The survey strategy was pragmatic rather than exhaustive, aiming to answer the minimum number of questions needed to derive simple yet reliable indexes—of market structure, associated regulatory frameworks and usage prices—which would then allow countries to be compared and ranked. To achieve this, survey tools were developed which aimed to place a value on the regula-

tory environment and the market structure and to determine the local prices for access Internet services.

The study aimed to develop indicators that would allow for comparison of market structures and costs of connectivity in different African countries. It also aimed to compare various strategies to reduce cost of access, and to understand the relationship between these measures and other development indicators, some of which have the potential to override ICT data (e.g., per capita GDP).

The ICT market structure and policy framework of the entire 13 countries studied were assessed by assigning points on a scale from one to five for a series of seven variables: fixed-line competition; state ownership of fixed-line operators; regulatory strength; technology openness; VSAT; WiFi/unlicensed spectrum; and interconnectivity. These variables were used to generate a comparison of the success of various strategies in reducing the cost of access to communications infrastructure. Equally important was the need to understand the relationships between these measures and other development indicators as indicated above.

The results from the study revealed that the impact of market structure and regulatory framework differs from one country to another, depending on the existing policy, market openness and the wealth of the country. Furthermore, the impacts differ for varying levels of Internet penetration. In South Africa, for example, there were more than 680 Internet users for every 10,000 inhabitants in 2002. This was due primarily to a high per capita income of US \$2,542 in 2001 compared to the continental average of US \$705 and to some extent due to the openness of the market and the effectiveness of the regulator. In comparison, Algeria, with a per capita income that was two-thirds that of South Africa’s, had fewer than 160 users per 10,000 inhabitants. But Nigeria, with a relatively high GDP per capita, had among the lowest number of Internet users,

while Kenya had a high number of users with a low GDP per capita. Generally, what emerged from the analysis was that cost of access has a dramatic impact on usage patterns. In terms of telecom prices, the report revealed that the costs of telecom facilities were high in Africa, and they impacted negatively on the usage levels (www.researchICTafrica.net/research).

However, the report acknowledged that other factors including privatization, competition and independent regulation could, and have, impacted on the provision of telecommunications services in Africa.

The report concludes by arguing that Internet growth in Africa was constrained by the low penetration rates for fixed-line telecom services, which set the geographical bounds for Internet participation. Other important factors were: basic access charges for telephone service; the start date of Internet provision, as that determined the number of months/years that Internet services had a chance to grow; access and usage charges for Internet service; disposable income; the extent to which countries had completed their telecom reform processes, prices charged by fixed-network operators to ISPs; the extent of competition in the supply of Internet services to the public; and the effectiveness of telecom regulation in providing a framework conducive to the development and growth of Internet services (www.researchICTafrica.net/research).

CONCLUSION

Though there has been some impressive growth and development in ICT adoption in some countries—particularly South Africa and Uganda—there were no cases of entirely open markets, with monopolistic or partially competitive markets not being regulated in an effective manner. Some markets had slightly more providers than others, and there was no market on the continent that provided a developed model by which to assess

competitive efficiency, price reductions and increased penetration rates.

In addition, the report acknowledged that available baseline data in African countries was often inaccurate and did not include the informal sector, which could be highly developed and yet was seldom reflected. The report recommended the development of methodologies and indicators that could reliably draw these activities into assessment.

REFERENCES

- Adam, L. (2004). *Presentation on ICT Policy in Africa*, APC Regional ICT Policy and Advocacy Workshop, Kenya, Nairobi, 19-22 July 2004.
- Gillwald, A., & Kane, S. (2003). *South African sector performance review*. LINK Center, University of the Witwatersrand, South Africa.
- Okpaku, O.J., & Figueres, J.O. (2003). *Information and Communications Technologies for African development*. New York: UN ICT Task Force.
- RIA - Research ICT Africa. (2004). *ICT sector performance in Africa: A review of seven African countries*. LINK Centre, University of the Witwatersrand, South Africa.
- RIA, Gillwald, A., Jensen, M., Esselaar, S., & Melody, W.H. (2004). *Fair access to internet report*. LINK Centre, University of the Witwatersrand, South Africa.

Research ICT Africa Network Members

- Albert Nsyenyiyumva – University of Rwanda
- Alison Gillwald – University of the Witwatersrand, South Africa
- Americo Muchanga – University of Eduardo Mondlane, Mozambique.

- Amos Anyimadu – University of Ghana, Accra
- Beda Mutagahywa – University of Dar es Salaam, Tanzania
- Christoph Stork - Namibia Economic Policy & Research Unit
- Doyin Salami – Lagos Business School, Nigeria
- FF Tsubira - University of Makerere, Uganda
- John Munsaka – University of Zambia
- Lishan Adam – in collaboration with the University of Addis Ababa, Ethiopia
- Mureithi Muriuki – Summit Strategies, Nairobi, Kenya
- Olivier Nana Nzepa – University of Yaoundé, Cameroon
- Sebusang Sebusang – University of Botswana

KEY TERMS

ICT: Information and Communications Technology generally used in relation to any computer-based processes in which information and content are developed, shared and transmitted over local, regional or international boundaries.

Internet: A world wide interconnection of individual networks operated by government, industry, academia, and private parties.

ISPS: Internet Service Providers provide access to the Internet via different communications channels such as traditional telephone lines or high-speed fiber-optic channels.

PSTN: Public-Switched Telephone Network, consist of analog local loops that connect subscribers to the local central office, and digital facilities that link central offices together via various regional, long- distance, and international backbone.

VOIP: Voice over Internet Protocol applications send telephone voice calls over the Internet inexpensively, by transforming people’s voices into packet-based data.

WIFI: Wireless Fidelity networks use small, low-power antennas to carry voice and data communications between a backbone and users at schools, businesses, households and public places, all without laying a single wire, thus greatly reducing the cost of “traveling the last mile.”

ENDNOTES

- ¹ Vanessa Phala is the knowledge manager at the LINK Center and a Ph.D. student at Wits University, P&DM.
- ² The Learning Information Networking Knowledge (LINK) Centre is the leading public policy, regulation and management education body in the area of information and communication in Southern Africa. The mission of the Centre is to enhance capacity-building in the public sector and development arenas through quality training, applied research and consultancy services necessary to maximize the benefits of the information society and economy.
- ³ Mike Jensen is a research consultant on ICT in Africa.

- ⁴ Research ICT Africa is an ICT policy and regulatory resource base and research “collaboratory” for decision-makers in the public and private sectors and civil society, developing public-interest research findings through the networking of researchers at African universities. Built through the development of collaborative relationships among African institutions in Botswana, Cameroon, Ethiopia, Kenya, Mozambique, Namibia, Nigeria, Rwanda, Tanzania, Uganda, Zambia and South Africa, the network has linked with prestigious international research networks, such as LIRNE.NET, to create rigorous and independent research in the public domain.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 687-691, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.12

The Arab World, Culture, and Information Technology

Mohamed El Louadi
University of Tunis, Tunisia

INTRODUCTION

In 801, Harun Rashid offered Charlemagne a water clock, the like of which was inexistent in all of Europe at that time; the King's court thought that a little devil was hidden inside the clock. In the 1930s, King Abdulaziz of Saudi Arabia had to convince his people that the radio was not the making of the devil and that it could in fact be used to broadcast and spread the Quran. In 2003, the Arab region is found to be still lagging in modern technologies adoption (UNDP, 2003). Thus, in a little more than 11 centuries, the Arabs were transformed from leaders to adopters, then to late adopters as far as technologies are concerned.

The Arab world is taken to mean the 22 members of the Arab League, accounting for more than 300 million people with an economy of 700 billion dollars. Although most Arabs practice Islam, they represent less than one third of all Muslims. The Arab world is often thought of as economically prosperous due to its oil resources; yet its total GDP is lower than that of Spain (UNDP, 2003).

Arab countries share language and culture but differ in size, geography, demographics, govern-

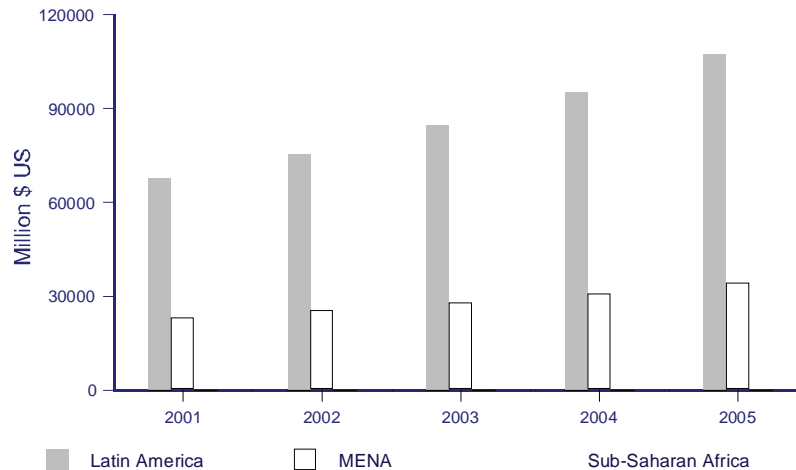
ment type, etc. In terms of spending in and use of IT, statistics portray the Arab world as far from being up-to-date (UNDP, 2003).

This article raises the question of whether existing research models are appropriate to explain this delay. If certain characteristics proper to the Arab culture play an important role in explaining the delay in IT adoption, then we anticipate the answer to be that no existing model is able to adequately study the IT adoption phenomena in the Arab world.

THE ARAB WORLD AND IT

It is a recognized fact that the Arab world lags behind in terms of IT (Aberdeen, 2001; UNDP, 2003). (See Figure 1.) In 2001, Ajeeb reported that the number of Arab Web sites reached 1.24% of the Arab population (Ajeeb, 2001), it predicted that the number of Internet users would equal 5 million by 2001, and reiterated DITnet's March 2000 prediction that Internet users would number ten to twelve million by the end of 2002. In fact,

Figure 1. The MENA region is under-performing in terms of IT spending even when compared with other developing regions (Source: Aberdeen, 2001)



there were a reported 8.2 million users by the end of 2002.

To date, no Arab country has been able to develop its electronic commerce capabilities to the extent seen in the West.

REASONS FOR THE LAG

The lag can partly be explained by the delay with which technologies have traditionally reached Arab countries¹. Davison et al. (2000) suggested several other reasons: a perceived incompatibility between local cultures and imported technologies, a preference for autonomy and independence with respect to technology, and a lack of economic resources to acquire technology.

The first two of are plausible as is it often the case that IT stumbling blocks occur not because of technical reasons but rather because of human and social obstructions. The third reason can be excluded for the six Gulf countries which claim per capita revenues of nearly five times the average of the rest of the Arab countries. The rate of adoption of the Internet for these countries is up to fifteen times that of the rest of the Arab world.

Other factors also explain the low rate of Internet penetration in Arab nations as compared to the rest of the world. In these nations, the rate of penetration is essentially measured based on only one part of society: men.

The Arab Woman

Two thirds of the 65 million illiterate Arabs are women. Women make up only 4% of all Arab Internet users while in Europe women make up 42% on average². The UNDP states that the condition of women is one of the three main factors explaining the current state of economic development in the Arab world.

In that more than 40% of women in Arab countries are denied participation to the technological revolution, Arab nations are failing to integrate a considerable part of their human resources in their future economies.

Information and IT

When Arab countries invest in IT, they do so mainly in hardware. While this may be a characteristic of developing countries, it may also be

Figure 2a. While hardware is projected to represent less than 35% of all IT investments in the world...

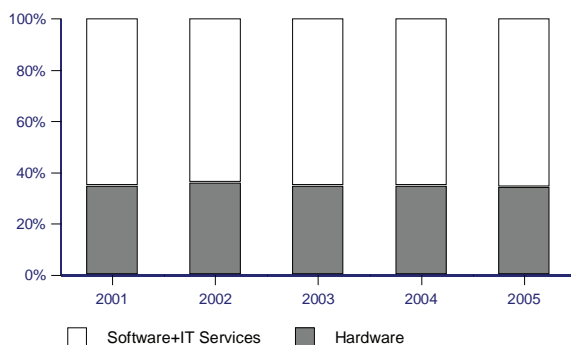
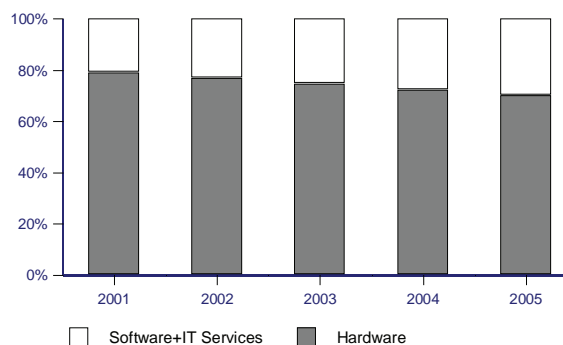


Figure 2b. ...it will continue to represent more than 70% of all IT investments in the MENA region (Source: Aberdeen, 2001)



viewed as Arabs’ distrust of anything immaterial. Software on the other hand is associated with innovation, creativity, and the free flow of information and knowledge, qualities that the Arabs have been found lacking (UNDP, 2003). Thus, not only Arabs are increasing their dependence to the West being consumers of hardware, they seem to be passive users of the software and intelligence produced elsewhere.

This issue leads to the tight relationship between information (and not IT, let alone hardware) and democracy and freedom. If Arab countries are truly “information shy” (Henry, 1998), then what information is to be shared and circulated by IT? Therefore, the Arab does not see what use he could make of IT and would therefore not consider it an instrument of development.

Culture

Culture is “[the] collective programming of the mind that distinguishes the members of one group of people from those of another” (Hofstede, 1991). For Ibn Khaldun, 14th century Arab sociologist, man is son to his habits and his environment, not to his nature and his moods³.

Hill et al. (1998) claim that the Arab culture is one of the most complex of the world. It is complex

for several reasons. Though the majority of Arabs are Muslim, many are Jewish or Christian while others are agnostic and even atheists. Many actions and symbols assume a particular significance. Often in traditional Arab cultures a handshake or the spoken word are seen as more legally binding than a signed contract and the written word has less significance than in other cultures⁴.

For Arabs bartering is very different from what the West calls negotiating. The numerous steps involved in bartering hold social meanings, the least of which is to learn about and get more acquainted with the other so as to build trust in terms of the product quality. Selling and buying are social acts not replicated by technology.

In his study of Qatari and Emirati cultures, Solberg (2002) found that “wasta” (social connections and string-pulling) could be used to lower the level of uncertainty during business transactions. Even when more direct means are available, Arabs prefer wasta because of the human contact it offers. Wasta is a way of life that builds upon human interactions, a major part of an Arab’s life, which she or he may not be willing to sacrifice to technology.

Arabs tend to be more talkative than Westerners; they are fond of sentences with several adjectives, the number of which, combined with

the length of sentences and the tone of the voice, make up an integral part of the message. For example, when a guest is offered a cookie, it is customary to not accept too keenly or quickly. It is up to the host to insist (invoking God) to convert the initial refusal into a yes⁵. Arabs rarely say yes or no, rather, they are inclined to answer using less committed terms such as “usually” and “Inshallah”. The design of computer interfaces with only the “yes”, “no” and “cancel” options is clearly rooted in other cultural norms.

THEORIES AND RESEARCH MODELS

Many research models are available to study IT adoption. Flowers et al. (1975), for example, built upon the framework of Graves (1970) in which people would evolve through levels of “psychological existence” reflecting their personal values and lifestyles, which vary with their cultural programming.

Research using this framework suggests that dominant value systems of Middle-Eastern managers are conformist, sociocentric and existential and their dominant decision-making style is consultative (Amirshahi, 1997).

Another important stream is represented by Hofstede’s work (1991) which considers culture a national trait. The results of Hofstede’s research is a typology of cultures based on five cultural dimensions: power distance, individualism, masculinity, uncertainty avoidance, and long-term orientation⁶.

In research pertaining to IT, some dimensions have been invoked more than others: individualism (Jarvenpaa et al., 1999), power distance (Simon, 2001) and masculinity (Hofstede, 2001b). Findings from Hofstede (2001b) show a relationship between masculinity and fax machines, and femininity and cellular phones. Like authority, a masculine trait, a fax is not interactive; and like

exchange and dialogue, which are feminine traits, a cellular phone is interactive.

Certain Arab values could be mapped onto Hofstede’s cultural dimensions⁷. What one calls “*maslaha el amma*” (public interest) happens to mean the exact opposite of individualism. In the Arab culture, public interest could even be extended to the notion of Umma (nation). Family commitments and responsibility towards authority figures and political leaders are often held as priorities over other matters. Arabs from the Gulf swear allegiance to the family, clan, tribe, religion, and nation⁸ (Abbas, 1987). Usunier (1993) suggests that Arab cultures tend to resemble cultures that are focused on the present and for whom the future (destiny) is inevitably predestined (Mektoub) by God (Inshallah: God willing). For Patai (1973), fatalism is a predominant trait of the Arab culture. If past-oriented cultures are more passive than future-oriented cultures, the Arabs should have an attitude that can be summarized as “if it is written then it will happen” henceforth they will not feel the urge to go toward the technology and will expect it to come to them⁹.

LIMITATIONS OF EXISTING MODELS

The Absence of Arab Dimensions

If in Hofstede’s model, the first four dimensions are applicable to other cultures, it would be useful to more closely study Arab values in order to include them in existing models.

Cultures are likely to diverge rather than come together as we would assume on the basis of globalization and the democratization of media. Hofstede (2001b) has shown that cultures are diverging rather than converging. More specifically, current world events do not lend support to the hypothesis that Arab and Western cultures are closing in.

Current research models would therefore benefit from including Arab dimensions; otherwise they would risk being applicable only to those cultures for which they were developed or for the Arab culture to continue being perceived through the lens of another culture. This could be done following the example of the Far East cultures. These cultures were really only taken into account into Hofstede's model with the addition of the fifth dimension, Confucian dynamism, thereafter called long-term orientation. It was added in order to complete Hofstede's model since it was the dimension that distinguished western and far-eastern cultures.

The Implicit Cultural Homogeneity

Differences exist among Arab countries (Solberg, 2002), and even between different regions of a same country. This is even more noticeable as the borders between Arab countries were often drawn arbitrarily during colonization.

Fundamental cultural differences exist between Sunnis and Shiites, among them masculinity (Noland, 2003). Sunnis are considered more "triumphant" (sic.) while Shiites focus more on suffering. The two strains of Islam could therefore be considered at the extremes of the masculinity dimension although scores for this dimension place the Arab world at the midpoint of the scale. However, even Sunnis bear certain feminine traits such as seeking good relationships with leaders and cooperating with colleagues in order to foster equally good relationships with them (Weir, 2001).

Differences can also be found between the cultures of the Gulf and other nations of the Arab world. The discovery of oil in the 1930s resulted in an odd mix of traditional and tribal cultures with modern cultures. This mix did not manifest itself in North Africa resulting in the Arab world composed of countries generally having either people or oil¹⁰. Furthermore, North African countries have not always had Arab identity.

Unlike the Gulf countries, they became Arabs at the same time as Muslims.

The Cultural Barrier

Arabs, Arab culture, and Arab religion have always been a black box for the Westerner. For instance, some westerners have a near-Manichean tendency to dichotomize (Good vs. Evil, Them vs. Us, etc.) and are fond of clash-of-civilizations theories (see Huntington, 1996). El-Solh and Mabro (1994, p. 14) show how the application of over-simplistic dichotomies to the study of gender relations in the Middle East have left out much of the flexibility women might have in actual terms. The simple idea that the sexes have a complementary role in Arab society has often been misunderstood in Western studies as a binary opposition with a tacit hierarchy.

Furthermore, if by fatalism it is understood that humans have no say in their destiny, then the concept of time orientation of Patai (1973) originates from a fundamentally inaccurate understanding of a large part of the Arab world. Islam is founded on the promise of salvation (Jenna) or the threat of damnation (Jehenna). Debates on the "kadha and kadar"¹¹ (destiny and predestination) continue to fuel the controversy that divides theologians on the issue. Suffice it to mention that Arab societies do not necessarily neatly fit within cultures anchored in either the past or the present.

CONCLUSION

Significant contradictions may exist between how Arabs perceive themselves and how they are perceived by others. For example, Hill et al. (1998) argue that the adoption of technologies is rarely in quest of imitating the West. But Ibn Khaldun maintains that imitation is characteristic of Arabs. Abbas and Al-Shakti, (1985) even suggested that Arab executives are the product of cultural values that tend to produce more followers than

leaders. Yet, imitation is sometimes suspicious in the Muslim's eye as some believe that imitation of the non-Muslims is "haram" (sinful) While it is also believed that imitating non-Muslims is permissible, the average Arab Muslim sometimes wonders when imitation stops being haram and starts being hallal (allowed)¹². How to reconcile these points of view?

Two theories seem promising in that they may complement the research models we reviewed here. Social Identity Theory recognizes that cultural layers exist that describe different levels of programming (social, national, regional, religious, contextual, organizational, etc.).

Abdul-Gader and Kozar (1995) borrowed the construct of technological alienation from psychosociology to explain certain purchase and use decisions of IT. They showed that alienated individuals resist any kind of technology adoption. More generally, Value-Expectancy Theory (Feather, 1995) promises to enrich the debate on IT adoption by Arabs since it addresses the issue of the value attributed to things by individuals and their expectations, founded or not, such as their resistance to the possible danger of technological and cultural dependence. This is all the more valid that Arabs view IT as a technology, not as a medium of knowledge and of accessing knowledge, something they need direly as evidenced by the conclusions of the UNDP (2003).

REFERENCES

- Abbas, A. (1987). Value systems as predictors of work satisfactions of Arab executives. *International Journal of Manpower*, 8(2), 3-7.
- Abbas, A., & Al-Shakti, M. (1985). Managerial value systems for working in Saudi Arabia: An empirical investigation. *Group & Organizational Studies*, 10(2), 135-152.
- Abdalla, I.A., & Al-Homoud, M.A. (2001) Exploring the implicit leadership theory in the Arabian gulf states. *Applied Psychology An International Review*, 50(4), 506-531.
- Abdul-Gader, A.H., & Kozar, K.A. (1995) The impact of computer alienation on information technology investment decisions: An exploratory cross-national analysis. *MIS Quarterly*, 19(4), 535-559.
- Aberdeen Group. (2001, May). Worldwide IT spending 2001-2005: Forecast and analysis for hardware. *Software and Service*, 1-70.
- Ajeeb. (2001, March 25). *Over 3.5 million Arabs accessing the Net*. Retrieved from http://eit.ajeib.com/ViewArticle.asp?Article_ID=27643
- Amirshahi, M. (1997). *An empirical of managerial value systems and decision-making styles among the managers in Iran*. Unpublished PhD dissertation, Curtin University of Technology.
- Davison, R., Vogel, D., Harris, R., & Jones, N. (2000) Technology leapfrogging in developing countries-An inevitable luxury? *The Electronic Journal on Information Systems in Developing Countries*, 1(5), 1-10.
- El-Solh, C.F., & Mabro, J. (1994). Introduction: Islam and Muslim women. In C.F. El-Solh & J. Mabro (Eds.), *Muslim women's choices. Religious belief and social reality. Cross-cultural perspectives on women: Vol. 12*. Oxford/Providence: Berg.
- Feather, N.T. (1995). Values, valences and choice: The influence of value on the perceived attractiveness and choice of alternatives. *Journal of Personality and Social Psychology*, 68(6), 1135-1151.
- Flowers, V.S., Myers, C.L., Myers, M.S., & Myers, S.S. (1975). Managerial values for working (An AMA Survey Report). New York: Amacom.
- Graves, C.W. (1970). Levels of existence: An open systems theory of values. *Journal of Humanistic Psychology*, (2), 131-155.

- Gupta, V., Hanges, P.J., & Dorfman, P. (2002). Cultural clusters: Methodology and findings. *Journal of World Business*, 37(1), 11-15.
- Hill, C.E., Loch, K.D., Straub, D.W., & El-Sheshai, K. (1998) A qualitative assessment of Arab culture and information technology transfer. *Journal of Global Information Management*, 6(3), 29-38.
- Hofstede, G. (1991). *Cultures and organizations, software of the mind: Intercultural cooperation and its importance for survival*. McGraw-Hill.
- Hofstede, G. (2001a). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations* (2nd ed.) Thousand Oaks: Sage Publications.
- Hofstede, G.J. (2001b). Adoption of communication technologies and national culture. *Systèmes d'Information et Management*, 6(3), 55-74.
- House, R., Javidan, M., Hanges, P., & Dorfman, P. (2002). Understanding cultures and implicit leadership theories across the globe: an introduction to project GLOBE. *Journal of World Business*, 37(1), 3-10.
- Huntington, S.P. (1996). *The clash of civilizations and the remaking of world order*. New York: Simon and Schuster.
- Jarvenpaa, S.L., Tractinsky, N., Saarinen, L., & Vitale, M. (1999). Consumer trust in an Internet store: A cross-cultural validation. *Journal of Computer-Mediated Communications*, 5(2). Retrieved from <http://www.ascusc.org/jcmc/vol5/issue2/jarvenpaa.html>
- Kabasakal, H. & Bodur, M. (2002). Arabic cluster: A bridge between East and West. *Journal of World Business*, 37, 40-54.
- Khalid, A. (1994). Printing, publishing and reform in tsarist central Asia. *International Journal of Middle East Studies*, 26, 187-200.
- Noland, M. (2003) Religion, culture, and economic performance, WP 03-8, The Institute for International Economics. Retrieved from www.iie.com/publications/wp/2003/03-8.pdf
- Patai, R. (1973). *The Arab mind*. New York: Scribners.
- Simon, S.J. (2001). The impact of culture and gender on Web sites: An empirical study. *Database for Advances in Information Systems*, 32(1), 18-37.
- Solberg, C.A. (2002, December 5-7). Culture and industrial buyer behavior: The Arab experience. *Proceedings of the 18th IMP Conference de l'IMP*, Dijon.
- UNDP. (2003, October 20) Arab Human Development Report 2003. United National Development Program.
- Usunier, J-C. (1993) *International marketing: A cultural approach*. Prentice Hall.
- Weir, D. (2002, May 8-11) *Management in the Arab world: A fourth paradigm?* The European Academy of Management (EURAM 2002), Stockholm, Sweden.

KEY TERMS

Arab World: The Arab world is taken to include all 22 countries members of the Arab League.

Culture: According to Hofstede (1991), it is “[the] collective programming of the mind that distinguishes the members of one group of people from those of another”. For the 14th century Arab scholar, Ibn Khaldun, man is son to his habits and his environment, not to his nature and his moods. In all the literature about culture, there is a common understanding that culture is an abstraction from concrete behaviour but is not behaviour itself. Hofstede’s typology includes five cultural dimensions:

- **Individualism:** as opposed to collectivism, describes the degree to which a culture relies on and has allegiance to the self or the group.
- **Power Distance:** reflects the degree to which a culture believes how institutional and organizational power should be distributed.
- **Masculinity:** indicates the degree to which a culture values such behaviours as assertiveness, achievement, acquisition of wealth, social supports and the quality of life.
- **Uncertainty Avoidance:** refers to the extent to which a culture feels threatened by ambiguous, uncertain situations and tries to avoid them.
- **Long-Term Orientation:** reflects the degree to which a culture is oriented toward the search for virtuous behaviour rather than being oriented towards the search for truth.

Information Technology: Hardware, software, network and services related to the use and operation of equipment with the aim of processing and communication of analogue and digital data, information, and knowledge. These include computers and computer applications such as the Internet, Intranets, Extranets, Electronic Data Interchange, electronic commerce, mobile and fixed lines, etc.

ENDNOTES

¹ Most technological innovations are adopted by the Arabs with some delay. For example, if the printing press was invented around 1450, the first Arab book to have been printed was the Quran, in 1537 in Venice. Arabic character-based printing reached the Arabs only in 1728 under the reign of Ahmed III (1703-1730) when the Arabs were occupied by the Ottoman Empire. Bukhara (today's

Uzbekistan) delayed the introduction of printing until 1917 (See Khalid, 1994). It is as though in the Muslim world, the advent of printing broke the ulama's long-established control of knowledge. Similarly to the Bible and the printing press, no longer could knowledge be obtained through someone "more knowledgeable". It could be read and understood - or misunderstood—in libraries, schools, and even homes. Later, while e-mail was invented in 1971, the first Arabic Web-based mail solution was released in December 1998 (see <http://web1.maktoob.com/maktoob/press1998/press1998-1.html>). See more on Kaitlin Duck Sherwood's site, <http://www.webfoot.com/advice/WrittenArabic.html>.

² Nielsen//NetRatings (May 2003), www.journal_dunet.com/cc/01_internautes/inter_profil_eu.shtml, accessed August 31, 2003.

³ Ibn Khaldun, *The Muqaddimah, An Introduction to History*, Translated from French by F. Rosenthal, Princeton, 1958; 1967.

⁴ For Muslim Arabs, this may be explained historically and religiously by the fact that when the Divine message was delivered, the Angel Gabriel dictated the Quranic verses to the Prophet Muhammad. In all pre-modern times, documents were not copied; they were memorized, where there was no other way to preserve them.

⁵ In his book, "The Saddam Years" (Fayard, 2003), Saman Abdul Majid, personal interpreter to the deposed dictator, explains how, in 1993, President Clinton sent a secret agent to Iraq to suggest that a new leaf be turned over and that discussions be resumed. Saddam did not immediately answer, an act that Clinton took as a refusal. That file was then closed. In fact, Saddam was expecting a more solid and thought-out proposition to be put forward, and was surprised that Clinton did not come through with one. This mis-

communication between two men of very different cultures has had the now all-too known consequences.

⁶ It is assumed that most readers are familiar with Hofstede's work. Due to space limitations, details of his work will not be elaborated here. For more information, the reader is referred to Hofstede (2001b).

⁷ Also of interest is the GLOBE (Global Leader and Organizational Behavior Effectiveness) project which seeks to determine the relationship between leadership and societal culture (House et al., 2002). GLOBE uses nine dimensions, six of which are the same as Hofstede's: uncertainty avoidance, power distance, institutional collectivism, in-group collectivism, gender egalitarianism, assertiveness, future orientation, performance orientation, and humane orientation. Using these dimensions, Gupta et al. (2002) identified 10 "cultural clusters": Asia, Anglo, Arab, Germanic Europe, Latin Europe, Eastern Europe, Confucian Asia, Latin America, Sub-Sahara Africa and Nordic Europe. Unfortunately, often in GLOBE papers, the Arab cluster is composed of very few countries (see Abdalla and Al-Homoud, 2001). Other countries, such as Turkey, have disconcertingly been found in such "Arab clusters" (see Kabasakal & Bodur, 2002) ignoring the fact that Turkey is not a member of the Arab League and overlooking its claim to European Union membership.

⁸ Perhaps even in this order, especially if one takes into account the famous proverb in which an Arab states: "Me, against my

brother; my brother and I against our cousin; my brother, my cousin and I against all others." Was it not written of Ishmael (and by extension of all Arab children) in the Bible that "And he will be a wild man; his hand will be against every man, and every man's hand against him; and he shall dwell in the presence of all his brethren" (Genesis 16:12). This, however, does not seem to hold any longer given the events that took place between Iraq and Kuwait in 1990-1991 as well as since then.

⁹ Judging by the lack of cultural sensitivity of today's graphical user interfaces and icons, that technology is all but coming to the Arab culture.

¹⁰ The only exception being Iraq.

¹¹ This highly philosophical issue revolves around the overly simplified question that if God had already decided on much of what we humans will do on Earth even before we were created, what is the Last Judgment about?

¹² One has to remember that the digging of the trenches around Madina in the battle of Al-Ahzab, which was led by the prophet Mohamed (Peace Be Upon Him) and his companions as a defense system, and the application of Omar Ibn Al-Khattab, the second khalif after the prophet, of the filing system in the Islamic State, for organizing taxes on cultivated land and payroll of the soldiers are examples of imitation as they were borrowed from Non-Muslim Persians (see more on this subject on www.islam1.org/khutub/Imitation_of_None-Muslims.htm, accessed April 13, 2004).

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 21-27, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.13

ICT Growth and Diffusion: Concepts, Impacts, and Policy Issues in the Indian Experience with Reference to the International Digital Divide

Saundarjya Borbora
IIT Guwahati, India

ABSTRACT

This chapter examines the role of technology in economic and social development in developing countries, with a particular emphasis on India as an example. The concepts of ICT growth and ICT diffusion are examined. From this the chapter reviews the Indian government's successful policies encouraging ICT Growth through the support of the export-oriented service industry. This industry has witnessed long-term growth primarily as the result of the increasing tradability and consequent internationalisation made possible by changes in ICTs. However, the export focus policy has created enclaves within the Indian economy without significant forward and backward linkages. Evidence suggests that the International Digital Divide may be increasing. This chapter suggests that in order to maintain its relative technological position and to increase its comparative advantage in the IT sector, government policy should focus on domestic

ICT Diffusion. The chapter reviews several local public, private, and public-private initiatives to spread the use of ICT throughout Indian regions that have been successful and may serve to offer examples for future development. We conclude that ICT-driven development may be achieved with supportive central government policies, lessening the International Digital Divide.

INTRODUCTION

Today Information and Communication Technologies (ICTs) pervade almost all human activities. In both developed and developing countries there is an intense debate concerning the contribution of these technologies towards economic development and, consequently, human welfare. In relation to the economic benefits, several cross-country studies in recent years have indicated that the return on investment in information technology created by

increasing productivity and growth is substantial (Kraemer and Dedrick, 2001; Pohjola, 2001). According to Pohjola's study, the output elasticity of IT capital was found to be 0.31 for a sample of 39 countries, which is quite high, and a figure of 0.23 in the OECD sub-sample. Another cross-country study by the IMF (2001) also provides a similar conclusion. Country-specific studies, of Singapore for example, have concluded that the net return to IT capital is 37.9 percent compared to 14.6 percent for non-IT capital, which is about two and a half times higher (Wong, 2001). These studies also highlight that IT-induced productivity, and thereby economic development, is still concentrated in developed countries and the developing countries are yet to gain the same order of benefits as their counterparts in developed economies.

This leads us to the ongoing debate over the International Digital Divide. Examining the present unequal access to ICT, it may be stated that new technologies reinforce the disparities between developed societies and developing societies. Several studies supplement this view. OECD (2000) stated that affluent states at the cutting edge of technological advantage have reinforced their lead in the knowledge economy. The benefits enjoyed by the most technologically advanced economies have not yet trickled down to their neighbors. Many European countries are still behind the most advanced countries, not to speak of poor countries in the Sub-Saharan Africa, Latin America or South East Asia that are much further behind. Similarly, UNDP (1999) argues that productivity gains from ICT may actually widen the gulf between the developed economies and those that lack the skills, resources, and infrastructure to invest in ICT.

The impact of ICT can be seen from the perspective of two inter-related issues: ICT growth and ICT diffusion. ICT growth refers to the growth of IT-related industries and services and their effect on employment, export earnings,

and the outsourcing of activities. ICT diffusion refers to IT-induced development, which increases productivity, competitiveness, economic growth, and human welfare from the use of the technology by different sectors of the economy. Until now, India has mainly benefited from ICT growth through a series of institutional innovations and policy measures, although it would not be correct to say that the importance of ICT diffusion has not been recognized. For example, the software policy of 1986 explicitly recognized the importance of the balanced development of the software industry both for export and domestic use. But of late emphasis has been given to the diffusion of new technology and ICT-induced development. Therefore, in the Indian context, the often-cited success of the IT sector has not been achieved by the harnessing of new technology to increase efficiency and productivity, but mainly derived from earning foreign exchange by exporting IT-enabled goods and services. India's export performance in this sector is noteworthy in comparison with other producers of exports, not only in terms of its growth rates but also in terms of its stability.

The current chapter will focus on the direct benefits of ICT growth, paying special attention to the service sector. We argue that the role of IT in economic development has not received adequate attention. The purpose of the chapter is to highlight the contemporary economic realities and to suggest that the ICT development should be the focus of research and policymaking in India. We propose to undertake this both on the basis of empirical facts and on the basis of the arguments regarding the International Digital Divide. The central message of this chapter is that although ICT growth is important for developing countries such as India, it is time to shift the focus towards ICT-induced development. The following section subjects these issues to analytical and empirical scrutiny within the limits of data availability.

THE DIGITAL DIVIDE

The concept of the Digital Divide is a complex one that manifests itself in different ways in different countries. This leads us to accept that there is no single definition of the Digital Divide, although it is clear that there are growing disparities between the “haves” and “have-nots,” and to conclude that the potential impact on society will be exacerbated by technology. This divide poses both practical and policy challenges. It is also evident that solutions that work in developed countries cannot simply be transplanted to a developing country’s environment. Solutions must be based on an understanding of local needs and conditions.

Broadly, we can examine both International and Domestic Digital Divides. Real disparities exist both in the access to and the use of information and communication technology between countries (the International Digital Divide) and between groups within countries (the Domestic Digital Divide). The concept of the Digital Divide is grounded in substantial empirical research (Norris, 2001) and the extent of the Divide can be suggested with some statistics: “In the entire continent of Africa, there are a mere 14 million phone lines – fewer than in either Manhattan or Tokyo. Wealthy nations comprise some 16 percent of the world’s population, but command 90 percent of Internet host computers. Of all the Internet users worldwide, 60 percent reside in North America, where a mere five percent of world’s population reside” (Nkrumah, 2000). In addition to this, even the positive outlook adopted by the Economist (2000) accepted that “One in two Americans is online, compared with only one in 250 Africans. In Bangladesh a computer costs the equivalent of eight years’ average pay.” From such studies and statistics, the following patterns emerge:

There is a trend of growing ICT disparities between and within countries:

- All countries are increasing their access to and use of ICT. But those countries that are

the “information haves” are increasing their access and use at such an exponential rate that, in effect, the divide between countries is actually growing.

- Within countries, all groups are increasing access to ICT. But the “information haves” are increasing access and use at such an exponential rate that the division within countries is actually growing.

ICT DIFFUSION

The Digital Divide is not a simple phenomenon, but a complicated overlapping set of issues created by varying levels of ICT access, basic ICT usage, and the patterns of ICT applications among countries and peoples. Developing countries may have to achieve higher levels of *per capita* income in order to support the level of IT dissemination throughout society that is a precondition for ICT-induced development. However, due to the characteristics of ICTs, the leapfrogging of stages of development is possible as long as supportive government policies are in place. In fact it can be argued that there is an advantage in not having the problems associated with obsolete IT infrastructures and legacy systems typical in early investing countries for late entrants. Investment made in new technologies also complements investments already made in communication technologies such as satellites, telephone, and cable networks. Again newly developed technologies like the “wireless in local loop” (WILL) can significantly reduce the cost of last-mile connectivity, making it possible to connect remote villages cost-effectively (Planning Commission, 2001). Many new computer technologies are essentially multi-user by nature and there is scope for Internet kiosks, community Internet centers and hubs to provide access for many users. As previously indicated, late entrants such as India have the advantage of access to frontline technologies and cost-effective infrastructure development without the sunk costs in extant systems carried by many more developed

countries (Planning Commission, 2001). There exists real opportunities for promoting ICT diffusion through the involvement of both the public and private sectors, NGOs and other stakeholders (Mansell, 1999).

The new technologies are mostly supply-driven and provide a greater scope for diffusion agents to influence the technology diffusion process. There are a large number of organizations involved in developing country's ICT development and adoption. This multi-institutional stakeholder network should be in the forefront of diffusion of ICT in developing countries. In India recently there have been a number of ICT diffusion initiatives undertaken by the government, the private sector, and NGOs for economic development and to provide services to citizens. Some of the initiatives are in the initial stages, but acceptance by local communities has the potential to transform technological usage in rural areas of the country.

Bridging the Digital Divide: Selected Experiments from Indian States

The following section details some of the government initiatives that are underpinning technological change in Indian regions. This does not seek to be a comprehensive survey, but rather to present a selection of initiatives to give a feel for the type of development plans currently being undertaken. The first example examines an initiative in the state of Andhra Pradesh, which includes 23 districts, 1,125 mandals, 295 assembly constituencies and 28,245 revenue villages. This area has been digitized to a certain extent by a state-wide area network (SWAN) called APSWAN. With this SWAN the state is in a position to provide government-to-citizen services. Agricultural market yards have been computerized and connected with state headquarters, providing the prices of commodities and arrival times to markets and other important information to agriculturists. This process has the aim of eliminating middlemen and, in policy terms, the exploitation of farmers.

This digital connectivity also brings transparency and efficiency to the functioning of government. Other states are also trying to undertake similar projects.

The second example considers the Gyandoot Dotcom project in Madhya Pradesh, which has demonstrated the feasibility of universal access to information. The Dhar district has been connected by 21 centers situated in 30 villages using locally made servers and multimedia kits in a cost-effective way. Villagers are required to pay a nominal charge for services such as accessing land records and for regular market updates. Each of these centers has a potential clientele of around half a million inhabitants in the Dhar district. The success has emphasized the social and economic benefits of mass empowerment. The potential of this project has been recognized internationally for introducing a new paradigm in the use of IT in bringing about social transformation.

In addition, the region of Uttar Pradesh provides more examples of central and state government-initiated ICT service-based projects. Initiatives such as Internet kiosks providing e-mail and access to computer education programmes are common. In eastern UP, for example, Kashika Telecom has established a presence in low-cost dhabas (computer kiosks) financed through bank loans. Such initiatives can be seen in Karnataka, Tamil Nadu as well in the North Eastern States of India.

The private sector also has been responsible for developing new IT initiatives. The Zee Interactive Learning System Project, for example, provides interactive multimedia learning using satellite, video, Internet, and a cable network for delivery at several "ZED point" kiosks. This is directed towards educating rural children by constructing "knowledge building communities" at an affordable cost even to the rural population. With a continuing focus on education, the Intel Corporation has taken the initiative to set up teacher training laboratories to train 100,000 schoolteachers in India. At the time of this writing,

Table 1. Indicators of IT use in India's industrial sector, 1997

| Industries | Total no. of Factories | Percent of Factories with: | | | |
|---------------------------|---------------------------|----------------------------|---------|----------|-------------------------------------|
| | | Computers in office | Network | Internet | Robots or computer in production |
| Food products | 14,695 | 13.01 | 0.84 | 1.39 | 0.29 |
| Other food products | 8,109 | 24.17 | 1.38 | 2.01 | 1.64 |
| Beverages, tobacco, etc. | 8,669 | 47.81 | 0.36 | 0.28 | 0.14 |
| Cotton textiles | 9,227 | 22.28 | 0.54 | 1.87 | 1.37 |
| Wool/silk textiles | 3,989 | 49.76 | 1.25 | 2.28 | 0.25 |
| Jute/other fibre textiles | 503 | 16.70 | 0.40 | 3.78 | 0.60 |
| Textile incl. apparel | 5,409 | 51.32 | 3.18 | 11.31 | 2.09 |
| Wood and wood products | 3,787 | 8.98 | 0.40 | 0.95 | 0.24 |
| Paper and paper products | 6,304 | 38.50 | 1.84 | 3.73 | 4.71 |
| Leather products | 1,742 | 37.60 | 1.89 | 7.18 | 0.29 |
| Basic chemicals/related | 9,357 | 50.69 | 2.91 | 5.58 | 2.56 |
| Rubber/plastic/coal | 7,597 | 42.57 | 2.80 | 4.01 | 1.59 |
| on met. mineral product | 11,376 | 13.37 | 0.41 | 0.95 | 1.09 |
| Basic metal/alloys | 6,915 | 41.94 | 0.93 | 3.69 | 1.72 |
| Metal products | 8,243 | 31.68 | 0.92 | 2.86 | 1.01 |
| Machinery/equipment | 8,203 | 44.46 | 2.12 | 5.63 | 2.66 |
| Electric machinery | 5,743 | 55.77 | 3.53 | 10.92 | 4.89 |
| Transport equipment | 3,999 | 46.96 | 1.63 | 7.15 | 2.58 |
| Scientific equipment | 2,243 | 48.02 | 4.01 | 14.00 | 3.97 |
| Repair of capital goods | 2,240 | 25.89 | 0.80 | 1.96 | 0.36 |
| Electricity | 3,644 | 64.71 | 0.93 | 3.10 | 3.24 |
| Gas and steam | 80 | 75.00 | 2.50 | 3.75 | 5.00 |
| Water works and supply | 293 | 10.58 | 0.68 | 1.02 | 0.68 |
| on-conventional energy | 4 | 25.00 | 25.00 | 25.00 | 0.00 |
| Storage and warehousing | 1,078 | 0.37 | 0.37 | 0.09 | 0.00 |
| Sanitation | 102 | 0.00 | 0.00 | 0.00 | 0.00 |
| Motion pictures, etc. | 51 | 7.84 | 7.84 | 27.45 | 0.00 |
| Laundry and others | 94 | 0.00 | 0.00 | 0.00 | 0.00 |
| Repair services | 1,966 | 2.59 | 2.59 | 1.12 | 0.00 |
| All Industries | 135,679 | 34.70 | 1.50 | 3.72 | 1.77 |

Source: Annual Survey of Industries (CSO), 1997

Intel also envisages operating a “cyber school on wheels” project also targeted toward educating rural masses.

Despite the initiatives outlined above, there is no specific central government policy for ICT diffusion in India. However, the current evidence

suggests that there has been some degree of ICT diffusion created by both the activities of industry and discrete public and private initiatives. Within India, computers for accounting and management functions are widespread, especially in private enterprises (as in Table 1). With regard to Internet

use, some industries are ahead of others. Evidence shows, in this time of liberalization and globalization, that some firms are using technology to increase their productivity and competitiveness. Some degree of ICT diffusion has been taking place, although it may be mostly confined to the manufacturing sectors of the economy, even though this has been a low central government political priority.

ICT AND THE SERVICE SECTOR

Economic globalization has facilitated the internationalization of the service sector and the advances in ICTs have made it possible for firms to provide novel services that are creating new forms of international trade. Service industries provide links between geographically dispersed economic activities and play an important role in the growing interdependence of markets and production activities across nations. As technology develops, it further reduces communication costs, stimulating the faster growth of the international trade in services.

For developing countries such as India, the internationalization of services and the development of the ICT sector have provided an opportunity as well as a challenge. The opportunity has been in terms of the potential exports of services and of service-related foreign investments and trade. The challenges are for designing appropriate regulatory environments for the service sector as it is an important factor influencing productivity and competitiveness, providing the necessary investments in the ICT sector and adapting the education system in line with the requirements of the Information Age.

Until recently economists characterized the service sector as generally non-tradable activities whose growth was perceived to be a by-product of expansion of the primary and secondary sectors. The changes in the service sector driven by development in ICTs have changed this concep-

tion and today service industries are regarded as a pre-condition of economic growth. The main growth in this area has been the rapid expansion of knowledge-intensive services (KIS), such as professional and technical services, advanced health care, education, banking, and insurance. The growing tradability of services has been a direct outcome of these changes, and many developing countries have benefited from the outsourcing of services by multi-national companies (MNCs) made possible by ICTs. Today service industries are important investors in IT throughout the world, and KISs that have high income elasticity are growing in both developed and developing economies. Technological innovation has expanded the opportunities for the provision of services, and electronic networks such as the Internet are a dynamic force for creating new possibilities for trade between distant areas. Technological developments in ICTs are driving not only the internationalization of services but also of manufacturing and primary industries, as technology blurs the boundaries between products and services. In the United States, for example, as much as 65 to 75 percent of employment in manufacturing may be associated with service-based activities (Braga, 1996). With falling communication costs the potential for international outsourcing in both the service and manufacturing industries has grown.

Service activities such as data entry, the analysis of income statements, the development of computer software and financial products are mostly exportable services. The impact of ICTs on the tradability of services is not only limited to international markets, but has facilitated the expansion of services within and between regions, from firms to final consumers. Even services in which consumer-provider interaction has been very high, such as education and health services, are today offered using high technology in ICT. Advances in computer-mediated technology make it possible to effectively gain the benefits in distance education and tele-medicine without

relocating to provider locations. Trade in commercial services has been growing exponentially, and with the internationalization of services the flow of FDI to developing countries has increased faster than global trade and output. Services now represent a much higher share of FDI. The prospect for the continuing internationalization of services through FDI is bright as the demand for services is still in the growth phase. Developing countries are attracted to FDI in services as a means of obtaining the transfer of technical and professional skills and know-how.

As modern service industries are highly ICT-dependent they require human and financial capital input. Developing countries such as India are carving out areas of comparative advantage in IT-based services, and one of their key strengths is the ability to offer access to large numbers of highly trained and lower-cost IT professionals. This phenomenon not only acts to expand exports, but also helps domestic producers gain access to more efficient and diversified services in world markets. Efficient producer services are increasingly important in this outward-oriented development strategy.

Developing countries have much scope for the expansion of traditional service export areas. Data entry was one of the first services to be the subject of international outsourcing. Software programming is another activity that is increasingly traded internationally. India has taken a big lead in these areas and one estimate suggests that India has captured roughly 12 percent of the international market for customized software. Yet another area of strong comparative advantage is in “back office” service activities. For example, several US and UK-based insurance and accounting companies now send claims overseas for processing. In manufacturing, service activities such as logistics management, design, and customer services are being outsourced internationally. It may be difficult to estimate precisely the size of these markets, but from the perspective of developing

countries the potential impact in terms of higher exports over the long term is significant. These important developments reveal that developing countries with large workforces and a modern technology infrastructure can successfully exploit the changing patterns of international production made possible by ICTs.

THE INDIAN IT EXPORT SCENARIO

The growth of IT exports from India over the last decade has been the subject of considerable interest to developed as well as developing economies. This attention has been stimulated by studies demonstrating that the spillover benefits and linkages with the rest of the economy from the IT sector are extensive (Joseph, 2002). The contribution made by Software Exports to India’s Economy is shown in Table 2.

Table 2 illustrates the sustained growth of foreign exchange earnings represented by Software Exports to the Indian economy, and highlights the rapid increase made after the liberalization of the Indian economy to the international services sector began in 1991.

Whether the IT sector with its export-oriented growth strategy will generate significant spillovers and linkage effects with the rest of the economy is not the focus of this chapter, but on the basis of available data this seems unlikely. The Indian IT industry appears to be locked into activities such as low-level design, coding and maintenance with negligible linkages to rest of the economy (D’Costa, 2001). As these activities are primarily driven by the export market, the growth of this sector remains an enclave of the general economy without many forward or backward linkages. In terms of the spatial location of the industry, approximately 90 percent of software development and export is confined to the four major metropolitan areas of Bangalore, Mumbai, Delhi and Chennai (as shown in Table 3), leading

ICT Growth and Diffusion

Table 2. India's software exports (gross foreign exchange earnings)

| Year | Software Exports(US\$m) | Export Growth (%) |
|------------------|--------------------------------|--------------------------|
| 1980 | 4.0 | - |
| 1981 | 6.8 | 70% |
| 1982 | 13.5 | 99% |
| 1983 | 18.2 | 35% |
| 1984 | 25.3 | 39% |
| 1985 | 27.7 | 9% |
| 1986 | 38.9 | 40% |
| 1987 | 54.1 | 38% |
| 1988/89(Apr-Mar) | 69.7 | (29%) |
| 1989/90 | 105.4 | 51% |
| 1990/91 | 131.2 | 24% |
| 1991/92 | 173.9 | 33% |
| 1992/93 | 219.8 | 26% |
| 1993/94 | 314.0 | 43% |
| 1994/95 | 480.9 | 53% |
| 1995/96 | 668.0 | 39% |
| 1996/97 | 997.0 | 49% |
| 1997/98 | 1650 | 65% |
| 1998/99 | 2180 | 32% |
| 1999/2000 | 3600 | 65% |
| 2000/01 | 5300 | 47% |
| 2001/02 | 6200 | 17% |
| 2002/03 | 7800 (est.) | 24% |

Source: Heeks, 1999

Mansell (1999) to perceive that export-oriented IT growth would seem to have generated marginal spillover benefits.

The IT sector export-based strategy has been successful in India primarily as a result of the outsourcing of services by the firms based in the developed economies. India has been the focus for many Western firms as its competitive advantage is based on technological agility, flexibility, cost control, time-to-market and quality. These advantages are rooted in the established education sector, and Indian technology institutes are acknowledged as world-leading institutions that

select and train IT professionals. 115,000 Indian IT professionals graduate annually in a country with an English speaking population of around 1 billion people. There is expansion in the IT market with more than 3,000 Indian software exporting companies currently having export relationships with over 100 countries. Some of the leading Indian companies are registered with the NYSE or Nasdaq.

It should be noted here that the IT sector is highly labour intensive, and one that employs mostly skilled labour, although the level of this varies with the nature of a firm's activities. Avail-

Table 3. Distribution of software sales and exports across major locations in India

| Location | Sales % | | Exports % | |
|-------------|---------|------|-----------|------|
| | 1997 | 1998 | 1997 | 1998 |
| Bangalore | 33.9 | 27.9 | 30.3 | 29.7 |
| Mumbai | 24.3 | 24.7 | 27.5 | 24.0 |
| Delhi/Noida | 15.9 | 20.3 | 15.3 | 18.5 |
| Chennai | 14.8 | 16.8 | 15.5 | 17.3 |
| Hyderabad | 4.2 | 5.4 | 5.3 | 6.3 |
| Calcutta | 3.3 | 2.3 | 1.5 | 1.3 |
| Others | 3.6 | 2.6 | 4.6 | 2.9 |

Source: Joseph, 2002:16

Table 4. IT labour costs across different countries in 1995 (Note: Figures are averages for 1995 and were likely to rise 5 to 10 percent approximately per annum, with rates being slightly higher in lower-income countries.)

| | Switzer land | USA | Canada | UK | Ireland | Greece | India |
|------------------------------|------------------|--------|--------|--------|---------|--------|--------|
| | (US\$ per annum) | | | | | | |
| Project leader | 74,000 | 54,000 | 39,000 | 39,000 | 43,000 | 24,000 | 23,000 |
| Business analyst | 74,000 | 38,000 | 36,000 | 37,000 | 36,000 | 28,000 | 21,000 |
| System analyst | 74,000 | 48,000 | 32,000 | 34,000 | 36,000 | 15,000 | 14,000 |
| System designer | 67,000 | 55,000 | 36,000 | 34,000 | 31,000 | 15,000 | 11,000 |
| Development programmer | 56,000 | 41,000 | 29,000 | 29,000 | 21,000 | 13,000 | 8,000 |
| Support programmer | 56,000 | 37,000 | 26,000 | 25,000 | 21,000 | 15,000 | 8,000 |
| Network analyst/designer | 67,000 | 49,000 | 32,000 | 31,000 | 26,000 | 15,000 | 14,000 |
| Quality assurance specialist | 71,000 | 50,000 | 28,000 | 33,000 | 29,000 | 15,000 | 14,000 |
| Database data analyst | 67,000 | 50,000 | 32,000 | 22,000 | 29,000 | 24,000 | 17,000 |
| Metrics/process analyst | 74,000 | 48,000 | 29,000 | 31,000 | - | 15,000 | 17,000 |
| Documentation/training staff | 59,000 | 36,000 | 26,000 | 21,000 | - | 15,000 | 8,000 |
| Test engineer | 59,000 | 47,000 | 25,000 | 24,000 | - | 13,000 | 8,000 |

Source: Heeks (1999), adapted from Rubin (1996)

able empirical evidence suggests that the IT export boom of the last decade should be considered in the context of India's labour cost advantage (as shown in Table 4). The IT sector upswing has led to increases in the demand for labour and also wage rates.

Table 4 reflects India's cost advantage in relation to skilled employable labour in the IT sector.

More than this, off-shore IT work is also cheaper for MNCs than employing Indian IT labour onsite. For example, using data invoice processing as an example, onsite work at the client's site would cost US \$8,000 (plus local taxes) as opposed to US \$4,600 offsite in India (Heeks, 1999).

POLICY MEASURES SUPPORTIVE OF IT GROWTH IN THE INDIAN EXPERIENCE

The importance of promoting the software development industry has long been recognized in India by the Department of Electronics (DoE), and suitable supportive policies were in place as far back as in 1972 (Parthasarathi and Joseph, 2002). By 1982 the DoE had begun concentrating on software export promotion policies, and the Computer Policy of 1984 gave further thrust to the industry by underlining the need for institutional and policy support in key areas. The accelerated growth of the computer industry after 1984 created calls for the rationalization of the import policies and for additional export promotion. As a result of this, a new policy was announced in 1986 that identified software specifically as one of the key areas for export promotion and underlined the importance of an integrated approach to the development of software for both domestic and export markets. This policy had the following major objectives:

- To promote software exports to take a quantum leap and capture a sizeable share in international software markets;
- To promote the integrated development of the national software industry for both domestic and export markets;
- To simplify existing procedures allowing the software industry to grow faster;
- To establish a strong base for the national software industry in India;
- To promote the use of the computer as a decision-making tool, to increase work efficiency, and to promote appropriate applications in order to gain long-term benefits of computerization for the economy.

To achieve these objectives various commercial incentives were provided to software firms. These measures included tax holidays, income-tax

exemption on software exports, and the subsidized and duty-free import of hardware and software used for export industries.

In 1991 the Indian government began to open the economy with a programme of market liberalization and economic reform. At that time the Indian government's assessment of the IT industry was that India had a comparative advantage in the software export market but not the hardware sector. Following this evaluation, the government consciously prioritized software exports and new policy measures were initiated to support this strategy, including the removal of entry barriers for foreign companies, the lifting of restrictions on foreign technology transfers, the participation of the private sector in policymaking, the provision of finance through equity and venture capital, reforms for faster and cheaper data communication facilities, and the rationalization of taxes and tariffs (Narayanmurthy, 2000).

In addition to these measures the Indian government also undertook a series of institutional reforms including the establishment of an integrated Ministry of Communications and Information Technology. One key development stemming from these reform was the establishment of Software Technology Parks (STP) to provide the necessary infrastructure for software exports. At the time of this writing, there are 18 STPs in India throughout the country and these play a significant role in exports. The total number of units registered with the STPs increased from 164 in 1991 to 5,582 in 1999, accounting for about 68 percent of all Indian IT Exports (Table 5). The facilities in these STPs include, amongst others, modern computers and communication networks that are beyond the reach of individual firms. In June 2000 a new STP consisting of a business support center and an India Infotech Center was set up in Silicon Valley to facilitate software exports by small and medium Indian firms to the US (Economic Times, 2000). The center also fosters business relationships by providing access to US financial institutions, venture capitalists and

Table 5. Trends in IT exports from units registered with software technology parks

| Year | No. of units registered With STPs | Total exports from India (US\$million) | Share of STP units in total exports |
|-----------|--------------------------------------|---|--|
| 1991-92 | 164 | 164 | na |
| 1992-93 | 227 | 225 | 8 |
| 1993-94 | 269 | 330 | 12 |
| 1994-95 | 364 | 485 | 16 |
| 1995-96 | 521 | 734 | 29 |
| 1996-97 | 667 | 1085 | 46 |
| 1997-98 | 844 | 1750 | 54 |
| 1998-99 | 1196 | 2650 | 58 |
| 1999-2000 | 5582 | 3900 | 68 |

Source: Joseph, 2002

specialized trade bodies to promote partnership between the US and Indian ICT software and service companies.

The success of the aforementioned policies and of the STPs led to an appreciable growth of investment in ICT exports (Venkitesh, 1995). The growth of the sector outstripped that of the workforce, leading to eventual labour constraints (Schware, 1987; Sen, 1995). Traditionally the main source of ICT and software professionals was from Indian public-sector educational institutes such as the Indian Institutes of Technology (IITs), Industrial Training Institutes (ITIs) and engineering colleges, as well as additional public-sector institutions such as C-DAC and CMC, Ltd. engaged in training computer personnel. With the demand for skilled IT-sector labour increasing in the early 1980s, the Government permitted private investment in IT training. Today, there are private companies running training centers throughout the country through franchise networks offering many courses. These institutes primarily cater to the middle and lower-skill-level labour demand. In addition to this, seven Indian Institutes of Information Technologies (IIITs) were established to provide excellence in IT with the input of academics. Available estimates indicate that in 1999 there

were over 1,832 educational institutions providing training in IT to 67,785 professionals (Nasscom, 1999). The breakdown of the current labour pool indicates that holders of the three main awards relevant to the sector, B.Techs, diplomas and ITI certificates, account for some 70 percent of the total IT workforce in India.

Besides development of the infrastructure and labour pool for the IT sector, the Indian government has taken measures to address the problem of software piracy by including the protection of the computer software copyright within the established Indian Copyright Act of 1957, reinforcing active role of the state in promoting the industry. Other factors which have added to India's comparative advantage in this sector have been the availability of a highly skilled English speaking workforce and also the time difference between India and major export markets such as the USA.

It is clear that over the last decade the Indian IT sector has benefited enormously from a national system of innovation comprised of many actors working effectively together in order to develop international competitive advantage and credibility. This successful strategy has been the result of a focused state development strategy

toward the promotion of the ICT software and service sector for foreign exchange earnings. This export-oriented strategy has so far overlooked the importance of ICT diffusion to the economy in general, such as improved efficiency, productivity, and competitiveness to domestic industries and services.

CONCLUDING REMARKS

Today there is an increasing realization that the benefits offered by IT for improvements to human welfare, economic productivity, and growth are mainly limited to the developed economies. Even though this International Digital Divide is a feature of the current global environment, there is potential to reducing the gap between the leading and developing countries with appropriate government policies. The development of such policies requires an integrated approach with the involvement of actors in counties across the public and private sectors. Sustained development requires both revenues from ICT-growth strategies and from improvements to the economy obtained through ICT diffusion. With reference to the Indian experience, we can observe that an export-oriented IT-growth strategy has deflected attention away from ICT diffusion at a time when a recent study by the IMF (2001) has reported that IT-using countries tend to benefit more than IT-producing countries. The disappointing welfare gains for IT producers have been attributed to the deterioration in the terms of trade between the producers and users. Despite the growth of the software industry, India is also among the losers. These finding underline the importance of the complementary roles of the domestic market in promoting innovation and exports and export-orientated, IT-induced productivity and growth. The policy implication for developing countries, and for India in particular, would suggest that ICT diffusion should be prioritized for economic development and growth.

The growth of the service sector has been one of the key drivers of economic development in both the developed and developing world in the last decades, underlining the fact that international competitive advantage will in the future be determined more by trade in intangibles rather than goods. Developing countries such as India can obtain the benefits resulting from the internationalization of services with the adoption of liberal trade and investment policies designed to support IT growth. However, in order to maximize the wider economic and social benefits, complimentary policies supporting national ICT diffusion cannot be overlooked, and should be the focus of future policy development.

ACKNOWLEDGMENTS

I would like to express our gratitude to Professor K. J. Joseph (Jawaharlal Nehru University, India), Dr. Richard Heeks (University of Manchester, UK), and the information officer of Bridges.org for allowing the use of the duly acknowledged sources in the development of this chapter.

REFERENCES

- Arora, A., Arunachalam, V.S., Asundi, J. and Ronald, F. (2000). The Indian Software Services Industry. *Research Policy*, 30, 1267-1287.
- Bedi, K., Singh, P.J. and Srivastava, S. (2001). *Government @ Net: New Governance Opportunities for India*. New Delhi: Sage Publications.
- Braga, C.A.P. (1996). The Impact of the Internationalization of Services on Developing Countries. Retrieved February 17, 2002 from the World Wide Web: <http://www.worldbank.org/fandd/English/0396/articles/070396.htm>.
- Bridges.org. (2001). Spanning the Digital Divide: Understanding and Tackling the Issues Retrieved

February 17, 2002 from the World Wide Web: <http://proto.bridges.org.za/spanning/pdf/SpanningTheDigitalDivide.pdf>.

Compaine, B.M. (Ed.). (2001). *The Digital Divide: Facing a Crisis or Creating a Myth?* London: MIT Press.

D'Costa, A. (2001). *Export Growth and Path Dependence: The Locking in of Innovations in the Software Industry*. New Delhi: University of Pennsylvania Institute for the Advanced Study of India, Mimeo.

Economic Times. (2000). STPI Now Opens Office at Silicon Valley, USA. Special Supplement on Software Technology Parks of India, June 11, New Delhi, India.

The Economist. (2000). *Falling Through the Net?* Print Edition, September 21.

Government of India. (1972). Annual Report. New Delhi: Department of Electronics.

Government of India. (1982). Annual Report. New Delhi: Department of Electronics.

Government of India. (1985). New Computer Policy. *The Gazette of India*, August 31, 679-681.

Government of India. (1986). Policy on Computer Software Exports, Software Development and Training. New Delhi: Department of Electronics.

Government of India. (1996). Guide to Electronics Industry in India. New Delhi: Department of Electronics.

Heeks, R. (1996). *India's Software Industry: State Policy, Liberalization and Industrial Development*. New Delhi: Sage Publications.

Heeks, R. (1999). Indian Software Labour: Cost Breakdown and Comparison. Retrieved March 15, 2002 from the World Wide Web: <http://idpm.man.ac.uk/rsc/is/isi/isiscost.shtml>.

IMF. (2001). *World Economic Outlook: The Information Technology Revolution*. Washington, D.C.: IMF.

Joseph, K.J. (1997). *Industry Under Economic Liberalization: The Case of Indian Electronics*. New Delhi: Sage Publications.

Joseph, K.J. (2001). IT Boom, the Economy and Labour. *Labour and Development*, 7(2), 1-36.

Joseph, K.J. (2002). Growth of ICT and ICT for Development: Realities and Myths of the Indian Experience. World Institute for Development Economics Research. Discussion paper No. 2002/78. Retrieved February 15, 2002 from the World Wide Web: <http://www.wider.unu.edu/publications/dps/dps2002/dp2002-78.pdf>.

Joseph, K.J. and Harilal, K.N. (2001). Structure and Growth of India's IT Exports: Implications of an Export-Oriented Growth Strategy. *Economic and Political Weekly*, 36(34), 3263-3270.

Kanungo, S. (1999). *Making Information Technology Work*. New Delhi: Sage Publications.

Kiely, R. and Marfleet, P. (Eds.). (1998). *Globalization and the Third World*. London: Routledge.

Kraemer, K.L. and Dedrick, J. (2001). Information Technology and Economic Development: Results and Policy Implications of Cross-Country Studies. In M. Pohjola (Ed.), *Information Technology, Productivity and Economic Growth*. Oxford: OUP.

Kumar, N. (2001). Indian Software Industry Development: International and National Perspective. *Economic and Political Weekly*, 36, 4278-4290.

Mansell, R. (1999). *Global Access to Information Communication Technologies*. Johannesburg and Canada: International Development Center.

Michie, J. and Smith, J.G. (Eds.). (1998). *Globalization, Growth and Governance: Creating an Innovative Economy*. Oxford: Oxford University Press.

- Monen, P. (2001). International R&D Spillovers and Economic Growth. In Pahjola, M. (Ed.), *Information Technology, Productivity and Economic Growth*. Oxford: OUP.
- Narayanamurthy, N.R. (2000). Making India a Significant IT Player in This Millennium. In Thapar, R. (Ed.), *India: Another Millennium*. New Delhi: Viking and Penguin Books.
- Nasscom. (1999). *Directory of Indian Software and Service Companies*. New Delhi: Nasscom.
- Nasscom. (1999). *The Software Industry in India: A Strategic Review*. New Delhi: Nasscom.
- Nkrumah, G. (2000). Digital Divide. Al-Ahram Weekly, 27 July to 2 August. Retrieved August 25, 2000 from the World Wide Web: <http://weekly.ahram.org.eg/2000/492/in3.htm>.
- Norris, P. (2001). *Digital Divide: Civic Engagement, Information Poverty and Internet Worldwide*. Cambridge: Cambridge University Press.
- Oberoi, S.S. (1991). Software Technology Park: Concepts, Procedures and Status. *Electronics Information and Planning*, 19(3), 42-46.
- OECD. (2000). *Information Technology Outlook*. Paris:OECD.
- Parthasarathi, A. and Joseph, K.J. (2002). Limits to Innovation Set by Strong Export Orientation: The Experience of India's Information Communication Technology Sector. *Science, Technology and Society*, 7(1), 13-49.
- Planning Commission. (2001). *India Knowledge Super Power: Strategy for Transformation*. New Delhi: Planning Commission.
- Pohjola, M. (2001). Information Technology and Economic Growth: A Cross-Country Analysis. In M. Pohjola (Ed.), *Information Technology, Productivity and Economic Growth*. Oxford: OUP.
- Rodrik, D. (1995). Trade and Industrial Policy Reform. In J. Behrman and T.N. Srinivasan (Eds.), *Handbook of Development Economics, Vol. III B*. New York: Elsevier.
- Rubin et.al. (1996). *Worldwide Benchmark Project*. Pound Ridge, NY: Rubin Systems.
- Schware, R. (1987). Software Industry in the Third World: Policy Guide Lines, Institutional Options and Constraints. *World Development*, 15(10/11), 1249-1267.
- Schware, R. (1992). Software Entry Strategies for Developing Countries. *World Development*, 20(2), 143-164.
- Sen, P. (1995). Indian Software Exports: An Assessment. *Economic and Political Weekly*, 30(7-8), 2053-2058.
- UNDP. (1999). *Human Development Report 1999*. New York: Oxford University Press.
- Venkitesh, P. (1995). *India's Software Exports: A Study with Special Reference to Technology Parks*. Trivandrum: Center for Development Studies, JNU. Unpublished M.Phil dissertation.
- Wong, P.K. (2001). The Contribution of Information Technology to the Rapid Economic Growth of Singapore. In M. Pohjola (Ed.), *Information Technology, Productivity and Economic Growth*. Oxford: OUP.

This work was previously published in Digital Economy: Impacts, Influences and Challenges, edited by H. Kehal & V. Singh, pp. 236-251, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.14

ICT, Education, and Regional Development in Swiss Peripheral Areas

Chiara Giorgi

Università della Svizzera Italiana (USI), Switzerland

Dieter Schürch

Università della Svizzera Italiana (USI), Switzerland

INTRODUCTION

Since the end of 20th Century, the introduction of Information and Communication Technologies (ICT) has deeply influenced many aspects of everyday life, leading to the creation of new meanings for the traditional concepts of identity, culture, economy and, above all, communication (Mantovani, 1995; Perriault, 1989; Rullani, 2002). Trends about technological development show how, in the next years, the change will gradually concern all elementary daily actions, due to spreading of the electronic devices in the environment (OCDE, 2002; Saracco, 2003). If ICT will be ever more deeply-rooted in our reality, how fast will they consequently influence our socio-cultural identity? What sort of consequences do we have to imagine at economic level? What variety of scenarios can we draw about our future?

And, above all, how will the concept of development change?

If on the one hand the global trend seems to lead towards a reality without any kind of borders, on the other one the political and cultural centres are privileged in taking advantage of the opportunities opened by ICT. Therefore, peripheral areas¹ run the risk of becoming more and more isolated and excluded from the innovation process. Is it possible to reverse this tendency by using ICT as developmental devices? Can we re-direct the attention on those areas that seem to be “dead” regions? And in what way?

BACKGROUND

The relationship between communication and regional development has deeply influenced the fate of a great number of geographical areas;

examples are the building of railways, of roads and fluvial connections. If and in what way can the CmC² be considered a factor, parallel to those we have mentioned, to open new opportunities for peripheral regions?

The rapid spread of communication networks— ignoring the presence of natural and political boundaries—is changing the economic and social scenarios. In this context, new kinds of “regions” are emerging, the so-called “learning regions” (Florida, 1995). They are characterized by a system in which communication networks and data processing work give both shape and substance to connections between public institutions (such as schools and universities) and private institutions (firms), this leading to generate new knowledge and productiveness.

In Switzerland, a country characterized by a strong multicultural and multilingual tradition (above all in valleys of alpine regions), the creation of a new idea of “region” meets several kinds of dissensions. There are a lot of questions about the way to get over mental and cultural borders (see Arnaud & Perriault, 2002; Bressaud & Dirlter, 2003; Calvo, Ciotti, Roncaglia & Zela, 1998).

The behavioural changes always continue in daily action, and the action always places itself in a human, social, geographical, cultural and economic territory (Brown, Collins & Duguid, 1989). The use of communication devices can't escape this rule, because they've got a sense if they can be interpreted and situated by the people who live in that particular area (Galimberti & Riva, 1997). The process of interpretation of these devices had to consider, on the one hand, the starting of forms of “unlearning” (Grabher, 1993), and on the other one the building of a different nature of the concept of territory that has to be identified and tested (Delai & Marcantoni, 1992).

REGIONAL DEVELOPMENT IN SWISS PERIPHERAL AREAS

Situation in Peripheral Sub-Alpine Regions

Swiss reality is characterized by fragmentation at several levels. From a geographical perspective, the mountainous territorial morphology creates several natural partitions, causing the isolation of some areas and particularly those distributed along the Alpine chain. Besides, the Swiss Confederation is a set of 26 political Cantons, each of these having its own administrative independence even if partial, and with four official languages³. At a deeper level, the fragmentation is perceived as socio-cultural complexity: geographical and political configurations, in fact, don't correspond to an unequivocal identity; very often different cultural and language realities—including dialects - are present on the same territory, giving it a cross cultural profile⁴.

The process of globalisation over the last decade has led to the trend of concentrating the power in the centres, namely those places having infrastructures and accessibility to innovation, and so to choose a developmental way. These centres become the reference point for all the relevant activities. These are the “places of the knowledge,” the places where people decide the future trends of development, definitely the places that the peripheral regions “gravitate around.” From this perspective, the break between central and peripheral areas becomes even more perceivable. Peripheral regions seem to have neither any kind of power about their future development, nor interesting elements making them recognizable as “cultural regions.” If this trend is observed at a general level, now it has repercussions also

on Swiss Confederation, European symbol of a perfect integration between different cultures and ethnic groups.

What is actually going on in these regions, often coincident with valleys? First of all, it is important to point out the trend of native people moving out from the territory, frequently youth, to find a better working perspective just in the centres. This leads, obviously, to a progressive death of the local economy and working activities. The economic sphere, anyway, can't be separate by the question regarding education, in which the working world is deeply-rooted. If this movement from the regions begins in the young age, it's necessary to understand the reason underlying that.

During the period of education, the young decide to abandon his/her own place of origin to look for better education and training opportunities. In some cases, the young have no other choice. This problem is strongly felt about vocational training, that represents a relevant portion of educational system: more than 60% of young people, in the age of secondary education, choose the way of apprenticeship. Swiss apprenticeship is based on the dual vocational system coming from the German tradition. Apprentices work in a company or small firm and at the same time attend Vocational School. The dual system spans over the whole training period, up to four years, thus insuring the connection between school and education and the working world. What happens in remote regions? Vocational Schools collect different professional trainings and are often dislocated far away. The apprentice is forced to leave his native territory during the week to move to the place where he can study and carry on his/her apprenticeship in a firm. This situation of eradication from the native territory leads the young to a progressive loss of his/her own socio-cultural identity, to get hold of the place he/she will study or work.

Finally, we have to face a sociological problem: the development of a negative mentality. If valleys are characterized by the elements mentioned before, the young person—but not only our youth—is

led to relate his/her native region with lack of real opportunities for the future, and definitely not to recognize any chance of development.

What long-term consequences can we imagine for the increasingly isolated valleys? How is it possible to intervene, so as to change this vision about the future? Can the introduction of ICT change this situation?

Swiss Regional Development

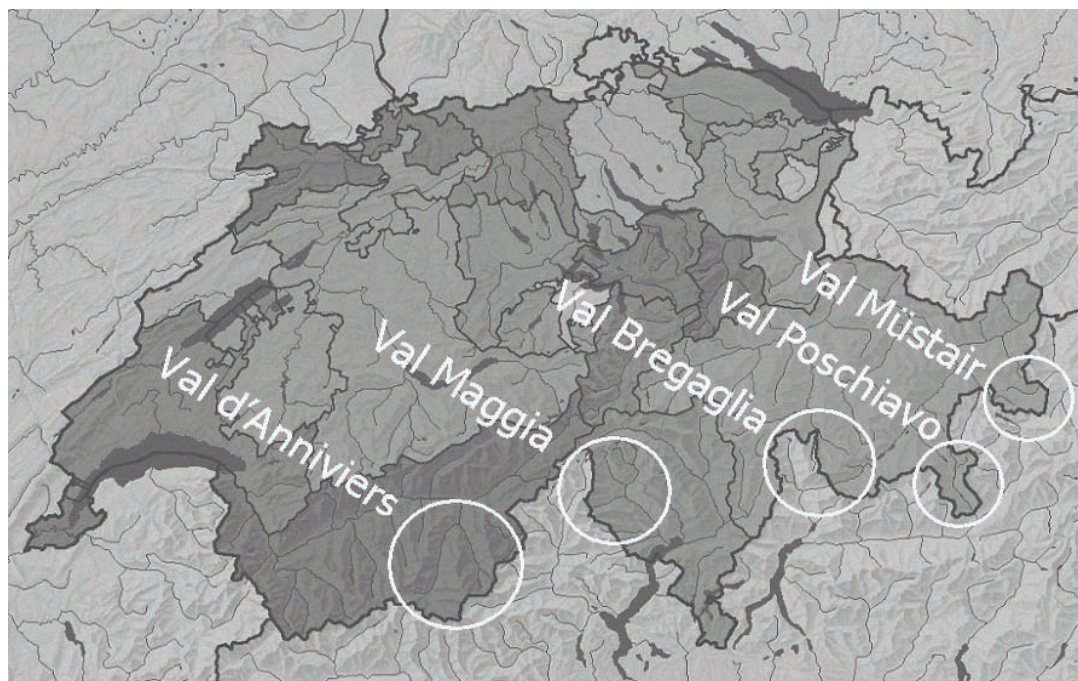
Since 1995, Swiss peripheral zones of sub-alpine arch (see Figure 1) are involved in projects of regional development, based on the conviction that changes take place not simply by giving direct financial support, but by setting up educational and training devices, to achieve a revaluation of these regions as characterized by their own specific social, cultural and economic values and so to allow them to survive both on the identity level and the economic one.

Poschiavo Project: A Pilot Project

The pilot project, Progetto Poschiavo⁵, started in 1995 involving the area of Poschiavo Valley, a region of the Grisons Canton at the boundaries with Italy, speaking Italian, German and Romansh. The aims of the project were both the revaluation of the cultural and linguistic reality by a human ecology approach⁶, and the realization of a communication network that allows a cultural exchange not only within Poschiavo region, but also between this territory and the centres, to promote a reversal of the tendency towards isolation.

From a practical point of view, the project followed a regional development strategy founded on the direct involvement of the local people. After an initial contact with local institutions, a group of people was trained to take the role of Practice Assistant in Distance-Education (APFD)⁷, to accompany the local population in project of territorial development. In this sense, it was important that APFD were native people,

Figure 1. Swiss peripheral territories involved in projects of regional development



to avoid any hindrance to the developmental process itself. The second step was the setting up of project groups (composed of local people and accompanied by an APFD) and the introduction of Information and Communication Technologies. During this period, participants acquired both the means to “read” the territory through a human ecology approach and the necessary know-how to use ICT. The project groups took the role of connection between the valley and the centres. Finally, in a consolidation phase, project groups began a more operative and practical work, involving in their activities the whole population and local Institutions.

Nowadays, we can observe a new trend for Poschiavo Valley, characterized by a consciousness about the value of its own cultural identity, a new esteem of the role of education in processes of regional development, a consolidated trend to self-entrepreneurship and a resumption of economic vitality. A simple example is represented by Polo Poschiavo: a body born from the pilot

project, now institutionally recognized as a reference point for the development of the region, that is the promoter and responsible for some training projects in the valley.

The progress of the Poschiavo Project and the relapses of the project itself (Rieder, Giuliani & Schürch, 2000; Schürch, 1999, 2000), show how it is possible to achieve concrete regional development, without betraying the region’s historical and geographical roots, to satisfy the demands of the present time and create innovative scenarios for future years.

movingAlps Project

In 2000, these outcomes lead to the birth of the movingAlps Project⁸, based on Progetto Poschiavo experience and representing its natural consequence. If the old Poschiavo Project focused on a limited area, movingAlps extends its action field to all the peripheral regions of the sub-alpine arch at the boundaries with Italy.

movingAlps tries to work out and to practice a regional development model that may represent both a rediscovery of the peripheral areas as characterized by specific elements and a chance to increase the values of these areas themselves. To allow the isolated regions to identify and develop opportunities that may be synonymous of social and cultural identity survival⁹, movingAlps chooses to start moving from local people project ideas. This implies an analysis of the ground and of people expectations and representations about their future. Financial support is given only in a second time. By this strategy, the developing process not only fits the demands of the region, but it's shared by the involved people. This also allows the creation, step by step, of a new vision about the opportunity to act on and modify the current situation going towards a better one. The process of development is then characterized by a steady and progressive adaptation of the project to consider and to include the unexpected elements rising up from the territory and people living in.

In conclusion, movingAlps aims to:

1. Perform a change of social perceptions, allowing a gradual and progressive re-appropriation of entrepreneurial, working and formative culture that finds its origins and nourishment in the region itself;
2. Overturn the relationship between centres and peripheral areas, to reverse a process of progressive isolation of the peripheral zones as regards to the centres, and to reach a joint and mutual exchange of knowledge and culture.

The Role of ICT

How to achieve this reversal of relationship between centres and peripheral regions? In this developmental approach, the introduction of Information and Communication Technologies (ICT) can play a central role, both by making

easier the involvement of the isolated zones in the intercultural exchange typical of the global village and by supporting a push towards innovation and development.

To overcome temporal and spatial barriers by ICT means the establishment of continuity and interchange relationships between centres and peripheral areas. ICT enables the onset of a process of de-centralization of knowledge, by offering the opportunity of training "in situ" that may emphasize the value of the cultural traditions of the territory which people belong to.

From another perspective, this process leads to a renewal and updates the knowledge and skills acquired over the formative itinerary (Schürch, 2004). Education and its links with the economic and working spheres have obviously to be considered as the key-points from which development becomes possible. ICT, in this sense, provide access to a kind of knowledge that is typical of the information age and that's becoming the base enabling participants to act and work in the future daily life.

Education and ICT in movingAlps Project: A Concrete Micro-Example

A concrete example of regional development with the help of ICT is represented by a project¹⁰ involving the vocational school of Samaden, in Bregaglia Valley, and in particular a class of bricklayer apprentices living in various dispersed locations in the valley.

As mentioned previously, apprentices are forced to leave their villages to reach the place of study and carry on their apprenticeship. Often this situation leads to migration to these centres and consequently to an abandonment of the native valley. On the other hand, a series of studies in Bregaglia Valley¹¹ have pointed out how it is characterized by the presence of multiple diversified sectors of production, covering the entire outline of traditional regional activities. This means a working reality that is still alive,

at least at a potential level. The question is: how to meet young people's demands and to rebirth the local economy?

The way chosen by moving Alps-Bregaglia was to develop a net of collaborations between educational bodies and private firms by using ICT, to allow the apprentices to study without leaving their locations in the valley. This should lead, on one hand, to creating the necessary conditions to encourage the introduction of young people in the local working activities, but also lead to a renewal of the professions based on the new approaches brought in by the apprentice who has learnt to use ICT.

The experience of Progetto Muratori, started in May 2002 and stopped in June 2003, has given the opportunity to a group of 12 bricklayer apprentices to attend courses in General Studies and in Professional Knowledge in a blended-learning form¹². The course ran from December 2002 to May 2003, and took the form of three three-week distance sessions alternated with periods of classroom-based learning. Over the distance-learning phase, communication and interaction between apprentices, teachers and the other people involved in the project has been secured by a virtual learning environment (Giorgi & Schürch, 2004).

This experience shows, at several levels, what are the opportunities arising from a territorial intervention. Briefly, it has led to:

1. Overcoming the problem of spatial and temporal distances—by the use of technology—leading to apprentices having wider accessibility to training and to knowledge in general;
2. Moving from a vocational training based on the culture of the “places of knowledge” towards an education founded on the values and on the identity characteristics of the native region;
3. The development of a training system preparing young people to face changes due to the introduction of ICT in professional world, by integrating them within the formative itinerary; and
4. The development of the necessary basis for a reevaluation of vocational training and of professional activities within Bregaglia Valley, and an input towards innovation.

CONCLUSION

Regional development goes through both the revaluation of the culture and of the regional identity, and education and training in a large sense. To be effective, this process has to occur at different levels; some can be considered at micro-levels (as in the case of Progetto Muratori, focused on a limited target), others regard wider spheres such as the projects of territorial development considered as a whole. Sharing of future sceneries and collaboration between institutions and local people are central elements for development that becomes possible.

Information and Communication Technologies offer interesting tools for the revaluation of peripheral areas own identity, introducing at the same time a wave of innovation. It's not a question of assimilating a particular territory to defined standards but instead to make the innovation a means to give a new value to the culture, economy and local identity.

However a question still remains open: Is it possible to define a model of regional development, integrating ICT, that is flexible enough to be adapted and transferable to every territory? Furthermore, can such a model be characterized by a defined structure of functioning?

REFERENCES

- Arnaud, M., & Perriault, J. (2002). *Les espaces publics d'accès à internet*. Paris: PUF.
- Bressaud, A., & Dirlter, C. (2003). Il tempo dell'economia: Collisione di orizzonti o carenze negoziate? In D. De Kerkhove (Ed.), *La conquista del tempo* (pp. 61-74). Roma: Editori Riuniti.
- Brown, J.S., Collins, A., & Duguid, P. (1989). Situated learning and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Calvo, M., Ciotti, F., Roncaglia, G., & Zela, M.A. (1998). *Internet '98*. Bari: Laterza.
- Delai, N., & Marcantoni, M. (1992). *Il giusto confine*. Milano: Il Sole 24 Ore.
- Florida, R. (1995). Toward the learning region. *Futures*, 27, 527-536.
- Galimberti, C., & Riva, G. (1997). *La comunicazione virtuale*. Milano: Guerini e Associati.
- Giorgi, C., & Schürch, D. (2004). Distance learning: A dimension without presence? In H.M. Niegemann, D. Leutner, & R. Brünken (Eds.), *Instructional design for multimedia learning. Proceedings of the 5th International Workshop of SIG 6 Instructional Design of the European Association for Research on Learning and Instruction (EARLI)*, June 27-29, 2002 in Erfurt (pp. 223-236). Münster, New York: Waxmann.
- Grabher, G. (1993). The weakness of strong ties: The lock-in of regional development in the Ruhr area. In G. Grabher (Ed.), *The embedded firm: On the socio-economics of industrial networks*. London: Routledge.
- Mantovani, G. (1995). *Comunicazione e identità*. Bologna: Il Mulino.
- OCDE. (2002). *Science, technologie et industrie: Perspectives de l'OCDE 2002*. Québec: Publications Gouvernementales 2002-2004.
- Perriault, J. (1989). *La logique de l'usage. Essai sur les machines à communiquer*. Paris: Flammarion.
- Rieder, P., Giuliani, G., & Schürch, D. (2000). *Identità e sviluppo delle regioni dell'arco sud alpino: Un progetto di educazione innovativa che fa capo anche alla comunicazione Mediata da Computer per offrire ai giovani nuove opportunità di lavoro*. Lugano: Istituto Svizzero di Pedagogia per la Formazione Professionale.
- Rullani, E. (2002). Innovazione e complessità. In G. Ardrizzo (Ed.), *Ragioni di Confine*. Bologna: Il Mulino.
- Saracco, R. (2003, September). Ubiquitous Computing. *Mondo Digitale*, 7, 19-30. Retrieved May 25, 2004, from http://www.mondodigitale.net/Rivista/03_numero_tre/Saracco_p.19-30.pdf
- Schürch, D. (1999). L'esperienza del Progetto Poschiavo. *Proceedings of the Conference of Società Economica Valtellinese "Lavoro, formazione e imprenditorialità in Provincia di Sondrio"* (pp.128-135). Milano: Franco Angeli.
- Schürch, D. (2000). Verso una pedagogia dello sviluppo territoriale: Il Progetto Poschiavo. In P.L. Amietta (Ed.), *I luoghi dell'apprendimento* (pp. 83-122). Milano: Franco Angeli.
- Schürch, D. (2004). Nouvelles technologies et valeurs de l'éducation – réflexion épistémologique. In M. Gather-Thurler & J.P. Bronckart (Eds.), *Transformer l'école* (pp. 169-191). Bruxelles: De Boeck.

KEY TERMS

Developing Project: Creation of a small group of people that work on an existing problematic theme and design solutions where Information and Communication Technologies make sense.

Human Ecology: In a holistic vision of the environment, human ecology is an approach to read changes and transformation in action; a way of integration of history, culture and work in peripheral regions in a communicative and distance-exchange perspective; a tool for creating conditions for sustainable development.

Information and Communication Technologies: Technology referring to IDP systems; examples include the Internet, videoconferencing, videostreaming, text-editing, robotics, productive processes automation, etc.

Peripheral Regions: Geographical areas characterized by a particular territorial morphology that causes the isolation from bordering zones inhabited by a linguistic and cultural identity minority. Areas cut off from economic and cultural development.

Regional Development: The notion of development that has been recently better defined with the concept of “learning region” (“regionalità apprendente”) that suggests the existence of a dynamic net of relationships among different activity sectors (economic, administrative, educational and cultural) of a region. It is thought that education and training represent the central device of such development.

Regional Identity: Is a linguistic and cultural concept linked to the feeling of belonging shown by the inhabitants.

ENDNOTES

- ¹ For example, mountainous zones.
- ² Computer-mediated-Communication.
- ³ These are: French, German, Italian and Romansh.
- ⁴ For instance, in some areas of the Grison Canton, which is open to Italy and where Italian is spoken, we can perceive that, although politically belonging to Switzerland cultural traditions are strongly rooted in Italian culture.
- ⁵ Progetto Poschiavo is born from the collaboration of Istituto Svizzero di Pedagogia per la Formazione Professionale (ISPFP) of Lugano, Cantons Ticino and Grisons, Jacobs Foundation, Progetto Poschiavo Foundation, Ufficio Federale per la Formazione e la Tecnologia (UFFT), Swisscom, University of Svizzera Italiana of Lugano, University of Ginevra, University of Neuchâtel and University of Bologna; web site: <http://www.progetto-poschiavo.ch>.
- ⁶ The concept of “human ecology” refers to the environment in a global sense, originated by the consideration of all its components and where the human being has an important role.
- ⁷ The APFD, or Assistente di Pratica in Formazione a Distanza was a new professional category created within the ISPFP of Lugano; their role is to accompany groups of

development projects, offering both technical and pedagogical assistance, sometimes at a distance but mainly face-to-face. The particular characteristic of the APFD, however, is that they originate in the same regions as the people themselves, and so share the same socio-cultural background as the people they are working with.

⁸ As Progetto Poschiavo, movingAlps derives from the collaboration of Istituto Svizzero di Pedagogia per la Formazione Professionale (ISPFP) of Lugano, Cantons Ticino and Grisons, Jacobs Foundation, Progetto

Poschiavo Foundation, Ufficio Federale per la Formazione e la Tecnologia (UFFT), Swisscom, University of Svizzera Italiana of Lugano, University of Ginevra, University of Neuchâtel and University of Bologna; Web site: <http://www.movingalps.ch>.

⁹ Obviously, in a sense of multi-culture and multilingualism survival.

¹⁰ That is Progetto Muratori.

¹¹ The studies were carried out by ISPFP-Lugano and Politecnico Federale of Zurigo.

¹² Either face-to-face or through ICT-based distance learning.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, & X. Yu, pp. 393-398, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.15

Applying for Government Grants for ICT in Australia

Lynne H. De Weaver

Southern Cross University, Australia

BACKGROUND

The legend on the CTC@NSW Web site, <http://www.ctc.nsw.gov.au/about/>, defines Community Technology Centres (CTCs) as “computer enabled multi-purpose facilities based in the Main Street or main centre of a town. They provide access to Internet-connected computers as well as provide printers, video and teleconferencing facilities, business equipment, and e-commerce incubator facilities. CTCs are owned and managed by a non-profit group, such as an incorporated association, co-operative, or local government committee. There are a number of titles that have been used to date to describe CTCs including Telecentres and Telecottages.”

The CTC@NSW program was established to build capacity and deliver a range of nominated services to communities with populations of less than 3,000 through the use of information and communications technologies (ICTs). Each applicant community had to develop its own business plan to meet the identified needs of their community. Successful applicants received grants

of between \$150,000 and \$200,000. These funds were to be used as seed money to establish a community owned and operated business.

The NSW State Government and Commonwealth Government jointly funded this program to run from early 2000 to June 30, 2004. During this period, over 60 new Community Technology Centres (CTCs) were funded in small, regional communities throughout NSW. Unfortunately, towards the conclusion of the funding period, those communities who had been funded in later rounds had to do without the support, resources and assistance provided by the CTC@NSW Support Unit because the funding for this part of the program concluded on June 30th. Only the CTCs that had been funded in earlier rounds would be the full beneficiaries of this aspect of the program.

In order to be eligible for funding under the CTC@NSW program, interested communities had to first complete an Expression of Interest and demonstrate that they met the program’s specific eligibility criteria. If they made it through this “hoop,” they then had to complete a complex application form, which required them to develop

a comprehensive business plan, which included technology and marketing plans in addition to annual cash-flow projections for the first three years of operation. Applicant communities had to demonstrate how they could establish and maintain viable businesses within their communities during the three-year period of funding as well as how they planned to make their CTC viable after all grant funding had been expended.

However, it was through working on the CTC@NSW program, as well as several other ICT programs, that the author came to grips with many of the issues that make economic development in regional Australia so problematic. Her findings were, in many ways, similar to those of Wolstenhome's (1995) who stated, "The continued application of inappropriate models may arise out of difficulties in communication between government representatives and members of community groups during the consultation and planning process. Such difficulties may be due to a lack of understanding about the ways in which rural communities work" (p.1). In particular, some of the difficulties with communications were often exacerbated by the bureaucratic language used in the information packs supplied by the funding bodies as well as in the actual applications themselves.

While it is perhaps easier to have a relatively esoteric discussion about regional economic development, perhaps the single most important asset that is often overlooked or marginalized in these discussions, is the people who actually live and work in regional communities *and* apply for grant funding. It is important to note that while the levels of formal education of these people may not be as high as those living in major urban centres, this does not mean they are not as capable of successfully administering grant funds, but rather they are not familiar, or comfortable with, the phraseology and business-oriented buzzwords that proliferate in the documentation of government funding programs.

Shepherd (1998) noted that, "Rural development, like other creatures of the 'development

industry'...is prone to jargon and the extensive use of buzzwords. Sustainable development, sustainable agriculture, participation, women's involvement, indigenous knowledge, integration, are all examples of phrases which are uttered ritualistically when the need arises" (p. 19).

It is also worth noting that during the period of time the author worked with small communities in the Northern Rivers to help them gain access to a range of ICT services, she drew many of the same conclusions about the nature of the people who lived in regional communities as did Plowman, Ashkanasy, Gardner, and Letts (2003). They stated, "Innovative towns were perceived to have these characteristics in greater abundance: administrative and managerial capacity to run and promote the town...availability of a variety of experts to provide the breadth of services that the residents expected...managerial attitude towards change...a higher proportion of residents who had lived elsewhere, a higher proportion of residents working in the so-called creative-class" (p. 2).

Over the course of her work with regional communities, the author developed a methodology for the process of applying for grant funding which helped to increase the "success rate" for applicant communities. This is not to say that all of the communities and grant applications she worked with were successful, but rather the communities that used this methodology, and had more of the characteristics mentioned earlier, tended to be more successful with their applications for funding.

A STAGED APPROACH TO THE TASK

Stage 1: Getting Started

In order to better understand the nature of the grant for which they were applying, communities first had to determine:

Applying for Government Grants for ICT in Australia

- Who is offering the grant, e.g., the State or the Federal Government?
- What does the government expect to achieve through offering the grant?
- What is the grant expected to achieve for the applicant communities, e.g., what are the expected outcomes?
- Which region(s) is the grant supposed to benefit?
- Is there a time span involved? (Many government grants have specific periods of availability, e.g., funding rounds as well as closing dates.)
- A list of the criteria against which the application will be assessed;
- Information regarding the supporting documentation that might be required;
- The contact details of the people who may be able to assist communities with their applications;
- Information regarding any other resources that might be available;
- Any specifics that pertain to a particular program; and
- Information as to the number of funding rounds and their closing dates or, if it's a one off program, the actual closing date.

Communities also had to consider that there may be political implications or other issues regarding the particular program for which they were applying. They also needed to look at it from the government's perspective because in their eyes, a successful grant program is expected to generate a high level of interest from potential applicants. This means that government agencies actively seek to encourage as many applications as possible in the belief that this will help them direct their funds to the most promising projects. (It is worth noting, that the most deserving communities might not be the ones most able to prepare and submit the "best" application.) Additionally, applicant communities must make sure that their funding objectives match those of the grant program's so that the collective time and energy of the people involved in the process isn't wasted.

However, the first step in the process is to acquire the program's information pack and read it carefully. Much of this information is also available on the relevant agencies' Web site, <http://www.grantslink.gov.au>, is an excellent reference site for communities to explore as it takes a whole-of-government approach to funding.

Good "grant information packs" should be comprehensive and include such things as:

- A clear statement of the funding program's objectives;

Applicant communities also need to be aware that government-funding programs are usually created in response to policy decisions and often focus on a particular issue or range of issues that the government of the day has decided to address. Applicant communities must determine, at the very onset of the process, whether some of the funding program's objectives or criteria have greater weight than others. This is often the case in regional Australia, and that's why it is a good idea to establish a good working relationship with the program's administrators.

Jargon and three letter acronyms (TLAs) are often the hallmark of grant programs and applicant communities need to familiarize themselves with the "language of the grant" before proceeding. They also need to understand all of the requirements at each step in the process, e.g., an initial Expression of Interest (EOI) to determine eligibility, the application itself, regular progress reports, Memorandums of Understanding (MOUs) from potential partners, and so forth.

While applicant communities must also build and maintain ongoing community support for their funding project, they must also determine who will be on the Grant Planning Committee. Having the right mix of skills on that committee plays a crucial role in achieving a positive outcome, and the importance of strategic partner-

ships cannot be under-estimated in achieving a successful outcome. If training is to be one of the services provided, then strategic alliances with like-minded organizations such as Adult & Community Education (ACE) programs, University of the Third Age (U3A) groups, local libraries, and so forth, cannot be under-estimated in terms of the skills and experience they can provide. The planning committee also needs to include representatives from all the key stakeholder groups in the community and have a chairperson who is well-respected and networked in the community.

Finally, members of this committee must possess the range of skills required to successfully complete the application. The capacity of the committee to prepare marketing plans, spread sheets and understand accounting or bookkeeping procedures and software applications is essential for achieving a successful outcome. Last but not least, a good planning committee needs to maintain community interest and support through ongoing public relations activities.

Stage 2: Meetings and the Application Process

All successful communities had strong committees that held regular and productive meetings. These meetings were productive because the committees were committed to the proposition that good meetings led to good outcomes. These committees would:

- Set agendas and stick to them;
- Use the application as their reference point;
- Determine priorities, e.g., what needed to be done and in what order;
- Determine which tasks could be done concurrently;
- Appoint sub-committees as required BUT make sure they reported back to the entire committee;
- Assign tasks or set homework;

- Set timelines and met deadlines;
- Establish a communications procedure, e.g., who is going to keep the minutes at meetings and who will distribute them; and
- Set times, dates and venues for subsequent meetings as far in advance as possible.

Stage 3: Finding Out How to Find Out

Grant applications include a range of questions that need to be addressed so that the funding body can determine need and eligibility. The committee must therefore address all of the criteria for the grant for which they are applying and complete all sections as comprehensively as possible. This means they have to:

1. Identify their critical reference group and understand its needs;
2. Determine what they really need to find out;
3. Test/challenge assumptions they may have about their communities;
4. Identify the questions on the application that need substantive, well-researched answers;
5. Develop a strategy for getting the answers, e.g., written surveys, public meetings, focus groups, services audit, telephone surveys, traffic counts, interviews, etc.;
6. Determine other factors that might be impacting on their community, e.g., conflicts, service overlaps, other issues on the front burner;
7. Analyze and discuss their “research” findings at meetings and prepare concise reports supported by facts and figures;
8. Build ongoing community support for the project; and
9. Communicate—keep everyone in the loop.

While point three might seem unnecessary, one of the communities that planned to apply for a CTC@NSW grant wasted a considerable amount of time due to lack of knowledge about their community. They had originally decided that their primary target population would be seniors. But when they finally conducted their research, they were surprised to find out that this group was particularly well served in the community as there was a Seniors' Computer Club, free Internet access at the Public Library and the U3A had recently established a branch and were planning to offer a computer and Internet training program.

While there are many ways to gather information, each community must devise the strategies they need to employ in order to gather the type of information required for the particular grant for which they are applying. If surveys are undertaken, then the questions need to be as unambiguous as possible and key demographic information captured. Short surveys are much easier to prepare, undertake and analyze.

Conducting a community survey can be a discrete task undertaken over a designated period of time. However, in order to be effective, the preparation work required for that survey must be thorough and comprehensive, as it requires solid intellectual and physical input in order to provide convincing evidence or data, to support the community's application, e.g., all projected user groups for the proposed CTC facility must be included in the survey. The planning committee must decide who needs to be surveyed, what type of questions need to be asked and how many responses are required to yield a statistically relevant level of response, e.g., their sample size. It is also important to ensure that the questions in the survey are written to support an application rather than as promises of things to come.

It is both practical as well as advisable, to approach other people in the community to assist in conducting a survey, as they may be very interested in the project, but don't have the time to be on a planning committee. Assisting with

the application process in this way also helps to generate greater community "buy-in".

Often the results of a community survey make an interesting story for the local newspaper and this is another good way to keep the community informed. Once the survey information has been collected and analyzed, it's time to actually start completing the application, which leads to Stage 4 of the process.

Stage 4: Preparing and Submitting the Grant Application

In order to complete and submit an application, the planning committee will need to:

- Allow sufficient time for the task because applying for a grant *does* take time;
- Include as much supporting documentation as possible, e.g., if you state in the application that public transport is limited, include evidence, bus schedules, ABS statistics on car ownership, etc.;
- Answer all questions in each section carefully and accurately;
- Pay attention to detail;
- Make sure the application demonstrates that the community has the management capability to take on the project;
- Comply with all presentation and submission requirements, e.g., soft copy on disk and two bound hard copies, etc.;
- See if someone from the grant program can "preview" the application before it is officially lodged as they might be able to make some additional suggestions to strengthen it;
- Make a copy of the completed application, including all attachments, for the committee's records; and
- Meet all deadlines.

Once the application has been submitted, it is important to continue to manage the community's

expectation. The planning committee, as well as the community, must remember that just because they have put in the time and effort, there is no guarantee of a favorable outcome.

CONCLUSION

A great deal of community consultation and business planning is required in the application process. The skills of the people on the planning committee are crucial to achieving a favourable outcome. Some of the other key factors that emerged as determinants to the success of a community's application were:

- The capacity of the organizing committee to understand *all* of the requirements of the application;
- Their ability to articulate community needs;
- The business skills and financial acumen of the members of the planning committee;
- The community's commitment to the project for which they are seeking funds; and
- Their understanding of how ICTs could serve as a means of promoting economic development and building capacity in their communities.

Further research is being conducted to determine whether or not the communities that received CTC@NSW Grants have been able to achieve their goals.

REFERENCES

Plowman, I., Ashkanasy, N.M., Gardner, J., & Letts, M. (2003). *Innovation in rural Queensland: Why some towns thrive while others languish* (Main Report). Brisbane: University of Queensland.

Shepherd, A. (1998). *Sustainable rural development*. London: Macmillan Press Ltd.

Wolstenholme, R. (1995). *Understanding small rural communities and the consultation process*. Armidale: The Rural Development Centre.

KEY TERMS

Australian Bureau of Statistics (ABS): ABS provides information to assist governments and communities with their research, planning and policy formulation. It houses Australia's largest statistical database, covering a wide range of economic, social and demographic information. The ABS Web site can be found at <http://www.abs.gov.au>.

Broadband: "Broadband" refers to a telecommunication service in which a "wide band" of frequencies is available to transmit information. When a wide band of frequencies is available to subscribers, information can be multiplexed and sent on many different frequencies or channels within the band concurrently. This means more information can be transmitted in a given amount of time, just as more lanes on a highway allow more cars to travel on it at the same time. As a general rule, the greater the bandwidth, the faster the service.

Demographics: Involves the statistical study of characteristics within any populations such as age, gender, marital status, address, occupation, mobility, health or disease rate, etc.

Grant, Tied Grant: A grant is generally a sum of money that is either paid in full or installments over the life of a particular project, while a tied grant stipulates particular conditions.

Target Population: A particular group within a larger group, about which the researchers are trying to generalise their study or research findings, e.g., seniors. Sometimes referred to as the Reference Group.

U3A: An educational organization with charitable status, where retired people from all walks of life, meet like-minded members to expand their knowledge, share interests or acquire new skills. Members usually offer a lifetime of experience, expertise or know-how in professions, occupations or hobbies and form study or activity groups to share their knowledge with fellow members. Although called a University, no academic qualifications are required or given. Those who teach are also those who learn.

Wireless Local Loop (WLL): A system that connects subscribers to the public switched telephone network (PSTN) using radio signals as a substitute for the usual copper phone lines for all, or part, of the connection between the telephone subscriber and the switch. This includes cordless access systems, proprietary fixed radio access, and fixed cellular systems. WLL technology is an efficient-as well as cost-effective-way to deploy telephony services to subscribers in remote and regional areas without the expense of burying tons of copper wire. WLL services enable newer telecommunications companies such as Norlink to bypass Telstra's wireline networks to deliver more affordable telephony and data access services.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor & X. Yu, pp. 16-20, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.16

Role of ICTs in Socioeconomic Development and Poverty Reduction

Hakikur Rahman

Sustainable Development Networking Programme (SDNP), Bangladesh

ABSTRACT

Information and Communication Technologies (ICTs) are often promoted as central to reviving and sustaining regional communities. Apart from these, the revolutionary feature of modern ICTs—mainly the Internet and mobile telephony—facilitate low cost and speedy interaction among network participants. In this context, knowledge and information are fundamental for facilitating rural development and bringing about social and economic escalation. Nowadays, ICTs are universally acknowledged as powerful tools for development. At the same time, ICTs are seemingly essential to social development and economic growth. In recent years, the process of ICTs has been influencing the socioeconomic context in many countries. Despite that, in many countries a significant proportion of the population does not have access to clean water, sanitation, basic health services and proper education; ICTs provide novel opportunities for information

interchange and technology transfer. This chapter looks into critical aspects of ICTs in raising socioeconomic development in underdeveloped countries and tries to illustrate success cases in developed countries that can be replicated in developing countries to reduce poverty. Emphasis has been given to analyze the role of ICTs in poverty reduction processes upholding regional developments. Enactment of ICTs has been elaborately discussed for the uplift of community and it has been observed that solving common causes for common citizens needs strategic implementation of policies at the central core and pragmatic implementation of actions at the grass roots. Simultaneously, this chapter discusses various critical aspects of the development processes to achieve good governance that is vital for sustainable development. However, as ingredients for uplift through ICTs, institutional approaches in various forms have been found to be extremely effective for socioeconomic development and at the same time for regional developments.

HARNESSING ICTS FOR DEVELOPMENT

Information and Communication Technologies (ICTs) are frequently promoted as central to reviving and sustaining regional communities (Simpson & Hunter, 2001). In this context, knowledge and information are fundamental for facilitating rural development and bringing about social and economic escalation. The position that ICTs have a role in enhancing sustainability in regional communities has various threads and can be seen from the three spheres; community, government, and business (Kasigwa, Williams & Baryamureeba, 2005).

Many pre-Marchallian classical economists and their immediate post World War II followers like Lewis, Rodan and others viewed “economic development as a growth process that requires the systematic reallocation of factors of production from a low-productivity, traditional technology, decreasing returns, and mostly primary sector to a high-productivity, modern technology, increasing returns, and mostly industrial sector” (Adelman, 1999, p. 1).

In recent years, the process of ICTs has been influencing the socioeconomic environment in many countries. While ICTs provide novel opportunities for information exchange and technology transfer, they have increased deprivation for those nations that have not been able to update with these neoteric adjustments. In many countries, a significant proportion of the population does not have access to clean water, sanitation, basic health services and proper education (Ghaus-Pasha, 2005). To overcome these, ICT procedures can be utilized in bridging the digital divide and harnessing the potential of ICTs as a development tool (European Commission, 2005). Each country needs to find the proper determinants on the use of ICTs for development in the context of acculturation processes of socioeconomic development and poverty reduction (Graham, 2005).

The connection of economic development to ICTs is based both on the communication and the information elements. Communication includes both affective and cognitive analysis, while the information element includes only the cognitive portion (Pigg & Crank, 2004). However, the information function is rather complex due to its variety of features within the network along the Internet-based information transfer. Hence, the information transfer can be treated as *active* (interactive information interchange), or *passive* (repositories or knowledge management features), and can be transmitted in many forms.

The content side of ICTs has often been neglected when dealing with ICTs and development. The creation and strengthening of a content repository in different countries represent significant advantages on the usage of ICTs and their development aspect. First, socially it provides contents for society by operators in close contact with it, its needs, expectations and demands. Second, culturally it helps to keep local cultures alive and allows them to be presented to the rest of the world, thus safeguarding and enriching cultural diversity. Third, economically it generates local employment based on its own sustainable resources, and even constitutes a source of income when exported (European Commission, 2005).

The revolutionary feature of modern ICTs—mainly the Internet and mobile telephony—is their ability to facilitate low cost and speedy interaction among network participants (Proenza, 2002). It makes the economic aspects of people’s lives more efficient, as they keep in touch with personal networks, learn about markets, refine production techniques, eliminate time spent on travel to meet people to get information (Hudson, 1984), and able to take knowledgeable decisions. It also helps to build social capital (Woolcock & Narayan, 2000).

Connectivity to the Internet can help overcome some of the most significant obstacles undermining the development of remote rural areas. It can enable low-cost access to governmental services,

agricultural product and market information, local investment opportunities, financial services, distance education, online health services, and job vacancies to uplift community development processes (Proenza, 2002).

The vast majority of donors recognize the potential of ICTs as a catalyst for socioeconomic development but not all of them have reached the same consensus in using ICTs to assist development activities. While some are planning to develop new ICT strategies, others have already used ICTs for years and have drawn lessons from their success stories. In all cases, donors put ICTs to the service of the achievement of their broader strategic objectives in a number of development sectors (health, education, e-commerce, e-government, etc.). However, the overall focus is on meeting specific objectives, not on technology, *per se*.

Achieving the Millennium Development Goals (MDGs), particularly poverty reduction, is a frequently cited objective reinforcing most donor ICT strategies. These strategies aim at creating an inclusive information society with special attention paid to underserved regions, that is, the least developed countries (LDCs) and marginal communities. In this endeavor most of the donors prefer to build ICTs for development strategy on a partnership basis involving a number of actors from other bilateral and multilateral agencies, ministries, civil society, the private sector, universities and research institutions in both developed and developing countries (OECD, 2003). This has created reinforcement of institutional development approach for socio-economic development in many regions, and in reality immensely increased credibility of institutional partnership at grass roots.

It has been found that regional policies increasingly derive their parameters from a global horizon of different development paths, technological options, product life cycles, and so forth, and must also do justice to regional policy objectives such as employment, income,

taxation, and welfare development (Braczyk & Heidenreich, 1996). Thus, global development logics, dynamism (Harvey, 1989), and creation of fluidity vs. regionality (Laepfle, 1999) deserves immense dialogues at each and every stakeholders' stake conforming its proper implementation through information networking and upgrading technological knowledge.

Technological knowledge is not only organized in large-scale technical systems (Hughes, 1987), in branches or in professions but frequently also in regional economic areas. And this knowledge incorporated in regional production clusters, cooperative relations, institutions and policy patterns does not usually develop in great leaps and bounds, but incrementally, step by step. Regional economies can be understood from the accumulation of collective technological learning (Braczyk & Heidenreich, 1996). Technological knowledge and technological learning are, therefore, bound to context, community and region; and "technological capabilities reflect local, regional and national contexts and environments" (Storper, 1995, p. 897).

"Despite the growing importance, civil society organizations in the developing world remain only partially understood" (Ghaus-Pasha, 2005, p. 2), they are the important contributors in raising awareness, creating enable environment and promoting ICTs for potential development of the society. At the same time, the government has a critical role to play in promoting technological dynamism, policy, and in increasing productivity in related sectors, including industry and agriculture. Technological dynamism was the essence of the Industrial Revolution (Adelman, 1999), but, nowadays information dynamism is the core of all development perspectives.

However, rapid technological change and global connectivity has generated an information and knowledge gap between countries, the so-called "digital divide." About half of the world's population has never made a phone call, or Africa has only 2% of the world's telephone

mainlines (World Bank, 2000). Only 2.4% of the world populations are users of the Internet (internetworldstats.com, 2005a) and almost all of whom are concentrated in the Organization for Economic Cooperation and Development (OECD) countries. Roughly, 90% of Internet host computers are located in high-income countries that account for only 16% of world population (Global Reach, 2005; World Bank, 2000). Overcoming this dynamically changing digital divide is going to be a potential challenge for many developing countries in the coming years.

This chapter looks into critical aspects of ICTs in raising socioeconomic development in under-developed countries and will try to illustrate success cases in developed countries that can be replicated in developing countries to reduce poverty. Furthermore, emphasis has been given to analyze the role of ICTs in poverty reduction processes upholding regional development.

BACKGROUND

ICTs are universally acknowledged as powerful tools for development. ICTs are seemingly essential to social development and economic growth. Simultaneously, they are critical to the development of good governance, can be effective vehicles for the maintenance of security, and are vital for sustainable development (Pacific Plan, 2005). As discussed earlier, enactment of ICTs in the uplift of community and common causes for common citizens needs strategic implementation policies at the central core and pragmatic implementation at the grass roots. However, as ingredients for uplift through ICTs, institutional approaches in various forms have been found to be extremely effective for socioeconomic development and at the same time for regional development.

Before starting with the arguments on the context of socioeconomical development and relating it to the reduction of poverty utilizing ICTs, the author feels it is important to elaborate on defi-

nitions of a few related terms. The first term is development. Development refers to improvement of the economic and social conditions of poorer countries,¹ and can be treated as the process of improving the quality of all people living in a country.² Then comes poverty. Poverty can be seen as the state of being deprived of basic essentials of well-being such as food, shelter, income, employment, access to social services, and social status.³ Naturally, another question arises. What has been understood by ICTs in this chapter? Generally, it is the acronym for Information and Communication Technologies and used to handle information and assist communication.⁴ ICTs are the fusion of computers and telecommunications.⁵ But ICTs incorporate innovative ways to provide their users with global access to information, learning, and support.⁶ Information technology comprises the knowledge, skills and understanding needed to use ICTs appropriately and effectively⁷ to process, transmit, and store data and information⁸ for appropriate use.

These background definitions of ICTs can lead the researchers to think ICTs as a catalytic agent of development. Now comes the reasoning. What is social development, what is meant by economic development, and how can institutional development be defined?

Social development encompasses a commitment to individual well-being and the opportunity for citizens to determine their own needs, and to influence decisions that affect them. It incorporates public concerns in developing social policy and economic initiatives.⁹

Economic development can be related to the institutional changes made to promote economic betterment. It is the social organizational changes made to promote growth in an economy.¹⁰ Economic development strengthens an area's economy and employment base¹¹ with sustained increase in the economic standard of living of a country's population by increasing its stocks of physical and human capital through improved technology.¹² Economic development is the process of

improving the quality of human life through increasing per capita income, reducing poverty, and enhancing individual economic opportunities, including better education, improved health and nutrition, conservation of natural resources, a cleaner environment, and a richer cultural life.¹³ In other words, economic development is a sustainable wealth creation process that works within the framework of community parameters to maximize the efficient and effective utilization of community resources for economic gain for the local community.¹⁴

Regional development refers to the improvement in the capability of regions to conduct development programs such as agriculture, education, skill development, research, health, and other public issues, including physical infrastructure, information infrastructure, and institutional infrastructure but primarily aimed to the development of human capital.¹⁵ Regional development is the process of enabling and facilitating a region to develop and increase its capacities and capabilities to meet its desired objectives.¹⁶

The synthesis above has tried to define all parameters related to ICTs and regional development. Before proceeding towards the main thrust of the chapter, it is important to emphasize on a few intimate contexts of ICTs in poverty reduction phenomenon through several implicit manifestations.

ICTs are cross-cutting technologies with a fundamental impact on the various sectors of society, culture, and the economy. A decade ago, ICTs were considered marginal to the issues of economic growth and poverty reduction. Since then, skepticism has given way to more open cognizant and attitudes. ICTs are now seen as powerful enablers of development goals. In many developing countries, policy attention has begun to turn towards the convergence of industrial policies that emphasize manufacturing capabilities and science, technology. At the same time, innovative policies are increasingly seen as important tools

for development because of their power to generate and utilize knowledge (UN, 2005).

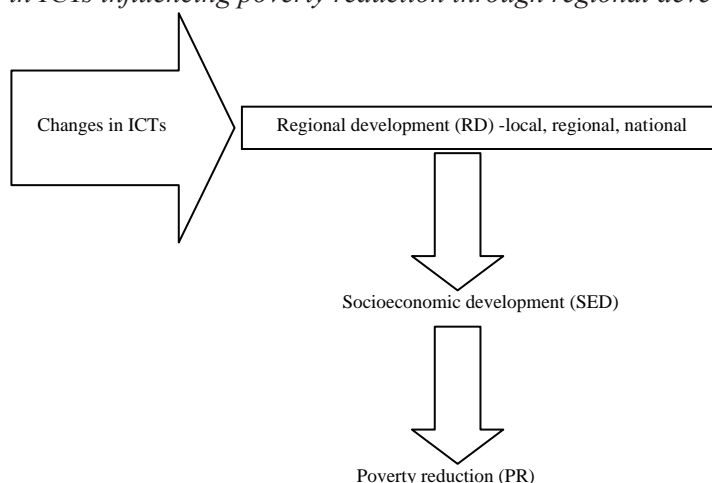
More precisely, ICTs are increasingly being seen by global analysts, the governments of many countries (especially developing ones), and development agencies as stimulating catalysts of collective learning. They enhance social development; improve individual people's lives by allowing them to acquire the knowledge and skills that empower them to be productive in innovative ways; and strengthen overall economic growth and income by raising productivity. Policies designed to enhance the role of ICTs in development have created new avenues for reducing poverty, especially through the beneficial effects they have on mainstream development objectives like, health, education, capacity-building, knowledge management and improving overall living conditions (UN, 2005).

RELATIONSHIPS OF ICTS WITH REGIONAL DEVELOPMENT

For having clear understanding of relationship between methods of ICTs and factors of socioeconomic development (SED) and poverty reduction (PR) in effect regional development (RD), as depicted in *Figure 1*, a mathematical model was established in this research that was formulated as shown in *Formula 1*. In a broader context, ICTs can be directly related to RD (see *Figure 2*), or in a more specific context (see *Figure 3*), a three tier RD perspective can be portrayed. However, for realistic propagation of ICT effects, a five tier RD can be more effective as shown in Table 1. Furthermore, a direct relationship between ICTs and RD can effect SED (see *Figure 4*) and between ICTs and RD can effect PR (see *Figure 5*) can be transformed into another mathematical model as formulated in *Formula 2*.

Factors₁ of *Formula 2* are related to socioeconomic development, but encompass ICT methods

Figure 1. Changes in ICTs influencing poverty reduction through regional development



Formula 1. Relationships among factors of socio-economic development and poverty reduction for regional development

$$\int (\text{factors of SED} \pm \text{factors of PR}) \Big|_{\text{ICTs}} \infty \text{ RD}$$

in their implementation. Similarly, factors₂ are related to poverty reduction processes. With clear understanding of the factors related to SED and PR, and adequate nourishment at each stake during the formulation, formation, and implementation phases can eventually lead to incremental institutional development. Moreover, for having better strategic implementation, a transparent understanding of the input and out determinants specified in Table 2 and 3 would be helpful.

To implement ICT based proponents in consolidating socioeconomic development and poverty reduction processes and make ICTs more meaningful to those who need information and knowledge the most (Adam, 2005), various approaches have been discussed in this section. However, before that, a few objectives have been described that seem essential for strategic planning. An ICT-based system for SED and PR, should:

- Clearly focus on identifying role of ICTs in generating opportunities that have more of a pro-poor focus.
- Find ways to link e-government, public sector and institutes reform and enhance public service delivery.
- Create opportunities to involve a variety of partners, including local business and telecom operators by linking the development of ICT infrastructure and access the development uses and strategies (UNDP, 2004).

At the same time, the strategies should have:

- a more strategic regional focus and an agreed economic development directive;
- improved knowledge of a region’s strengths and advantages that the future projects can be attuned along the success cases;

Figure 2. Broad aspect of ICTs for regional development



Figure 3. Changes in ICTs influencing regional development affecting socio-economic development and poverty reduction

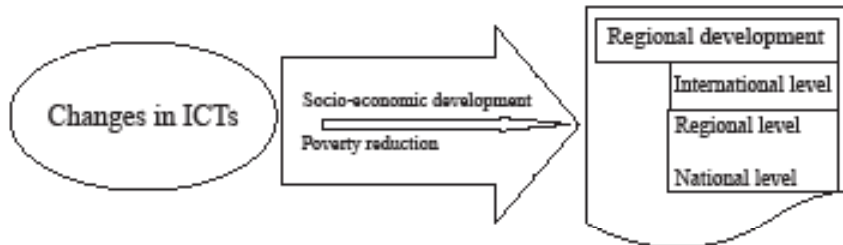


Figure 4. Direct implication of ICTs for regional development through socio-economic development

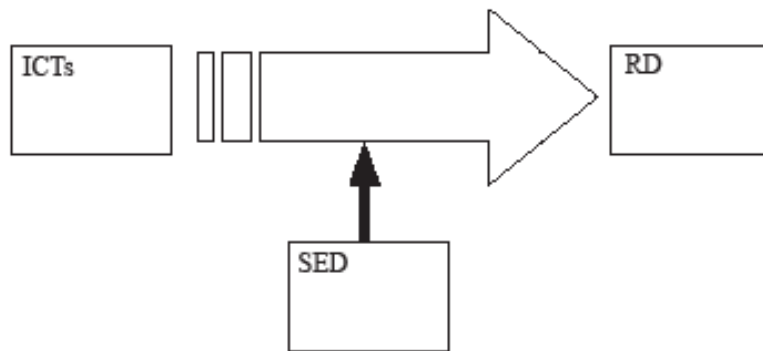
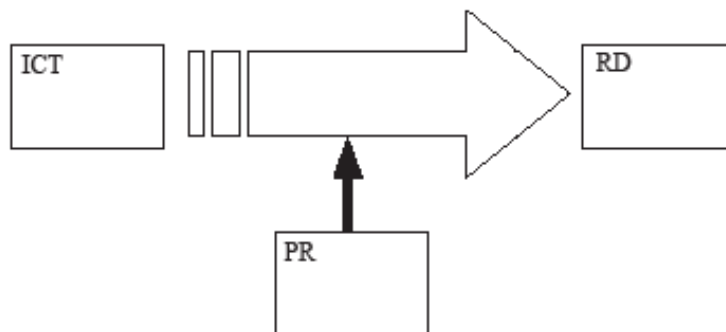


Figure 5. Direct implication of ICTs for regional development through poverty reduction



Role of ICTs in Socioeconomic Development and Poverty Reduction

Table 1. Five tiers of regional development

| | |
|--|------------------------|
| Regional development incorporating aspects of development at | Global Level |
| | Regional Level |
| | National Level |
| | Divisional/Zonal level |
| | Local level |

Table 2. Input determinants for institutional development ^c

| | |
|--|--|
| Regional development through utilization of information and communication technologies | Input Determinants ^c |
| | Networking |
| | Acceptability |
| | Social norms/behavior |
| | Economic condition |
| | Poverty level |
| | Knowledge services |
| | Shared vision |
| | Adaptability |
| | Local content |
| | Leadership at grassroots |
| | Policy initiations at various levels |
| | Form of content storage |
| | Resource optimization |
| | Skill at grass roots |
| | Content management |
| | Training schemes |
| | Investment at local level |
| Role of transnational companies | |
| IP addresses | |
| Domain name system | |
| Root server system | |

^c Amin & Thrift, 1994; Flora, 1998; Lallana, 2004; Onyx Bullen, 2000; Putman, 1993; Roure, Jennings & Shadbolt, 2002; Wall, Ferazzi & Schryer, 1998; UNDP, 2003c, 2004; Woolcock & Narayan, 2000, Giddens, 1990

- extended economic development networks with increased partnership approaches;
- Improved cooperation and trust among groups with better understanding of other stakeholders' goals and processes.
- Better cooperation and alignment between central and local government resources (Government of New Zealand, 2004a).
- A better working environment conducive to improved partnership among various local development agents and stakeholders (representing government, private sector and civil society) (Demeksa, 2001).

Formula 2. A mathematical model for regional development ^a

$$RD \approx \sum_{k=0}^n \int_{SED} ICTs + \int_{PR} ICTs$$

$$\approx \sum_{k=0}^n factors_1 + \sum_{i=0}^p factors_2$$

factors₁ = factors of SED, and
|
ICTs

factors₂ = factors of PR
|
ICTs

factors₁

- science education, ^a
- research and development (R&D), ^a
- coordination and cooperation, ^a
- information dissemination, ^a
- natural resources, ^a
- information technology (education, training, human resource development), ^a
- capital investment (e-commerce), ^a
- higher education, public research system, ^a
- human capital, ^a
- demographic indicators, ^a
- adequate/ reasonable policy, ^a
- networking, ^a

factors₂

- assessing best practices and sharing valuable knowledge, ^b
- governance (top, mid, grass roots), ^b
- partnership (multi-sectoral), ^b
- performance management (monitoring), ^b
- updating information (policy, planning), ^b
- education (basic literacy), ^b
- social protection system, ^b
- information infrastructure, ^b
- technological development, ^b
- regional cooperation, ^b

Furthermore, to implement these strategies, the institutions should be:

- Decentralized and team-based with strong lateral communication and coordination that crosses functional boundaries within and among organizations.

- Acting to empower stakeholders and facilitate cooperation among them.
- Able to analyze regional development structures and strategies needed to justify the aims, objectives and effectiveness.
- Able to supplant more conventional institutional features of governance (Ansell, 2000).

Table 3. Output determinants of institutional development

| | |
|--|--|
| Regional development through utilization of information and communication technologies | Output Determinants ^d |
| | Knowledge base society |
| | Improved decision support |
| | Transparency in system |
| | Industrial districts and their distinctiveness |
| | Organizational flexibility |
| | Regional economic planning |
| | Human capital formation |
| | Technology parks |
| | University expansions |
| | Access to market prices |
| | Access to information for improved decision-making, technology options and improved family links |
| | Improved policy environment to attract Foreign Direct Investment |
| | Equitable universal service policies and provisions |
| | Establish financial mechanisms to promote cost effective access and connectivity |
| | Governance (at all levels of the decision making processes) |
| | Poverty diagnostics, monitoring and evaluation |
| | Institutional arrangements |
| | Development of ICT infrastructure |
| | Creation of a secured cyberspace environment |
| | Creation and management of local content |
| | Establishment of effective regulatory policies and agencies |
| | Launching of education policies that utilize and encourage the expansion of ICT capacities |
| | Improving economic governance |
| | Developing human resources, including education and health |
| | Developing infrastructure, with particular attention paid to ICTs |
| | Improving market access and trade |
| | Improving financial flows and managing debt |
| Management of IP | |
| Community networking | |
| Content repositories | |
| Availability | |
| Affordability | |

^d Roure, Jennings & Shadbolt, 2002; Putman, 1993; Flora, 1998; Onyx Bullen, 2000; Wall, Ferazzi & Schryer, 1998; Woolcock & Narayan, 2000; Lallana, 2004; UNDP, 2004; UNDP, 2003c; Amin & Thrift, 1994; Demeksa, 2001, Worldbank, 2004; Marshall & Taylor, 2005; Salvadore & Sherry, 2004

FORMULATING A MATHEMATICAL MODEL LEADING TO ICT DEVELOPMENT MATRIX

Tichy and Fombrum (1979) and Shrader, Lincoln, and Hoffman (1989) argued that the organic form of organization can be reinterpreted in the terms

of mathematical network theory. They also argued that Burns and Stalker’s (1994) mechanistic organization corresponds to “sparse” internal networks, low degrees of connectivity, and the predominance of asymmetrical relationships, while organic organizations have “dense” networks, high degrees of connectivity, and a predominance

Figure 6. Global Information backbone hierarchy

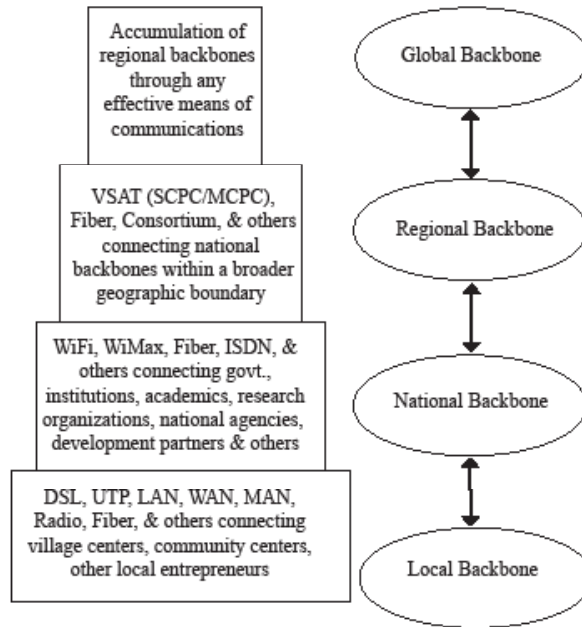
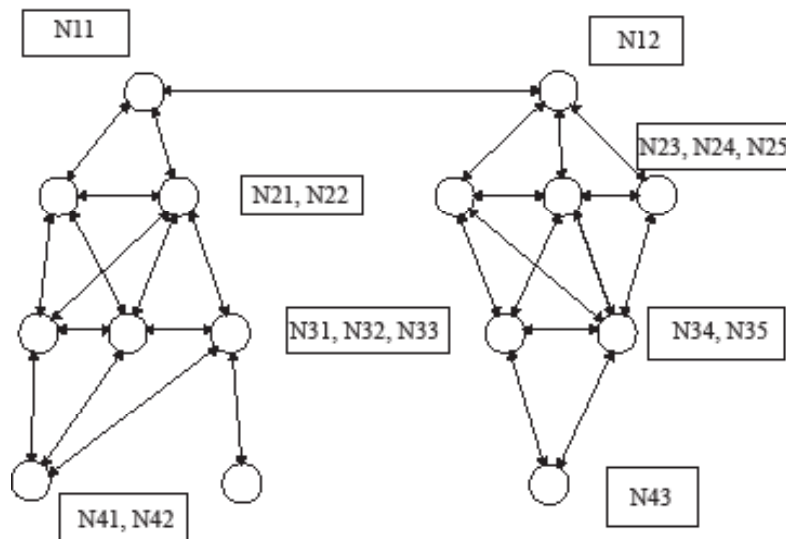


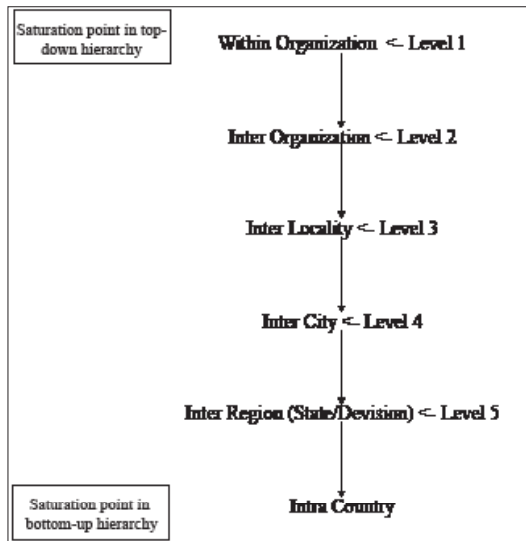
Figure 7. “One-to-one,” “one-to-many,” and “many-to-many” network relations



of symmetrical relationships. Structurally, the network organization can be characterized as heterarchical rather than hierarchical (Ansell, 2000). On the other hand, for a N-Form Organization (a symmetrical network) Hedlund argued that in a heterarchy “several strategic apexes emerge, that

these shift over time” (Hedlund, 1994, p. 87). What distinguishes a heterarchy from a hierarchy is the capacity of lower-level units to have relationships with multiple higher-level centers as well as lateral links with units at the same organizational level. Figure 6 shows a possible formation of global

Figure 8. Networking hierarchy within a country (Adapted from Rahman, 2004b)

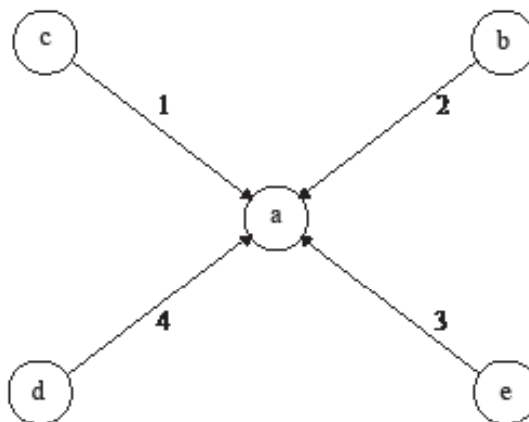


Formula 3. Degree of connectivity of a network

$$d = \frac{\sum_{i=1}^n d(n_i)}{n}$$

where $d(n_i)$ = number of edges incident on node i
 i = node as depicted in figure 8 (Rahman, 2004b).

Figure 9. Person a is virtually linked to persons b, c, d, and e (Adapted from Rahman, 2004b)



information backbone through institutional build up (Rahman, 2004a), while Figure 7 illustrates the various network relationships.

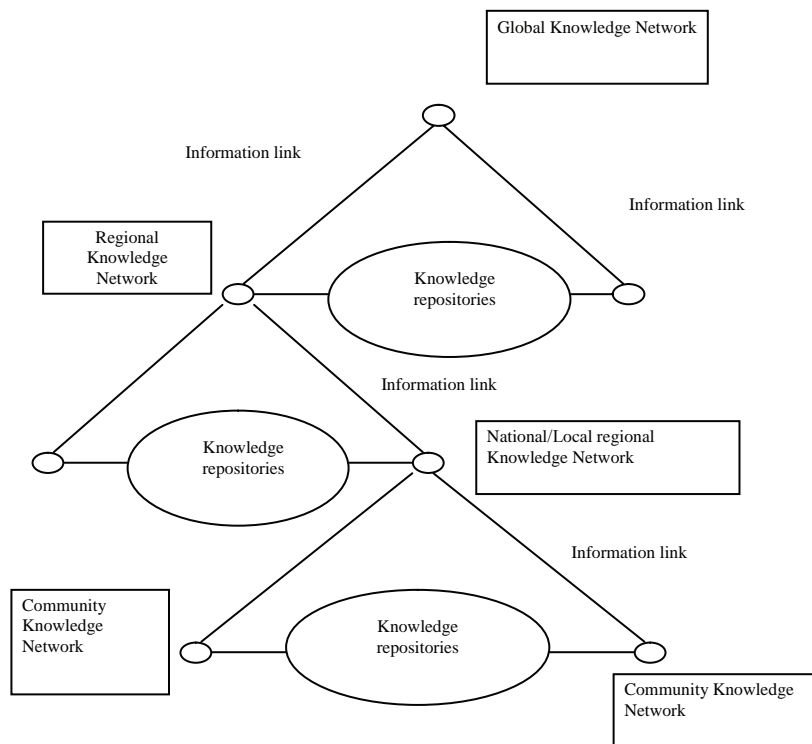
Kontopoulos (1993) suggests that while hierarchy entails a “many-to-one” form of structural aggregation, heterarchy entails a “many-to-many” relationship between different nodes in a social structure. The parallel to the mathematical network language is clear: many-to-many relations imply dense networks and high degrees of connectivity (Ansell, 2000). However, an exchange of information is characterized by the ability to be easily transferred, carefully measured and can be specified as valuable content, and at the same time it has to be reciprocally exchanged to become a value-added product. Figure 7 represents one-to-one, one-to-many, and many-to-many connectivity relationships within network hierarchies. N11 and N12 designate level 1 (national backbone); N21, N22, N23, N24, N25 designate

level 2 (state/division/local region); N31, N32, N33, N34, N35 designate level 3 (city/town/district backbone); and N41, N42, N43 designate level 4 (village centre/call centre/local centre/telecentre/knowledge centre) junctions/terminations.

The degree of a network gives an indication of how many entities a user interacts with. The average degree is calculated by.

Research works indicate that degree of around unity in a typically medium network is acceptable, while degree of around 1.5 can be taken as medium interaction, and greater than 1.5 can be referred as heavy interactions. Figure 8 illustrates acceptable information infrastructure hierarchies and it can be saturated by both hierarchies (top-down, or bottom-up). However, the author proposes establishment of bottom-up networking hierarchy in weaker economies. This way network establishment may be made more easily adaptable to the society and may be made more versatile by using

Figure 10. Global knowledge pyramid



Matrix 1. ICT Development matrix for uniform network distribution

| | | | | | | | |
|----------|--|---|---|---|---|---|--|
| <i>a</i> | | - | 1 | 1 | 1 | 1 | |
| <i>b</i> | | 1 | - | 0 | 0 | 0 | |
| <i>c</i> | | 1 | 0 | - | 0 | 0 | |
| <i>d</i> | | 1 | 0 | 0 | - | 0 | |
| <i>e</i> | | 1 | 0 | 0 | 0 | - | |

indigenous methods. Afterwards, by aggregating in dynamic fashion these hierarchical networks as shown in Figure 8 may be integrated with the next upper layer of aggregation.

Another indicator about the relationship among the member of a network can be derived, if the edges of the network (Figure 9) can be set in a symmetrical matrix, as in Matrix 1. while in Figure 9, a knows b, c, d and e. But, the relationship between b, c, d and e may not be known (Rahman, 2004b). These relationships will establish the ICT matrix and with point-to-point relationships among the network entities, the ideal relationship value may be given to unity. The ICT development matrix evolves from this unity relationship. Even if the network entity may follow point-to-multipoint, or multipoint-to-point paths, for a development matrix it must be upgraded to provide unity relationship value (either a zero communication, or unity communication). However, alternate to ICT development matrix, a global knowledge pyramid (see Figure 10) may be formed following illustrated hierarchies. In Figure 10, establishment of a global knowledge pyramid has been shown incorporating community, national, and regional networks.

Approaches to Strengthen Socioeconomic Development

Approaches in different forms that have been taken varying from Keynesian to neo-liberal

approaches on economic and regional developments are being indicated in Table 4. However, the author proposes an approach that may be enacted in distributed network driven system to make it sustainable.

As indicated in columns two and three of Table 4, the approaches have been described as “imperative” by Hausner (1995) and referred to be modest in terms of stimulating sustained improvements in the economic competitiveness of the Least Focused Regions (LFRs). Though Keynesian approaches have assisted in increased employment and income in the LFRs, they have failed in securing increased productivity compared to those in more prosperous regions, and importantly, also failed to achieve sustaining growth in terms of mobilizing resources and becoming less dependent on externally driven growth factors. The market therapy has revealed a far more threatening outcome that by removing barriers on financial and income transferring processes (though vital for social survival), have exposed lower spectrum LFRs to become more deprived of basic social elements, creating by far more divide (digital, economic, social, and others).

Recent global trend has enlarged the free market zones and seemingly failed to balance the flow of relevant input-output parameters. It may be improved through an incentive-based, open-economy approach for quite a few years more, until regional specialization attains at an appropriate state. Each of the LFR governing

Table 4. Different approaches for socio-economic development

| | | | |
|-----------------------|---------------------------------|--|---|
| Level of intervention | Keynesian Approach (Amin, 1998) | Neo-Liberal Approach (Amin, 1998; Hausner, 1995) | Proposed Approach |
| Financial | Income Redistribution | Market Mechanism | Clustered through distributed networks (uniform distribution) |
| National Policy | Welfare Policy | Firm Policies | Emphasize SMEs, CBOs, CSOs |
| Regional Level | Focus Less Favored Regions | Market Deregulation | Integration into a common platform |
| Local Level | Direct/indirect incentives | Free Market | Transform towards sustainability (long term transparent policy) |
| All Approaches | Top-Down | Top-Down | Bottom-Up |

Table 5. Transformation of approaches for socio-economic development

| Conventional approaches | Transformed approaches |
|--------------------------------|--|
| Firm centered | Demand driven |
| Incentive-based | Incentive-based, but with focus on sustainability |
| State-driven | State-entrepreneurs partnership |
| Standardized | Dynamically adjusted |
| Top-down | Bottom-up |
| National-specific | Region-specific (more meaningful if, local specific) |
| Short and medium-term | Short, Medium and Longer-term |
| Single-sectored | Multi-sectored |

entities must act through a common achievable platform (MDGs, WSIS¹⁷, WSSD¹⁸, etc. are a few). ICTs, a plethora here can assist in migrating from older to newer approaches.

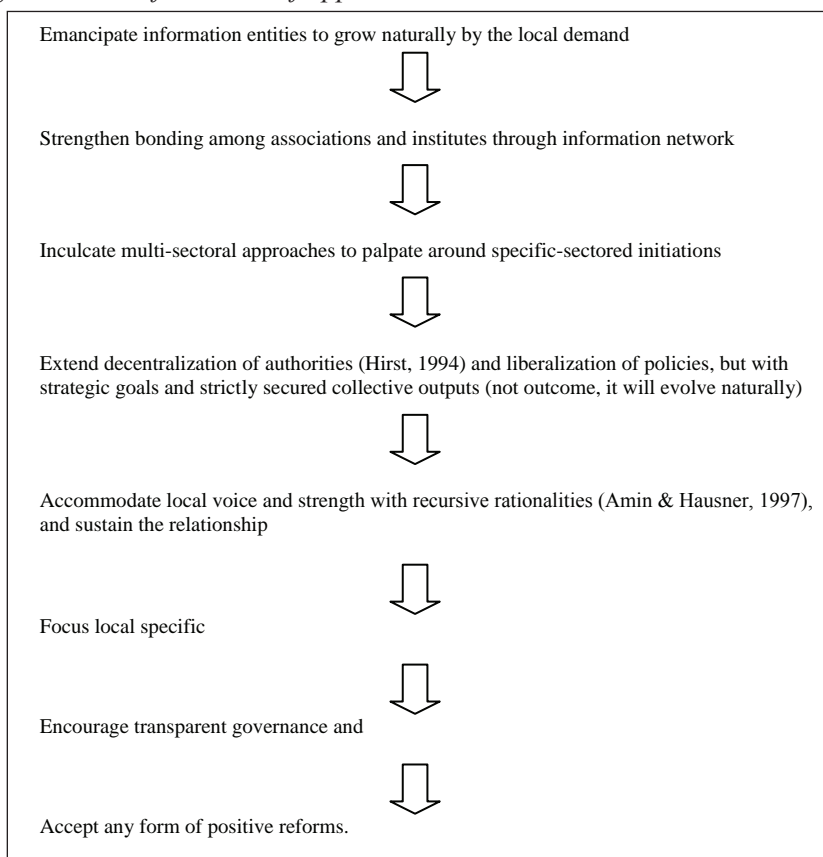
The local supply side infrastructure (the author prefers information infrastructure) need to be upgraded eventually to accommodate this transformation processes and ultimately compete with the upcoming, seemingly unknown (may be more uneven), distribution of resources. Resources may be propagated from concentrated supply to thinner supply depending on the acceptability,

capability, and transformation successes (never be trapped within any nontransparent consequences). For achievable transformation process, a proper information infrastructure is a must.

A bottom-up, local-specific, longer-term and multisectored approach has to be initiated at the early stage within all the developing economies. The author has tried to compile the transformation of approaches in Table 5.

The author describes a workflow on approaches to transform a conventional economy towards networked information driven economy as shown in Figure 11.

Figure 11. Workflow on transformation of approaches



Many of the so called learning regions (Morgan, 1997) such as Silicon Valley in the U.S., Baden Wurttemberg in Denmark, Indian IT Parks, and the Italian industrial districts have gained comparative advantages over others along these years in forming information networks with specialization (Amin, 1998) have found to adopt similar transformation in their approaches.

Effort has been made here to incorporate the determinants related to the institutional development on effect of ICTs with a few successful approaches. Firstly, the author would like to relate the potential of community enhancement that leads to institutional development.

Community Development Approach

Community informatics represents an emerging subset informatics that addresses the commu-

nity-based institutional dimensions (Gurstein, 2001; Loader, Hague & Eagle, 2000). Sometimes, community informatics tends to concentrate on communities of place rather than communities of interest. Hence, this field has to focus on social capital as well as studies related to community development (Doheny-Farina, 1996; Kavanaugh & Patterson, 2001; Pigg, 2001), rural economic development (Pigg & Crank, 2004), health care, and education. This approach and its work plan should address issues on sustainability of technology development, community networking, digital divide factors (Civille, Gurstein & Pigg, 2001), design issues, and effective usage (Gurstein, 2004; Pigg & Crank, 2004) of ICTs.

Rhetoric abounds regarding the importance of social capital in considerations of community sustainability. Considerable rhetoric also exists regarding the potential of modern ICTs to affect

the development of social capital in positive ways (Pigg & Crank, 2004). Furthermore, integrating low income or hard-to-employ workers and targeting disadvantaged groups are also important cornerstones of poverty alleviation strategies at the grass roots (Ghaus-Pasha, 2005). ICTs in this context can act as the facilitator of local content and information interchange and can enhance the process of development and create bonds of relationship among the stakeholders.

Social content is a second dimension of exchange relationships. Communication among parties and their respective knowledge of one another can complete the exchange. Common normative commitments are unimportant, and the value of the relationship is limited to the value of the exchange. They share common normative commitments and these relationships produce value-added products at the end. Together these two independent but often closely correlated dimensions—discreetness and social content—allow in drawing a relative (but not absolute) distinction between demands, markets, and networks (Ansell, 2000). ICTs can transform this discreetness towards togetherness and thus leading to empowerment of the community.

So, empowerment of societal actors and the creation of networks among them is an essential characteristic of the networked society for reasons identified both by work on the embeddedness of states in society (local demand) and work on constitutional order (state demand) (Ansell, 2000; Sabel, 1989, 1994). It is not difficult to imagine a community-based system that would act primarily on information function and then support the networking component of social capital building. Following Kretzman and McKnight's (1993) "asset model" of community building, the development of a searchable database that contains a brief description of community members' interests and skills (assets) could be useful in creating new networks among community members based on those interests or on skill building (Pigg & Crank, 2004).

However, economic behavior is embedded in networks of interpersonal relations, and therefore, crucially influenced by aspects such as mutuality, trust, and cooperation (Amin, 1998; Ingham, 1996; Smelser & Swedberg, 1994) and economy is shaped by enduring these forces collectively (Amin, 1998; Hodgson, 1994; Samuels, 1995), especially their role in disseminating information, knowledge, and learning for economic adaptability (Amin, 1998). These call for collective approaches through networked institutes of similar nature or of associations linking markets and states in participatory form. Institutional building in various natures has been evolved in many countries that have contributed positively in their development processes. Establishment of various civil societies across the globe can be cited here.

Civil Society Approach

Civil society is comprised of autonomous associations to develop a dense, diverse and pluralistic network. As it extends, civil society may consist of a range of local groups, specialized organizations and linkages among them to amplify the corrective voices of civil society as a partner in governance and in economy (Connor, 1999). Civil society should not be commensurate to non-government organizations (NGOs). NGOs are a part of civil society though they play an important and sometimes leading role in activating citizen participation in socioeconomic development and in shaping or influencing policy. Civil society is a broader concept, encompassing all organizations and associations that exist at the outer periphery of the state and the economy (Ghaus-Pasha, 2005).

"Civil society" is a relatively loose concept. Customarily used in reference to civil society organizations (CSOs), civil society includes a wide spectrum of community-based organizations (CBOs), trade unions, local communities, advocacy groups, policy research institutions,

private entrepreneurs, and social movements (Gabriel, 2003).

Through the free flow of information, which is clear and accessible, civil society groups with a vibrant media, can serve as a monitoring mechanism to ensure that government policies are carried out in a manner intended and thereby significantly contribute to good governance. Social mobilization (organizational strengthening) of CBOs at grassroot/sectoral levels is another major contribution of CSOs. It has been found that many civil society groups are constituted around specific issues of social concern such as the environment, labor rights, gender equity, and public health (Ghaus-Pasha, 2005). Encouraging new technologies including policy advice, technical support, information sharing, and resource optimization to establish their own businesses in the form of entrepreneurship, partnership, cooperative, or community enterprises in various agricultural, trade, or consumer commodities can promote RD. Simultaneously, integrating low income or hard-to-employ workers and targeting the marginal communities can form an important cornerstone of poverty alleviation strategies at local level.

Telecenter Approach

The deployment of ICTs in developing countries has become a key tactics of the international development community to support poverty reduction strategies. In this context, telecenters are seen as a tool to bring the benefits and potential of ICTs to locations that have so far been suffering from their remoteness and lacking connectivity to the world's information alliance. Very often telecenters are established to target communities in their entirety, providing Internet access, e-mail services, telephone services, educational services, and also library services or even postal services to large parts of the community. Consequently, these "Multipurpose Community Telecenters (MCT)" take an approach to improve the access to ICTs

on a broad range, in order to narrow the "digital divide" (UNIDO, 2003). Globally, telecenters is not a new concept anymore. However, Murray and Comford (1998) found that more than 60% of them in the UK and Ireland have been operating on a sustainable basis, though they may or may not be profitable.

UNIDO has clear finding on the success of MCT in Sri Lanka and Uganda which contribute to their national economic development. The Uganda Business Information Network (UBIN) in its capital, Kampala, is acting as an "infomediary," a One-Stop-Shop (OSS) in the form of a physical location operated by a private entrepreneurship that provides information services, ICT support services, and enterprise Internet solutions to SMEs on a commercial and demand driven basis (UNIDO, 2003).

INCLUSION IN PRSPS

At this moment, Poverty Reduction Strategy articles (PRSPs) are being treated as the driving force behind the overall development strategy of many developing countries. It is, therefore, essential to consider the role of information infrastructure in poverty reduction process (Murooka, 2004). In this context, private sector development comprising support for Small- and Medium-scale Enterprises (SMEs) also forms one of the contemporary strategies in PRSPs that may lead to socioeconomic development.

Like other developing countries of this region, in 2004 the Government of Lao PDR completed its National Growth and Poverty Eradication Strategy (NGPES) as the country's poverty reduction strategy article (PRSP). The NGPES identifies agriculture, education, health, and transport as priorities for public investments, and sets the country's medium-term development objectives. As an instrument to implement the NGPES, the Government has launched preparation of its Five-Year Socioeconomic Development Plan (SEDP)

for 2006-2010, and is keen to incorporate the management for development results (MfDR) approach in its formulation that undoubtedly involves ICT applications (Government of Lao PDR, 2005). However, countries of similar context must launch even longer-term initiatives to stabilize the economy and social sustainability.

They can establish programs enhancing the three-tier effect of ICTs:

- By enhancing access to information and creating and sharing of knowledge.
- By effectively speeding up the production processes and facilitating financial transactions throughout the economy with reduced costing.
- By connecting individuals, groups, enterprises, communities, and governments faster and more cost-effectively. (Lallana, 2004)

ARGUMENTS

Pervasive poverty and inequality are the major threat to prosperity, stability, and peace at the dawn of the 21st century. Notwithstanding extensive anecdotes about the digital divide, most ICT initiatives start by encouraging nations to become e-ready: to boost economic growth and increase e-commerce. These initiatives may assist countries to grow and contribute to poverty alleviation. However, globalization and ICT development tend to increase the inequality. Countries that seek widespread prosperity and sustainability may focus on e-ForAll; that is, on making the opportunities of ICTs open up for individual and social improvement accessible to all its citizens; and on applying ICTs to empower common folk and engage their participation in national and local development initiatives (Proenza, 2002).

There has been much experimentation, and much discussion, in recent years on the contributions that ICTs can make in combating poverty and promoting broad-based economic and social

development. Yet, there is still much needed to know about the actual impact of ICTs relative to other tools and resources; about the most effective strategies for mainstreaming ICTs as strategic tools of development and poverty reduction; about the necessary enabling factors for assuring maximum effective access to and sustained impact of ICTs in poor communities; and about how developing countries can use ICTs for growth and competitiveness in a global economy (infoDev, 2005). The question that always remains is how to effectively mainstream ICTs as tools of development and poverty reduction. Poverty reduction should be considered the entry point and not ICTs per se (UNDP, 2004).

By its very nature, ICT development tends to increase income inequality within the country for several reasons: (1) it requires relatively good education and special skills to make full use of ICTs for socioeconomic gains, (2) ICT infrastructure is more profitable and therefore easier to develop in urban areas, thus further broadening the gap between urban and rural access to ICTs, (3) those who developed widely used ICT applications are mainly from urban areas who could reap benefits from being first in tapping the ICT market in the country. However, despite the inequality bias, ICTs have the potential to improve the livelihoods of low-income earners by enhancing delivery of socioeconomic services, offering them opportunities to increase income and empowering them through participation in decision making processes.

CASE STUDIES

This section puts forward several case studies from different countries ranging from developed to developing with varying nature of ICT implementations, but mainly related to regional development through socioeconomic development and poverty reduction. Many of them are successful cases in their own localities, countries, and regions, and

Table 6. Countries and programs under APPEAL

| Country | Program(s) |
|------------|--|
| Lao PDR | Non Formal Education (NFE) to strengthen Community Learning Centres (CLCs) |
| Sri Lanka | Sarvodaya |
| Thailand | NFE with inter-village connectivity |
| Uzbekistan | Community empowerment |
| Indonesia | NFE through CLCs |

may be replicated elsewhere, while a few had some difficulties that have been discussed here. Activities of a few organizations with tangible output have also been noted in this section.

Despite the poor growth of the overwhelming majority of developing countries, that of East Asian and some South Asian countries, in which governments continued to play an active role, had been remarkably good in managing ICT for development (Adelman, 1999). The use of ICTs in non-formal education programs to foster participation of marginal community in literacy, basic education, and continuing education activities in Indonesia, Lao PDR, Sri Lanka, Thailand, and Uzbekistan has launched with funds from Japan as UNESCO's Asia-Pacific Program of Education for All (APPEAL) (UNESCO, 2004). Table 6 shows the program that has been started in those countries. This program mainly aims at PR through ICTs, which ultimately improves SED.

In 2002-2003, New Zealand's Ministry of Economic Development (MED) undertook a review of the Regional Partnership Program (RPP). That review included an assessment of regional development policy in building local economic development capability and governance, development of partnerships and networks, and building of institutional linkages (Government of New Zealand, 2004a).

The review reveals that the RPP was performing against policy objectives, and the indicators of success that were selected to measure impact on outcomes. The indicators were mainly focused

on changed economic development partnership behaviors (Government of New Zealand, 2004b). After the review, two sets of changes were recommended, including those associated with the program itself, a few changes in the RPP, and changes in policies. Among many, one is "building better information into the next stage of strategy development (where there are regional data and information needs and gaps), to strengthen existing strategies, and in particular, identified regional specializations" (Government of New Zealand, 2003, p. 4).

In 1992, Estonia had just lost its major trading partner and was experiencing hyperinflation and a 15% fall in GDP (Darling, 2001). The country was turned around with sound economic policies and a thrust to modernization in which equitable ICT development played a key role. In similar context, building on a traditional policy of equitable growth, South Korea's informatization program has raised the number of Internet users from 2% in 1995 (Park, 2001) to 55% in 2001 (ITU, 2003) to 63% in 2004 (Internetworldstats.com, 2005b). Primarily both countries have a substantial educational base that developed through sustained effort over the years. Furthermore, their action programs include cost-effective comprehensive measures to ensure that all citizens have access to and partake in the benefits of ICT development (Proenza, 2002).

In the U.K., Scotland and Wales have been adopting a "network strategy" for creating regional interfirm networks. In Belgium, creation

of smaller “impulse regions” has encouraged the formation of a social network and network among municipal bodies to provide comprehensive ways of thinking about the region (Ansell, 2000; Scottish Enterprise Network Strategy, 2005). This process of “regional networking and comprehensive thinking can be considered an important innovation in regional development practice” (Houthaave, 1998, p. 172).

In 1973, Ireland’s membership in the EEC enhanced its economic development. From 1973 to 1981, foreign direct investment increased by more than 27% per year. However, at the same time, traditional businesses were impacted by severe competition and from 1973 to 1988, 75% of domestic textile and apparel firms and 50% of domestic metal and engineering organizations collapsed. By 1987, Ireland took some measures through the Program for National Recovery and these actions helped restore confidence in the management of the public finances, break a cycle of inflationary wage expectations, improve relationships with the commercial sector, and establish an ongoing focus on economic development reform through partnership. During the 1990s, Ireland was ranked high for growth and development among many “rapid technological advances in industries” and “competitive telecoms and e-commerce infrastructure” (Dravis Group, 2004, p. 4) that could encourage foreign direct investments.

Malaysia, a high middle-income country is leading among many Asian counterparts in terms of telephone (fixed and mobile) and Internet penetration. Malaysia is also well known for its Multimedia Super Corridor (MSC) initiative. The Philippines is emerging as one of the key players in ICT enabled services like call centers and Business Process Outsourcing (BPO). Similarly, Sri Lanka has boldly declared that by 2007 it will be better known as the “e-SriLankan Miracle,” a model achieving global recognition in the deployment of ICTs towards the achievement of Social and Economic Development (Lallana, 2004).

On March 29, 2001, the “e-Japan Priority Policy Program” was adopted to realize the e-Japan Strategy and taken all measures that the government should rapidly implement it by 2006. The roles of the private and public sectors are detailed in the program with the private sector playing the leading role in the area of IT. The Program also identifies five areas for action:

1. Formation of the world’s most advanced information and telecommunications networks.
2. Promotion of education and learning as well as development of human resources;
3. Facilitation of electronic commerce.
4. Digitization of the administration and application of IT in other public areas.
5. Ensure security and reliability of advanced information and telecommunications networks. Further to this, in July 2003, “e-Japan strategy II” was launched aiming to create a “vibrant, safe, impressive and convenient” society with the active use of IT (Lallana, 2004, p. 5).

The South Korean government unveiled its fourth ICT master plan in December 2003, named “Broadband IT Korea Vision 2007.” This new master plan focuses on improving national productivity and individual quality of life through informatization (Lallana, 2004). Among its objectives, “e-Korea Vision 2006” aimed to facilitate continued economic growth by promoting the IT industry and advancing the information infrastructure.

By far the biggest contribution to Vietnam’s development process and poverty reduction over the past fifteen years has come from the *doi moi* reform process aimed at transforming the economy towards being more market oriented. ODA and UNDP have key roles in providing research based policy advice and analysis to facilitate the reform process (UNDP, 1999). Among four of the socioeconomic development strategies 2001-

2010, “science and technology for modernization” with practical implications in education and information technology has accelerated the increasingly knowledge-based economy in Vietnam. The Socioeconomic Development Strategy (2001-2010) aims to accelerate economic growth and poverty reduction through macroeconomic and structural policies designed to protect macroeconomic stability. It has been observed that, in the absence of a long-term strategic framework to guide and coordinate microfinance activities, the response to emergency challenges would be ad hoc. At the same time, the technical assistance program financed by the Japan special fund has emphasized enhancing the institutional capacity of various organizations within the economy. In this program, a microfinance library including a Web site and data center has been targeted (ADB, 2001) for ICT facilitation.

In accordance with the International Monetary Fund (IMF) and World Bank framework, the Royal Government of Cambodia (RGC) prepared an interim Poverty Reduction Strategy Article (IPRSP) in October 2000 based on a broad consultative process launched with active participation from inter-ministerial setup, development partners, and NGOs. The RGC has identified a number of priority public actions to reduce poverty. Among many, agriculture, rural development, trade, infrastructure, education, and health validates the potential areas where ICTs can be utilized for strategic implementation (Royal Government of Cambodia, 2001).

The Jamaican national poverty eradication program may have contributed, tangentially, towards the reduction of absolute poverty levels over the last half-decade, as claimed by the government, but a close examination of program management revealed deep-seated problems. These included a weak political analysis, poor coordination at the national and local levels (weak information backbone), and a lack of adequate institutional support (Osei, 2001).

The Government of Guyana and UNDP have agreed that the main thrust of UNDP’s assistance to Guyana should be directed towards supporting policies and programs for the eradication of poverty in the country. It was consistent with the strategies laid out in the two key Government policy documents, namely the National Development Strategy (NDS) and the Interim Poverty reduction Strategy chapter (IPRSP). Both of these documents recognize that no individual factor can be singled out as the cause of poverty in Guyana (IPRSP Guyana, 2000). However, a project support document (UNDP, 2005) suggests the involvement of ICTs by creating a modern and cost-effective management information system to facilitate aid coordination and management, including strengthening institutional capacity within central government agencies and increased ability to interface with donors and line ministries.

On June 7, 2004 the Government of Albania publicly presented its second Annual Progress Report (APR-2) of the National Strategy for Socio-economic Development (NSSED). Among several recommendations, strengthening the monitoring and evaluation functions within key line ministries and monitoring indicators for each line ministry were emphasized. In addition, a department of the NSSED (DoNESSED) has been established for coordination of all NSSED-related activities (IMF, 2004). These entail articulation of ICT applications within the Government systems. UNDP Albania has been supporting projects fostering capacity building and deployment of ICTs or the facilitation of their use within other development activities for many years. In 2001, the Country Office, with assistance of the regional SURF/BDP, formulated an ICTs for Development Framework document designed to focus ICTs for Development (ICTD) activities to have maximum impact and effectively mainstream ICTD tools within all UNDP programme areas. In June 2003, the document was updated to reflect the efforts of UNDP to support national efforts on the MDGs

and create a comprehensive MDG Umbrella Support Program (UNDP, 2003a).

Over the years, the Government of Malawi has taken a number of steps within specific socioeconomic development frameworks and programs to address some of the social and economic challenges facing the country. The Vision 2020 recognized the important role that ICTs can play in national development. Malawi has acknowledged the need to emphasize on ICT usage to solve its multifarious socioeconomic problems that include widespread poverty, rising urban unemployment and rural under-employment, deteriorating terms of trade and balance of payments, low growth in output, and environmental degradation (SDNP Malawi, 2003).

Philanthropy Australia is a peak national body in Australia in the philanthropic sector, representing individuals, families, communities, and corporate grant making trusts and foundations. Since 2001, Philanthropy Australia's ICT environment has improved significantly. The successful redevelopment of its ICT base has contributed to the development of more positive attitudes to the use of ICTs in the philanthropy sector and created more operational transparency (Government of Australia, 2005a). Barnardos Australia, another leading children's charity organization in Australia has developed an innovative ICT application, the Looking After Children Electronic System (LACES) to create a streamlined case management system and ultimately assists in improving children's community in Australia (Government of Australia, 2005b).

Between two of the very small organizations, SIDSNet (<http://www.sidsnet.org>) the Small Island Developing States Network, is a communication medium to discuss and share information on biodiversity, climate change, coastal and marine management, energy sources and trade. It promotes sharing experiences and developing a global SIDS agenda through information networking (World Bank, 2002). The other one, Fantsuam Foundation of Nigeria uses Microfinance and ICTs

as complementary tools for poverty alleviation. The ICT program started with only two rooms provided by the community. One of the rooms was the Community Library and the second was the IT training room (Comfort, Goje & Funmilola, 2003).

The New partnership for Africa's Development (NEPAD) strongly advocates private sector development for increased trade and investment as a key component to Africa's growth for poverty reduction (DBSA, 2003). However, Africa is already too dependent on the rest of the world. Sub-Saharan Africa's trade in goods with the rest of the world accounted for 56% of GDP in 2001 while the same ratio for North America was only 13.2%, 12.8% for Western Europe, 23.7% for Latin America, and 15.2% for Asia (World Bank, 2003). This does not translate into more effective poverty reduction processes. Increased trade could guarantee foreign debt service capacity but will not guarantee progress towards poverty reduction targets. Partnerships across social sectors and spheres of governance and policy development are, therefore, emphasized. These demand more effective civil society formation with better communication strategies (Gabriel, 2003).

On the other hand, recognizing the role of science and technology in socioeconomic development, many countries of Sub-Saharan Africa established science and technology policy-making bodies and research and development institutions. The United Nations Education and Scientific and Cultural Organization (UNESCO) acted as a catalyst by organizing the CASTAFRICA conferences for African ministers responsible for science in 1974 and 1987. The 1979 Vienna global conference on science and technology for development organized by the United Nations further sensitized and spurred African countries towards action. Along this path, Science and Technology policy making bodies and research and development institutions that were formed during the decade of independence are the National Council for Scientific Research (NCSR) in

Zambia, the Council for Scientific and Industrial Research (CSIR) in Ghana, the National Council for Science and Technology (NCST) in Kenya, and the Commission for Science and Technology (COSTECH) together with its many other research institutes and centers in Tanzania. The recognition of the role of ICTs in development by governments continues till today by putting in place national policies on science and technology, by the enactment of science and technology legislation and by the establishment of ministries of science and technology (Siamwiza, 2002).

The Organization for Economic Cooperation and Development (OECD) defines an international non-governmental organization (INGO) as “an organization established and governed by a group of private citizens for a stated philanthropic purpose, and supported by voluntary individual contributions” (Wheeler, 1988, p. 2). Throughout the 1980s, INGOs from around the world had been learning to use a computer network for socio-economic development. In 1984, a few INGOs agreed to establish a computer network, Interdoc, with member institutions from four continents. Interdoc formalized its mandate with an international accord called the Vallettri Agreement, and aimed to manage the system from a social perspective. Mainly, the network was used to inform and empower organizations, and disseminate information on sustainable development. Later on, Interdoc and its members assisted in forming the Association for Progressive Communications (APC). APC is one of the world’s largest computer networking institution at this moment, and serving NGOs dedicated to human rights, social, economic, and environmental aspects (Murphy, 2005).

ICTs was one of the major subjects that were discussed at G8 Kyushu-Okinawa Summit in July 2000, which adopted the “Okinawa Charter on Global Information Society.” In the Charter, ICTs were defined as one of the most potent forces in shaping the twenty-first century as well as an important means for communities to fulfill their potential demand. The Charter urged all stake-

holders concerned, including the private sector, to participate in constructing a global information society in which everyone, no matter where they live, can benefit from ICTs (JICA, 2001).

UNESCO recognizes the importance of using ICTs to achieve broad development goals. It has also given importance in the learning processes in understanding how ICTs can play an effective role in economic development, social transformation, political empowerment, and cultural enrichment.

The Global Village Energy Partnership (GVEP) was launched at the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002. As a “partnership of partnerships,” it brings together a wide variety and number of partners. By accelerating the pace and scope of energy activities in a more coordinated fashion to reach the target of improving access to energy services for an additional 300 million people, mainly living in rural areas, by 2015. GVEP mainly rely on a multi-sectoral partnership approach (UNDP, 2003b).

InfoDev is an international consortium of official bilateral and multilateral development agencies and other key partners, facilitated by an expert Secretariat housed at the World Bank. Its mission is to assist developing countries and their partners in the international community to use ICTs effectively and strategically as tools to combat poverty, promote sustainable economic growth, and empower individuals and communities to participate more effectively and creatively in their societies and economies. It is an ongoing effort to develop innovative forms of partnership for knowledge-sharing and joint action bringing together government, the private sector and civil society in developing countries with the international donor community, the international private sector and other key partners (InfoDev, 2005).

There is a growing stake in using ICTs to support poverty reduction efforts and strategies to achieve the Millennium Development Goals (MDGs). However, many development initiatives

are increasingly incorporating an “ICT component” in their activities, but mostly as mere projects without a focus on policy variables that could enhance longer term impact and sustainability. UNDP is supporting this initiative in many countries by integrating ICTs appropriately into poverty reduction processes and other development strategies with linkages between ICT development strategies and policies, with a view to identifying opportunities, constraints, and priority areas of focus (UNDP, 2004).

FUTURE OF ICTS IN THE CONTEXT OF SOCIOECONOMIC DEVELOPMENT

ICTs, as enabling technologies are being used in almost all sectors of economy and facets of human life. However, how they impact on the development of the ICT sector remains always critical. Subsequently, it is equally important to assess the wider ramifications of ICTs on society at large. Delving more deeply, there is consensus in many researches that ICTs will shape the future of the world through growing reliance on the technology itself, in all aspects of life and in all sectors—at work, at home, in medicine, in communications, in transport, and so forth. The Internet is seen as the lynchpin, ushering in a world that is more “connected” than ever before. Nevertheless, concerns are raised in some studies that access may become increasingly restricted to those who can afford the technology by creating the information rich and information poor. There has been a paradigm shift in innovation of ICTs with convergence between ubiquitous computing, ubiquitous communication, near-zero telecommunications costs and intelligent user interfaces providing seamless interoperability of devices across networks (EMCC, 2003a, 2003b).

ICTs can play a variety of roles in sustainable development in many countries, acting as monitoring tools, assisting improved production

techniques, enhancing resource optimization, assisting environmental management, improving lifelong learning, and so forth. At the same time, ICTs should not be allowed to create negative impact through channeling any obsolete technology (EMCC, 2003a). The technology gap may grow (DotCom, 2005). However, ICTs should not just be treated as tools for development; rather, they should be treated as tools for empowerment.

At the end of 2000, the U.S. had about 135 million Internet users. Between 1990 and 1995, the compound annual growth rate of U.S. Internet users was over 73%, and from 2000 to 2007, the growth rate is expected to be less than 8% per year, while, the Asia Pacific region became the largest with 178 million Internet users in 2001 and it is expected to grow to over 615 million in 2007. At the same time, the wireless Internet users are expected to grow at a very rapid pace. Wireless Internet users in 2001 were about 102 million, and it is expected that in 2007 it will be more than 800 million (about 41% rise per year). Thus, the wireless Internet will take off rapidly as an always on service, readily available and a useful content provider with small displayable wireless devices (eTForecasts, 2005).

Enterprise development at the marginal end requires adoption of ICTs by SMEs. Duncombe and Heeks (2001) conducted a study for DFID and found that the most direct benefit (employment, growth and local capacity) within the ICT sector itself goes to the institutes that are working at the grass roots. Raising local ICT sector capacity was identified as a key enabler for other sectors—government, private, and NGOs—particularly those concerned with implementing ICTs within wider poverty alleviation programs—in health, education, environment, and governance (ICT4D Social Enterprise Toolkit, 2005).

Many policies, initiatives and measures concerning ICTs exist, impacting at the national, regional, as well as at global level. In the global context, there are international agreements, treaties (concerning international trades, protection

of intellectual property, Internet domain name system coordination, telecommunication standards, etc.) enhancing parameters of development at all levels. Activities of the World Trade Organization, the World Intellectual Property Organization, the Internet Corporation for Assigned Names and Numbers, and the International Telecommunication Union are there to name a few (EMCC, 2003c).

Despite all the massive obstacles that stand between small and medium sized enterprises (SMEs) in developing countries and state-of-the-art entrepreneurs in developed countries, there are opportunities to create demand, provided that the establishment has something of quality to offer and deliver it reliably (Southwood, 2004). ICTs can assist there to bridge the gap and able to make them easily achieve the target. Ranging from controlling internal cash flow, to zero-time-delayed order placing via Internet, to secured financial transaction, to management of entire operation can be effectively controlled by ICT applications.

ICTs allow a reduction in transaction costs, improved communications with different marketing interfaces, and improved information about new opportunities. They can remove the constraints in obtaining and communicating information through empowerment of Micro and SMEs. Evidence suggests that service based enterprises (business, financial, technical) and value-added entrepreneurs (tourist sector, manufacturing—ready made garments, and so forth—utility, call centers, offshore software houses, etc.) will reap most benefit from ICTs and will be in a better position to transmit benefits to the wider community (ITDG approaches, n.d.).

Emphasizing on increased engagement of community groups and development NGOs in the design of regulatory frameworks for public-private-partnership-based ICT access in remote areas might result in more balance in the competitive bidding of operators between achieving least cost (and/or subsidy) and livelihood-driven

performance. The design parameters of partnership projects should be formulated for ICT entrepreneurs to test the financial viability of marketing or products/service development targeted to low-income consumers. And, successful partnership business models should be replicated into low-income consumer market in developing countries (UNICT Task Force Report, 2004a).

However, to take full advantage of these relative strengths demands vision and leadership in different segments of the society with a clear and renewed definition of roles and responsibilities among government, business, civil society, academia and international organizations. Active leadership is needed in regulatory support for the breakthrough of wireless solutions and delicensing of frequency spectrum. Sustained funding for digital divide research and development projects and pilots is another prerequisite. Leadership is also essential in areas that can employ ICTs by reengineering the public sector such as e-government (UNICT Task Force Report, 2004a draft).

For business, leadership is needed for the allocation of investment in financial, human and organizational resources in ICTs. For civil society, leadership is needed for leveraging the process of transforming ICT technology into tools for transparency emphasizing the benefits of the poor. For multilateral institutions and international agencies, leadership in the form of funding is needed for continued and renewed support in mobilizing resources for roll-out of ICT infrastructure, and continued support for applications of ICTs in all sectors (UNICT Task Force Report, 2004a draft).

Strategic alliances amid government, business, civil society and international organizations are a growing feature of both developed and emerging economies. Such multi-stakeholder partnerships (MSPs) are essential because it is evidently clear that no other sector in society can deliver the complexities of sustainable human development alone. MSPs are alliances of parties drawn from government, business, civil society, and

international organizations that strategically aggregate the resources and competencies of each to resolve the key challenges of ICTs as enablers of empowerment that are founded on principles of shared risk, cost, and mutual benefit (UNICT Task Force Report, 2004b).

CONCLUSION

Despite the huge potential of ICTs in assisting communities to increase their overall well-being through community development, there are relatively a few examples of sustained community networks built around ICTs when compared to commercial applications, even in the developed countries where the technologies have been increasingly available for more than 20 years (Marshal and Taylor, 2005). Koanantakool (2002) stated that though the burgeoning use of ICTs is widely acknowledged and discussed today in the global economy, it remains largely undefined and unrecognized in official ICT statistics. This is mainly because various data on ICTs are not readily available or differ widely or varied in nature, depending on the definition and methodology used by each entity collecting them. Therefore, the ICT measurement is becoming a universal issue in many countries and international organizations, comprised of agreed definitions, methodologies, and guidelines.

It demands combined and complementary efforts by international agencies, national governments, local authorities, private sector, and civil society organizations (CSOs). In this aspect, civil society can make a larger contribution both directly and indirectly to the process of poverty reduction and attainment of other MDG targets (Ghaus-Pasha, 2005). The question remains how to effectively mainstream ICTs as tools of socioeconomic development and poverty reduction (InfoDev, 2005). Given the ability to accept and control the situation at local level, the local infrastructure is not always a barrier to use but skill,

resources, and funds remain always susceptible to sustained operation.

It is important to distinguish between the incidence of poverty as a percentage of the total population and the absolute number of the poor. The share of the population in poverty has declined for many developing countries as a whole (28.3% in 1987 to 24% in 1998 based on \$1/day and from 61% in 1987 to 56% in 1998 based on \$2/day), and in all developing regions except Sub-Saharan Africa and Eastern Europe and Central Asia. Declines have been pronounced and sustained over a longer period for the most populous developing countries (World Bank, 2000).

When choosing the appropriate technology for any poverty intervention project, particular attention should be paid to infrastructure requirements, local availability, training requirements, and technical challenges. Innovative technology solutions can be used to take advantage in development projects when they respond to user requirements at the grassroots. Existing technologies, particularly the telephone, radio, and television, can often convey information at less expense, in local languages, and to larger numbers of people than can newer technologies. In some cases, the former can enhance the capacity of the latter (InfoDev, 2003). However, financial sustainability remains as the most important challenge for ICTD initiatives.

The impact of ICTs in rural areas and particularly on rural poverty is very limited despite its penetration into every corner of society. Although, experiences abound demonstrating that ICTs can make a significant contribution to reduce poverty, the list of failed initiatives appears even longer. One of the major reasons for this mixed performance in rural areas is that its adaptation to the local needs was left either to the private sector or to non-governmental organizations. These organizations seldom operate without an official framework of policies and guidelines and a clear definition of tasks and responsibilities for the different “players.”

Development of national ICT strategies for poverty alleviation is a relatively complex matter. There is no single solution or best ICT project to fit all situations, but a variety of approaches would be needed, particularly in the early stage of ICT insemination. Understanding how ICTs can service specific development goals requires both knowledge of appropriate technologies and how these technologies could be operationalized to address socioeconomic goals. Key policymakers need to make informed decisions to enact “enabling” policy frameworks appropriate for their contexts and demands (Expert Group Meeting, 2003). It has to be understood that:

- ICTs alone are insufficient for making significant benefits to emerge in a near future.
- ICTs will not transform bad development into good development in a nightfall but can make good development better in a few years.
- Effective applications of ICTs comprise both a technological infrastructure and an information infrastructure.
- In rural settings in developing countries (where the vast majority of poor people live), it is always a challenge to install the technological infrastructure, but the task is relatively simple in establishing the information infrastructure.
- The application of ICTs in the absence of a national development strategy will inevitably result in sub-optimal outcomes.
- Though ICTs provide opportunities for development, desirable outcomes always arise from the actions of people at large (Lallana, 2004).

There is no clear-cut measurement for the value and significance of institutional consistency or their partnerships in regional context. Firstly, the resource functions are associated with the limitation to trusted and tried development paths, the concentration on certain contents, the exclu-

sions of other possibilities—up to institutional lock-ins (Grabher, 1993). Secondly, regions are neither autonomous nor sovereign in the relations to the national state or supranational organizations (Braczyk & Heidenreich, 1996). Thirdly, regional innovation capacity depends mostly on the individual elements of local order (Friedberg, 1995) and their inherent governance elements (Braczyk & Heidenreich, 1996). Finally, attention should be paid to the process of how poverty is perceived and defined vis-à-vis ICTs at both ends of the pipeline.

If all agreed that poverty is the sum of all hungers then ICTs can play a definite role as tools to provide information. Furthermore, links to other seemingly unrelated areas such as energy provision services, disaster prevention and management, and education and learning should become more self-reliant (UNDP, 2005). For optimal partnership effectiveness among development actors, there is a need to patronize coordination and cross sectoral fertilization within and among the regions (World Bank, 2003b).

REFERENCES

- Adam, L. (2005, January). *Financing ICT's for development with focus on poverty*. Montevideo, Uruguay: Instituto del Tercer Mundo (ITeM).
- ADB. (2001, October). *Technical assistance to the Socialist Republic of Vietnam for preparing the framework for microfinance development*. Asian Development Bank, TAR: VIE 34368.
- Adelman, I. (1999, May). *The role of government in economic development* (Working Paper No. 890). University of California at Berkeley: CA Agriculture Experiment Station.
- Amin, A. (1998, July 3). *An institutionalist perspective on regional economic development*. Paper presented at the Economic Geography Research Group Seminar, Institutions and Governance, London.

- Amin, A., & Hausner, J. (1997). *Beyond market and hierarchy: Interactive governance and social complexity*. Edward Elgar: Aldershot.
- Amin, A., & Thrift, N. (Eds.). (1994). *Globalization, institutions, and regional development in Europe*. Oxford University Press.
- Ansell, C. (2000, July). The networked polity: Regional development in western Europe. *Governance: An International Journal of Policy and Administrative*, 13(3), 303-333.
- Bekkulova, J.E. (2004). *Transboundary water resources management issues*. Tashkent: UNDP Uzbekistan.
- Braczyk, H.-J., & Heidenreich, M. (1996). Regional governance structures in a globalized world. In H.-J. Braczyk & M. Heidenreich (Eds.), *Regional innovation systems* (pp. 414-440). London: UCL Press.
- Burns, T., & Stalker, G.M. (1994). *The management of innovation*. Oxford: Oxford University Press.
- China's Human Rights. (2005). *Background: The global conference on scaling up poverty reduction*. Retrieved June 27, 2006, from China Society For Human Right Studies <http://www.humanrights.cn/news/>
- Civille, R., Gurstein, M., & Pigg, K. (2001). *Access to what? First mile issues for rural broadband* (Report prepared for the Computer Science and Tele. Board, Broadband Last Mile Technology Project). Washington, DC: National Research Council.
- Comfort, K., Goje, L., & Funmilola, K. (2003, August/September). *Relevance and priorities of ICT for women in rural communities: A case study from Nigeria*. Bulletin of the American Society for Information Science and Technology, pp. 24-25.
- Connor, D.M. (1999, December). Public participation and civil society. *Constructive Citizen Participation*, 27(3). Connor Development Services Ltd.
- Darling, P. (2001). *From communism to dot com*. Retrieved June 27, 2006, from EuroViews 2001, [http://manila.djhdk/estonia/stories/storyReader\\$4](http://manila.djhdk/estonia/stories/storyReader$4)
- DBSA. (2003). *The development report*. The Development Bank of Southern Africa (DBSA).
- Demeksa, K. (2001, July 23-24). The new Africa initiative: A view from the Economic Commission for Africa. In *Proceedings of the Peace, Human Security and Conflict Prevention in Africa*, UNESCO-ISS Expert Meeting, Pretoria, South Africa.
- Doheny-Farina, S. (1996). *The wired community*. New Haven, CT: Yale University Press.
- DotCom. (2005, October 22). *DOT-COM TAG shares thoughts on future of ICT and development*. Paper presented at the First Annual Technical Advisory Group (TAG) Meeting. Retrieved June 27, 2006, from <http://www.dot-com-alliance.org/newsletter/>
- Dravis Group. (2004, October). *Ireland: Their ICT success story*. The Dravis Group LLC, San Francisco, CA.
- Duncombe, R., & Heeks, R. (2001). *Enterprise development and communication technologies in developing countries: Supporting "ICT-Flyers."* UK: Institute for Development Policy and Management, DFID.
- EMCC. (2003a). *Sector futures: Shaping the future of ICT*. Dublin: European Monitoring Centre on Change.
- EMCC. (2003b). *Sector futures: The future of IT—now it's getting personal*. Dublin: European Monitoring Centre on Change.

- EMCC. (2003c). *Sector futures: Policies, issues and the future of ICT*. Dublin: European Monitoring Centre on Change.
- ETForecasts. (2005). Retrieved June 27, 2006, from http://etforecasts.com/products/ES_intusersv2.htm
- European Commission. (2005). *Towards a global partnership in the information society: The contribution of the European Union to the second phase of the World Summit on the Information Society*, a communication from the commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, Brussels, 02.6.2005, COM(2005) 234 Final.
- Flora, J. (1998). Social capital and communities of place. *Rural Sociology*, 63(4), 481-506.
- Friedberg, E. (1995). *Ordnung und Macht. Dynamiken organisierten Handelns, Europäisches Zentrum Wien [Order and Power: Dynamiken organisierten acting, EuropeScience Center Vienna]*, Frankfurt: Campus.
- Gabriel, N. (2003, July 2-4). *The millennium development goals: Towards a civil society perspective on reframing poverty reduction strategies in southern Africa*. Paper presented at the Southern Africa MDGs Forum, Johannesburg, South Africa.
- Ghaus-Pasha, A. (2005, May 24-27). *Role of civil society organizations in governance. In Proceedings of 6th Global Forum on Reinventing Government Towards Participatory and Transparent Governance*, Seoul, Republic of Korea. Retrieved November 14, 2006 from <http://unpan1.un.org/intradoc/groups/public/documents/un/unpan019594.pdf>
- Giddens, A. (1990). *The consequences of modernity*. Stanford, CA: Stanford University Press.
- Global Reach. (2005). Online documents. Retrieved June 27, 2006, from <http://www.glreach.com>
- Government of Australia. (2005a, January). *Philanthropy Australia, In case study: Enhancing operational efficiency and capability, information technology and the arts*. Author. ISBN: 0 642 75268 0.
- Government of Australia. (2005b, January). *Barnardos Australia, In case study: Enhancing operational efficiency and capability, information technology and the arts*. Author. ISBN: 0 642 75232 X.
- Government of Finland (2004). Government Resolution 5.2.2004. *Development Policy*, Ministry for Foreign Affairs of Finland. Helsinki, Finland.
- Government of Lao PDR. (2005). *Concept paper: Capacity development for monitoring development results of the National Growth and Poverty Eradication Strategy*. Vientiane: Author.
- Government of New Zealand. (2003, June 18). *Regional Partnerships Programme review*. (Final report). Ministry of Economic Dev. (MED), Government of New Zealand.
- Government of New Zealand. (2004a). *Regional Partnership Programme review. Ministry of Economic Development*. Retrieved June 28, 2006, from <http://www.med.gov.nz>
- Government of New Zealand. (2004b). *Regional Development and Regional Partnerships Programme review: A report from the office of the Minister*, Ministry of Industry and Regional Development to the Chair, Cabinet Economic Development Committee. Author.
- Government of Ukraine. (2003). *Mykola Azarov: Under the economy growing of Ukraine is powerful base*. Ministry of Finance, Ukraine.

- Grabher, G. (1993). The weakness of strong ties. The lock-in of regional development in the Ruhr area. In G. Grabher (Ed.), *The embedded firm. On the socioeconomics of industrial networks* (pp. 255-277). London: Routledge.
- Graham, G. (2005). Community networking as radical practice. *The Journal of Community Informatics*, 1(3), 4-12.
- Gurstein, M. (Ed.). (2000). *Community informatics: Enabling communities with information and communications technologies* (pp. 596: 1-30). Hershey, PA: Idea Group Publishing.
- Gurstein, M. (2004, December). Effective use: A community informatics strategy beyond the digital divide. *First Monday*.
- Harrington, J.W. (2001). *Readings in regional economic development*. Seattle: University of Washington.
- Harvey, D. (1989). *The condition of postmodernity*. Cambridge, MA: Blackwell Publishers.
- Hausner, J. (1995). Imperative vs. interactive strategy of systematic change in Central and Eastern Europe. *Review of International Political Economy*, 91, 481-510.
- Hedlund, G. (1994). A model of knowledge management and the N-form corporation. *Strategic Management Journal*, 15, 73-90.
- Hirst, P. (1994). *Associated democracy*. Cambridge: Polity.
- Hodgson, G.M. (1994). The return of institutional economics. In N. Smelser & R. Swedberg (Eds.), *The handbook of economic sociology* (pp. 86-106). Princeton, NJ: Princeton University Press.
- Houthaeve, R. (1998). Changing aspects of the role of regional development agencies in Flanders (Belgium): The case of West Flanders. In H. Halkier, M. Danson, & C. Damborg, (Eds.), *Regional development in Europe* (pp. 21-45). London: Jessica Kinsley.
- Hudson, H. (1984). *When telephones reach the village*. Paris: Ables Publications.
- Hughes, T.P. (1987). The evolution of large technical systems. In W.E. Bijker (Ed.), *The social construction of technological systems* (pp. 51-82). Cambridge: MIT Press.
- Hutagaol, P., & Sugino, T. (2005). *Policy framework for poverty reduction by realizing sustainable diversified agriculture through the development of secondary crops*. Retrieved June 28, 2006, from the Palawija News, The UNESCAP-CAPSA Newsletter, http://www.cgprt.org/palawija_detail.asp?VJournalKey=105
- ICT4D Social Enterprise Toolkit. (2005). *Empowering disadvantaged communities in developing countries*. Retrieved June 28, 2006, from <http://www.un.org.kh/undp/ict4dToolkit/ICT4D.htm>
- IMF. (2004, July). *Albania: Joint staff assessment of the Poverty Reduction Strategy paper: Annual progress report* (IMF Country Rep. No. 04/205).
- infoDev. (2003). *ICT for development: Contributing to the millennium development goals: Lessons learned from seventeen infoDev projects*. The World Bank.
- infoDev. (2005). *Mainstreaming ICTs: Mainstreaming ICT as tools of development and poverty reduction*. Retrieved June 28, 2006, from http://www.infodev.org/section/programs/mainstreaming_icts
- Ingham, G. (1996). Some recent changes in the relationship between economics and sociology. *Cambridge Journal of Economics*, 20, 243-275.
- Internetworldstats.com. (2005a). Retrieved June 28, 2006, from <http://www.Internetworldstats.com/>
- Internetworldstats.com. (2005b). Retrieved June 28, 2006, from <http://www.Internetworldstats.com/stats3.htm>

- IPRSP Guyana. (2000, October). *Interim Poverty Reduction Strategy paper* (Prepared by the Guyanese Authorities).
- ITDG approaches (n.d.). *ITDG approaches, enterprise development and ICTs*. Retrieved June 28, 2006, from <http://livelihoodtechnology.org/home.asp?id=ict2Intro1>
- ITU. (2003, March). *Broadband Korea: Internet case study*. Geneva: Author.
- JICA. (2001, June). *The information revolution in development assistance*. Tokyo: Institute for International Cooperation, Japan International Cooperation Agency.
- Joseph, K.J. (2003, September 18-19). *Development of enabling policies for trade and investment in the sector of the Greater Mekong Subregion*. Paper presented at the National Workshop on Development of Enabling Policies for Trade and Investment in the IT Sector of the Greater Mekong Subregion, Hanoi, Vietnam.
- Kavanaugh, A.L., & Patterson, S. (2001). The impact of community computer networks on social capital and community involvement. *American Behavioral Scientist*, 45(3), 494-509.
- Kasigwa, J., Williams, D., & Baryamureeba, V. (2005). *A critical analysis on the role of ICTs and its sustainability in developing countries*. Retrieved June 28, 2006, from http://cit.ac.ug/events/srec/PapersSubmitted/Justine_SAREC_paper_Aug_2005.pdf
- Koanantakool, T. (2002, September 19-20). Forward of the executive summary. In *Proceedings of the ASEAN Workshop on Measurement of Digital Economy*, (p. 3). Bangkok, Thailand.
- Kontopoulos, K. (1993). *The logic of social structure*. New York: Cambridge University Press.
- Kretzman, J.P., & McKnight, J.L. (1993). *Building communities from the inside out*. Evanston, IL: Center for Urban Affairs and Policy Research, North Western University.
- Laepple, D. (1999, July 8-11). Ambiguities of globalization: The urban economy as a nexus of disembedding and reembedding processes: The case of the City of Hamburg. In *Proceedings of the 11th International Meeting on Socio Economics*, Madison, Wisconsin. Retrieved November 14, 2006 from http://www.sase.org/conf1999/papers/dieter_laepfle.pdf
- Lallana, E.C. (2004). *An overview of ICT policies and e-strategies of select asian economies*. New Delhi, Elsevier. ISBN: 81-8147-753-7. Retrieved June 28, 2006, from <http://www.adbi.org/book/2004/11/05/725.implementing.egovernment.book/2.summary.of.country.reports/>
- Loader, B.D., Hague, B., & Eagle, D. (2000). Embedding the Net: Community empowerment in the Age of Information. In M. Gurstein (Ed.), *Community informatics: Enabling communities with information and communications technologies* (pp. 81-103). Hershey, PA: Idea Group Publishing.
- Mali, F. (2002). *Is it possible to come to balance of different functions in academic research systems of small transitional countries of Central and Eastern Europe? The case of Slovenia*. Retrieved June 28, 2006, from the Sociology of Science and Technology NETWORK, <http://sstnet.iscte.pt/>
- Marshall, S., & Taylor, W. (2005, March 26). Facilitating the use of ICT for community development through collaborative partnerships between universities, governments and communities. *International Journal of Education and Development using ICT*, 1(1). Retrieved June 28, 2006, from <http://ijedict.dec.uwi.edu/viewarticle.php?id=24>
- Morgan, K. (1997). *The learning region: Institutions, innovation and regional renewal* (paper

from Planning Research 157). Cardiff: Department of City and Regional Planning, University of Wales.

Murphy, B.M. (2005, May). Interdoc: The first international non-governmental computer network. *First Monday*, 10(5). Retrieved June 28, 2006, from http://firstmonday.org/issues/issue10_5/murphy/index.html

Murooka, N. (2004, October 27-29). *Role of infrastructure in economic growth and poverty reduction: Lessons learned from PRSPs of 33 countries*. Paper presented at the POVNET Infrastructure for Poverty Reduction (InfraPoor) Task Team Workshop, Berlin, Germany.

Murray, B., & Comford, D. (1998). *Universal access: Telecottage and Telecentre Survey 1998*. Small World Connections, International Telecommunication Union (ITU).

NAO. (2002). *Performance management: Helping to reduce world poverty*. London: National Audit Office, Department of International Development, The Stationery Office.

OECD. (2003, December). *Donor ICT strategies matrix*. Development Assistance Committee.

Onyx, J., & Bullen, P. (2000). Measuring social capital in five communities. *Journal of Applied Behavioral Science*, 36(1), 23-42.

Ortner, G.E. (1999). *Socioeconomics of virtual universities*. Hagen Germany: Fern University.

Osei, P.D. (2001, September 10-12). *A critical assessment of Jamaica's national poverty eradication policy and programme*. Paper presented at the Development Studies Association Conference, Manchester, England.

Pacific Plan. (2005). *Pacific Plan for strengthening regional cooperation and integration: Regional digital strategy*. Retrieved June 28, 2006, from <http://www.pacificplan.org/tiki-page.php?pageName=Digital+Strategy>

Park, H.W. (2001, November). *Digital divide in Korea: Closing and widening the divide in the 1990s*. Paper presented at the Symposium on the Digital Divide, Austin, TX.

Pigg, K. (2001). Applications for community informatics for building community and enhancing civic society. *Information, Communication, & Society*, 4(4), 507-527.

Pigg, K.E., & Crank, L.D. (2004). Building community social capital: The potential and promise of information and communications technologies. *The Journal of Community Informatics*, 1(1), 58-73.

Proenza, F.J. (2002). *e-ForAll: A poverty reduction strategy for the Information Age*. Retrieved June 28, 2006, from http://communication.utexas.edu/college/digital_divide_symposium/papers/index.html

PRSP Report. (2005). *Poverty Reduction Strategy paper: Progress report: August 2003-December 2004*. Yerevan: Republic of Armenia.

Putnam, R.D. (1993). *Making democracy work: Civic traditions in modern Italy*. Princeton, NJ: Princeton University Press.

Rahman, H. (2004a). Social impact of virtual networking. In S. Dasgupta (Ed.), *Encyclopedia of virtual communities and technologies* (417-423). Hershey, PA: Idea Group.

Rahman, H. (2004b, December 15-17). Information dynamics in developing countries. Paper presented at the *5th International Conference on IT in Regional Areas*, Caloundra, Queensland, Australia.

Romanenko, N. (2003). *Assessment of NGO activity in Rovenskaya, Sumskaia and Khersonskaya Oblasts of Ukraine* (Short-term Mission Report: NGO Needs Assessment), Donetsk, Ukraine.

Roure, D.D., Jennings, N.R., & Shadbolt, N.R. (2002, December). *The semantic grid: A future*

- e-science infrastructure* (Tech. Rep. No. UKeS-2002-02). National e-Science Centre.
- Royal Government of Cambodia. (2001, December). *PRSP: Preparation status report*. Ministry of Planning.
- Sabel, C. (1989). Flexible specialization and the re-emergence of regional economies. In P. Hirst & J. Zeitlin (Eds.), *Reversing industrial decline? Industrial structure and policy in Britain and her competitors* (pp. 23-49). Oxford: Berg.
- Sabel, C. (1994). Learning by monitoring: The institutions of economic development. In N. Smelser & R. Swedberg (Eds.), *The handbook of economic sociology* (pp. 137-165). Princeton, NJ: Princeton University Press.
- Salvadore, T., & Sherry, J. (2004). Local learnings: An essay on designing to facilitate effective use of ICTs. *The Journal of Community Informatics*, 1(1), 76-83.
- Samuels, W. (1995). The present state of institutional economics. *Cambridge Journal of Economics*, 19, 569-590.
- Scottish Enterprise Network Strategy*. (2005). Retrieved June 28, 2006, from <http://www.scotnet.co.uk/netstrat.html>
- SDNP Malawi. (2003). *Malawi ICT policy framework 2002*. Retrieved June 28, 2006, from <http://www.sdnp.org.mw/ict/framework-2002/>
- Shrader, C.B., Lincoln, J.R., & Hoffman, A.N. (1989). The network structures of organizations: Effects of task contingencies and distributional form. *Human Relations*, 42(1), 43-66.
- Siamwiza, M.N. (2002). *The impact of globalization on science and technology in sub-Saharan African countries* (Series No. 3). Kenya: African Technology Policy Studies Network. ISBN: 9966-916-63-6/9966916636.
- Simpson, R., & Hunter, A. (2001). *The Internet and regional Australia: How rural communities can address the impact of the Internet*. Canberra: Rural Industries Research and Development Corporation.
- Smelser, N., & Swedberg, R. (Eds.). (1994). *The handbook of economic sociology*. Princeton, NJ: Princeton University Press.
- Southwood, R. (2004, March). *ICT and small enterprise: A motor of economic development in Africa* (Brief No. 9). The Hague: IICD Research.
- Storper, M. (1995). Regional technology coalitions: An essential dimension of national technology policy. *Research Policy*, 24, 895-911.
- Tichy, N.M., & Fobrun, C. (1979). Social network analysis for organizations. *Academy of Management Review* 4, 507-559.
- UN. (2005, July 27-29). *Note by the Secretary-General, Third annual report of the ICT Task Force, Substantive session of 2005*. New York: Author.
- UNDP. (1999). *Research and policy advice* (UNDP Vietnam Annual Report).
- UNDP. (2003a). *ICT for development program framework: Achieving the millennium development goals through the use of information and communication technologies (ICT)* (UNDP Albania ICTD Framework, Revised Document) Albania: Author.
- UNDP. (2003b, November). *SURF-WA Newsletter*, 1(2).
- UNDP. (2003c). *National ICT strategy paves the road for a new generation of "e-citizens."* Hanoi, Vietnam: Author.
- UNDP. (2004, November 2-3). *Report: Workshop on Policy Tools to Support ICT Use for Poverty Reduction and the Achievement of the MDGs*. Dakar SURF: Author.

UNDP. (2005). *Programme support document, Strengthening capacity for the reduction of poverty in Guyana*, Programme of the Government of Guyana. Author.

UNESCO. (2004). *Five Asian countries start using ICT for community empowerment*. Retrieved June 28, 2006, from <http://portal.unesco.org>

UNICT Task Force Report. (2004a, November 18-20). *Mainstreaming information and communication technologies for the achievement of the millennium development goals* (draft). Berlin, Germany.

UNICT Task Force Report. (2004b, November 18-20). *Mainstreaming information and communication technologies for the achievement of the millennium development goals* (final). Berlin, Germany.

UNIDO. (2003, December). *Review of telecenter sustainability criteria for the establishment of sustainable rural business resource centers for SMEs in developing countries* (prepared by C. Jauernig for the Small and Medium Enterprises Branch). Vienna, Austria.

UNESCAP (2003, January 28-29). *Expert Group Meeting on ICT for rural poverty reduction: Developing national policies*. UNESCAP, Bangkok, Thailand.

Wall, E., Ferazzi, G., & Schryer, F. (1998). Getting the googs on social capital. *Rural Networks*, 18(3), 347-354.

WCL. (2005). *Millennium goals, time for striking a first balance!* Brussels: WCL Press Department. Retrieved June 28, 2006, from <http://www.cmt-wcl.org/cmt/>

WCS. (1999, March 1-3). Basic sciences for development of Eastern and South Africa. In *Proceedings of the World Conference on Science*, Arusha, Tanzania.

Wheeler, J.C. (1988). *Voluntary aid for development: The role of non-governmental organizations*. Paris: Organization for Economic Cooperation and Development.

Woolcock, M., & Narayan, D. (2000). Implications for development theory, research and policy. *The World Bank Research Observer*, 15(2).

World Bank. (2000, October). *Poverty in an Age of Globalization*. retrieved November 14, 2006 from <http://www1.worldbank.org/economicpolicy/globalization/documents/povertyglobalization.pdf>.

World Bank. (2002). *Small island developing states network*, Retrieved June 30, 2006 from <http://wbln0018.worldbank.org/html/smallstates.nsf>

World Bank. (2003a). *World development indicators 2003*.

World Bank. (2003b, February). *Culture and the corporative priorities of the World Bank* (Report on progress from April 1999 to December 2002). Retrieved November 14, 2006 from <http://sitere-sources.worldbank.org/INTCHD/Resources/report-progress-april99-december02.pdf>

World Bank. (2005). *ICT and environmental sustainability: Selected World Bank Group funded projects*. The World Bank Groups, Washington DC

ENDNOTES

¹ www.interenvironment.org/wd1intro/glossary.htm

² www.bized.ac.uk/virtual/dc/resource/glos2.htm

³ www.undp.org/rbec/nhdr/1996/georgia/glossary.htm

⁴ www.defra.gov.uk/corporate/ebus/maffrole/annexe.htm

Role of ICTs in Socioeconomic Development and Poverty Reduction

- 5 www.fraw.org.uk/library/005/gn-irt/glossary.html
- 6 http://asp2.wlv.ac/its/Website/everyone/its_jargon.htm
- 7 www.ictadvice.org.uk/index.php
- 8 www.mckinnonsc.vic.edu.au/la/it/ipm-notes/misc/glossary.htm
- 9 <http://envision.ca/templates/profile.asp>
- 10 <http://oregonstate.edu/instruct/anth370/gloss.html>
- 11 www.mbaa.org/consumer/mterms.cfm
- 12 www.personal.umich.edu/~alandear/glossary/e.html
- 13 www.agtrade.org/glossary_search.cfm
- 14 www.delawarecountybrc.com/glossary-terms.htm
- 15 http://pdacrsp.oregonstate.edu/pubs/admin/admin_12/admin12.appA/admin12.appA.html
- 16 www.undp.org/rbec/nhdr/1996/georgia/glossary.htm
- 17 World Summit on Information Society (WSIS) held in 2003 and 2005
- 18 World Summit on Sustainable Development held in 2002

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp.180-219, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.17

Evolution of the Euro and Currency Competition in the Global ICT Age

Sadayoshi Takaya
Kansai University, Japan

ABSTRACT

This chapter focuses on the function of international currencies as foreign exchange vehicles, which has a character of the network externality. On January 1999, the euro was introduced in Europe where the functions of the euro are limited as a currency. After January 2002, the euro had perfect functions, while the competition between the euro and the U.S. dollar was keen as the dominant international currency. We present the currency competition model with a decreasing transaction cost that reflects the character of the network externality, to investigate the competition between the euro and the dollar. We suggest the impact of introduction of the euro is the determinant for competition winner between the euro and the dollar.

KEY CURRENCY AND INTERNATIONAL MONETARY REGIMES

International monetary regimes are arrangements that are made for agents to carry out foreign official and private settlements. These regimes include provisions pertaining to the use of international currencies as settlement currencies, exchange rates regimes and degree of capital mobility in order to decide the availability of foreign settlements. In particular, the international currency that is used primarily in international settlements is referred to as a key currency. Furthermore, there exists an inherent asymmetry in international monetary regimes between the key-currency country and the non-key currency countries. In other words, although the country providing the key currency can make foreign settlements using its home currency, the country providing a non-key currency cannot. Therefore, the key-currency country does not face exchange rate risks.

Since the key-currency country is secure in the independence of its own policy objectives, it has the option of altering the exchange rates regime and the degree of capital mobility depending on the global economic situation. The degree of flexibility of the fiscal policy is also a criterion for the choice of an international monetary system. If a government intends to expand its fiscal deficits, it would be inclined to opt for a system wherein it is easier to raise finance from foreign agents. In brief, if liberalization is faced with a difficulty in sustaining a fixed exchange rate regime, the government will be able to liberalize capital controls in order to alter the flexible exchange rate regime.

Non-key currency countries use the key currency because of its easy availability and for international settlements. Under this circumstance, non-key currency countries choose an exchange rates regime and the degree of capital mobility taking into consideration the effects that exchange rates and capital mobility have on their economies. The choice of an international monetary system depends on the preference of the country or the government. For example, if a government prefers to stabilize exchange rates, it will not hesitate to restrain capital mobility. If a government prefers to import foreign capital, it will opt to liberalize capital controls and adopt a fixed exchange rates regime. However, such countries will face a difficulty in maintaining a consistency between free capital mobility and fixed exchange rates regime.

Historically, the international gold standard persisted before World War I with free capital mobility and fixed exchange rates. The pound sterling of Great Britain was the key currency at that time. The gold exchange standard survived through the interval period with unstable exchange rates and capital controls. Although the pound sterling continued to be the key currency during this period, its significance was diminished. Post World War II saw the emergence of the Bretton Woods regime with fixed exchange rates and

capital controls. The U.S. dollar has since been the key currency. Since the 1970s, most major countries have experienced the flexible exchange rates regime. Although international capital movements were formerly restrained, these have gradually been liberalized in developed countries since the 1980s. This liberalization led to the emergence of a global financial economy and intensified capital mobility by hedge funds, mutual funds, pension funds and so forth.

The evolution of the euro in the 1990s is considered to be a prominent characteristic of the globalized economy. The emergence of a single currency area accelerated the further integration of money and financial markets in the European Union (EU) to promote the possibility of the euro emerging as not only an international currency but also the key currency. As a non-national but common currency, the euro is currently not used in most countries in the EU, but only in the periphery countries of the EU. It is possible that the euro will compete with the U.S. dollar, which has been the key currency globally since World War II. This chapter investigates the possibility and conditions for the euro to emerge as the key currency by presenting the dynamic currency competition model.

The primary functions of an international currency are described in terms of its three roles. It acts as (1) a unit of exchange, (2) a means of payment, and (3) a store of value. These three functions of the international currency are not independent of each other. Any currency or medium of exchange has the function of being a store of value, which implies purchasing power. Money cannot work as a medium if currency does not play the role of a unit of account. Therefore, any currency must perform these perfect functions.

On the other hand, the functions of the international currency include six roles, which are classified by users, the private sector, the official sector, and traders in foreign exchange markets. In the private sector, the international currency is used as denomination currency, vehicle currency,

payments currency and investment currency for portfolio allocation. The denomination currency is used when private agents write an invoice to denominate prices in trading goods and services with foreign countries. In addition, agents use this currency for domestic trading in high-inflation countries. This case is referred to as currency substitution. Vehicle currency is used for trading with foreign agents, and payments currency is used for trading settlements. Private agents also use the international currency when they prefer global portfolio allocation. If capital movements are liberalized, it will be possible for private agents to invest in foreign assets or currencies. The international currency for portfolio allocation is the currency that these assets or moneys are denominated in.

As mentioned above, in foreign exchange markets, traders use the international currency as a foreign exchange vehicle. In the foreign exchange markets, official agents use international currencies to intervene in the markets to restore the stability of exchange rates. Hereafter, we will refer to the international currency as “intervention currency” in the context of this function.

International currencies do not always perform all six functions. At present, only the key currency, such as the U.S. dollar, has these perfect roles. However, the U.S. dollar does not always play a dominant role as an international currency. Private agents in industrialized countries prefer to use their home currency for exchange risks or transaction costs. This results in a decline in the private use of the U.S. dollar as the denomination and the vehicle currency.

The determinants of international currencies are transaction costs, security issues, policy incentives, policy instruments and risk¹. From among these determinants, this chapter will focus on transaction costs because they are related to the settlement system, which is dependent on Information and Communication Technology (ICT). The transaction cost of international currencies implies a bid-ask spread, which becomes low if

the market for the foreign exchange vehicle is large and deep. Further, as pointed out by Hartman (1997), high exchange volatility increases the transaction cost. Monetary authorities tend to use the same currency for intervention.

One of the determinants of international use for a currency is safety, which depends on the settlement system between cross-border banks. This is because global risk and more importantly, systemic risk that arises from currency crisis and contagion, result in a cross-border bank failing to run other banks not only in the same country but in other countries as well. Since cross-border banking is always faced with systemic risk, banks with cross-border operations pay particular attention to safety settlement networks. Further, risk-averse investors tend to select the currency without systemic risk, resulting in the use of banks participating in safety settlement networks or RTGS.

The Economic Monetary Union (EMU) in Europe now has a settlement system between banks in EMU and non-EMU member countries-Trans-European Automated Real-time Gross settlement Express Transfer (TARGET). TARGET is a pan-European system interlinking EU real-time gross settlement systems. It allows large euro payments to be made in real time across EU countries. Although private banks in EMU member countries have deposits in each central bank for settlement purposes, the central banks of member countries share information on settlements through the EMU in order to connect to a common information platform, or TARGET, which is a decentralized system, not through the European Central Bank (ECB) but through interlinking or bilateral linking. EMU member countries can connect with each other through this system with low risk. The real-time gross settlements system (RTGS) is sustained by ICT, which provides the potential to conduct massive settlement procedures between banks in EMU and non-EMU member countries.

In addition to TARGET, private foreign settlement systems such as EURO1 by the Euro Banking Association (EBA), RTGS^{Plus} in Germany, and Paris Integrated Settlement (PIS) in France provide payments services.

EURO1 is not a gross settlement but a net settlement system operated by EBA, which was a former ECU clearing system. The use of TARGET incurs a high transaction fee because it employs RTGS; however, the transaction fee incurred for EURO1 is lower because it employs a netting payment system for large transactions. In addition, the STEP1 system connected to EURO1 is a netting payment system for small transactions.

The Euro Access Frankfurt (EAF), a net settlement system operated by Landesbank Hessen, has been substituted by RTGS^{Plus} following its declining usage since the introduction of the euro. RTGS^{Plus} has two payments systems, express payments and limit payments. The former is for emergent settlements and the latter for regular settlements. RTGS^{Plus} is open to banking institutions not only in Germany but also in other European countries.

PIS is a liquidity bridge between two net settlement systems: the Paris Net Settlement (PNS) and RTGS in France and Transfers Banque de France (TBF). PNS carries out continuous daily bilateral settlements. Meanwhile, the system makes multi-lateral netting unsettled volume. PNS is connected to TBF, which is operated by Banque de France and is also interlinked with TARGET.

On the other hand, the Clearing House Interbank Payment System (CHIPS) sustains international settlements by using the U.S. dollar. CHIPS is installed in the New York Clearinghouse, where net settlement amounts are calculated. Finally, the amounts are cleared through Fed Wire in the Federal Reserve Bank of New York, where 21 member banks make settlements through deposits in the Reserve Bank. Non-member banks can use deposits in member banks for domestic and international settlements. In addition, information can be obtained regarding agreements and

confirmations of international settlements, such as trade payments, international investments, loans and deposits, and transmits through the Society for Worldwide Interbank Financial Telecommunication (SWIFT), which is a computerized system for information transfer.

TARGET, like RTGS, differs from CHIPS as a net settlement system in real-time risk management. Worldwide users of international settlements would make a choice between the euro and the U.S. dollar for risk management. In other words, because the development of ICT sustains the safety of the settlement system, ICT would be one of the determinants of the international currency.

If the role of the U.S. dollar as a foreign exchange vehicle declines, an alternate international currency has the potential to emerge as a dominant currency in foreign exchange markets. We attempt to investigate the conditions for the shift of the key currency from the U.S. dollar to the euro. In the next section, we develop a model with decreasing cost function.

The remainder of this chapter is organized as follows. In Section 2, the model is introduced in order to explain the characteristics of the foreign exchange vehicle function of the international currency and discuss the competition between the euro and the U.S. dollar. Section 3 is a summary that discusses the future role of the euro.

THE MODEL OF THE CURRENCY COMPETITION

Framework of Our Model

We focus on constructing the model of exchange vehicle currency among foreign exchange traders. This is done for following reasons. First, the use of international currency as exchange vehicle currency is dominated in foreign exchange markets, while the share of trade vehicle currency is small in the markets. This situation is resulted

by a series of exchange control liberalization in developed and developing countries. Second, Krugman (1980) suggests the exchange vehicle currencies are the most important factor of the character of international currency, which has a network effect including increasing return. However, Krugman doesn't indicate the dynamic model of international currency. So, his suggestion is not sufficient to explain why a currency becomes the international currency. We assume a dynamic model in this chapter, which basically has same structure in Takaya (2005).

The increasing return model is applied to explain the characteristic of the network effect of exchange vehicle role of international currency in the foreign exchange markets. The network effect means that the more of an international currency trader of foreign exchange use, the smaller the transaction fee for the international currency becomes. To explain this, the decreasing cost model that applies the increasing return model is introduced. Recent studies by Krugman (1991), Matsuyama (1992) and Murphy, Shleifer and Vishny (1989) have attempted to derive multiple equilibrium to mention economic development when the paths both to good development and to bad development. Their studies suggest roles of expectation for future return and historically initial equilibrium. In this chapter, the increasing return model is applied to our non-linear decreasing transaction model to describe the network effect of the international currency. Krugman (1991) constructs the linear model with increasing return to investigate the characteristic of local equilibrium. Krugman's model is expanded to non-linear model in our model.

We assume two relevant currencies. These are international currencies traded in the foreign exchange markets, for example, the euro and the U.S. dollar. Here, we introduce currency speculators in the third country, who maximize their returns in each period. 1 denotes the currency or assets denominated in the euro, 2 ones denominated in the U.S. dollar. The third countries' currencies are

not international currency, therefore, traders in the countries trade the euro or the U.S. dollar for international transactions. They decide on which currency they investment inter-temporally without considering interest rate differentials. Here, δ_j denotes interest differentials between interest rate in j country and home country.

Since traders face the volatility of exchange rates between international currencies and home's, they make expectations on exchange rates. ε_j represents expected fluctuation of exchange rates. While ε_j generally depends on volume of trade in foreign exchange markets, we assume ε_j is constant at first. We relax this assumption later².

All of trade are assumed to be charged the ratio of transaction fee c_j ($j=1, 2$) which is decreasing function of the total assets balances, B_j ($j=1, 2$) denominated by each currency. In the practical markets, there are differentials between bid rate and ask rate, so called bid-ask spreads, which are though to be reflected in the search cost of each currency trade. Since the search cost assumed to be depend on convenience of meeting currency which trader intend to buy and sell it, the more the volume of transaction increase, the smaller the transaction fee decrease. That is, the transaction cost has the character of economy of scale. Form the other view, difference of ICT innovation related with settlement system results in different structure of transaction cost. We assume z as the ICT innovation parameter by the euro. z represents TARGET system, which is superior to CHIPS. The flows not only of transactions in the foreign exchange markets but also of potential transactions affect the cost, which are the asset positions. Then, we assume c_j decreasing function³. However, each trader deals with c_j exogenously because economy of scale is externality. The cost function is as follows;

$$C_1 = zc_1(B_1) \tag{1}$$

$$c'_j = \frac{\partial c_j}{\partial B_j} > 0, c''_j = \frac{\partial^2 c_j}{\partial B_j^2} < 0$$

where α is assumed to be the parameter representing technology for transaction by using the euro.

We assume each trader also faces the adjustment cost φ , depending on investment volume N . Adjustments of asset position assume to be expense increasingly. The function φ is a following increasing function;

$$\varphi = \varphi(N) \quad (2)$$

Here, we assume $\varphi' = \frac{\partial \varphi}{\partial N} > 0$, $\varphi'' = \frac{\partial^2 \varphi}{\partial N^2} > 0$.

The number of traders in the third countries is assumed constant. For simplicity, trader's investment volumes are supposed to be constrained constant instantaneously. When each trader determines whether they invest in assets denominated in the euro or the U.S. dollar, she or he faces the constraint:

$$n_t = n_{1,t} + n_{2,t} \quad (3)$$

where n_t denotes constraint of each speculator's total investment in period t , n_1 investment to assets denominated in the euro, n_2 investment to assets in the U.S. dollar. Total investments in this whole economy are defined as N in each period, which is assumed to be constant for simplicity. In other words, we assume accumulation rate of total assets is given. Investment constraint in this whole economy is as follows:

$$N = N_1 + N_2 \quad (4)$$

where N_1 denotes investments in the euro assets, N_2 investments in the U.S. dollar assets. Stock constraint of each trader is as follows:

$$b = b_1 + b_2$$

where b denotes total holding assets of each speculator, b_1 holding euro assets, b_2 holding

U.S. dollar assets. Aggregated stock constraint in whole economy is as follows:

$$B = B_1 + B_2 \quad (5)$$

where B denotes aggregate assets in this economy, B_1 aggregate the euro assets, B_2 aggregate the U.S. dollar assets.

Let an individual speculator's profit function be represented by π as follows:

$$\pi = (\varepsilon_1 + \delta_1)b_1 + (\varepsilon_2 + \delta_2)b_2 - zc_1(B_1)n_1 - c_2(B_2)n_2 - \varphi(N_1 + N_2)$$

We can aggregate each speculator's profit function to get a profit function in this whole economy:

$$\Pi = (\varepsilon_1 + \delta_1)B_1 + (\varepsilon_2 + \delta_2)B_2 - zc_1(B_1)N_1 - c_2(B_2)N_2 - \varphi(N_1 + N_2) \quad (6)$$

Π denotes an aggregate profit function. The change of asset denominated by the 1 currency is as follows:

$$\dot{B}_1 = N_1 \quad (7)$$

Each trader maximizes inter-temporal profit subject to the change of asset denominated by the euro. Trader's maximization problem is as follows:

$$\begin{aligned} \max \quad & \int_t^\infty \Pi_t e^{-\rho(s-t)} ds \\ \text{s.t.} \quad & \dot{B}_1 = N_1. \end{aligned} \quad (8)$$

Each speculator in each period determines the volume of investment in euro assets or U.S. dollar assets, while she or he regards transaction cost function as given.

We can define the current value Hamiltonian as follows:

$$H = (\varepsilon_1 + \delta_1)B_1 + (\varepsilon_2 + \delta_2)B_2 - zc_1(B_1)N_1 - c_2(B_2)N_2 - \varphi(N_1) + \lambda N_1 \quad (9)$$

where γ denotes co-state variable. Necessary condition is as follows;

$$\frac{\partial H}{\partial N} = 0, \quad (10)$$

$$\dot{\lambda} = \rho \lambda - \frac{\partial H}{\partial B_1}. \quad (11)$$

Transversality condition is as follows:

$$\lim_{t \rightarrow \infty} \lambda_t B_{1,t} \exp(-\rho t) = 0. \quad (12)$$

From (10),

$$-\alpha c_1(B_1)N_1 - c_2(B_2)N_2 - \phi'_{N_1} + \lambda = 0,$$

which can be written by a form of inverse function as follows:

$$N = N(\lambda, B_1), \quad (13)$$

where we note $\frac{dN}{d\lambda} = \phi'' > 0$, $\frac{dN}{dB_1} = -\frac{zc'_1 + c'_2}{\phi''}$ for our assumptions.

From (13), Equation (11) yields:

$$\dot{\lambda} = \rho \lambda - \left(\Omega - zc'_1(B_1)N_1 + c'_2(B_2)N_2 \right), \quad (14)$$

where we note $\Omega = (\epsilon_1 - \epsilon_2) + (\delta_1 - \delta_2) = const.$ from our assumption. With attention to (12), equation (14) can be solved as follows:

$$\lambda = \int_0^{\infty} \left(\Omega + \alpha c'_1(B_1)N_1 - c'_2(B_2)N_2 \right) \exp((- \rho)(s - t)) ds, \quad (15)$$

where γ represents a current value of a series of difference of expected gains and transaction cost between both two currencies. This suggests determinants of investment are current and future gains from both assets and transaction costs. In other words, difference of future transaction costs depends on other speculator's expecta-

tion for future transaction costs for a reason of externality.

A simple way of exploring how speculations to the assets denominated in the euro determine is to take a linear approximation to the two-equation system in a neighborhood of the steady state. The result is:

$$\begin{pmatrix} \dot{B}_1 \\ \dot{\lambda} \end{pmatrix} = \begin{pmatrix} A_1 & \phi''_{\lambda} \\ A_2 & \rho \end{pmatrix} \begin{pmatrix} B_1 - \bar{B} \\ \lambda - \bar{\lambda} \end{pmatrix}, \quad (16)$$

where we define $A_1 = \frac{\partial N}{\partial B_1} < 0$,

$A_2 = \alpha c''_1 N_1 + c''(\bar{N} - N_1) + zc'_1 N'_{B_1} + c_2 N'_{B_1}$. The sign of A_1 is negative, but that of A_2 is ambiguous.

The transaction cost c assumed to be a decreasing function of B . Then, the sign of A_2 is negative, which is shown above. Trace (tr.) and determinant (det) of matrix (16) are as follows:

$$tr. = A_1 + \rho = -\phi''^{-1}(zc'_1 + c'_2) + \rho, \quad (17)$$

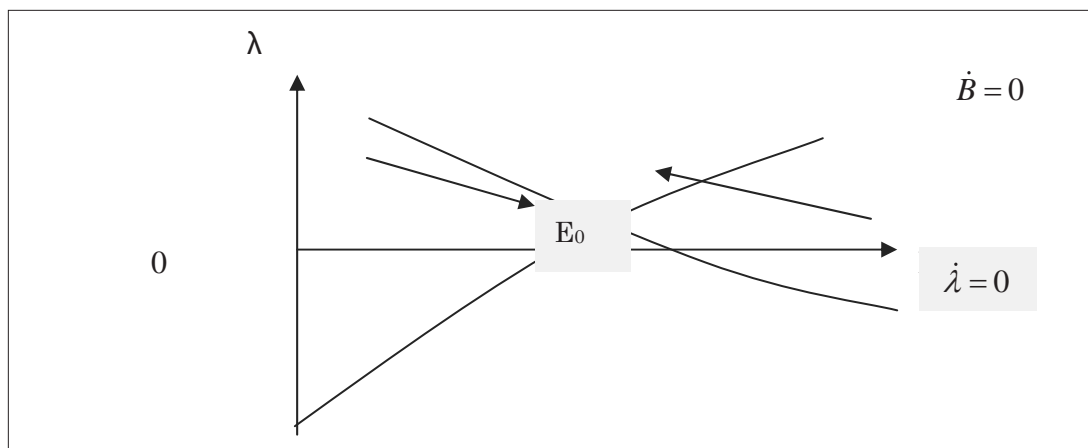
$$\begin{aligned} \det &= A_1 \rho - A_2 \phi''^{-1} \\ &= -\left(\phi''^{-1}(zc'_1 + c'_2) \right) \left(\rho - \phi''^{-1}(\alpha c'_1 + c'_2) \right) - \phi''^{-1} \\ &\quad \left(\alpha c''_1 N + c''(\bar{N} - N_1) \right). \end{aligned} \quad (18)$$

Both of signs of trace and determinant are ambiguous a priori. Here, we suppose *trace* is positive. That is:

$$\rho \phi'' - (\alpha c'_1 + c'_2) > 0, \quad (19)$$

is assumed⁴. This inequality implies that the size of ρ and ϕ is sufficient large, or the technological innovation z is large. z means ICT innovation speed in the euro might be higher than that in the U.S. if the innovation causes the cost decrease through the construction of rigid sage and convenience system. Now, we can make a distinction between some cases below, according

Figure 1. The phase diagram in the case of decreasing function of transaction cost (1)



to parameters of the determinant because the sign of determinant is ambiguous a priori.

Case 1

We assume the following inequality:

$$\begin{aligned} & \left| -(zc'_1 + c'_2)(\rho - \phi^{-1}(zc'_1 + c'_2)) \right| \\ & > \left| (zc''_1 N_1 + c''_2(\bar{N} - N_1)) \right|. \end{aligned} \quad (20)$$

This inequality (20) means that the degree of decreasing cost of transaction is smaller. In case 1, the network effect of an international currency as the foreign exchange vehicle is not strong.

In case 1, two equilibriums E_1 and E_2 are saddle because the determinant of each equilibrium is negative. Because det is negative in this case, the equilibrium is saddle point with unique stable arm, which we have explored in the previous section. The phase diagram is shown as Figure 1.

Case 2

In case 2 of the parameters of the determinant, the following inequality is assumed:

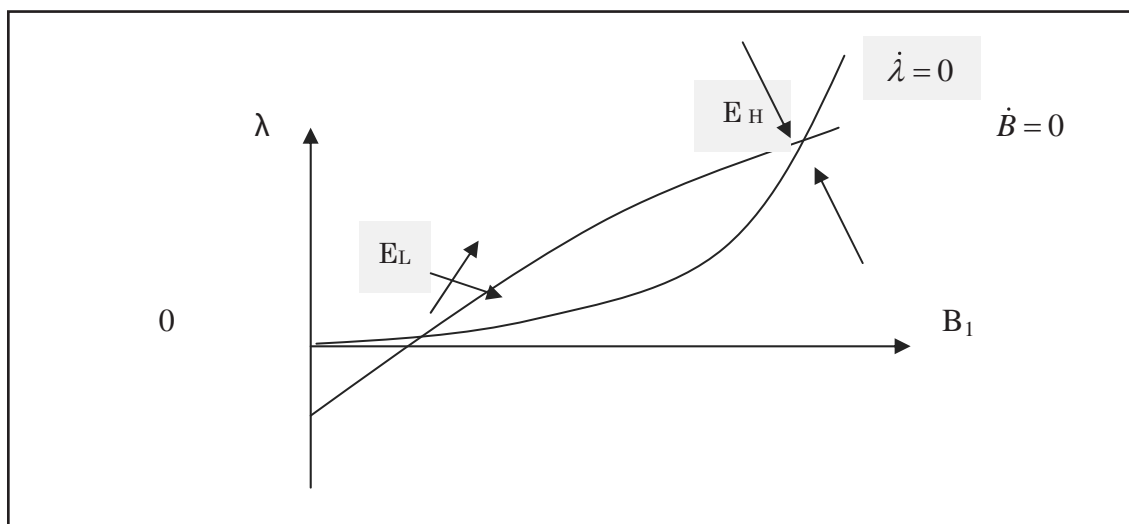
$$\begin{aligned} & \left| -(\alpha c'_1 + c'_2)(\rho - \phi^{-1}(\alpha c'_1 + c'_2)) \right| \\ & < \left| (\alpha c''_1 N_1 + c''_2(\bar{N} - N_1)) \right|. \end{aligned} \quad (21)$$

This inequality (20) means that the degree of decreasing cost of transaction is larger. In case 1, the network effect of an international currency as the foreign exchange vehicle is strong.

Figure 2 shows the phase diagram of λ and B . The lines of $\dot{\lambda} = 0$ and $\dot{B} = 0$ are right upper slope with two equilibrium E_L and E_H . E_H is equilibrium where share of the euro is highest in the equilibrium. Also, E_H is saddle point. The reason is that determinant of matrix of coefficients of (16) is negative since B_1 is smaller for the bigger B_1 from our assumptions. The share in E_L is lower than one in E_H . The determinant of matrix of coefficients in E_L is positive since B_1 is bigger for the reason of relatively smaller B_1 . Thus, this point is source. The point 0 is also equilibrium, where the share is zero. The determinant of matrix of coefficients in zero point is positive as we mentioned above.

Thus, smaller uses of the euro can move to high uses in case 3 by speculator's expectations. At the beginning of introduction of the euro, frequency of use is lower than that of the U.S. dollar. However, the share of the euro could be higher if expectation of use of the euro is evolved in the near future, to higher frequency than the U.S. dollar.

Figure 2. The phase diagram in the case of decreasing function of transaction cost (2)



IMPLICATIONS FOR THE FUTURE OF THE EURO

This chapter investigated the conditions for the euro to dominate the U.S. dollar as the key currency in foreign exchange markets. When the euro was first introduced, technical innovations in dealing in the euro significantly decreased the transaction costs due to network effects. We focus only on the foreign exchange vehicle function of the international currency because this is more important a factor than the other factors. Even if there were no technical innovations in dealing in the euro, the large increase in the transaction volumes in the euro could still be regarded as technical progress.

Table 1 lists recent statistics on the current use of major currencies. As evident from this table, the U.S. dollar has the largest share in terms of international use, but not a dominant share, except in the case of foreign exchange turnover. Therefore, today, the U.S. dollar as the key currency is sustained by its role as a foreign exchange vehicle. In this chapter, we focus on this role. We attach importance to the foreign exchange vehicle function since it is the dominant function in foreign

exchange markets. In particular, the currency that function as a vehicle of trade between small volume currencies in foreign exchange markets emerges as an international currency. The logic that applies here is the same as that applicable to the evolution of money. Alogoskoufis, Portes and Rey (1997) use Hartman's estimates to compute the bid-ask spreads with zero volatility, which are shown in Table 2 as spot foreign exchange transaction costs. Although the difference in transaction costs due to difference in liquidity is very small for a ten thousand dollar transaction, the actual amount of the difference is very large because the number of daily transactions in foreign exchange markets is very high. Therefore, these differences are very important for traders dealing in currencies.

The U.S. dollar is likely to retain its current status for some period of time even after the introduction of the euro. The hysteresis effect or the history of the use of the U.S. dollar causes traders to deal in the dollar. However, if the areas using the euro expand — if Central and Eastern Europe accept the euro as their currency — it will result in the euro being used more frequently as the denomination or vehicle currency. If Asian or

Evolution of the Euro and Currency Competition in the Global ICT Age

Table 1. The recent statistics on the present international use of the main currencies

| Market Share | USD | Yen | Euro | Others* |
|--|------|------|------|---------|
| Foreign exchange turnover (2001) | 90.4 | 22.7 | 37.6 | 49.3 |
| Gross issuance of long-term international debt securities (2003q3-2004q2) | 43.1 | 7.0 | 32.0 | 17.9 |
| Official reserves (2003) | 63.8 | 4.8 | 19.7 | 11.7 |

Source: ECB, *Review of the International Role of the Euro, 2005*; BIS, *Central Bank Survey of Foreign Exchange and Derivatives Market Activity*.

Notes: * Other currencies include pound sterling, French franc, Netherlands guilder and ecu.

Table 2. Spot foreign exchange transaction costs (\$ for a 10,000 transaction, assuming zero volatility)

| | |
|--------|------|
| \$/DM | 4.06 |
| DM/Yen | 4.37 |
| \$/Yen | 4.16 |
| FF/\$ | 4.61 |
| /\$ | 4.27 |

Source: Alogoskoufis, Portes and Rey (1997)

other countries prefer to hold assets denominated in the euro, its importance as portfolio currency will increase. This will result in a decline in transaction costs for the euro, making it more convenient to use. Once the use of the euro becomes more frequent, the transaction costs will dramatically decrease, and its share will increase correspondingly as it will be able to compete with the present key currency — the U.S. dollar. Therefore, the euro has the potential to emerge as the key currency of the world.

With regard to a bipolar key currency regime, we have historical experience of the sterling-dollar regime during the interwar period, when massive capital flow resulted in instability in the sterling/dollar exchange rates. Furthermore, the international monetary regime became unstable

due to the competition in devaluation in order to take advantage of lower prices in foreign trade. Theoretically, exchange rates are indeterminate if capital mobility is deregulated to become perfect between symmetric countries. If capital mobility became perfect between the areas using the euro and the U.S. dollar, and the network effect diminished, the bipolar regime would become unstable through speculative capital flows between these areas.

As a method of preventing these instabilities, the following points may be considered: (1) implementation of capital controls, (2) introduction of a fixed exchange rates regime, and (3) promotion of discretionary economic policy coordination. The first proposal — implementation of capital controls — is expected to be resisted under cur-

rent globalizing capital flows and the ICT age. Although controls by different governments may succeed in restraining globalizing capital, profit-seeking entities such as hedge funds, mutual funds, pension funds, and individual investors object to the implementation of capital controls. Second, if a fixed exchange rates regime is introduced, macroeconomic policies will be restrained in the concerned country. Therefore, the government may hesitate to introduce the fixed regime. The areas using the euro have decided upon a macroeconomic policy mix of price stability by the European Central Bank and fiscal deficit by the Stability and Growth Pact, leaving no scope to commit to exchange rates stability. Third, policy coordination is the only way to prevent instability; however, in some ways, this constrains room for discretion in macroeconomic policies. Agreement on policy coordination is a comparatively easier option because it does not require strict rules. Thus, policy coordination is the only realistic solution to prevent an unstable international monetary regime. To be more precise, the current key-currency country, the United States, should control its twin deficits, namely, its current account deficits and fiscal deficits. On the other hand, the areas using the euro should pay attention not only to price stability but also to economic growth in order to have an impact on world business cycles.

Although policy coordination among these areas may enable the realization of a stable situation, this coordination has the potential to become a moral hazard for the U.S. government. The government may have an incentive to suffer fiscal deficits as a consequence of the facility to finance these deficits. Therefore, the U.S. government should commit to policy coordination in order to decrease its current account and fiscal deficits. If traders in foreign exchange markets realize the U.S. government's reluctance to coordinate its policies with the areas using the euro, they may shift the massive funds they own from the United States to other countries, thereby resulting in unstable exchange rates and real economy. As

suggested by our model in the previous section, a small change in the expectations of traders, arising from mistrust regarding policy coordination, can cause massive capital flows and a switch in the key currency.

In the global ICT age with globalizing capital, the stability of the international monetary system may depend on appropriate policy coordination between the U.S., which provides the existing key currency, and the areas using the euro, which have the potential to provide the next key currency.

REFERENCES

- Alogoskoufis, G., Portes, R., & Rey, H. (1997). The emergence of the euro as an international currency. *CEPR Discussion Paper*, 1741.
- Bénassy-Quere, A., Mojon, B., & Schor, A.-D. (1998). The international role of the euro. *CEPII, Document de Travail*, 98-03.
- Cohen, D. (1997). How will the euro behave? *CEPR Discussion Paper*, 1673.
- Goodhart, C. (1988). The foreign exchange market: A random walk with a dragging anchor. *Economica*, 55, 437-60.
- Guckenheimer, J., & Holmes, P. (1986). *Nonlinear oscillations, dynamical systems and bifurcations of vector fields*. New York: Springer-Verlag.
- Hartman, P. (1998a). *Currency competition and foreign exchange markets: The dollar, the yen and the euro*. Cambridge, UK: Cambridge University Press.
- Hartman, P. (1998b). Do Reuters' spreads reflect currencies' differences in global trading activity? *Journal of International Money and Finance*, 17, 757-784.
- Howitt, P., & McAfee, P. (1988). Stability of equilibria with externalities. *Quarterly Journal of Economics*, 103, 261-277.

Kingman, P. (1991). History versus expectations. *Quarterly Journal of Economics*, 106, 651-667.

Kiyotaki, N. (1988). Trade, accumulation and uneven development. *Journal of Development Economics*, 103, 695-714.

Krugman, P. (1980). Vehicle currencies and the structure of international exchange. *Journal of Money, Credit, and Banking*, 12, 503-526.

Matsuyama, K. (1991). Increasing Returns, Industrialization and Indeterminacy of Equilibrium. *Quarterly Journal of Economics*, 106, 17-650.

Matasuyama, K. (1992). A simple model of sectoral adjustment. *Review of Economic Studies*, 59, 375-388.

Murphy, K., Shleifer, A., & Vishny, R. (1989). Industrialization and the big push. *Journal of Political Economy*, 97, 1003-1026.

Romer, P. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94, 45-75.

Takaya, S. (2005). Competition between the euro and the U.S. dollar. *Kansai University Review of Business and Commerce*, 7, 41-62.

Tavlas, G. S. (1997). The international use of the U.S. dollar: An optimum currency area perspective. *The World Economy*, 20, 709-747.

ENDNOTES

- ¹ See Bénassy-Quere, Mojon and Schor (1998) for details.
- ² We extend this model with endogenously expected fluctuation of exchange rates in Takaya (2005).
- ³ We explain the increasing function case in Takaya (2005).
- ⁴ Negative case is ignored here, because the system is stable.

This work was previously published in Global Information Technology and Competitive Financial Alliances, edited by Y. Kurihara, S. Takaya, and N. Yamori, pp. 102-117, copyright 2006 by Information Science Publishing (an imprint of IGI Global).

Chapter 1.18

The Genesis, Political, and Economic Sides of the Internet

Andrew Targowski

Western Michigan University, USA

ABSTRACT

The purpose of this chapter is to show that the Cold War is behind the invention of the Internet. This is one of very few positive results of this war, which had tremendous influence on the further development of civilization. The research on the universality of info-communication processes was conducted on both sides of the Iron Curtain, which indicates the similarities in engineering thinking, regardless of geographic locations. The political meaning of the Internet does not only result from its history but also stands for the support of democratic development and the obstruction of dictatorships. The history of the Internet is also an example of the development of great engineering talents and research and development centers, which rise to the occasion on such ambitious projects. All of these aspects of the Internet will be investigated in this chapter, as well as its impact on the emergence of the global civilization.

INTRODUCTION

The purpose of this chapter is to show that the Cold War is behind the invention of the Internet. This is one of very few positive results of this war, which had tremendous influence on the further development of civilization. Research on the universality of info-communication processes was conducted on both sides of the Iron Curtain, which indicates the similarities in engineering thinking, regardless of the geographic locations.

The political meaning of the Internet does not only result from its history but also stands for the support of democratic development and the obstruction of dictatorships. The history of the Internet is also an example of the development of great engineering talents and research and development centers, which rise to the occasion on such ambitious projects. All of these aspects of the Internet will be investigated in this chapter, as well as its impact on the emergence of the Global Civilization.

CHALLENGES OF THE COLD WAR

The Cold War began to take shape just before the end of the World War II in April 1945 when President Harry Truman reprimanded Vyacheslav Molotov, the Soviet Foreign Minister and Stalin's confidant for sabotaging the Yalta Agreement in Poland, where a free election was postponed. Formally speaking, the Cold War began after Winston Churchill's speech on the Iron Curtain in Fulton, Missouri, on March 5, 1946. He said that an "Iron Curtain had fallen from Stettin in the Baltic to Trieste in the Adriatic. The Soviets had installed pro-communist governments in every country which had been occupied by the Red Army as well in the Soviet zone of Germany" (Kissinger, 1994).

The Cold War lasted 46 years, from 1946 to 1991, when the Soviet Union collapsed. This war relied on the symmetry of military power between the United States (U.S.) and the USSR, who both kept their respective military forces in balance to avoid unwanted military confrontations. The U.S. treated this war as a means of promoting democracy and containing communism (Kennan, 1947), while the USSR used the war to conduct the double standard, officially promoting world peace and unofficially looking for the opportunity to defeat capitalism (Targowski, 2000).

The politics of communist containment was implemented by the strategy of circling the USSR by friendly states, which hosted American bases (Spykman, 1942, 1944). In Europe, NATO was organized to counter the Warsaw Pact armies (Moczulski, 1999). The architecture of the Cold War is shown in Figure 1.

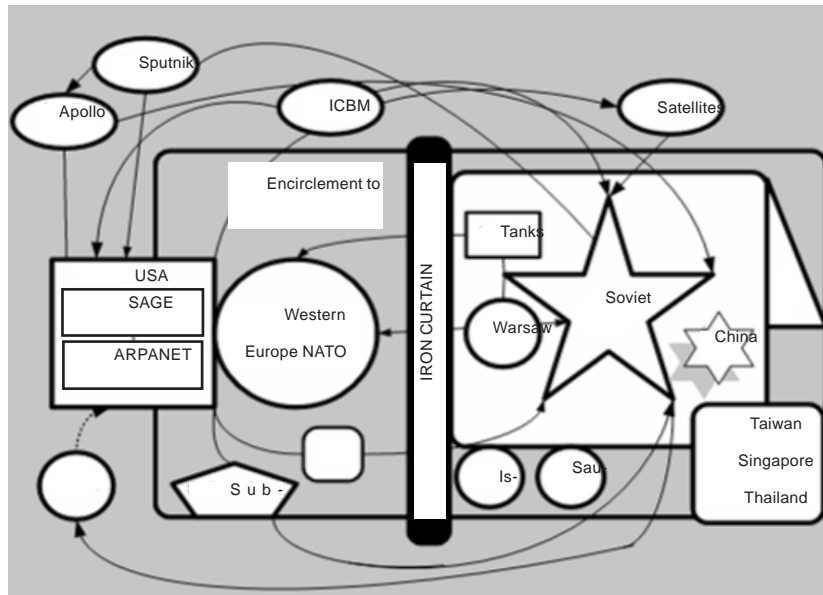
The Cold War was a good pretext for the development of different kinds of weapons, which pushed scientific and technological progress forward both in military and civilian areas. In this respect, the Soviets surprised the Americans when they sent Sputnik 1 into space in 1957. This was a message that the Soviets were transforming from the aircraft to the rocket-oriented strategy to

reach the American homeland. In the U.S., there took place a short-lived consternation, which led towards the growth of funding for universities and research.

The development of American weaponry in the period of the Cold War was oriented around systems of communications, information, transportation and efficient destruction armaments as follows:

1. Offensive systems:
 - 1.1. Fusion bombs to enhance the striking power of the Air Force
 - 1.2. Long-range bombers, such as the B29 and B52
 - 1.3. "Polaris" atomic submarines
 - 1.4. Project Atlas: the development of Intercontinental Ballistic Missiles (ICBMs) during the 1950s
 - 1.5. Satellite technology for gathering intelligence in the 1950s
 - 1.6. Space technology for ruling space—the Apollo Project in the 1960s
 - 1.7. Other
2. Defensive systems:
 - 2.1. Semiautomatic Ground Environment Project (SAGE)—a real-time computer-and-radar-based air defense system, created in the 1950s under the Atlas project, to collect and process information for commanding the Air Force in defending the country
 - 2.2. A reliable telecommunication network ARPANET, later transformed into the Internet to assure governing the country "the day after" an atomic assault
 - 2.3. Other
3. Management and problem-solving systems:
 - 3.1. System analysis in the 1950s
 - 3.2. PERT in the 1960s
 - 3.3. Intelligence, Command, Control and Communication (I/C³) in the 1960s
 - 3.4. Other

Figure 1. The architecture of the Cold War and its major weapons



In the 1950s-70s, military-funded projects dominated the technological and management landscape. These projects were developed in the so-called military-industrial-university complex. Many young engineers and scientists had chosen to work in this complex, since they believed that they were responding to the threats of the Soviet Union. The commitment of these professionals, however, began to erode in the 1960s during the Vietnam War, and with the rise of counterculture values, were strongly present in the San Francisco Bay area.

Among the then-leading research centers was the RAND Corporation, created in 1948 in Santa Monica, Calif., and later transformed into the Air Force's Think Tank. Other leading centers were the MITRE Corporation, Western Development Division (WDD) of the Air Force Research and Development Command, the Ramo-Wooldridge Corporation, the Advanced Research Project Agency (ARPA), Betchel/Persons Brinckerhoff and the National Aeronautic and Space Administration (NASA).

At the beginning of its existence, RAND was involved in the development of the U.S. atomic strategy and later undertook projects on research operations and system analysis to optimize the complexity of large-scale weapons. For RAND, it was just one step in moving from system analysis to systems of info-communications in the military.

THE POLITICAL GENESIS OF THE INTERNET

In 1959-60s, the Cold War was dominated by the strong personalities of Soviet Premier Nikita Khrushchev and the American President John F. Kennedy. After sending Sputnik to space in October 1957, on November 10, 1958, Khrushchev delivered a speech demanding an end to Berlin's four-power status and warning that the Soviet Union intended to turn control of its access over to its German satellite. In May, 1960 an American U-2 spy plane was shot down over the Soviet

Union. The summit in Paris was cancelled by the Russian Prime Minister. By the time John F. Kennedy entered office, one of his first projects was the attempt to send Cuban exiles to overthrow Fidel Castro at the Bay of Pigs in April 1961.

In the summer of 1961, the U.S. confronted the Soviet Union over the divided city of Berlin. Opposing Khrushchev's effort to break the long-standing impasse over Berlin on Soviet terms, Kennedy announced a new military buildup and employed martial rhetoric to summon U.S. citizens to a new test of their resolve. In response, the Soviets constructed the Berlin Wall in 1961, the hardware of the Iron Curtain. The following year, in 1962, the Soviet Union began building missile bases in Cuba, which threatened the U.S.. President Kennedy ordered a naval blockade of Cuba and demanded that the Russians remove the missiles. Faced with the threat of war, Khrushchev agreed to dismantle the bases if the U.S. secretly agreed to withdraw nuclear-tipped missiles from nearby Turkey.

THE TECHNICAL GENESIS OF THE INTERNET

After the Cuban crisis, the Americans became aware of how close to catastrophe they were if Soviet rockets could be launched from Cuba, just about 90 miles away from American soil. In such a political climate, the U.S. government initiated work on communication systems that could function the "day after." These systems brought the Internet to our civilization practice.

The official birth of the Internet is associated with the development of ARPANET in 1969-'72 by ARPA (located at the DoD (DoD) since 1958). At the beginning of its existence, ARPA was involved in researching how to detect attacking rockets and the enemy's atomic tests. In 1959, ARPA began sponsoring a research project on interactions between an operator and computer within a system of control-command. This project

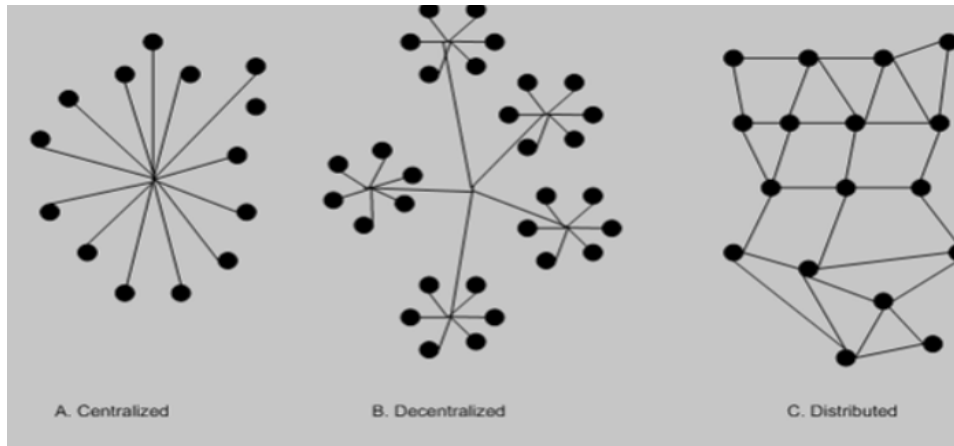
was done by the System Development Corporation (SDC), which trained hundreds of future computer programmers. It is worth mentioning that at that time, the education of computer specialists was in its infancy.

Prior to ARPA's involvement in the development of ARPANET, one must take into account RAND's work on telecommunication systems in the late 1950s. This was the post-Sputnik period, when both sides of the Cold War were developing intercontinental ballistic missiles targeted at the enemy's communication systems to stop the country's activities. Without an efficient communication system, the U.S. could not function. In 1959, Paul Baran began to work at RAND, and his first major project was to define the feasibility of a survivable communication system.

At RAND, Baran spent 2 years creating a workable design and another 3 years trying to prove it could work. In other words, his initial research lasted 5 years (1959-1964) until he could write an 11-volume outline of a decentralized network where the nodes have a redundancy level of three, thus making it extremely resistant to destruction. His ideas were published in open literature in 1964. "We felt," Baran said, "that it properly belonged in the public domain." Not only did RAND create it, they sent it to laboratories around the world. Therefore, RAND did not apply for a patent. These ideas have become the basis for the modern Internet.

In 1959-1964, years of the Berlin and Cuban crises, Baran was asking the question, "What is the minimum requirement for a survivable communication system?" He calculated that the U.S. network of AM radio stations could be used to relay messages by attaching a little digital logic at each of the broadcast "nodes." With this design, it would be possible to send a message under almost any circumstance, because once a message was sent, it would continue transmitting itself until copies of it bounced back. However, the idea was scoffed at by military leaders for lack of enough bandwidth.

Figure 2. Three topologies of a network



To develop more communication capacity and efficiency, Baran devised five guidelines:

1. The network cannot be centralized
2. The network of nodes must have distribution, each node connected to more than one neighbor (Figure 2)
3. The network must have redundancy, which is where each node must be connected to more nodes than necessary for normal communications
4. Messages should be divided into small blocks, called “packets”
5. Message blocks should be digital rather than analog

Baran’s inspiration for a non-centralized system is based on human brain functioning. He knew that the most reliable network is the human brain. His question was: How does the brain work? Does it have any centralized points? With such questions, Baran contacted a brain surgeon, Warren McCulloch of the Massachusetts Institute of Technology. He said that if “you cut a piece of the brain or damaged a part, its functions will move over to the undamaged part.” “So that is a distributed network—neurons connected to one another” (Baran, 2003).

A distributed network was only a part of the plan. Baran’s “decisive invention” was packet switching. This invention has changed the world. Baran’s solution breaks a message into small blocks; hence, its transmission is more efficient. These small blocks can take a variety of routes and be rebuilt at the destination’s node. It is how data travels online today.

To achieve the best transmission quality, message blocks must be digital, not analog, according to Baran’s solution. Digital signals, unlike analog ones, do not degrade every time they are transmitted. Furthermore, if the signal is damaged, several error-correcting procedures can be used to correct distortions.

Moreover, Baran divided the signal into what he calls “message blocks.” The message is broken into several data streams, and each is independently routed, using packet switching, for a destination. The network would relay each segment without any centralized control. He developed a rapid store-and-forward algorithm that indicates the best possible route to the destination. In addition, the table is constantly being updated by information on neighboring nodes.

The centralized network has all its nodes connected to a central switching node to allow simple switching, giving it a single point of high vulner-

ability; for example, a single explosion could destroy the point of control. The decentralized network, representative of the AT&T long-distance network at the time, is better. Instead of a single central switching node, the network comprises small-centralized clusters, with most traffic going to nearby neighbors, and only the longer-distance traffic routed to the longer links.

The distributed network is a network without any hierarchical structure; thus, there is no single point of vulnerability to bring down much of the network. Manhattan has streets organized in a semi-distributed network, while Paris is organized into a decentralized streets network.

The latter had been built by a police chef (Haussman) to stop revolutionary crowds. However, in today's environment, this network slows traffic, while it's still manageable in downtown New York City, due to its streets network.

The DoD wanted AT&T to develop Baran's network. AT&T replied that, "it's not going to work, and furthermore, we're not going into competition with ourselves." A few years later, Baran said: "The 'Net's biggest threat wasn't the USSR, it was the phone company" (Baran, 2003). Because of the roadblocks at AT&T and the Pentagon, it wasn't until the 1970s that the technology was finally adapted as the foundation architecture of ARPANET, the precursor of the Internet.

Baran's Vision of the Web and Projects

Around December 1966—when IBM had just introduced its famous IBM 360 series with disks and online capability of processing transactions and queries, the first mature solutions in the industry—Baran presented a paper at the American Marketing Association called "Marketing in the Year 2000." He described push-and-pull communication and how we are going to do our shopping via television set and virtual department store. This is pretty much what Web TV is today. Some in the audience were furious. They said, "People

don't go shopping to buy things. They go there because of the enjoyment." Today, online shopping has not replaced traditional shopping, but it remains very popular.

The architect of the Internet, Baran, quit RAND and moved to the private industry as an entrepreneur. He and Millard started a string of companies specializing from consulting to satellites. In 1972, the two men founded CableData Associates, with an initial contract to study the divestiture of ARPANET into MILINET and INTERNET. The next set of companies is rich: The latest one is Com21 Inc., founded by him in 1992, which is a major supplier of cable modems and head ends for cable systems. Baran also works to preserve the history of technology as a member of RAND President's Council, as a trustee of the IEEE History Center, a trustee of the Charles Babbage Foundation and a trustee of the Marconi Foundation at Columbia University. He is recipient of many honors and awards. To mention a few: Armstrong Award (1987); Alexander Graham Bell Medal (1990); Electronic Frontier Foundation Pioneer Award (1993); IEEE's Life Fellow (1993); Franklin Institute Bower Award and Prize for Achievements in Science (2001; he received \$250,000, later donated by Baran to education); and more.

THE NEXT MILESTONES OF THE INTERNET'S DEVELOPMENT

The Information Processing Techniques Office (IPTO) at ARPA was supported by Congress generously. IPTO initiated the ARPANET project in 1966 to interconnect time-sharing computers at the 17 ARPA-founded academic, industrial and government computer centers around the country. This project had in mind the electric-generating station analogy to optimize capacity utilization through sharing of computer resources to meet demand. This was a time when the cost of large-scale computing could be in the tens of millions

of dollars.

The future designers of ARPANET were supposedly more familiar with Leonard Kleinrock's dissertation (published in 1964) on "time slicing," which anticipated packet switching and distributed control in data networks, than with Baran's concept (Hughes, 1998). On the other hand, "time slicing" as a concept of time-sharing was implemented by General Electric (GE) in its "225" computer in 1962, which applied John Kemeny's interactive BASIC language. It is hard to accept the view that RAND's major project developed by Baran for the DoD was not known by the DoD's ARPA researchers.

The next milestones of future Internet solutions are as follows:

- **1967:** Interface Message Processors (IMP) are defined by Lawrence Roberts at ARPA.
- **1969:** IMP hardware and software are developed by Bolt Beranek and Newman (BBN) company, where the project was led by Frank Heart and Robert Khan. Also, Honeywell's crew adapted Honeywell 516 computer as an IMP.
- **1972:** Network Control Program (NCP), including host-to-host and host-to-IMP protocols, was defined and implemented by the Network Working Group at UCLA, led by Kleinrock.
- **1972, August:** 15 host-computer sites connected to the network were using the NCP protocol; however, the network ran at only 2% capacity.
- **1973:** E-mail constituted 75% of ARPANET traffic, giving the greatest stimulus for the growth of the 'Net.
- **1974:** Transmission Control Protocol/Internet Protocol (TCP/IP) was defined by Vinton Cerf and Robert Kahn.
- **1983:** The DoD decided that all ARPANET computers must apply TCP/IP and not the OSI standard.
- **1983:** The DoD divides ARPANET (with hundreds of host computers) into MILINET and a public net, after advice from Baran and Millard.
- **1984:** Internet is named and the TCP/IP protocol adapted.
- **1989:** World Wide Web (WWW) was created by Tim Berners-Lee at CERN in Geneva, Switzerland.
- **1990:** Information Superhighway – Al Gore.
- **1992:** The Internet Society, a private non-profit group, supports the Internet Activity Board (IAB), which handles much of the Internet's behind-the-scenes and architectural issues.
- **1993:** Mosaic, the first user-friendly software-oriented browser, was developed by Marc Andreessen at the University of Illinois.
- **1994:** Netscape, the first commercial-friendly software-oriented browser was developed by Andreessen at the Mosaic Communications Group (later renamed to Netscape), which was bought by America onLine (AoL) in 1998.
- **1995:** First version of Microsoft's Internet Explorer was launched, which in the 1990s has about 70+ percent of the browsers' market.
- **1997:** E-commerce takes off, Amazon.com – Jeff Bezos.
- **1998:** Growth of the New Economy (Global Economy based on the Net).
- **1999:** Internet2 created. It is a project led by 200+ universities working with corporations to develop a leading-edge network for the national research community.
- **2000:** Dot.Com crisis.
- **2001:** The rise of an e-republic.
- **2003:** The rise of an e-enterprise.
- **2004:** About 1 billion users of the Internet in Global Economy.
- **2005:** Emergence of Global Civilization and "flattened" world.

POLITICAL CONSEQUENCES OF THE INTERNET

The development of a universal telecommunication network is of great importance for politics and civilization. As indicated, the Internet is a product of the Cold War, when at its peak in 1972 it reached the first phase of development, connecting 15 centers within the pilot system of ARPANET. It is necessary to mention that behind the Iron Curtain, a concept of the INFOSTRADA was launched in the same year, 1972. *La strada* means “highway” in Italian; hence, with an exception in Germany, all European highways are called “*autostrada*.” The Polish INFOSTRADA was planned to transform Poland from an uninformed to informed society within the communist regime. Already in 1973, three nodes, Gdańsk – Warsaw – Katowice, had been interconnected via Singer 10 computers (IMP) within a “packet switching” network. Targowski learned about the technical solutions of ARPANET from Dr.

L. Roberts during the Diebold Research Program Conference in Madrid in June 1971. The project, in addition to the Polish funds, was also sponsored by \$1 million from the Singer Corporation, which wanted to apply tested solutions in its business in the U.S. However, ARPANET was designed to interconnect super-computers of scientific centers, while INFOSTRADA (Figure 3) was planned to support a flow of economic-social information among main organizations and citizens within the National Information System. Very soon, the communist authority found that INFOSTRADA led to the uncontrollable flow of information, and immediately the project was closed and its leaders, including the author, were put out of the job market (Targowski, 1991, 2001).

Of course, the INFOSTRADA project was not foreign to the Central Intelligence Agency (CIA), since it was widely publicized in the Polish press. At that time, a young Congressman—Albert Gore—was member of the Intelligence Committee and had to know all about the Polish project. When he became vice president of the U.S., he

Figure 3. National Information System and INFOSTRADA (Targowski model, 1972)

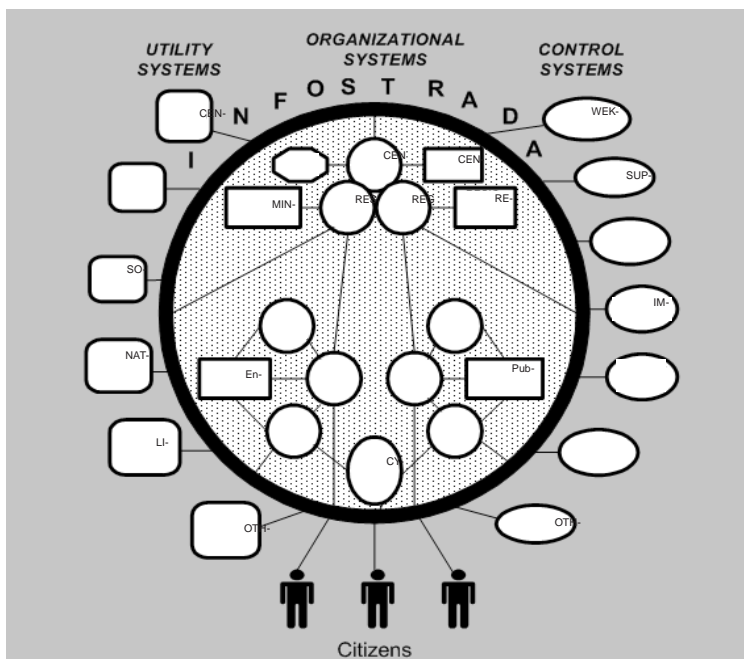
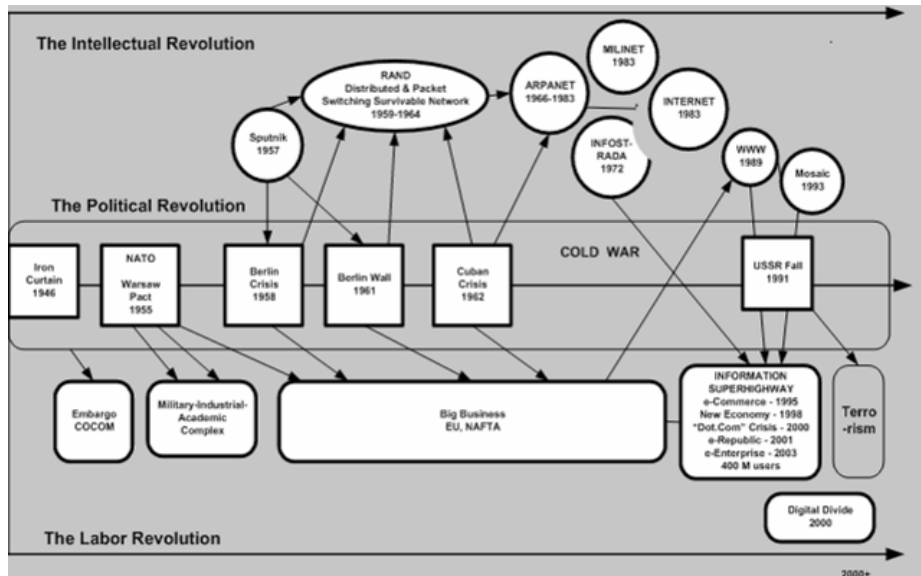


Figure 4. Relations among civilization revolutions



translated “INFOSTRADA” into “Information Superhighway” and admitted as much in the December 1995 issue of *Wired* magazine (Hellman, 1995). This idea soon became the leading concept for the development of all sorts of information infrastructures, triggering the emergence of the so-called New Economy in the U.S. as well as in the “new” Global World.

The Internet on the global scale supports the free-flow of info-communication and is positive for the expansion of democracy and negative for political or theocratic dictatorships. These types of dictatorships censor the info-communication flow on their servers. These attempts are reminiscent of the Pony Express strategy, where faster horses were introduced when the telegraph was introduced for the first time in America. Of course, the Internet enables the dissemination of criminal info-communications, including those among terrorists. The issue of practically applying ethics to the Internet is a hot topic among many societies. For example, in Russia, e-commerce cannot be applied due to dishonest practice of all involved parties, including gangsters.

Figure 4 illustrates the relationships among intellectual, political and labor revolutions. This model proves how these relationships are important for each type of revolution development.

THE SOCIAL CONSEQUENCES OF THE INTERNET

The use of the Internet requires access to a computer and an Internet service provider (ISP), which can be afforded by people with some resources. Hence, the digital divide issue takes place not only in underdeveloped countries but in developed ones, too. Nowadays, in the world there are 1 billion people with a password to a computer net and 5 billion without such a password. This leads towards the bifurcation of civilization and all of the negative consequences of it. One can say that the Internet accelerates the development of developed nations and relatively slows the development of underdeveloped nations. However, many civilization positives, such as education, training, and information and knowledge dissemination, can be accelerated by the Internet in those less-fortunate nations.

THE ECONOMIC SIDE OF THE INTERNET

The Emergence of Global Economy and Civilization

These transportation and info-communication technologies provide the infrastructure for global operations. Table 1 illustrates the decreased costs of transportation in the last 160 years (1830-1990), and Table 2 shows how the costs of communication and computers declined in the last 40 years (1960-2000). During the first and second waves of globalization, technology provided incredible productivity in making and moving things. In the third wave, technology is driving the productivity of information itself.

Information and communication technology (ICT) triggers a shift in the post-industrial society's *modus operandi*, which is based on new key features (Bell, 1981):

1. The shift from a goods-producing to a service economy
2. The increasing reliance on theoretical knowledge

3. Creation of a new “intellectual technology” based on computers and other smart machines

Manuel Castells (1996) observes that, “what has changed is not the kind of activities humankind is engaged in, but its technological ability to use as a direct productive force what distinguishes our species as a biological oddity: its superior capacity to process symbols.” ICT technology does not replace agriculture and industry, but optimizes them. It leads towards the “informatization” of the Global Society, which by connecting all of us makes us the Global Open Society (Anderson, 2004). The emerging Global Digital Consciousness (GDC) as the symbiosis of humans and machines provides cognition and external memory systems that support Global Civilization and vice versa. Hence, the GDC is composed of:

- *infosphere* (computerized info-communication systems composed of databases, applications and networks),
- *cyberspace* (the Internet and Web applications),
- *mediasphere* (radio, TV, cable), and
- *mindsphere* (global ideas generated by previous global spheres).

Table 1. Transport costs, 1830-1990 (Sources: Baldwin and Martin, 1999, World Economic Outlook, May 1997, Table 11)

| Year | Ocean Transport | | Average Air Transportation Revenue per Passenger Mile (in 1990 US \$) |
|------|-----------------------------------|---------------|---|
| | Wheat, Percent of Production Cost | Ocean Freight | |
| 1830 | 79 | | |
| 1850 | 76 | | |
| 1880 | 41 | | |
| 1910 | 27.5 | | |
| 1920 | | 100 | |
| 1930 | | 65 | 0.68 |
| 1940 | | 67 | 0.46 |
| 1950 | | 38 | 0.30 |
| 1960 | | 28 | 0.24 |
| 1970 | | 29 | 0.16 |
| 1980 | | 25 | 0.10 |
| 1990 | | 30 | 0.11 |

Table 2. Communication and computer costs, 1960-2000 (Sources: World Economic Outlook, May 1997, Table 11, updated to 2000; U.S. Commerce Department, Bureau of Economic Analysis and Mason [2001])

| Year | Cost of a 3-Minute Telephone Call, New York to London (in 2000 US \$) | Price of Computers and Peripheral Equipment Relative to GDP Deflator |
|------|---|--|
| 1960 | 60.42 | 1,869,004 |
| 1970 | 41.61 | 199,983 |
| 1980 | 6.32 | 27,938 |
| 1990 | 4.37 | 7,275 |
| 2000 | 0.40 | 1,000 |

The Globalization Index, which breaks down globalization into its most important component parts, indicates that the “most wired” countries in the world are beneficiaries of globalization. The Globalization Index tracks the movements of money in terms of investments and business transactions in the era of “electronic capitalism” (Bledsoe, 2001).

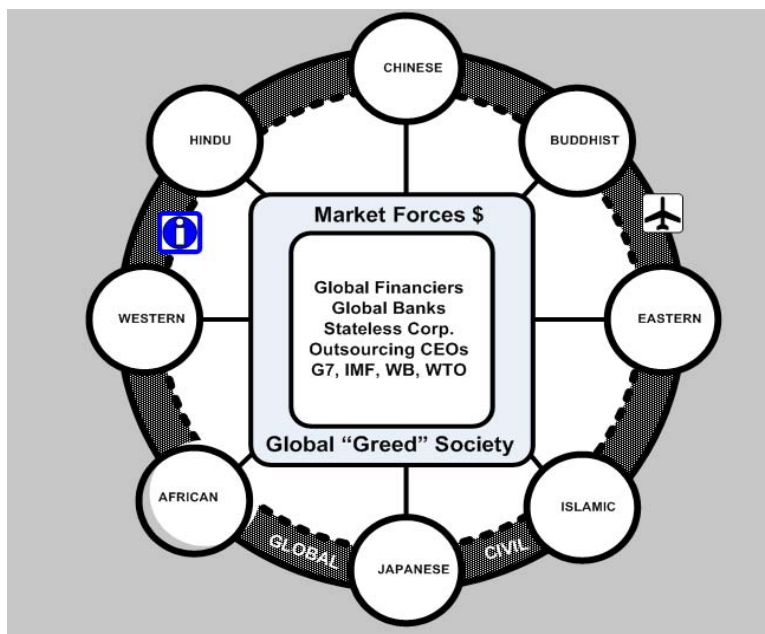
The fourth wave of modern globalization at the beginning of the 21st century leads towards the emergence of Global Civilization, because this civilization meets the general criteria of civilization (Targowski, 2004). For example:

- Human entity as the global society is composed of certain segments of the societies of eight autonomous civilizations (Western, Eastern, Islamic, Japanese, Chinese, Buddhist, Hindu and African), which apply global culture and infrastructures
- Culture has global character, which means that similar patterns of behavior are practiced (*de facto* by certain segments of those societies only) in those autonomous civilizations; for example, such ones as “English,” professional and student dress code, music, movies, food, drinks and so forth
- Global Infrastructure of Information (1) (the Internet and global area networks) and of material (2) (transportation, finance, and business) are reaching every autonomous civilization and integrating them into an

emerging global society and global economy. Furthermore, there are many international organizations (for-profit and non-profit, official and unofficial), such as United Nations (UN), UNESCO, GATT, World Trade Organization (WTO), World Bank (WB), IMF, NATO and others, which create the Global Infrastructure of Regulations (3). The last kind of infrastructure plays a paradoxical role, promoting justice and enhancing inequality, triggering world conflicts and instability. For example; globalization triggers the anti-globalization movement, putting emphasis on local forces and potential, which *de facto* can be called “glocal” (GLObal-lo-CAL), since their uniqueness is a product of global forces. Among anti-global forces, one that is becoming very violent is global terrorism, which can destroy huge parts of any civilization. In response, civilization develops security systems that protect global order against global chaos. Hence, the Global Infrastructure at the same time creates order and chaos!

The global economy is only possible because it is supported by global infrastructures, supporting; global communication (the Internet, global area networks); global transportation; global finance activities; global scientific knowledge creation and dissemination; global management practices; even global peace keeping (with less success).

Figure 5. The solar model of global civilization in the 21st century (Driven by info-communication and transportation technologies)



The solar model of global civilization is shown in Figure 5. The global civilization is controlled by an invisible power, composed of global financiers and banks, stateless corporations, outsourcing CEOs (receiving fat bonuses for better performing stocks), G7, IMF, WB, WTO. The evolution of this civilization is driven by the following process of wealth formation with the help of technology: The dynamics of global civilization is not limited to economic rivalries and financial operations only. This dynamics is more complex: Religious and sectarian forces for global harmony and conflict have become pervasive, and they are intensified on the Web. The accelerated migration of peoples and the speeding of e-communications, especially by means of the Internet, have led to the globalization of religion. This process has generated contradictory responses: Some communities are confrontational, insisting on their monopoly of truth and access to salvation, whereas others

are more adaptive (Fred W. Riggs, webdata.soc.hawaii.edu/fredr/faith.htm).

Global culture develops to support a global flow of ideas, capital, goods, services and people. It interconnects different national cultures by common patterns of behavior. For example, English becomes the main language and the Western dress code, and international food is applied in global activities of business, politics, science, entertainment and art. Global communication culture is based mostly on the Internet and “CNN” culture. Global business transactions and political dialogs are supported by Western Culture’s patterns of behavior, encoded in policies of the WTO, IMF, WB, UN and UE. In general, global culture interconnects national cultures to conduct Global Civilization’s activities. However, because of the lack of the global society (or pseudo “global government”), global culture is very weak in regulating global economy and infrastructures.

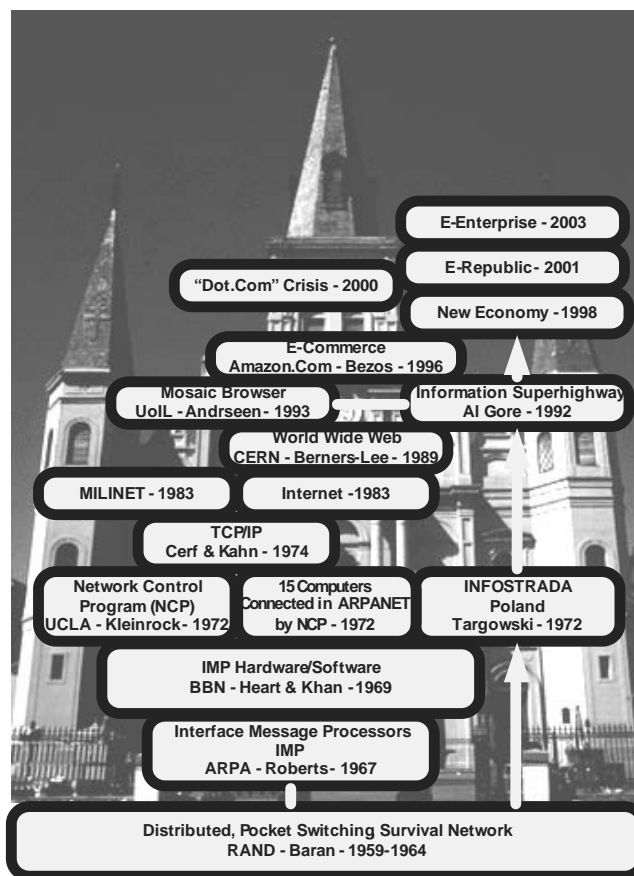
THE “FLATTENED” WORLD

According to Friedman (2005), the world has been flattened by convergence of 10 major political events, innovations and companies:

1. The victory of Solidarity in Poland on August 1, 1989 and the fall of the Berlin Wall on November 9, 1989 unleashed forces that ultimately liberated all the captive people of the Soviet Empire. It was caused by the impact of the underground press (information), which exceeded the readership of the official press.
2. The world has not been same since Netscape went public on August 9, 1995, since everybody could easily navigate the Internet to any location in the world, connecting millions of personal computers.
3. Work flow software (based on such standards as SOAP, XML and others) enabled the collaboration of many contributors dispersed throughout the world—a supply chain of making movies, publishing books, organizing big events and so forth.
4. Open sourcing, leading to self-collaborating communities producing competing software (like Linux, Open Office, and so forth), mostly for free, which looks at the post-capitalistic model of production.
5. Out-sourcing—making software components, mostly programming them by specialized workers from other companies and delivering their solutions via global networks, either private or public (the Internet).
6. Off-shoring—outsourcing to foreign countries, with well-educated workers “enjoying” low wages and delivering their solutions via global networks, either private or public (the Internet).
7. Supply-chaining—the computers and their networks allow for brand companies such as Wal-Mart to sell 1 million products through highly automated and computerized distribution centers. The high volume of business puts special pressure on subcontractors, who have to trim costs and keep good quality. In order to get “always” low prices, Wal-Mart is outsourcing and off-shoring its orders, mostly to China and other low-wage countries.
8. In-sourcing—based on asking world-oriented companies such as UPS or FedEx to carry the transportation processes inside of a company to speed up the delivery of goods and semi-products among units of a company or to its customers throughout the world.
9. Informing via Web search engines, such as Google, Yahoo and others, to speed up information-seeking users.
10. Mobile communication—a growing number of wireless gadgets (cell phone, iPaq, etc.), which can beam information to/from any location in the world, making people connected and informed with bullet train speed.

The Convergence I of all mentioned flatteners allows (according to Friedman, 2005) for multiple forms of collaboration at the level of knowledge production or project implementations in real time, without regard to geography and language. The Convergence II allows for the connection of all computers and involved workers/specialists into one virtual organization, which works productively and at low cost as one, but is spread out through the world. Convergence III allows for inclusion into the global economy/civilization people from developing or undeveloped countries, who without info-communication technology could be left behind the fast-progressing world. Of course, not everybody welcomes this working world, which takes advantage of weak partners, their discontent expressed under the form of anti-global activities.

Figure 6. The Internet cathedral



CONCLUSION

1. Development of the Internet is the result of the Cold War, which has strong influence on the growth of the global economy and civilization.
2. Systems like the Internet are the results of many coincidences, where the most important one is the presence of exceptional research talent, such as Baran and others mentioned in this investigation.
3. Systems of the Internet's type are outcomes of many peoples' effort, similar to that which takes place when a cathedral is under construction for many centuries. Every new builder adds a new brick and says: "I built the cathedral." (Baran's statement in Hughes, 1998, p. 274). The Internet cathedral is shown in Figure 6.
4. The wide acceptance of info-communication systems depends on its "user friendliness." Therefore, the discovery of the WWW and Mosaic/Netscape browsers accelerated the acceptance of the Internet at the end of the 20th century and its influence on the further development of civilization.
5. The most unexpected influence of the Internet is on the conduct of war. For example, both sides of the battle can communicate via e-mail, as happened during the war in Iraq in 2003.
6. New capabilities of the Internet are con-

stantly being discovered, and it seems that this process has not yet reached the point of saturation.

7. The close of INFOSTRADA/NIS in Poland in 1974 stopped the development of advanced info-communication systems for at least 25 years. In 2003, Poland created a Ministry of Science and Infomatization and launched the project to develop e-Poland.
8. Because global civilization at the same time creates order and chaos, it means that it becomes more “closed” and “undemocratic” than it looks at first glance, as can be explained by the II Law of Thermodynamics (closed systems generate more entropy, which is a measure of chaos-disorder). What does it mean? It means that global civilization should be more open, accepting not only one view (“Western View”), but many views, perhaps by development of another layer of world civilization, a universal-complementary civilization, which exchanges and accepts main and complementary values from all civilizations, as shown in Figure 7 (Targowski, 2004b).

REFERENCES

- Abbate, J. (1999). *Inventing the Internet*. Cambridge: MIT Press.
- Anderson, W. T. (2004). *All connected now, the life in the first global civilization*. Boulder: Westview Press.
- Baldwin, R., & Martin, P. (1999). *Two waves of globalization: Superficial similarities, fundamental differences* (NBER working paper).
- Baran, P., et al. (1964). *On distributed communications* (RM 3420, 3103, 3578, 3638, 3097, 3762-7). Santa Monica: The RAND Corp.
- Baran, P. (1964). *On distributed communications* (vol. V), History, alternative approaches, and comparisons (RM-3097-PR). Santa Monica: The Rand Corp.
- Baran, P. (2002). The beginning of packet switching: Some underlying concepts: The Franklin Institute and Drexel University seminar on the evolution of packet switching and the Internet. *IEEE Communications Magazine*, July, 2-9.
- Baran, P. (2003). *Inventor of packet switching and Internet pioneer*. A tribute to famous Polish-American, Gold Award Banquet. Detroit: American Polish Engineering Association.
- Bledsoe, W. (2001). Globalization and comparative civilizations: Looking backward to see the future. *Comparative Civilizations Review*, 45, 13-31.
- Castell, M. (1996). *The information age. Economy, society and culture (vol. 1): The rise of the network society*. Oxford: Blackwell.
- Costa, J. (1966). RADC develops logic design for emergency broadcasting. *Electronic News*, January 10, 32.
- Davies, D.W. (2001). An historical study of the beginnings of packet switching. *Brit. Cop. Sc. J.*, 44(3), 151-162.
- Dyson, G. (1997). *Darwin among the machines*. Addison Wesley.
- Friedman, L. Th. (2005). *The world is flat*. New York: Farrar, Straus and Giroux.
- Hafner, K. (2001). A paternity dispute divides Net pioneers. *New York Times*, Nov 8.
- Hafner, K., & Lyons, M. (1996). *Where wizards stay up late*. New York: Simon and Schuster.
- Hughes, T. P. (1998). *Rescuing prometheus*. New York: Pantheon Books. Available at www.rand.org/publications/RM/baran.list.html
- Kennan, G. (1947). X article, the sources of Soviet conduct. *Foreign Affairs*, July. Reprinted in Spring 1987.

The Genesis, Political, and Economic Sides of the Internet

- Kissinger, H. (1994). *Diplomacy*. New York: Simon & Schuster.
- Moczulski, L. (1998). *Geopolitics, power in time and space*. In Polish: Geopolityka, potęga w czasie i przestrzeni. Warsaw: Bellona.
- Naughton, J. (1999). *A brief history of the future*. Woodstock: Overlook Press.
- Norberg, A., et al. (2000). *Transforming computer technology*. Baltimore: John Hopkins University Press.
- Selover, E. E. (1965). HF survivable communications system. *Proceedings of the IEEE Mohawk Valley Communication Symposium (NATCOM)* (pp. 35-40).
- Soros, G. (2002). *On globalization*. New York: Public Affairs Press.
- Soros, G. (2003). *The bubble of American supremacy*. New York: Public Affairs Press.
- Spykman, N. J. (1942). *America's strategy in the world politics. The United States and balance of power*. New York: New Edition: Hamden, 1969.
- Spykman N. J. (1944). *The geography of peace*. New York: Reprinted by Shoe String Press, 1969.
- Targowski, A. (1991). Computing in totalitarian states: Poland's way to an informed society. *The Journal of Information Management, Information Executive*, 4(3), Summer, 10-16.
- Targowski, A. (2001). *Informatics without illusions*. In Polish, Informatyka bez złudzeń. Toruń: Adam Marszałek.
- Targowski, A. (2004). A dynamic model of an autonomous civilization. *Dialogue and Universalism*, XIV(1-2), 77-90.
- Targowski, A. (2004). A grand model of civilization. *Comparative Civilizations Review*, 51, 81-106.
- Targowski, A. (2004b). From global to universal civilization. *Dialogue and Universalism*, XIV(3-4), 121-142.
- Targowski, A. (2005). From the Cold War to Internet cathedral. *International Journal of Information and Communication Technology Education*, 1(2), 87-98.
- Targowski, A., et al. (2000). *The fate of Poland and the world*. In Polish: Losy Polski i świata. Warsaw: Bellona.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L.Tomei, pp. 62-82, copyright 2007 by Information Science Publishing (an imprint of IGI Global)

Chapter 1.19

The Transformation of the Distribution Process in the Airline Industry Empowered by Information and Communication Technology

Patrick S. Merten

International Institute of Management in Technology, Switzerland

ABSTRACT

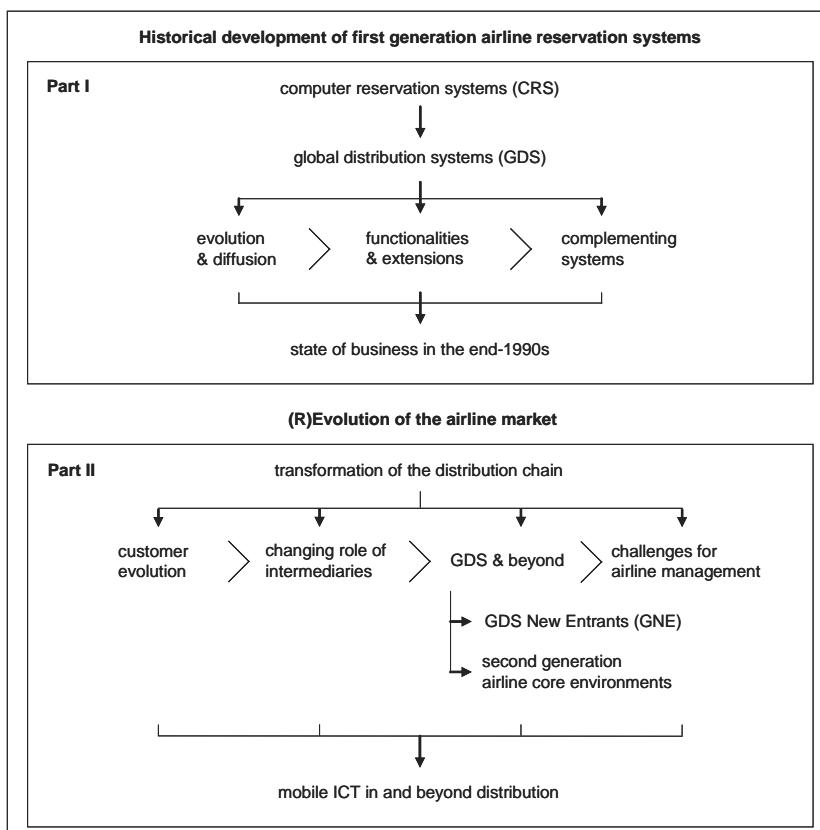
This chapter reviews the historical evolution of the airline market and its first-generation airline reservation and distribution systems. The development and diffusion of computer reservation systems (CRS) and global distribution systems (GDS) is discussed extensively in order to provide a comprehensive overview of the state of business in the 2000s. Based on this evaluation, the influence of modern information and communication technology (ICT) on the airline distribution system environment is discussed. The traditional distribution chain has been transformed into an electronic multi-channel distribution environment. This (r)evolution of the airline market is analysed for the different market participant groups, as the competitive and cooperative situation increases in this cross-influence network industry.

INTRODUCTION

The information revolution has dramatically reshaped global society and is pushing the world ever more towards an information-based economy. Tourism is one of the industries which is able to generate enormous synergy effects from the use of the Internet. This technology is a potential instrument to implement change in the structure and processes of the entire sector. In particular, the airline market environment has experienced significant changes in the recent decades, induced by the different generations of information and communication technology (ICT). Consequently, this chapter deals with the fundamental transformation of the airline industry—with a focus on the technologies in the distribution process.

Since its emergence, the tourism industry has experienced continuous and sustainable growth,

Figure 1. Overview of chapter structure



not only in terms of increasing customer numbers, but also in the acquisition of new markets. These developments have been coupled with the expansion of travel intermediaries in response to an increasing demand for travel. While airlines first sold their products separately and on their own, they soon became an integral part of the tourism industry, which in turn gained complexity in terms of distribution. Therefore, and not surprisingly, the airline industry is one of the first business sectors that introduced and relied on information and communication technology to cope with the challenges of rising complexity, notably in distribution. Accordingly, the first main part of this chapter reviews the historical evolution of the airline market and its first-generation airline reservation and distribution systems. This

provides a comprehensive overview of the state of business in the latter part of the 1990s.

The following and key part of this chapter focuses in particular on the current reshaping of distribution processes, caused by and based on the development of new information and communication technology. The exponential growth of online platforms and Internet usage has led to the appearance of numerous alternative distribution channels and new intermediaries. Having already established their positions on the market, the new electronic distribution channels now co-exist alongside traditional channels. As a result, the market structure and balance of power between airlines, distributors and customers is rapidly changing. To understand this multi-channel distribution environment, an in-depth analysis of

today's airline market is required. Therefore, in the second part of this chapter, the (r)evolution of the airline market is examined from diverse perspectives, that is, those of the different market participants. Furthermore, the evolution towards second-generation airline core environments is investigated, in order to understand the forces behind the emerging paradigm shift.

Figure 1 gives an introductory overview of this chapter's structure.

FIRST-GENERATION AIRLINE RESERVATION SYSTEMS

Today's airline industry is a product of post-World War II prosperity. Civil aviation took off in the second half of the 20th century with the introduction of many new technologies including jet engines, new lightweight metals, radar systems, and computers—making air transportation faster, more comfortable, and above all safer (Prideaux, 2001). In the early years of commercial air flights, bookings were made via telex, telephone, and postal services. These methods were labour intensive, relatively slow, and expensive. However, there were no options to paper-based storage and retrieval systems. Usually, a “request and reply” system was used, collecting all the information and inquiries at a central location. Other airlines used wall-sized availability boards, which had to be updated manually (Sheldon, 1997). This situation changed radically with the emergence of information technology and the diffusion of modern telecommunication networks. The ensuing evolution of first-generation airline reservation systems is discussed in the following sections. For a more detailed description of the historical development leading to computer reservation systems see Copeland and McKenney (1988).

The Emergence of Computer Reservation Systems (CRS)

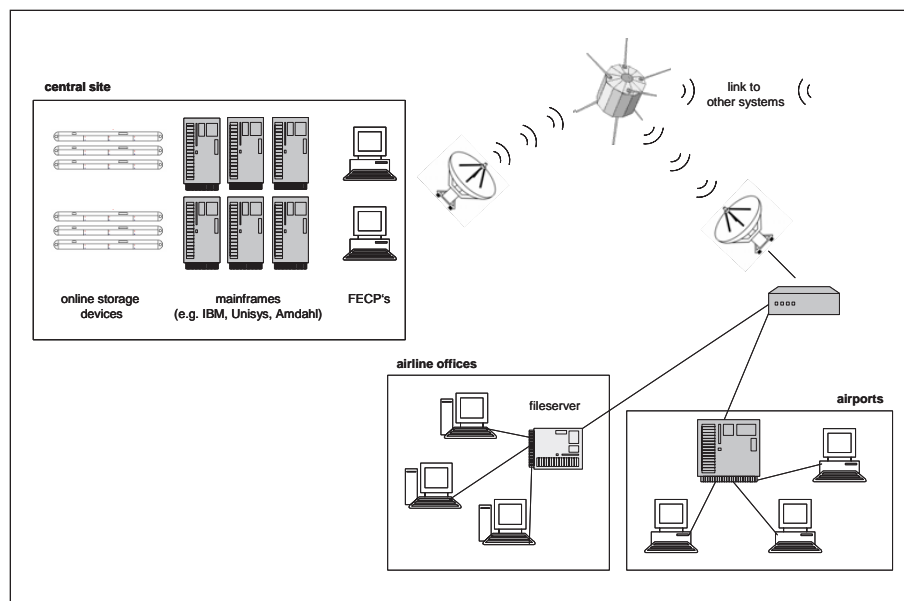
Since the 1950s, when air travel became a mass phenomenon, airlines have had to deal with large amounts of diverse information (Sheldon, 1997). The enormous increase in demand (passenger numbers) in the 1950s and 1960s brought management and operational challenges for airlines and airports. In particular, the complexity of all passenger related processes increased dramatically (Buhalis, 2003). Sheldon (1997) stated, that “it is a daunting task to keep track of thousands of flights, fares, seat inventories, crew, passengers, cargo and baggage without automation” (p. 15). Hence it is not surprising that from the outset the airline industry has been one of the most technologically advanced sectors in the field of tourism. The need to formalise the exchange of booking related information led to the introduction of computerized reservation systems (Werthner & Klein, 1999). A harbinger of such systems in the 1950s was a mechanical system called Reservisor used by American Airlines. It performed arithmetic algorithms with the aid of random access memory drums (Sheldon, 1997).

The concurrent computing revolution paved the way for the following first technology driven reservation and distribution systems. However, as no standard platforms and solutions were available at that time, first *computer reservation systems* (CRS) had to be developed in a “hand coded” manner (Werthner & Klein, 1999). For this reason, American Airlines initiated cooperation with IBM in 1953, finally developing the first computer reservation system after years of research and investments of over US\$40 million (Sheldon, 1997). This significant breakthrough system was initially called SABER (Semi-Automated Business Environment Research) and has been trailblazing ever since.

The immense technological requirements for the introduction of automated reservation systems ranged from real time and simultane-

The Transformation of the Distribution Process in the Airline Industry

Figure 2. Configuration of an airline reservation system environment (Source: Sheldon, 1997)



ous transaction processing to an airline specific message code for transmitting information. In addition, the system had to be designed for permanent operation with high reliability (Werthner & Klein, 1999). This necessity resulted in the advancement of new technological concepts such as hardware redundancy, backup generators and uninterrupted power supplies (UPSs). The fully functional SABER was launched by American Airlines and IBM in 1963/64, consisting of two IBM 7080 mainframes for real time and batch processing, an online storage of six magnetic drums and terminal connections at 2,400 baud (Copeland & McKenney, 1988) and met the demanding requirements.

The first requirement for real time and simultaneous transaction processing was fulfilled by the introduction of a new operating system, the Transaction Processing Facility (TPF). Originally this real time inquiry-response system had a response time of less than three seconds and is still the core of most of today's airline reservation systems. But as the TPF is a 6-bit processing first-generation computer language, it requires large investments

in human resources to keep the system running and updated; for example, in the 1990s an airline employed an average of 1,200 programmers, each paid approximately US\$100,000 to keep the system up to speed (Feldman, 1994).

The second requirement for an airline specific message code for transmitting information led to the introduction of the Airline Line Control (ALC), a full-duplex, synchronous communication protocol, which is still used today (Sheldon, 1997). However, the real challenge at the time was the design of an extensive data communication network across the U.S. and "eventually" across the world (initially offering a 2,400 bits per second transmission rate). This pioneering goal was reached in cooperation with telecommunication companies, in particular the ARINC network (Aeronautical Radio Incorporated) and the SITA network (Société Internationale Télécommunications Aéronautique).

After SABER's completion, IBM used its know-how to create the Programmed Airline Reservation System (PARS) which incorporated application software into the TPF operating system

(Sheldon, 1997). Capitalising on their experience with state-of-the-art mainframes, IBM offered PARS to other airlines such as Delta, Continental, Northwest, PanAm, and United Airlines, enabling them to create their own systems similar in function to SABER. In response to IBM's move, American Airlines renamed the original system as SABRE. While the evolution of CRS described so far mainly refers to developments in the U.S., in Europe and Asia airlines also computerised their reservation systems, but did so using videotext technology to perform queries and bookings.

Figure 2 shows the typical configuration of an airline reservation system environment, keeping the mainframes, storage devices, and front-end communication processors (FECs) on a central site, under high security because of its immense value to the airline, and designed to withstand natural disasters such as fire, flood or earthquake in addition to bomb attacks (Sheldon, 1997).

Implemented as illustrated in Figure 2, the first terminals were installed at airports and airline offices in the late 1960s. These terminals enabled agents to check airline schedules, seat availability and prices from their desktop, allowing them to make confirmed bookings at the time of first inquiry. Until the mid-1970s, computer reservation systems were used only for proprietary airline information, that is, every airline had to have its own system running (Sheldon, 1997). To conclude, CRS can be “regarded as a critical initiator of the electronic age, as they formulated a new travel marketing and distribution system” (Buhalis, 1998, p. 412).

The Development of Global Distribution Systems (GDS)

The distribution of products and services—available through the CRS—became the next unique challenge for the industry in the 1970s. At an early stage, the distribution of flights was handed over from the airlines (at airports and offices) to travel intermediaries (Werthner & Klein, 1999).

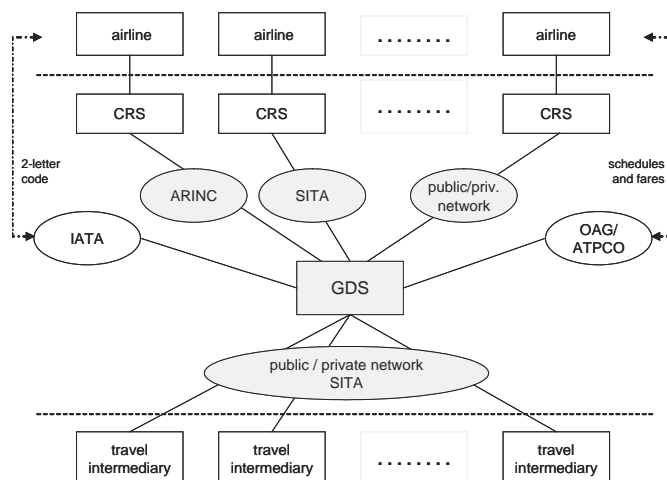
As travel intermediaries needed access to more than one CRS, but more than one terminal on an agent's desk did not make sense, an initiative was started in 1975 to create a single industry reservation system. In the same year, the Joint Industry Computer Reservation System project took place, bringing together the major carriers to plan a system which could enable travel intermediaries access to all major airline information. However, despite intense discussions, the effort failed and no agreement was reached (Sheldon, 1997). The situation remained unchanged: the different CRS were each in the possession of single airlines and used exclusively by them.

However, due to the increasing number of airlines and respective CRS, vice versa, combining the different CRS became mandatory in the 1970s. Consequently, some of the CRS, such as SABRE, opened their systems to other airlines. As a result of a continuous concentration process, different CRS were combined and became known as global distribution systems (GDS) (Inkpen, 1994). From this point on, airlines were able to store their information either directly in a GDS or in their own CRS and link it to one or more GDS. This choice basically depended on whether an airline was affiliated with a GDS company or not (Sheldon, 1997). Despite the affiliations, GDS suppliers became generally independent market participants. Therefore the term GDS denotes both the systems as well as the companies operating these systems. Their shareholders are mainly airlines, since the management of airline inventories and their distribution constitute their origin (Werthner & Klein, 1999).

Despite the systems' evolutionary differences, the two terms CRS and GDS are often used synonymously in the literature. This can be legitimated by the overlapping functionalities and complexity of the systems. Henceforth, in this chapter, the systems also are referred to as first-generation airline reservation systems. In general, the CRS/GDS:

- Contain and handle flight schedules, seat inventories, availability and prices

Figure 3. Distribution structure of first-generation airline reservation systems (Source: Werthner & Klein, 1999)



- Enable airline reservations and ticketing
- Store passenger name records (PNRs)

Thus, CRS/GDS have provided airlines with a powerful database that enabled new efficiencies in inventory control and other fields, for example through the introduction of yield management methods (Prideaux, 2001). As GDS contained all necessary distribution information of a growing number of airlines, the GDS suppliers have leased their systems to travel intermediaries. This move led the GDS providers to become the key link between the airlines and travel intermediaries (Prideaux, 2001). The consequential basic distribution structure is shown in Figure 3.

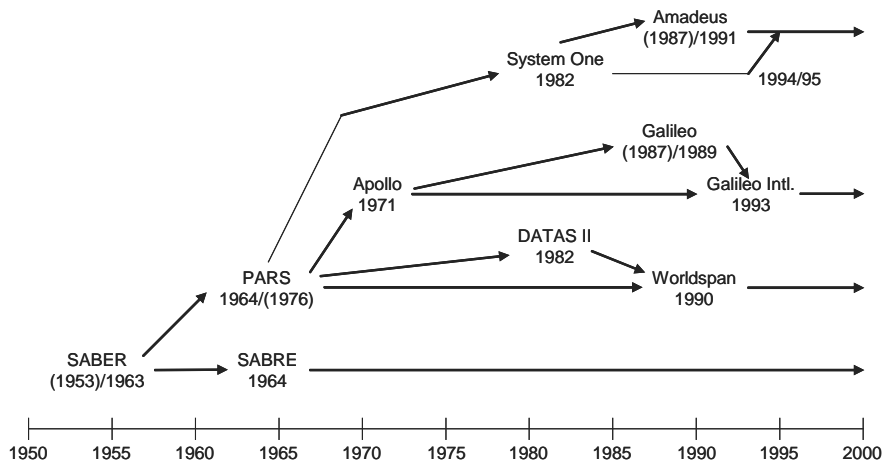
The complex structure of first-generation airline reservation systems can be justified by “the huge number of interconnected companies, both on supply as well as the demand side” (Werthner & Klein, 1999, p. 186) and the existence of numerous different communication channels. Although the underlying architecture can be simply displayed as a star, as illustrated in Figure 3, over time the network has expanded due to new business needs, technological progress and also legal interventions. Companies or institutions such as the

Official Airline Guide (OAG) and Airline Tariff Publishing Company (ATPCO) have maintained databases of flight schedules and fares (Werthner & Klein, 1999). For instance, a new airline must be first certified and assigned a two-letter code by the International Air Transport Association (IATA). Subsequently, the airline has to deposit its fares at the ATPCO and its schedules in the OAG, or appropriate institutions (if not based in the U.S.). The transfer of all these files, containing approximately 40 million fares and schedules, over private or public networks is handled by the Aeronautical Radio Incorporated (ARINC) or Société Internationale Télécommunications Aéronautique (SITA). Founded in 1949, SITA is owned by over 600 airlines and air transport related companies and offers support connections in over 220 countries worldwide (SITA, 2006).

The GDS Worldwide Evolution and Diffusion

A cause and effect of the emergence of global distribution systems were the travel intermediaries, by taking over the business of distribution of airline products to the end customer. For this

Figure 4. History of CRS/GDS (Source: Kärcher, 1997)



reason, travel intermediaries, also often referred to as travel agents, though not including tour operators and speciality providers, were equipped with CRS/GDS terminals in the mid-1970s. Not taking telephone, fax and telex into account, these originally “dumb” terminals were the first kind of information technology in travel offices, providing a connection to the host mainframes and an interface to the airlines. For instance, they replaced the printed Official Airline Guide (OAG) for schedule and fare information. Over time, more and more computer terminals were installed to facilitate airline bookings.

Due to the deregulation of the U.S. airline market in 1978, the number of terminals installed increased tremendously, reaching a penetration of over 85% in the early 1980s (Werthner & Klein, 1999). As prices, schedules and routes were liberated, airlines were able to change them indefinitely, that is, they could be flexible in adjusting pricing, and in setting the medium range schedules and adapting routes to the actual demand. This led to increasing complexity as well as a lack of transparency in fares, which again increased the computing and communication needs for airlines as well as travel intermediaries (Boberg & Collison, 1985). In addition, “until the late 1970s, airlines relied

on the International Air Transport Association (IATA) to negotiate international fares on behalf of airlines. IATA mediated between airlines and regulators on the determination of bilateral air service agreements and operation of distribution systems. Domestic fares were often subject to government regulation” (Prideaux, 2001, p. 215). However, with the deregulation and the challenge to IATA’s fare regime by non-IATA airlines in South East Asia (Singapore Airlines, Thai and MAS) the importance of IATA as a price regulator subsequently declined.

As a further consequence of deregulation, the American Civil Aeronautics Board issued the first regulation on CRS/GDS in 1984. This directive forced the CRS/GDS providers to display all airline offers in a neutral order, sorted by flight numbers. Until then, SABRE for example always listed American Airlines flights on top (so-called biased listing). This was a lucrative approach for their owner, as it generated as much as 40% extra income (Werthner & Klein, 1999). Following Boberg and Collison (1985) flights of the first screen were booked in 90% of the time, in 50% even of the first line of the first screen. According to Williams (1994), airline-owned GDS allowed a small number of carriers to achieve positions of

The Transformation of the Distribution Process in the Airline Industry

market dominance through the airline's ability to control the sale of their products via travel agencies. Despite the U.S. Department of Transportation regulations, in 1984, sorting algorithms for flights were often still not fully unbiased, as other variables such as displacement time, non-stop, direct, or connecting flights and elapsed time of the journey were "legal" variables to be used.

Looking at the GDS providers themselves again, SABRE remained affiliated with American Airlines during this period, while Apollo belonged to United Airlines. Other airlines such as Delta Airlines, Eastern Airlines and TWA followed with GDS called DATAS II, SystemOne and PARS respectively. By the 1980s travel intermediaries wishing to automate had a choice of these five systems. A merger between DATAS II and PARS created a new system called Worldspan and reduced the number to four by the early 1990s. Figure 4 shows the start-ups and merges within the CRS/GDS market, leading to four main systems, holding over 98% of the total market in 1992.

Having reviewed the historical evolution and diffusion of GDS in terms of the systems them-

selves, the terminals for travel intermediaries and the merges of suppliers in the U.S. market, the following sub-sections reflect on the development of airline reservation systems in other parts of the world.

The European and Asian Markets

The European idea of nationally developed systems and the subsequent goal of later on dominant GDS was the creation of systems representing multiple carriers—learning from problems in the U.S., where systems were originally affiliated with only one airline. Overall, the European market developed differently from the U.S. market. In the beginning, airline reservations could be made through videotext terminals of the national airline's computer systems (Sheldon, 1997). In the UK, for example, TRAVICOM, a multi-access reservation system owned by the national carrier British Airways, was used primarily; another videotext system was called Prestel (Bennett, 1988). However, in Germany a system called START was designed and implemented jointly by

Table 1. Airline affiliations with GDS in the 1990s (Source: Sheldon, 1997)

| GDS | Airline | Affiliation |
|-----------|--|-------------|
| Amadeus | Lufthansa | 29.2% |
| | Air France | 29.2% |
| | Iberia | 29.2% |
| | Continental Airlines | 12.4% |
| Galileo | United Airlines | 38% |
| | British Airlines | 15% |
| | Swiss Air | 13% |
| | KLM Royal Dutch Airlines | 12% |
| | US Air | 11% |
| | Alitalia | 8.7% |
| | Olympic, Air Canada, TAP Air Portugal, Austrian Airlines | 2.3% |
| | Aer Lingus | |
| Sabre | American Airlines | 100% |
| Worldspan | Delta Airlines | 38% |
| | Northwest Airlines | 32% |
| | TransWorld Airlines | 25% |
| | Abacus | 5% |

Table 2. Estimated market value of major GDS in the 1990s (Source: Green, 1996)

| GDS | Million US\$ |
|----------------------|---------------------|
| Abacus | 650 |
| Amadeus (System One) | 600 (500) |
| Galileo (Apollo) | 400 (1100) |
| Sabre | 1500-2000 |
| Worldspan | 500 |

Table 3. GDS scope and penetration (Source: Original by the author)

| GDS | Scope | Major markets |
|------------|----------------|--------------------------------|
| Abacus | Southeast Asia | Southeast Asia |
| Amadeus | Worldwide | Europe, South America, USA |
| Apollo | USA, Canada | USA and Canada |
| Galileo | Worldwide | Australia, Europe, New Zealand |
| Sabre | Worldwide | Canada, Europe, USA |
| Worldspan | Worldwide | Europe, Middle East, USA |

travel agencies, the national carrier Lufthansa as well as German Rail and a tour operator. START subsequently merged with Amadeus (Sheldon, 1997). Finally, in Europe two systems: Amadeus and Galileo appeared and dominated the market. Merging with SystemOne (Amadeus) and Apollo (Galileo) respectively, these GDS expanded the global reach of the systems (Sheldon, 1997). But unlike in the U.S., the Europeans and Asians designed their systems to be unbiased from the beginning. This choice was made by the European Commission and the management of Abacus after seeing the controversy created by biased systems in the U.S. (Sheldon, 1997).

In the Asian market (the next most automated area after the U.S. and Europe), a system called Abacus was established by an independent company; however, it has not operated its own GDS. It initially used the system Worldspan, but in March 1998 signed a cooperation agreement with SABRE and switched its operations to this platform (Werthner & Klein, 1999). In addition

to Abacus other GDS vendors, represented by so-called national marketing companies (NMC), have established a 40% market share of GDS in Asian travel agencies.

Tables 1 and 2 give an overview of the airline affiliations and the huge market value of the major GDS Amadeus (including SystemOne), Galileo (including Apollo), SABRE and Worldspan in the 1990s.

Other Regions Worldwide

In Australia NMC again took over the promotion of the GDS: Sabre is distributed by Fantasia and Southern Cross has the marketing rights to the Galileo system, which hold 53% of the Australian market. The distribution of the GDS in Australia is carried out under the auspices of TIAS (Travel Industries Automated Systems, Ltd.). In New Zealand, all four major GDS are represented but Galileo and SABRE cover 80% of the agencies and 95% of the bookings (Sheldon, 1997).

Finally, in some lesser developed countries, the GDS vendors are aggressively trying to capture the market. In India, for example, the SABRE system is being marketed under the name SITAR and in Latin America, SystemOne from Amadeus is well represented with two national airlines (Varig and Aerolineas Argentinas) being part of the Amadeus consortium. Still, due to the lack of telecommunication infrastructure, numerous countries do not have GDS access (Sheldon, 1997).

Although GDS act on a worldwide basis, they have regionally dominant positions in specific markets (see Table 3), for example the nearly exclusive position of Amadeus in Germany. Overall, however, the four GDS providers Sabre, Amadeus, Galileo and Worldspan hold a worldwide dominant market position as distribution partners of airlines, and intermediaries between airlines and travel intermediaries (Sheldon, 1997).

A comprehensive overview of the historical GDS development and their role in distribution is given by Sloane (1990) and Truitt, Teye, and Farris (1991).

GDS Functionalities and Extensions

Having discussed the appearance, evolution and diffusion of global distribution systems, this section concentrates on their functionalities and extensions, again focusing on the travel intermediaries, as their agents are the main end users of the systems. "Even though all GDS have much in common, there are variations in the product and in the contract that must be considered" (Sheldon, 1997, p. 45). A travel agents' choice of GDS involves the consideration of many factors. In general, the system of choice should provide easy access to the most relevant and updated information on the one hand, and a most flexible contract with low costs and excellent service on the other hand.

GDS Product and Contracts

The first aspect mentioned above refers to direct access links, quicker communication, faster confirmations, and access to last seat availability, as well as an unbiased display of data. Then again the aspects of the contract itself are much more complicated. Historically, contracts issued by the GDS supplier were very restrictive and were often referred to as a "golden handcuff." However, very tight contractual clauses became more flexible over time as, prior to the deregulation, contracts had an infinite length with no option to discontinue or switch systems without paying damage costs. In addition, the GDS had to be used exclusively and required a certain minimum usage level. Finally, productivity pricing was part of the contract, meaning that travel agencies with larger volumes of transactions were charged less by the GDS supplier (Sheldon, 1997). The latter point is still part of most contracts while the other aspects have undergone some change over time. For example, in 1984 the maximum length of contracts was limited to five years, and again reduced to three years in 1992. The U.S. Department of Transportation also decided that exclusivity was illegal (Sheldon, 1997).

It is thus clear that the complexity of GDS contracts is a huge challenge for travel agency managers, and the need for careful analysis of contractual clauses cannot be overemphasized. More room for negotiation lies in the level of service and training provided by the GDS suppliers. For a long time, this aspect has been of some importance, as the GDS have traditionally been command-driven, requiring the use of formats and codes to process inquiries and perform transactions. Compared with menu-driven systems, they are often faster for expert users and are still widely used (Sheldon, 1997). Nevertheless, the dominant Microsoft Windows environment forced

the GDS to offer a graphical user interface, this in turn reducing the need for expert training. In addition, as most systems today have computer-aided instruction modules, training issues have become less critical. Finally, the service aspect or rather the repair or replacement of hardware as well as software problems are mostly solved on-site (often by a national service company) or online.

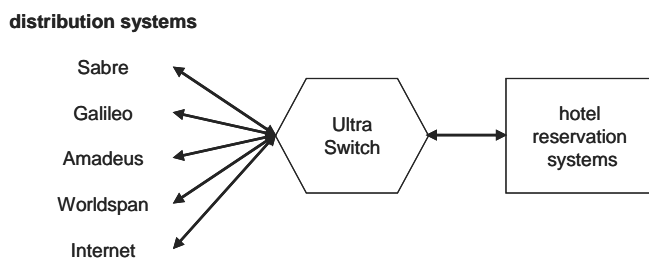
As the handling of information is critical to business for the travel intermediaries, not only the contract and service level agreements, but also the range of functions of the GDS product is of fundamental importance. Sheldon (1997) stated that “indeed, information on travel products, destinations, schedules, fares, rates, and availabilities is their most important product and defines their existence. The more information the travel intermediary can access electronically, the more timely, accurate and efficient service can be provided to the client” (p. 42). Consequently, the entire airline distribution process should be supported by the system. Starting with the request of flight information (schedules, availability and prices) and followed by reservations and bookings, the system also should include a payment and ticketing engine as well as diverse management functionalities (Sabathil, 2002).

GDS Extensions

As GDS became the first and most important interface and database to be used widely, other industries from the fields of tourism became interconnected with the GDS. Hence the systems contain or connect to various sets of other information, for example concerning transport and accommodation as well as tour operator products. This information is integrated by links to the respective reservation system. For instance, the hotel industry established a system called THISCO (The Hotel Industry Switch Company) in 1989 to link major hotel chains. It is owned by 70 major hotel chains and provides common electronic booking interfaces for hotel reservation systems worldwide. The core of this system is called the UltraSwitch, which performs the switching and translation of data formats necessary for the communication of different systems; see Figure 5 for illustration (Werthner & Klein, 1999). In fact, it has been recognised and obviously accepted that GDS networks represent the main distribution channel.

Following Hart (1997), THISCO processed 600 million messages and made 18 million net reservations per year in the mid-1990s. It covered 60% of the worldwide market share and generated US\$3.2 billion in room revenue. THISCO also has subsequently adjusted its strategy to the Internet and launched an Internet system travelWeb.

Figure 5. THISCO system basic structure (Source: Hart, 1997)



Wizdom, owned by Avis Rent-a-car, is a similar system with access to the GDS world (Sheldon, 1997). It serves a client base of car rental companies and other travel businesses.

GDS Widespread Functionalities

Having discussed aspects of the GDS products and contracts, as well as their extensions, the overall functionalities can now be recapitulated. In general, Buhalis (1998) described the role of GDS as horizontally integrating airlines and vertically integrating all other tourism suppliers in a system that can be described as the circulation system of the tourism industry. By 1995 the coverage of GDS had expanded to such an extent that they could be termed ‘global travel and tourism information and reservation systems’ (O’Conner, 1999). Therefore, the widespread functionalities of GDS systems and terminals can be summarised according to Sheldon (1997):

- Flight information: schedules, inventories, availability, fares, fare rules, bookings
- Passenger information: create, modify and store passenger name records (PNRs), itineraries, frequent flyer information, and special requests
- Document printing: facilities to print tickets, boarding passes, and itineraries
- Car rental, hotels, cruises, rail, and tour packages booking*
- Theatre & event ticket and foreign currency ordering*
- Accessing Department of State travel advisories*
- GDS subsection TIMATIC provides information on visas and passports, health, customs, currency controls, and departure taxes*
- Communication service: fax & e-mail*

** Non-airline functions mostly available through today’s GDS*

In general, business applications such as word processing and spreadsheets but also data communication programs (e.g., e-mail clients) represent the standard of today’s computer infrastructure of travel agents—independently from the GDS.

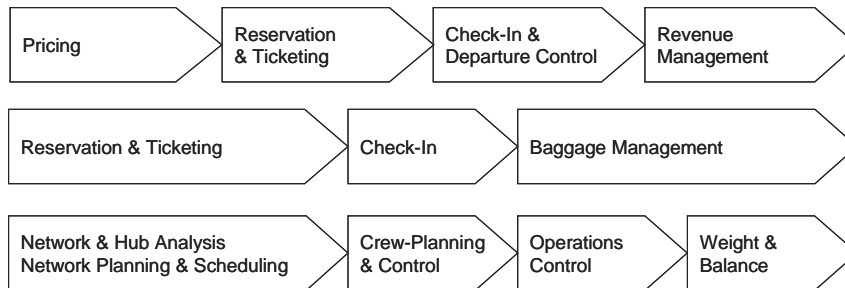
GDS Complementing Airline and Airport Systems

Due to their historical evolution, their functionalities and extensions as well as their worldwide spread and dominance, the GDS have become the core systems of operational and strategic airline management. In general, a wide range of business functions of tactical and strategic management are supported: revenue analysis and forecasting, yield management, competition monitoring, maintenance of historical data to predict demand or to design desirable products, and finally management of business models. In addition, numerous information management and decision support systems are used to support core business processes. The operational management requirements for airlines include check-in procedures, allocation of seats, generation of reports and orders, such as flight paths, weather forecasts, load and balance calculations, manifests for airports, in-flight catering orders, and crew rotas (Buhalis, 2003).

However, as management needs and processes have increased in complexity, different distribution and distribution related tasks had to be supported or executed by additional systems. So far in this paper, distribution has been equated with the GDS, but as Figure 6 shows, the understanding of the term “distribution” has to be expanded to cover enlarged management and process challenges. Figure 6 shows different views on distribution, taking airline, airport, intermediary and customer aspects into account.

To deepen the view of Figure 6, the following paragraphs briefly consider some special systems; as described extensively in Buhalis (2003). For example, special flight schedule management

Figure 6. Different views on the distribution process (Source: LufthansaSystems, 2006)



systems have been introduced to optimise network performance, taking technical and operational characteristics into consideration, including, for example, equipment, human resources, availability of seats, regulations, demand for traffic, or air traffic control rules. Following the flight scheduling, station control systems monitor all kinds of connections on a hub in an airline's network, including passenger and crew connections. The handling of crew planning processes is supported by crew management systems. These assist in the creation and maintenance of duty rotas, ensuring that they are efficient, complete, legal, economical, and fair.

Due to the multiplicity and complexity of all these systems, a separate operations control system is often included to generate alert messages and update all other operational systems, such as flight scheduling, reservation, maintenance, and crew control systems.

In addition, all airlines need airport infrastructure for their operations. Different systems cope with the challenges of requesting landing slots and docking gates, informing about arrivals and departures, altering slots in case of delays, declaring flight paths and coordinating their operations. Other activities at the airport, such as maintenance, refuelling, catering and cleaning as well as the loading and dispatch of aircraft are carried out by different cooperating organisations. The latter interacts closely with

the baggage handling and monitoring systems, ensuring that baggage is distributed correctly and no baggage is transported without its owner, as per the International Civil Aviation Organisation (ICAO) regulations.

The GDS and Airlines State of Business in the 1990s

To round off the historical analysis of first-generation airline reservation systems the airline distribution situation in the 1990s is more closely examined in this section. Economically, the 1990s were challenging for the airlines. Even though the overall passenger numbers increased, ticket prices had to be lowered constantly and profits deteriorated due to growing competition. The challenge of keeping up or even improving current market shares led to different worldwide operations and marketing alliances. Competition between alliances replaced the rivalry between single airlines—introducing an intra-alliance-cooperation, a mix of cooperation and competition. A good example of this new strategy seems to be the combination of different frequent flyer programmes (FFP), which were introduced by airlines earlier, due to the new possibilities of the digitalisation of all reservation based information. These kinds of new marketing strategies represent one possible instrument of cooperation. However, in the beginning, alliances were initiated in terms

The Transformation of the Distribution Process in the Airline Industry

Figure 7. Fees and commissions in the airline distribution chain (Source: GAO, 2003)

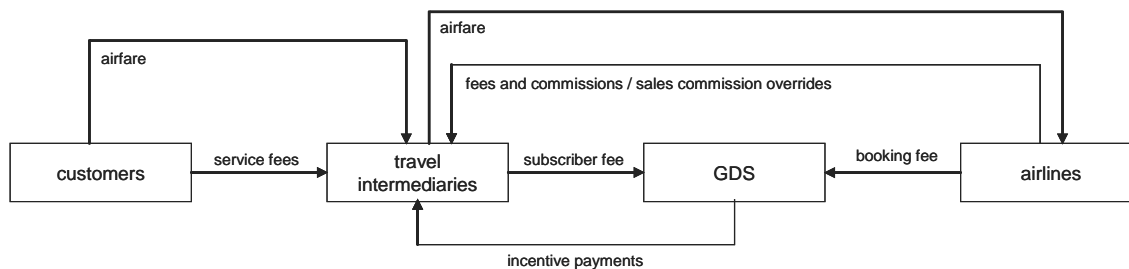
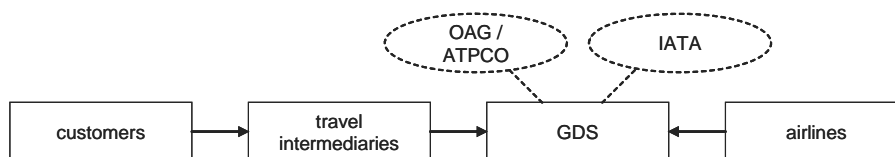


Figure 8. Traditional distribution chain (Source: Original by the author)



of code sharing agreements to overcome air traffic regulations, for example concerning departure and touch down slots restrictions. Another key aspect of strategic cooperation has been the stabilisation of the market environment, as competitors became partners and gained bargaining power within a network. These network effects could not only be identified in back office activities but, above all, have been clearly visible and advantageous to the customers. In contrast to today's three large strategic airline alliances (StarAlliance, OneWorld, and SkyTeam) the emergence of low-cost airlines evoked a serious competitive challenge to traditional airlines, even forcing them to retreat from some markets, especially on short distance routes. It is worth noting that most of these developments would not have been possible without the emergence of modern information and communication technology (ICT), especially the diffusion of the Internet and online platforms.

In fact, traditional airlines suffered from their dependency on the GDS supplier throughout the decade. The cost of GDS representation and distribution increased considerably in the 1990s, when it was estimated that average airline expen-

diture on distribution represented 25-30% of their turnover. Basically, the GDS income rested upon usage based fees, which were rather high compared to the respective costs. In addition, suppliers and intermediaries also had to pay to link their systems to a GDS. Furthermore, airlines relied on travel agencies to distribute their products in exchange for a commission payment, which was usually between 5 to 10% or more. During this era, distribution costs were regarded as a fixed cost (Prideaux, 2001). Doganis (1991) estimated ticketing, including commission and promotion costs, comprised 18% of the total operating cost. The different fees and commissions are represented in detail in Figure 7.

Thus it becomes clear that the fees and commissions (illustrated in Figure 7) in the traditional airlines' distribution chain represented a growing threat to the existence of many airlines. The rising costs of distribution were additionally accompanied by stagnating market segments. Still, until the end of the decade, GDS suppliers represented major players in the tourism value chain, since they provided the main (electronic) link between a huge supplier group and the travel intermediary

community. As illustrated throughout this first main part of this chapter, Figure 8 summarises the traditional distribution chain on the airline market.

By the mid-1990, this traditional distribution chain had already existed for almost three decades, being a constant in an ever-changing environment. Although the basic structure remained the same, the underlying processes altered over time, concerning all market participants. But, due to the emergence of new information and communication technology the entire distribution process is now almost turned upside down. With the rapid growth of the Internet in the late 1990s, the second stage of information and communication technology (ICT) evolution in the airlines industry ended. The third phase of growth of airline distribution systems is discussed in the following part.

(R)EVOLUTION OF THE AIRLINE MARKET

In the early years of the new millennium the airline industry is facing major challenges subsequent to the privatisation of many national airlines and the establishment of partnerships and global alliances. The airline free market economy has become highly volatile in recent years, especially after facing an economic and psychological crisis in the light of the terror attacks using passenger aircrafts in the United States on September 11, 2001. Furthermore, economic factors such as deteriorating revenues, the fluctuating health of several major national economies, and new competitors such as low-cost carriers have further exacerbated the situation. Thus, deregulation and globalisation forces have brought both new challenges and threats to airline management. These include, for example, over-capacity, high investment pressure, and rising cerosin prices. Consequently, the influence of such wide-ranging factors on the airline business frequently demands

rapid adaptations or even a change of business models (Merten & Teufel, 2006).

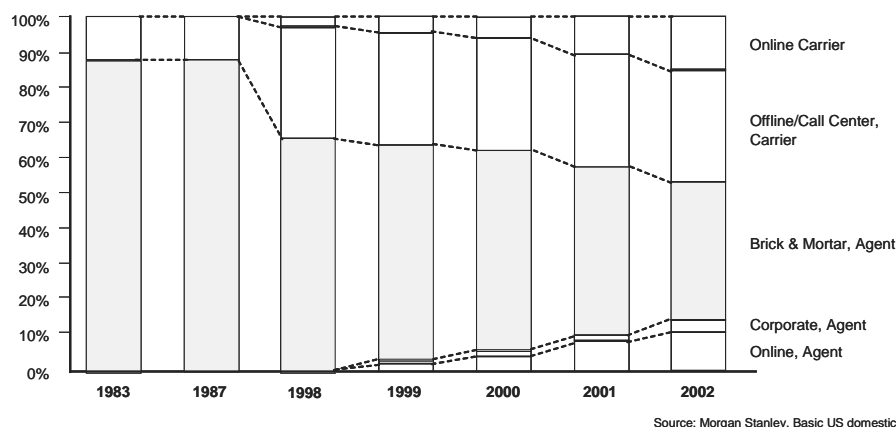
Above all, the emergence of modern information and communication technology (ICT) has led to a fundamental transformation of the airline market environment. In particular, the appearance of the Internet and the diffusion of the World Wide Web have radically reshaped the distribution environment. This alteration of the distribution structure and processes is examined in the following sections. For this analysis the impact on each market participant group will be considered separately, using the relationships outlined in Figure 8 and starting with the customer. After looking at customer evolution, the changing role of travel intermediaries will be studied. Subsequently, the main section of this chapter analyses the transition from first-generation airline reservation systems (CRS/GDS) to the introduction of second-generation airline core environments. To round off the discussion, the consequences of modern information and communication technology are reviewed from an airlines perspective, including future scenarios, even beyond the distribution systems themselves.

Customer Evolution

The rapidly increasing popularity of the Internet in the 1990s and its penetration into private households as well as business environments pushed airlines to launch their first Web sites in the mid-1990s. By 1998 most airlines already offered Web sites, which primarily informed visitors about schedules, prices and itineraries as well as other flight and airline-related information. Over time the interaction potential of these platforms grew and the adoption of modern technologies brought new opportunities. Indeed, the Internet provided airlines with the potential to open direct channels to their customers, offering their whole range of services, from flight information (schedules, availability and prices) to reservations and ticketing

The Transformation of the Distribution Process in the Airline Industry

Figure 9. Trends of online distribution on the airline market (Source: von Götz, 2005)



(including payment options), as well as further value-adding services. As a rapidly increasing number of flights are booked over the Internet, more and more information is being made available to the end consumer. By bringing all necessary booking information right to the customer, online booking engines have enlarged product availability and price transparency.

In this newly created online distribution environment, customers are increasingly using the Internet to obtain travel information and book online. Thus, their behaviour has become more individual, heterogenic, mobile, sovereign, and time-sensitive, as they can take advantage of a far wider range of options than it was previously the case. Furthermore, a broad shift of bookings from classical distribution channels back to the airlines themselves can be observed, while customers seem to swap between channels during the buying process. Therefore, in future, a multi-channel distribution environment will be the most likely scenario (Schmidt, 2004). Figure 9 underlines these trends.

So far, the discussion focused on the customer as an individual. However, customers as a category also can be subdivided into leisure customers as well as unmanaged and managed business travel

customers. The business analyst PhoCusWright Market Research forecasts that the online part of leisure and unmanaged business travel bookings would double in size in the period from 2003 to 2006, being worth some US\$78 billion in the U.S. In addition US\$36 billion is predicted to be spent online on the managed corporate market (N.N., 2005). On closer examination of the latter point, it can be noted that in particular large-scale businesses hold strong framework agreements with single airlines. However, in the corporate market, companies more and more allow their employees to make their own bookings online, but within the rules set by their employer. These online booking services are thus proving extremely popular. Moreover, low-cost airlines encourage, and in most cases require, customers to buy their tickets online. In addition, America's and Europe's market-shaking shift to online travel services and bookings is yet to take off in the huge Asian market, for which an enormous potential also is forecast. These trends, along with ever-changing customer behaviour and new airline strategies represent a threat to travel intermediaries, to be considered in the next section.

The Changing Role of Travel Intermediaries

Obviously, the establishment of direct channels to customers also marked a turning point in the relationship between airlines and travel intermediaries. As the Internet allowed airlines to bypass travel agencies, commission payments from airlines were lowered or even cancelled. Indeed, tensions peaked when airline management embarked on its policy of reducing or eliminating the existing commission structure. In turn, this zero commission forced travel agencies to move to charging customers a fee for products and services offered (Prideaux, 2001).

Since electronic connectivity brings air travel products directly into the hands of the consumer, this poses a potential threat to the existence of travel intermediaries. But in the same way, information and communication technology is threatening the agencies; they also mitigate the threat by creating value-added products and services, and by integrating ICT into their strategic planning and operational processes. For instance, the World Wide Web can not only be used by them to access more information about transportation and destination products, which is in turn passed on to the customer. Offering their services online also can widen their geographical range when receiving requests and booking orders through the Internet.

These trends can be exemplified by looking at the “.travel” initiative. The Tralliance Corporation is the registry for these “.travel” sponsored top level domain names. Its major aim is to improve the Internet identity of travel-related companies and to increase the level of trust between the tourism industry and its customers. For this, the initiative features an authentication of a registrant’s industry credentials and name(s) eligibility by an independent third party. With this confirmed identity, a registrant lifts its business out of anonymity of today’s Internet. Beyond this, a first of its kind

central online directory has been established, based on a unique vocabulary to match providers travel products and services precisely with consumers needs worldwide (www.directory.travel). The success of this initiative is however yet to be confirmed as the whole system was only launched on January 2, 2006 (Tralliance, 2006).

Beyond the external opportunities offered by the Internet, modern ICT also can be used to optimise, simplify and extend current internal business processes, for example, by sending tickets or booking information via e-mail. Finally, online platforms from airlines, which enable the bypass of travel intermediaries from an airlines point of view, of course also can be used by the travel agents themselves. In doing so, they in turn bypass GDS, no longer relying on a terminal infrastructure and tight contracts with the GDS.

GDS and Beyond

Due to their historical development, the GDS providers have established supremacy in the airline industry and its traditional distribution chain. They have proven to be reliable, they succeeded in standardising the products included and still hold a dominant market position (see Figure 10) (Merten & Teufel, 2006).

Although the GDS provide airline managers with powerful management tools, for example to identify new market segments and maximize yields, the use of GDS adds to the overall distribution costs (Prideaux, 2001). On the one hand, the systems themselves have become more and more expensive in terms of maintenance and upgrades, with respect to finance and personnel (Werthner & Klein, 1999). On the other hand, fees and commissions increased over time as already shown in Figure 7. As Graham Atkinson, a United Airlines Senior Vice-President, noted, “The company spends about US\$250 million on GDS fees annually” (Tedeschi, 2005). In fact, the margin of airline market participants correlates

The Transformation of the Distribution Process in the Airline Industry

Figure 10. GDS air bookings year-on-year percent growth at month end (Source: Sattel, 2005)

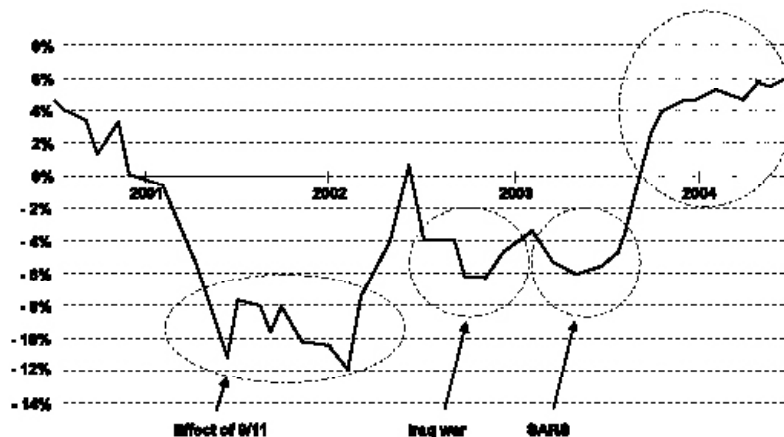
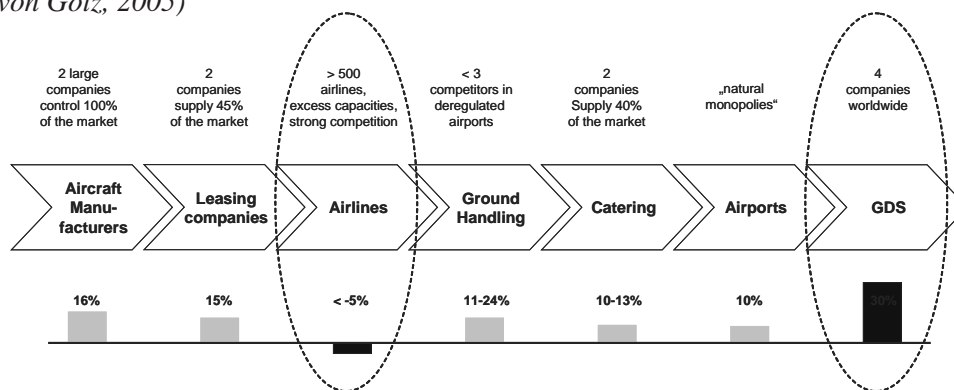


Figure 11. Margins of air travel participants in correlation with their relative dominant market position (Source: von Götz, 2005)



with their relative dominant market position and is especially high for the GDS companies, as shown in Figure 11.

Similarly, Atkinson (ibid.) remarked, that “there has been awareness in the industry for some time that the price-value relationship there is out of sync. Anytime that happens, you will ultimately find someone with a better solution to the business problem. That is what has happened” (Tedeschi, 2005).

In consequence, airlines and travel agencies have sought for possibilities to bypass the GDS as distribution intermediaries, not least because

GDS fees amount to approximately \$12 per ticket (LufthansaSystems, 2006). Parallel to this development and due to rapid technological progress, alternative distribution platforms have achieved maturity and market penetration in recent years, which has enabled airlines to compete directly with the traditional distribution channels. Still the airlines’ backend systems are the GDS, but new technologies opened up new opportunities with alternative front ends for new distribution channels, which therefore not directly involve the GDS companies any more. This competition has placed increasing pressure on the GDS suppliers.

To give an example, in 2004, Northwest Airlines cancelled, with immediate effect, a new fee charged to travel agencies for a round-trip domestic ticket booked through global distribution systems. Northwest hoped the move would drive customers and travel agents to its Web site to buy tickets, which did not include ticketing fees. In response, Sabre said they would no longer prominently display Northwest fares on the schedules they provided to travel intermediaries. In consequence, Northwest sued Sabre for changing the way it displayed fares on its reservation system and Sabre sued the carrier for alleged violation of contract (von Götzt, 2005)

This example shows that the Internet enables airlines to regain control over the distribution of their products by bypassing the travel intermediaries and enforcing a zero-commission. Likewise, travel agencies use these online platforms to become more independent from the GDS suppliers. These distribution platforms were first set up by airlines by adapting the front end of their distribution systems. As airlines are not only trying to bypass the GDS in the distribution chain, but also search for opportunities to replace the existing GDS as backend systems themselves, the GDS suppliers have to reflect on their own strategy. The first step for GDS suppliers has been, not surprisingly, to counter with their own online booking engines like amadeus.net. However, having to deal with the problem of brand (non)recognition, they also have started to offer their complete range of services under new brand names, as they have developed or bought special alternative Internet platforms such as opodo.com (Amadeus) or lastminute.com (Sabre). Further, GDS providers have reacted by expanding the functionality of their old platforms using modern technologies—but still having old legacy technology in the centre of their systems. Consequently, and in addition to the adoption of front ends of GDS, also the backend systems were due for redesign.

In addition, in July, 2004, the U.S. Department of Transportation formally phased out all GDS

regulations. This deregulation empowered suppliers to re-evaluate their participation in the four major global distribution systems. Finally, GDS became fully independent and no longer airline owned. Airlines were thus able to selectively distribute inventory at different levels in the four systems. Therefore, with the deregulation of GDS, it was no longer possible to rely upon a single GDS as the sole source of all air travel information. As a single source information distribution model, the GDS were no longer sufficient to ensure total content availability. Therefore new platforms were needed to aggregate disparate content and enable comparative shopping from multiple sources of fares and inventory. These platforms should seamlessly provide content from traditional distribution sources (GDS), direct connections to emerging suppliers and Web-based inventories as well as private fares and Internet fare sources.

These developments clearly show that the GDS suppliers have to fear for their traditional core business. As Holger Taubmann, CEO of Amadeus Germany, admitted in 2005, due to growing online bookings the whole classical GDS market will stagnate or even decrease in the long run as increasing cost pressure and declining margins are foreseeable (Genger, 2005). Therefore GDS providers today have to re-evaluate their business strategy. Nevertheless, airlines will still rely on the traditional distribution system at least for some years.

In the light of these challenges and threats, GDS companies turn their business strategy from travel distribution system and content providers to travel IT solution providers with new technologies (Merten & Teufel, 2006). For example Amadeus changed its name to Amadeus IT Group SA and identified three future business fields (Amadeus, 2006): the travel distribution business area covers all aspects related to the traditional GDS (more and more building on modern technologies), including additional tools and services. Second, Amadeus e-travel provides online travel technology and corporate travel management solutions for airlines,

corporations, travel agencies and other online travel businesses. Next to this e-commerce division, the airline IT services business area offers a new second generation IT platform: Amadeus Altéa Customer Management Solution (CMS). It is built on open system technology and consists of three different modules: Amadeus Altéa Reservation (sell), Amadeus Altéa Inventory (plan) and Amadeus Altéa Departure Control (fly). This CMS platform has been designed scalable for airlines, low cost carriers and as well as airline networks or alliances (Amadeus, 2006).

Despite all these developments, decisions and improvements, GDS suppliers have been struggling for some years, as new companies appeared on the market and offered simpler and cheaper solutions—so called GDS new entrants (GNE). Although, as start-up companies, GNE could not effectively compete the GDS in all fields, they increased the competition and enabled airlines and travel agencies cheaper access to the market and new opportunities.

GDS New Entrants (GNE)

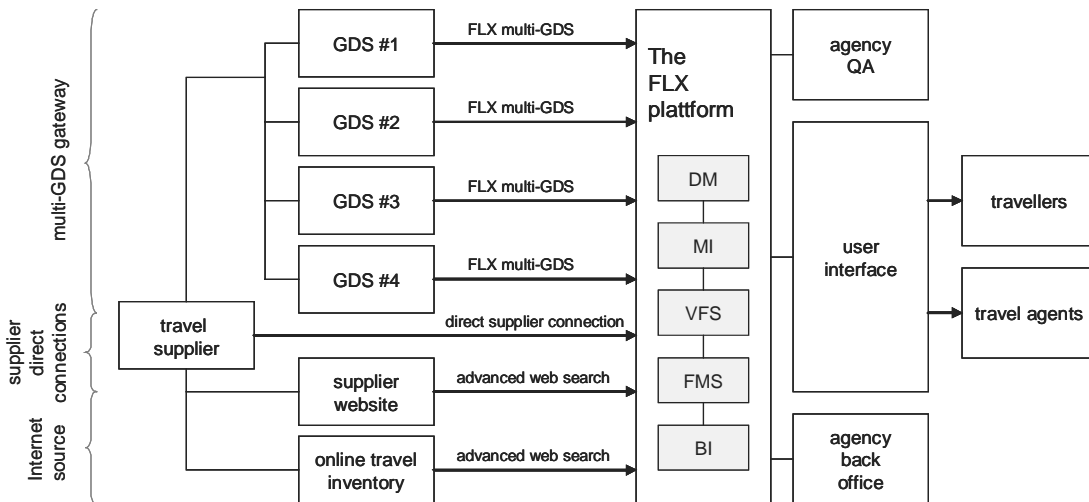
Due to the GDS deregulation and the emergence of alternative platforms for direct sales, the limits of the original GDS and their underlying technologies became more and more obvious in the last years. Additionally, as the number of alternative platforms for direct sales grew, GDS became unable to cover the full range of services on the market. Consequently, different kinds of work around systems, combining the “legacy” GDS with new technology appeared on the market and called themselves GDS new entrants (GNE; also known as global new entrants). GNE providers used modern technologies to allow airlines to close this gap and pool the offers from GDS and other distribution platforms. Table 4 gives a short overview of the leading GNE players on the market, listing some highlights of the different companies.

All of these companies target low cost distribution with their systems, while recognizing the need to aggregate content from all kinds of

Table 4. GDS new entrants (GNE) credible players (Source: Lewitton, 2005)

| GNE Company | Highlights |
|--------------------|--|
| ITA Software | Founder: Jeremy Wertheimer, PhD (MIT) Established in 1996, privately held. Built industry-leading shopping engine. Supplied code for Orbitz launch. Clients include agencies, suppliers and GDS. |
| G2SwitchWorks | Founder: Alex Zoghlin, built 3 successful tech. companies, including Orbitz. Privately held start-up (2004). Employing existing direct connects to AA, CO, NW, UA and others. |
| FareLogix INC. | Founder: Rick Gossage CEO: Jim Davidson, ex-CEO Amadeus US Established in 1998, privately held. Built industry leading contract management system and call centre travel booking applications. Clients include major agencies and consolidators. |

Figure 12. Components of the FareLogix FLX platform solution (Source: FareLogix, 2006)



different sources. FareLogix is exemplarily in its approach and will therefore be examined more closely. The company currently provides solutions with multiple source content to some of the largest travel companies in Canada and the United States, including Navigant International, American Express, and Carlson Leisure Group Services. The centrepiece of the FareLogix system environment is the FareLogix FLX platform, as illustrated in Figure 12. Following FareLogix (2006), it represents a multi-GDS gateway that connects to all four GDS, using structured data streams that normalize the communication in a common application programming interface (API). The multi-GDS gateway provides independence from the single-source GDS model and allows the integration of multiple GDS inventories at an individual-itinerary level. In addition, direct connections to supplier systems can be established for real-time availability. And finally, as new Web-based direct distribution platforms have diffused, content from low-cost carriers and online travel sites is integrated via appropriate interfaces. Consequently, FareLogix banks on advanced Web search technology to capture and aggregate content from different online portals to provide travel agents and travellers with a comprehensive integrated inventory solution.

As illustrated in Figure 12, the FareLogix FLX platform consists of a set of different systems. First of all, the Distribution Manager (DM) is a business rules engine, which controls the supply and handling of source information. The sources are the different GDS, direct supplier connections and Web inventories. The Master Itinerary (MI) integrates the supplied source information into a so called super-PNR (passenger name record), which acts as a single record repository for all travel itinerary information. Furthermore, the Virtual Fare Store (VFS) incorporates fares from the Airline Tariff Publishing Company (ATPCO) and private fares from the Fare Management System (FMS) to calculate the lowest fare for each itinerary. The FMS itself provides a new flexible platform to store private fares from airlines, no longer requiring the cumbersome reliance on traditional ATPCO fare filing. This independent faring and pricing engine allows airlines a new level of distribution channel management that did not exist in the ATPCO-driven, GDS-centric environment. Finally, the business intelligence (BI) module primarily serves reporting purposes on operational performance and vendor analysis. For a more comprehensive description of the FLX platform, see FareLogix (2006).

Going one step further, travel intermediaries and customers can either access the FLX platform by a standard certified user interface or use an existing neutral agent point-of-sale (POS) application. Based on an API technology, it also allows simple interfaces to agency quality assurance (QA) and back office accounting systems. Obviously, the FLX platform is built on open standards using Web technologies such as “the Extensible Markup Language (XML), simple object access protocol (SOAP), Web Services Description Language (WSDL), and the universal description, discovery, and integration (UDDI) open standards over an Internet protocol (IP) backbone. This robust open architecture enables seamless integration of disparate inventory sources. Furthermore, the platform uses standard Open Travel Alliance (OTA) XML schemas and traditional EDIFACT communication protocols to provide suppliers with familiar communication methodologies” (FareLogix, 2006).

In conclusion, referring to the CRS/GDS as first-generation airline distribution systems, the GNE platforms can be seen as a transitional solution, which will presumably have a growing importance in the airline distribution market in forthcoming years. The GNE platforms provide airlines with a sophisticated and cheaper solution and the possibility to circumvent the GDS companies as distribution intermediaries; still the GDS remain the systems in which airlines store all their business critical data. But, as airlines are offering more and more information and functionalities via direct connections (for example the FLX platform), they increasingly have to develop their own systems, often with the aim of becoming totally independent from the GDS. With regard to the growing complexity of airline systems, not only in terms of distribution, but also with regard to internal and external processes and management, it can be foreseen that second-generation airline core environments will emerge (also including new systems of the GDS providers). Of course, airline distribution will remain their central fo-

cus. As system development is generally not part of the airlines’ core competences, the need for airline IT providers has risen. These providers can either position themselves as a full service provider of airline systems and supporting IT solutions, the latter going beyond airline core processes (so-called value added services), or they can be a specialised supplier of only these value adding systems.

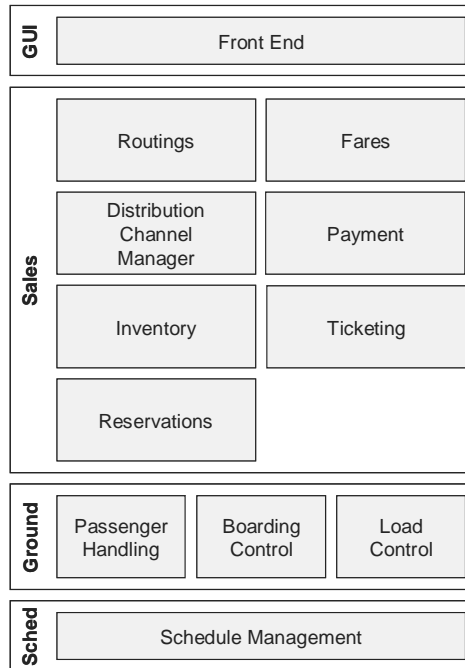
Second-Generation Airline Core Environments

In the current changing market environment, airlines are offering their products through a wide range of distribution channels. Nevertheless, although circumventing the GDS in the distribution chain through direct channels (for example online platforms), the airline system environment still relies on the GDS. Therefore, if airlines are to regain total control over the whole distribution process they will be forced to undertake a radical shift towards completely new airline core system environments. Regaining control means not only cutting costs and eliminating commissions. The new systems also can provide new kinds of management information, while supporting a much broader range of operational and management processes.

In addition to new IT platforms of traditional GDS companies, new airline IT full service providers offer these new systems and promise flexible solutions for quick reactions in a fast paced market environment. In general, the requirements for a second-generation core environment range from multi-channel distribution and distribution cost control to immediate adjustment possibilities of core processes to keep the system in line with the business strategy.

Different new airline full service IT providers have emerged on the market recently and have developed completely new information system environments. An example of such a system in terms of the fundamental change from first to second-

Figure 13. FACE—Future Airline Core Environment by Lufthansa Systems (Source: LufthansaSystems, 2006)



generation systems is that of Lufthansa Systems, whose new system is called FACE: Future Airline Core Environment. The struggle of global distribution systems will inevitably “be an opportunity for flexible and cost-effective solutions to move into spotlight”, predicted Wolfgang F.W. Gohde, CEO of Lufthansa Systems, at a press conference in Frankfurt/Germany on June 24, 2005 (LufthansaSystems, 2006). Lufthansa Systems is currently investing 40 million euros in the future development of its airline systems—regarding FACE as the cornerstone of the new information based landscape (LufthansaSystems, 2006).

The FACE platform uses a modular approach, enabling a suitable fit for different business models: from classic network carriers with global route networks, to low-cost airlines with point-to-point transportation. Furthermore all business models can be used simultaneously within a single airline or airline group. FACE supports the classic core

processes of passenger airlines, from inventory, schedule distribution, reservations, ticketing and departure control, to passenger service processes as classified in Figure 13.

“FACE enables airlines to freely choose their favourite distribution channels,” stated Gohde (ibid.). “This makes airlines more flexible and allows them to respond faster to market changes. FACE provides open interfaces, thus ensuring seamless data communication between different technology platforms—including airlines using different systems” (LufthansaSystems, 2006). The modular approach further enables airlines to adopt different parts of the system over time and adapt them to their business processes and requirements. The different parts or functional areas introduced in Figure 13 support the following business processes (LufthansaSystems, 2006):

- All schedule management processes support the creation of schedules and the conversion

- into marketable offers, thus allowing the distribution to all relevant partners.
- Passenger ground handling processes maintain the passenger handling from check-in to boarding, including additional customer care activities. The management of flight-related processes involved in loading an aircraft and preparing it for departure also is included.
 - Sales processes range from the management of the inventory via reservation and sale to the issuing of and payment for a ticket. Special emphasis is placed on enabling airlines to actively manage and effectively control sales through the various traditional and upcoming distribution channels in a deregulated, competitive, and agile market environment.
 - Finally, the FACE front-end graphical user interface (GUI) provides the business process logic with workflow orientation and a high degree of automation.

Beside the fact that FACE is GDS neutral, it operates under the IATA code L1 so that it can be run as a computer reservation system by Lufthansa Systems, and therefore represents a potentially fully equivalent system to replace the GDS backend. Of course, connections to GDS, GNE, and Internet sources will still be possible; to keep the backdoors open for all intermediaries and customers still relying on these kinds of information sources. Enabling airlines to combine different distribution channels, FACE also is designed for use in airlines alliances, and will therefore be marketed both inside and outside of the StarAlliance.

New Management Challenges for Airlines

At the beginning of this part of the chapter, general airline management challenges relating to economic factors were already discussed. This section therefore concentrates on the opportunities

and threats for airlines with regard to distribution. In fact, distribution is increasingly regarded as one of the most critical managerial aspects, as it can determine the competitiveness and profitability of organisations.

In the airline business, distribution has always been ICT driven, in the past heavily relying on the first-generation of airline reservation systems (CRS/GDS). However, modern information and communication technology has provided airlines with a completely new set of diverse opportunities. Today, airlines can take advantage of such opportunities by using the Internet as a distribution channel, starting with airline-owned Web sites, alliance booking engines, electronic intermediaries and other kinds of sales tools, including electronic auctioning of unsold seats. Airlines have managed to bypass intermediaries and to enforce zero commission, and also regained control over distribution. All of these different options represent a potential threat to travel intermediaries and GDS suppliers, as examined throughout the previous sections. As a result, the airlines' distribution chain has undergone a fundamental transformation. An overview of these transformations is given in Figure 14.

In this highly competitive market environment, airlines of all sizes have to react swiftly to market trends and constantly cut costs. In fact, increased cost pressure seems to have become a constant. In the past, management often concentrated on cost cutting while improving efficiency and effectiveness—traditionally targeting fields such as engineering, engine efficiency, air traffic control systems, administration, wage costs, and improvement in the design of aircrafts and related systems. With the emergence of the Internet, however, airline managers were enabled to shift the emphasis from these previous fields to a focus on reducing distribution costs. To round off the analysis of today's distribution environment from the different perspectives throughout the previous section, Figure 15 reflects on the different stages of distribution technologies and providers.

Figure 14. Transformation of the distribution chain (Source: Original by the author)

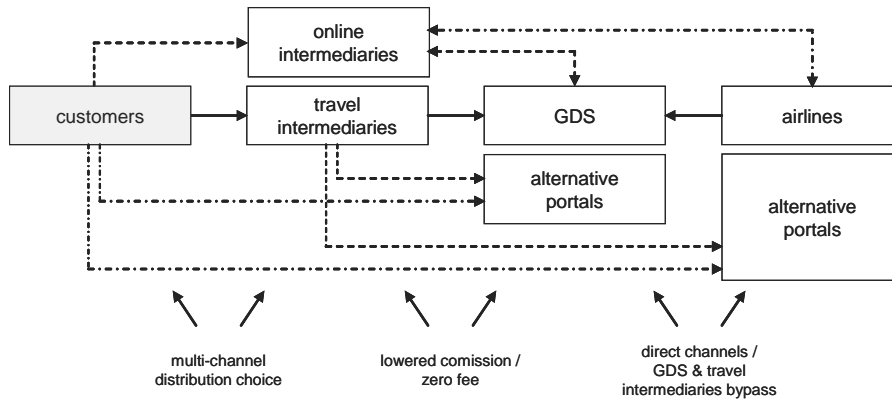
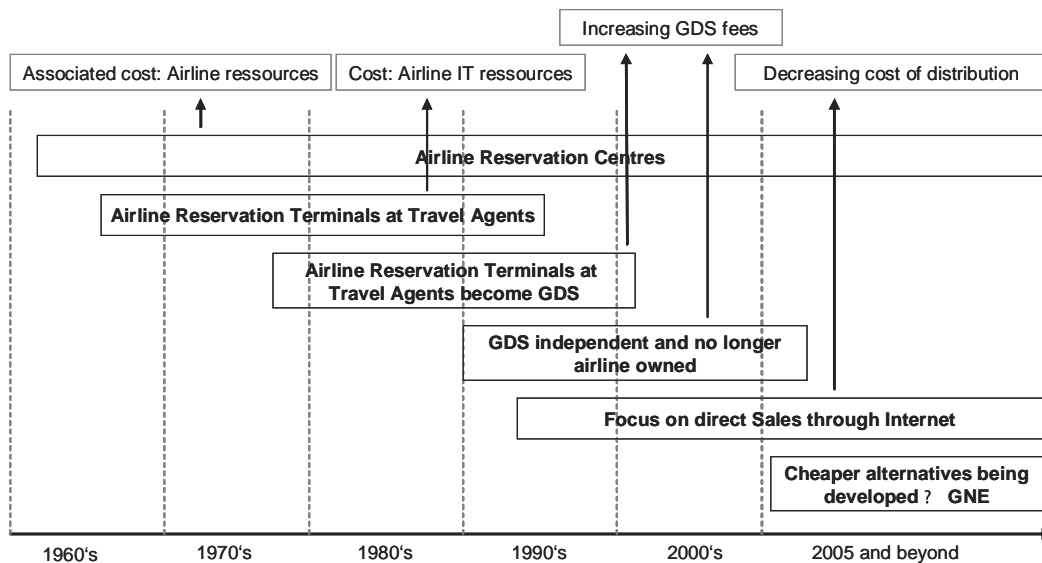


Figure 15. Stages of evolution in distribution technologies and providers (Source: LufthansaSystems, 2006)



Overall, modern information and communication technology has led to a fundamental reshaping of the airlines’ distribution, internal processes as well as the market structure and balance of power. As the ICT induced opportunities for airlines become obvious in terms of distribution processes, the possible use of modern information and communication technology beyond the distribution rises. The following section concentrates on these

new efforts and future developments, going one step further beyond distribution.

Mobile ICT in and Beyond Distribution

In recent years, not only “traditional” information and communication technology have developed rapidly. Increasingly, also the impact of mobile

The Transformation of the Distribution Process in the Airline Industry

Figure 16. Network architecture of in-flight entertainment and communication systems (Sources: Jahn, Holzbock, & Werner, 2002a; Jahn, Holzbock, Diaz, & Werner 2002b)

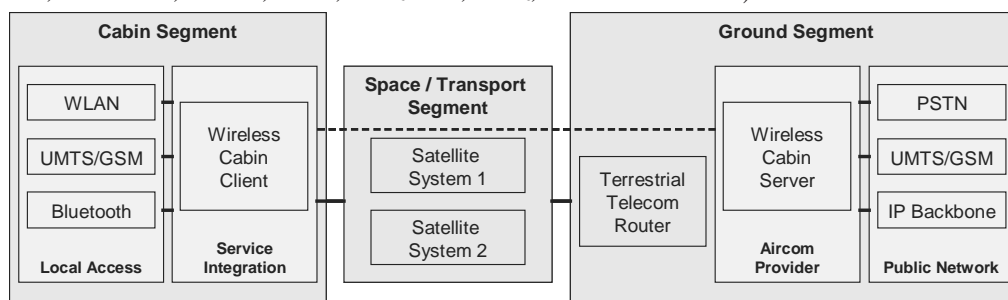
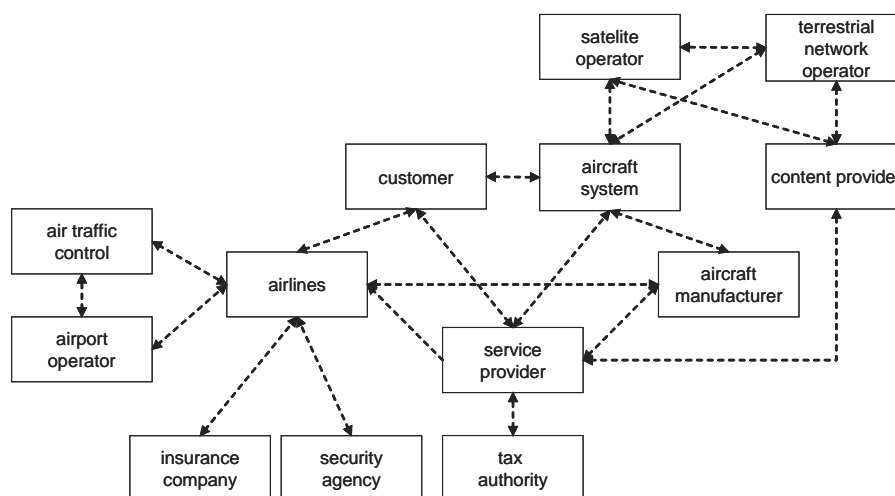


Figure 17. Parties and relationships involved in the new business model (Source: WirelessCabin, 2006)



technologies has to be considered when planning and developing business solutions and system environments. For companies as well as private and business customers, mobile networks and end devices represent new opportunities and are becoming widely used standards. Clearly both airlines and other distribution channel providers are thinking about means of transferring and integrating existing online booking engines to mobile platforms. As successful general mobile platforms (for example, i-mode or Vodafone live!) vary markedly depending on providers and countries/continents, it seems difficult to identify a representative solution among those available. Except for some information services, so far mobile

ticketing is the only available mobile distribution service going beyond the booking process itself. Principally, it is based on a similar assumption to electronic ticketing, that is, clients who book online also possess an e-mail address and a mobile end device respectively, to receive their booking confirmation. This mobile ticket could replace not only the printed invoice and booking confirmation, but also the whole paper-based ticket. In addition, the electronic ticket is the basic precondition for most available self-check-in procedures at airports. Again, the check-in procedure marks today's end of a seamless electronic distribution process, due to the necessity of passport control and registration of baggage.

To return to the discussion on the use of mobile end devices, it can be observed that a growing number of passengers are carrying their notebooks, organisers or mobile phones on to the aircraft. On the ground, that is, at airports, these devices can be widely used, encouraging airports to ensure good network coverage or even install wireless access points, so far often been restricted to business and first class lounges. Furthermore, a survey from WirelessCabin (2006) shows that business customers in particular, increasingly demand on-flight connectivity. The survey identified 30% of these customers as potential frequent users. The demand for services on-board ranges from news (84%), e-mail (78%), Internet (73%) and virtual private network (VPN) access to the company's intranet (66%) to mobile telephony (60%) and video conferencing (16%).

For these reasons different interest groups of industrial and scientific background work on new technological and business solutions for a new generation of in-flight entertainment and communication systems (IECS). For example, as part of the European initiative (European Union contract no IST 2001 37466) the WirelessCabin project has been launched with the aim to clarify a possible system and business structure. Based on these elaborations and different scientific publications on numerous mobile technology conferences the basic network architecture can be displayed as shown in Figure 16.

Following Jahn et al. (2002a, 2002b), a future IECS will consist of three different parts: the cabin segment, space or transport segment, and the ground segment. Passengers are offered mobile access with their own notebooks, PDAs, or mobile phones via different wireless technologies, which are combined in a so called collectively mobile heterogeneous network (CMHN). After the service integration, the wireless cabin client establishes a satellite connection to the terrestrial server, which is handled by the aircom provider. As part of the ground segment, this server also provides links to fix-line and mobile networks as well as

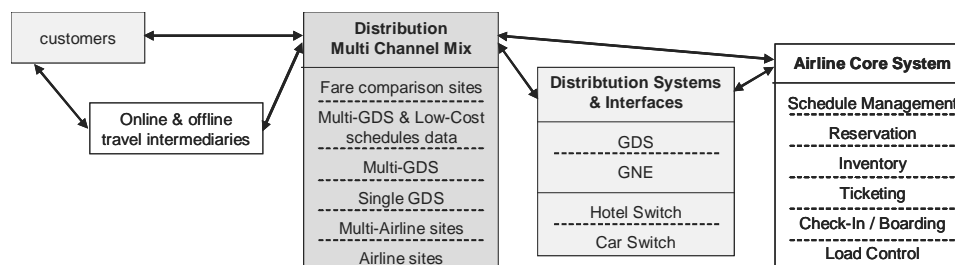
the Internet and other networks as for example corporate intranets or virtual private networks (VPN). The complexity of establishing such new systems can be generally underlined by showing an abstract diagram of the parties involved as well as their relations in Figure 17.

Due to customer expectance and the complexity of these new systems, it is not surprising that Boeing and Airbus as the major aircraft companies are investing in the development of innovative new on-board systems. The current communication and entertainment infrastructure in airplanes is planned to be completely replaced within this decade by new systems called "Connexion by Boeing" or "OnAir", the latter being a joint venture system of Airbus, SITA, and Tenzing. In both cases, the business model involves a large number of parties as pointed out in Figure 17 and represents a major challenge to all participating players. This shows on a more general level that the entire distribution process, including all related processes, is a complex phenomenon—inter alia caused and affected by information and communication technology.

CONCLUSION

Throughout this chapter, it has been shown that information and communication technology (ICT) has always been a driver of change in the airline industry. For over four decades, ICT has repeatedly affected and determined the way of airline business. In turn, the airline industry also has been a driver of evolution for the ICT sector. First, ICT helped the airline industry to lift-off in the 1950s and 1960s, by providing new methods of handling the rising flood of passenger related information. Indeed, ICT soon became critical to business in the distribution process. As a result of ongoing system enhancements and due to the influence of deregulation on the airline market, original computer reservation systems (CRS) slipped into a concentrating process, which led to

Figure 18. The airline industry's electronic multi-channel distribution environment (Source: Merten & Teufel, 2006)



an interconnected network of different systems, calling themselves global distribution systems (GDS). Over several decades, the GDS suppliers grew to be major players on the airline market, handling the distribution of products for the airlines, with the aid of travel intermediaries as main access to the end consumer. Finally, modern information and communication technology has led to a fundamental reshaping of the airlines' internal processes as well as the market structure and balance of power, resulting in a need for completely new airline core system environments. In this process the traditional distribution chain has been transformed into a form of multi-channel distribution environment as illustrated in Figure 18.

In this, all different market players form an interconnected network, where every action directly influences the entire network and vice versa. Due to this cross-linking the complexity of management decisions increases, and enforces a much stronger competitive situation. As a result, a duality of competitive and cooperative relationships coexists. Therefore future research ought to examine the network effects and challenges of the so-called co-competition in the airlines industry's cross-influenced network. A particular focus should be on the different market players in this multi-channel distribution environment. For further details see Merten and Teufel (2006).

This chapter aimed to provide a comprehensive overview of the transformation of the distribution process in the airline industry empowered by information and communication technology. Today, airlines, old and new intermediaries as well as the customers are all affected by changes made possible through the Internet. While airlines are successfully using the opportunities provided by the Internet, travel agents quarrel with lowered commissions and are forced to charge customer fees as they have not yet identified the potential of the World Wide Web for their sector. Customers, on the other hand, drift off to online services using the new diversity of distribution channels, exploring and exploiting the possibilities of their newly gained independence.

REFERENCES

- Amadeus. (2006). *Amadeus: Your technology partner*. Retrieved March 31, 2006, from <http://www.amadeus.com/>
- Bennett, M. (1988). Information technology and the travel agency. *Geographical Papers*, 105, University of Reading, p. 42.
- Boberg, K., & Collison, F. (1985). Computer reservation systems and airline competition. *Tourism Management*, 174-183.

- Buhalis, D. (1998). Strategic use of information technologies in the tourism industry. *Tourism Management, 19*(5), 409-421.
- Buhalis, D. (2003). *Etourism: Information technology for strategic tourism management*. Harlow, UK: Financial Times Prentice Hall.
- Copeland, D., & McKenney, J. L. (1988, September). Airline reservation systems: Lessons from history. *MIS Quarterly*, 353-370.
- Doganis, R. (1991). *Flying off course: The economics of international airlines*. London: Routledge.
- FareLogix. (2006). *The new multi-source environment*. Retrieved March 31, 2006, from <http://www.farelogix.com/solutions/index.html#ebt>
- Feldman, J. (1994, August). Airline distribution under siege—at last. *Air Transport World*, 35-43.
- GAO. (2003). Airline ticketing—impact of changes in the airline ticket distribution industry. *United States General Accounting Office, Washington, Report to Congressional Requesters*. Retrieved July 20, 2005, from <http://www.gao.gov/new.items/d03749.pdf>
- Genger, J. (2005, June 21). Amadeus fürchtet um sein kerngeschäft. *Financial Times Deutschland*, 6.
- Green, D. (1996, March 9). Airline ticket shops bridge the atlantic. *Financial Times*.
- Hart, P. (1997). *Tourism industry innovation in securing online sales*. Paper presented at the 4th ENTER Conference, Edinburgh.
- Inkpen, G. (1994). *Information technology for travel and tourism*. London: Pitman Publishing.
- Jahn, A., Holzbock, M., & Werner, M. (2002a): *Dimensioning of aeronautical satellite services*. Paper presented at the 53rd International Astronautical Conference.
- Jahn, A., Holzbock, M., Diaz, N. R., & Werner, M. (2002b): *Passenger multimedia service concept via future satellite systems*. DGLR Jahrbuch.
- Kärcher, K. (1997). *Reinventing the package holiday business*. Wiesbaden: Deutscher Universitäts-Verlag.
- Lewitton, D. (2005). Emerging changes in travel distribution economics and technologies: Letting the gne out of the bottle. *Travel Technology Congress*. Berlin: ITB.
- LufthansaSystems. (2006). *FACE module concept*. Retrieved January 21, 2006, from http://www.lhsystems.de/en/resource/document/pdf/br/br_face_einleger.pdf
- Merten, P., & Teufel, S. (2006). *Co-opetition in an electronic multi-channel distribution environment: The airline industry case*. Paper presented at the EURAM, 6th Annual Conference: Energizing European Management, Oslo, Norway.
- N. N. (2005, October 1). Flying from the computer. *The Economist*.
- O’Conner, P. (1999). *Electronic distribution technology in the tourism and hospitality industries*. New York: CABI Publishing.
- Prideaux, B. (2001). Airline distribution systems: The challenge and opportunity of the Internet. In D. Buhalis & E. Laws (Eds.), *Tourism distribution channels: Practices, issues and transformations* (pp. 213-227). London: Continuum.
- Sabathil, S. (2002). *Lehrbuch des linienflugverkehrs* (4th ed.). Frankfurt/Main: Schule für Touristik Datz und Weigand.
- Sattel, J. (2005). New opportunities in travel it and sales, *Travel Technology Congress*. Berlin: ITB.
- Schmidt, I. D. (2004). *Kunden in mehrkanalsystemen—eine prozessorientierte analyse des kanal-*

The Transformation of the Distribution Process in the Airline Industry

wahlverhaltens von kunden in der reisebranche. University of St.Gallen, Switzerland.

Sheldon, P. J. (1997). *Tourism information technology*. Oxford, UK; New York: CAB International.

SITA. (2006). *Sita corporate profile*. Retrieved 31 March, 2006, from http://www.sita.com/News_Centre/Corporate_profile/default.htm

Sloane, J. (1990). Latest developments in aviation crss. *EIU Travel & Tourism Analyst*, 4, 5-15.

Tedeschi, B. (2005, January 31). *E-commerce report*.

Tralliance. (2006). *Tralliance.Travel registry*. Retrieved January 21, 2006, from <http://www.tralliance.info/>

Truitt, L., Teye, V., & Farris, M. (1991). The role of computer reservation systems. *Tourism Management*, 21-36.

von Götz, G. (2005). Flexibility—it all boils down to the right choice, *Travel Technology Congress*. Berlin: ITB.

Werthner, H., & Klein, S. (1999). *Information technology and tourism: A challenging relationship*. Wien; New York: Springer.

Williams, G. (1994). *The airline industry and the impact of deregulation* (revised ed.). Aldershot: Avebury Aviation.

WirelessCabin. (2006). *Advanced communications for aircraft passengers*. Retrieved January 21, 2006, from <http://www.wirelesscabin.com>

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper, pp. 76-113, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.20

Technological Innovation, Trade, and Development

Laura Márquez-Ramos
Universitat Jaume I, Spain

Inmaculada Martínez-Zarzoso
Universitat Jaume I, Spain

Celestino Suárez-Burguet
Universitat Jaume I, Spain

ABSTRACT

This chapter tests empirically to what extent technological innovation influences international trade and studies its effect on different groups of countries according to their level of economic development. Different measures used in the literature to proxy for technological capabilities are reviewed and two of them are selected. The estimation results show that technological innovation has a considerably high explanatory power on trade compared with other traditional determinants. Countries tend to trade more when they have similar technological capabilities and the development of technological innovation has lowered the effect of geographical distance on trade. According to the obtained results, investing in technological innovation leads to

the improvement and maintenance of the level of competitiveness, therefore a good economic policy in developing countries is to invest in technological innovation.

INTRODUCTION

In the last decades there have been important changes in the international environment, with an increasing number of countries that are closely linked to one another through international trade and foreign direct investment. Globalization, new technologies, and information flows play an important role in this worldwide interdependence. In this framework, trade theory highlights the importance of technological change in explaining the competitiveness of a country.

The main purpose of this chapter is to test empirically to what extent technological innovation influences international trade and to study its effect on different groups of countries according to their level of economic development.

In the next section, different measures used in the literature to proxy technological capabilities are presented. In a knowledge-based economy with high and increasing dependence on technology, information and human capital, the development of relevant indicators to measure the level of technological innovation across countries is a matter of great importance. For this purpose, three components of technological innovation are considered: creation of technology, diffusion of recent innovations and diffusion of old innovations (as measures of information technology), and development of human skills (as a measure of human capital).

The third section presents the estimated model and the empirical results. Empirical results show that technological innovation has a considerably high explanatory power on trade in comparison to other traditional determinants. Moreover, the view that countries tend to trade more when they have similar technological capabilities is supported. Results also show that the development of technological innovation has lowered the effect of geographical distance on trade, since long distances are less important nowadays than in the past. Therefore, investing in technological innovation could help to improve and maintain the level of competitiveness and this will increase the participation of the poorest countries in the world economy.

The fourth section includes a sensibility analysis where groups of countries with different levels of income are considered in order to test for the pooling assumption. Since the magnitude and sign of the explanatory variables depend on certain characteristics of the trading partners, the estimation results support the existence of important differences concerning the goodness of fit, and the significance and magnitude of the variable coefficients.

The fifth section includes three future perspectives for this research, related to the variables included in the model (distance as proxy of transport costs) and the improvement of the estimation methodology (division of countries in different groups and panel estimation). Finally, some conclusions of this research are presented in the last section.

BACKGROUND

The interest in the study on the relationship between technological innovation and competitiveness dates back to the so-called “neo-technological trade theories” of the sixties (technology gap, product-cycle). Most of the research in this field was based on Schumpeter’s analysis of innovation and diffusion as the driving forces behind the competitiveness of firms. This author placed technological change and innovation at the core of economics.

The development of relevant indicators to measure the level of technological innovation across countries is a matter of great interest in a knowledge-based economy that is driven by high and increasing dependence on information technology and human capital. In recent years, important attempts have been taken to measure technology creation and diffusion, and human skills across countries. For example, Wakelin (1997) classifies different proxies for technological innovation used in the literature and points out that the main choice of technological innovation proxies has been between using an input to the innovation process, such as R&D expenditure or the number of scientists and engineers employed in research departments, and an output, such as number of patents. In a more recent study, Keller (2004) states that technology is an intangible parameter that is difficult to measure directly and he proposes that three indirect approaches can be used to measure it. This can be done through the measurement of inputs (research and

Table 1. Measurement of technological innovation with composite indices

| Variable | Description | Source |
|--------------------------------|--|------------------------------------|
| ArCo | This index takes into account three dimensions: Creation of technology (number of patents, number of scientific papers), diffusion of technology (Internet penetration, telephone penetration, electricity consumption) and development of human skills (gross tertiary science and engineering enrolment, mean years of schooling, adult literacy rate). | Archibugi and Coco (2004) |
| European Innovation Scoreboard | This index takes 17 indicators into account. The aspects of the innovation process measured by the scoreboard are: Availability and use of people with the right skills, creation of new ideas, innovation by firms, and a range of issues. From these indicators a so-called “tentative summary innovation index” (SII) is constructed. The index is normalised to the interval [-10, 10]. An index of zero represents the European Union average (Grupp and Moguee, 2004). | European Commission (2005) |
| ITR | The “Internet Traffic Report” monitors the flow of data around the world. The index takes values between zero and 100. Higher values indicate faster and more reliable connections. | ITR ¹ (2004) |
| ICT | The Index of Information and Communication Technology (ICT) diffusion consists of two dimensions: Connectivity (Internet hosts, PCs, telephone mainline,s and cellular subscribers) and access (Internet users, literacy, GDP per capita, and cost of a local call). Moreover, a third dimension (policy) is presented separately. | Biggs, UNCTAD (2003) |
| TAI | The “Technology Achievement Index” is built up of four dimensions: Creation of technology (number of patents granted to residents, receipts of royalty, and license fees from abroad), diffusion of recent innovations (Internet hosts, exports of high technology and medium technology products), diffusion of old innovations (number of telephones, electricity consumption) and human skills (mean years of schooling, gross tertiary science enrolment ratio). | UNDP (2001) |
| NRI | The “Network Readiness Index” measures the degree of preparation of a nation or community to participate in and benefit from Information and Communication Technology (ICT) developments. It is built up of three dimensions: Environment offered by a country or community, the readiness of the community’s key stakeholders, and the usage of ICT. | WEF, World Bank, and INSEAD (2004) |

development), outputs (patents) and the effect of technology (higher productivity). From a different point of view, Archibugi and Coco (2005) review several synthetic indexes that are used to assess the impact of technological capabilities on economic and social indicators. These authors also recommend considering individual indicators and sub indexes to understand how and why countries differ. The use of composite indices is criticised by Grupp and Moguee (2004), since composite scores and country rank positions can vary considerably depending on the selection process and alternative methods of calculation.

Table 1 shows six different composite indices that measure countries’ endowment of technological innovation and that have been recently developed by some institutions and individuals. Most of the indices take into account several dimensions (3 or 4) that include variables related to the creation, the diffusion and the use of new technologies and the development of human skills and new ideas. However, the correlation coefficient among these indices is high and the availability of the data varies considerably.

Table 2 shows a selection of 20 papers that have used single variables to proxy technological

Technological Innovation, Trade, and Development

Table 2. Proxies for technological innovation

| Variable | Description | Source |
|---|---|---|
| Proportion of non-managers using computers | Measures the impact of computers on productivity | Black and Lynch (2004) |
| R&D expenditure Workers in R&D and innovation sectors Number of researchers | Indicators of R&D and innovation | Caballero, Coca, and Escribano (2002) |
| Expenditure on innovation per worker | Indicators of innovation | Calvo (2002) |
| Imports of computer equipment | Proxy for technological adoption | Caselli and Coleman (2001) |
| Foreign R&D capital stock | R&D <i>spillovers</i> | Coe, Helpman, and Hoffmaister (1997) |
| Variable related to the stock of past research effort and the stock of human capital in countries | Level of technology | Eaton and Kortum (1997) |
| R&D expenditure | Input measure of investments in new technologies | Fagerberg (1997) |
| Absolute difference between the ArCo of the two trade partners | Proxy for technological distance | Filippini and Molini (2003) |
| Internet <i>hosts</i> | Measures the Internet development in a country | Freund and Weinhold (2004) |
| International patents | National innovative output | Furman and Hayes (2004) |
| Telecommunications and Internet consumption | Indicators of Information and Communication Technology (ICT) | García Castillejo (2002) |
| Total factor productivity (TFP) | Output measure of investments in new technologies | Gustavsson, Hansson, and Lundberg (1997) |
| Firms introducing an innovation (preceding year) Innovation expenditure | Indicators of innovation in firms | Lachenmaier and Woessmann (2004) |
| Average number of patents <i>per capita</i> | Proxy of innovative output | Moreno, Paci, and Usai (2004) |
| R&D expenditure Inputs assigned for basic research Information and Communication Technology (ICT) expenditure | Indicators of R&D and ICT | SánchezUsaz, López, Cervantes and Cañibano (2000) |
| R&D expenditure | Identifies industries where countries tend to have relatively efficient technology | Torstensson (1996) |
| R&D expenditure Number of patents | Input measure of investments in new technologies Output measure of investments in new technologies | Verspagen and Wakelin (1997) |
| Total factor productivity (TFP) | Output measure of investments in new technologies | Wolff (1997) |
| Equipment investment per person engaged in production | Proxy for technological change | Wolff (2002) |
| Telephone call traffic | Proxy for “disembodied” idea flows | Wong (2004) |

innovation. More than half of them have selected the innovation process as an input and only a few have chosen it as an output measure.

Among all the indices available in the literature, the technology achievement index (TAI), developed by the United Nations Development Program (UNDP, 2001), and the ArCo technology index, introduced by Archibugi and Coco (2004), have been selected to be used in this study. The selection has been made in order to analyse as many countries as possible. The TAI is available for 72 countries, but it is not comparable across time because the maximum and the minimum observed values used to calculate the index can change over time. The ArCo technology index is available for 162 countries. The authors fix an identical time period for a maximum and a minimum value (1987-1990 and 1997-2000) to allow symmetrical time-series comparisons. These indicators are also more complete compared to others, as they take into account a wider array of variables related to technological innovation.

The effect of the technological innovation dimensions on international trade is analysed, and each of the components of the TAI was included separately in the regression analysis. A detailed description of the components of the selected indices is presented in Martínez-Zarzoso and Márquez-Ramos (2005).

ESTIMATED EQUATION AND EMPIRICAL RESULTS

To evaluate the empirical effects of technological innovation on international trade, a gravity model, augmented with technological variables and a transport infrastructure index is estimated. The theoretical framework is taken from Suárez-Burguet, Martínez-Zarzoso, and Márquez-Ramos (2005). These authors analyse the role played by cross-country differences in both relative factor endowments and relative country size when determining the volume of trade. They developed a

model based on Helpman and Krugman (1996) and introduced trade barriers, and “hard” and “soft” investment in infrastructure as determinants of the volume of trade. The model supports the notion that comparative advantage determines international trade, adding factors with a positive influence on production factors: “hard” (transport infrastructure) and “soft” (technological innovation) investment in infrastructure. Although the gains of increasing trade are attenuated by the resistance imposed by geographical barriers, infrastructure endowment also determines countries’ specialisation and trade flows.

Based on this theoretical framework, an empirical model is derived to test the influence of technological innovation on trade. Integration dummies are included to take into account the impact of trade agreements on international trade. A number of dummies representing geographical and cultural characteristics are also added. The model is expressed in additive form using a logarithmic transformation.

The estimated equation is shown in equation 1, where \ln denotes natural logarithms.

The model is estimated with data from 62 countries available in 1999 and a total of 3782 (62*61) bilateral trade flows are obtained (see Figure 1). The presence of missing/zero values in the bilateral trade flows data reduces the sample to 3126 observations. An Ordinary Least Squares (OLS) estimation on the double log specification is performed as given in Equation (1).

X_{ij} denotes the value of exports from country i to j ; Y_i and P_i are income and population in the exporter’s country; Y_j and P_j are income and population in the destination market; Adj_{ij} is a dummy that takes a value of 1 when countries share the same border and zero otherwise; Isl takes a value of 1 when the exporter or the importer are an island; $Land$ is a dummy for landlocked countries; $CACM$ is a dummy that takes a value of 1 when both countries belong to the Central American Common Market; $CARIC$ is a dummy that takes a value of 1 when both countries belong

Equation 1.

$$\ln X_{ij} = \alpha_0 + \alpha_1 \cdot \ln Y_i + \alpha_2 \cdot \ln Y_j + \alpha_3 \cdot \ln P_i + \alpha_4 \cdot \ln P_j + \alpha_5 \cdot Adj_{ij} + \alpha_6 \cdot Isl + \alpha_7 \cdot Land + \alpha_8 \cdot CACM + \alpha_9 \cdot CARIC + \alpha_{10} \cdot MERC + \alpha_{11} \cdot NAFTA + \alpha_{12} \cdot CAN + \alpha_{13} \cdot UE + \alpha_{14} \cdot \ln Dist_{ij} + \alpha_{15} \cdot Lang_{ij} + \alpha_{16} \cdot TAI_i + \alpha_{17} \cdot TAI_j + \alpha_{18} \cdot Inf_i + \alpha_{19} \cdot Inf_j + u_{ij}$$

to the Caribbean Community; MERC is a dummy that takes a value of 1 when both countries belong to Mercosur; NAFTA takes a value of 1 when countries are members of the North American Free Trade Area; CAN is a dummy representing Andean Nations Community members; and UE takes a value of 1 when countries are members of the European Union. Since direct measures of trade costs are unavailable, geographical distance between countries is often used as a proxy for transport costs in gravity equations, so $Dist_{ij}$ is the geographical great circle distance in kilometres between the capitals of country i and j . $Lang_{ij}$ is a dummy for countries sharing the same language, and TAI_i and TAI_j are technological variables measuring technological innovation in the exporter and the importer countries. Inf_i and Inf_j are infrastructure variables measuring the level of transport infrastructures in the exporter and the importer countries. Finally, u_{ij} is independently and identically distributed among countries.

Table 3 shows the results for the baseline model and the contribution of the dimensions considered in the TAI (creation of technology, diffusion of recent innovations, diffusion of old innovations, and human skills) to trade flows. Model 1 presents the OLS results, excluding technological and transport infrastructure variables. The coefficients on income are both positive, as expected, and the income elasticities are below one for the exporter and the importer. The coefficients on population are positive and significant – a higher market fosters trade, thus indicating the presence of economies of scale. However, since countries with different levels of development are included, the sample should be divided according to the

specialisation patterns in order to analyse the effect of demographic variables on trade². Developed countries can be considered as manufacturing exporters and developing countries can be seen as non-manufacturing exporters. The elasticity of demographic variables might have a different sign and dimension across the two groups of countries (Filippini and Molini, 2003). The coefficient of distance has a negative sign, as expected, because lower distances imply lower transport costs and a higher amount of goods traded.

Models 2, 3, 4, and 5 consider the gravity model augmented with technological variables: creation of technology, diffusion of recent innovations, diffusion of old innovations, and human skills. These variables are significant and have the expected sign, although some differences in the magnitudes of the coefficients and in the significance of variables can be observed, depending on the dimension included in the gravity equation. For example, adjacency is not significant when human skills are considered and some coefficients and signs on integration dummies are also different. Moreover, income coefficients are lower when technological diffusion or human skills are added than when the creation of technology index is added. The reason could be that the two former variables are capturing part of the positive effect of income on trade. Results show a higher explanatory power when including technological variables for exporter countries than when including them for importer countries. Then a higher technological innovation in the exporter country leads to greater exports. When the diffusion of old innovations index is included as a proxy for technological innovation, a higher variability of the bilateral export flows is experienced.

Table 3. Determinants of international trade. Baseline model and augmented gravity model (technological innovation differentiated by 4 dimensions)

| Variable | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|--|-----------------------|-----------------------|-----------------------|----------------------|-----------------------|
| Constant term | -10.42*** (-11.94) | -10.84*** (-13.84) | -11.62*** (-17.64) | -22.8*** (-37.41) | -16.69*** (-26.49) |
| Exporter's income | 0.27*** (13.22) | 0.15*** (11.15) | 0.08*** (8.75) | 0.02** (2.16) | 0.06*** (7.79) |
| Importer's income | 0.22*** (11.47) | 0.14*** (9.31) | 0.09*** (7.34) | 0.04*** (3.09) | 0.07*** (6.38) |
| Exporter's population | 0.70*** (23.08) | 0.71*** (29.37) | 0.77*** (39.42) | 1.03*** (57.95) | 0.94*** (48.66) |
| Importer's population | 0.51*** (15.79) | 0.53*** (21.36) | 0.57*** (26.41) | 0.77*** (37.38) | 0.69*** (34.71) |
| Adjacency dummy | - | 0.44** (2.36) | 0.49*** (3.15) | 0.37** (2.23) | 0.17 (1.18) |
| Island dummy | - | -0.4*** (-3.58) | -0.27*** (-3.01) | -0.45*** (-5.32) | -0.23*** (-2.61) |
| Landlocked dummy | - | -1.08*** (-10.48) | -1.16*** (-13.47) | -0.75*** (-9.54) | -0.84*** (-10.21) |
| CACM dummy | - | 0.93*** (2.89) | 1.22*** (4.92) | 2.38*** (9.96) | 2.17*** (8.04) |
| CARICOM dummy | - | 2.99*** (2.91) | 4.44*** (4.65) | 2.88*** (2.86) | 4.37*** (4.65) |
| MERCOSUR dummy | - | 2.52*** (8.56) | 3.12*** (10.09) | 1.74*** (5.54) | 2.55*** (5.81) |
| NAFTA dummy | - | 3.07*** (7.41) | 0.47 (1.11) | 1.42*** (2.96) | 1.53*** (2.69) |
| CAN dummy | - | 0.67 (1.4) | 1.68*** (3.9) | 0.71* (1.74) | 0.76 (1.36) |
| UE dummy | - | 0.51*** (4.33) | 0.17* (1.75) | -0.05 (-0.53) | -0.17* (-1.66) |
| Distance | -1.38*** (-31.19) | -0.98*** (-20.82) | -0.97*** (-23.32) | -0.98*** (-26.53) | -1.12*** (-27.92) |
| Language dummy | - | 0.67*** (6.12) | 0.72*** (7.43) | 0.88*** (10.58) | 0.73*** (8.51) |
| Exporter's creation of technology | - | 4.89*** (19.98) | - | - | - |
| Importer's creation of technology | - | 3.04*** (10.59) | - | - | - |
| Exporter's diffusion of recent innovations | - | - | 5.78*** (33.17) | - | - |
| Importer's diffusion of recent innovations | - | - | 3.88*** (21.44) | - | - |
| Exporter's diffusion of old innovations | - | - | - | 7.07*** (39.27) | - |
| Importer's diffusion of old innovations | - | - | - | 4.95*** (30.38) | - |
| Exporter's human skills | - | - | - | - | 6.46*** (41.31) |
| Importer's human skills | - | - | - | - | 4.52*** (27.35) |
| Exporter's infrastructure | - | 1.23*** (24.21) | 0.82*** (17.18) | 0.72*** (19.31) | 1.03*** (26.6) |
| Importer's infrastructure | - | 0.98*** (17.76) | 0.72*** (13.9) | 0.58*** (13.09) | 0.83*** (17.99) |
| R-squared | 0.407 | 0.637 | 0.719 | 0.786 | 0.761 |
| Adjusted R-squared | 0.406 | 0.634 | 0.717 | 0.785 | 0.759 |
| S.E. of regression | 2.511 | 1.971 | 1.733 | 1.511 | 1.598 |
| Number of observations | 3126 | 3126 | 3126 | 3126 | 3126 |

Notes: ***, **, *, indicate significance at 1%, 5%, and 10%, respectively. T-statistics are in brackets. The dependent variable is the natural logarithm of exports in value (current U.S. dollars). Income, population, and distance are also in natural logarithms. The estimation uses White's heteroscedasticity-consistent standard errors.

Model 1: Baseline model; **Model 2:** Augmented gravity model. Contribution of the creation of technology dimension on trade; **Model 3:** Augmented gravity model. Contribution of the diffusion of recent innovations dimension on trade; **Model 4:** Augmented gravity model. Contribution of the diffusion of old innovations dimension on trade; **Model 5:** Augmented gravity model. Contribution of the human skills dimension on trade.

In the quest of the differential effect of investing on each one of the four dimensions, the variability between the maximum and the minimum values of the indices is analysed. It has been found that the variability in the indices is 61.9% for creation of technology, 79.35% for diffusion of recent innovations, 87.86% for diffusion of old innovations and 89.72% for human skills. Therefore, those countries that do not reach a basic level of technological innovation should invest in old innovations and education for fostering international trade.

Table 4 shows estimation results when the technological variables included are the TAI index (Models 6, 7, and 10) and the ArCo index (Models 8, 9, and 11). Technological variables are found to be significant and positive, as expected. A higher technological innovation endowment fosters international trade, although the magnitude of the estimated coefficient for TAI is higher than the estimated coefficient for ArCo.

In Models 7 and 9, a different way to add technology in the trade equation is considered: the variable included is the technological distance between trading partners (Filippini and Molini, 2003). This is defined as the absolute difference between technological indicators in the exporter and the importer countries. This variable indicates that two countries can be far away from each other not only geographically, but also from a technological perspective. Technological gaps can deter trade since similar countries trade more. Therefore, a negative correlation between this new variable and the export flows is expected. In Models 7 and 9, the TAI and the ArCo indices, respectively, have been used to construct the technological distance variable. Technological distance has been found to be significant in both models and it increases the explanatory power of the regressions. Therefore, results support the view that countries tend to trade more when they are “closer” from a technological point of view.

In order to determine the relative importance of the different variables included in the aug-

mented gravity model, the beta coefficients are calculated (see Table A.2). They are used by some researchers to compare the relative strength of the various predictors within the model. Since the beta coefficients are all measured in standard deviations they are comparable when the explanatory variables are expressed in different units. The estimates of Model 6 imply that the highest beta coefficients are, in absolute value, for technological variables (0.504 for TAI in the exporter and 0.359 for TAI in the importer country). This means that a standard deviation increase in the endowment of technological innovation in the exporter country would lead to a 0.504 standard deviation increase in the logarithm of exports, whereas a standard deviation increase in the endowment of technological innovation in the importer country would enhance a 0.359 standard deviation in the logarithm of exports. Clearly, this indicates that technological variables are important determinants of international trade flows. Beta coefficients for technological innovation are also the highest in Model 7 (0.506 for TAI in the exporter country and 0.357 for TAI in the importer country). However, when beta coefficients for geographical and technological distance are compared, geographical distance appears to be a more important determinant of international trade flows since this variable may be capturing the effects of trade barriers that is different than transport costs such as cultural proximity, a shared history and information costs.

Freund and Weinhold (2004) fail to show evidence of the role played by the Internet in altering the effect of geographical distance in trade patterns. They use a dummy variable (LONGDIST), which equals one if the distance between trade partners exceeds the average distance between all countries. Then, they interact it with the growth in the number of Internet hosts in each country. In the process of comparing the results in this research with those obtained by these authors, the same interaction variable is added in the estimated equation. As in Freund and Weinhold

Table 4. Determinants of international trade. Augmented gravity model

| Variable | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 | Model 11 |
|-------------------------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------------|-----------------------|
| Constant term | -15.38*** (-25.71) | -15.72*** (-27.04) | -19.24*** (-31) | -19.36*** (-32.05) | -14.37*** (-21.18) | -17.01*** (-24.41) |
| Exporter's income | 0.02*** (2.62) | 0.02** (2.53) | 0.05*** (6.35) | 0.04*** (5.69) | 0.02** (2.34) | 0.04*** (5.61) |
| Importer's income | 0.04*** (3.72) | 0.04*** (3.61) | 0.06*** (5.21) | 0.05*** (4.64) | 0.04*** (3.51) | 0.05*** (4.65) |
| Exporter's population | 0.89*** (49.34) | 0.89*** (51.41) | 0.97*** (53.45) | 0.98*** (55.1) | 0.89*** (49.5) | 0.98*** (53.6) |
| Importer's population | 0.66*** (34.92) | 0.67*** (35.64) | 0.71*** (36.5) | 0.72*** (37.46) | 0.67*** (34.66) | 0.72*** (36.43) |
| Adjacency dummy | 0.43*** (2.89) | 0.32** (2.15) | 0.38** (2.34) | 0.24 (1.52) | 0.31** (2.03) | 0.13 (0.8) |
| Island dummy | -0.46*** (-5.64) | -0.47*** (-5.77) | -0.27*** (-3.17) | -0.31*** (-3.72) | -0.46*** (-5.58) | -0.28*** (-3.26) |
| Landlocked dummy | -0.86*** (-11.34) | -0.83*** (-10.99) | -1.04*** (-13.82) | -0.97*** (-12.92) | -0.86*** (-11.29) | -1.02*** (-13.68) |
| CACM dummy | 1.95*** (8.08) | 1.99*** (8.56) | 2.41*** (9.27) | 2.39*** (9.55) | 1.74*** (6.96) | 1.95*** (7.22) |
| CARICOM dummy | 4.29*** (4.49) | 4.17*** (4.38) | 4.07*** (4.03) | 3.91*** (3.89) | 4.24*** (4.44) | 3.99*** (3.95) |
| MERCOSUR dummy | 2.58*** (7.66) | 2.49*** (7.73) | 2.91*** (8.72) | 2.76*** (8.5) | 2.56*** (7.18) | 2.85*** (7.62) |
| NAFTA dummy | 0.71 (1.16) | 0.83 (1.36) | 1.12* (1.65) | 1.2 (1.51) | 0.81 (1.31) | 1.31* (1.85) |
| CAN dummy | 1.22*** (2.61) | 1.05** (2.24) | 1.06** (2.22) | 0.89* (1.87) | 1.26*** (2.69) | 1.14** (2.4) |
| UE dummy | -0.24** (-2.54) | -0.35*** (-3.76) | -0.11 (-1.1) | -0.26** (-2.45) | -0.22** (-2.36) | -0.09 (-0.89) |
| Distance | -1*** (-26.72) | -0.95*** (-25.44) | -0.95*** (-24.82) | -0.91*** (-24.13) | -1.12*** (-20.55) | -1.2*** (-21.8) |
| Language dummy | 0.92*** (11) | 0.87*** (10.49) | 0.91*** (10.41) | 0.83*** (9.81) | 0.93*** (11.16) | 0.93*** (10.78) |
| Exporter's TAI | 9.12*** (46.46) | 9.17*** (47.61) | - | - | 9.01*** (42.97) | - |
| Importer's TAI | 6.39*** (30.7) | 6.35*** (31.09) | - | - | 6.2*** (27.19) | - |
| Technological distance (TAI) | - | -1.73*** (-9.43) | - | - | - | - |
| Exporter's ArCo | - | - | 7.71*** (46.75) | 8.04*** (48.74) | - | 7.48*** (43.72) |
| Importer's ArCo | - | - | 5.44*** (30.08) | 5.68*** (32.69) | - | 5.21*** (26.8) |
| Technological distance (ArCo) | - | - | - | -1.93*** (-11.61) | - | - |
| Exporter's infrastructure | 0.68*** (17.65) | 0.68*** (18.26) | 0.91*** (25.06) | 0.88*** (24.89) | 0.67*** (17.34) | 0.88*** (23.63) |
| Importer's infrastructure | 0.57*** (12.57) | 0.57*** (12.89) | 0.74*** (17.45) | 0.71*** (16.94) | 0.56*** (12.31) | 0.71*** (16.51) |
| LONGDISTi | - | - | - | - | 0.21 (0.99) | 0.59*** (2.75) |
| LONGDISTj | - | - | - | - | 0.36 (1.53) | 0.59** (2.52) |
| R-squared | 0.788 | 0.793 | 0.781 | 0.789 | 0.788 | 0.783 |
| Adjusted R-squared | 0.786 | 0.792 | 0.779 | 0.788 | 0.786 | 0.782 |
| S.E. of regression | 1.506 | 1.484 | 1.529 | 1.499 | 1.505 | 1.522 |
| Number of observations | 3126 | 3126 | 3126 | 3126 | 3126 | 3126 |

Notes: ***, **, * indicate significance at 1%, 5%, and 10%, respectively. T-statistics are in brackets. The dependent variable is the natural logarithm of exports in value (current U.S. dollars). Income, population, and distance are also in natural logarithms. The estimation uses White's heteroscedasticity-consistent standard errors.

Model 6: Augmented gravity model (technological innovation measured by TAI); **Model 7:** Augmented gravity model and estimation of the effect of technological distance on trade (technological innovation measured by TAI); **Model 8:** Augmented gravity model (technological innovation measured by ArCo); **Model 9:** Augmented gravity model and estimation of the effect of technological distance on trade (technological innovation measured by ArCo); **Model 10 and Model 11:** Augmented gravity model and estimation of the effect of technological innovation on geographical distance and, therefore, on trade.

(2004), the coefficient of this variable is not significant. It could be that a more general proxy for technological innovation would be better to measure this effect. In Model 10, the technological variable TAI is interacted with the dummy LONGDIST, instead of using Internet hosts, obtaining LONGDIST_i (LONGDIST*TAI_i) and LONGDIST_j (LONGDIST*TAI_j). If technology and the advance of information and knowledge have reduced (increased) the impact of geographical distance on trade, then the coefficient on the interaction term should be positive (negative). However, though these coefficients have been found to be positive but they seem to be non-significant.

Finally, ArCo is used instead of TAI in Model 11 to analyse the effect of the knowledge-based economies on trade (LONGDIST_i and LONGDIST_j are interacted with TAI_i and TAI_j). Since the coefficient of LONGDIST_i and LONGDIST_j are both positive and significant, results in this research offer partial evidence showing that the information and knowledge advances have reduced the effect of geographical distance on trade. This result supports the inference to take into account different dimensions of technology, such as creation and human capabilities, and not only diffusion.

MODEL EXTENSIONS

Sensibility Analysis

To understand whether there exists a differential behaviour concerning the determinants of trade flows for developed (high-income) and developing (low-income) countries, the 62-country sample is divided into three groups according to their level of economic development: countries with high GDP per capita, medium GDP per capita, and low GDP per capita. Countries are ordered from higher to lower income levels, and then an upper level of GDP is composed by calculating

the average of the first half of the sample, and an inferior level is set by calculating the average of the second half (see Martínez-Zarzoso & Márquez-Ramos, 2005).

Table 5 shows the main results of the augmented gravity model for developed and developing countries. Results are only presented for two groups instead of three in a way to have a higher contrast between them³.

Model 12 presents the OLS results for the augmented gravity equation in the richest countries. Results show that income variables, adjacency, island and landlocked dummies, geographical distance, exporter's TAI, and exporter's transport infrastructure are significant. These variables have the expected sign, although island dummy presents a positive coefficient indicating that, when the richest economies are islands, they export more. Demographic variables (population of the countries) are not included since they are highly correlated with income in this group. The language dummy is not significant in this group of countries, proving that to share an official language with other high-income countries is not an important determinant of bilateral exports. However, it is positive signed and significant when trade among medium-income countries is analysed (see Table A.3)⁴. Variables in this model explain 87.8% of the variability in exports.

In Model 13, the augmented gravity model is estimated for low income countries. Exporter's and importer's population, being landlocked, geographical distance, the language dummy, and the exporter's and importer's TAI are significant and have the expected sign. Demographic variables for exporters have a positive relation with trade, indicating that greater availability of cheap labour force for industries in developing countries fosters trade. This model has a lower explanatory power (66.8%) than the model for the richest economies, which could be due, in part, to the data for developed countries' being of higher quality.

In Model 14 and 15, the technological differences variable is included. Results show that,

when trade is among countries with a similar level of development, technological endowments are more important for trade than the technological gap existing among these countries. Integration dummies are considered for the richest and the poorest countries, although they are only significant for the latter group.

In relation to the income coefficients, Garman, Petersen, and Gilliard (1998) analyse economic integration in a number of developing countries and support the notion that the costs and benefits of integration are unevenly distributed among members of an integration agreement in favour of the richest countries. They found that the income coefficients for Latin American countries have a smaller magnitude than those reported in other studies of European trade. Table 5 shows that income coefficients are negative signed and low in magnitude for the poorest economies; however, as income coefficients are not significant for these economies, the obtained results do not show clear evidence about this issue.

Technological and transport infrastructure variables are expected to have a positive influence on trade. Results show that they are non-significant for importers when trade is among high-income countries, and transport infrastructure variables are not significant for low-income economies. One explanation could be the non-arrival at a minimum level of infrastructure in developing countries.

Testing the Pooling Assumption

To improve the understanding of the differential behaviour concerning the determinants of trade flows for developed and developing countries, equation (1) is estimated by interacting the exogenous variables (except integration dummies) with a dummy (DP)⁵ that takes the value of one when trading partners are richer than the simple average in the 62-country sample. DP takes the value zero when trading partners are poorer than the simple average in the sample. In Model 16,

an OLS estimation is performed on the double log specification.

The Wald test is used in order to check whether both the exogenous variable and its interaction with the dummy representing developed countries present a different coefficient. The null hypothesis on equality of the coefficients in the two sub-samples (developed and developing countries) cannot be accepted. Table 6 shows the estimation results.

Model 16 presents the results for low-income and high-income countries, with the inclusion of interaction dummies. Results in this model can be compared to those obtained in Model 9. The results from the Wald test show that the poolability assumption is indeed rejected for bilateral exports and that the estimated parameters are not identical across bilateral relationships. In this research, the DP dummy has also been included as independent variable, to analyse whether the different behaviour of the determinants of trade in groups of countries can be found in the constant term and not only in the slope coefficients. Estimation results show that this dummy is not significant.

The income variable is more relevant for developed countries. A 1% increase in own GDP increases exports from developed countries by 0.52% (0.04+0.48), and by only 0.04% when exports are from developing countries. Very similar coefficients are obtained for foreign GDP. Since the gravity equation is an accepted methodology to analyse the effects of economic integration on trade flows, a lower magnitude obtained in the elasticities of income may indicate that the costs and benefits of integration and globalisation are unevenly distributed among different economies depending on their level of development and it goes in favour of the richest countries (see Garman et al., 1998).

The coefficients for population variables present positive signs, but with a very low magnitude for developed countries and a magnitude close to unity for developing countries. As developing

Table 5. Determinants of international trade. Estimation results for high and low income countries.

| Variable | Model 12 | Model 13 | Model 14 | Model 15 |
|------------------------------|-----------------------|----------------------|-----------------------|----------------------|
| Constant term | -24.11*** (-13.68) | -12.78*** (-4.63) | -24.41*** (-12.88) | -17.16*** (-4.85) |
| Exporter's income | 0.81*** (15.82) | -0.01 (-0.22) | 0.81*** (14.63) | -0.02 (-0.36) |
| Importer's income | 0.82*** (17.81) | -0.08 (-1.15) | 0.82*** (16.79) | -0.09 (-1.27) |
| Exporter's population | - | 1.22*** (11.04) | - | 1.32*** (11.09) |
| Importer's population | - | 0.62*** (5.24) | - | 0.73*** (5.08) |
| Adjacency dummy | 0.43** (2.3) | 0.36 (0.72) | 0.44** (2.32) | 0.13 (0.27) |
| Island dummy | 0.27* (1.96) | 1.91 (0.58) | 0.28** (1.99) | 3.48 (1.02) |
| Landlocked dummy | -0.36*** (-2.81) | -1.12*** (-2.77) | -0.35** (2.59) | -0.91** (-2.08) |
| CACM dummy | - | - | - | 2.57*** (3.35) |
| NAFTA dummy | - | - | -0.09 (-0.28) | - |
| UE dummy | - | - | 0.02 (0.18) | - |
| Distance | -0.94*** (-12.17) | -1.36*** (-7.22) | -0.94*** (-10.13) | -1.17*** (-6.01) |
| Language dummy | -0.06 (-0.34) | 1.23*** (2.89) | -0.06 (-0.34) | 1.18*** (2.73) |
| Exporter's TAI | 2.39*** (2.88) | 5.37** (2.39) | 2.73*** (2.61) | 4.13* (1.81) |
| Importer's TAI | 1.02 (1.1) | 6.73*** (2.91) | 1.36 (1.25) | 5.48** (2.24) |
| Technological distance (TAI) | - | - | -0.65 (-0.61) | -1.58 (-0.54) |
| Exporter's infrastructure | 0.21*** (3.04) | -1.34 (-0.36) | 0.19*** (2.76) | -2.53 (-0.66) |
| Importer's infrastructure | -0.03 (-0.54) | -1.88 (-0.51) | -0.04 (-0.61) | -3.08 (-0.82) |
| R-squared | 0.886 | 0.694 | 0.886 | 0.708 |
| Adjusted R-squared | 0.878 | 0.668 | 0.876 | 0.678 |
| S.E. of regression | 0.716 | 1.731 | 0.722 | 1.702 |
| Number of observations | 182 | 165 | 182 | 165 |

Notes: ***, **, * indicate significance at 1%, 5%, and 10%, respectively. T-statistics are in brackets. The dependent variable is the natural logarithm of exports in value (current U.S. dollars). Income, population, and distance are also in natural logarithms. The estimation uses White's heteroscedasticity-consistent standard errors. For the richest countries, income and population variables are highly correlated; only income variables are included in the gravity equation for this group of countries.

Model 12: Determinants of trade in developed countries; **Model 13:** Determinants of trade in developing countries; **Model 14:** Determinants of trade in developed countries and estimation of the effect of technological distance on trade (integration dummies are included); **Model 15:** Determinants of trade in developing countries and estimation of the effect of technological distance on trade (integration dummies are included).

countries are more specialised in labour intensive exports, the results indicate that greater availability of cheap labour force in developing countries fosters trade, whereas in developed countries the trend of population growth is stable and almost close to zero (see Filippini and Molini, 2003).

The magnitude of the distance coefficient is lower for developed, -0.72 (-0.97+0.25), than

for developing countries (-0.97). The adjacency dummy coefficient falls 68% (-0.45/0.66) for developed countries, and also the language dummy is reduced 50% (-0.53/1.04) when countries are developed. Therefore, the responsiveness of trade to adjacency falls by about 36% $\{\exp(-0.45)-1\} \times 100\}$ and to language by 41% $\{\exp(-0.53)-1\} \times 100\}$.

Summarizing, results show that trade flows are more sensitive to geographical and cultural variables (adjacency, geographical distance, and language) for developing than for developed economies. Since developing countries face higher transport costs, higher institutional and informal barriers, and more limited access to market information they tend to trade more with neighbouring countries. The result that language links have an impact on international trade has also been found by other authors, such as Guo (2004) who shows that language influences on trade are more significant in China (a developing country) than in the U.S. (a developed country).

The estimated coefficients for technological innovation and transport infrastructure variables are significant and higher in magnitude for developing countries. Moreover, results show that trade flows are more sensitive to technological distance in developing than in developed economies and suggest that technological innovation investments are a good economic policy for developing economies.

FUTURE TRENDS

Future developments for this research are related to the variables included in the model and to the improvement of the estimation methodology.

Concerning the first issue, distance between country capital cities has been used in this chapter as a proxy for transport costs, assuming that $t_{ij} = t_{ji}$. Better transport costs measures could be investigated and included in gravity models instead of distances. Since transport costs tend to be fixed according to the supply and demand conditions applying in the market, the endogeneity of the transport cost variable in the gravity equation could also be investigated.

Concerning the second issue, a further extension of the current research could be not to impose *a priori* by dividing countries into developed and developing economies, but to estimate both the number of “regimes” and their positioning.

Finally, the sample could be extended to more countries and years and a panel data analysis could be undertaken, in order to investigate whether trade is beneficial for all countries in a dynamic environment. Nowadays, information flows, new technologies, regionalisation and globalisation are strengthening the interconnection and dependence among all countries.

CONCLUSION

The recent changes attended in international trade patterns and the growing interest in technological innovation claim for a better understanding of the relationship between both variables.

In this chapter, a gravity equation augmented with technological innovation and transport infrastructure variables is estimated in order to analyse their impact on trade. Geographical (distance, adjacency, being an island, and being landlocked) and social variables (integration agreements among countries and sharing a language) are also considered.

When the 62-country sample is considered, variables included have the expected sign and are significant, excluding some integration variables. Distance has a considerably low explanatory power on trade compared with transport infrastructure and technological innovation. Importers' technology has a lower effect on trade than exporters' technology and a higher technology endowment in the exporter country leads to greater exports. Moreover, results support the hypothesis that countries tend to trade more when they are “closer” from a technological point of view.

In a further step, it is analysed whether technology has any effect on geographical distance in a more globalised and integrated world. The results partially support that the development of technological innovation has lowered the effect of distance on trade, since its development means that long distances are less important nowadays than in the past.

To infer whether there is a differential behavior among countries, the components of the 62-country sample are divided according to their level of economic development. For the high-income countries, the model has a higher explanatory power than for the low-income countries. Geographical factors are always relevant, but geographical distance and being landlocked have higher elasticities for poorer countries than for richer ones. Technological and social factors also seem to be more important for developing economies. Furthermore, technological endowment in each group of countries seems to be more important for trade flows than technological differences among the countries in the same group.

Finally, the pooling assumption has been tested. This chapter shows that the coefficients of the explanatory variables are not the same for all the trading patterns and that the magnitude and sign of the explanatory variables depend on certain characteristics of the trading partners.

A common result is obtained in all regressions. Technological innovation and transport infrastructure can be considered as barriers to trade for those countries with lower endowment levels; thus, investing in these variables could foster international trade and increase the participation of developing economies in a more globalised and integrated world. Results obtained in this chapter advise authorities of developing economies to promote investments in traditional information technologies and human capital, since these variables are a good starting point to improve technological innovation and international competitiveness.

REFERENCES

- Archibugi, D., & Coco, A. (2004). A new indicator of technological capabilities for developed and developing countries (ArCo). *World Development*, 32(4), 629-654.
- Archibugi, D., & Coco, A. (2005). Measuring technological capabilities at the country level: A survey and a menu for choice. *Research Policy*, 34(2), 175-194.
- Biggs, P. (2003). Information and Telecommunication Technology (ICT) development indices (Document: WICT-40E.). Paper presented at the 3rd World Telecommunication/ICT Indicators Meeting. UNCTAD.
- Black, S.E., & Lynch, L.M. (2004). What's driving the new economy? The benefits of workplace innovation. *The Economic Journal*, 114 (493), 97-116.
- Caballero, M., Coca, P., & Escribano, R. (2002). La transferencia de tecnología al tejido empresarial valenciano: Diagnóstico de la situación. *Revista Valenciana de Economía y Hacienda*, 5, 47-63.
- Calvo, J. L. (2002). Innovación tecnológica y convergencia regional. ¿Se amplía o se cierra la brecha tecnológica entre las CCAA españolas? *Economía Industrial*, 347, 33-40.
- Caselli, F., & Coleman, W.J. (2001). Cross-country technology diffusion: The case of computers. *American Economic Review*, 91(2), 328-335.
- Central Intelligence Agency (CIA). (2003). *The world factbook*. Retrieved June 17, 2006, from <http://www.odci.gov/cia/publications/factbook>
- Coe, D.T., Helpman, E., & Hoffmaister, A.W. (1997). North-south R&D spillovers. *The Economic Journal*, 107(440), 134-149.
- Eaton, J., & Kortum, S. (1997). *Technology and bilateral trade (NBER Working Chapter 6253)*. 70(5), 1741-1779.
- European Commission. (2005). *European innovation scoreboard*. Retrieved June 17, 2006, from <http://www.cordis.lu/innovation-smes/scoreboard/home.html>
- Fagerberg, J. (1997). Competitiveness, scale and R&D. In J. Fagerberg, P. Hansson, L. Lundberg

- & A. Melchior (Eds.), *Technology and international trade* (pp. 38-55). Cheltenham, UK: Edward Elgar.
- Filippini, C., & Molini, V. (2003). The determinants of East Asian trade flows: A gravity equation approach. *Journal of Asian Economics*, 14(5), 695-711.
- Freund, C.L., & Weinhold, D. (2004). The effect of the Internet on international trade. *Journal of International Economics*, 62(1), 171-189.
- Furman J.L., & Hayes, R. (2004). Catching up or standing still? National innovative productivity among "follower" countries, 1978-1999. *Research Policy*, 33(9), 1329-1354.
- García Castillejo, A. (2002). El consumo de servicios de telecomunicaciones e Internet por las empresas españolas. *Economía Industrial*, 343, 111-130.
- Garman, G., Petersen, J., & Gilliard, D. (1998, Summer). Economic integration in the Americas: 1975-1992. *Journal of Applied Business Research*, 14(3), 1-12.
- Great circle distances between cities.* (2003). Retrieved June 17, 2006, from <http://www.wcrl.ars.usda.gov/cec/java/lat-long.htm>
- Grupp, H., & Mogege, M.E. (2004). Indicators for national science and technology policy: How robust are composite indicators? *Research Policy*, 33(9), 1373-1384.
- Guo, R. (2004). How culture influences foreign trade: Evidence from the U.S. and China. *The Journal of Socio-Economics*, 33(6), 785-812.
- Gustavsson, P., Hansson, P., & Lundberg, L. (1997). *Technical progress, capital accumulation and changing international competitiveness*. In J. Fagerberg, P. Hansson, L. Lundberg, & A. Melchior (Eds.), *Technology and international trade* (pp. 20-37). Cheltenham, UK: Edward Elgar.
- Helpman, E., & Krugman, P.R. (1996). *Market structure and foreign trade. Increasing returns, imperfect competition, and the international economy*. Cambridge, MA: MIT Press.
- Internet Traffic Report. (ITR). (2004). Retrieved June 17, 2006, from <http://www.internettrafficreport.com/main.htm>
- Keller, W. (2004). International technology diffusion. *Journal of Economic Literature*, 42(3), 752-782.
- Lachenmaier, S., & Woessmann, L. (2004). Does innovation cause exports? Evidence from exogenous innovation impulses and obstacles using German micro data. CESifo Working Paper Series No. 1178. Available at SSRN: <http://ssrn.com/abstract=540982>
- Martínez-Zarzoso, I., & Márquez-Ramos, L. (2005). Does technology foster trade? Empirical evidence for developed and developing countries. *Atlantic Economic Journal*, 33, 55-69.
- Moreno, R., Paci, R., & Usai, S. (2005). Spatial spillovers and innovation activity in European regions. *Environment and Planning A*, 37(10), 1793-1812.
- Sánchez, M.P., López, A., Cervantes, M., & Cañibano, C. (2000). *El capital humano en la nueva sociedad del conocimiento*. VI Premio Círculo de Empresarios. Madrid: Círculo de Empresarios.
- Suárez-Burguet, C., Martínez-Zarzoso, I., & Márquez-Ramos, L. (2005). *The non-linear specification of the gravity model: An empirical application on international trade* (PD-ECO 2005/1). Castellón, Spain: Universitat Jaume I.
- Torstensson, J. (1996). Technical differences and inter-industry trade in the Nordic countries. *Scandinavian Journal of Economics*, 98(1), 93-110.
- United Nations Development Program (UNDP). (2001). *Human development report*. New York: Oxford University Press.

Verspagen, B., & Wakelin, K. (1997). *Technology, employment and trade: Perspectives on European integration*. In J. Fagerberg, P. Hansson, L. Lundberg & A. Melchior (Eds.), *Technology and international trade* (pp. 56-74). Cheltenham, UK: Edward Elgar.

Wakelin, K. (1997). *Trade and innovation. Theory and evidence*. Cheltenham, UK: Edward Elgar.

World Economic Forum (WEF), World Bank, and INSEAD (2004). *The global information technology report 2003-2004: Towards an equitable information society*. New York: Oxford University Press.

World Trade Analyzer (2001). *The International Trade Division of Statistics of Canada*.

Wolff, E. N. (1997). *Productivity growth and shifting comparative advantage on the industry level*. In J. Fagerberg, P. Hansson, L. Lundberg & A. Melchior (Eds.), *Technology and international trade* (1-19). Cheltenham, UK: Edward Elgar.

Wolff, E. N. (2002). The impact of IT investment on income and wealth inequality in the postwar US economy. *Information Economics and Policy*, 14 (2), 233-251.

Wong, W. K. (2004). How good are trade and telephone call traffic in bridging income gaps and TFP gaps? *Journal of International Economics*, 64 (2), 441-463.

World Bank (2001). *World Development Indicators*. Washington.

Australia, 7 routers in Asia, 25 in Europe and fifty in North America. A lower number of routers has an adverse effect on Internet data flows.

² This is carried out in the next section.

³ Results for medium GDP per capita countries are presented in the Table A.3 (Appendix).

⁴ Two trading countries that speak a same language trade a 197% [$\exp(1.09)-1$]*100 more than the rest of country pairs in this group of countries.

⁵ **Developed countries:** Belgium-Luxembourg, United States, Norway, Iceland, Switzerland, Canada, Ireland, Denmark, Austria, Japan, Australia, Netherlands, Germany, Finland, France, Sweden, Italy, United Kingdom, Hong Kong, Singapore, Cyprus, Israel, Spain, Portugal, Republic of Korea, Greece, Czech Republic, Argentina, and Slovak Republic.

Developing countries: South Africa, Uruguay, Costa Rica, Chile, Poland, Mexico, Trinidad and Tobago, Croatia, Brazil, Turkey, Panama, Colombia, Dominican Republic, Bulgaria, Algeria, Peru, Syrian Arab Republic, Paraguay, El Salvador, China, Jamaica, Egypt, Honduras, Nicaragua, India, Ghana, Pakistan, Sudan, Senegal, Nepal, Kenya, Mozambique, and Tanzania.

ENDNOTES

¹ In 2004, this measure only considers three routers in South America. However, 4 routers measure ITR in Australia, there are 13 routers in Asia, 22 in Europe and 58 in North America. In 2006, the ITR considers 6 routers in South America, 7 routers in

APPENDIX

Data, Sources, and Variables

Table A.1 shows a summary of the data used in the analysis. With respect to technological and infrastructure variables, some additional explanations are needed. Values for TAI have been calculated using the same criteria followed by the United Nations Development Program. The classification obtained is slightly different from the Human Development Report classification for 2001 because the arithmetic averages are calculated for Organisation for Economic Cooperation and Development (OECD) member country indicators and then they are used to fill the gaps of missing data for some OECD countries, thus increasing the sample size. Results are able to be summarised in a ranking (see UNDP, 2001; also see Martínez-Zarzoso & Márquez-Ramos, 2005).

Transport infrastructure variables are calculated with data on kilometres of paved roads and kilometres of motorways per square kilometre, taking into account the quality of the roads. Equation (A.1) is used to calculate the index.

$$\text{Infrastructure variable} = \frac{((0.75 \cdot \text{paved roads (km)}) + \text{motorways (km)})}{\text{Land area (km}^2\text{)}} \quad (\text{A.1})$$

The dependent variable is the natural logarithm of exports in value (current U.S. dollars). Income, population, and distance are also in natural logarithms. The estimation uses White's heteroscedasticity-consistent standard errors. For the medium income countries, income and population variables are highly correlated; only income variables are included in the gravity equation for this group of countries.

Figure A.1. Selected countries



Table A.1. Variable descriptions and sources of data

| Variable | Description | Source |
|-------------------------------------|---|--|
| X_{ij} : Exports from i to j | Nominal value of bilateral exports | Statistics Canada (2001) |
| Y_i : Exporter's income | Exporter's GDP, PPP (current international \$) | World Bank (2001) |
| Y_j : Importer's income | Importer's GDP, PPP (current international \$) | World Bank (2001) |
| P_i : Exporter's population | Total population in the exporter's market | World Bank (2001) |
| P_j : Importer's population | Total population in the importer's market | World Bank (2001) |
| Adj_{ij} : Adjacency dummy | Dummy variable = 1 if the trading partners share a border, 0 otherwise | CIA (2003) |
| Isl : Island dummy | Dummy variable = 1 if the country is an island, 0 otherwise | CIA (2003) |
| $Land$: Landlocked dummy | Dummy variable = 1 if the country is landlocked, 0 otherwise | CIA (2003) |
| CACM dummy | Dummy variable = 1 if the trading partners are members of CACM, 0 otherwise | |
| CARICOM dummy | Dummy variable = 1 if the trading partners are members of CARICOM, 0 otherwise | |
| MERCOSUR dummy | Dummy variable = 1 if the trading partners are members of MERCOSUR, 0 otherwise | |
| NAFTA dummy | Dummy variable = 1 if the trading partners are members of NAFTA, 0 otherwise | |
| CAN dummy | Dummy variable = 1 if the trading partners are members of CAN, 0 otherwise | |
| UE dummy | Dummy variable = 1 if the trading partners are members of European Union, 0 otherwise | |
| $Dist_{ij}$: Distance | Great circle distances between country capitals of trading partners (km) | Great circle distances between cities (2003) |
| $Lang_{ij}$: Language dummy | Dummy variable = 1 if the trading partners share the same official language, 0 otherwise. | CIA (2003) |
| TAI_i : Exporter's TAI | Technological variable | UNDP (2001), author's calculations |
| TAI_j : Importer's TAI | Technological variable | UNDP (2001), author's calculations |
| $ArCo_i$: Exporter's ArCo | Technological variable | Archibugi and Coco (2004) |
| $ArCo_j$: Importer's ArCo | Technological variable | Archibugi and Coco (2004) |
| Inf_i : Exporter's infrastructure | Transport infrastructure variable | CIA (2003), authors' calculations |
| Inf_j : Importer's infrastructure | Transport infrastructure variable | CIA (2003), authors' calculations |

Note 1: The first column lists the variables used for empirical analysis, the second column outlines a description of the variables, and the third column shows the data sources.

Note 2: UNDP denotes United Nations Development Program and CIA denotes Central Intelligence Agency.

Table A.2. “Beta coefficients” of the variables included in the augmented gravity model

| | <i>Beta Coefficients in Model 6</i> | <i>Beta Coefficients in Model 7</i> |
|---------------------------|-------------------------------------|-------------------------------------|
| Exporter’s income | 0.0183443 | 0.016847 |
| Importer’s income | 0.0385702 | 0.037293 |
| Exporter’s population | 0.4261248 | 0.4307026 |
| Importer’s population | 0.3156517 | 0.3216922 |
| Adjacency dummy | 0.0245367 | 0.0180214 |
| Island dummy | -0.0533542 | -0.054391 |
| Landlocked dummy | -0.0967349 | -0.0929241 |
| CACM dummy | 0.0370647 | 0.0379439 |
| CARICOM dummy | 0.0333055 | 0.0323905 |
| MERCOSUR dummy | 0.0489882 | 0.0473729 |
| NAFTA dummy | 0.0095025 | 0.0111667 |
| CAN dummy | 0.0094735 | 0.0081441 |
| UE dummy | -0.0172897 | -0.0255349 |
| Distance | -0.2706165 | -0.2572081 |
| Language dummy | 0.1000771 | 0.0942539 |
| Exporter’s TAI | 0.5036714 | 0.5065245 |
| Importer’s TAI | 0.359052 | 0.3571144 |
| Technological distance | - | -0.0817619 |
| Exporter’s infrastructure | 0.1562054 | 0.1565873 |
| Importer’s infrastructure | 0.1290454 | 0.1297312 |

Table A.3. Determinants of international trade; estimation results for medium income countries

| Variable | (1) | (2) |
|------------------------------|-----------------------|-----------------------|
| Constant term | -30.36*** (-18.06) | -30.18*** (-17.83) |
| Exporter's income | 0.97*** (24.13) | 0.97*** (23.98) |
| Importer's income | 0.77*** (18.79) | 0.77*** (18.73) |
| Adjacency dummy | 0.99*** (4.34) | 0.78*** (3.92) |
| Island dummy | -1.12*** (-6.47) | -1.15*** (-6.44) |
| Landlocked dummy | -0.94*** (-6.78) | -0.96*** (-6.68) |
| MERC dummy | - | 1.07** (1.96) |
| UE dummy | - | -0.2 (-1.42) |
| Distance | -0.88*** (-15.05) | -0.91*** (-14.15) |
| Language dummy | 1.1*** (7.93) | 1.09*** (7.81) |
| Exporter's TAI | 5*** (11.47) | 4.95*** (10.32) |
| Importer's TAI | 2.18*** (3.95) | 2.15*** (3.81) |
| Technological distance (TAI) | - | 0.39 (0.76) |
| Exporter's infrastructure | 0.75*** (9.53) | 0.77*** (9.4) |
| Importer's infrastructure | 0.52*** (7.16) | 0.54*** (7.22) |
| R-squared | 0.781 | 0.782 |
| Adjusted R-squared | 0.777 | 0.777 |
| S.E. of regression | 1.335 | 1.334 |
| Number of observations | 736 | 736 |

Notes: ***, **, * indicate significance at 1%, 5% and 10%, respectively. T-statistics are in brackets.

Column (1): Determinants of trade in medium income countries; Column (2): Determinants of trade in medium income countries and estimation of the effect of technological distance on trade (integration dummies are included). The dependent variable is the natural logarithm of exports in value (current U.S. \$\$). Income, population and distance are also in natural logarithms. The estimation used White's heteroscedasticity-consistent standard errors. For the medium-income countries, income and population variables are highly correlated, then only income variables are included in the gravity equation for this group of countries.

This work was previously published in *Information and Communication Technologies for Economic and Regional Developments*, edited by H. Rahman, pp. 79-101, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.21

ICT and Business in the New Economy: Globalization and Attitudes Towards E-Commerce

John Sagi

George Washington University, USA

Elias Carayannis

George Washington University, USA

Subhashish Dasgupta

George Washington University, USA

Gary Thomas

Anne Arundel Community College, USA

ABSTRACT

Many authors argue that information and communications technology (ICT) in this New Economy is causing a globalized, unified society. Others take the opposite stand, viewing local factors such as national culture as very important to the success of information technology (IT). Research indicates that related factors such as gender may also play important roles in the use and accep-

tance of IT. This paper uniquely examines these perspectives by using electronic commerce as the common technology. Business students from the U.S., Greece and England expressed opinions on the important issues of national control, privacy cost, property rights and consumer preferences. The authors find evidence that concludes that there are statistically significant differences in attitude about e-commerce among cultural groups, but not with gender.

INTRODUCTION

In this age of information, researchers postulate that information technology (IT) is providing a new medium to finally unite society. According to the futurist Francis Fukuyama (1992), the end of the Cold War signals a shift towards a “normative integration of principles and institutions”. Todd (1986) states that technology provides ever-narrowing approaches to social problems, and these approaches are reducing social options. He notes that an “unnatural” selection process caused by technology results in a loss of diversity in human society. Volti (1992) discusses a “convergence theory” where opportunities and demands presented by modern technology promote the convergence of all societies towards a single set of social patterns and individual behaviors, due in part to the requirements of technology for a common set of development and implementation steps, and for common organization constraints. Rosabeth Moss Kanter (1995), in her classic *World Class*, predicts that internationalism will prevail over “nativism”. That is, for future corporate profitability, the boundaries of national identity must be subsumed to the need for quality products and global goodwill.

Greider (1997) writes of *One World, Ready or Not*, with mobile phones as the “universal artifact of the revolution”. He predicts that there will be four major competitive factors: labor, national governments, multinational corporations and financial investors. Hope and Hope (1997) discuss the “third wave” leading to more homogeneous global marketing patterns. Cairncross (1997) observes that time zones and language groups will soon define distance, rather than mileage. She further notes that the credit card is the certain symbol of a unified world currency. Kevin Kelly (1998), editor of *Wired* magazine, in his *New Rules for the New Economy*, writes that technology has “been able to infiltrate into our lives to the degree it has become more like us...Technology has become our culture” (p. 33).

On the other hand, however, some argue that a globalization of society has not, and perhaps will not occur. Ferkiss, in *Technological Man* (1969), claims that the existence of technology change presupposes cultural acceptance, and that a single culture, “embracing both the famine-stricken world and the well-fed nations is obviously impossible...cultural variation is likely to be the rule” (p. 171). Volti (1992) observes that technologies developed and implemented in one culture or society may fail when taken to a different setting. Nelson and Clark (1994) note that European firms commonly develop differing computer systems for different nations. Hamel and Prahalad (1994), in their classic *Competing for the Future*, warn firms to address and work with global differences; that global markets emerge at differing speeds; and that global differences will continue to be a challenge. Doremus et al. (1998) note that corporate governance is closely linked to national culture, and boldly claim that the global corporation is a myth. Fine (1998) cautions managers to be more sensitive to the effects of national business mores, values, standards, laws and cultures. Bowers (2000) claims that the most dominant characteristic of computers is their culturally mediating and transforming effect, but that computers are viewed as a destructive form of Western colonization. “Members of other cultures are aware that when they use computers, they must adapt themselves to radically different patterns of thought and deep culturally-bound ways of knowing” (p. 22).

Castells (2001) observes that “core economic, social, political and cultural activities throughout the planet are being structured by and around the Internet...(yet) its logic, its landscape and its constraints are not well understood beyond the realm of strictly technological matters” (p.3). He further writes of a large digital divide within a globalized Internet between developed and developing nations; and of a resulting number of challenges, including ownership and control of data, and the exclusion of groups by virtue of edu-

cation, technology, and national culture. Albrow (2000) discusses several facets of globalization, including values related to daily behavior of many groups (also called “globalism”), universally available information and commodities (“globality”), communications technologies used to maintain relationships (“time-space compression”), and worldwide institutional arrangements permitting personal mobility and local lifestyles (“disembedding”) (p. 199). This research was concerned with personal values, information and technologies, using globalization under those contexts.

The late Michael Dertouzos (1997) predicted that the “homogenizing forces” of information technologies can “only go so far, because of the overwhelming power of ethnicity... Most likely, the Information Marketplace will superimpose a cultural veneer of shared experiences on top of the individual cultures of the world” (p. 283). Berger and Huntington (2002) write about differing and separate globalization processes. “The emerging global culture is defined through both elite and popular vehicles,” including a business-oriented “Davos culture” and an academic-oriented “faculty club culture”.

Further, globalization encompasses ideologies other than culture, such as environmentalism and feminism. The International Telecommunications Union (ITU) identified gender differences as important to global technology policies. In a recent paper, they observe that technology is not gender neutral, and that there is a statistically significant correlation between the gender of Web users and the global UN Development Program (UNDP) Technology Achievement Index (Hafkin, 2003). Several Internet statistical monitors also claim that the number of female Internet users in the U.S. now equal males.

Thus there are conflicting theories about globalization, with issues often embracing a broader group of ideologies than national culture. The purpose of this research is to investigate and understand the extent of globalization by studying attitudes about electronic commerce. It will show

whether the world is truly coming together as prophesized by Fukuyama, Volti, Greider, Kelly and others. It will also identify certain global differences about e-commerce, in spite of the common technology. Also, given the recent increases in female Internet users, this research investigates the effects of gender on these attitudes.

LITERATURE REVIEW

E-commerce relies heavily upon information and communications technology (ICT). The Internet, and specifically the World Wide Web, is being used by businesses worldwide to manage day-to-day transactions and as an integral part of their marketing strategy. E-commerce, as a global transaction system, must fall under the same multi-cultural scrutiny and research as previous ICT projects. The success of e-commerce across national borders is a function of several variables, including the national economy, national literacy, national culture, telecommunications availability, and Internet technology penetration and acceptance (Tillquist, 1997; Pitkow and Kehoe, 1996). Still, little research has been conducted that examines the extent of globalization on Web usage and the associated social implications.

From a comparative analysis of cross-cultural studies, Ein-Dor et al. (1993) observe that economic, demographic and socio-psychological factors affect information systems. They integrate these into a framework of research and write that “perhaps the most important immediate finding to emerge is...that cultural differences have greater impact on the technical and procedural aspects of IS.” Deans and Ricks (1993) provide an agenda for research linking IS and International Business. They write that, from an IB perspective, the role of IS “may be viewed as a facilitator of information flows across national borders”, and that IB offers “theoretical underpinnings that may be relevant for international IS research.”

National Culture

Straub (1994) studies the globalization of IT using email and fax in the U.S. and Japan. He concludes that while U.S. companies exploit the advantages of IT, the Japanese do not, and that a strong sense of uncertainty avoidance and the use of complex language symbols make the fax a more useful tool in the Japanese culture. Straub et al. (1997) test the Technology Acceptance Model (TAM) on email use with airline employees in Japan, Switzerland and the US. They find that the cultural works of Geert Hofstede (1983, 1997) are not strong predictors of technology use across all cultures. They write that cultural differences alone may not explain differing results. In Japan cultural tendencies towards uncertainty avoidance (UAI), greater power distance (PDI) and collectivist sentiments may limit email use and disassociate the TAM concept of perceived usefulness (PU) from actual technology use. Hasan and Ditsa (1999) interviewed managers in Australia, West Africa and the Middle East to study the impact of culture on the global adoption of IT. They question the belief that technology is culturally neutral, and also use Hofstede (1997) to explain differences in attitudes. They confirm that many aspects of IT are not culturally neutral and conclude that IT products should “accommodate the cultural, economic, social and other characteristics of a particular group.” Markus and Soh (2002), in studying the structural influences on global e-commerce activity, find that cultural differences alone do not provide a satisfactory explanation. Research by McLeod et al. (1997), Rose and Straub (1998), Dasgupta et al. (1999), Al-Khaldi and Wallace (1999), Cheung and Lee (2001) and Carayannis and Sagi (2001) also find differences across the nations in IT use and attitudes.

Gender

Several of the aforementioned studies note that cultural differences do not provide sufficient

explanation for differences in attitudes and use of IT. One of these other factors is gender. Harris and Davison (1999) research global anxiety and technology involvement, and their influence upon attitudes towards computers in developing societies. Using computer students in China, Hong Kong, Malaysia, New Zealand, Tanzania and Thailand, they find that many differences are attributable to gender and computer experience. Hoxmeier et al. (2000) study the impact of culture, gender and other variables on user confidence in email. They report gender differences that “appear to diminish through technical education and experience.” In a study of national level culture and global Internet diffusion, Maitland and Bauer (2001) write that economic factors were strong predictors of IT adoption, that cultural variables are slightly less powerful predictors and that gender plays a significant role. Simon (2001) studies Web site perceptions, and finds that there are both cultural and gender factors involved. Zhang et al. (2002) study the characteristics of Internet users and privacy concerns, surveying U.S. undergraduate students and Chinese graduate students, university professors and managerial professionals. They observe that female respondents are “more concerned with the Internal Unauthorized Use of personal information and the possible misuse of credit card information than male respondents.”

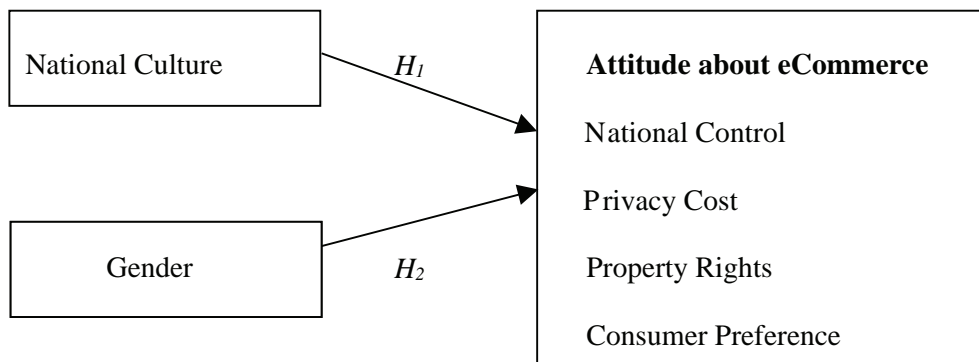
RESEARCH MODEL AND HYPOTHESES

From the literature it is clear that there are aspects of e-commerce which can be explored to understand globalization. Straub et al. (1994, 1997), Hasan and Ditsa (1999), Markus & Soh (2002) and others find cultural differences in IT use. Harris and Davison (1999), Hoxmeier et al. (2000), Maitland & Bauer (2001), Simon (2001) and Zhang et al. (2002) also report gender differences in cross-cultural studies. Thus, this study chose cultural groups and gender, and their influence

Table 1. Research hypotheses

| |
|---|
| <p>H1: Cultural groups will differ significantly in attitudes about eCommerce. H1A: Cultural groups will differ significantly about attitudes towards National Control of data. H1B: Cultural groups will differ significantly about attitudes towards Privacy Cost. H1C: Cultural groups will differ significantly about attitudes towards Property Rights. H1D: Cultural groups will differ significantly about attitudes towards Consumer Preferences. H2: Genders will differ significantly in attitudes about eCommerce. H2A: Genders will differ significantly about attitudes towards National Control of data. H2B: Genders will differ significantly about attitudes towards Privacy Cost. H2C: Genders will differ significantly about attitudes towards Property Rights. H2D: Genders will differ significantly about attitudes towards Consumer Preferences.</p> |
|---|

Figure 1. Research model



upon attitudes about a globalized e-commerce, with the following research questions:

1. What aspects of e-commerce may be influenced by national culture?
2. What aspects of e-commerce may be influenced by gender?

The independent variables were national culture and gender, while the dependent variables were attitudes about e-commerce. These are shown in Figure 1.

To test the extent of globalization based upon differences in attitude among the independent variables of culture and gender, given the previously discussed research, several hypotheses were created. These hypotheses were developed from

issues about electronic commerce described in Turban et al. (2000). These issues include national control of data across borders, the individual cost of privacy, property rights and consumer preferences.

RESEARCH METHODOLOGY

Instrument Creation, Validity and Reliability

This research developed an instrument that measured the attitudes about e-commerce. Students were chosen as a convenience sample, and they provide a uniform group of educated samples, with common technology access and education representing the future leadership in technology

(Harris and Davison, 1999). Zmud and Boynton (1991) state that Likert-scale self-reporting questionnaires are very important to information systems research. The design of this research was a cross-sectional study to probe attitudes about major issues of e-commerce. The questions were opinion questions asking the subjects what they think about an event. Opinions are the verbal expressions of attitude (O'Sullivan and Rassel, 1999). This study built upon previously unpublished research conducted in October 2000 at Anne Arundel Community College (AACC), Arnold, Maryland (Sagi, 2000). In that study, business students in an electronic commerce course identified major issues and developed a list of 43 Likert-scale questions related to these issues. The students were directed to develop questions on both the

national and macro-economic levels, as well as including personal issues such as Napster and commercial trust. Demographic and behavioral questions about age, gender, prior Web purchases and number of hours online were added to the instrument. The researchers and several faculty edited the questions for content validity.

Validity was further improved by a literature scan for similar questions, techniques and issues. The research of Doll and Torkzadeh (1988) was helpful in understanding the measurement of end user attitude. The works of Harris and Davison (1999) and Hoxmeier et al. (2000) were used as excellent examples of the cross-cultural survey instrument development and use, and of Analysis of Variance (ANOVA) methodology. The revised questions were then given to a pilot group of busi-

Table 2. Factor analysis

Rotated Component Matrix^{a,b,c}

| | Component | | | | | | |
|-------------------|-----------|-------|-------|-------|-------|-------|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| national control | .861 | | | | | | |
| control | .771 | | -.368 | .310 | | | .316 |
| give up privacy | .768 | | | | | | -.383 |
| privacy cost | .684 | -.626 | | | | | |
| own name | | .891 | | | | | -.280 |
| pay for less ads | | .864 | | | | | |
| more connected | | | .888 | .245 | | -.311 | |
| right to resell | .354 | .276 | .769 | | | | .208 |
| copy ok | -.213 | | .745 | | -.255 | .217 | -.415 |
| good friends | | | | .844 | | | -.333 |
| reliable web info | .215 | -.226 | | .769 | | | |
| subsidized access | | .328 | | | .809 | .270 | |
| domain names | | | .248 | .501 | .713 | | |
| licensed sites | .534 | -.330 | | | .617 | .233 | |
| private email | | .476 | .312 | -.464 | .477 | | -.252 |
| new privacy laws | | | | | | .952 | |
| access rights | .319 | | | .350 | | .808 | |
| buy from store | | -.247 | | | | | .859 |
| return problems | -.443 | .254 | | -.255 | | | .587 |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 14 iterations.

b. Only cases for which class = Pilot are used in the analysis phase.

c. class = Pilot

ness students (N=17). Cronbach's alpha was an acceptable .7281 for this pilot group. According to Harris and Davison (1999), who develop a similar instrument, an alpha above .7 is satisfactory. Factor analysis was used to reduce the questions to express one or more concepts. All of the variables (43 questions) were originally considered, and a correlation matrix constructed. Several stronger correlations appeared to express similar attitudes about similar issues. These correlations were rotated using Varimax rotation. According to George and Mallery (1999), the process is highly subjective. The results are shown in Table 2.

Component 1 (Eigenvalue = 21.6) represents two e-commerce issues, national control and privacy. Hofstede's (1983, 1997) research identifies both of these with the index Individualism (IDV). However, these are differing and unique aspects of e-commerce. Thus in this study Component 1 represents two variables, National Control (national control, control) and Privacy Cost (give up privacy, privacy cost). Component 3 (Eigenvalue = 14.6) also contains two questions and represents the construct Property Rights (right to resell, copy ok). Finally, Component 7 (Eigenvalue = 5.8) factors two questions that were chosen to form the construct Consumer Preferences (buy from store, return problems).

It is not unusual in information technology research to rely upon two questions as the basis for operationalizing a research construct. For example, in their seminal work on studying the measurement of end-user computer satisfaction and a model for this current study, Doll and Torkzadeh (1988) rely upon two questions in an 18-item instrument to operationalize one of their major study factors. Lederer et al. (2000) use two questions for the construct Information Focus, and Jiang et al. (2000) have two questions comprising the construct Internet Experience. The results of the factor analysis provided the constructs and their associated instrument questions as shown in Table 3.

Dependent Variables

According to Shields (1996): "The Internet raises challenging policy issues of access, privacy, copyright and regulation. It poses cultural problems as information is made available regardless of social and cultural boundaries" (p. 1). Cairncross (1997) observes that national attitudes "differ enormously, reflecting the extent to which citizens in different countries trust their governments and private industries" (p. 196). She also asserts that the "culture and not just the language of the

Table 3. Research constructs

| |
|---|
| <p>National Control NC1. The government should control the Web to better protect the consumer from fraud. NC2. A nation should be able to control the Web content that crosses its borders.</p> <p>Privacy Cost PC1. I'll gladly give up some privacy information for cheaper prices on the Web. PC2. Loss of privacy is a cost of new technology benefits.</p> <p>Property Rights PR1. Web sites should have the right to resell <i>any</i> user information that is freely given PR2. It is ok to save a copy of anything on the Web.</p> <p>Consumer Preferences CP1. I surf the Web for product information, but I usually prefer to buy from a store. CP2. Returning a purchase is still a problem on the Web.</p> |
|---|

Internet is also strikingly American. Its quirky blend of technocratic individualism, egalitarianism and passionate resistance to government control all seem to many foreigners quintessentially American” (p. 95). For example, the U.S. government provides a *Framework for Global Electronic Commerce* which says that the private sector should lead and governments should avoid “undue restrictions.”

National Control and Privacy Cost

Hofstede (1997) sees national control of data and the concept of personal privacy as culturally similar under a national index “Individualism” (IDV). He postulates that IDV influences control and the acceptance of government influence, and has an impact upon attitudes about privacy and individual rights. Tavani and Moor (2001), however, distinguish between these concepts. They define privacy in terms of protection from intrusion and information gathering, and control in terms of framing policies that provide privacy protection. They postulate that privacy is best defined in terms of restricted access, and is fundamentally about protection from intrusion and information gathering by others. Control, on the other hand, plays a critical role in the management of privacy and should be understood under that framework. They observe that “virtually all societies establish normative private situations...the details of these... vary somewhat from culture to culture.” Further, they recommend that e-commerce should be designated as an international “zone of privacy”, as per the intent of the European Union’s directive on privacy discussed previously. Thus this study separates these concepts.

Rose (2001) writes that the Internet is at a “crossroads” between the ability to collect and relate personal data, and the potential for misuse. Citing research, he also notes a common hesitancy for consumers to provide personal data, the common practice of providing erroneous data and marketing’s increasing desire to utilize

the potential for data analysis provided by new technology. He notes several common definitions of privacy: “The right to be left alone”, “the right to control...”, “the degree of access others have to us”, “freedom from the judgment of others”, and “a means for creating social context in relationships with others”. Rose concludes that consumer confidence must be established and maintained to get any value from the data obtained and manipulated by technology. National government may play a role in this.

Etzioni (1999) identifies a “privacy paradox”. He observes that privacy is often preferred, in the US, over the common good, and national government is often perceived or characterized as the victimizer. Yet, according to Etzioni, the threats to privacy are more often from the commercial private sector. “When privacy is threatened by the private sector in our culture, policies and doctrines provide a surprisingly weak defense” (p. 10). The solution, he offers, is a greater focus on the corresponding social responsibility and commitment to the common good that was, according to Etzioni, lost after 1965.

Kizza (1998) writes, “Individuals are forced to give up some of their rights in order to protect individual privacy”. He discusses the problems with the private sector, and with data collection; similar to the issues raised by Etzioni (1999). According to Kizza, nations enact laws to protect from the loss of privacy, and that the Internet has heightened the awareness of the potential privacy loss due to technology. He notes that privacy can be protected by information control, property control and the use of anonymity of addresses in Internet communications.

Ferkiss (1969), in his early work defining the *Technological Man*, observes that privacy will present a future problem, based upon both the potential for a large increase in population and the possibility for absolute surveillance. “Spheres of privacy” may be defined, but the threat of absolute surveillance may be prohibitably costly when compared with the benefits. Volti (1992) writes

that technology often leads to a “restructuring of power relations, the redistribution of wealth and income, and an alteration of human relationships” (p. 18). Kelly (1998) notes that society clearly has a need for anonymity and privacy in communications. He then offers some direction in his seminal *New Rules for the New Economy*: “One of the chief chores in the network economy is to restore the symmetry of knowledge.” He discusses this idea by formulating privacy as a type of conversation between two trusted parties. “Firms should view privacy not as some inconvenient obsession of customers... but more as a way to cultivate a genuine relationship” (p. 134). However, questions remain over the role of governments in the national control of data and the price users are willing to pay.

Property Rights

The right of a website to sell information and of a user to freely copy data from the web are prominent issues in e-commerce and the topic of national legislation. Recent intellectual property rights (IPR) law applying to e-commerce includes the international *Trade-Related Aspects of Intellectual Property* (TRIPS) agreement, ratified in 1994 by over one hundred nations. TRIPS provides international IP standards, and specifically provides copyright protection for computer programs as intellectual creations. The US *Anticyber-squatting Consumer Reform Act* (ACRA) of 1999 makes it illegal for a person to “register, traffic in, or use” domain names under certain conditions of “bad faith intent”. The *Digital Millennium Copyright Act* (DMCA) of 1998 restricts the circumvention of encryption software and absolves the Internet Service Provider (ISP) of liability for certain copyright infringement violations by its users. Disputes are resolved by the *Uniform Dispute Resolution Policy* (UDRP) of the *Internet Corporation for Assigned Names and Numbers* (ICANN) and the United Nations’ *World Intellectual Property Organization Arbitration and Mediation Center* (WIPO).

Consumer Preferences

The propensity to prefer the store as the purchase location instead of the Internet and the expectation that those Internet purchases are subject to issues with returns are also common issues in e-commerce. Cairncross (1997) addresses the drivers of the Internet and the resulting new business models, and elaborates about the increased confidence required for consumers to embrace this technology. “The overall low percentage (of Internet sales to total commerce) suggests that the vast majority of customers are perfectly happy to buy at real-world stores” (p. 130). Trust and confidence with this new technology may be factors, as well as differences in consumer location and in buying habits among nations. Rural consumers or consumers in nations where face-to-face agreements are considered important, such as the Middle East, may cause consumers to prefer stores over the Internet. Further, rural customers may not be able to return items purchases on the Web to a store as easily as the urban customer. The impact of culture and other sociologic factors on these consumer attitudes is not understood.

Population Sampling

The respondents were 195 business students at colleges in the U.S., Greece and England. Business students were particularly good subjects because of their homogeneity of education, familiarity with the Internet and e-commerce topics, their availability for study, and their potential for future leadership in the Internet and e-commerce. Students were used as subjects in many similar studies referenced in this paper, including Stylianou et al. (2003), Simon (2001), Jiang et al. (2000), Hoxmeier et al. (2000) and Harris and Davison (1999). The institutions were chosen based upon previous relationships between the researchers and the schools, and compare as shown in Table 4.

Table 4. School profiles

| | | | |
|----------------------------|---------------------------------------|---|-------------------|
| School | Anne Arundel Community College (AACC) | Athens Laboratory of Business Administration (ALBA) | Southwark College |
| Location | Arnold, Maryland, USA | Athens, Greece | London, England |
| Class | Undergraduate | Graduate | Undergraduate |
| Business Enrollment | 1000 | 200 | 500 |

AACC serves the Maryland county of Anne Arundel, on the western shore of the Chesapeake Bay. Total enrollment exceeds 13,000 students, with over 7,000 full time equivalent students (FTE). The School of Business, Computing and Technical Studies prepares students to enter the job market with expert skills and training. Hands-on courses provide experience and realistic simulations of the work environment. Transfer options prepare students for entry into four-year institutions. AACC offers Associate degrees in Business, Accounting, and Law, among others. Business students have access to over 160 PCs in eight classroom-laboratories. PC instruction is mandatory for all students.

ALBA was founded in 1992, through a joint initiative of the Federation of Greek Industries, the leading Employers' Union in Greece, and the Hellenic Management Association. ALBA was originally funded by the European Commission and local Athens contributions. ALBA offers MBA and law degrees. The computer network consists of approximately 100 PCs configured with the latest software versions. More than half of the PCs are available to the students at study rooms, the Computer Laboratory and the Library, as well as in the classrooms and amphitheatres, to be used during lectures and case study/projects presentations. Students have free 24-hour access to the Internet. ALBA is located in the suburb of Vouliagmeni, about 25 kilometers southeast from the center of Athens.

Southwark College is in a suburb on the South Bank of the Thames, opposite London. Southwark is a working-class neighborhood. The college's 3,000 FTE and 7,000 part-time students use the college's three campuses, all within the immediate area of the South Bank. Southwark maintains close relations with and often serves as a feeder school for several nearby universities, including the University of London. Students have access to a large research facility containing about 100 new Internet-able PCs and current software. There are also several computer technology labs. Most students have PCs at home and rely on the school facilities primarily for class-related activities. The descriptives for the samples are shown in Table 5.

Analysis

Multivariate Analysis of Variance (MANOVA) was used to test the hypotheses since there was more than one dependent variable (survey questions) under study. MANOVA tests are interpreted by examining the significance level of the F-ratio, which is the comparison of the "Between-groups Means Square" and the "Within-groups Mean Square". As the means of the treatment groups (cultural groups and gender) become similar, the F-ratio approaches 1. The significance is based upon the distribution and the degrees of freedom. Significance is interpreted as the chance of making a Type I error. For this research, the acceptable

Table 5. Sample descriptive statistics

| Item | US | | UK | | GR | |
|--------------------------|---------------|---------|---------------|---------|----------|---------|
| | Count | Percent | Count | Percent | Count | Percent |
| Male | 44 | 59% | 46 | 54% | 23 | 66% |
| Female | 31 | 41% | 39 | 46% | 12 | 34% |
| Totals | 75 | 100% | 85 | 100% | 35 | 100% |
| Education | Undergraduate | | Undergraduate | | Graduate | |
| Age < 20 | 34 | 45% | 69 | 81% | 0 | 0% |
| 20-25 | 18 | 24% | 8 | 10% | 6 | 17% |
| 26-30 | 10 | 13% | 2 | 2% | 16 | 46% |
| 31-40 | 11 | 15% | 4 | 5% | 9 | 26% |
| > 40 | 2 | 3% | 2 | 2% | 4 | 11% |
| Online Hours / wk | | | | | | |
| < 3 | 23 | 31% | 31 | 36% | 5 | 14% |
| 4-10 | 20 | 27% | 33 | 39% | 13 | 37% |
| 11-20 | 17 | 23% | 16 | 19% | 8 | 23% |
| 20-30 | 8 | 11% | 4 | 5% | 6 | 17% |
| > 30 | 7 | 8% | 1 | 1% | 3 | 9% |

significance for assuming a difference in treatment groups was $< .05$.

RESULTS

Note from Table 6 that the significance .012 was $< .05$ for hypothesis H1. The null hypothesis, that the means of the treatment groups are similar, could be rejected, and the hypothesis that there are culture differences in attitude could be supported. However the significance .102 of H2 led to the conclusion that there were no statistically significant differences in gender attitude.

From Table 7 it was noteworthy that national culture was not an influence on the constructs of Privacy Cost and Consumer Preferences. ANOVA generates a significance value indicating whether there are differences among the treatments. This does not indicate, however, what the differences are when the number of treatment groups exceeds 2. To identify the differing treatments in this situation, this research uses Scheffe's Bivariate

Comparison test. There were differences among cultural groups in several constructs. UK ($\mu=4.04$) and GR ($\mu=3.88$) students were more likely to agree with National Control of the Web than their US ($\mu=3.15$) counterparts.

All respondents in this study generally disagreed with giving up privacy as a cost of technology ($\mu=2.31$). Both US ($\mu=1.99$) and GR ($\mu=1.88$) students disagreed with the idea that Web sites should have the right to resell any user information. UK ($\mu=2.58$) students, on the other hand, also disagreed but were less sure about that construct. Cultural groups generally concurred with the construct of Consumer Preferences ($\mu=3.92$), preferring to buy from a store and expecting problems with their purchases.

From Table 8, the general agreement between genders is interesting. Genders were close to disagreement about Privacy Cost (sig. = .052) as females ($\mu=2.11$) tended to disagree more than males about giving up privacy as a cost of technology.

Table 6. MANOVA analysis

Test: If the F ratio > 1 and its significance level at the degrees of freedom for the two mean squares is < .05, the null hypothesis, that the means are the same, can be rejected.

| Hypothesis | Source of Variance | Sum of Squares | df | Mean Square | F | Sig. | Result |
|---|--------------------|----------------|-------|-------------|---------|------|----------------|
| H1: Cultural groups will differ significantly in attitudes about eCommerce. | Between groups. | 87.47 7 | 2 | 43.739 | 4.547 . | 012* | Supported. |
| | Within groups. | 1741. 242 | 181 9 | .620 | | | |
| H2: Genders will differ significantly in attitudes about eCommerce. | Between groups. | 22.90 7 | 1 | 22.907 | 2.309 . | 102 | Not Supported. |
| | Within groups. | 1805. 811 | 182 9 | .922 | | | |

* - Indicates statistical significance.

Table 7. ANOVA for cultural groups

| Test: If the F ratio > 1 and its significance level at the degrees of freedom for the two mean squares is < .05, the null hypothesis, that the means are the same, can be rejected. | | | | |
|---|---------|--------------|---|----------------|
| Hypothesis F | | Significance | Differences | Result |
| H1A: National Control | 9.622 . | 000* U | K (4.04) > US (3.15)* GR (3.88) > US (3.15)* | Supported. |
| H1B: Privacy Cost | 2.470 . | 087 | | Not Supported. |
| H1C: Property Rights | 6.656 . | 002* U | K (2.58) > GR (1.88)* UK (2.58) > US (1.99)* | Supported. |
| H1D: Consumer Preferences | 1.441 . | 239 | | Not Supported. |

DISCUSSION

Certainly the world is not in common agreement about e-commerce. Ferkiss, Clark, Hamel, Prahalad, Dertouzos and others expected cultural groups to differ. It is particularly interesting that this research found differences in National Control, given the previously discussed cultural work of Hofstede (1983, 1997), and no differences in

Consumer Preference, given the variety of business models and distribution channels among the nations. Areas of agreement and difference were anticipated by Mittleman (2000), who writes: "...The architecture of globalization is too high to perceive as a whole, but if one moves to a finer scale—more discreet issues - the structures become discernable" (p.13).

On differences in National Control, Castells (2001) discusses Singapore as an example of a government proactive in Internet control. “Attempting to steer a narrow path between (embracing technological modernization and maintaining a sophisticated authoritarian regime), the government of Singapore has tried to expand the use of the Internet among its citizens, while retaining political control over this by censoring Internet service providers” (p.164). Further, the nations of the European Union are developing the “Directive of Distance Selling”, a mandate of standards for Websites to protect the consumer from fraud. Sheff (2002) discusses the emergence of China as an economic power but also as an unpredictable government having the dual role of both expanding the Internet while attempting to regulate and censor it. Zhang et al. (2002) also discuss Chinese research subjects, and report that respondents are more likely to support an increased government involvement for greater privacy protection.

On the common attitudes towards Privacy Cost, this may be important to e-commerce site developers and certainly refutes the common idea that “privacy is dead”. Castells (2001) also writes “Most people waive their rights to privacy in order to be able to use the Internet” (p.174). Clearly any waiving of rights is not done consciously. Zhang et al. (2002) report that among

their Chinese respondents, those with online shopping experience were more likely to trade their personal information for free merchandise and for targeted advertisements. The US and GR strong common disagreement with selling Web information is interesting, and is another message to developers about the nature of e-commerce expected by those nations. That all three cultural groups concurred with Consumer Preferences is also interesting given the diverse business models and different commercial distribution channels present in each nation.

On gender, we hypothesize that the level of education reported by the respondents may be related to this lack of difference. The subjects here were all college students. Other possible factors may include age and technology access, which are areas for further research. Hoxmeier et al. (2000) report that, although gender plays a role in confidence in technology use, the role of gender greatly diminishes with education and with experience. The non-statistically significant differences in attitudes about Privacy Cost are similar to the findings of Zhang et al. (2002). They report that their female respondents were more concerned with unauthorized use of personal information by Web sites than were males. These findings also correlated with recent studies by British Telecom (BT PLC). While over half of

Table 8. ANOVA for gender

| <i>Test: If the F ratio > 1 and its significance level at the degrees of freedom for the two mean squares is < .05, the null hypothesis, that the means are the same, can be rejected.</i> | | | | |
|--|----------|---------------------|--------------------|----------------|
| Hypothesis | F | Significance | Differences | Result |
| <i>H2A: National Control</i> | 2.457 | .119 | | Not Supported. |
| <i>H2B: Privacy Cost</i> | 3.822 | .052 | | Not Supported. |
| <i>H2C: Property Rights</i> | 1.030 | .312 | | Not Supported. |
| <i>H2D: Consumer Preferences</i> | 2.691 | .103 | | Not Supported. |

* Indicates statistically significant at $p < 0.05$

UK males purchase some form of content online, only one fourth of females were willing to pay for content (*Internet Works*, Autumn, 2002, p. 13). Simon (2001) reports that gender may also have different influences in different nations. Stewart et al. (2001) find gender differences in the use of Internet communications. Further, Htun (2000) observes that, while culture is an essential concept, it does not alone explain gender issues.

Limitations

Markus and Soh (2002) discuss structural influences on global e-commerce, including financial (electronic payment systems, credit financing), legal and regulatory (consumer protection, taxes), national policies about promoting or regulating the Internet usage and e-commerce, space and logistics (home size, distance to shopping, transportation, warehousing), telecommunications, IT penetration and use, local business practices (purchasing, payment, financing), language, education, firm size, structure, and control systems, and industry concentration. Markus and Soh conclude that structural conditions may vary widely across countries, and are not fully captured in measures of national culture. This research attempted to control as many of these as possible. The subjects were students with similar interests (business), technology access (via school computers) and language (instruction in English). Many of the structural influences were reasonably not applicable to the subjects. Others may result from culture and physical resources, such as national policies, legal and regulatory infrastructures, and local business practices.

From Table 5 it is clear that gender ratios and the self-reported online hours are reasonably similar across cultural groups. Several other factors may arguably have presented a bias and a limitation to this research. Subject age is not commonly considered in IT research. Harris and Davison (1999) report that age is not a factor in PC anxiety. Education is commonly reported in

research but level differences are not often noted. Harris and Davison (1999) also use both graduate and undergraduate students in their study. Zhang et al. (2002) find that education level is not an issue in attitudes about online privacy. The use of student subjects is criticized for its limited generalizability to the population. However, students are often used (Zhang et al., 2002; Simon, 2001; Hoxmeier, 2000; Jiang, 2000) in IT research. The use of students is supported by their potential as managers and are often more strongly associated with technology utilization. However, the results obtained from such a study of students should be generalized with caution. The difference in sample size may be a limitation in the findings. Harris and Davison (1999) also have similar differences among the six cultural groups in their study. Pelto and Pelto (1981) note that differences may be more difficult to identify with smaller sample sizes. The assumptions for ANOVA do not include equality of sample sizes, but that the samples are independently drawn and selected with some degree of randomness.

It is certainly possible that one group is more culturally homogenous than another. Many researchers who use cultural groups to study technology rely upon national borders to determine those groups (Stylianou et al., 2003; Zhang et al., 2002; Jiang et al. 2000; Hasan and Ditsa, 1999; Harris and Davison, 1999; Straub, 1994). Straub et al. (2001) tested the survey responses against home of birth and report no correlation. That is, while respondents may report other nations as home of birth, their attitudes towards technology are more similar to those in their residence nation than those within their home nation. Harrison and Huntington (2000) discuss this rather pointedly and write that: "The diversity – the vast number of subcultures – is undeniable. But there is a foundation of shared values, attitudes and institutions that binds together the nations... analogous to that of Great Britain ... no one would question the existence of a British culture" (p.67). Finally, the instrument was developed within one culture

and administered to two others. There may be an inherent bias in the wording or interpretation of the questions that was unforeseen and that influenced the responses. However, that the topic was mostly technology use and the shared language English, this bias is not expected to be influential. While noting differences in age and education level, and the possibility of bias from national cultural heterogeneity and from the instrument, these are not considered major limitations to the findings of this study.

Recommendations for Research and Business

It is recommended that future researchers expand this study to other cultural groups to better identify cultural traits corresponding to the use of e-commerce. Researchers should study other populations and subjects with this research model, such as managers and technology workers. Other factors such as the national infrastructure conditions, electronic payment systems, consumer protection, home sizes, distance to stores and information technology penetration should be

investigated. Researchers may test the influence of gender on the attitudes expressed by cultural groups, age groups and those with differing technology access. Although this research attempted to provide a common sample, the results may have been influenced by factors such as local business customs, personal income and credit card access. Nonetheless, businesses must identify national culture as influential on the acceptance of e-commerce, and know that nations may differ on controls and access to this technology. Businesses must also recognize that consumer attitudes about information technology may differ across nations. Not all cultures may react the same way to the need to develop and control the Internet infrastructure, for example. They must pay particular attention to the influence of culture on attitudes about National Control and Property Rights. That is, businesses must remain aware that nationalities may expect governments to control various aspects of e-commerce and the Internet, that ideas about data and software ownership may be different; and that the citizens of other nations may differ on opinions about wholesale Web access and control of facets of the Internet structure such as domain naming.

Table 9. Culture group reactions

| Culture Reactions | Research Constructs | F-ratios | Significant Differences |
|-----------------------------|----------------------|----------|--|
| Acceptance. | Consumer Preferences | 1.441 | None |
| | Privacy Cost | 2.470 | |
| Modification and Rejection. | Property Rights | 6.656 | UK (2.58) > GR (1.88) UK (2.58) > US (1.99) |
| | National Control | 9.622 | UK (4.04) > US (3.15) GR (3.88) > US (3.15) |

CONCLUSION

This study found that globalization and common technology have not resulted in common attitudes about e-commerce. It also uniquely revealed several interesting facts about the nature of globalization as perceived by various cultural groups and genders. This study found that culture influenced attitudes about e-commerce yet gender did not. It was clear that cultural groups differed in attitude about National Control and Property Rights. However, and very important, culture played no role in influencing attitudes about Privacy Cost and Consumer Preference. This study found that U.S. e-commerce users were less tolerant of government control of the Web. Gender did not play a statistically significant role in attitudes about e-commerce. It may be that gender differences diminish with education. However, it was noted that females were more concerned about giving up privacy.

One possible explanation of shared attitudes towards aspects of privacy and consumer behavior may be the work of Dertouzos (1997, 2001). He writes of the "Information Marketplace" as exerting a "blending and levelling force on the local and global cultures..." (p.283). He postulates a "thin but universal cultural layer" but casts doubt upon a single universal culture due to local conditions and the "overwhelming power of ethnicity". Similarly, Berger and Huntington (2002) write of cultural "globalization" or synchronomy and of cultural "localization" or autonomy. This study postulates that aspects of privacy and consumer behavior may be early indicators of Dertouzos "veneer" layer, and of the "middle ground of cultural homogeneity" discussed by Berger and Huntington.

Berger and Huntington also postulate several possible consequences for the intersection of globalizing forces and indigenous cultures. These include replacement of the local culture with the new, coexistence of the local and new cultures, synthesis of the new and the local resulting in a

modified local culture, and total rejection of the new. It was interesting to note the correspondence between the work of Berger and Huntington and this research, leading us to uniquely postulate that the constructs of Privacy Cost and Consumerism may be areas of global agreement, while Property Rights and National Control may be areas of local modification across cultures as shown in Table 9.

REFERENCES

- Al-Khaldi, M. & Wallace, R. (1999). The influence of attitudes on personal computer utilization among knowledge workers: The case of Saudi Arabia. *Information and Management*, 36, 185-204.
- Albrow, M. (2000). Travelling beyond local cultures. In Lechner, F. & Boli, J. (Eds.). *The globalization reader*. Oxford: Blackwell.
- Berger, P. & Huntington, S. (Eds.). (2002). *Many globalizations: Cultural diversity in the contemporary world*. Oxford: Oxford University Press.
- Bowers, C. (2000). *Let them eat data: How computers affect education, cultural diversity, and the prospects of ecological sustainability*. GA: University of Georgia Press.
- Cairncross, F. (1997). *The death of distance*. Boston: Harvard Business School Press.
- Carayannis, E. & Sagi, J. (2001). Dissecting the professional culture: Insights from inside the IT "black box". *Technovation*, 21, 91-98.
- Castells, M. (2001). *The Internet galaxy: Reflections on the Internet, business and society*. Oxford: University Press.
- Cheung, C. & Lee, M. (2001). Trust in Internet shopping: Instrument development and validation through classical and modern approaches. *Journal of Global Information Management*, Jul-Sep, 23-35.

- Dasgupta, S., Agarwal, D., Ioannidis, A. & Gopalakrishnan, S. (1999). Determinants of information technology adoption: An extension of existing models to firms in a developing country. *Journal of Global Information Management*, Jul-Sep, 30-40.
- Deans, P. & Ricks, D. (1993). An agenda for research linking information systems and international business: Theory, methodology and application. *Journal of Global Information Management*, Winter, 6-19.
- Dertouzos, M. (1997). *What will be: How the new world of information will change our lives*. NY: HarperCollins.
- Dertouzos, M. (2001). *The unfinished revolution: Human-centered computers and what they can do for us*. NY: Harper Collins.
- Doll, W. & Torkzadeh, G. (1988). The measurement of end-user computing satisfaction. *MIS Quarterly*, June, 259-273.
- Doremus, P., Keller, W., Pauly, L. & Reich, S. (1998). *The myth of the global corporation*. Princeton NJ: Princeton University Press.
- Ein-Dor, P., Segev, E. & Orgad, M. (1993). The effect of national culture on IS: Implications for international information systems. *Journal of Global Information Management*, Winter, 33-44.
- Etzioni, A. (1999). *Limits of privacy*. New York: Basic Books.
- Ferkiss, V. (1969). *Technological man: The myth and the reality*. New York: Braziller.
- Fine, C. (1998). *Clock speed: Winning industry control in the age of temporary advantage*. Reading MA: Perseus Books.
- Fukuyama, F. (1992). *The end of history and the last man*. New York: Free Press.
- George, D. & Mallery, P. (1999). *SPSS for Windows*. Boston: Allyn and Bacon.
- Greider, W. (1997). *One world, ready or not: The manic logic of global capitalism*. NY: Simon & Schuster.
- Hafkin, N. (2003). Some thoughts on gender and telecommunications. *Proceedings of the 3rd World Telecommunications/ICT Indicators Meeting*. Available online at www.itu.int.
- Hamel, G. & Prahalad, C. (1994). *Competing for the future*. Boston: Harvard Business School Press.
- Harris, R. & Davison, R. (1999). Anxiety and involvement: Cultural dimensions of attitudes toward computers in developing societies. *Journal of Global Information Management*, Jan-Mar, 26-38.
- Harrison, L. & Huntington, S. (Eds.). (2000). *Culture matters: How values shape human progress*. New York: Basic.
- Hasan, H. & Ditsa, G. (1999). The impact of culture on the adoption of IT: An interpretive study. *Journal of Global Information Management*, Jan-Mar, 5-15.
- Hofstede, G. (1983). National cultures in four dimensions. *International Studies of Management and Organization*, 9(1-2). 46-74.
- Hofstede, G. (1997). *Cultures and organizations: Software of the mind*. New York: McGraw Hill.
- Hope, J. & Hope, T. (1997). *Competing in the third wave: The ten key management issues of the information age*. Boston: Harvard Business School Press.
- Hoxmeier, J., Nie, W. & Purvis, G. (2000). The impact of gender and experience on user confidence in electronic mail. *Journal of End User Computing*, Oct-Dec, 11-20.

- Htun, M. (2000). Culture, institutions and gender inequality in Latin America. In Harrison, L. & Huntington, S. (Eds.), *Culture matters: How values shape human progress*. New York: Basic Books.
- Jiang, J., Hsu, M. & Lin, B. (2000). E-commerce user behavior model. *Human Systems Management*, 19(4), 265-277.
- Kanter, R. (1995). *World class: Thriving locally in the global economy*. New York: Simon and Schuster.
- Kelly, K. (1998). *New rules for the new economy*. NY: Viking.
- Kizza, J. (1998). *Ethical and social issues in the information age*. New York: Springer-Verlag.
- Lederer, A., Maupin, D., Sena, M. & Zhuang, Y. (2000). The technology acceptance model and the World Wide Web. *Decision Support Systems*, 29, 269-282.
- Lee, M. (2001). The adoption and diffusion of electronic commerce. Editorial. *Journal of Global Information Management*, 9(3), 3.
- Maitland, C. & Bauer, J. (2001). National level culture and global diffusion: The case of the Internet. In Ess, C. (Ed.). *Culture, technology, communication: Towards an intercultural global village*. New York: SUNY Press.
- Markus, M. & Soh, C. (2002). Structural influences on global e-commerce activity. *Journal of Global Information Management*, 10(1), 5-12.
- McLeod, R., Kim, C., Saunders, C., Jones, J., Scheel, C. & Estrada, M. (1997). Information management as perceived by CIOs in three Pacific Rim countries. *Journal of Global Information Management*, 5(3), 5-16.
- Nelson, K. and Clark, T. (1994). Cross-cultural issues in information systems research: A research program. *Journal of Global Information Management*, 2(4), 19-29.
- O'Sullivan, E. & Rassel, G. (1999). *Research methods for public administrators*. NY: Addison Wesley Longman.
- Pelto, P. & Pelto, G. (1981). *Anthropological research: The structure of inquiry*. Cambridge: University Press.
- Pitkow, J. & Kehoe, C. (1996). Emerging trends in WWW user population. *Communications of the ACM*. GVU Technical Report: GIT-GVU-96-11. Available at www.gatech.edu.
- Rose, E. (2001). Balancing Internet marketing needs with consumer concerns: A property rights framework. *Computers and Society*, March, 17-21.
- Rose, G. & Straub, D. (1998). Predicting general IT use: Applying TAM to the Arabic world. *Journal of Global Information Management*, 6(3), 39-46.
- Sagi, J. (2000). *Inside the new economy: Business students and issues of e-commerce and the Web*. Unpublished manuscript, School of Business, Computing and Technical Studies, Anne Arundel Community College, Arnold, MD.
- Sheff, D. (2002). *China dawn*. NY: Harper Collins.
- Shields, R. (1996). *Cultures of Internet*. London: Sage.
- Simon, S. (2001). The impact of culture and gender on Web sites: An empirical study. *The DATA BASE for Advances in Information Systems*, Winter, 18-37.
- Stewart, C., Shields, S. & Sen, N. (2001). Diversity in online discussions: A study of culture and gender differences in listserves. In Ess, C. (Ed.), *Culture, technology, communication: Towards an intercultural global village*. New York: SUNY Press.
- Straub, D. (1994). The effect of culture on IT diffusion: E-mail and FAX in Japan and the US. *Information Systems Research*, Mar, 23-47.

Straub, D., Keil, M. & Brenner, W. (1997). Testing the technology acceptance model across cultures: A three country study. *Information and Management*, 33, 1-11.

Straub, D., Loch, K. & Hill, C. (2001). Transfer of information technology to the Arab world: A test of cultural influence modeling. *Journal of Global Information Management*, 9(4), 6-28.

Stylianou, A., Robbins, S. & Jackson, P. (2003). Perceptions and attitudes about e-commerce development in China: An exploratory study. *Journal of Global Information Management*, 11(2), 31-47.

Tavani, H. and Moor, J. (2001). Privacy protection, control of information, and privacy-enhancing technologies. *Computers and Society*, March, 6-11.

Tillquist, J. (1997). Managing the global impacts of IT: Standing on conceptual quicksand. *Journal of Global Information Management*, 5(4), 6-8.

Todd, J. (1986). A modest proposal. In Teich, A. (Ed.), *Technology and the future*. NY: St. Martin's Press.

Turban E., Lee, J., King, M., & Chung, H. (2000). *Electronic commerce: A managerial perspective*. NJ: Prentice Hall.

Volti, R. (1992). *Society and technological change*. NY: St. Martin's Press.

Zhang, Y., Chen, J. & Wen, K. (2002). Characteristics of Internet users and their privacy concerns: A comparative study between China and the United States. *Journal of Internet Commerce*, 1(2), 1-16.

Zmud, R. & Boynton, A. (1991). Survey measures and instruments in MIS: Inventory and appraisal. *Harvard Business School Research Colloquium*.

This work was previously published in Journal of Global Information Management, Vol. 12, Issue 3, edited by F. B. Tan, pp. 44-64, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.22

Collaboration Challenges in Community Telecommunication Networks

Sylvie Albert

Laurentian University, Canada

Rolland LeBrasseur

Laurentian University, Canada

ABSTRACT

This article reviews the literature on networks and, more specifically, on the development of community telecommunication networks. It strives to understand the collaboration needed for innovative projects such as intelligent networks. Guided by a change management framework, collaboration within a community network is explored in terms of the formation and performance phases of its development. The context, content, and process of each phase is analyzed, as well as the interaction of the two phases. User involvement and technology appropriation are discussed. Collaboration challenges are identified and linked to the sustainability of the community network. Policy makers are presented with a model that gives some insight into planning and managing a community network over time.

INTRODUCTION

Collaboration in networks and managing performance across organizations has gained the attention of researchers (Huxham & Vangen, 2000). Our comprehension of collaborative networks² has progressed substantially over a couple of decades (Oliver & Ebers, 1998), but it lacks integration (Ebers, 2002).

Collaborative networks cover a range of purposes such as innovation requiring heavy investment in R&D, international ventures, and the delivery of public services like health and education. This article is focused on telecommunication networks that operate within a physical and shared community space. The more ambitious community networks aim to become “intelligent” communities with broad participation and significant impact on the local social and

economic development. To understand them as a dynamic phenomenon, a framework is needed that can accommodate and organize the conceptual pillars of organizational environment, structure, culture, leadership, and management. Pettigrew (1992, 1987) offers such a framework, and Ebers (2002) and LeBrasseur et al. (2002) demonstrate its effective application.

Organizations in all sectors have become more interested in inter-organizational collaboration to encourage synergy, innovation, and economic development. Although there are many pockets of successful collaborative efforts, there is a continuing need to identify the challenges and opportunities inherent to community networks. With this focus, this article is divided into four main sections. First, collaborative networks are defined and described, and community telecommunication networks and their potential for supporting intelligent communities are analyzed. Second, key collaboration challenges that impact on the development of a community network are introduced. Third, the literature is reviewed and organized according to the context, content, and process involved in these community networks during their two phases of development—formation and performance. The collaboration challenges present in each phase of development are explored, including challenges that the users experience. Fourth, the article concludes with policy implications for network planners.

TELECOMMUNICATION NETWORKS AS AN EXAMPLE OF COLLABORATION

Collaboration is the pooling of resources (e.g., information, money, labour), by two or more stakeholders or partners³, to solve a set of problems, which neither can solve individually (Gray, 1985). It involves an interactive process whereby organizations, using shared rules, norms, and structures, act or decide on issues related to a

problem domain (Wood & Wood, 1991). The intentional goal-oriented collaborative arrangement that emerges is that of a network (Poyhonen & Smedlund, 2004).

Networking represents a particular form of organizing or governing exchange relationships among organizations and is an alternative to markets and hierarchies (Ebers, 2002, p. 23). Network partners maintain their autonomy and retain residual property rights over their resources that have been pooled to achieve mutually agreed outcomes (Bailey & McNally-Koney, 1996; Brown et al., 1998; Gray & Hay, 1986; Huxham & Vangen, 2000; Oliver & Ebers, 1998). The principal coordination mechanisms for allocating resources are negotiation and concurrence. Informal social systems, rather than bureaucratic ones, coordinate complex products or services and reduce uncertainty (Jarillo, 1988; Jones et al., 1997).

Networks have gained in importance over the last two decades. For the private sector, globalization and the speed of change have encouraged collaborative efforts. For government, downloading⁴ since the 1990s has forced new ways to view management of programs and services for resource maximization (Bradford, 2003; Bailey et al., 1996). Municipalities and regions have also demonstrated an increased interest in collaboration efforts and network development to attract new opportunities and maintain their competitive advantage. Collaborative networks typically increase the scale and visibility of program efforts, increase support for projects, and leverage capital to enhance feasibility, speed, and effectiveness (O'Toole, 1997). Synergy is achieved through improved resource management and intensive exchanges on specific projects.

To achieve synergistic gains and programming enhancements from sharing resources, risks, and rewards, stakeholders need to shift their focus toward collaborative rather than competitive advantage (Lowndes & Skelcher, 1998). Too often in the past, public sector organizations built independent silos and their private sector

counterparts viewed potential partners as competitors rather than collaborators. Public policies dealing with ambitious or complex issues, like community sustainability, are likely to require networked structures that allow for the pooling and mobilization of resources from both private and public sectors within a government policy initiative (O'Toole, 1997).

Community telecommunication networks reflect the trend in western society away from bureaucratic government to network governance (Sorensen, 2002): the latter delivers more services efficiently with less risk and uncertainty (Considine & Lewis, 2003; Jones et al., 1997). Stakeholders and collaborators include municipalities, health, education, social services organizations, and private sector organizations. These networks are part of a wider agenda to increase the country's capability for the knowledge-based economy.

There are several kinds of community networks (Gurstein, 2000; Pigg 2001), ranging from those serving a restricted membership (usually called private networks) to those serving a broader segment of the community or region. A private network may, for example, link several schools and/or municipal sites, and members would include the students, administration, and staff of these organizations. In contrast, a community network is built on a platform that gives broad access to community citizens, businesses, and agencies; it encourages many stakeholders to become a user and service provider. These stakeholders may come together simply to upgrade an aging infrastructure, especially when market forces cannot be relied upon to meet community needs or to co-build economic foundations. Leading communities strive to build partnerships and synergy to overcome barriers to access, job creation, and innovation (Agres et al., 1998; Eger, 2001; Tan, 1999; Industry Canada, 2002a, 2002b). Community networks facilitate information dissemination, discussion, and joint activity by connecting neighbours, creating new opportunities, and empowering residents, institutions, and

regions (Carroll & Rosson, 2001; Igbaria et al., 1999; Canadian National Broadband Task Force, 2001).

A community network has four basic components: a telecommunication infrastructure with broadband capability, applications or content, devices (such as computers, cellular telephones, i-pods, and blackberries), and users. The development of a community telecommunication network typically occurs through a governing board representing the needs of users, which is supported by a small management structure (e.g., executive committee and network manager). The network relies on information and communication technologies (ICTs) and allows the community to import and export knowledge, encourage innovation, and overcome distance. The opportunities for economic and social development are contingent on attracting many users and creating a culture of "digital" use. The network must fulfill user needs and be attentive to their requirements, which may include a fair price, access to computers and the Internet, and training and education.

Infrastructure investment in the telecommunication network aims for the widest possible coverage of the community and region, with the constraint of reasonable cost. Investment also tries to ensure that users have access devices; some users have modest means, and schools and other organizations may have budget constraints. On the human resources front, technical training of local staff may be required to install the infrastructure and devices, and provide support to users. Organizations may need to re-design processes in order to meet the changing needs of their supplier and distribution partners, and to offer services online to end-users. The transformation effort may also require promotion campaigns to attract both individual and organizational users. These many resource challenges imposed on the community require a collaborative effort to pool resources and find innovative solutions.

A community network has users at the individual, organizational, and community levels of

human activity and endeavours. Individuals or end-users use the network to communicate with friends, play games, access information, obtain training, and occasionally innovate. Organizations are often stakeholders and use the network for a wide variety of purposes (Waits, 2000), including providing information and services, and selling online. They are intermediate users (Williams et al., 2005) and are the drivers of the development of the network. These organizations are the channels through which collective innovation is exercised and community change takes place (de la Mothe, 2004; Rycroft, 2003). At the community level, these individuals and organizations create aggregate demand and use of the network, and determine the sustainability of the network. The challenge is to create a culture of “digital” use that is integrated into the broader culture that is shared by community members.

During the development of the network, user involvement can be traced through participation in articulating a “digital” vision for the community, in the purchase of access devices and services that will connect users to the network (e.g., telephone, cable, wireless, computers, and Internet), and in the utilization of applications being made available through these access devices. Users may also be involved in creating employment by innovating on the network configuration, and in helping to create a culture of use by providing additional attractive applications.

Good governance requires legitimacy with an appropriate range of stakeholders, and involves building cohesion and commitment. Relationships are voluntary, and network survival depends upon the collective will and commitment of the stakeholders. The intentionally-planned network takes on a collaborative structure composed of local residents, non-governmental organizations, private sector businesses, and government. The stakeholders create a product that reflects the concerns, priorities, and aspirations of the local population. If the infrastructure, devices, and applications meet the needs of the users, a culture of

“digital” use emerges as an organic extension of existing community ways and practices. Without broad participation, the network is likely to reflect narrow interests and weaken the community’s social sub-system, which in turn will limit the economic success of the network.

A sustainable community telecommunication network makes consistent and positive contributions to the economic and social development of the community (ITU, 2003), thereby enhancing the community’s capital base. In large measure, these positive outcomes depend upon the collaboration of partners. They also reinforce the efforts invested in collaboration. Networking allows individuals, professionals, and entrepreneurs to access information and knowledge, learn about a wide range of issues, recognize opportunities, and achieve innovative products and services (Suire, 2004; Martin & Matlay, 2003; Corbett, 2002; Ardichvili & Cardozo, 2000; Kickul & Gundry, 2000). Whether a community network realizes its potential depends upon how well it is developed.

The above discussion portrays the formal structure of a community network as a fluid organization composed of volunteers with the purpose of facilitating the community’s transition and participation in the information society. However tempting, this viewpoint is non-critical in nature; it ignores the community context and processes by which the network emerges (Pigg, 2001; Day 2002).

COLLABORATION CHALLENGES FOR COMMUNITY NETWORKS

Communities around the world have demonstrated that transformation is possible using network technology. For example, Sunderland (UK) reduced unemployment from 30% to 4% by moving from a shipbuilding and coal industrial base to a knowledge and technology economy. Similarly, Spokane Washington (USA), once a

railroad town reliant on natural resources, dramatically improved the fortunes of its downtown by installing the highest density of broadband in the country. In Tianjin (China), a major push on broadband connectivity was accompanied by rapid user growth, from 20,000 to 2,700,000 in two years. Their stories make ample reference to the intensive collaboration of many actors, but the patterns of influence are not well articulated.⁵ Bell (2001) compared six urban communities noted for their telecommunication achievements and identified two effective patterns of collaboration: (1) a comprehensive and formal plan, and (2) a coherent pattern of individual initiatives. Similarly, Williams et al. (2005) reviewed numerous ICT initiatives, both small and large, and emphasized the overlapping nature of the planning, implementation, and use stages of development. These patterns are explored under the phases of network development section of this article.

Individuals and organizations involved in the creation of a community network face four collaboration challenges:

1. Defining and agreeing on the transformation effort (includes vision, transformation, and planning)
2. Assembling and mobilizing resources (includes interdependence, tasks, and structure)
3. Assembling and mobilizing trust (includes prior experience, communication, and distribution of power among collaborators)
4. Balancing leadership and collaborative management (includes the broadening requirements of the network, user appropriation, and power).

These challenges are tied to the coherence and adaptability of the network, and specifically to the dynamic relationship between the formation and performance phases of its development. Collaboration is inter-woven in each of these challenges. Network sustainability is achieved

by collaboration efforts that evolve during the network's development.

PHASES OF DEVELOPMENT OF A COMMUNITY NETWORK

We propose that network development takes place in two phases that are iterative in nature. Phase 1, the formation of the community network, is marked by the emergence of a leader and/or a board of directors, to respond to environmental pressures. These pressures may occur as a result of globalization and the need to remain competitive in the face of other communities or regions. It may occur as a result of downsizing or social development pressures (e.g., lack of medical practitioners, youth out-migration). The broad goals of the network are developed, including a representation of the future user. Phase 2, network performance, involves the concrete objectives and steps that the board takes to achieve the community goals that were agreed upon and the measures taken to attract and retain users. User involvement can and should take place in both phases of development.

Smaller communities need collaborators to solve a wide variety of challenges including infrastructure availability. Larger communities tend to have more resources and thus need collaboration to resolve economic and social pressures rather than infrastructure issues. In this second phase, the network can develop a culture and structure that gives meaning and coherence to a variety of projects. Some communities are more liberal and hands-off, allowing the private sector and citizens to develop content and opportunity. Others intentionally plan a vision of community transformation based on an improved telecommunication infrastructure. Phase 1 depends highly on leadership dynamics whereas Phase 2 is closer to managerial dynamics but with a distinctive collaborative flavor. These two phases are interdependent over time in that formation sets the

stage for performance, and performance impacts on the board and leadership dynamics. Positive outcomes at the performance phase consolidate the dynamics of the formation phase; negative outcomes challenge the board and leadership and initiate a re-formation phase. This iterative process was demonstrated in the feedback loop identified by Arino and de la Torre (1998) and Thomas (1993).

Because networks are fluid in nature (pooling from existing resources, changing membership, and varied timelines) and focused on both results and relationships, two interactive phases are considered sufficient. The two phases are supported by case studies of strategic alliances (Doz, 1996) that found that successful partners actively exchanged information, re-evaluated the project (in terms of efficiency, equity and adaptability), and consequently readjusted the initial conditions of their cooperation. They are also consistent with the ICT social learning findings of Williams et al. (2005).

Formation Phase

The push and pull factors in the environment impact on the community members and prompt them to consider uniting their forces to address the issue or opportunity that has been identified. Under the leadership of a visionary, and through ample interpersonal communication, a group is assembled that represents the initial membership

of a potential network. If a consensus on vision and goals is attained, the group becomes the founding board of a network and plans for the performance phase. The principal outcome is a collaborative base on which to build the network. Table 1 provides an overview of the critical factors present in the formation phase.

Context of Formation

The outer context or environment includes factors such as economic, political, culture, demographics, funding opportunities, pressures from government agencies, and technology innovation trends (Agres et al., 1998; Bailey & McNally-Koney, 1996; Igbaria et al., 1999; Keenan & Trotter, 1999; and Tan, 1999). Global competitiveness and turbulence are the underlying catalysts for creating networks for organizations, communities, and governments (Poyhonen & Smedlund, 2004; Scheel, 2002).

Interdependencies exist because organizations possess or control vital resources (material, human, political, structural, or symbolic) and thus are the source of environmental pressures for one another (Wood & Wood, 1991). Organizations seek to reduce these pressures and manage the interdependencies by gaining control over crucial resource supplies. The network form, as opposed to markets and hierarchies (e.g., vertical integration), provides a neutral space within which organizations can meet to explore solutions and synergies.

Table 1. Influencing factors at the formation phase

| Context | Content | Process |
|--|---|---|
| <ul style="list-style-type: none"> • Economy • Social/cultural • Political • Urbanization • Funding • Technology • Globalization & competition • Cost Benefit/ Synergy | <ul style="list-style-type: none"> • Vision • Power • Board Membership • Concept of Sustainability • User representation | <ul style="list-style-type: none"> • Values • Expectations • Goals • Planning • Leadership (transformational, visionary) |

International bodies such as the World Bank (1999), the United Nations (1998), and OECD (1997) have adopted the paradigm of the information society as a guide to many of their development policies. According to Castells (1996, 1997, 1998), ICTs have produced a network society in which mobilizing knowledge and information have become more important than mobilizing physical resources. He argued that both organizations and individuals can benefit from electronic networks; they support the development and dissemination of knowledge and information, and facilitate innovation. Castells warns that these changes are accompanied by growing wealth disparities, social fragmentation, and dislocation. Governments are addressing these concerns, in part, by financially supporting the creation of community networks with broad accessibility. Locally, these new opportunities are often communicated through the chamber of commerce and other economic development agencies to mobilize or inspire stakeholders into action.

Communities come in all sizes and density, and all are influenced by the urbanization trend. Rural settings are witnessing the exodus of their youth and an erosion of their economic base as cities attract both talent and investment, including initiatives in telecommunications (OECD, 2004). Recent studies of Canadian rural communities concluded that ICTs can act as enablers of community building and development processes (New Economy Development Group Inc., 2001; Canadian Advisory Committee on Rural Issues, 2004). Given that the Internet is content-rich, offers online education, facilitates social networking, and offers a platform for the creation of new enterprises and the expansion of existing ones, the viability of the digital community network becomes crucial for the future of small communities.

When governments create generous programs to create community networks (e.g., Brown et al., 1998), communities are pressured to apply for capital funds even when they may not have the

organizational and resource capacity to sustain the network. Smaller communities have relatively fewer and less diverse resources and a push-style policy may be the only way to spur action. Another example of a push factor is when a major telecom firm seeks a community partner for a demonstration project, or when the private sector chooses to make an investment to upgrade its infrastructure. The telecom supplies the ICTs, but the community stakeholders still need to demonstrate and plan on how the technology can be applied to personal and organizational purposes. Often, infrastructure is built and languishes until there are other pressures in the environment of the community, such as closure of a major employer or the arrival of a strong champion. At other times, communities struggle with the lack of open access that inhibits economic development and competition. Pushing for open access can discourage the involvement of incumbent carriers, at least at the onset. The key here is to evaluate how context issues can stimulate communities into action toward their transformation.

Content of Formation

Stakeholders need to find the community vision attractive and see a benefit for themselves and for their organization. When the problem is broad in scope and complex, such as economic development, it requires a larger variety of stakeholders with legitimate interest to devise solutions and bring sufficient resources to bear. Stakeholders must have the right and the capacity to participate, and include organizations with legitimate power as well as those who will be affected by the network.

Collaborative action necessarily involves interdependence between individuals and organizations (Ouchi, 1980) and can yield both intangible (e.g., image of citizenship) and tangible benefits (e.g., cost reductions and additional revenues). Interdependence is strongly linked to the vision of the network and the factors motivating stakehold-

ers. It allows for an exchange among stakeholders that is built on trust, and an understanding of mutual benefit or advantage. According to Olk and Young (1997), the more ties an organization has to others in a network, the less likely is it to act opportunistically. Blois (1990) argued that collaborators should engage in bargaining on who will accept responsibility for certain elements of the transaction costs. They must come to the table understanding their role and develop a level of interdependence and mutual benefit in order to sustain the network effort.

The economic and social exchanges that take place are mediated by mutual trust. Ring (2002) distinguishes between “fragile” and “resilient” trust. The former is typical of opportunistic settings such as markets and involves the formal processes of negotiation, transaction, and administration. In contrast, the latter is the foundation of successful networks and is based on the informal processes of sense-making, understanding, and commitment. However, prescribing resilient trust does not ensure that it takes place. Ring proposed that it will emerge when the participants have a shared history of experience and when reputations for reliability are well established. On the other hand, Doz (1996) has documented the role of trusted intermediaries in helping other participants to shift gradually from fragile to resilient trust. We conclude that if a community has rich social relations, it can establish resilient trust early, but that parachuting in partners and stakeholders makes fragile trust more likely. However, if trusted intermediaries become involved, they can build the level of trust within the network.

There is a need for legitimate authority, credibility, and multiple memberships (Bailey & McNally-Koney, 1996; Gray & Hay, 1986) if a sustained transformation is to occur. Jones et al. (1997) have argued that networks need to restrict membership access and choose its members according to their reputation and status. Important stakeholders may choose to join a network or a project because of the presence of other members. A smaller number of leaders may allow the net-

work to realize quick wins, reduce coordination costs, and improve interaction frequency. One could argue that success will breed success—trust will increase, motivation will increase, and faster output can be generated. This view is less applicable to community networks where innovation, legitimacy, and broad reach is critical and leads to a large membership and numerous exchanges. Therefore, a smaller, more restricted network may be mobilized quickly and act efficiently, but be less effective in producing varied output. The larger network may slow the pace of change, but may be important enough to attract accomplished leaders. Structure issues become important in managing a larger group of stakeholders and are discussed in the performance phase of the network.

Another content issue is sustainability. Stakeholders want to know, “How much will it cost,” but few ask “How will the network become sustainable in the long-run?” Sustainability is a function of revenues (stemming from the use of the infrastructure and its applications), and the costs of the network (human resources, equipment, and materials). There are opportunities for synergistic gains when partners chose to purchase as a group, or share the operating costs. At the formation phase, the concept of sustainability is hazy, but becomes clearer as projects develop during the performance phase. Nevertheless, the board must carefully address the sustainability issue early to ensure that it becomes incorporated into their common frame of reference.

In the formation stage, the planning includes an explicit model of future users, their communication needs, and their likely use of the telecommunication network. Williams et al. (2005, p. 112, Figure 5.2) identify ways for direct involvement of users, such as user panels, market research, and trials. They also identify sources of indirect evidence about users through information on demand and markets for similar products, and competitive offerings. With the additional input of board members who understand their community, a representation of the users is developed. This user-centered approach is helpful in guiding the

design of the system and identifying training and promotion requirements. However, Williams et al., emphasize its limitations and the design fallacy that it breeds: “the presumption that the primary solution to meeting user needs is to build ever more extensive knowledge about the specific context and purposes of an increasing number and variety of users in the technology design” (p.102). The idea of perfect user representation ignores the reality that users are active agents and appropriate the technology later, primarily in the performance phase of network development.

Communities would be wise to involve users in all facets of their formation stage, but users are often thought of as passive participants that can be surveyed for the eventual purchase of devices or services at the performance stage. Yet, users have concerns over ownership, access and distribution of information, privacy, security, and copyrights (Agres et al., 1998), and most of these issues need consideration early on. However, the design fallacy mentioned above emphasizes the limitations of comprehensive user involvement in the formation phase.

Process of Formation

Leaders and champions can enhance or constrain the development of a community network (Industry Canada, 2002; Jones et al., 1997; Huxham & Vangen, 2000). Leaders tap into the collective awareness of the community stakeholders and mobilize the initial change efforts by supplying a vision and practical steps to realize it (Bailey & McNally-Koney, 1996; Roberts & Bradley, 1991). Sustaining collaboration depends on the emergence of a common view of the community and shared organizational values. Leaders and champions play a role in consolidating and expanding the collaborative initiatives, but a wider involvement is needed to foster innovation. It is important to have a community cross-section of members as well as individuals with sufficient power to rally other stakeholders. The parties must freely participate, knowing and agreeing on who

is involved and in what capacity (Glatter, 2004; Roberts & Bradley, 1991); prior experience and trust facilitate the membership drive.

Network goals are created, implemented, evaluated, and modified through purposeful social construction among network stakeholders and partners (Van de Ven & Poole, 1995; Ring & Van de Ven, 1994). Network effectiveness may be defined as the harmonization, pursuit, and attainment of the goals sought by the various stakeholders and partners. With diverse stakeholders, it becomes difficult to satisfy all parties equally; therefore, managing expectations and potential conflicts help to maintain the social cohesion of the network. Members will likely persist so long as they can positively identify with the intermediate and long term outcomes, whether they are social or economic in nature.

According to Hardy and Phillips (1998), when individuals come to share a vision of the issues and the solutions, they become stakeholders and begin to create a collective identity with mutually agreed upon directions and boundaries that, in time, may become a permanent network. The catalyst is a transformational leader who encourages collaboration as a means to create synergy for innovation, growth, or to protect against future turbulence. Engaging the stakeholders in a planning exercise can address their many concerns; tasks and roles can be organized and assigned within the network to fit their expectations. Because work is complex and elaborate in networks, planning and coordinating task-specialized activities is required (Roberts & Bradley, 1991). However, planning follows the visioning that the leader has enacted.

Challenges in the Formation Phase

Defining and Agreeing on the Transformation Effort

It is argued that a multi-sectoral and multi-organizational network is needed for a transformation to an intelligent community. The wide variety of

stakeholders impact the style of leadership and structure needed for joint initiatives. The leader (or leaders in the case of shared roles) shares a vision of a desirable future and initiates a flexible structure that can accommodate differences in orientation (profit versus not for profit), time horizons (short versus long term), and civic engagement (self versus community focus). Given the diversity of stakeholders, the visioning must be consistent and persuasive, but large enough in scope so that stakeholders can personalize the vision to suit their personal and organizational interests. Key activities include:

- Utilizing context issues to create a sense of urgency and sell the concept of the community network
- Identifying solutions to problems and synergistic opportunities
- Preparing a plan for producing meaningful and motivating outcomes

Agreeing on the vision depends on the availability and abilities of the local leader. Individuals with strong communication skills, an established reputation of trustworthiness, an ability to deliver on promises made, and conceptual skills to craft a vision are in short supply. While large communities have a greater pool of candidates, small communities may have to draw more on external talent and work hard on establishing trustworthiness.

Assembling and Mobilizing Resources

The community network depends upon its board to acquire the physical, financial, and organizational resources that make a broadband network functional. Collaboration among stakeholders and partners facilitates the pooling of their resources. Choosing board members should flow from resource requirements and the likelihood that the stakeholders recruited or volunteering are favorably disposed to sharing with other organiza-

tions. Community citizenship of board members channels the resources to create and enhance the network. Key activities include:

- Assembling the representatives of a variety of public and private sector organizations to form the board, including both small and large stakeholders;
- Mobilizing the resources controlled by board members and reaching out to obtain vital resources from the environment.

Too many resources may harm the development of the network if the board lacks the capability to make good use of them. Waste would damage the network's reputation and make future resource acquisitions more difficult. Likewise, too few resources can harm the network because the scope of activities would be narrow and appeal to only a small segment of the community's population. A narrow focus would appear self-serving and lack broad legitimacy.

Assembling and Mobilizing Trust

For the board to be effective in creating and enhancing the network's resource base, its members must trust each other so that extensive sharing becomes possible. When stakeholders engage in joint efforts and initiatives, they are putting the community first and themselves second, making them vulnerable to exploitation by less citizen-minded organizations. When trust exists on the board, stakeholders can tolerate some exposure. Therefore building and maintaining trust in a realistic manner is essential to the network's resource base and projects. Key activities include:

- Assembling the board membership on the basis of reputation, prior experience, and diversity of stakeholders;
- Creating a shared vision that reflects the underlying values of community spirit;

- Distinguishing between fragile and resilient trust, and building the latter.

Building and maintaining resilient trust is at the core of the inter-dependent culture that emerges in the network. When a transformational vision is complemented with solid resources and trust, the community network has met the challenges of the formation phase of its development and is ready to shift into the performance phase.

Performance Phase of Development

The performance phase of network development is centred on concrete projects that require the pooling of resources by its members. The resources may be tangible (finances, staff secondment, office space, and equipment) and intangible (time, information, influence, and reputation) in nature. Pooling is facilitated by both the culture and structure of the network in which horizontal interactions, exchanges among equals, are based on trust. These resources are organized and controlled to attain the project objectives, and the management style is collaborative and accountable to the membership of the network. Pursuing these objectives gives collaborators opportunities to learn how they can make the network function effectively. In the short term, the level of attainment of the project’s objectives dominates; small wins and their public recognition are important to confirm the value of the network (Bouwen & Taillieu, 2004). Effective project management is

needed. In the long term, the board focuses on the level of attainment of the broad goals of the network. To ensure that the projects and the general management of the network are aligned with the original vision and goals, effective leadership is required. Table 2 provides an overview of the critical factors in the performance phase.

CONTEXT OF PERFORMANCE

The interdependence of members within a community network is reflected in both its structure (O’Toole, 1997) and culture. Structure requires careful attention because a poor structure—one that gives too much power to one partner or that does not embody the values of stakeholders—will affect the performance and longevity of the collaboration.

Poyhonen and Smedlund (2004) and Nootboom (1999) identified three network structures: vertical, horizontal, and diagonal. The latter consists of firms and organizations from several different lines of business. A diagonal structure is appropriate for community networks because it includes as many collaborators as possible to create synergy and innovation within and between sectors; transformational, as opposed to incremental change, is facilitated. The success of collaborative networks is contingent on managing the ambiguity, complexity, and dynamics of the structure. It becomes more important in the performance phase because it must sustain an action plan and

Table 2. Influencing factors at the performance phase

| Context | Content | Process |
|---|---|--|
| <ul style="list-style-type: none"> • Structure • Roles • Trust • Power of stakeholders • Interdependence & Culture | <ul style="list-style-type: none"> • Goals • Achievement/output • Innovation | <ul style="list-style-type: none"> • Team management • User appropriation • Communication |

organize resources to carry it out. However, a telecommunication network is developed to resolve dynamic context issues and can only do so within a process of continuous improvement. A rigid structure that minimizes innovation diminishes the network's sustainability. Though difficult to assess, the effectiveness of the structure can be judged by its internal coherence and fit with the culture of the network. This puzzle, identified by Bailey & McNally-Koney (1996), needs a solution that retains the fluidity of communications and decision-making, while providing for a framework for productivity and sustainability.

Collaboration is associated with incremental innovation when partners share on several levels: a larger purpose, explicit and voluntary membership, an interactive process, and temporal property (Roberts & Bradley, 1991). Hardy and Phillips (1998) pointed out that more powerful stakeholders may force collaboration on weaker players to control them. Consequently, there is a lessening of the level of interdependence and common vision. Weaker stakeholders are bound to minimize their participation and find excuses to exit the network when they are being coerced. Though asymmetrical power is a likely reality, leaders that seek innovation must put less emphasis on control and more on incentives and opportunities.

Creating a culture of collaboration gives coherence to the stream of actions that builds the community network. Collaboration is described as a relational system of individuals within groups in which individuals share mutual aspirations and a common conceptual framework (Bailey & McNally-Koney, 1996). Individuals are guided by their sense of fairness and their motives toward others (caring and concern, and commitment to work together over time). Through communication and shared experiences, they create a system of shared assumptions and values, and accepted approaches and solutions to problems, including collective sanctions, to safeguard exchanges and reinforce acceptable behaviors (Jones et al., 1997).

Sanctions may include exclusion from certain benefits (present or future) and opportunities (participation in projects), and as a last measure forced exit (temporary or permanent) from the network.

Collaborators often choose to stay in a poorly performing network based on the strength of their social ties. However, if they conclude that they can meet all of their needs outside of the network, they may view the network as superfluous (Brown et al., 1998). Linkages or interdependence must be solid and intentional (Bailey & McNally-Koney, 1996) and may be a strong indicator of sustainability (Olk & Young, 1997). Conversely, Brown et al. (1998) identified that greater resource interdependence makes successful partnerships more difficult to achieve. In order to find common ground and encourage persistence, the reasons for enhancing an interdependence need to be emphasized, and stakeholders must want to belong and believe in the vision.

Content of Performance (Specific Projects)

The content of performance includes a wide variety of projects that meet the goals of the network, including the needs of stakeholders and users. Among them are projects to launch or upgrade an infrastructure, acquire devices to deliver applications, develop content for the network, and promote the network to potential users. The outcomes include cost savings to deliver services, revenues from users, and additional capability for the social and economic development of the community.

Waits (2000) described collaborative networks in terms of their pursuits:

- Co-inform: actions to identify members and impacts, promote a heightened awareness of the issues, and improve communication among the members;
- Co-learn: educational and training programs sponsored by the network;

- Co-market: collective activities that promote member products or services abroad or domestically;
- Co-purchase: activities to strengthen buyer supplier linkages or to jointly buy expensive equipment;
- Co-produce: alliances to make a product together or conduct R&D together;
- Co-build economic foundations: activities to build stronger educational, financial, and governmental institutions that enable them to compete better.

Some of these pursuits appear easier to realize and only require fragile trust (co-inform and co-learn). They are more likely to give quick “small wins.” Others may be challenging and require resilient trust (co-market, co-purchase, and co-produce); their success will take more time but are more highly valued. Co-building economic foundations appeals less to self-interest and more to a communal interest, and depends on a broad vision that will lead to a series of concrete actions and sustained effort. Waits’ objectives are compatible with each other, but have different time horizons and commitments. The strength of the formation phase influences the commitment of stakeholders in the development phase. In particular, a strong collaborative climate encourages them to be patient and willing to invest additional time and resources to achieve long term goals.

PROCESS OF PERFORMANCE

Leaders require managerial sophistication to recognize appropriate circumstances and tools for collaboration (Glatter, 2004). In networks, collaboration depends upon an ongoing communicative process (Lawrence et al., 1999). Roles and responsibilities are negotiated in a context where no legitimate authority is necessarily recognized (Glatter, 2004; Lawrence et al., 1999; Lowndes & Skelcher, 1998). Like in partnerships, there is

concern for trust, politics, emotions, and results. Furthermore, leaders require an understanding of user appropriation of the digital network to effectively channel the collaborative efforts.

Du Gay et al. (1997) describe the appropriation of technology as an active process in which users make choices around the selection and local deployment of the technological components, and create meaning and sense of the technology. Appropriation has both a technical and cultural side. In this spirit, Williams et al. (2005) have argued that user appropriation has two distinct but inter-related processes: *innofusion* (users adjust and innovate to improve the usefulness of the technology) and *domestication* (users adapt the use of the technology to integrate it meaningfully in their activities). When both processes are fully engaged, the community may be said to have a “digital” culture that sustains the network.

The pace of change within the network must be properly managed. Effective use of communication will allow collaborators to react and contribute. Because of large boards and membership and turnover in representation, some collaborators may not know everyone or their status. Indeed, some may be confused over the degree of autonomy they have in making decisions for their organization (Huxham & Vangen, 2000). Changes in government mandates and organizational priorities create uncertainty as collaborators plan and structure the network. Communication and recognition of accomplishments become important to keep everyone focused.

The board’s effectiveness in tackling problems within their community as well as within their respective organizations will directly influence the achievement of the intelligent community objectives. Leaders need to guide the board and create bridges with important outside players. They must align the requirements of their own organization with the vision of the intelligent community initiative for success; they must create a high performance team environment (Albert, 2005; Wheelan, 1999; Smith, 1994). This standard

is not easily achievable, especially for a volunteer board with diverse membership and affiliation.

Challenges in the Performance Phase

Continuing Challenges from the Formation Phase

The consensus on the community vision that was created in the formation phase needs to be reinforced. The leader can remind stakeholders of the urgency to capture opportunities, but must incorporate measures for sustaining collective efforts. Key transformation activities include:

- Expanding planning and monitoring projects and measures of performance;
- Marketing the network concept to mobilize and gain the support of the wider community and further engage the stakeholders.

In terms of resources, the community network continues to depend upon its board to acquire resources to develop, acquire, and develop applications to attract numerous users. Key activities include:

- Modifying board membership to improve the resource base of the network as projects change over time;
- Engaging both small and large partners for innovation to create new resources;
- Creating a small management structure for the performance phase of the network.

As for trust, the performance phase requires continuing sharing of resources in the face of uncertain outcomes. Key activities include:

- Applying different trust standards as the situation warrants;
- Encouraging the broad sharing of resources instead of specialized contributions.

Resilient trust can block new stakeholders and partners from joining the network; they may have key resources but be deemed untrustworthy. In such a case, the network requires the flexibility to resort to fragile trust with its emphasis on formal agreements and contracts. The reverse situation can also damage the network, when fragile trust dominates relationships. While formal contracts increase accountability of the parties, they are narrow in scope and participation is contingent on self-interests being satisfied. Community considerations remain secondary. In time and through active leadership, these new members may buy into community citizenship through association and success.

Balancing Leadership and Collaborative Management

Both the formation and performance phases of development have their champion. The leader dominates the formation (and re-formation) phase through visioning, planning, and attracting and retaining stakeholders with key resources and disposed to collaborate. The manager guides and maintains the performance phase, and ensures that both tangible and intangible benefits are created for the stakeholders and the community.

The “collaborative” manager is needed to reinforce the user appropriation by supporting the innovation and domestication in which users engage. By encouraging the involvement of intermediaries (e.g., Chamber of Commerce, owner of a cybercafé, entrepreneur who wants to keep control), the network manager allows the network to evolve along lines that reflect the different groups and segments in the community’s population (Williams et al., 2005).

Formal planning becomes less important, as a pattern of coherent projects becomes established. At the same time, these intermediaries (or small groups of individuals in large networks) interact to keep the board informed and reinforce their individual efforts. By working together, they ensure

that the vision of the network creates a coherent set of initiatives and projects, and opportunities and issues relevant to the board meetings are identified. Key activities include:

- Encouraging innovation and proper planning to achieve the transformation effort;
- Reaching out to intermediaries to broaden user involvement;
- Ensuring that the vision that binds the board members remains true to the community values as the network develops and expands;
- Confronting head-on the need to modify the board composition to respond to internal or external factors;
- Managing projects with a blend of fragile and resilient trust, the former with binding contracts and the latter with negotiation and concurrence;
- Choosing projects that are likely to succeed and that are valued by the stakeholders;
- Building and maintaining redundant communication systems, both formal and informal, to reflect the culture of inter-dependence that binds the stakeholders of the network.

The network can be damaged by a dominant leader or manager who insists on being involved at all times and on controlling the process, whether at the board or project level. This situation emerges when there is a failure to share multiple roles and to act as a team. The lack of experienced persons may push one individual to assume both the leadership and managerial role; this solution ensures positive momentum, but may block future sharing of roles as the incumbent becomes entrenched. Similarly, the abundance of strong and experienced personalities facilitates the sharing of roles, but may slow down momentum as too many persons insist on prominence. Developing a team spirit among members of the board and management should be encouraged as early as possible in the network's development (Albert, 2005).

Collaboration Challenges for Users

At the formation stage, the infrastructure and applications are planned and guided by a vision. Stakeholder requirements are addressed in the planning of the network through the methods of user representation. At the performance stage, when the network is functional, the users actualize the network in both expected and emerging ways. A community network is validated by the applications it makes available to its users, and the extent to which the users actually use them. Furthermore, the design features of the telecommunication network influence the collaboration opportunities that the network creates. When the network design enhances collaboration, it has succeeded in creating effective socio-technical patterns (Huysman & Wulf, 2005; Evans & Brooks, 2005).

Challenges for Individual Users

IT and a community network challenge the individual because they put into question existing ideas and routines, and add knowledge and skill requirements. Being open to change means making efforts to understand and use the network. The younger generation makes more use of the internet than the established older generation for social contact and is likely to push for internet connection in the home (Bernier & Laflamme, 2005; Crowley, 2002). The older adults are more likely to be introduced to ICT changes in the workplace. Age aside, the Internet facilitates the local-global link through which knowledge and expertise from around the world can be channelled to community members (Stevenson, 2002). Creative individuals can interact to exchange expertise and create innovations (e.g., open source development), and are motivated by reputation and recognition built into the Web site (Fischer et al., 2004). To generate ideas, group support systems that ensure anonymity appear more effective (Pissarra & Jesuino, 2005). In general, the individual must learn to

assess the trustworthiness of the Internet information sources (Franklin, 1999; May, 2002) and assume risks when making transactions online. Similarly, participating in virtual communities and discussion forums challenges the individual to change roles from spectator to contributor (Ginsberg, 2001) and activist.

Challenges for Organizational Users

Organizations that are stakeholders in the community network need to share their “network” vision with their board members, managers, employees, and organizational partners within their supply chains and customer/client networks. Key individuals likely were involved in the network formation stage to ensure that the design of the systems would support expected transactions and activities. At the performance stage, each organization is challenged to mobilize its ICTs, skill base and network use, and do so in dialogue and coordination with their organizational networks. Internally, this means empowering employees and lower levels of management through information systems and decision-making authority. Externally, this refers to the network of relations and the integration of the organizational and community networks. Failure to have extensive collaboration diminishes the benefits that the community network can deliver to stakeholders. Knowledge sharing (Van den Hooff et al., 2004) and knowledge management (Ackerman & Haverton, 2004) are useful frameworks for channelling this collaboration. In addition, involvement can include intra-preneurship (Von Oetinger, 2005) and joint ventures supported by collaborative groupware (McKnight & Bontis, 2002). The organization can also reach out to innovators and entrepreneurs in the community, who view the network as their business platform, and initiate partnerships. The above array of activities pushes leaders and senior managers to adopt an organizational model that incorporates trust.

Challenges for the Community

As the community network is fully implemented, the stewardship vision (Block, 1993) incipient in the formation phase must be reinforced by extending inclusiveness to all segments of the local population, imagining a broad culture of use, and providing for economic development with a digital component. Community leaders should have concrete programs to diminish access barriers such as network connectivity at a reasonable cost (or at no cost for public terminals) and to training and education. Adoption of the network will vary across socio-economic dimensions, and programs are needed that are adapted to specific groups such as youth, seniors, and the non-profit and small business sectors. Developing and implementing these programs can take place with community stakeholders in collaborative projects. An innovation culture (Martins & Terblanche, 2003), linked to the network, can be encouraged.

A culture of “digital” use is emerging in many communities; the Internet and its many activities are being integrated into everyday routines of social communication, work, and play (Bernier & Laflamme, 2005; Crowley, 2002; Wellman et al., 2001). In contrast, civic participation has had less success. The evidence indicates that internet use reinforces civic participation and makes it more sophisticated, but does not increase the levels of activity (Shah, 2002; Uslaner, 2004; Warkentin & Mingst, 2000; Wellman et al., 2001). Pigg (2001) has argued that networks can be designed to enhance civic participation, but so far, these designs have failed to incorporate the nature of participation. The designs typically focus on customer services and support instead of sharing of information, ideas, and knowledge to influence civic decisions. With a customer focus, the civic authorities may increase the satisfaction of its citizenry, whereas a participation focus obliges the authorities to share decision-making powers and accept more uncertainty in the process and outcomes.

CONCLUSION

A community network faces four inter-related collaboration challenges during its development that are tied to transformation, resources, trust, and management. When these challenges are met, the network will have a solid culture and structure of interdependence, and the flexibility to change over time. The network will maintain a positive momentum that is constructive and manageable, and lead to medium and long-term sustainability. When these challenges are not met adequately, the pace of change will be either too slow or too fast, or blocked at some point in time. Sustainability of the network will be compromised unless the underlying issues are addressed.

These four challenges are anchored in the proposed network development model where formation and performance phases, and adaptation through reformation are critical for the sustainability of the community network. Policy makers and change agents among the stakeholders of community networks are well advised to shape their interventions with the aim of establishing and maintaining positive momentum, while paying continued attention to issues of visioning, resources, trust, leadership, and management. They would do well to expand their views of technology development to include user appropriation and the challenges that users face. They must accept the uncertainty that is inevitable with user involvement to support the goal of network sustainability.

REFERENCES

- Ackerman, M., & Haverton, C. (2004). Sharing expertise: The next step for knowledge management. In M. Huysman & V. Wulf (Eds.) *Social capital and information technology* (Chapter 11). Cambridge, USA and London, England: The MIT Press.
- Agres, C., Edberg, D., & Igarria, M. (1998). Transformation to virtual societies: Forces and issues. *The Information Society*, 14(2), 71-82.
- Albert, S. (2005). Smart community networks: Self-directed team effectiveness in action. *Team Performance Management*, 1(5), 144-156.
- Ardichvili, A., & Cardozo, R. N. (2000). A model of the entrepreneurial opportunity recognition process. *Journal of Entreprising Culture*, 8(2), 103-119.
- Arino, A., & de la Torre, J. (1998). Learning from failure: Towards an evolutionary model of collaborative ventures. *Organizational Science*, 9(3), 306-325.
- Bailey, Darlyne, & McNally-Koney, K. (1996). Interorganizational community-based collaboratives: A strategic response to shape the social work agenda. *Social Work*, 41(6), 602-610.
- Bell, R. (2001). *Benchmarking the intelligent community—a comparison study of regional communities*. The Intelligent Community Forum of World Teleport Association.
- Bernier, C., & Laflamme, S. (2005). Uses of the Internet according to type and age: A double differentiation. [Usages d'Internet selon le genre et l'age: Une double différenciation] *The Canadian Review of Sociology and Anthropology/La Revue Canadienne De Sociologie Et d'Anthropologie*, 42(3), 301-323.
- Block, P. (1993). *Stewardship—Choosing service over self-interest*. San Francisco: Berrett-Koehler Publishers.
- Blois, K. (1990). Research notes and communications—transaction costs and networks. *Strategic Management Journal*, 11, 493-496.
- Bouwen, R., & Taillieu, T. (2004). Multi-party collaboration as social learning for interdependence: Developing relational knowing for sustainable natural resource management. *Journal*

of Community & Applied Social Psychology, 14, 137-153.

Bradford, R. (2003). Public-private partnerships? Shifting paradigms of economic governance in Ontario. *Canadian Journal of Political Sciences*, 36(5), 1005-1033.

Brown, M., O'Toole, L., & Brudney, J. (1998). Implementing information technology in government: An empirical assessment of the role of local partnerships. *Journal of Public Administration Research and Theory*, 8(4), 499-525.

Canadian National Broadband Taskforce. (2001). *Report of the national broadband taskforce: The new national dream: Networking the nation for broadband access*. Ottawa, Canada: Industry Canada.

Canadian Rural Partnership. (2004, October). *Report of the advisory committee on rural issues*. Paper presented at the Third National Rural Conference, Red Deer, Canada.

Carroll, J. M., & Rosson, M. (2001). Better home shopping or new democracy? Evaluating community network outcomes. 3(1), 372-377.

Castells, M. (1996). *The rise of network society, vol. 1 of the information age: Economy, society and culture*. Oxford: Blackwell.

Castells, M. (1997). *The power of identity, vol. 2 of the information age: Economy, society and culture*. Oxford: Blackwell.

Castells, M. (1998). *End of millennium, vol. 3 of the information age: Economy, society and culture*. Oxford: Blackwell.

Caves, R. (2001). E-commerce and information technology: Information technologies, economic development, and smart communities: Is there a relationship? *Economic Development Review*, 17(3), 6-13.

Considine, M., & Lewis, J. (2003). Networks and interactivity: Making sense of front-line gover-

nance in the United Kingdom, the Netherlands and Australia. *Journal of European Public Policy*, 10(1), 46-58.

Corbett, A. (2002). Recognizing high-tech opportunities: A learning and cognitive approach. *Frontiers of Entrepreneurship Research* (pp. 49-60). Wellesley, MA: Babson College.

Crowley, D. (2002). Where are we now? Contours of the internet in Canada. *Canadian Journal of Communication*, 27(4), 469-508.

Day, C. (2002). *The information society—a sceptical view*. Malden, MA: Blackwell Publishers.

De la Mothe, J. (2004). The institutional governance of technology, society, and innovation. *Technology in Society*, 26, 523-536.

Doz, Y. (1996). The evolution of cooperation in strategic alliances: Initial conditions or learning processes? *Strategic Management Journal*, 17, 55-83.

Du Gay, P., Hall, S., Janes, L., Mackay, H., & Negus, K. (1997). *Doing cultural studies: The story of the Sony, Walkman*. London and New Delhi: Sage.

Ebers, M. (2002). *The formation of inter-organizational networks*. Oxford: Oxford University Press.

Eger, J. (2001, November). *The world foundation for smart communities*. Retrieved January 28, 2003 from www.smartcommunities.org

Evans, J., & Brooks, L. (2005). Understanding collaboration using new technologies: A structural perspective. *Information Society*, 21(3), 215-220.

Fischer, G., Scharff, E., & Ye, Y. (2004). In M. Huysman & V. Wulf (Eds.). *Social capital and information technology* (Chapter 14). Cambridge, MA and London: The MIT Press.

- Franklin, U. (1999). *The real world of technology*. Toronto: House of Anansi Press.
- Ginsburg, M. (2001, November). *Realizing a framework to create, support, and understand virtual communities*. Maastricht, Holland: Infonomics.
- Glatter, R. (2004). Collaboration, collaboration, collaboration: The origins and implications of a policy. *MiE*, 17(5), 16-20.
- Gray, B. (1985). Conditions facilitating interorganizational collaboration. *Human Relations*, 38(10), 911-936.
- Gray, B., & Hay, T. (1986). Political limits to interorganizational consensus and change. *The Journal of Applied Behavioral Science*, 22(2), 95-112.
- Gurstein, M. (2000). *Community informatics: Enabling communities with information and communications technologies* (Introduction, pp. 1-29). Hershey, PA: Idea Group Publishing.
- Hardy, C., & Phillips, N. (1998). Strategies of engagement: Lessons from the critical examination of collaboration and conflict in interorganizational domain. *Organizational Science*, 2, 217-230.
- Hock, D. (2000). Birth of the chaordic age, *Executive Excellence*, 17(6), 6-7.
- Huxham, C., & Vangen, S. (2000). Ambiguity, complexity and dynamics in the membership of collaboration. *Human Relations*, 53(6), 771-805.
- Huysman, M., & Wulf, V. (2004). *Social capital and information technology*. Cambridge, MA and London: The MIT Press.
- Huysman, M., & Wulf, V. (2005). The role of information technology in building and sustaining the relational base of communities. *The Information Society*, 21(2), 81-89.
- Igbaria, M., Shayo, C., & Olfman, L. (1999). *On becoming virtual: The driving forces and arrangements* (pp. 27-41). New Orleans, LA: ACM.
- Industry Canada. (2002a, April 4). *Fostering innovation and use*. Retrieved July 30, 2002 from <http://broadband.gc.ca/Broadband-document/english/chapter5.htm>
- Industry Canada. (2002b, April 4). *Smart communities broadband*. Retrieved July 12, 2002 from http://smartcommunities.ic.gc.ca/index_e.asp
- ITU (International Telecommunications Union). (2003). *World summit on the information society* (pp. 1-9). Retrieved from www.itu.int
- Jarillo, C. (1988). On strategic networks. *Strategic Management Journal*, 9(1), 31-41.
- Jones, C., Herterly, W., & Borgatti, S. (1997). A general theory of network governance: Exchange conditions and social mechanisms. *Academy of Management Review*, 22(4), 911-945.
- Keenan, T., & Trotter, D. (1999). The changing role of community networks in providing citizen access to the Internet. *Internet Research. Electronic Networking Applications and Policy*, 9(2), 100-108.
- Kickul, J., & Gundry, L. (2000). Pursuing technological innovation: The role of entrepreneurial posture and opportunity recognition among internet firms. In *Frontiers of Entrepreneurship Research*, MA: Babson College.
- Lawrence, T., Phillips, N., & Hardy, C. (1999). Watching whale watching. *The Journal of Applied Behavioral Science*, 35(4), 479-502.
- LeBrasseur, R., Whissell, R., & Ojha, A. (2002). Organizational learning, transformational leadership and implementation of continuous quality improvement in Canadian hospitals. *Australian Journal of Management*, 27(2), 141-162.
- Lowndes, V., & Skelcher, C. (1998). The dynamics of multi-organizational partnerships: An analysis of changing modes of governance. *Public Administration*, 76, 313-333.

- Martin, L., & Matlay, H. (2003). Innovative use of the Internet in established small firms: The impact of knowledge management and organizational learning in accessing new opportunities. *Qualitative Market Research*, 6(1), 18-26.
- Martins, E. & Terblanche, F. (2003). Building organisational culture that stimulates creativity and innovation. *European Journal of Innovation Management*, 6(1), 64-74.
- May, C. (2002). *The information society—A sceptical view*. Cambridge, UK: Polity Press.
- McKnight, B. & Bontis, N. (2002). E-improvisation: Collaborative groupware technology expands the reach and effectiveness of organizational improvisation. *Knowledge and Process Management*, 9(4), 219-227.
- New Economy Development Group Inc. (2001). *Sustainability project on sustainable communities*. Paper presented at the Canadian Rural Partnership. Rural Research and Analysis, Government of Canada.
- Nooteboom, B. (1999). Innovation and inter-firm linkages: New implications for policy. *Research Policy*, 28(8), 793.
- OECD. (1997). Organisation for economic co-operation and development. *Towards a global information society*. Paris: OECD.
- OECD. (2004). Organization for economic co-operation and development. *Information and communication technologies and rural development*. Paris, France: OECD Publication Service.
- Oliver, A., & Ebers, M. (1998). Networking network studies: An analysis of conceptual configurations in the study of inter-organizational relationships, *Organization Studies*, 19, 549-83.
- Olk, P., & Young, C. (1997). Why members stay in or leave an R&D consortium: Performance and conditions of membership as determinants of continuity. *Strategic Management Journal*, 18(11), 855-877.
- O'Toole, L. (1997). Treating networks seriously: Practical and research-based agendas in public administration. *Public Administration Review*, 57(1), 45-52.
- Ouchi, W. (1980). Markets, bureaucracies, and clans. *Administrative Science Quarterly*, 1, 129-141.
- Pettigrew, A. (1992). The character and significance of strategy process research. *Strategic Management Journal*, 13, 5-16.
- Pettigrew, A. (1987). Context and action in the transformation of the firm. *Journal of Management Studies*, 24(6), 649-670.
- Pigg, K. (2001). Applications of community informatics for building community and enhancing civic society. *Information, Communication & Society*, 4(4), 507-527.
- Pissarra, J., & Jesuino, J. (2005). Idea generation through computer-mediated communication: The effects of anonymity. *Journal of Management Psychology*, 20(3/4), 275-291.
- Poyhonen, A., & Smedlund, A. (2004). Assessing intellectual capital creation in regional clusters. *Journal of Intellectual Capital*, 5(3), 351-365.
- Ring, P. (2002). Processes facilitating reliance on trust in inter-organizational networks. In M. Ebers (Ed.), *The formation of inter-organizational networks* (pp. 113-45). Oxford, England: Oxford University Press
- Ring, P., & Van de Ven, A. (1994). Developmental processes of cooperative interorganizational relationships. *Academy of Management Review*, 19, 90-118.
- Roberts, N., & Bradley, R. (1991). Stakeholder collaboration and innovation: A study of public policy initiation at the state level. *Journal of Applied Behavioral Science*, 27(2), 209-227.
- Rycroft, R. (2003). Technology-based globalization indicators: The creativity of innovation

- network data. *Technology in Society*, 25(3), 299-317.
- Scheel, C. (2002). Knowledge clusters of technological innovation systems. *Journal of Knowledge Management*, 6(4), 356-367.
- Shah, D. (2002). Nonrecursive models of internet use and community engagement: Questioning whether time spent online erodes social capital. *Journalism & Mass Communication Quarterly*, 79(4), 964-987.
- Snow, C. & Thomas, J. (1993). Building networks: Broker roles and behaviours. In P. Lorange, B. Chakravarthy, J. Roos, & A. Van de Ven (Eds.), *Implementing strategic processes: Change, learning and co-operation* (pp. 217-38). Oxford: Blackwell.
- Sorensen, E. (2002). Democratic theory and network governance. *Administrative Theory & Praxis*, 24(4), 693-720.
- Stevenson, T. (2002). Communities of tomorrow. *Futures*, 34(8), 735-744.
- Suire, R. (2004). Des réseaux de l'entrepreneur aux ressorts du créatif Quelles stratégies pour les territoires? *Revue Internationale PME*, 17(2), 123-143.
- Tan, M. (1999). Creating the digital economy: Strategies and perspectives from Singapore. *International Journal of Electronic Commerce*, 3(3), 105-22.
- United Nations. (1998). *Knowledge societies: Information technology for sustainable development*. Report prepared by R. Mansell & U. Wehn. Oxford: United Nations Commission on Science and Technology for Development/Oxford University Press.
- Uslaner, E. M. (2004). Trust, civic engagement, and the Internet. *Political Communication*, 21(2), 223-242.
- Van de Ven, A. & Poole, M. (1995). Explaining development and change in organizations. *Academy of Management Review*, 20(3), 510-540.
- Van den Hooff, B., de Ridder, J. & Aukema, E. (2004). Exploring the eagerness to share knowledge: The role of social capital and ICT in knowledge sharing. In M. Huysman, & V. Wulf (Eds.), *Social capital and information technology* (Chapter 7). Cambridge, USA and London, England: The MIT Press.
- Von Oetinger, B. (2005). From idea to innovation: Making creativity real. *The Journal of Business Strategy*, 25(5), 35-41.
- Waits, M. (2000). The added value of the industry cluster approach to economic analysis, strategy development, and service delivery. *Economic Development Quarterly*, 14(1), 35-50.
- Warkentin, C., & Mingst, K. (2000). International institutions, the state, and global civil society in the age of the World Wide Web. *Global Governance*, 6(2), 237-257.
- Wellman, B., Haase, A. Q., Witte, J., & Hampton, K. (2001). Does the internet increase, decrease, or supplement social capital? Social networks, participation, and community commitment. *American Behavioral Scientist*, 45(3), 436-455.
- Wheelan, S. (1999). *Creating effective teams: A guide for members and leaders* (p. 154). Thousand Oaks, CA: Sage Publications.
- Williams, R., Stewart, J., & Slack, R. (2005). *Social learning in technological innovation—Experimenting with information communication technologies*. Cheltenham, UK and Northampton, USA: Edward Elgar.
- Wood, D., & Wood, G. (1991). Toward a comprehensive theory of collaboration. *Journal of Applied Behavioral Science*, 27(2), 139-162.
- World Bank (1999). *World development report 1998/99: Knowledge for development*. New York: Oxford University Press.

Zollo, M., Reuer, J., & Singh, J. (2002). Interorganizational routines and performance in strategic alliances. *Organizational Science*, 13(6), 701-713.

ENDNOTES

- ¹ The authors acknowledge the helpful comments of the reviewers. By addressing their concerns and suggestions, this article found a better balance between organizational and involvement issues.
- ² Multi-organizational collaboration, partnerships, and networks are considered interchangeable terms and refer to a variety of organizations collaborating for a common purpose. "Collaborative network" is proposed as an inclusive alternative.

- ³ A stakeholder is defined as an organization that contributes programs and services to the network. A partner is one that makes a financial contribution to the overall project.
- ⁴ The term downloading has become a popular expression in Canada as a result of higher levels of government shifting responsibility for programs to lower levels of government. Municipalities have inherited a number of costs and responsibilities previously held by the province and the province has inherited responsibilities previously held by the federal government.
- ⁵ These communities have been highlighted at the annual conference of ICF (Intelligent Communities Forum).

This work was previously published in International Journal of Technology and Human Interaction, Vol. 3, Issue 2, edited by B. C. Stahl, pp. 13-33, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.23

Patents and Standards in the ICT Sector: Are Submarine Patents a Substantive Problem or a Red Herring?

Aura Soininen

*Lappeenranta University of Technology, Finland
Attorneys-at-Law Borenius & Kempainen, Ltd, Finland*

ABSTRACT

Multiple cases have been reported in which patents have posed dilemmas in the context of cooperative standard setting. Problems have come to the fore with regard to GSM, WCDMA, and CDMA standards, for example. Furthermore, JPEG and HTML standards, as well as VL-bus and SDRAM technologies, have faced patent-related difficulties. Nevertheless, it could be argued that complications have arisen in only a small fraction of standardization efforts, and that patents do not therefore constitute a real quandary. This article assesses the extent and the causes of the patent dilemma in the ICT sector through a brief analysis of how ICT companies' patent strategies and technology-licensing practices relate to standard setting and by exemplifying and quantifying the problem on the basis of relevant articles, academic research papers, court cases

and on-line discussions. Particular attention is paid to so-called submarine patents, which bear most significance with respect to the prevailing policy concern regarding the efficacy of the patent system.

INTRODUCTION

Background

Our society is filled with various types of standards, commonly agreed ways of doing things. Standards may be sociocultural, political, economic, or technical. Language is a standard, the metric system is a standard, and so is our social etiquette (Cunningham, 2005). Technical standards could be defined as any set of technical specifications that either provide or are intended to provide a common design for a product or a

process. They range from a loose set of product characterizations to detailed and exact specifications for technical interfaces. Some of them control product interoperability, some ensure quality or safety, and some are so-called measurement standards (Grindley, 2002).

Particularly interoperability/compatibility standards are paramount in industries such as information and communications technology (ICT) that are dependent on interconnectivity. In fact, the telecommunications industry has relied on them throughout its history. These standards define the format for the interface, allowing different core products, often from different manufacturers, to use the same complementary goods and services, or to be connected together as networks (Grindley, 2002; Teece, 2000). Thus, interoperability standards enable gadgets to work together and thereby they further the goal of increased communicative potential. This follows that their use may also lead to financial benefits due to so-called network externalities (Cunningham, 2005; Shurmer & Lea, 1995). These strong network effects are present when a product or a service becomes more valuable to users as more people use it. Examples of products that benefit from network effects include e-mail, Internet access, fax machines, and modems (Shapiro & Varian, 1999).

A further economic effect of interoperability standards is that they reduce the switching costs from one supplier to another by preventing producers and consumers from being locked into a proprietary system. Standards, however, do not totally eliminate switching costs. When producers and users become committed to a particular system or standard, and the longer they stay with it, the more expensive and difficult it is for them to switch to another that is comparable (Blind, 2004). Consequently, due to these strong economic effects, control of the outcome of standard setting may yield significant economic advantage on the sale of both core and related products (Hjelm, 2000). Patents that provide their holders with

a defined right to prevent others from making, using and selling an invention can be used to gain that leverage or to control the adoption of a standard. Therefore, potential conflicts between patent rights and the need for standardization affect the ICT industry and the consumers at large, and these economic effects need to be bared in mind when examining the deficiencies of prevailing standard-setting procedures and the legal framework.

This article studies the patent-related dilemmas that may arise both in the course of standard setting and after the standard has been established. Potential conflicts and their causes are identified and exemplified on specific case studies, and the study of Blind, Bierhals, Thumm, Hossain, Sillwood, Iverser, et al. (2002) is used to quantify the problems further. The aim is to find out whether the problem with patents, particularly with so-called submarine patents, is substantial, or whether it is only a minor concern that has attracted undeserved attention. Term “submarine patent” is used here for patent applications and patents that may yield significant economic power because they “read on” a standard and come to the fore after it has been established.

Standardization and Patents in General

Standards can be established in many ways: the markets determine *de facto* standards, and organized standards bodies agree upon *de jure* standards. These bodies could be said to include government legislators, official standards organizations, various industry committees, and consortia. Unlike *de facto* standards, *de jure* standards are usually established in advance and are later implemented by multiple vendors (Grindley, 2002; Messerschmitt & Szyperski, 2003; Mueller 2001).

Standards emerge from all the sources in the ICT sector listed previously. The Internet Society (ISOC), the Organization for the Advancement of Structured Information Standards (OASIS), the

World Wide Web Consortium (W3C), and the Internet Engineering Task Force (IETF) could be mentioned as examples of bodies active in the field of software and the Internet. Then again, the European Telecommunications Standardization Institute (ETSI), the American National Standardization Institute (ANSI), the International Telecommunications Union (ITU), and the International Organization for Standardization (ISO) could be mentioned as organizations operating in the telecommunications industry (Rahnasto, 2003).

A further distinction is that between open and proprietary standards. The purpose of open standards is to provide an industry with well-documented open specifications that could be implemented without prior business and legal arrangements (Caplan, 2003; Messerschmitt & Szyperski, 2003). Furthermore, with open standards, unlike proprietary standards, development of the specification is open to participants without restrictions. The openness may not always be absolute, however, and as a consequence the term “open standards” has various interpretations in practice (Caplan, 2003; Messerschmitt & Szyperski, 2003). In fact, although patent-free standards have traditionally been preferred in the interests of ensuring their success and promoting their use, it has become more difficult to design standards that do not contain any patentable inventions. This holds true particularly when the aim is to choose pre-eminent technology for a standard (Frank, 2002; Soininen, 2005). Therefore, it is not rare to call a standard open even if it includes patented technology providing that licenses are accessible to all. This definition has been adopted in this article as well.

As to the connection between de facto and de jure standards and open and proprietary standards, privately set de facto standards are typically proprietary in nature (Lemley, 2002) meaning that the patent holder controls their utilization. Then again, official standards organizations typically promote open standards, and those originating

from various industry groups and consortia may fall in either category or somewhere in between depending on whether everyone has been able to participate in the selection of the technical specification, or whether the standard has been agreed upon by a handful of companies having the technical knowledge in the area and who then have it adopted throughout the industry (Rahnasto, 2003). The focus of this article is on open, commonly agreed de jure standards.

As said earlier, although open standards are in principle available for anyone to use proprietary technology may be involved in their implementation, and using the specification may require a license (Rahnasto, 2003). Consequently, many official standards organizations and also some consortia have policies that permit their members to contribute proprietary technology under certain conditions: disclosure of the contributor’s essential patents may be required, and before the technology is elected, patent holders are asked whether they are willing to offer a license at least on a non-discriminatory basis and on fair and reasonable terms (Frank, 2002). The purpose is to protect the patent holder’s interests while fostering standards that incorporate the best technology and have the capacity for worldwide promulgation (Berman, 2005; Soininen, 2005). These organizations are called together as “standards bodies” or “standards organizations” from now on.

From the companies’ perspective the dilemma between patents and open standards arises from the need to ensure returns on R&D investments through the exclusion of others while interoperability requires the inclusion of other parties. In fact, patent holders are free to refuse licensing altogether or they may choose the licensees and the licensing terms freely as long as the practice complies with relevant legislation, such as competition regulation/ antitrust regulation. Thus, companies appear not to be very willing to license their patented technologies to everyone, particularly not to their competitors, on a royalty-free basis or for low returns. It seems, however, that in the context of

common standards a limited exception can often be made for business reasons (Interview data U.S., 2004). Indeed, the use of common protocols and interfaces may expand the markets for networks of products that implement them, and producers then compete by innovating on top of the standardized functions (Peterson, 2002a). Nonetheless, even if a company decided to take part in standard setting, the interests of firms, individual contributors and users participating diverge and patents may be utilized strategically to achieve patent holder's objectives. Consequently, the standardization process may turn out to be burdensome as the mere existence of vested interests, for example, intellectual property rights (IPRs), complicates matters (Farrell, 1996; Shurmer & Lea, 1995; Soininen, 2005). Identifying relevant patents and agreeing on their beforehand cause complications and delays to the standardization process.

The relationship between ICT companies' patent strategies and technology licensing practices discussed earlier in general and in respect to open standards is one of the main questions that need to be addressed further in order to find an explanation to why it is that patents may raise such thorny issues in respect to standards. Moreover, attention has to be paid to the standards organizations' practices and bylaws aimed at reducing that tension in practice.

Standardization and Submarine Patents

As mentioned earlier, different types of standards bodies play an important role in establishing standards in the ICT sector, and many of them allow patented or patentable technology to be submitted, but specifically require disclosure of the patents and occasionally even of pending patent applications during the standardization process, as well as their licensing. This is to clarify relevant rights during the process of standard development and reduce the risks of submarine patents so that patent holders cannot claim infringements

afterwards, and thereby prevent others from using a standard, or to extract overly high licensing fees. If all essential, relevant rights are clarified during the process, a well-informed decision can be made (Kipnis, 2000). It might also be possible to design around the identified patents and patent applications, or to choose another technology for a standard. In fact, since patent-free standards are often the first choice, disclosure may have a negative effect on what technology is chosen (Soininen, 2005). For instance, when selecting the GSM standard another viable option was apparently rejected because it was considered too proprietary (Bekkers, Verspagen, & Smits, 2002).

Since proprietary technology may easily be discriminated, companies may even have an incentive to manipulate the standardization process and hide the fact that they have relevant patents. Standardization namely gives patents market power they did not have before (Rahnasto, 2003), which in turn improves the holder's negotiation position following the election and adoption of a standard. Furthermore, the disclosure requirement has its shortcomings and therefore companies may not even need to break the rules to capture an industry standard. The disclosure requirement is not necessarily extended beyond the personal knowledge of the individual participant, it may not be practically possible for a company to clarify all the patents and patent applications, and the obligation does not always cover pending patent applications, especially unpublished ones (Lemley, 2002). Consequently, a large share of the rights is not necessarily considered during the standardization process. Moreover, since standard setting may take a long time, many years in some cases, undertakings usually continue their R&D projects and file more and amend their existing patent applications during that period. Therefore, if the obligation to disclose does not hold throughout the standard setting, it is even more likely that patents will surface after it has been established (Soininen, 2005).

The optimal scope of the disclosure requirement, what happens if the guidelines are breached, and what course of action should be taken if there was no contractual duty or even a recommendation to disclose patents or pending applications and a patent surfaces after the adoption of the standard, remain matters for debate both outside and inside the courts. The submarine patent risk stemming partially from non-disclosure also involves third-party patents. Indeed, as Lemelson's submarine patent tactic has demonstrated, it is ideal from the patent holder's perspective to have a patent claiming technology that becomes widely adopted within an industry (Soininen, 2005). In fact, the submarine patent scenario could be said to have become more probable in recent years as numerous cases have been reported in which, despite efforts to identify relevant patents, claims have surfaced after the standard has been agreed upon (Blind et al., 2002). Furthermore, the importance of patents in business has increased in many respects and the legal framework constituting of patent laws and competition/antitrust regulation that may pose limits to the utilization of patents could also be described as pro-patent even though the system has been severely criticized (FTC, 2003; OECD, 2004). This has resulted not only in a higher number of applied-for and granted patents, but also in more aggressive enforcement and increases in technology licensing, bare patent licensing and cross-licensing, which in turn has the potential of generating more conflicts (Peterson, 2002). In fact, it appears that there is an increase in all types of patent claims and charges that relate to standards, and particularly in telecommunications, negotiations over such matters cause delays in the development of standards worldwide (Krechmer, 2005). Therefore it is essential to study the patent landscape in the ICT sector further, take a closer look at realized disputes and examine the loopholes of the system. Only by understanding how it is failing, it is possible to implement better practices.

Standardization and Licensing

There is another quandary involving patents and standards in addition to the submarine patent dilemma described earlier, and that has to do with licensing. This dilemma relates mainly to the mainstream obligation to license one's essential patents on fair, reasonable and non-discriminatory terms (RAND). The problem is that this problem may be limited in firms' patent statements in various ways, resulting in unexpected hold-ups. Companies may, for example, agree to license only patents that are essential for using that portion of the standard they have suggested, or they may impose limits by stating that licenses are available to any qualified applicants (Frank, 2002; Rahnasto, 2003; Soininen, 2005). One typical qualification is that licenses are offered only to companies that offer reciprocal treatment or promise not to threaten patent litigation against the licensing company (Berman, 2005). Moreover, specific licensing terms are not typically agreed upon during the standardization process so that the standards organization would play a role in it (Kipnis, 2000). Each company negotiates terms separately, which allows it to apply its own interpretations of what is considered fair, reasonable and nondiscriminatory (Frank, 2002; Rahnasto, 2003). In fact, it is for this reason that manufacturers participating in standards committees may even be forced to delay the standards development in order to negotiate acceptable terms before the final vote. The worst-case scenario is that the sum of license fees exceeds the total profit available to a product manufacturer, and that the standard never becomes adopted (Krechmer, 2005). Ultimately, consideration of the fairness, reasonableness and nondiscriminatory nature of the terms is left to the courts (Soininen, 2005). So far, however, the courts have not provided proper guidelines on how to determine what is fair, reasonable and nondiscriminatory (Rahnasto, 2003).

Thus, the problems related to the adoption of standardized technology may have to do with dis-

agreement over the content of a company's licensing statement, even in the absence of submarine patents. One might even wonder, considering the large number of patents that are being reported as essential in the course of standardization, whether the disclosure obligation bears any significance in practice. Therefore, it is not enough to concentrate merely on the submarine patent problem and its causes when there is a possibility that limiting that particular risk might have only minimal effect.

Research Objective and Methodology

Standard setting is the cornerstone of today's economy, and it is essential particularly in the ICT sector. The most important feature of open standards is that they have the potential to become widely promulgated and used without undue restriction: this is essential to their success and to the very idea of something being or becoming a standard. Patents may, however, be used exclusively and therefore they may jeopardize the purpose for which standards have been created. Indeed, submarine patents as well as perplexity regarding proper licensing terms may result in increased costs in the form of excessive licensing fees, or they may force the industry to abandon the standard altogether meaning that the societal benefits may be lost. Since patents help companies to gain leverage over the standard-setting procedure and the adoption of the standard, potential dilemmas addressed in this article are also a policy concern. One may ask particularly in the context of so-called submarine patents whether the patent system fulfils its goal. These patents have factually been hidden and thus they have not contributed to technological development of that specific industry, as is the purpose of the patent system.

This article examines the patent-related dilemmas and analyses their causes by exemplifying and quantifying them on the basis of newspaper stories, online articles, research papers, and trial

documents. Further data was collected from interviews with eleven Finnish ICT companies and eight U.S. ICT companies in order to illustrate the relationship between patent strategies and licensing practices in general and in the context of standard setting. The interviews with the Finnish companies focused on patent strategies and were conducted by the author in 2003. Those with U.S. companies based in the Bay Area, CA, were more general and related to their innovation models, appropriability strategies and licensing practices. They were conducted by the author in cooperation with Pia Hurmelinna-Laukkanen and were completed in 2004. The interviewed firms included different types of ICT companies operating in the fields of information technology (software, hardware and related services for different purposes), chip interface technology, audio technologies, and digital entertainment products designed for computers and the Internet, and telecommunications. It should be noted that most of the U.S. case companies were larger than the Finnish companies, their revenues spanning from \$60 million to \$19,000 million. Furthermore, the size of their patent portfolios was substantially larger and varied mostly between 300 and 2,000 issued patents (one of the companies did not have patents at all). Only one Finnish company had a substantial portfolio of over 5,000 issued patent families, two of them had a medium-sized portfolio of approximately 60 issued patent families and close to 200 pending applications, and the rest had less than 10 issued patents/pending patent applications. The U.S. companies were also more actively involved in standard setting than the Finnish companies.

Obviously, it is difficult to make generalizations on the basis of such limited data. Thus, the data are used to complement other studies and views presented in the literature. In some cases, however, there were common features applicable to all of the firms, or several of them were found to have certain common denominators. Then again, some of the results are presented as examples of

corporate operational models. One reason for this is that the interviews were in-depth in nature, meaning that the discussion was sometimes focused more on certain areas, and it would not therefore be possible to say whether the expressed views were common to all of the companies or not. Furthermore, in some situations less than 8 (U.S.) or 11 (Finnish) companies yielded relevant data: only a few companies in the Finnish sample were involved in setting standards. In the following, I refer to the interview data as interview data U.S. (2004) and interview data Finland (2003).

I will start by re-examining the submarine patent concept because the original meaning of submarine patents has largely disappeared as a result of legislative amendments. Nevertheless, certain aspects of the current patent law still contribute to their existence. I will then study ICT companies' patent strategies and technology licensing practices in order to demonstrate the general developments in the area and tensions between proprietary and open operation models and their implications on standardization. After that I will review the disclosure and licensing challenges that have been reported in the context of standardization and patents, and examine the likelihood of such conflicts. I conclude the article by considering the extent of the problems and whether the submarine patent problem really exists and can be limited, or whether it is merely a red herring that needs no further attention. It should however be noted that the sufficiency and flexibility of the prevailing legal framework applicable to solving potential conflicts is not particularly examined in this article even though it is clear that applicable legal tools influence companies' negotiation power, and thereby their behavior during and after standard setting. These legal tools could also prove helpful in minimizing the harmful societal effects of submarine patents. This type of in-depth analysis would be the next phase following the recognition of the prevailing problem, its magnitude and main causes.

THE ORIGINS OF SUBMARINE PATENTS

The term submarine patent has been traditionally used to refer to (U.S.) patents that are issued after a long, intentionally delayed pendency at the patent office. The purpose of prolonging the application period by filing continuation applications, for example, has been to keep the invention secret as long as necessary for the industry to mature on the basis of the technology. When the industry is faced with the challenge of changing the technology, the patent is allowed to be issued, and the patent holder is in a position to prevent others from utilizing the invention and to demand royalties from those who began to use the technology while the application was pending (Heinze, 2002). Indeed, in the U.S. it is possible to file continuation applications and to preserve the priority date of the parent application as long as the parent application and the following continuation application disclose the same invention. There are no limitations on how many times a parent application can be continued (Graham & Mowery, 2002). The application period may thus last over a decade, and all this may happen even if the patent has not made any contribution to the development of the technology it covers: if it has been secretly pending for a long time, no-one has had the opportunity to find out about the invention, design alternative technologies, or develop the patented technology further. Thus, the trade-off between the inventor (the right to exclude others) and society (detailed information about the invention), the keystone of the patent system, is not in balance (Soininen, 2005). Figure 1 illustrates the popularity of continuations in relation to software and other patents in the U.S.

It is clear from the statistics in Figure 1 that continuations are filed frequently. Nevertheless, submarine patents as defined earlier are rare. In many cases it is inefficiency in the patent office that causes long delays rather than intentional postponement on the patentee's part (Ferguson,

1999). Nonetheless, Jerome Lemelson's patents in particular, issued after decades of pendency at the patent office, have attracted a lot of public attention (Stroyd, 2000; Varchaver, 2001). Lemelson, who was above all a visionary who anticipated where technology was heading, applied for patents for inventions that he did not himself implement, and amended his applications when necessary to prevent them from being issued. Some of his applications were continued half a dozen times, potentially adding years to the process each time (Varchaver, 2001). He claimed a total of more than 500 patents on basic technologies used nowadays in industrial robots and automated warehouses, as well as in fax machines, VCRs, bar-code scanners, camcorders, and the Sony Walkman. His "machine vision" patent No. 5,283,641 was issued after 42 years of pendency (Stroyd, 2000; Ferguson, 1999; The Lemelson Foundation, n.d.; Soininen, 2005).

Lemelson was active in enforcing his rights. Once someone had developed a product that had some relation to one of his patents, the potential violator was confronted and reasonable compensation was demanded. Aggressive enforcement continues even today, after the death of Lemelson himself. Although quite a few of his patents have been challenged in court, over 750 companies paid royalties for them in 2001 (Soininen, 2005; Stroyd, 2000; Varchaver, 2001). Lemelson is not the only one to have used submarine patenting tactics, however. Another famous example is Gilbert Hyatt, whose patent for a single-chip microcontroller was issued in 1990 after 20 years of pendency. It was successfully challenged by Texas Instruments, but by that time Hyatt had already been able to collect approximately \$70 million in royalties. Submarine patentees also include Olof Soderblom, whose patent for token-ring technology was pending in secrecy in the USPTO for 13 years until it was granted in 1981 (Heinze, 2002). While the application was pending, other companies developed token-ring technologies independently. This development took place in

connection with a public-standard-setting process carried out by the Institute of Electrical and Electronic Engineers (IEEE). Since Soderblom's patent surfaced companies have been forced to pay him more than 100 million dollars in royalties (IPO, n.d.; Soininen, 2005).

Legal Changes and the Tactics of Submarine Patenting

Since Lemelson's, Hyatt's, and Soderblom's times the U.S. Congress has taken action and amended patent laws in order to discourage submarine patenting. The change from the 17-year patent term counted from the day of issuance to a 20-year term starting from the application date took place in 1995 in accordance with the GATT agreement (Graham & Mowery, 2002). Consequently, a prolonged application period reduces the life of an issued patent. Another amendment made in 1999 was related to the publication of patent applications within 18 months from filing. Although there are exceptions to this rule, the change has reduced the prospect of surprising an industry before 1999 all patent applications filed in the U.S. remained secret until the patent was issued (Graham & Mowery, 2002; Heinze, 2002; Soininen, 2005). A further modification to the Patents Act that would obligate disclosure of all patent applications within 18 months has also been proposed recently before Congress. The introduced bill, H.R. 2795: Patent reform Act of 2005, is currently in the committee hearing phase (GovTrack.us, n.d.).

Furthermore, the U.S. Court of Appeal for the Federal Circuit held some years ago in the Symbol Technologies et al. v. Lemelson case that the equitable doctrine of prosecution laches, which is one of the defenses that can be used in patent infringement cases in order to demonstrate that even though there was a patent infringement, the patent should be held unenforceable, can be applied when the patent is issued following an unreasonable and unexplained delay by the applicant

during the patent prosecution. Here, it does not matter whether the patentee's practice of keeping the application pending for many years has been accomplished strictly in accordance with the rules or not (Calderone & Custer, 2005; Soininen, 2005; *Symbol Technologies Inc. v. Lemelson Medical, Education & Research Foundation*, 277 F.3d 1361, 1363 (Fed. Cir. 2002); *See also Symbol Technologies, Inc et al. v. Lemelson Medical, Education & Research Foundation, LP et al.*, 422 F.3d 1378 (Fed. Cir. 2005)).

Thus, it has been confirmed that the doctrine of laches, a defense based on prolonged patent application period, can sometimes be used for protecting an infringer from the harmful effects of submarine patents. Moreover, it is not only after the patent has been granted that the doctrine of prosecution laches can be applied. The Federal Circuit made it clear in the *In re Bogese* case that it is possible for the USPTO to address the issue before the patent is granted, and to reject it on this basis (*In re Bogese II*, 303 F.3d 1362, 1367 (Fed. Cir. 2002)). As far as Europe is concerned, patent applications have traditionally been automatically published within 18 months from filing, and the 20-year patent term has begun from the filing date. Moreover, although it is possible to file divisional applications, continuations are not allowed (Graham & Mowery, 2002; Soininen, 2005).

Submarine Patents Today

If submarine patents are defined narrowly as meaning patents issued after a long, intentionally delayed, secret pendency at the patent office, they do not seem to exist. Nonetheless, despite the legal amendments, circumstances in which patent applications are concealed long enough for the industry to start using a technology without knowing about the lurking patent arise particularly in fields characterized by fast technological development. In some parts of the ICT industry, for example, 18 months of secrecy may already be too long, and prolonging the application phase intentionally

is not required for achieving the intended result (Soininen, 2005). Furthermore, patent applicants filing only in the U.S. may currently opt out of the 18-month publication rule and file continuations in order to detect industry developments and to postpone the grant of the patent for five years or so. Since the U.S. is a large and relatively lucrative market, particularly in the computer and software sector (Mueller, 2001), many companies do not even seek international patent protection. Also, provided that the numbers of filed ICT patent applications and granted patents continue their upward trend (OECD, 2005; OECD, 2004), it is getting more and more difficult to be aware of all relevant patents and applications. Especially if inventions are systemic, and innovation is fast and cumulative, multiple patented or patentable inventions may be incorporated into one innovation (Bessen, 2003; FTC, 2003), and therefore infringement is not merely a coincidence that can be avoided but is likely no matter how well the patents and pending patent applications are screened (Interview data U.S., 2004; Watts & Baigent, 2002). For this reason, published patent applications and granted patents may, in reality, be hidden (Soininen, 2005).

Another issue that has to be taken into account is that the scope of a patent typically changes during prosecution. Patent examiners often come up with patentability bars during examination, and require that the scope is limited in some way. Furthermore, as mentioned, the applicant may be able to add and amend patent claims during prosecution so that the scope will better reflect developments in the industry. Here the original application sets the limits for such changes, as its claims must support the new claim and no new matter can be included (EPC, Art 123; Mueller, 2001). As a consequence, although patent application might have been deemed non-essential at the time it was first published, the situation may change before it is granted. Certainly, one element of surprise relates to claim interpretation. Although a patent is a relatively well-defined right,

the boundaries are never exact. The scope is not clear until it has been tested in court.

The concept of the submarine patent is understood in this article as broadly referring to patent applications and patents that surface after the standard has been established and take the industry by surprise. Here it does not matter, whether the patent application has been secretly pending or not, even though this possibility certainly contributes to the problem.

Tensions between patents and standards are examined in the following, and the problem of submarine patents and its causes are identified and exemplified further. ICT companies patent strategies and technology-licensing practices are analyzed briefly at first in order to place the dilemmas between patents and standards into a broader context and to find those practical elements that may contribute to them.

PATENT STRATEGIES AND TECHNOLOGY LICENSING PRACTICES IN THE ICT SECTOR

General Developments

With the shift from an industrial economy toward an information economy, the importance of intellectual property rights (IPRs) has increased. Today, a large proportion of companies' assets constitute intangibles, and IPRs are used to protect and profit from certain of these. Patents, for instance, provide their holders with the right to forbid others from utilizing patented inventions. Holders may thus gain competitive advantage due to their ability to stand out from the competition, or they may use their position to choose their licensees, which is one of their core rights due to the exhaustion doctrine (Kipnis, 2000). Then again, if the patent holder issues a license, as a rule he is entitled to secure any monetary or other compensation he is able to extract from the licensee (Shurmer & Lea, 1995) as long as the licensing

terms are coherent with relevant regulation. The objective of licensing is to generate more revenue for the undertaking than it would be able to produce if it manufactured the patented products or utilized patented methods only by itself. Indeed, a well-reasoned licensing program helps a company to position itself favorably in the market place (Megantz, 2002; Soininen, 2005).

Obviously, there are differences between industries with respect to licensing tendencies, but generally speaking, the markets for technology licensing the component of which patents have grown. In fact, in a survey conducted by the OECD/BIAC, 60% of the responding companies reported increased inward and outward licensing, and 40% reported increased cross-licensing. Other types of knowledge sharing have become more common too, and collaboration takes place in the form of sponsored and collaborative research, strategic alliances, as well as in mergers and acquisitions. This has been said to stem from the growing technological complexity, increased technological opportunities, rapid technological change, intense competition, and the higher costs and risks of innovation. As a consequence, companies have namely become more focused on certain areas while they acquire complementary technologies increasingly from other undertakings and universities (OECD, 2004).

The features mentioned previously apply also to the ICT sector, and companies lean heavily on cooperation and networks. Contemporary academic literature refers to this type of innovation as the open innovation model, in contrast to the closed model that used to dominate. Companies applying the closed model seek ultimate control and do everything themselves, while those adopting open innovation realize that valuable ideas do not only originate within their firms, and that it does not have to be the company itself that releases these ideas in the market. Whereas making innovation proprietary and exclusive is a central feature of the closed innovation model, open innovation is characterized by the exploitation of intellectual

property in order to create value. The boundary between the company and its environment is said to have become more permeable, enabling ideas and knowledge to flow more freely (Chesbrough, 2003).

One further characteristic of the competitive environment of the ICT sector is so-called co-competition that was pointed out by one of the U.S. interviewees. Co-competition basically means that companies may very well be business partners in some fields and compete aggressively in others (Interview data U.S., 2004). Naturally, all the elements mentioned before signaling the importance of networks, openness in innovation, and co-competition are reflected in ICT firms' patenting practices, the use of patents in their business, enforcement and infringement avoidance. Furthermore they affect the technology licensing tendencies and licensing terms. Similarly it is possible to detect their implications on standardization and also on settling of disputes as some of the example cases discussed later on demonstrate.

The U.S. Patent Landscape

The patent landscape of the U.S. ICT sector could be described as a thicket to the birth of which strong patent system, technological complexity and fast technological development have contributed. Thus, although a reading of the patent laws gives the impression that there is a correspondence between a product and a patent, this is not necessarily the case: patents may overlap, and the manufacture of one product may require access to hundreds or thousands of patents, or one patent may "read on" many types of products, not just one (FTC, 2003). Therefore, in order to avoid the resulting hold-up problem, many U.S. ICT companies employ defensive patent strategies, and if they have the resources to do so they build large patent portfolios in order to guarantee that others cannot prohibit them from innovating. This in turn increases the number of relevant patents in the industry. Naturally, in addition to the better

negotiation position and increased ability to agree on the licensing and cross-licensing they facilitate, patents also provide the means to prevent outright imitation in these cases (FTC, 2003; Interview data U.S., 2004; Soininen, 2005).

In general, the significance of patents as protection mechanisms used to exclude others and thus to generate competitive advantage appears not to be very high in the ICT field, and it is rather competition that spurs innovation in this sector (FTC, 2003). This was reflected in the patent-enforcement activities of the U.S. companies that were interviewed, and which operated on the basis of a defensive patent strategy. Unlike the company that employed an offensive patent strategy and attempted to generate its revenues from technology and patent licensing, defensively operating firms focused more on their core businesses of making and selling products rather than devoting resources to detecting infringements (Interview data U.S., 2004). Similarly, Messerschmitt and Szyperski (2003) have observed that the exclusionary use of patents is less common in the software industry than in some other industries such as biotechnology and pharmaceuticals. In their opinion this is in part because patents tend to be less fundamental and they can be circumvented easily. Furthermore, according to a quantitative study of U.S. manufacturing firms conducted by Cohen, Nelson, and Walsh (2000), compared to other appropriability mechanisms such as secrecy, other legal tools, lead time, complementary sales, services and manufacturing, patents ranked rather low in effectiveness in fields such as the manufacture of electrical equipment and electronic components, semiconductors and communications equipment, all of which are connected to the ICT sector. Moreover, there were substantial variations between industries: patents appeared to be most important in the chemical industry. This does not mean that they are not acquired for other purposes, such as those indicated earlier, and naturally all of their functions are based on the patent holder's ability to prevent others from utilizing the invention.

Since many ICT companies are dependent on one another as indicated earlier and patents are not vital for protection, they generally have no reason to complicate their business relationships by claiming patent infringement. However, while particularly large U.S. ICT firms seem to be aggressive in building patent portfolios mainly for defensive purposes, offensive patent strategies tend to predominate for individuals and small software companies (Messerschmitt & Szyperski, 2003). Indeed, various sources have reported an increase in companies that derive their revenue purely from patents. These companies, also called patent trolls, do not typically have any R&D of their own, nor do they manufacture any products themselves: unlike most ICT companies therefore, they are not dependent on other firms. Their business is to force companies involved in manufacturing to license their patents by claiming patent infringement (FTC, 2003; Interview data U.S., 2004; Peterson, 2002b; Surowiecki, 2006). Patent trolls seek for direct licensing revenues and do not usually benefit from a cross-license. Therefore a defensive patent strategy that might otherwise help certain ICT companies to maintain their freedom-to-operate, and that has proven successful also in the context of standards as will be illustrated later has only minimal influence on them.

It is not only patent trolls that seek to make better use of their patent portfolios, however. The prevailing trend in the U.S. has been to found patent-licensing programs, sometimes by forming a separate patent-licensing unit, for the purpose of generating extra revenues mainly from inventions that are not considered core to the company's main operations (Rivette & Kline, 2000). This trend is likely to have an effect also on standardization as standards are becoming more and more vital for the ICT industry and thus they also carry a lot of economic significance. Consequently, having a patent that claims a broadly adopted standard may be a dream come true for a company seeking licensing revenues and not operating in that particular technology area.

Basically, patents are viewed as core elements of corporate business strategies in the U.S. ICT sector. They are employed for multiple purposes in different contexts. They may be used as protection measures and as components in joint ventures, in patent pools, and technology licensing arrangements. A license may also be a pure patent license or a broad cross-license providing a company with not-to-sue coverage. Furthermore, patents may be used to attract other types of resources to the company. They serve as indicators of innovativeness, and can be helpful in attracting financing: they can be used as collateral and are seen as a positive indication in the eyes of venture-capital investors and potential buyers. In fact, one trend that is detectable in the U.S. is the increased tendency of selling and buying patent portfolios and individual patents (FTC, 2003; Interview data U.S., 2004). This may happen in conjunction with the acquisition of an entire company, or patents may be bought from bankrupt firms. This follows that it is not easy to avoid patent infringement as patents may easily find their way to unknown parties meaning that a notification of potential patent infringement may practically come from anyone.

There is one further feature about the U.S. patent landscape that should be noted. It has been claimed that a substantive number of patents are being granted particularly in new areas such as software and the Internet that do not actually fulfill the patentability requirements. These so-called bad patents have contributed to various patent-related difficulties and they have been deemed to be one of the main reasons why the U.S. patent system is not in balance (FTC, 2003).

The European Patent Landscape

So far Europe has not faced patent trolling on a large scale, which could be explained by the fact that the consequences of litigation and infringement are less severe: while the average cost of patent litigation in the U.S. amounts to more than \$2 million per side (Vermont, 2002), in Finland

the figure for hearing an infringement the case in the district court is closer to EUR 150 000 per side. Of course the total amount of litigation costs may be fundamentally higher if the case involves various phases such as a precautionary measure claim, and both infringement and annulment actions. Moreover, the damages issued are substantial in the U.S. For instance, in 1990 the Federal District Court awarded \$910 million in damages to Polaroid in its patent-infringement litigation against Kodak, Alpex Computers was awarded \$260 million for patent infringement (litigation against Nintendo) in 1994, and in 2003 Microsoft was forced to pay Eolas \$521 million for infringement of an Internet browser patent (PwC Advisory, 2006). By way of comparison, the largest amount of damages ever awarded in Finland was EUR 252,282 (Labsystems Oy v. Biohit Oy, HO S 94/1922, Court of Appeal).

Furthermore, the patent web in the ICT sector appears to be less complex in Europe than in the U.S., although there are certainly variations between different technology areas. For instance, the European mobile-phone industry and the electronics field are areas in which large patent portfolios are common (OECD, 2004; Watts & Baigent, 2002). However, with the exception of the large telecommunications and electronics companies, patents seem to be regarded not so much as strategic assets, but rather as legal tools applied and used for protecting the results of the company's own R&D efforts, and occasionally for licensing (DLA, 2004; Interview data Finland, 2003).

It was evident, for instance, from the interviews with the Finnish companies that were not involved in the mobile-phone area as manufacturers, and had less than 70 issued patent families, that small-scale portfolio building was the preferred strategy for avoiding otherwise weak patent protection. There were no cross-licenses, however, and the companies appeared to be able to operate freely without paying much attention to the patents of others (Interview data Finland, 2003). In general, the

patent application part of the patent strategy was well thought out, although it should be noted that the process was technology-oriented and lacked the type of business acumen that was present in the U.S. (Interview data Finland, 2003). In fact, this is a conclusion that has been shared also by others. For instance Kratzman (2005) pointed out in his research:

Finnish patents tend to be academic and not written to generate revenue. They are not commercial nor do they cover multiple applications, an essential element in generating licensing interest. (p. 14)

With respect to the utilization of the patents in the company's business transactions and the infringement surveillance, they could be described as incidental, perhaps because patents were not regarded as important contributors to the company's revenue stream, and most Finnish companies had so few of them. Lead time, constant innovation and, in the area of software, copyright protection, were considered more important (Interview data Finland, 2003). Furthermore, attitudes towards patents appear to be largely negative, even indifferent, in the software industry in particular (Interview data Finland, 2003), which, based on Blind et al. (2001), applies not only to Finland but also to the rest of the Europe as far as independent software developers are concerned. It should be noted, though, that even small and medium-sized companies are beginning to realize the importance of strategic patent management, perhaps partially as a response to the attention paid to patents by investors. Generally speaking, there is a steady increase in the propensity of filing patents in the European ICT sector (OECD, 2005), which in turn will probably increase the likelihood of patent-based conflicts, and make it more difficult to design around the patents when selecting a standard, for instance. Currently, however, European companies appear not to be employing their patents as aggressively as U.S. undertakings and therefore there is a chance that

even though European companies had patents that could be characterized as submarines, this would not create substantial hindrances to the industry. On the other hand, markets for technology are international and as the case with GSM standard that will be discussed in the licensing section of this article illustrates, also patent strategies of U.S. companies tend to influence European standardization efforts.

Licensing Practices in the ICT Sector

As regards to companies licensing practices, some companies tend to be more open in their operations than others. Usually it is rather easy to outsource the manufacturing of products, their distribution and marketing, but it is the development that R&D-intensive companies prefer to keep to themselves. This could be detected in the technology-licensing practices of the U.S. ICT companies, which, given the reported increase of 4000% in licensing revenues from 1980 to 1990 (Vermont, 2002) and the recent fascination surrounding the success of open-source software licensing, were surprisingly closed, particularly in terms of licensing in external technologies.

One of the interviewees explained the situation by saying that it was difficult to find useful technologies, and counting on outside technologies was usually considered risky due to potential problems with third-party rights and quality issues, for example. In-house R&D was simply trusted more. When companies did rely on external technologies, they rather acquired the entire company than licensed-in the technology. If they did license-in it was largely limited to non-core elements and design tools. As for licensing-in open-source software, the companies were very careful, and typically had tools in place to make sure that they audited what came in (Interview data U.S., 2004).

When it comes to licensing out their technologies interviewed companies tended to be more open, and there was one company whose business

model was based mainly on this. Furthermore, licensing out was used in order to integrate in-house technologies into other companies' products and to make them compatible so that the market for that technology would expand. The licensing models adopted in the interviewed software companies were basically very broad for distribution purposes, and they licensed software to their customers as a package and to other companies to be used as embedded in their products. However, with the exception of commonly established standards, other types of technology licensing that did not involve a complete product were limited (Interview data U.S., 2004).

The licensing terms companies follow naturally vary depending on the subject matter, the business model adopted for the particular product or technology, and the parties involved. Nevertheless, there are certain typical configurations that reflect the extent of control the licensor or the licensee has. The scope of the license is paramount: the licensor retains more control over the technology if he or she grants only non-exclusive rights, which appears to be the most common form in the ICT sector. The possibility to define the degree of exclusivity, for example, in terms of geographic areas or certain uses, and the ability to assign and sublicense the rights are other key elements in determining the scope of a license (Poltorak & Lerner, 2004). Incorporating technical assistance also gives the licensor control over the licensed technology. In the case of trademarks in particular, the licensor has good reason to control the quality of the licensed products, and to put in place certain procedures for testing them and inspecting the licensee's production facilities (Megatz, 2002). It is also advisable to include a termination clause to enable either party to get out of the contractual relationship if necessary. One of the most intriguing termination clauses that reflects the atmosphere in the ICT industry relates to patent peace: such clauses are frequently used in open-source licenses, for instance, and in their broadest form they provide the licensor with

the right to terminate the license in the face of claims by the licensee regarding infringement on any of its patents. Representations, warranties, and indemnification clauses related to risk allocation, as well as royalty rates, also affect the balance of the contractual relationship.

Most importantly, however, attention needs to focus on terms relating to modifications, improvements, and therefore also grant-backs. From the licensor's perspective, it is often advantageous to obtain the rights to any improvements developed by the licensee, preferably including the right to sublicense the improvements to other licensees. This would prevent the licensee from using a fundamental improvement or an extensive new development to gain control over the licensor's core technology. Then again, access to improvements developed by the licensor is important for the licensee in ensuring the continued viability of the licensed product or technology (Megantz, 2002).

Some of the companies interviewed had adopted a very restrictive approach to modifications, allowing them only rarely and even then often requiring grant-back terms. Control was maintained through the heavy involvement of the licensor's engineers in the implementation phase, and through quality control. The licensor also typically maintained the right to modify the license terms. Then again, in the context of software licenses, the licensees had very few rights, the source code was seldom provided, and reverse engineering was typically prohibited. Obviously, this depended on whether it was an end-user license, an OEM agreement or a VAP bundle agreement. On the other hand, some companies had adopted a more open approach and operated on a more flexible and market-driven basis. Interfaces were opened up, for instance, and one of the companies even licensed out its software under various open-source agreements (Interview data U.S., 2004).

It could be concluded from previous discussion that R&D intensive ICT companies have rather

control-seeking licensing models, but they may be flexible too if it suits the company's business model. Thus, since standards are of crucial importance in this industry, exceptions are often made for the essential purpose of securing product compatibility, interoperability and interconnection (Interview data U.S., 2004). In fact, since many companies may be developing equipment or software for the same systems and platforms, for example, and there are inevitably huge numbers of relevant patents involved (Watts & Baigent, 2002), standardization may prove effective in providing access to essential patents held by various firms. On the other hand, it must be remembered that companies' prevailing licensing practices tend to show also in the standard-setting context, and although the patent policies of standards organizations typically give specified options to the patent holder, different licensing terms can be used to maintain control over the technology as indicated already in the background section of this article. Furthermore, it is only the essential patents need to be licensed when a company participates in setting a standard. As one of the interviewees pointed out, this constitutes a fairly thin layer. Only patents that are technically or commercially necessary to ensure compliance with the standard must be licensed, and only to the extent that it is necessary. Therefore, if the patent holder has waived its rights, for instance, patents cannot be asserted for complying with the standard, but they can be asserted if something extra is being done (Interview data U.S., 2004). Then again those companies that do not benefit from a common standard or are after royalties have generally no interest in taking part in standard setting because doing so could require the licensing of their rights under royalty-free or RAND terms.

The licensing quandaries will be discussed later on, and I will now turn to a more detailed analysis of the submarine patent risk stemming from deficient identification of essential patents to which some of the factors presented in this and the earlier section clearly contribute. Generally

speaking the highlighted importance of intellectual property rights and their substantial role as part of companies' business strategies has made it more difficult to avoid conflicts of interests.

STANDARDIZATION AND SUBMARINE PATENTS

Both patents providing their holders with exclusive rights, and open standards expected to be widely promulgated without exclusive control are important to the ICT sector. As they both want different things resolution is not always easy (Cunningham, 2005). From the perspective of this article the core element contributing to the tension between patents and standards, is that it is not always known in advance whether undertakings have patents or pending patent applications that might cover the standards technology. This complicates matters, since patents that surface after the adoption of the standard may, in the worst case, result in no other choice than abandoning it. Although both licensing and patent identification quandaries that were introduced briefly already in the background section may lead to significant economic losses, it is more difficult to anticipate the consequences and to avoid problems in the latter case. Therefore, submarine patents that surface after a standard has been elected and adopted are not only a practical dilemma but also a policy concern. Submarine patents may face the industry with unpredictable predicaments, and ultimately harm consumers. Cases in which unidentified patents of standard setters have caused concern and resulted in legal disputes include Dell and Rambus litigations. Third-party submarines contain the patents of Forgent Networks, Inc and Eolas Technologies, Inc among others.

The most effective way to reduce the possibility of hidden patents that have the potential to cause complications with respect to the adoption of a standard is to conduct a proper patent due diligence periodically and to agree upon the

contravening issues beforehand. This is where the patent policies of standards organizations that are aimed at creating shared expectations among standardization participants with respect to licensing and disclosure rules come to the fore (Interview data U.S., 2004; Ohana, 2005). Indeed, if companies participate in setting a standard they usually do their best to follow the standardization organization's patent policies, and consider any deviation unethical (Interview data U.S., 2004; Ohana, 2005). Sometimes the rules are simply not very transparent, and since different standardization organizations have different types of policies it may be burdensome to be aware of and to comply with them all, particularly if the company is involved in many standards organizations. In fact, about 40% of companies in Blind et al. (2002) sample group reported that they had problems due to the unclear IPR structure, resulting, for instance, in the late identification of the patent holders. There is a need for rules that hold as few surprises as possible (Interview data U.S., 2004; Ohana, 2005).

The standards organization's patent policies and their shortcomings with respect to the disclosure obligation are examined in subsequent paragraphs. Since companies adopting the standard ultimately bear the responsibility for patent infringement, there is then a brief glimpse into that part of companies' patent strategies that is aimed at reducing that risk. Combined with what has been said earlier about the patent system and the patent landscape in the ICT sector, these sections constitute the analysis of the causes contributing to the likelihood of infringing others' essential patents in the ICT sector and the challenges companies face in settling these disputes particularly due to the emergence of so-called patent trolls. Case studies illustrate the situation further and give examples of actualized disagreements. The fact that many disputes have been handled in court demonstrates that it has not been possible to settle the issues amicably and that there are significant economic interests involved.

Patent Policies

Many, although not all, standards bodies that are responsible or involved in coordinating the development of standards have implemented explicit IPR or patent policies for handling issues to do with standardization and patents. These policies aim at discouraging the manipulation of the process in order to gain market power, and at easing the tension between the open nature of standards and the proprietary nature of IPRs (Feldman & Rees, 2000; Kipnis, 2000; Soininen, 2005). The policies guide the participant's behavior, and from the legal point of view their nature and content affect the determination of whether a company participating in standard setting and failing to disclose its relevant rights has breached a contract, defrauded, competed unfairly or deceptively or abused its dominant position, for example. Therefore, if the patent policy is deficient, it is difficult to challenge the patent holder's right to prevent all others from using his invention, discriminate among licensees or to condition the license however he wants as long as this is done in accordance with relevant laws. In the following attention is paid to the nature, extent, scope and timeframe of the prevailing disclosure obligations of different organizations such as ITU, ANSI, ETSI, W3C, OASIS, and IETF and their ability to reduce the risk of submarine patents is assessed.

Nature of the Policy

It has been argued that without legally binding policies standards could easily become the subject of "hold-up" because once a standard has been established, all the patents necessary to comply with it become truly essential. The more widely the standard is adopted, the more power the patent holders gain (Shapiro, 2001). Nonetheless, not all standards organizations aspire to control their participants through imposing on them explicit contractual obligations, and many use their policies more as a "code of practice" (e.g., ITU-T

Patent Policy, n.d.). ANSI, for example, has taken the position that it does not mandate disclosure or impose licensing obligations on patent holders because this would overburden the process. It relies more on its participants to voluntarily act in accordance with the policy. Nevertheless, according to Marasco (2003) it has not so far faced abuse of the process. Actually, even though the guideline-nature of the disclosure requirement may narrow down the possibilities to enforce it in court and to claim damages in case of an infringement, non-obligatory rules may also bear significance when it is determined whether a certain participant has operated in good faith under some other principle of law, such as Federal Trade Commission Act, Section 5 that prohibits unfair and deceptive business practices. The case studies of Dell and Rambus examined later will demonstrate this issue further.

The Duty to Disclose

The patent policies of standardization organizations differ in their approach to disclosure in terms of duty to disclose, the scope of the disclosure and its timing. For the most part, they tend to rely on their participants (submitters or members [Perens, n.d.]) to voluntarily disclose all patents that could influence the standard. This is by no means a simple task, and failing to disclose patents that are essential for using the standard may happen by accident. Searching the portfolio is time-consuming and expensive, and therefore companies may not want to make the expense of searching them. Also, it is not always easy to recognize all essential patents and patent applications. This follows that particularly in big companies with large portfolios a company's representative in a standard-setting process may not know whether a proposed standard incorporates a patent within his company's portfolio (Kipnis, 2000; Peterson, 2002b; Soininen, 2005).

It is probably for this reason that standards organizations generally take no responsibility

for finding all relevant IPRs, or for verifying the information disclosed by the contributors (e.g., ANSI, 2003b; IETF, 2005; OASIS, 2005), and they are not keen on imposing such obligations on their participants. Thus, many of them do not require disclosure that goes beyond the personal knowledge of the discloser (e.g., IETF, 2005; OASIS, 2005), nor do they require their participants to carry out patent searches (e.g., ANSI, 2005a; ETSI, 2005; ITU-T, 2005; OASIS, 2005; W3C, 2004), which in turn increases the probability that relevant patents remain undisclosed (Soininen, 2005).

Scope of the Disclosure Requirement

Another contributing factor to the submarine patent risk is that it is not necessarily required for companies to disclose their pending, particularly unpublished, patent applications (e.g., ANSI, 2003b; ANSI, 2003a; Kipnis, 2000; Lemley, 2002). The W3C disclosure requirement is an exception, however. It also extends to the unpublished patent claims that were developed based on information from a W3C Working Group or W3C document (W3C, 2004). The OASIS policy also requires the disclosure of all patents and/or patent applications known to the technical committee member (OASIS, 2005). The problem with announcing pending patents is that, although the protection provided by a patent is always unclear until confirmed in court, the scope is even more ambiguous until the patent is issued, and it is therefore not possible to assess whether it will be essential in order to use the technology. It is also possible that it will never be granted. The problem is, however, that if there is no obligation to disclose pending patent applications, waiting until the standard has been agreed upon before allowing the patent to be issued does not constitute a policy breach. In fact, given the need to make informative decisions about standard “characteristics,” there has been discussion on whether participants should also be obliged to disclose their potential patenting

activity. The U.S. patent system includes a so-called grace period, which allows the inventor to file for a patent up to one year after disclosing it in a printed publication. Thus, it is possible for a company that has submitted a technical proposal to the standards body to then file for a patent covering it after the standard has been elected.

Opinions on the scope of the disclosure obligation are divided. Some people feel that, although companies were required to state their possible interest in patenting their technology, it is never certain that they will apply these patents in reality, or that they will be granted or even essential. On the one hand, if companies had to announce their potential pending patents, other committee members could take them into account when decisions about standardized technology were made (Kipnis, 2000). At the same time, there might be a risk of “sham” announcements in these cases (Soininen, 2005).

Timing of the Disclosure

The timeframe of the disclosure requirement also bears significance in respect to the causes of the submarine patent problem. Since standardization may be valid for years and companies’ R&D development is definitely not frozen during that time, it is likely that pending patent applications will be modified and new applications filed during the process. Therefore, although a company may have no pending patent applications or granted patents at the beginning, it might have them when the standard is finally set. For this reason, some standards bodies, such as W3C, have patent policies that incorporate an obligation to disclose essential patents throughout the entire process (W3C, 2004). The ETSI IPR Policy also requires each member to make reasonable efforts to inform the ETSI in good time about any essential patents, both its own and third-party, of which it becomes aware at any stage (ETSI, 2005). Then again, the IETF policy encourages contributors to update their disclosures if the claims are modified, or if a patent is granted or abandoned (IETF, 2005).

Third-Party Patents

Standards organizations patent policies can never bind third parties and even though some patent policies do encourage also other interested parties as well as contributors to bring attention to potential third-party patents (e.g., IETF, 2005; ITU-T, n.d.; ITU-T, 2005; OASIS, 2005), this is not enough to record all of them. One option to increase the awareness of third-party rights would be to conduct a patent search. Standards bodies are not typically involved in such an activity, however (e.g., IETF, 2005; OASIS, 2005). On the other hand, ETSI is now considering an ex ante approach to declaring relevant patents with respect to the Long-term Evolution (LTE) standard (Informamedia.com, 2006). This would at least diminish the likelihood that new essential patents emerge after the standard has been elected and it remains to be seen whether this approach will be adopted on a broader scale.

It could be concluded that patent policies are helpful in reducing particularly the risk of standard setters' submarine patents and even though they could be strengthened in many ways to narrow down the possibility of manipulating the process in order to gain market power, some of the difficulties are mainly practical. Therefore it might not be possible to avoid them even if companies were posed an obligation to disclose their potential patenting activity, for instance. The only effect of doing so could be that companies are discouraged from participating which in turn would increase the risk that patents remain undisclosed and generate problems at a later stage.

Patent Strategies to Avoid Infringement

There may be a room for improvement in standards bodies patent policies but it is not only loopholes in them but also deficiencies in companies' own patent strategies that contribute to the fact that relevant rights may remain unnoticed and standard

adopters may face predicaments due to them. Obviously, it is the company incorporating a standard into its products and services that ultimately bears the risk of infringing others' patents, and therefore identifying relevant rights is not by any means only the responsibility of standards organizations. Indeed, in addition to enhancing a company's own patenting, licensing and enforcement activities, a proficient patent strategy also helps in avoiding patent infringements.

A major goal in managing corporate patent liability is to avoid being sued and paying substantial royalties to other patent holders. What is even more important is to avoid being prevented from using a particular technology, which could force the company out of a lucrative market (Miele, 2000). Furthermore, the costs of patent litigation, particularly in the U.S., could be substantial and a drain on financial and human resources (Knight, 2001). Thus, if it is necessary to prevent significant liability, the company should consider refraining from using technology that infringes others' rights. In some cases this is not possible, and the company has to employ such technology that has been patented by others in order to operate in a particular market. Keeping both situations in mind, there are certain steps that could be taken in order to reduce the liability, the likelihood that patent holders will assert their rights against the company, and the amount of royalties that should be paid in cases in which patent liability cannot be avoided (Miele, 2000). One of these steps includes identifying patent problems early in the product cycles. For instance, a freedom-to-operate search conducted on the basis of patent classification numbers and certain keywords might be useful for identifying close references, which could then be examined in more detail (Knight, 2001) before the product is released onto the market. Another step is to monitor the patent activities of the company's closest and biggest competitors because companies are often particularly sensitive to infringing activities that originate from their competitors (Miele, 2000).

In practice avoiding infringements is not that easy and companies' patent strategies are not flawless. No patent search is or can be 100% thorough (Knight, 2001), and as many Finnish interviewees mentioned, it may be difficult to identify relevant rights and to make sense of the scope of patent rights (Interview data Finland, 2003). Sometimes, a company may not even have any specialized infringement surveillance. Indeed, in Finnish companies infringement checkpoints were rarely incorporated into R&D projects. This does not indicate, however, that there was no knowledge whatsoever about the patent landscape: information regarding other companies' patent position can be obtained as a side product when the company is considering patenting its own inventions and conducts prior art searches for that purpose (Interview data Finland, 2003). As far as the U.S. companies were concerned, the extent of due diligence with regard to others patents varied depending on the situation: some technology areas were more important, and some were known to be more heavily patented than others, thus requiring more thorough clarification. Nevertheless, these companies typically did not have any systematic patent clearance (Interview data U.S., 2004).

A further risk-reducing alternative to freedom-to-operate analysis and other types of patent surveillance is to use the porcupine approach discussed earlier in the section on patent strategy in the ICT sector. This means that a company builds a defensive patent portfolio aimed at reducing potential infringement allocations and making settlement easier. It may also have broad cross-licenses in place, thereby removing a huge block of patents from its surveillance list (Interview data Finland, 2003; Interview data U.S., 2004). This is a strategy that has been favored by large U.S. and multinational Finnish ICT companies, but unfortunately it does not work well against individual patent holders or so-called patent trolling companies. The fact that patents are being assigned more than before, further increases the

risk that they find their way to such parties that do not come up in competitor surveillance and remain unnoticed for that reason.

In sum, companies may take certain precautions to prevent patent liability, but even if they do, the risk of patent infringement remains particularly high in areas in which it is simply not possible to keep track of new filed applications and issued patents. As one of the U.S. interviewees stated, there is always a risk that others' patents will read on your product. You can do all the clearance work and look at all the patents that are out there, but the next week a new patent may be granted (Interview data U.S., 2004). Nevertheless, there are many improvements that could be made in order to strengthen the infringement surveillance, and instead of fighting only their own battles during the standard-adoption phase, companies could pool their expertise and resources and help to limit the submarine patent risk already before the standard is established.

Case Studies of Standard-Setters' Submarine Patents

Standards organizations' IPR policies related to disclosure do not cover every situation, which is understandable, since weight must also be given to the flexibility of the process. Also the means ICT companies have currently implemented in order to avoid infringement of other companies' patents do not help much in identifying relevant rights. The unfortunate consequences are that despite the efforts there still is a high risk that patents surface after the establishment of the standard, and these (essential) patents are much more valuable than they would have been previously: it gets more difficult to change the specification as time passes and the technology becomes adopted. Therefore, particularly if they are not breaching IPR policy, some patent holders may seize the opportunity and seek to hide the fact that they have essential patents, or pending applications—otherwise the standard could be modified so that it no longer covers them.

The problem with standard-setters' submarine patents is not only theoretical, because the risk has actualized also in reality. Cases that have involved undisclosed patenting activities and have resulted in legal disputes include Dell, Rambus and Unocal from which Dell and Rambus cases are discussed in the following. These examples demonstrate further the importance and role of a proficient patent policy since it does not merely help to reduce the submarine patent risk beforehand but it also influences the possibilities to solve the problem later on. The previously-mentioned example cases indicate, for instance, that competition authorities do not take misbehavior during standard setting lightly and are keen on examining doubtful situations even though the merits of the case may not be sufficient in order to find fault from the defendant's side. In the end the result is dependent on the wording of the policy and proof of misbehavior. In a way legal tools that are available provide the last means to solve actualized conflicts. Luckily, litigation is not always needed. For instance IBM's behavior in relation to ebXML standard implies that consequences of the failure to disclose are not always detrimental. Since many ICT companies are largely dependent on one another it may be possible to reach an amicable solution rather easily in some situations.

Federal Trade Commission v. Dell Computer Corp. (1995)

In the Dell (1995) case the Federal Trade Commission (FTC) accused Dell Computer Corporation, on the basis of Section 5 of the FTC Act which prohibits unfair or deceptive business practices, of intentionally concealing its patent during the Video Electronics Standards Association (VESA) VL-bus technology standardization process. Although VESA's IPR policy required that its members disclose any potentially conflicting patents, Dell certified that it did not have such patents. After the standard had been widely ad-

opted in the marketplace, Dell sought to enforce its patent against VESA members. The Commission found that even if Dell's actions were not strictly speaking intentional, the company had failed to act in good faith. It also stated that had Dell disclosed its patents properly, VESA would have incorporated different technology into the standard. Dell's misrepresentation therefore caused restraints on competition resulting in the hindrance of industry acceptance and increased costs in terms of implementing the bus design (Federal Trade Commission v. Dell Computer Corp., FTC File No. 931 0097 (2 November 1995)) (Soininen, 2005).

In the end, a consent decree was agreed upon and Dell promised not to assert its patents against computer manufacturers that complied with the standard (Balto & Wolman, 2003; Hemphill, 2005; Lemley, 2002). It should be noted, however, that even though a satisfactory result was reached through a settlement the case was not decided in court leaving the industry with ambivalence about the proper interpretation. In fact, the Rambus litigation discussed later indicates that the conclusion could have been different if the case had been litigated further.

Rambus, Inc v. Infineon Technologies AG (Fed. Cir. 2003) and Federal Trade Commission v. Rambus, Inc

Rambus has faced two litigations due to its actions in the Joint Electronics Devices Engineering Council (JEDEC). The first one, Rambus, Inc v. Infineon Technologies AG (2003), arose when Rambus sued Infineon for synchronous dynamic random access memory (SDRAM) patent infringement. Infineon counter-claimed that Rambus had defrauded it when it failed to disclose patents and pending patent applications during its membership of JEDEC and while JEDEC was developing the industry standard for SDRAM. More specifically, Rambus had filed for a patent '898 for Rambus DRAM technology

in 1990, it cooperated in forming the standard from 1992 until 1996 when it resigned from the standards body just before the final vote, and both during and after its participation it had filed continuation and multiple divisional applications based on the original 898 application, and by doing so it amended its patent protection to cover the SDRAM technology. Later, it allowed these patents to be issued, and began to defend its own patents aggressively, requiring companies to pay royalties. Nonetheless, the Federal Circuit came to the conclusion that Rambus had not fraudulently failed to disclose its patent applications, but held that its duty to disclose as a JEDEC participant applied only to those containing claims that could reasonably be considered necessary in order to practice the proposed standard, and that this obligation arose only when the work had formally begun. The court held further that the duty to disclose did not cover the participant's future plans or intentions, that is, filing or amending patent applications, and criticized JEDEC's patent policy for its staggering lack of defining details. It thereby left its members with vaguely defined expectations as to what they believed the policy required. (*Rambus, Inc v. Infineon Technologies AG*, No. 01-1449 [Fed. Cir. 2003]; Soininen, 2005).

The second litigation, *FTC v. Rambus, Inc* was based on Section 5 of the FTC Act, and it is still pending. The FTC has accused Rambus of a series of anti-competitive acts and practices, claiming that through deliberate and intentional means it has illegally monopolized, attempted to monopolize, or otherwise engaged in unfair methods of competition in certain markets related to the technological features necessary for the design and manufacture of a common form of digital computer memory. It further claims that Rambus's anti-competitive behavior has, among other things, increased the royalties associated with the manufacture, sale, or use of synchronous DRAM technology, and has reduced the incentive to produce memory using it and to participate in

JEDEC or other industry standard-setting organizations or activities (*Administrative Complaint*, 2002; Soininen, 2005).

The difference between *FTC v. Rambus* and the *Dell* case is that in the former the FTC is attempting to demonstrate that Rambus gained market power through its misbehavior, and thus that the industry is locked into the JEDEC's SDRAM standard. According to the FTC, "It is not economically feasible for the industry to attempt to alter or work around the JEDEC standards in order to avoid payment of royalties to Rambus" (*Administrative Complaint*, 2002). In its initial decision released on 24 February 2004, Judge MacGuire stated that the FTC "failed to sustain their burden of establishing liability for the violations alleged," and dismissed the complaint. In her opinion there was no evidence, for example, that Rambus had violated JEDEC patent policy, or that the challenged conduct had had anti-competitive effects (*Initial Decision*, 2004; Soininen, 2005). To conclude, even though a standard setter has operated unethically and the other participants disapprove his conduct, it may be difficult to challenge it in court particularly if proper guidelines are lacking.

IBM and the ebXML Standard

Even though *Dell* and Rambus attempted to enforce their rights against those who had adopted the standard, patent holders do not always seek royalties although a patent emerges after the standard has been established. One reason for a submarine patent holder to comply with the standards organization's policy is the bad publicity, which may result in the loss of credibility as a fair standardization participant (Sarvas & Soininen, 2002). For example, IBM claimed in April 2002 that it had one patent and one patent application that were relevant for implementing the open, royalty-free ebXML standard developed by OASIS in cooperation with the United Nations, and that it was willing to license them on RAND terms.

IBM's announcement caused strong reactions in the public and in the industry, particularly because IBM had participated in the design of the standard. Furthermore, IBM had previously announced that it was willing to contribute to the standard without any restrictions, but had nevertheless made comments regarding the licensing terms and conditions of the two patents. However, soon after the news reached the public, IBM agreed to license the patents royalty-free (Berlind, 2002a; Berlind, 200b; Wong, 2002).

Case Studies of Third-Party Submarines

Those companies that do not benefit from a specific standard simply do not participate in setting it and therefore it may happen that third parties who are not covered by patent policies have patents that "read on" the standard, and do not appear before its adoption. If the patent holder then decides to enforce his rights, the benefits of the standard may be lost. In fact, many businesses that received patents during the technology boom were either purchased by other companies or landed in holding companies. Thus, in some cases a standards organization may adopt a standard believing it is royalty-free, and then find out that the new owner, which did not participate in the standard-setting process, is aggressively trying to enforce its IPRs (Clark, 2002). For instance, the director of intellectual property at Jupiter Networks Inc has observed a sudden surge in these types of third-party patent-infringement assertions, some of which are valid and some are not. This surge is understandable in his opinion, because patent holders hope to profit from the wide deployment of products that must implement Internet standards. He described a typical patent-assertion scenario in which a patent holder dusts off issued patents directed to old but related technologies or modifies claims in pending patent applications to read on published standards, and then targets standards-compliant network-

ing-equipment manufacturers (Lo, 2002). The case studies presented in subsequent paragraphs illustrate the type of legal disputes that may arise if a third-party patent holder attempts to enforce his rights. Basically, the accused infringer can defend itself by claiming non-infringement or unenforceability, or by attempting to invalidate the patent. These are the strategies followed also in the case studies presented.

Forgent Networks and the JPEG Standard

A third-party claim arose in 2002 when Forgent Networks Inc searched its portfolio of 40 patents and found that it had a patent (US Patent 4,698,672) related to the implementation of a baseline version of the ISO/IEC 1098-1 standard, that is, the JPEG image standard that is one of the most popular formats for compressing and sharing files on the Internet, and is also used in various industries in products such as digital cameras, personal digital assistants, cellular phones, printers and scanners. In its desperate search for profits, Forgent estimated the solidness of its infringement claim and entered into a multi-million-dollar licensing agreement with the Japanese companies Sony and Sanyo before making a public announcement in July 2002 of potential JPEG patent infringement and starting to pursue licensing fees from a range of companies. Forgent had, in fact, obtained the patent in question through the acquisition of Compression Albs Inc. in 1997. Since the inventors who originally filed for the patent in 1986 had not participated in the JPEG standardization process that was going on around that time, according to Forgent, no abuse of the standardization process had taken place (Clark, 2002; Lemos, 2002; Markoff, 2002; Reingold, 2006).

As a result of Forgent's aggressive patent enforcement, many U.S., European, and Asian companies agreed to license the '672 patent, and by April 2004 it had generated approximately \$90 million in licensing fees. Those who did not

agree to license willingly were sued for patent infringement. Indeed, on 22 April 2004 Forgent's subsidiary Compression Labs, Inc sued 31 major hardware and software vendors, including Dell and Apple Computers, for patent infringement, and on 6 August 2004 it initiated litigation against 11 companies (Asaravala, 2004; Forgent Networks, 2006).

Professionals in the field of compression technology and representatives of the JPEG committee doubted the validity of the patent and stated that there could be prior art available that would render it invalid. These doubts have been manifested in legal actions, such as those taken by 24 companies that filed a counter-complaint against Forgent and its subsidiary in the Delaware District Court seeking declaratory relief as to non-infringement, invalidity, and unenforceability of the patent. Even Microsoft, which had not been sued by Forgent at that time, filed a complaint against it on 15 April 2005, claiming that the patent had been obtained fraudulently. Furthermore, the non-profit Public Patent Foundation has filed a request for re-examination of the '627 patent in November 2005. In late January 2006 the U.S. Patent and Trademark Office (USPTO) made a decision to review the patent, which will in any case expire in October 2006 (Forgent Networks, 2006; Lemos, 2002; Reingold, 2006; Red Herring, 2006).

EOLAS and HTML Specification

Another third-party submarine example is the EOLAS case. Here, the dispute arose when Eolas Technologies Inc, which had licensed a patent from the University of California, sued Microsoft for the use of the patented invention, that is, the widely used feature of HTML, the format that describes the format of Web pages. After a long stream of litigation the Federal Circuit (2005) also found the patent valid and infringed (Eolas Technologies Incorporated and the Regents of the University of California v. Microsoft Corporation, Case Nr. 04-1234 (Fed.Cir, 2005)), and the Supreme

Court refused to hear the case (Malone, 2005). At the request of W3C the Eolas patent was also re-examined by the USPTO, which released two preliminary findings claiming that it was invalid. Ultimately, the patent office kept the patent in force, however (Perens, n.d.).

Although a patent holder has a very strong negotiating position if the patent accidentally "surfaces" after the adoption of the standard and those who are accused of patent infringement can mainly defend themselves by trying to invalidate the patent, third-party patents do not always create problems. In many cases reasonable licensing terms can be agreed upon. As with the cases in which the patent holder had participated in the standard setting, business relationships and bad publicity may also be reasons why third-party patent holders comply with a standardization organization's policy and license the patents royalty-free, for instance, although they may have no obligation to do so.

The Risk of Patent Problems and How to Reduce It?

It could be concluded from previous discussion that it is important to implement proficient patent policies that are clear, concise and transparent and hold as few surprises as possible. These policies should be drafted with an intention of influencing companies' behavior both during and after standard setting so that misconduct could be diminished and potential problems solved. The nature, extent, scope and the timeframe of the disclosure requirements are examples of such disclosure terms that could be clarified in order to reduce the submarine patent problem, which taking into account the recent litigations and the fact that 40% of companies in Blind and Thumm's sample group reported problems regarding unclear IPR structure (Blind et al., 2002) is not only theoretical. Furthermore, one way of reducing the problems that may result when not all patents are known prior to the establishment of a standard could be

to require that essential patents granted in the future will be identified and potentially licensed under the same terms as the disclosed patents. In fact, it is a common requirement in patent pools for essential future patents to be subject to grant-back and thus to contribute to the pool. This requirement may occasionally have anticompetitive effects, however, Balto and Wolman (2003) and patent holders would probably consider this type of requirement too restrictive.

As regards to third-party patents that are becoming a more and more relevant concern there is a lot that could be done in order to reduce the risk they may pose to the adoption of a standard. First of all, the standard-setting participants could be encouraged to conduct more thorough patent searches already during the standardization procedure, and to let the standards organizations know about potential third-party claims. Secondly, third parties could be reserved an opportunity to make a patent statement early on, and thirdly, standards organizations could take a more active role in finding relevant patents themselves. Otherwise, if dealing with the increasing number of third-party patents was only left to companies implementing the standard, they would be in different positions and the openness of the standard could be endangered: only those companies that already have cross-licensing agreements in place, have enough leverage in order to negotiate a good deal with the patent holder, or have the resources to fight the patent in court might be able to adopt the standard.

A further way to limit the risk of submarine patent-related troubles arising from both standard-setters and third parties, and to help companies to solve the conflicts better and therefore to reduce the harmful consequences of such patents would be to renovate the legal framework. The possibilities and the need to do so have not been estimated in this article, however. Obviously, when considering the actions needed, the advantages and disadvantages should be estimated and balanced carefully. Therefore, it is in place to examine also the other

patent and standard related quandary that has to do with licensing. These problems are similar to those experienced with submarine patents, and in fact, the GSM example presented later is in essence a submarine patent case. What basically differentiates submarine patent cases and those in which a patent has been properly disclosed is, however, the possibility to make informative decisions about the adoption of a standard, and to design around it or agree upon licensing terms in advance, and thus avoid great societal losses that would occur had the standard been already broadly adopted and if the parties were not able to solve the conflicts.

LICENSING OF PATENTS AND STANDARDIZATION

In case a patent holder has disclosed that it may have patents or pending patent applications that are essential for using a standard, standards bodies typically pose certain licensing alternatives for that company. The patent holder's options are usually the following: (1) the patent holder may state that it is willing to license its essential patents on royalty-free terms, (2) the patent holder may refuse from licensing altogether, (3) the patent holder may promise to license, but negotiate the terms separately, or (4) the patent holder may make a statement of licensing on fair, reasonable and nondiscriminatory terms (RAND). These alternatives are discussed further in subsequent paragraphs, and case studies are used to illustrate the licensing perplexities. The necessity and effects of addressing the submarine patent problem are estimated on this basis.

Royalty-Free Licensing

Royalty-free standards often have more chances of being broadly accepted and widely used than standards requiring licensing payments. For instance, the Internet has been said to require

freely available standards in order to work effectively. Patent-based standards requiring royalty payments inhibit its development because they slow down or discourage the adoption of new technologies. As a consequence, companies frequently agree to make their patented technology available on a royalty-free basis, and hope to generate more profits by selling products that use their standardized technology (Clark, 2002; Interview data U.S., 2004).

As mentioned, given the benefits, standardization participants are often willing to license their patents on a royalty-free basis for the specific purpose of using the standard. This holds true particularly if they are able to make sure that the patents could nevertheless be utilized for defensive purposes if the need arose (Interview data U.S., 2004). Naturally, participation and agreement to license to everyone require that such conduct is in accordance with the firm's commercial interests: having its superior technology chosen for a standard may provide it with a head start in incorporating that technology into its products, for example. Then again, companies seeking licensing revenues through incorporating their proprietary inventions into a standard do not typically have a business motivation to participate in designing royalty-free standards (Soininen, 2005).

Refusal to License

If a royalty-free licensing scheme cannot be negotiated, and the patented technology cannot be designed around, it may nevertheless be in the interests of the public to get the patent holder to agree to license it at least on RAND terms. If the patent holder refuses to license on these vague terms, the standardization process is halted and other solutions are sought (Hjelm, 2000). Refusing to license at all is rare, however, although it is the most influential form of leveraging one's patent rights (Rahnasto, 2003). As the following case study demonstrates it has nevertheless played a major role in making the ETSI Wideband Code

Division Multiple Access (WCDMA) standard backward compatible with the IS-95 standard favored by Qualcomm Inc, for instance (Soininen, 2005).

What happened in the WCDMA dispute was that Qualcomm accused ETSI of intentionally excluding Qualcomm's technology from its standards, thereby creating an unfavorable position for Qualcomm in the European third-generation telecommunications market. In order to make its voice better heard, the company claimed that the key technologies needed for WCDMA infringed its patents, and refused to license this technology unless the WCDMA was made backward compatible with the IS-95 standard. It seems that Qualcomm expected that a harmonized standard would increase its licensing revenues fundamentally (Hjelm, 2000; Westman, 1999; Soininen, 2005).

Ericsson, who was another key patent holder in the technology involved, was of the opinion that Qualcomm's patents were not infringed, and to gain a better negotiation position it also sued Qualcomm for the infringement of Ericsson's CDMA patents (one of the U.S. standards) Qualcomm was employing. Finally, consensus was reached as a result of cooperation between Qualcomm and Ericsson. The companies entered into a series of definitive agreements that resolved all disputes relating to CDMA technology, and as a part of the settlement Ericsson acquired Qualcomm's terrestrial CDMA wireless infrastructure business, including its R&D facilities. Furthermore, the companies gave a promise to license essential WCDMA patents (Hjelm, 2000; Westman, 1999). The standardization process was practically frozen during this period, which lasted roughly a year (Sarvas & Soininen, 2002).

Indeed, as the previous example demonstrates companies operating in the ICT sector are dependent on each other and therefore conflicts in one area may result in complex legal battles in another. Nevertheless refusing to license may be a feasible strategy for a company that opposes a

certain standard. A firm may also wish to delay the acceptance of a standard to give it more time to develop products that incorporate it.

Blank Promise to License

Firms typically agree to license their patents royalty-free, or on RAND or other terms, or they may merely agree to license but make no statement of the terms and conditions. Particularly if the last-mentioned option is available and chosen, there is likely to be a fight over the proper licensing conditions. One example of a disagreement over proper licensing terms was the one that arose during the formation of the European GSM standard in the 1980s, which was first coordinated by CEPT (Conference Europeenne des Administrations des Postes et des Telecommunications) and later by ETSI. In fact, this particular licensing dilemma, which involved Motorola, contributed to the change in patent culture that took place in the European telecommunications sector in which patenting had until that time been regarded as a secondary issue—specifically among the national telecommunications service providers whose markets had previously been monopolized but were now deregulated (Bekkers, Verspagen, & Smits, 2002; Granstrand, 1999).

What basically has been presented in literature to have happened in the context of the GSM standard was that a U.S. company, Motorola, for which patenting was a natural and integral part of doing business, entered the European scene and employed the aggressive patent strategy it was used to. While other standard setters operated in accordance with a “gentleman’s agreement”, shared their ideas and specifications during the standardization process in an open atmosphere, and refrained from patenting once the basic technical decisions had been made, Motorola pursued patent protection in the course of the process (Granstrand, 1999). Furthermore, Bekkers, Verpagen & Smits (2002) have argued that while most other companies agreed on licens-

ing their essential rights on fair, reasonable and nondiscriminatory terms, Motorola refused to make general declarations. It declined monetary compensation and was only willing to cross-license its patents to certain companies. Although Siemens, Alcatel, Nokia and Ericsson were able to negotiate cross-licenses, Motorola’s licensing strategy effectively prevented various other companies from entering the market. When a number of non-European companies finally managed to obtain all the necessary licenses to build GSM terminals in the late 1990s, the cross-licensees had already built up a strong market position. Moreover, since the cumulative licensing fee paid for a GSM handset was very high as confirmed by studies of Bekkers, et al., the price made it difficult to compete if the company was not part of a cross-licensing agreement. In fact it has been argued that the licensing fees have totaled as much as 29% of the costs of the GSM handset (Bekkers et al. 2002)

RAND-Licensing

Even under the RAND system, specific licensing terms are typically not agreed upon during the standard setting. Revealing the terms after adoption can generate conflicts and hamper the parties’ ability to compete in the affected market. Peterson (2002b) lists the following situations that could arise in this context: (1) the patent holder seeks a broad grant-back that appears non-discriminatory but has different effects on different parties; (2) the patentee requires a minimum annual royalty based on “administrative costs”, which may have the effect of excluding smaller rivals and new entrants; (3) the patentee seeks royalties from downstream providers such as manufacturers of finished goods, and refuses to license to suppliers of upstream inputs such as IC vendors, and thus to increase its income, which however may increase competitors’ costs and time to market; (4) the patent holder acquires admissions of infringement and validity, and/or retains the right

to immediately terminate a license if the licensor challenges infringement or validity; (5) the patentee requires acceptance of venue, which might constitute a major problem for small companies or foreign competitors; and (6) the patent holder seeks a royalty that it considers “fair” but that exceeds the average profit margin of all the parties who need licenses. For instance, one of the U.S. interviewees mentioned that his company had been approached with a royalty requirement as high as 10% (Interview data U.S., 2004).

Furthermore, even though the company may have made it clear in its licensing statement that the license was only available under certain conditions it considered as fair, reasonable and nondiscriminatory, these terms may come as a surprise to some and cause disputes. For instance, the *Townshend v. Rockwell International Corp. and Conexant Systems* (N.D.Cal.2000) litigation arose when Townshend, whose patents “read on” the V.90 standard for 56K chipset modems and who had promised to license them on certain terms, filed a patent-infringement suit against Rockwell and its successor Conexant. In response Rockwell and Conexant asserted two antitrust counterclaims based on the Sherman Act Sections 1 (conspiracy) and 2 (monopolization and its attempt) among others, and claimed that Townshend and 3Com had conspired to restrain trade by deceiving the ITU into incorporating Townshend’s patent into the industry standard, denying competitors access to the technology, and filing a patent-infringement lawsuit to prevent Conexant from using Townshend’s technology. Furthermore, Townshend and 3Com were accused of having attempted to monopolize the market for 56K modem chipset products (Kirsch, 2000; *Townshend v. Rockwell International Corp. and Conexant Systems, Inc.*, 55 U.S.P.Q.2d 1011 (N.D.Cal.2000)).

I am not going to go into the legal specialties of the case here, but the Court found all Rockwell’s and Conexant’s counterclaims unfounded. With regard to the antitrust-based claims it noted, among other things, that there had been no col-

lusion, and since 3Com—to which Townshend had non-exclusively licensed its essential patent prior to the setting of the ITU V.90 standard—had declared during the standardization procedure that Townshend had relevant patents pending, ITU had not been deceived. Since 3Com had also made a proposition prior to the acceptance of the standard to license those patents for a per-unit royalty fee, or to cross-license them in return for technologies that were specified in the standard, or related to it and were otherwise practically necessary or desirable for technical or economic reasons in order to make a commercially viable product compliant with the standard, and further that it had not been shown that Rockwell and Conexant could not have obtained a license under those terms, Townshend’s actions could not be held anticompetitive (Kirsch, 2000; *Townshend v. Rockwell International Corp. and Conexant Systems, Inc.*, 55 U.S.P.Q.2d 1011 (N.D.Cal.2000)).

The previous case illustrates that it is particularly difficult to defend oneself against such patent holders that have disclosed their patents properly and declared their licensing terms during the standard-setting procedure. Indeed, due to the flexibility in the interpretation of RAND, having patents in standardized technology could also become a valuable source of royalties or other resources. For instance, Qualcomm relies on a royalty stream resulting from others utilizing its patented technology incorporated into various standards. In fact, the pricing of Qualcomm’s licenses has led to huge disagreement between Qualcomm and six other companies involved in the WCDMA 3G standard. Basically, Broadcom, Ericsson, NEX, Nokia, Panasonic Mobile Communications and Texas Instruments have all claimed that Qualcomm, who promised to license its essential WCDMA patents on RAND terms, is charging excessive and disproportionate royalties for them. Qualcomm has been claimed to charge the same royalty rate on the WCDMA 3G standard as it does for the CDMA2000 standard adopted in the U.S., although it has fewer essential patents

in it. Furthermore, it offers lower royalty rates to handset customers who buy chipsets exclusively from Qualcomm than to manufacturers of chipsets for mobile phones, making entry into the market more difficult for chip makers (Nokia, 2005a; Outlaw.com, 2005; Nokia, 2005b).

As a result of this disagreement, all six of the previously-mentioned companies filed complaints to the European Commission in October 2005 requesting it to investigate and to put an end to Qualcomm's anticompetitive conduct (Nokia, 2005a, 2005b; Out-law.com, 2005). Qualcomm has responded to the allocations stating that they are legally without merit, and appear to be nothing more than an attempt by these licensees to renegotiate their license agreements. In a separate move, Qualcomm then filed a patent-infringement action against Nokia claiming that Nokia was infringing 12 of its patents that related to GSM, GPRS, and EDGE standards (Jacobs, 2005; Nokia, 2005c; Wireless Watch, 2005b).

This is not the end of Qualcomm's legal disputes, however. Previously, in July and again in October, the company had filed infringement suits based on the previously-mentioned patents against Broadcom. These actions were a follow-up of Broadcom's claims that included a patent-infringement action filed against Qualcomm in May 2005, a complaint with the U.S. International Trade Commission (ITC) suggesting that Qualcomm was unfairly importing products that infringed Broadcom's patents and requesting that the ITC investigate Qualcomm's imports, and a separate antitrust suit raised in July. This U.S. antitrust claim was based on similar grounds as the complaint made to the European Commission. In its antitrust complaint Broadcom charged Qualcomm with abuse of the wireless technology standards-setting process, failure to meet its commitments to license technology for cellular wireless standards on RAND terms, and various anticompetitive activities in the sales and marketing of chipsets based on CDMA technology (Gohring, 2005a, b; Regan, 2005).

As can be seen from the volume of suits and counter-suits discussed earlier, Qualcomm's strategy of using its essential patents as revenue generators is challenging and particularly litigation-sensitive, and it is not considered viable by all technology/patent-licensing firms even though their business model would support such activity. One of the U.S. interviewees stated, for example, that taking into consideration the current legal situation and the IPR policies adopted by many standards bodies, it was not beneficial for it to take any part in the standardization. Its business was based on technology and patent licensing, not on manufacturing products, and there was simply not enough monetary compensation involved in standards (Interview data U.S., 2004).

Cross-Licensing

As mentioned earlier, agreeing upon exact licensing terms is not part of the standard-setting procedure, and negotiations are held between the companies interested in using the standard. This follows that another reason beyond the technological benefits for promoting the selection of patented technology for a standard is the possibility to cross-license patents with those of other participants that also "read on" the standard. The more patents companies have, the less they have to pay others for using the standard. Cumulative royalties might otherwise reach the point of unprofitable manufacture (Alkio, 2003; Soininen, 2005). For this reason, companies have an incentive to obtain patents that are essential for using the standardized technology. They may therefore amend their pending patent applications and file for new ones during the standardization process in order to make sure that if a certain technology is chosen for a standard, their patents cover some of its elements. For example, with regard to the CDMA2000 standard, Qualcomm held 28%, Nokia 16%, NTT DoCoMo 13%, Ericsson 8%, Motorola 7% and Hitachi 5% of the essential patents involved. Then again, Ericsson

has 30%, Nokia 21%, Qualcomm 20% and Motorola 14% of the essential patents included in the WCDMA standard (Alkio, 2003). In fact, it has been estimated that some of these major patent holders will end up with a total royalty of 7% of costs or less, while a nonpatent holder could pay 25% of the wholesale price in GSM and WCDMA royalties (Wireless Watch, 2005a).

In order to diminish the problem with too high royalties, some manufacturing firms and operators have declared that they would prefer to agree upon cumulative royalty caps beforehand (Wireless Watch, 2005a). For instance, Nokia was behind such a proposal in respect of 3G patents (Naraine, 2002a). Nevertheless, there are different views on whether agreeing on licensing terms is the job of the standards organization at all, and Qualcomm, in particular, has opposed the royalty-cap proposition actively (Naraine, 2002b). Also one of the U.S. interviewees pointed out during the interview, that in the end, the markets determined whether a product was feasible at a certain price or not. This was not the licensor's responsibility. He further noted that the game in the industry seems to have turned into a price competition rather than the building up of value to customers and communicating that value to them (Interview data U.S., 2004). However, as far as the next version of the 3GPP-based radio standard, Long Term Evolution (LTE), is concerned, ETSI is considering getting all relevant patent holders to sign up to a pre-agreed cumulative cap of approximately 5% for royalties on the cost of LTE equipment (Informamedia.com, 2006).

Licensing and Submarine Patents

As explained earlier, standardization participants have diverging business interests that, combined with control over certain aspects of technology, complicate the standardization process and the adoption of standards particularly if monetary or other licensing compensation is pending. In fact, quantitative research conducted by Blind et al.,

(2002) has indicated that the dilemma is not rare at all: over 30% of European companies reported that they had faced dilemmas involving the high licensing fees demanded by the IPR/patent holders, and approximately 25% had had problems with cross-licensing (Blind et al., 2002; Soininen, 2005). However, if there were no compensation, fewer patent holders might be inclined to allow anyone to utilize their patented inventions, and technologically inferior technology might be chosen for the standard. In fact, it has been suggested that incentives offered to patent holders are not sufficient given the positive effects of standardization. Another quantitative study also conducted by Blind and Thumm (2002) demonstrated that the tendency to join standardization processes is lower if an undertaking has intense patent activity than if it does not. It is suggested that this could be an indicator that the use of IPRs, reflecting the success of the company's own R&D activities, and participation in standardization are, to certain extent, alternative innovation strategies (Blind et al., 2002, Soininen, 2005). Unfortunately this finding also indicates that a large chunk of patents may fall into the category of third-party patents that have a high likelihood to remain unnoticed.

What basically differentiates submarine patent cases and those in which a patent has been properly disclosed is the possibility to make informative decisions about the adoption of a standard, design around it or to agree upon licensing terms in advance. However, standards organization's patent policies only require a general promise to license on RF or RAND terms. Exact licensing conditions are negotiated separately between the parties and this is often done after the standard has been elected. Therefore, with an exception of the fact that a licensing statement has been given and therefore there are more changes of challenging the company's licensing terms, these situations bear a lot of similarities to submarine patent cases. Obviously, if licensing terms were specified better and RAND terms were determined in

accordance with the situation that has prevailed prior to the establishment of the standard, there would be less room for interpretation, and the patent holder would not be in such a good negotiation position. This follows that, even though it was possible to diminish the dilemma with submarine patents discussed earlier, licensing perplexities would probably continue to prevail. On the other hand early disclosure could at least diminish those significant economic losses that would occur if the submarine patent surfaced after the standard had been used broadly and various complementary products and services had been based on it. It should be pointed out, however, that the advantages of clearing all relevant patents beforehand also depends on whether the standard is such that it is constantly evolving as new features are incorporated into the system after the original standard has been set, or whether it remains unchanged after its establishment. In the former situations it would be important to be able to gain information also on those rights, which are essential for the purposes of implementing the standard in its amended form, while those rights that were initially essential may no longer be relevant at this phase.

DISCUSSION

In the previous sections I have identified multiple situations in which patents have caused concern during and after cooperative standard setting. These situations could basically be divided into those in which the holder of the disputed patent has participated in setting the standard and those in which the patent holder is a third party. Furthermore, a distinction could be made between patents that have been properly disclosed to the other participants, and the rights that come as a surprise either because the patent policy has not required their disclosure and no attention has been drawn to them, the patent holder has intentionally concealed them despite the patent policy, or

the rights holder has accidentally neglected to disclose them.

The number-one reason for the disputes that have arisen in the previously-mentioned situations is that patent holders use their position of being able to prevent others from using an invention that is essential for operating the standard to require licensing fees or other terms that are unacceptable to companies operating in the industry. When talking about properly disclosed patents, the patent holder may have made a declaration prior to the publication of the standard specification to the effect that it was willing to license its essential patents royalty-free, or that it was willing to license them on fair, reasonable and non-discriminatory terms. Here, the patent holder may have posed certain limitations, or the patent holder may have made only a blank promise of RF or RAND licensing, and a dispute may arise afterwards over what the correct interpretation of such a promise is. Sometimes, there may not be any kind of a promise.

The consequences of the patent holder refusing to license at all, or on terms accepted by most companies, depend on when the dilemma comes to light. The longer it takes for the dispute to arise the worse are the consequences from a societal perspective. Before the standard is set it may well be possible to design around the patents or to choose other technologies over heavily patented ones, and even after the standard specifications have been published, the abandoning of the standard altogether, or its modification, may not be detrimental as companies may have alternative standards to choose from. Of course, the time and the money invested in setting a standard would be lost. On the other hand, if the standard has already been broadly adopted it may be difficult and very costly to change the specifications without losing the network benefits. Ultimately, doing so would harm consumers who are already using a system in which various products are interchangeable and interoperable. Obviously, from the patent holder's perspective, the situation is reversed: the

later his patent comes to the surface, the more leverage he gains.

I posed the question in the title of this article whether especially the submarine patent problem truly existed or whether it was a red herring. Although the evidence is largely anecdotal and further quantitative research is needed, I have to conclude that problems to do with unidentified patents do come to the surface after the standard has been established. Obviously, even though there is a high likelihood that plenty of relevant patents remain unnoticed, it is only a minor aspect of the variety of conflicts that patents give rise to during or after standardization, and plenty of standards can be adopted without actually having to face troubles with submarine patents. Particularly those situations in which it can be proven that a standard-setting participant breached the patent policy and purposefully concealed the existence of relevant patents or patent applications and thus misled the industry and manipulated the process in order to gain market power, appear to be rare. Companies typically try to do their best to comply with the patent policy.

Avoiding problems with submarine patents seems to be getting more challenging all the time, however. This is because ICT patents, some of which are valid and some of which are not, are increasing in number making it more difficult to avoid infringement. Furthermore, patents are being assigned more often than before and therefore they may end up in companies that did not participate in setting the standard. Patents are also utilized more aggressively in the field, and the more patent-holding companies are seeking to extract as high royalties as they can get from those implementing a standard the less likely it is that an amicable solution can be reached. As a consequence, particularly the U.S. red herring population seems to be growing quickly in number, even though certain legal provisions such as the U.S. Sherman Act, sections 1 and 2, which prohibit conspiracy and monopolization or its attempt, and the FTC Act, section 5, which prohibits the use

of unfair and deceptive business practices, have been and could be used in an attempt to wipe out the most colorful individuals. Other legal tools include fraud, equitable estoppel that prevents a party that has not operated fairly from enforcing his rights, the doctrine of prosecution laches applicable to patents that have been issued following an unreasonable and unexplained delay during patent prosecution phase, and the implied-license and patent-misuse doctrines (Lemley, 2002; Mueller, 2001). Furthermore, non-infringement clarification and patent invalidation either in court or as an opposition (EPO) or re-examination (USPTO) procedure in the patent office could be attempted. In Europe the EC treaty, Art 81 (prohibits agreements and concerted practices that prevent, distort or restrict competition) and 82 (prohibits the abuse of dominant position) could offer limited help as well. Unfortunately, the legal means have not appeared to be very effective so far. The fact that legal disputes have arisen demonstrates that the dilemmas are serious and that they bear significant economic weight, however.

What makes particularly the submarine patent problem interesting from the societal and patent policy perspective is that in this case companies implementing the standard have not, for some reason or other, been able to identify the relevant rights or to plan their operations so as to avoid infringement. Moreover, the consequences of not being able to continue to use a specific standard may have far-reaching effects not only on the competition in a certain field but also on consumers. Therefore, the purpose of the patent system—to promote innovation and facilitate technology transfer through granting the inventor an exclusive right in return for publishing his invention—may not merely restrain trade in the traditional sense, that is, legal monopoly versus free competition, but may also contravene the public interest in a way that is no longer reasonable given the role of patents in enhancing innovation. This, incidentally, has been seriously questioned in areas such as software and semiconductors. In

fact, patents and standards are a policy concern linked to a more general concern regarding IPR protection and the possibility of using it in order to control product interoperability.

This article suggests that further attention should be paid to analyze the efficacy of the legal framework and the need for legislative amendments particularly in the context of standards and so-called submarine patents that come to surface after the standard has been established and adopted. As a practical matter for diminishing potential conflicts, clarifying patent policies in respect to disclosure and licensing obligations, conducting more thorough patent due diligence, and developing guidelines on how to determine RAND terms are recommended. It is further noted that limiting only the risk of submarine patents will not get us far in reducing the conflicts between patents and standards.

REFERENCES

- Administrative Complaint (2002), Docket No 9302, 18 June 2002.
- Alkio, M. (2003, March 9). Kovaa peliä patenteilla. *Helsingin Sanomat*, p. E3.
- ANSI. (2003a). *Guidelines for implementation of the ANSI Patent Policy*.
- ANSI. (2003b). *Patent policy*.
- Asaravala, A. (2004, April 24). Forgent sues over JPEG patent. *Wired News*. Retrieved August 29, 2006, from <http://www.wired.com/news/business/0,1367,63200,00.html>
- Balto, D.A., & Wolman, A.M. (2003). Intellectual property and antitrust: General principles. *IDEA The Journal of Law and Technology*, 43(3), 396-474.
- Bekkers, R., Duysters, G., & Verspagen, B. (2002). Intellectual property rights, strategic technology agreements and market structure. The case of GSM. *Research Policy*, 31, 1141-1161.
- Bekkers, R., Verspagen, B., & Smits, J. (2002). Intellectual property rights and standardization: The case of GSM. *Telecommunications Policy*, 26(3-4), 171-188.
- Berlind, D. (2002a, April 16). IBM drops Internet patent bombshell. *Tech Update*.
- Berlind, D. (2002b, April 25). The hidden toll of patents on standards. *Tech News on ZDNet*. Retrieved August 29, 2006, from http://news.zdnet.com/2100-9595_22-891852.html
- Berman, V. (2005, January-February). Is it time to reexamine patent policy for standards? *IEEE Design & Test of Computers*, 71-73.
- Bessen, J. (2003). *Strategic patenting of complex technologies* (Working Paper). Research on Innovation.
- Blind, K. (2004). *The economics of standards*. Edward Elgar.
- Blind, K., Bierhals, R., Thumm, N., Hossain, K., Sillwood, J., Iverser, E., et al. (2002). *Study on the interaction between standardisation and intellectual property rights* (EC Contract No G6MA-CT-2000-02001, 2002).
- Blind, K., Edler, J., Nack, R., & Strauß, J. (2001). *Micro- and macroeconomic implications of the patentability of software innovations. Intellectual property rights in information technologies between competition and innovation* (Study on Behalf of German Federal Ministry of Economics and Technology).
- In re Bogese II, 303 F.3d 1362, 1367, Federal Circuit (2002).
- Initial Decision (2004). Docket No 9302, 23 February 2004.
- Calderone, L.L., & Custer, T.L. (2005, November). *Prosecution laches as a defense in patent cases*.

- Flaster Greenberg Attorneys at Law. Retrieved August 29, 2006, from http://www.flastergreenberg.com/pdf/PatentArtic_prf3.pdf
- Caplan, P. (2003). *Patents and open standards* (White paper prepared for the National Information Standards Organization).
- Chesbrough, H. (2003). *Open innovation*. Harvard Business School Press.
- Clark, D. (2002, October). Do Web standards and patents mix? *Computer*, pp. 19-22.
- Clark, R. (2002, July 19). *Concerning recent patent claims*. Retrieved August 29, 2006, from <http://www.jpeg.org/newsrell.html>
- Cohen, W.M., Nelson, R.R., & Walsh, J.P. (2000, February). *Protecting their intellectual assets: Appropriability conditions and why U.S. manufacturing firms patent (or not)* (NBER Working Paper Series).
- Cunningham, A. (2005). Telecommunications, intellectual property, and standards. In I. Walden, & J. Angel (Eds.), *Telecommunications law and regulation*. Oxford.
- DLA. (2004). *European intellectual property survey*.
- Eolas Technologies Incorporated and the Regents of the University of California v. Microsoft Corporation, Case Nr. 04-1234, Federal Circuit, 2 March 2005.
- ETSI. (2005). *IPR policy*.
- Farrell, J. (1996). *Choosing the rules for formal standardization*. UC Berkeley.
- Federal Trade Commission v. Dell Computer Corp., FTC File No. 931 0097, 2 November 1995.
- Feldman, R.P., & Rees, M.R. (2000, July). The effect of industry standard setting on patent licensing and enforcement. *IEEE Communications Magazine*, pp. 112-116.
- Ferguson, K. (1999). 20/20 foresight. Retrieved August 29, 2006, from <http://www.forbes.com/1999/04/19/feat.html>
- Forgent Networks. (2006). *Intellectual property, '672 patent cases*. Retrieved August 29, 2006, from <http://www.forgent.com/ip/672cases.shtml>
- Frank, S.J. (2002, March). Can you patent an industry standard? *IEEE Spectrum*.
- FTC. (2003). *To promote innovation: The proper balance of competition and patent law and policy*.
- Graham, S.J.H., & Mowery, D.C. (2002, June 6-8). *Submarines in software? Continuations in U.S. software patenting in the 1980s and 1990s*. Paper presented at the DRUID Summer Conference on Industrial Dynamics of the New and Old Economy—Who is Embracing Whom?, Copenhagen/Elsinore.
- Granstrand, O. (1999). *The economics and management of intellectual property*. Edward Elgar Publishing.
- Grindley, P. (2002). *Standards, strategy and policy*. Oxford.
- Gohring, N. (2005a). Qualcomm files a second suit against Broadcom. *InfoWorld*. Retrieved August 29, 2006, from http://www.infoworld.com/article/05/10/21/HNqualcommsecondsuit_1.html
- Gohring, N. (2005b). Qualcomm files patent infringement suit against Nokia. *InfoWorld*. Retrieved August 29, 2006, from http://www.infoworld.com/article/05/11/07/hnqualcommsuit_1.html
- GovTrack.us. 109th Congress, H.R. 2795: Patent Act of 2005. Retrieved August 29, 2006, from <http://www.govtrack.us/congress/bill.xpd?bill=h109-2795>
- Hahn, R.W. (2001, March). Competition policy and the new economy. *Milken Institute Review*, 34-41.

- Heinze, W.F. (2002, May). Dead patents walking. *IEEE Spectrum*, 52-54.
- Hemphill, T.A. (2005, January). Technology standards development, patent ambush, and US antitrust policy. *Technology in Society*, 27(1), 55-67.
- Hjelm, B. (2000). Standards and intellectual property rights in the age of global communication: A review of the international standardization of third-generation mobile system.
- IETF. (2005). Intellectual property rights in IETF technology.
- Informamedia.com. (2006, March 1). ETSI acts on unfair, unreasonable and discriminatory IPRs. *Informamedia.com*.
- IPO. (n.d.). *21st Century Patent Coalition: "Submarine patents" ARE a significant problem*. Retrieved August 29, 2006, from <http://www.ipo.org/contentmanagement/contentdisplay.cfm?contentid=7334>
- ITU-T (n.d.). *Patent policy*.
- ITU-T (2005). *Patent policy implementation guidelines*.
- Jacobs, P. (2005, December). Qualcomm defends patent licensing programme. *wirelessweb*. Retrieved August 29, 2006, from <http://wireless.iop.org/articles/news/6/12/6/1>
- Kipnis, J. (2000, July). Beating the system: Abuses of the standards adoption process. *IEEE Communications Magazine*, pp. 102-105.
- Kirsch, E.D. (2000). International standards participation: Lessons from Townshend & Dell. *International Lawyers Network. The bullet "iln"*, 1(2). Retrieved August 29, 2006, from http://www.ag-internet.com/push_news_one_two/internationalstandards.htm
- Knight, H.J. (2001). *Patent strategy for researchers and research managers*. John Wiley & Sons.
- Kratzman, V.A. (2005). *Technology transfer mid-term report next step recommendations*. FINPRO.
- Krechmer, K. (2005, January). *Communications standards and patent rights: Conflict or coordination?* Paper presented at the Economics of the Software and Internet Industries Conference, Toulouse, France.
- Labsystems Oy v. Biohit Oy. HOS 94/1922. Finnish Court of Appeal.
- The Lemelson Foundation. (n.d.). Jerome H. Lemelson. Retrieved August 29, 2006, from http://www.lemelson.org/about/bio_jerry.php
- Lemley, M.A. (2002). *Intellectual property rights and standard setting organizations* (UC Berkeley Public Law and Legal Theory Research Paper Series, Research Paper No. 84).
- Lemos, R. (2002, July 23). Finding patent truth in JPEG claims. *CNET News.com*. Retrieved August 29, 2006, from http://news.com.com/Finding+patent+truth+in+JPEG+claim/2100-1001_3-945686.html
- Lo, A.M. (Jupiter Networks, Inc). (2002). *A need for intervention: Keeping competition alive in the networking industry in the face of increasing patent assertions against standards*. FTC/DOJ Hearings on Competition and Intellectual Property Law and Policy In the Knowledge-Based Economy—Standard Setting and Intellectual Property, 18 April 2002.
- Malone, S. (2005, November 1). *Microsoft loses Eolas Supreme Court appeal*. PC Pro. Retrieved August 29, 2006, from <http://www.pcpro.co.uk/news/news/79431>
- Marasco, A. (ANSI). (2003, October 30). *IPR and standards*. Presentation at AIPLA.
- Markoff, J. (2002, July 29). Patent claim strikes an electronics nerve. *The New York Times*.

- Megantz, R.C. (2002). *Technology management. Developing and implementing effective licensing programs*. John Wiley & Sons.
- Messerschmitt, D.G., & Szyperski, C. (2003). *Software ecosystem*. The MIT Press.
- Miele, A.L. (2000). *Patent strategy: The manager's guide to profiting from patent portfolios*. John Wiley & Sons.
- Mueller, J.M. (2001). Patenting industry standards. *John Marshall Law Review*, 34(897).
- Naraine, R. (2002a, May 8). Nokia calls for 5% cap on 3G patent royalties. *internetnews.com*. Retrieved August 29, 2006, from <http://internetnews.com/wireless/article.php/1041561>
- Naraine, R. (2002b, May 10). Qualcomm rejects Nokia patent cap proposal. *internetnews.com*. Retrieved August 29, 2006, from <http://www.interetnews.com/wireless/article.php/1116381>
- Nokia. (2005a, October 28). *Leading mobile wireless technology companies call on European Commission to investigate Qualcomm's anti-competitive conduct*. Retrieved August 29, 2006, from http://press.nokia.com/PR/200510/1018639_5.html
- Nokia. (2005b, October 28). *Leading mobile wireless technology companies call on European Commission to investigate Qualcomm's anti-competitive conduct*. Retrieved August 29, 2006, from http://europe.nokia.com/BaseProject/Sites/NokiaCom_CAMPAIGNS_57710/CDA/Categories/PressEvents/_Content/_Static_Files/transcript.pdf
- Nokia. (2005c, November 7). *Nokia responds to reports of Qualcomm GSM patent infringement suit*. Retrieved August 29, 2006, from http://press.nokia.com/PR/200511/1019958_5.html
- OASIS. (2005). *IPR policy*.
- OECD. (2004). *Patents and innovation: Trends and policy challenges*. Retrieved August 29, 2006, from <http://www.oecd.org/dataoecd/48/12/24508541.pdf>
- OECD. (2005). *Compendium of patent statistics*. Retrieved August 29, 2006, from <http://www.oecd.org/dataoecd/60/24/8208325.pdf>
- Ohana, G. (Cisco Systems, Inc). (2005. October 6). Intellectual property rights: Policies in standard-setting: Areas of debate. In *Proceedings of From A to Veeck: Standardization and the Law, 2005 ANSI Annual Conference*. Retrieved August 29, 2006, from <http://public.ansi.org/ansionline/Documents/Meetings%20and%20Events/2005%20Annual%20Conference/Legal%20Conference/Ohana-Panel%20I.pdf>
- Out-law.com*. (2005, November 31). Mobile-makers say 3G patent licensing breaks antitrust laws. Retrieved August 29, 2006, from <http://www.out-law.com/page-6280>
- Peterson, S.K. (Hewlett-Packard Company). (2002a). *Consideration of patents during the setting of standards*. For FTC and DOJ Roundtable, Standard Setting Organizations: Evaluating the Anticompetitive Risks of Negotiating IP Licensing Terms and Conditions Before A Standard Is Set, 6 November 2002.
- Peterson, S.K. (Hewlett-Packard Company). (2002b). *Patents and standard-setting processes*. FTC/DOJ Hearings on Competition and Intellectual Property Law and Policy in the Knowledge-Based Economy, 18 April 2002.
- Perens, B. (n.d.). *The problem of software patents in standards*. Retrieved August 29, 2006, from <http://perens.com/Articles/PatentFarming.html>
- Poltorak, A.I., & Lerner, P.J. (2004). *Essentials of licensing intellectual property*. John Wiley & Sons.
- PwC Advisory. (2006). *2006 patent and trademark damages study*.

- Rahnasto, I. (2003). *Intellectual property rights, external effects, and anti-trust law*. Oxford University Press.
- Rambus, Inc v. Infineon Technologies AG. No. 01-1449. Federal Circuit, 29 January 2003.
- Red Herring*. (2006, February 3). JPEG patent reexamined. Retrieved August 29, 2006, from <http://www.redherring.com/Article.aspx?a=15582&hed=JPEG+Patent+Reexamined§or=Industries&subsector=Computing>
- Regan, K. (2005, July 5). Broadcom suit accuses Qualcomm of antitrust tactics. *E-Commerce Times*. Retrieved August 29, 2006, from <http://www.ecommercetimes.com/story/44395.html>
- Reingold, J. (2006, January). *Patently aggressive*. 102. Retrieved August 29, 2006, from <http://www.fastcompany.com/magazine/102/patents.html>
- Rivette, K., & Kline, D. (2000). *Rembrandts in the attic*. Harvard Business School Press.
- Sarvas, R., & Soininen, A. (2002, October). *Differences in European and U.S. patent regulation affecting wireless standardization*. Paper presented at the International Workshop on Wireless Strategy in the Enterprise, Berkeley, California.
- Shapiro, C. (2001). *Navigating the patent thicket: Cross licenses, patent pools and standard setting*.
- Shapiro, C., & Varian, H.R. (1999). *Information rules*. Harvard Business School Press.
- Shurmer, M., & Lea, G. (1995, June). Telecommunications standardization and intellectual property rights: A fundamental dilemma? *Standardview*, 3(2).
- Soininen, A. H. (2005). Open Standards and the Problem with Submarine Patents. Proceedings SIIT 2005 pp. 231-244 4th International conference on standardization and innovation in information technology.
- Stroyd, A.H. (2000). *Lemelson bar coding patents: Attempting to sink the submariner*. Retrieved August 29, 2006, from <http://www.mhia.org/PSC/pdf/Lemelson.PDF>
- Surowiecki, J. (2006, December 26/January 2). Blackberry picking. *The New Yorker*, Financial Page.
- Symbol Technologies Inc. v. Lemelson Medical, Education & Research Foundation. 277 F.3d 1361, 1363. Federal Circuit, 2002.
- Symbol Technologies, Inc et al. v. Lemelson Medical, Education & Research Foundation. LP et al., 422 F.3d 1378. Federal Circuit, 2005.
- Teece, D.J. (2000). *Managing intellectual capital*. Oxford University Press.
- Townshend v. Rockwell International Corp. and Conexant Systems, Inc., 55 U.S.P.Q.2d 1011. Northern District of California, 2000.
- Varchaver, N. (2001, May 3). *Jerome Lemelson the patent king*. Retrieved August 29, 2006, from <http://www.engin.brown.edu/courses/en90/fall/2003/Lemelson%20Fortune%20may%2014%202001%20article.pdf>
- Vermont, S. (2002). The economics of patent litigation. In B. Berman (Ed.), *From ideas to assets. Investing wisely in intellectual property*. John Wiley & Sons.
- Watts, J.J.S., & Baigent, D.R. (2002). Intellectual property, standards and competition law: Navigating a minefield. *IEEE*, 837-842.
- Westman, R. (1999, October). The battle of standards—And the road to peace. *On—The New World of Communication*, pp. 26-30.
- Wireless Watch. (2005a, November 29). Mobile patents war shifts to email. *The Register*. Retrieved August 29, 2006, from http://www.theregister.co.uk/2005/11/29/mobile_email_patents_war/

Wireless Watch. (2005b, November 15). *The Register*. Qualcomm IP battle hots up. Retrieved August 29, 2006, from http://www.theregister.co.uk/2005/11/15/qualcomm_ip_battle/

Wong, W. (2002, April 18). IBM ebMXL patent plan royalty-free. *Tech Update*.

W3C (2004). *Patent policy*.

This work was previously published in International Journal of IT Standards and Standardization Research, Vol. 5, Issue 1, edited by K. Jakobs, pp. 41-83, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.24

Factors Influencing the Lifetime of Telecommunication and Information Technology Standards: Results of an Explorative Analysis of the PERINORM Database

Knut Blind

*Fraunhofer Institute for Systems and Innovation Research, Germany
Berlin University of Technology, Germany*

ABSTRACT

This article presents the results of an explorative study for the lifetimes and survival rates of formal standards in telecommunication and information technology. The analysis reveals that the survival rate depends on the dynamic development of technologies and on country-specific characteristics. In a second step, we tried to identify factors influencing the lifetimes of standards. In general, standards replacing an already existing document have an expected survival time compared to documents without a predecessor. Standards with a successor document have, as anticipated, a shorter expected lifetime. Finally, the increased speed of technological change reduces the life-

times of standards. Based on these first insights, we derive the following recommendations. First, standardisation bodies should adapt their standard maintenance according to the specific requirements of technologies and the related markets, but should also harmonise their processes at the international level in order to avoid frictions for the development of technologies and markets.

INTRODUCTION

The dynamic technological changes in information and communication technology (ICT) influence the lifetimes of standards. The need to change or adjust standards according to new

trends in the ICT sector has definitely increased in the last decade. Furthermore, some standards became obsolete, because new technologies led to completely new generations of standards. Consequently, standards have a life cycle.

Despite the high dynamics in ICT and the high relevance of standards for the development of ICT and the related sectors, there is no systematic quantitative analysis which tries to investigate the dynamics of ICT standards and its driving factors. An exception is the contribution by Egyedi and Heijnen (2005), who focus on the internal revision processes of ISO (International Organization for Standardization). This article presents first explorative results comparing different technologies and countries, based on the data of the PERINORM database published by the national standard development organisations (SDOs), BSI (British Standards Institute), DIN (Deutsches Institut fuer Normung) and AFNOR (Association Française de Normalisation). Another kind of evolution of standards is discussed and illustrated by Swann (2000), who analyses the interplay between innovation and standardisation. Starting with a basic standard, which defines the specifications of some platform technology, the field for further innovation is set in using this basic technology for various applications. We are not able to analyse this kind of interrelationship referring to the database used for this analysis. In contrast to the rather few quantitative studies, we can rely on a long tradition of theoretical analyses done by economists starting the 1980s by the work of Arthur (1989) applied in David's study of the typewriter keyboard standard QWERTY (David, 1985) and Farrell and Saloner's (1985, 1986) game theory approach. Based on network externalities, increasing returns but also information asymmetries these authors mainly explain the lock in effects of standardisation and the missing dynamics. Besides these very theoretical approaches to deal with standards dynamics, several case study analyses exist, which focus on the standard maintenance and succession (Egyedi

& Loeffen, 2002) in order to answer the question how to deal with heritage relations between standards and on standard integrity (Egyedi & Hudson, 2005) and in order to discuss control mechanisms that safeguard the integrity of (de facto) standards. This article adds an additional methodological dimension to the analysis of the dynamics of standards.

The remainder of the article is structured as follows. First, we analyse the average lifetimes of standards in a quantitative manner, taking into account differences between countries. The country differences are caused by institutional differences in the countries considered, like different time lags regarding the implementation of international and European standards, but also by the heterogeneous quality of the data delivered to the central database. Since the simple approach of calculating the average lifetimes of historical standards does not allow us to include standards which are still alive, we have to apply a more sophisticated methodology, the so-called survival analysis, which was initially mainly applied in medical science. The application of this statistical approach produces average lifetimes of standards, taking into account the expected lifetime of standards which are still valid. This approach is crucial, especially for the analysis of ICT standards, because the number of valid standards relative to historical standards is rather high. Due to the very high relevance of international standards in the ICT sector and the high quality of this subsample, we concentrate the survival analysis especially on the international standards including the standards released by the European standardisation bodies. The results of this analysis provide us with new insights about the expected lifetimes of standards differentiated by technology in the ICT area. The final step of our analysis tries to answer the question which causal factors influence the lifetimes of standards in the ICT sector. We present first insights by applying the so-called Cox regression, which allows us to identify whether some selected additional characteristics of a standard, like cross references

or references to international standards, but also the dynamics of technical change during its lifetime measured by a patent indicator have a significant impact on its actual or expected lifetime. The approach to assess the importance of a technical document by analysing its references to other documents or being referenced in other documents has a long tradition in evaluating the value of patents by counting and analysing their citations (see , for example the recent publication by Hall, Jaffe, and Trajtenberg, 2001). The article concludes with a brief summary of the main results, but also with some general recommendations regarding standardisation processes and the maintenance of standards.

HYPOTHESES AND THE DATABASE

As already indicated in the introduction, several factors influence standards dynamics, that is, changes, supplements or withdrawals of standards. However, we are restricted in our analysis by the information provided in the standards database we rely on. Therefore, we will concentrate in our analysis on testing the following general hypotheses, which will be explained in more detail and tested by various statistical approaches in the subsequent sections.

H1: The dynamics of standards depends on the type of technology, that is, ICT standards implemented in hardware infrastructure have a longer life expectancy than software standards, because of higher investments necessary to implement new hardware compared to new software (Egyedi & Heijnen, 2005; Katz & Shapiro, 1994). Furthermore, the network externalities and the switching costs of technologies have an influence on the likelihood of changes in a standard (Shy, 2001).

H2: The higher the speed of technical change, the higher the pressure to adapt, change or

withdraw an existing standard (Blind, 2004; Blind & Grupp, 2000).

H3: The institutional framework in which a standard is embedded matters, because cross references in general, references to international standards, links to predecessor or successor documents will change the life expectancy of a standard. In addition, the type of document is essential for its lifetime. Draft documents are changed or withdrawn more often than finalised standards.

H4: Although the differences between technologies should be more distinct than the differences between countries, we still observe significant institutional differences between national standardisation bodies, like the time lags in implementing international and European standards. Therefore, country differences regarding the lifetimes of standards should be expected.

We will apply different methodological approaches to test these hypotheses. We will perform simple descriptive statistics of average publication and withdrawal years, then continue with survival time analyses, which allow us to take into account the numerous still valid documents, and finally conduct Cox regression analyses in order to identify significant factors influencing the lifetimes of standards, at least in the fields with sufficient information and observations.

For our analysis we use the PERINORM database edited by the three major national standardisation bodies in Europe, BSI in the United Kingdom, DIN in Germany, and AFNOR in France. The database is also available online, but we use the CD ROM version.

The main characteristics of PERINORM edition 2004 relevant for our analysis are the following. Since we concentrate on the ICT sector, we select only the documents in the field of telecommunication and information technology, including office machines, by relying on the international classification of standards (ICS).

Telecommunication is identified by the ICS code 33, information technology by the ICS code 35. The next level of subdivision of the two ICT-related fields will be illustrated in the tables used. In total, we rely on more than 78,000 documents in the field of telecommunication and more than 31,000 documents in the field of information technology, and office machines. The majority of the documents have been published since the beginning of the 1990s.

In our analysis, we cover the following European countries: Austria (AT); Belgium (BE), Czech Republic (CZ), Switzerland (CH), Germany (DE), Denmark (DK), Spain (ES), France (FR), Great Britain (GB), Italy (IT), Netherlands (NL), Norway (NO), Poland (PL), Russia (RU), Sweden (SE), Slovakia (SK) and Turkey (TR).

In addition, the set of international and European standards are included (IX). The data on international standards do not include standards by the European Telecommunication Standards Institute ETSI published after 1997, which generates some bias in the results on international telecommunication standards. The data quality is rather heterogeneous, since the databases of the founding countries France, Germany, and Great Britain are of higher quality than those of most other countries. The data about the standards released by the international bodies is also of good quality. It has to be noted that the European and the international standards should be included in the set of national standards, because of the requirement of CEN and ISO members to integrate and implement the European, respectively the international standards.

Although each document is described by almost 50 characteristics, we rely in our analysis mainly on the following search fields: classification, cross references, expiry date, international relationship, issuing body, origin code, publication date, replaced by, replaces, status, withdrawal date.

In the more sophisticated analyses, we have to restrict ourselves to those countries which

provide high quality data for most of the relevant classification fields.

Due to the large number of documents and descriptors, we have set up two separate databases, one for the telecommunication standards and one for the information technology, office machines standards.

DESCRIPTIVE RESULTS

In a first step, we analysed the average publication and withdrawal dates, differentiated both by technological area and by country. In this first analytical step, we concentrate on all standards documents, that is, including drafts and prestandards, by calculating the average of their publication date. In calculating withdrawal dates, we just consider those documents which are already withdrawn by calculating their average withdrawal dates.

In Table 1, we present the average publication and withdrawal dates by technological area in telecommunication technology. The average publication dates vary between 1993 and 1998. The oldest documents can be found in the area of measuring equipment for use in telecommunication with an average publication date as far back as 1993. Standards on components and accessories for telecommunication equipment were published on average more than 10 years ago in 1994, those on telecommunication terminal equipment in 1995. In contrast, if we look at the standardisation fields with more recent average publication dates, we find standards for fibre optic communications with an average publication year of 1999. Standards for telecommunication services and mobile services are on average published in 1998. This first picture is in line with the technological and market development in telecommunication. First, standards are needed to solve the general measurement and testing problems, then to secure the compatibility between components of the equipment and the terminal equipment itself. With the maturing of

Table 1. Average publication and withdrawal dates in telecommunication differentiated by area of standardisation

| Categories | Publication Date | Withdrawal Date |
|--|-------------------------|------------------------|
| Telecommunications in general including infrastructure | 1996.59 | 1998.13 |
| Telecommunication services | 1998.34 | 2000.56 |
| Telecommunication systems including network (system) aspects | 1996.25 | 1998.14 |
| Telecommunication terminal equipment | 1995.25 | 1999.18 |
| Radio communications | 1996.61 | 1998.06 |
| Mobile services | 1998.08 | 1998.11 |
| Integrated Services Digital Network (ISDN) | 1997.27 | 1998.27 |
| Electromagnetic compatibility (EMC) including radio interference | 1998.19 | 1999.63 |
| Components and accessories for telecommunications equipment | 1994.59 | 1998.73 |
| Special measuring equipment for use in telecommunications | 1993.28 | 1997.88 |
| Audio, video and audiovisual engineering | 1995.57 | 1997.66 |
| Television and radio broadcasting | 1996.76 | 1998.32 |
| Fibre optic communications | 1999.03 | 1999.43 |
| Telecontrol telemetering including supervising, control and data acquisition | 1997.11 | 1997.94 |

the technology and the market itself, we observe a shift in the focus from fixed to mobile telephone technology. This is also reflected by the delayed publication of standards for mobile services. Furthermore, the telecommunication industry experiences a further shift to service-related applications. Consequently, at a later stage we observe the publications of standards structuring telecommunication services. In summary, the ranking of the average publication dates presents the historical development of a technology.

Although Egyedi and Heijnen (2005) indicate that the average withdrawal dates are not good indicators for the expected lifetime of standards, we report in this section also the average withdrawal dates. However, we perform a more sophisticated analysis which allows us to calculate

the expected lifetimes of standards in the next section. In general, we observe a rough correlation between average publication and withdrawal dates. However, the fields of standardisation which started relatively early are characterised by larger differences between withdrawal and publication dates. In the emerging fields of telecommunication standardisation, the differences between average withdrawal and publication date are smaller, which is caused by the fact that the majority of the standards in these areas are still alive. An exception is the area of telecommunication services, where a significant share of standards has obviously already been withdrawn.

In Table 2, we present the average publication and withdrawal dates differentiated by country. The overview confirms that the country-specific

Table 2. Average publication and withdrawal dates in telecommunications for various countries

| Country | Number of Standards | Publication Date | Withdrawal Date |
|-------------------------|----------------------------|-------------------------|------------------------|
| International standards | 18154 | 1995.26 | 1997.46 |
| Austria | 8377 | 1998.31 | 1999.27 |
| Belgium | 4679 | 1999.76 | 2001.64 |
| Switzerland | 1663 | 1995.18 | 1998.23 |
| Czech Republic | 3374 | 1998.25 | 2002.48 |
| Germany | 6983 | 1994.64 | 1997.30 |
| Denmark | 5355 | 1999.02 | 2000.21 |
| Spain | 1792 | 1996.13 | 1999.69 |
| France | 2927 | 1996.90 | 1999.17 |
| United Kingdom | 2029 | 1997.26 | 1999.77 |
| Italy | 19 | 1994.89 | 2002.33 |
| Netherlands | 5785 | 1997.44 | 1999.53 |
| Norway | 2467 | 1998.00 | 1998.44 |
| Poland | 1122 | 2000.02 | 2003.00 |
| Russia | 446 | 1988.95 | 1999.70 |
| Sweden | 4405 | 1997.46 | 1998.33 |
| Slovakia | 4654 | 1999.71 | 2000.69 |
| Turkey | 1422 | 1998.16 | 2002.00 |

databases differ significantly. On the one hand, we observe only small differences between averages of the large central European countries. On the other hand, the data of the eastern European countries indicate for Russia relatively old standards documents based on an average publication date before 1990, but for the Czech Republic, Slovakia, Poland, and Turkey a rather young set of standards with an average publication year close to 2,000. Whereas the Russian case is certainly influenced by a rather old and small national stock of standards, which has only recently been linked to the international standardisation activities. The other three countries are meanwhile linked to CEN, which means that they implement the stock of European standards in their national standardisation system. Since they possessed only a small stock of domestic standards, the implementation of the European stock of telecommunication

standards rejuvenated the national stock of standards drastically. The European effect can also be observed in Belgium, which has no significant own standardisation activities.

In the next step, we look at the dynamics of standards in the field of information technology. In Table 3 we are again able to detect the life cycle of information technology in the averages of the publication dates. Standardisation started obviously in the field of office machines in general with an average publication date in 1986. In a next step, standards for data storage devices were published with an average publication date of just after 1990. A further standardisation step, microprocessor systems, underwent a standardisation phase with an average publication date of 1992. The remaining average publication dates do not differ significantly, because they are all within the interval between 1994 and 1996. The

Table 3. Average publication and withdrawal dates in information technology differentiated by area of standardisation

| Categories | Publication Date | Withdrawal Date |
|---|-------------------------|------------------------|
| Information technology (IT) in general | 1995.33 | 1995.16 |
| Character sets and information coding | 1996.19 | 1997.69 |
| Languages used in information technology | 1996.01 | 1998.22 |
| Software including software development, documentation, Internet applications and use | 1995.12 | 1996.08 |
| Open systems interconnection (OSI) | 1995.75 | 1998.11 |
| Networking including LAN, MAN, WAN | 1995.80 | 1998.11 |
| Computer graphics | 1994.53 | 1998.20 |
| Microprocessor systems including PCs, calculators and so forth | 1992.44 | 1997.19 |
| IT terminal and other peripheral equipment including modems | 1994.75 | 1996.77 |
| Interface and interconnection equipment | 1993.98 | 1995.26 |
| Data storage devices | 1990.49 | 1994.70 |
| Applications of information technology | 1996.88 | 1998.39 |
| Office machines | 1986.26 | 1993.52 |

only exception is standards for the application of information technology, which were published on average in the year 1997.

The average withdrawal dates correlate rather closely with the average publication dates. Obviously, the historical standards for office machines are characterised by the largest difference between average publication and withdrawal date. Historical software standards have much shorter lifetimes.

The differentiation of information technology standards by country in Table 4 reveals a much more heterogeneous picture than in the field of telecommunication. The average publication year varies from 1992 to later than 1998.

For the eastern European countries, we find the pattern similar to the field of telecommunication of rather late publication and withdrawal dates. Russia is again characterised by a rather early average publication year of its standards. For the Netherlands, we even observe that the average pub-

lication year is later than the average withdrawal year, which is caused by the fact that only a few documents were withdrawn during the 1990s, but the majority of the documents were published since the end of the 1990s. However, the homogeneous picture among the central European countries observed in the telecommunication sector cannot be detected in the information technology sector. Consequently, country-specific analyses are required in the following analytical steps.

Results of the Survival Analysis

As already indicated in the previous section, the approach to compare average withdrawal and publication dates is not robust and reliable enough to give indications about the average lifetimes of standards. In addition, the survival times indicate the dynamics within a field of standardisation, whereas the average publication dates of standards may provide information about the development

Table 4. Average publication and withdrawal dates in information technology differentiated by country

| Country | Number of Standards | Publication Date | Withdrawal Date |
|-------------------------|---------------------|------------------|-----------------|
| International standards | 9429 | 1995.44 | 1997.14 |
| Austria | 1552 | 1995.97 | 1997.65 |
| Belgium | 740 | 1996.07 | 2002.11 |
| Switzerland | 860 | 1993.14 | 1996.54 |
| Czech Republic | 1412 | 1998.22 | 2002.64 |
| Germany | 3396 | 1992.88 | 1995.41 |
| Denmark | 2384 | 1997.81 | 2000.10 |
| Spain | 642 | 1997.32 | 2001.72 |
| France | 1508 | 1993.57 | 1998.95 |
| United Kingdom | 2510 | 1996.67 | 1999.48 |
| Italy | 721 | 1995.02 | 2002.27 |
| Netherlands | 2086 | 1997.55 | 1993.58 |
| Norway | 484 | 1993.97 | 2000.45 |
| Poland | 493 | 1998.24 | 2003.00 |
| Russia | 519 | 1992.25 | 1999.76 |
| Sweden | 1561 | 1992.55 | 1997.04 |
| Slovakia | 814 | 1996.96 | 1999.39 |
| Turkey | 663 | 1996.93 | n.a. |

of a technology, which is likely to start out with standards for hardware components and may later move to applications and services. Therefore, we apply the so-called Kaplan-Meier survival analysis see Norusis (1996). Survival analyses have their application origin in testing the effectiveness of medical treatments, especially on the survival times of patients. Meanwhile, the application of the methodology has been extended to analyses of the duration of unemployment and other economic phenomena for example, lifetime of companies (Cantner, Dressler, & Krüger, 2004).

In the following, we present the results of survival analyses only applied to the final standard documents differentiated by country and technological area. In an explorative analytical step we compared the expected survival times of draft or prestandards with those of standards themselves.

We found very short survival times for all the draft and preliminary documents, irrespective of country and technological field. Therefore, we restrict our analysis to the subsample of final standard documents in contrast to the approach presented in the previous section. Since we differentiate in this analysis by country and field of technology, the number of observations is sometimes reduced to a level which does not allow the application of the survival analysis, which is a kind of regression analysis. As we already observed significant differences between the considered countries in the average publication and withdrawal dates, it is no surprise that the expected survival times differ significantly between countries. In Figure 1, we present the expected survival times of telecommunications and information technology standards differentiated by country. The average

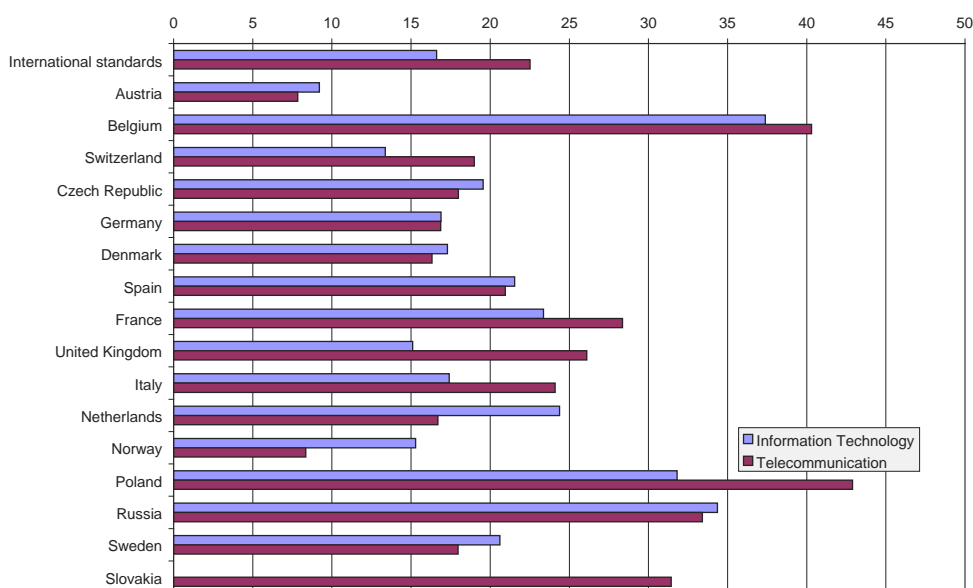
Factors Influencing the Lifetime of Telecommunication and Information Technology Standards

international standard is supposed to live for 22.5 years in telecommunication and 16.5 years in the field of information technology. The eastern European countries Poland, Russia, and Slovakia are characterised by expected survival times of over 30 years; the same is true for Belgium with an expected survival time of over 40 years. In the database of these countries, there is a dominance of rather old standards, which are still alive. However, these results can also be generated by a very few standards published early which are still alive, and a majority of rather new and probably international and European standards, which are also not yet withdrawn. Whereas the results of these countries are rather biased by some special effects, the calculations for the other European countries are more reliable. For these, we observe three clusters of countries. The survival times of standards in France and Great Britain are longer than the European standards. The Nordic and the central European countries, including the Czech Republic, have lower survival times. Whereas France and Great Britain still have a significant and

slightly older stock of national standards, the other countries are obviously more heavily influenced by the standardisation activities at the European and international level, which requires the withdrawal of respective existing national standards. Here we also observe a difference between Germany, on the one hand, and France together with Great Britain on the other hand; Germany is obviously under a stronger international and European influence in the area of telecommunication standards. In general, the survival analysis confirms the country-specific heterogeneity of the standards life cycle data already observed by analysing the average publication and withdrawal dates.

The variation of the survival times between countries can also be observed among the information technology standards. For most of the countries, we observe partly similar patterns as in the telecommunication area. On the one hand, Belgium and the eastern countries Poland and Russia are again characterised by very high expected survival times. On the other hand, in most central European countries, for example,

Figure 1. Survival times of telecommunication and information technology standards in years by country



Germany, the survival times of information technology standards are not very different from the set of international and European standards. Again, Austria represents an exception by having very low survival times of less than ten years. In contrast to the general pattern of shorter survival times of information technology standards in comparison to the telecommunication standards, the Dutch information technology standards last on average more than seven years longer than the Dutch telecommunication standards. The same is true for Norwegian, and to a limited extent, for Swedish standards.

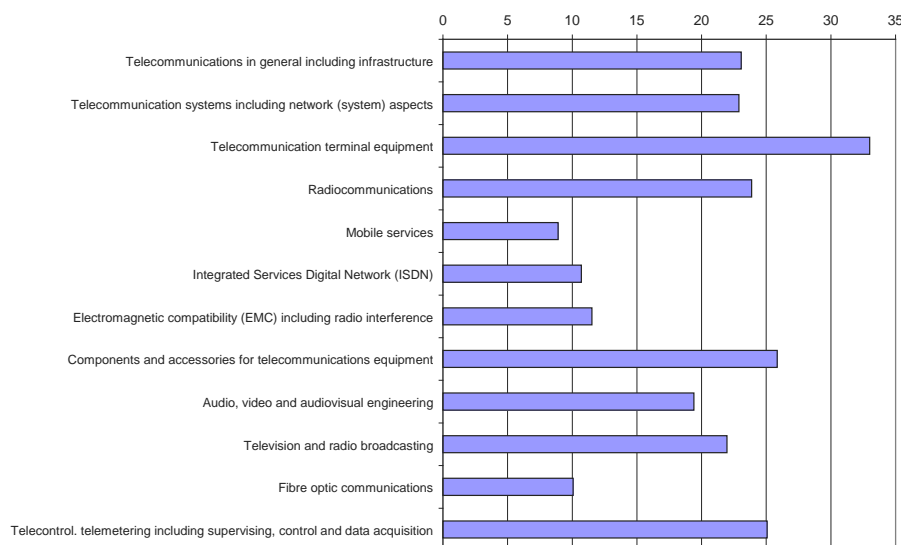
The comparison of the survival times of telecommunication and information technology standards reveals the country-specific influence by the high correlation of the survival times in both technological fields. The major conclusion from the results of this working step is the requirement to calculate the data in a country-specific way. In the next step, we check whether—as expected and already indicated by the average publication and withdrawal dates—we find also technology-specific differences in the survival times.

In our presentation of the survival times differentiated by field of standardisation, we concentrate on the European and international standards, because the relevance of European and international standards for telecommunication and information technology is of much more relevance than national standardisation activities. Furthermore, the database of the European and international standards is much larger and more complete than the databases of the national standards, which allows much more differentiated analyses. Bearing in mind the average survival time of 22.5 years of telecommunication standards in general, we concentrate just on the largest deviations from this mean value. The expected survival times for telecommunication terminal equipment standards are ten years longer than the average. This indicates, on the one hand, that standardisation started in this area earlier than in the other sub-areas. Furthermore, the average

lifetimes of historical documents, which are already withdrawn, has to be sufficiently long. Both explanations are consistent with reality. Since there is no other sub-area with significantly longer survival times than the average, we concentrate now on the sub-areas with rather short survival times. At first, we observe the rather short survival times of standards for mobile services, which are even lower also the very recent ETSI standards are taken into account. This phenomenon conforms to the explanation already made in the context of the average publication and withdrawal dates. The development of mobile services started rather late in comparison to telecommunication standardisation in general, and consequently the expected survival times are rather short. Whereas the development of services always occurs in a rather late stage of the development of a technology and an industry, in telecommunication we observe the emergence of fibre optic communication since the late 1990s. Consequently, standardisation activities started later than in telecommunication in general. The standardisation activities to ensure electromagnetic compatibility (EMC) also started rather late, as seen in Table 4, the presentation of the average publication dates. Therefore, the expected survival times of these standards are around ten years and much shorter than those of telecommunication standards in general. Finally, the rather short survival times of standards related to integrated services digital network (ISDN) must be discussed. Although standardisation started rather early in this field, the expected lifetimes are shorter than comparative sub-areas (see Table 1 with the publication dates). Obviously, there have been more revisions of standards leading to withdrawals of existing standards and to a shortening of lifetimes.

Summarising the results of the survival analysis of international telecommunication standards, three main results have to be noted. First, the average survival times depend very much on the starting of respective standardisation activities, that is, since standardisation for telecommunica-

Figure 2. Survival times of international telecommunication standards in years by area of standardisation

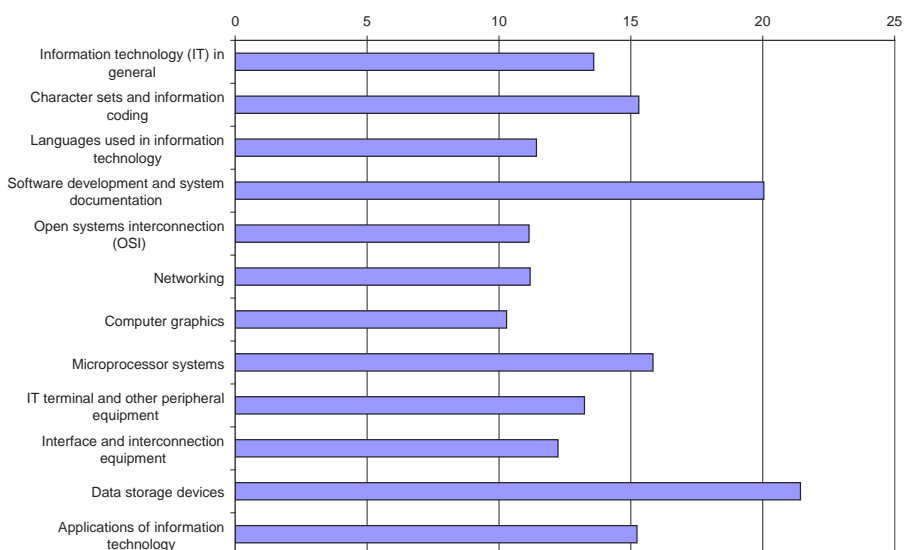


tion hardware already took place before the 1990s, the expected survival times of these standards is much higher than those related to standards for mobile services, which were mostly released after the mid 1990s. This result confirms also that telecommunication standards are in general rather stable. Second, the survival times of standards in telecommunication reflect—in the same way as the average publication years—the life cycle of telecommunication technology which started out with traditional hardware and equipment, then followed by application and services. Since fibre optic communication technology emerged only recently, the respective standards appeared in recent years, causing rather short survival times. Third, we still detect some technology-specific dynamics in the survival times, that is, there are sub-areas of standardisation in which standards are more frequently revised and withdrawn than in other areas. One example for such a sub-area are the international ISDN standards, which have consequently much shorter survival times than standards in other fields, which were published on average at the same time.

After the presentation and the analysis of the survival times of the international telecommunication standards, in the previous section of this section we will have a look at the survival times of the international information technology standards (Figure 3). On average, the survival time of an international information technology standard is 16.5 years and therefore five years less than the average telecommunication standard. This difference underlines that there is much more dynamics in the information technology standardisation compared to the telecommunication technology standardisation.

In contrast to the average survival times, we find an expected survival time of more than 20 years for standards for data storage devices. This result is caused by the fact that standardisation in this area started rather early, already in the 1980s. Standards for software development and system documentation also have a survival time of 20 years, but the standardisation activities in this area were initiated on average five years later than for data storage devices. From this difference, we are able to conclude that in the latter field

Figure 3. Survival times of international information technology standards in years by area of standardisation



standards are more frequently revised, adjusted to new generations of storage devices or even storage technologies than the more basic standards for software development, which focus more on general principles and terminologies. These obviously need less revisions and withdrawals over time.

If we focus on standardisation sub-areas with relatively short survival times, we identify open systems interconnection (OSI), networking, and computer graphics. The latter field is obviously characterised by relatively high dynamics especially triggered by a rapid technical change, since standardisation activities started already relatively early. The OSI related standards have also a rather limited lifetime. However, if we use the additional information on the average withdrawal dates, we find an early withdrawal year relative to the publication year. Taking this information together, we derived that in the field of international OSI standards, few standards have already been withdrawn, causing the rather short expected survival time. If we compare the OSI standards with the networking standards,

we observe, on the one hand, a similar survival time, but a much later average withdrawal date, which allows us to conclude that in this sub-area a larger number of standards has already been withdrawn.

If we summarise the results of the survival analysis of international telecommunication and information standards together, we observe the following main new insights. The survival times of telecommunication standards are much longer than for information technology standards, although the average publication dates do not differ significantly. Consequently, the dynamics within standards of information technology is much higher than those in telecommunication technology. In the latter field, the heterogeneity of the survival times is much higher, with rather low survival times of standards for mobile services and high survival times for telecommunication terminal equipment. In information technology, we just observe that standards for data storage devices and for software development and system documentation have a much higher survival time than the average for information technology standards. In the next

section, we will try to identify factors influencing the lifetimes of standards.

Factors Influencing the Survival Times of Standards: Results of the Cox Regression Analysis

In the previous section, we calculated and interpreted the survival times of telecommunication and information technology standards. Despite the fact that country differences exist, partly caused by country-specific data quality, the analysis of the European and international standards showed that technology-specific reasons influence the survival times. In this final section, by applying the Cox regression methodology for a small selection of countries, we analyze which influences standard-specific characteristics have on the survival times of standards.

Based on the data which is available for each standard document, we developed the following specific hypotheses derived from the more general hypotheses listed previously:

- If a standard amends another standard, then the expected lifetime is increased, because it has the character of a more basic and therefore longer lasting standard.
- If a standard is amended by another standard, then the expected lifetime is decreased, because the likelihood of a general substitution is higher.
- If a standard replaces another standard, its expected lifetime is higher, because the weaknesses of the predecessor standards have been solved.
- If a standard is replaced by another standard, its expected lifetime is lower, because of the replacement.
- If a standard has a cross reference to another standard, its expected lifetime is higher, because it is embedded in a whole network of standards, which is more stable than single and isolated standards.

- If a standard has a cross reference to another standard, its expected lifetime is lower, because it is embedded in a whole network of standards, which is more likely to be affected by external influences.
- If a standard has a reference to an international standard, its expected lifetime is lower, because the international standard is likely to change faster.
- If a standard has a reference to an international standard, its expected lifetime is higher, because the change of an international standard is likely to take more time.
- If a standard has a reference to regulation, its expected lifetime is higher, because changes in legislation take longer and its relevance is higher.
- If a standard contains more pages, its expected lifetime is higher, because the volume of codified knowledge is higher, which may cause further inertia (it may even represent the merger of various standards).
- If the speed or the amount of technical changes increases, the expected lifetime of a standard is lower. The impact of the national technical change is lower than the impact of the whole European technical change, especially for the smaller countries.

Since some data fields are not filled out for the selected countries, we had to restrict ourselves to testing some hypotheses only for a few or even a single country. Furthermore, we differentiate in general not by the sub-areas, because the number of observations is then insufficiently low.

In order to test the hypotheses, we apply the so-called Cox regression model see for technical details (Norusis, 1996). This approach allows us to investigate whether and how exogenous variables influence the survival probability of the standards documents. The methodology is a multiple regression or logistic regression analysis, which allows the inclusion of the still valid documents, like the Kaplan-Meier survival analysis.

The cumulative survival function $S(t)$, the proportion of the surviving cases at a particular point of time t , is the dependent variable. Then, the cumulative survival function at point t is calculated under the influence of the exogenous variables x_1 to x_n , which relate to the hypotheses listed earlier, as:

$$S(t) = [S_0(t)]^p, \tag{1}$$

with $S_0 = S_0(t)$ as baseline survival function at time t , the exponent p is determined by

$$p = e^{(B_i x_i)} \text{ with } i = 1 \text{ to } n \text{ explaining variables.} \tag{2}$$

The estimation of the coefficients B_1 to B_n will be solved by the Cox regression analysis. If all coefficients B_1 to B_n were equal to zero, then p would have the value of one and the baseline survival function would not be influenced by the exogenous variables (covariates). Positive coefficients B_i reduce the survival probability, negative ones increase the survival probability.

In Table 5, the exogenous variables for explaining the survival times of standards documents are summarised:

At first, we calculate separate models for each variable. In the Tables 6 and 7, the results for the telecommunication and information technology

standards are summarised. We concentrate our analysis on the data of international, Austrian, Swiss, German, French, British, and Dutch standards, but have to restrict ourselves to a subset of these countries for the variables “Amended”, “Amended by” and “Legislation”.

The results for the variables “Amended” and “Amended by” confirm for the few selected countries that both documents which amended and were amended by another document have a significantly higher survival time than documents without this kind of cross references. Therefore, the first hypotheses, that if a standard amends another standard, then the expected lifetime is increased, because it has the character of a more basic and therefore longer lasting standard, is confirmed. However, if a standard is amended by another standard, then the expected lifetime is increased and not decreased. The explanation for this result to be observed in some countries may be that amendments obviously stabilise a standard in general and reduce the likelihood of a general withdrawal.

For the second couple of hypotheses focusing on replacements, we find a consistent picture for the evident hypothesis that if a standard is replaced by another standard, its expected lifetime is lower. However, the hypothesis that if a standard replaces another standard, its expected

Table 5. Meanings and names of exogenous variables

| Meaning | Name of variable |
|---|--|
| Standard amends another standard | B_1 : Amends |
| Standard is amended by another standard | B_2 : Amended by |
| Standard replaces another standard | B_3 : Replaces; B_{3a} : Number of replacements |
| Standard is replaced by another standard | B_4 : Replaced by |
| Standard has a cross reference to another standard | B_5 : Cross reference; B_{5a} : Number of cross references |
| Standard has a cross reference to an international standard | B_6 : International reference; B_{6a} : Number of international references |
| Standard has a reference to legislation | B_7 : Legislation |
| Number of pages | B_8 : Pages |
| Average patent publication per year | B_9 : Patents |

Factors Influencing the Lifetime of Telecommunication and Information Technology Standards

Table 6. Results of Cox regression analysis for telecommunication standards

| Variable | International standards | | Austria | | Switzerland | | Germany | | France | | United Kingdom | | Netherlands | |
|--|-------------------------|-------|---------|-------|-------------|-------|---------|-------|--------|-------|----------------|-------|-------------|-------|
| | B | Sig | B | Sig | B | Sig | B | Sig | B | Sig | B | Sig | B | Sig |
| B ₁ : Amends | -0.136 | 0.006 | n.a | n.a. | n.a | n.a. | n.a | n.a. | n.a | n.a. | n.a. | n.a. | -3.622 | 0.000 |
| B ₂ : Amended by | -0.558 | 0.000 | n.a | n.a. | n.a | n.a. | n.a | n.a. | n.a | n.a. | 0.238 | 0.124 | -3.612 | 0.000 |
| B ₃ : Replaces | -0.432 | 0.000 | -0.671 | 0.000 | 0.358 | 0.324 | -0.473 | 0.000 | 0.379 | 0.250 | 0.375 | 0.009 | 0.547 | 0.000 |
| B _{3a} : Number of replaces | -2.341 | 0.000 | -0.403 | 0.000 | 0.146 | 0.529 | -0.253 | 0.000 | 0.171 | 0.088 | 0.158 | 0.108 | 0.290 | 0.000 |
| B ₄ : Replaced by | 3.600 | 0.000 | 5.139 | 0.000 | 3.075 | 0.000 | 2.538 | 0.000 | 4.402 | 0.000 | 2.829 | 0.000 | 6.143 | 0.000 |
| B ₅ : Cross reference | 0.142 | 0.000 | -1.053 | 0.000 | -0.350 | 0.014 | 0.183 | 0.000 | -0.458 | 0.001 | 0.467 | 0.025 | -4.682 | 0.000 |
| B5a: Number of cross references | 0.003 | 0.000 | -0.025 | 0.000 | -0.026 | 0.002 | 0.005 | 0.000 | -0.002 | 0.685 | 0.020 | 0.000 | -1.334 | 0.000 |
| B ₆ : International reference | 0.047 | 0.039 | 0.600 | 0.000 | 1.064 | 0.142 | 0.779 | 0.000 | 0.241 | 0.160 | -0.356 | 0.027 | -0.214 | 0.523 |
| B _{6a} : Number of international references | -0.096 | 0.000 | 0.303 | 0.000 | 0.084 | 0.219 | 0.102 | 0.000 | 0.067 | 0.295 | -0.130 | 0.145 | -0.604 | 0.000 |
| B ₇ : Legislation | n.a | n.a. | n.a | n.a. | n.a | n.a. | 0.338 | 0.000 | n.a | n.a. | n.a | n.a. | n.a | n.a. |
| B ₈ : Pages | 0.001 | 0.000 | -0.002 | 0.000 | 0.002 | 0.170 | 0.003 | 0.000 | 0.002 | 0.264 | 0.005 | 0.001 | 0.000 | 0.000 |

lifetime should higher, because the weaknesses of the predecessor standards have been solved, can only be confirmed for half of the countries considered. In the Netherlands, we even find a confirmation for information technology and a rejection for telecommunication standards. In telecommunication technology, the hypothesis is rejected only in Great Britain, in information technology also in France and Switzerland.

The testing of the hypotheses focusing on cross and international references reveal rather ambivalent results. For the standards in telecommunication technology, the hypothesis that if a standard has a cross reference to another standard, its expected lifetime is lower, because it is embedded in a whole network of standards, which is more likely to be affected by external influences, is confirmed by international, German and British standards. The analysis including instead the continuous variable of number of cross references confirms this result. However, the data from Austria, Switzerland, France, and the Netherlands confirm the counter hypothesis. For the standards in information technology, the latter hypothesis is confirmed for all countries except for Germany and France. If we use the number of cross references, the data for Great Britain also confirm the hypothesis that the expected survival time of a standard will decrease with an increasing number of cross references.

The reference to an international standard decreases the expected lifetime of a telecommunication standard for the international, the Austrian and the German sample, whereas the longevity of standards in the British database increases. In information technology international references lead to a reduction of the lifetime, with the exception of the international and the Dutch database. If we use the counts of international references, only the expected lifetime of standards of the Swiss and international databases increases with the number of international references.

Due to data restriction, we are only able to test the hypotheses for Germany that, if a standard has

a reference to regulation, its expected lifetime is higher, because changes in legislation take longer and its relevance is higher. We find a rejection of this hypothesis in the telecommunication area and no significant relationship for information technology. One explanation for the rejection in the telecommunication area may be the liberalisation and deregulation of the telecommunication sector causing a rather frequent change of regulations, which also causes the pressure to adapt the referred standards more often.

Finally, we wanted to test whether the quantity of content in a standard measured by the number of pages has an impact on their survival times. In contrast to our hypothesis, that the more pages a standard contains, the higher its expected lifetime, the counter hypothesis is confirmed for most of the regressions. Only in Austria did larger standard documents have a longer expected life. The reason for this counterintuitive result is the recent trend to produce larger standards documents.

Since we observe rather heterogeneous results between the few countries considered, we had a more in-depth look at the sub-areas of the international standards. For the following hypotheses, we find rather strong empirical evidence.

Whereas there is no empirical support for the hypothesis that standards which amend other documents have a longer expected survival time, standards which are amended by other documents have a longer life expectancy in the majority of the subclasses. This contrasts our hypothesis, that a standard amended by another standard has a reduced expected lifetime, because the likelihood of a general substitution might be higher. In line with our hypothesis, there is strong empirical support for the fact that standard documents which replace previous documents have a longer life expectancy. Consequently, the number of documents being replaced increases the survival time of the respective standards. In addition, the ambivalent role of the existence of cross references or international cross references supports the two contradicting aspects of cross references. On the

Factors Influencing the Lifetime of Telecommunication and Information Technology Standards

Table 7. Results of Cox regression analysis for information technology standards

| Variable | International standards | | Austria | | Switzerland | | Germany | | France | | United Kingdom | | Netherlands | |
|--|-------------------------|-------|---------|-------|-------------|-------|---------|-------|--------|-------|----------------|-------|-------------|-------|
| | B | Sig | B | Sig | B | Sig | B | Sig | B | Sig | B | Sig | B | Sig |
| B1: Amends | -0.267 | 0.000 | n.a | n.a. | n.a | n.a. | n.a | n.a. | 0.276 | 0.181 | n.a. | n.a. | -3.085 | 0.002 |
| B2: Amended by | -0.615 | 0.000 | n.a | n.a. | n.a | n.a. | n.a | n.a. | -0.167 | 0.512 | -0.291 | 0.004 | -3.065 | 0.002 |
| B3: Replaces | -0.710 | 0.000 | -0.630 | 0.000 | 0.382 | 0.027 | -0.498 | 0.000 | 0.586 | 0.000 | 0.266 | 0.005 | -0.449 | 0.000 |
| B3a: Number of replacements | -0.372 | 0.000 | -0.427 | 0.000 | 0.075 | 0.561 | -0.248 | 0.000 | 0.294 | 0.000 | 0.143 | 0.001 | -0.257 | 0.010 |
| B4: Replaced by | 2.862 | 0.000 | 2.421 | 0.000 | 1.741 | 0.000 | 2.103 | 0.000 | 2.393 | 0.000 | 2.142 | 0.000 | 7.508 | 0.000 |
| B5: Cross reference | -0.086 | 0.008 | -1.091 | 0.000 | -0.372 | 0.004 | 0.234 | 0.001 | 0.538 | 0.000 | -0.354 | 0.001 | -4.709 | 0.000 |
| B5a: Number of cross references | -0.008 | 0.000 | -0.053 | 0.000 | 0.001 | 0.949 | 0.006 | 0.001 | 0.015 | 0.000 | 0.010 | 0.000 | -1.095 | 0.000 |
| B6: International reference | -0.218 | 0.000 | 0.400 | 0.050 | 1.072 | 0.011 | 0.215 | 0.000 | 0.449 | 0.001 | 0.131 | 0.265 | -0.813 | 0.008 |
| B6a: Number of inter-national references | -0.046 | 0.000 | 0.013 | 0.733 | -0.064 | 0.048 | 0.043 | 0.004 | 0.137 | 0.000 | -0.018 | 0.764 | 0.067 | 0.433 |
| B7: Legislation | n.a | n.a. | n.a | n.a. | n.a | n.a. | -0.238 | 0.175 | n.a | n.a. | n.a | n.a. | n.a | n.a. |
| B8: Pages | 0.001 | 0.000 | -0.001 | 0.041 | 0.002 | 0.001 | 0.000 | 0.275 | 0.001 | 0.059 | 0.001 | 0.062 | 0.001 | 0.043 |

one hand, a standard with cross references to other standards is embedded in a whole network of standards, which should be more stable than single and isolated standards. On the other hand, a standard has cross references to other standards may be also influenced by changes in the area of the referenced standards. The link to a regulation is negative for German telecommunication standards, but slightly positive for German information technology standards. This means only for the later area, our hypothesis, that the expected lifetime is higher with a link to regulation, because changes in legislation take longer and its relevance is higher, is not confirmed. Finally, the survival time in the two areas in most countries decreases with an increasing number of page representing a largere volume of codified knowledge even the merger of various standards.

In addition to the PERINORM internal database, we have included external information about the speed of technological change to each document. Based on the assumption that every new technology may question the state-of-the-art of technology codified in a standard, we postulate that the more new technologies are developed, the higher the likelihood that a standard document has to be changed or even withdrawn. Based on a long tradition of literature (e.g., Grupp, 1998), we assume that patent applications are an adequate indicator for technical change. Then, we calculated the average number of patent applications either in telecommunication or in information technology (source of raw data: Schmoch, Laville, Patel, & Frietsch, 2003) related to the lifetime of a standard. For all documents, we computed the average annual number of all patent applications from the former 15 Member States at the European Patent Office related to their lifetimes. For selected countries, Austria, Belgium, Germany, Denmark, Spain, France, Great Britain, Italy, the Netherlands, and Sweden, we are also able to compute the respective indicator for national applications at the European Patent Office. The differentiation of two technology fields telecom-

munication and information technology in the sub-areas is not feasible because the international patent classification IPC does not allow a clear-cut separation into these sub-areas. This would allow to test the hypotheses whether standards related to technologies in a more mature phase have longer lifetimes than standards in rather emerging fields of the telecommunication and information technology.

The country-specific results of the Cox regression for the two technology fields are presented in the Table 8. The outcome of the Cox regression confirms impressively the hypotheses that if the speed or amount of technical change increases, the expected lifetime of a standard will be lower. The analysis of the international standards differentiated by sub-areas confirms the overall picture of a negative relationship between speed of technological change and the survival times of standards. This result is also confirmed for other technology fields based on Swiss standards (Blind, Jungmittag, & Grupp, 2000). The higher the average annual patent application at the European Patent Office related to the lifetime of a standard, the lower its expected survival time is. This result holds also for the country-specific patent applications at the European Patent Office. If we have a look both at the coefficients and the magnitude of the total European and the national patent applications, we find empirical support for the hypothesis that the impact of the national technical change is lower than the impact of the whole European technical change, because of the international technology spill-overs, that is, a standard within the body of German standards has also to take account of technological developments abroad.

Summarising the results of the Cox regression, the following general new insights have to be reported. First, technical change measured by a patent indicator has a negative impact on the survival times of standards. This is confirmed for the datasets of all countries considered. Furthermore, due to international spill-over effects

Factors Influencing the Lifetime of Telecommunication and Information Technology Standards

Table 8. Influence of technical change (= Patents B9): Results of Cox regression analysis for telecommunication and information technology standards

| | Telecommunication | | | | Information Technology | | | |
|-------------------------|---|-------|--|-------|---|-------|--|-------|
| | Average annual applications at the EPO in total | | Average country-specific applications at the EPO | | Average annual applications at the EPO in total | | Average country-specific applications at the EPO | |
| | B | Sig | B | Sig | B | Sig | B | Sig |
| International standards | 0.000 | 0.000 | 0.006 | 0.000 | n.a. | n.a. | n.a. | n.a. |
| Austria | 0.000 | 0.000 | 0.001 | 0.000 | 0.064 | 0.002 | 0.021 | 0.000 |
| Belgium | 0.004 | 0.000 | 0.000 | 0.003 | 0.435 | 0.077 | 0.263 | 0.023 |
| Switzerland | 0.001 | 0.000 | 0.001 | 0.000 | n.a. | n.a. | n.a. | n.a. |
| Czech Republic | 0.005 | 0.000 | 0.005 | 0.000 | n.a. | n.a. | n.a. | n.a. |
| Germany | 0.001 | 0.000 | 0.001 | 0.000 | 0.002 | 0.000 | 0.002 | 0.000 |
| Denmark | 0.001 | 0.000 | 0.001 | 0.000 | 0.064 | 0.003 | 0.037 | 0.001 |
| Spain | 0.001 | 0.000 | 0.002 | 0.000 | 0.070 | 0.013 | 0.123 | 0.011 |
| France | 0.001 | 0.000 | 0.002 | 0.000 | 0.013 | 0.000 | 0.010 | 0.000 |
| United Kingdom | 0.002 | 0.000 | 0.002 | 0.000 | 0.010 | 0.000 | 0.012 | 0.001 |
| Italy | 0.010 | 0.045 | 0.006 | 0.000 | 0.119 | 0.006 | 0.125 | 0.095 |
| Netherlands | 0.001 | 0.000 | 0.001 | 0.000 | 0.011 | 0.000 | 0.012 | 0.000 |
| Norway | 0.001 | 0.000 | 0.004 | 0.000 | n.a. | n.a. | n.a. | n.a. |
| Poland | -0.001 | 0.002 | -0.003 | 0.003 | n.a. | n.a. | n.a. | n.a. |
| Russia | 0.003 | 0.001 | 0.005 | 0.001 | n.a. | n.a. | n.a. | n.a. |
| Sweden | 0.001 | 0.000 | 0.002 | 0.000 | 0.013 | 0.001 | 0.005 | 0.000 |
| Slovakia | 0.001 | 0.000 | 0.001 | 0.000 | n.a. | n.a. | n.a. | n.a. |
| Turkey | 0.000 | 0.005 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |

the international technical change measured as the sum of European patent applications has a stronger impact on the survival time than the sole national technical change. Second, the document-specific information on predecessor and successor documents confirm, on the one hand, for the majority of countries and technological sub-areas that standards which replace a preceding document have a longer survival time compared to documents without a predecessor. On the other hand, standards with a successor document have as expected a shorter expected lifetime. Third, the existence and the number of cross references have a heterogeneous influence on the lifetimes of standards, depending on the country and technological area considered. References to international information technology standards reduce the lifetime of standards at least for the majority of country-specific documents. Finally, the length of standard document measured by pages correlates negatively with its survival time, which is at first glance counter-intuitive. However, this result can be explained by the fact that standard documents published earlier are much shorter than recently published documents.

CONCLUSION

An analysis of the telecommunication and information technology standards published by formal international, European and national standardisation bodies was performed in order to identify patterns of the dynamics of standards and factors influencing the dynamics of standard. We were able to detect the patterns of dynamics both based on quantitative statistics of average publication and withdrawal years and expected survival times, which are consistent with technology and market-related characteristics. However, we also find country-specific patterns which are caused either by institutional reasons, like the participation in the European standardisation activities, or by the quality of the database. For

the most important countries, the quality of the database is so homogeneous that comparative analyses are possible.

The analysis of factors influencing the dynamics of standards is restricted by two dimensions. First, we have to rely in general on the additional information which the database provides. Consequently, only a limited number of hypotheses can be tested. In order to test the major hypotheses whether the speed of technical change has an influence on the lifetimes of standards, we calculated for each document a patent indicator characterising the speed of technical change during its individual lifetime. The patent data allowed us only to calculate two indicators, one for telecommunication technology and one for information technology. Second, the quality of the document-specific information is rather heterogeneous. Consequently, we had to restrict our analysis to a few selected countries and to the international and European standards. Nevertheless, the results of the analysis confirmed some of our hypotheses, but also revealed new insights. In general, the dynamics of standards depend both on country, but also technology-specific characteristics.

Since both the institutional framework and the characteristics of technology are responsible for the lifetime of standards, further analyses have to take into account these two dimensions. Therefore, the approach by Egyedi and Heijnen (2005) to focus on just one standardisation body is confirmed by this general analysis. Furthermore, approaches have to be developed which will allow us to match systematically additional information to each standard document, because this facilitates the testing of further more sophisticated hypotheses about the causes influencing the dynamics of standards.

The observations that the lifetimes of standards are influenced both by related technology and the institutional framework should be considered by the standardisation bodies. First, different technologies require obviously specific adjust-

ment or withdrawal strategies in standardisation. Consequently, standardisation bodies should be more aware of this heterogeneity and adapt their processes accordingly, always taking into account the continuous change in science, technologies and markets. The differences between countries call for two strategies. First, benchmarking exercises may help to identify best practices in the adaptation of processes to adjust, modify or even withdraw existing standards. Second, and even more important, is the necessity to homogenise the maintenance processes among countries in order to avoid frictions causing risks for the development of technologies, but also common markets. This includes also a more homogeneous implementation or transfer of international and European standards into the body of national standards.

ACKNOWLEDGMENT

The author thanks for the financial contribution for the NO-REST project (507626) by the European Commission within the 6th Framework Programme. The paper was developed within the workpackage on the dynamics of standards of the NO-REST project. A previous version of the paper was published in the proceedings of the IEEE SIIT 2005 conference in Geneva. Valuable comments by the coeditor of the special issue Mostafa Hashem Sherif significantly increased the quality of the paper. Remaining shortcomings are in the sole responsibility of the author.

REFERENCES

Arthur, W.B. (1989). Competing technologies, increasing returns, and lock-in by historical events. *The Economic Journal*, 99, 116-131.

Blind, K. (2004). *The Economics of standards: Theory, evidence, policy*. Edward Elgar (Publisher), Cheltenham (Place).

Blind, K., & Grupp, H. (2000). *Gesamtwirtschaftlicher Nutzen der Normung, Volkswirtschaftlicher Nutzen: Zusammenhang zwischen Normung und technischem Wandel, ihr Einfluss auf die Gesamtwirtschaft und den Außenhandel der Bundesrepublik Deutschland*. Berlin: Deutschen Institut für Normung.

Blind, K., Grupp, H., & Jungmittag, A. (2000). *Der Zusammenhang zwischen technischem Wandel und Normung und ihr Einfluß auf den Außenhandel in der Schweiz—Der gesamtwirtschaftliche Nutzen der Normung*. Bericht 1. Institut für Öffentliche Dienstleistungen und Tourismus (Ed.), St. Gallen. Universität St. Gallen.

Cantner, U., Dressler, K., & Krüger, J. (2004). Verweildaueranalysen in der empirischen Wirtschaftsforschung. *Das Wirtschaftsstudium*, 10, 1287-1293.

David, P.A. (1985). Clio and the economics of QWERTY. *American Economic Review*, 75, 332-337.

Egyedi, T., & Heijnen, P. (2005). Scale of standards dynamics: Change in formal, international IT standards. In S. Bolin (Ed.), *The standards edge: Future generation*. Bolin Communications.

Egyedi, T.M., & Hudson, J. (2001). Maintaining the integrity of standards: The Java case. In K. Dittrich, & T.M. Egyedi (Eds.), *Standards compatibility and infrastructure development. Proceedings of the 6th EURAS Workshop*, (pp. 83-98), Delft University of Technology, The Netherlands.

Egyedi, T.M. & P. Heijnen (2005). 'Scale of Standards Dynamics: Change in formal, international IT standards', pp.289-308, in S. Bolin (Ed.), *The Standards Edge: Future Generation*. Felton, CA: Bolin Communications.

Egyedi, T.M., & Loeffen, A.G.A.J. (2002a). Succession in standardization: Grafting XML onto SGML. *Computer Standards & Interfaces*, 24(4).

- Egyedi, T.M. & A.G.A.J. Loeffen (2002b). 'Succession in standardization: grafting XML onto SGML', *Computer Standards & Interfaces*, 24, pp.279-290.
- Farrell, J., & Saloner, G. (1985). Standardisation, compatibility and innovation. *Rand Journal of Economics*, 16(1), 70-82.
- Farrell, J., & Saloner, G. (1986). Installed base and compatibility: Innovation, product preannouncements, and predation. *American Economic Review*, 76, 943-954.
- Grupp, H. (1998). *The foundations of the economics of innovation: Theory, measurement and practice*. Edward Elgar, Cheltenham
- Hall, B., Jaffe, A., & Trajtenberg, M. (2001). *Market value and patent citations: A first look*. University of California, Berkeley, CA: Institute of Business and Economic Research.
- Katz, M.L., & Shapiro, C. (1994). Systems competition and network effects. *Journal of Economic Perspectives*, 8(2), 93-115.
- Norusis, M. (1996). *SPSS advanced statistics 6.1*. Chicago: SPSS Inc.
- Schmoch, U., Laville, F., Patel, P., & Frietsch, R. (2003). *Linking technology areas to industrial sectors* (Final Report to the European Commission). Karlsruhe: DG Research.
- Shy, O. (2001). *The economics of network industries*. Cambridge: Cambridge University Press.
- Swann, G.M.P. (2000). *The economics of standardization* (Final Report for Standards and Technical Regulations, Directorate Department of Trade and Industry). Manchester, UK: University of Manchester.

This work was previously published in International Journal of IT Standards and Standardization Research, Vol. 5, Issue 1, edited by K. Jakobs, pp. 1-24, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.25

Some Insights into the Impact of ICTs on Learning Agency and Seamless Learning

Hitendra Pillay

Queensland University of Technology, Australia

John A. Clarke

Queensland University of Technology, Australia

Peter G. Taylor

Bond University, Australia

ABSTRACT

The learning capacity of individuals is becoming recognised as the most valued commodity in a knowledge and information society and this has fostered an increased attention on the innovation, transfer, and management of knowledge. To explain these processes, it is necessary to move beyond what has traditionally been conceived of as a learning environment and to develop alternative models that acknowledge and accommodate the learning competencies required to successfully engage with a contingent and dynamic learning culture, the changing nature of knowledge, and the influence of the cultural background of learners. Such models need to explain the lifelong and

continuous nature of learning as learners move seamlessly among a range of diverse learning environments. This chapter proposes the concept of learning agency which incorporates the intelligence inherent in learning environments as a mechanism to explain seamless learning within and across environments, particularly those that are rich in technology.

INTRODUCTION

The rapidly changing international social, economic, and political order has fostered an increased attention on innovation, transfer, and management of knowledge. While many believe

that the emergence of the centrality of knowledge to society's growth is a consequence of economic reform and the proliferation of communication technology (Jentzsch, 2001), others argue that it is also an outcome of a gradual evolution of our social, political, and economic models (Lank-shear, 1997). Irrespective of what might have triggered the focus on learning and knowledge creation, both the above assumptions imply that a very diverse and complex mix of concepts, principles, and variables may influence what constitutes knowledge, information technology, learning context and processes, learner motives, and social and political imperatives. This diversity and complexity challenges us to re-conceptualise learning and teaching.

As a consequence of the above complexity and the contingent nature of our society, the learning capacity of individuals is increasingly being recognised as the most valued commodity in a knowledge and information society (Department for Education and Employment, 1998; Hargreaves, 2003). The search for models to support contingent yet sustainable learning, accelerated deep approaches to learning and the development of an understanding of the distributed and complex nature of learning has resulted in intensive research focussing on understanding human cognition and the meaning-making processes (e.g., Collin & Tynjälä, 2003; Lave & Wenger, 1991). This increased research activity, while contributing new insights, has tended to be narrowly defined and focussed on specific aspects of problems rather than investigating how the various aspects complement and/or hinder each other. For example, despite the development of the actor-network theory and its application in research (Latour, 1988, 1993; Somerville, 1999), it has not been used to explore the relationships between learners' motives, beliefs and values, and their engagement with the various aspects of the actor-network systems. Similarly, the acknowledgement that learning permeates all aspects of our lives has resulted in the emergence

of constructs such as "learning society" (Nonaka & Teece, 2001), "knowledge workers" (Maxwell, 2003; Rifkin, 2000), and "learning communities" (Shapiro & Levine, 1999). These constructs challenge the traditional conception of learning environments as they are all underpinned by principles of lifelong learning and continuous learning—principles that assume learning occurs seamlessly throughout individuals' lives and types of learning environments, as they negotiate their way within and among different contexts, contents, strategies, tools, and artefacts.

Against this backdrop, we explore and revise the existing concept of what constitutes a learning environment and speculate on ideas that may assist in understanding how learners identify and engage with the diversity and complexity of those environments.

RECONCEPTUALISING LEARNING ENVIRONMENTS

Most assumptions underpinning research into learning environments have emerged from models derived from the discipline of psychology. Such research has furthered our general understanding of learners' affective and cognitive needs in formal settings by identifying a number of influential psychosocial dimensions and also provided coherent models that can be satisfactorily adapted for teaching in specific versions of such environments. For a recent extensive review of this type of learning environment research, see Harington (2001).

Current literature on learning environments can be synthesised into a matrix comprised of environments, processes, and approaches. There are a number of different types of learning environments such as institutional, workplace, home, and social and community networks wherein a number of learning processes, such as face-to-face, distance learning, mentoring, experimentation, observation, and online learn-

ing can be utilised in a blend of independent and instructor supported approaches. Each of these combinations of learning environment, process, and approach presumably has their own peculiarities and unless researched, understood, and managed appropriately, may not produce their intended outcomes. For instance, motivation in a face-to-face learning environment is often created by the instructor's personality and ability to engage learners whereas in an on-line situation, it is more likely to be the user friendliness and types of interaction embedded in the design of the instruction. However, most of the research summarised in reviews such as Harington's (2001) tends to have a uni-dimensional focus. There is extensive research into online learning environments (Teh, 1999) most of which explore only the characteristics of the technological support and the technological capabilities of learners while ignoring cultural influences that may affect the differential engagement of learners with such a learning environment. They may vary in their methodology or the aspects of technology they pursue, but still have the focus on technology which is only a tool and thus may not have all the answers. Similarly, while the workplace is often considered a rich learning environment because of the authentic experience available to learners in such contexts (Beckett & Hagar, 2000), little is known about the impact of learner capabilities in workplaces to deal with online learning or learning more abstract principles that underpin practices (Edwards, 1998; Eraut, 2000).

An examination of the current approach to learning environment research suggests that it is based on two fundamental assumptions. First, it assumes learning environments to be isolated entities, "bounded" in nature. This has hindered rigorous research into investigating learner behaviours as and when they traverse boundaries of traditionally defined learning environments. The current convergence of the formal learning (school), informal learning (at home and on excursions) and social learning (sport and social

events) challenges the perimeters of boundaries of learning, yet very little research is available that attempts to explain this emerging notion of seamless learning environments. An illustration of this "bounded" approach can be seen in Teh's (1999) comprehensive study on formal learning environments where the informal learning experiences are not given any consideration. Similarly, little is known about the mechanism of the transfer of learning skills and knowledge from one learning environment to another or how learners simultaneously deal with several learning environments. The shift of vocational education from institutions (formal) to workplaces (informal) generated considerable interest in transfer (Lave & Wenger, 1991) and as this change was very distinctive, it was relatively simple to study. But with the increasing overlap between the traditional learning environment and the choice options available to learners, attempting to map learning skills and knowledge has become much more complex and fluid. Further, the processes of learners negotiating and navigating through a range of learning environments will increasingly become common practice and will need to become the focus of serious research. Both the negotiation of and navigation among fluid learning environments are critical attributes needed by learners in a rapidly evolving knowledge society.

Secondly, learning environments are currently viewed as essentially homogenous entities with a lack of appreciation of the diversity and complexity contained within a specific environment. There is a need to explore the nature of the learning environments and their associated elements (Jamieson, Fisher, Gilding, Taylor, & Trevitt, 2000; Luppardini, 2003; Newhouse, 2001). Each environment has its own set of underlying ideologies, software and hardware (physical and human resources), optimum strategies, etc., and variables which can have a significant influence on how, when and why learners engage in learning. Investigating this issue, Pillay and his co-researchers (Pillay, in press; Pillay & Elliott, 2002; Pillay

& McCrindle, 2005) have proposed a distributed framework to conceptualise and deal with some of the significant variables in a holistic yet differentiated manner that recognises the different elements in an environment and allows them to exist as separate but connected systems. The framework has identified four key factors that the authors believe capture all significant sources of influence on learner engagement and subsequent pragmatic action: (1) socio-cultural and political dispositions and ideologies which provide a personal rationale for learners to appreciate why they need to engage with learning, (2) domain knowledge which is constantly evolving and being redefined. Understanding the functional and relational aspect of the evolutionary process and the content will encourage sustained engagement, (3) strategies and processes which provide learners with ways to optimise their learning outcomes. This is often referred to as the “software of learning systems,” and (4) tools and artefacts which extend our capacity to research, access, and collect data, simulate activities to illustrate the effect of input variables and provide support for, and the enhancement of, learning. In this distributed framework, the attributes of each factor can have different sub-elements depending on the type of learning environment under scrutiny. Nevertheless, the key factors and sub-elements all may variously and simultaneously influence learner engagement in learning tasks in a reciprocal manner with the influence also extending to the motives and the choice of strategies adopted by students.

While this model provides a framework for thinking about ways in which some of these elements may interact, it is essentially descriptive and lacks any explicit reference to the energy that entices the learners to consciously reflect, reason, and perform the necessary learning activity. A possible way of conceptualising that energy is considered next.

CATERING FOR COMPLEXITY AND DIVERSITY IN LEARNING AND LEARNING ENVIRONMENTS

Acknowledging the complex mix of variables that influence learning, our current longitudinal research into e-learning (Taylor, Pillay, & Clarke, 2003, 2004a, 2004b) provides the basis for our theorising that the influence of learning environments on learning can be thought of as an outcome of the knowledge and/or intelligence designed into that environment. In order to design the intelligence in the environment we need to consider the elements and the possible influence they might have on learner engagement. As an example, take one of the elements in the distributed learning model, variously referred to as tools, objects or artefacts (including ICTs). We are in agreement with Csikszentmihalyi and Rochberg-Halton (1981) in that we argue that they have an epistemology of their own which together with the learner’s own epistemological beliefs about learning, trigger a reciprocal engagement similar to Bandura’s (1997) “triadic reciprocal causation” (p. 6) which in turn fosters subsequent pragmatic actions (Taylor et al., 2004a). To explain the energy that fosters this reciprocal engagement, we have introduced the term “learning agency” to represent the mediating reciprocity emerging from the environmental effects (Pillay, Clarke, & Taylor, 2006). The term “learning agency” is derived from the original Bandurian concept of “learner agency” (Bandura, 1997). We argue that Bandura’s “triadic reciprocal causation,” where the triad is the person, the environment, and behaviour is not only triggered by chance but can also be engineered by designing the environment in ways that may stimulate the reciprocity. Therefore, the influence of the knowledge designed into and available within a learning context can influence how learners engage in and with that environment. Considering the possibility of dif-

differentiating each of the triadic nodes in Bandura's model and investigating the reciprocal causal links may contribute to our understanding of the energy that entices learners to consciously reflect on the various elements in an environment, to reason and to perform the necessary learning activity (Pillay et al., 2006).

There is a need to move away from a homogenised model of learning environments as emphasised in Harington's (2001) review paper and to engage with and investigate the complexity and diversity in learning environments together with the elements and relationships contained in them. We are increasingly recognising that the optimum competencies required to successfully engage with a contingent and dynamic learning culture cannot be appreciated by viewing learning environments as bounded and learning processes as linear and unidirectional. In real life contexts, learners do not stay in bounded learning environments but frequently navigate through several environments, each of which may have several different learning elements. The motivation for learners to stay engaged also varies and oscillates between the traditional intrinsic and extrinsic values. In addition, increasing recognition is being given to *strategic* rather than exclusively *surface* or *deep* approaches to learning. Therefore, what is required is a framework that has the capacity to go beyond the boundaries of specific environments and redefine/expand some of the traditional constructs such as motivation, deep learning and transfer of skills and knowledge in order to explain the seamless and continuous nature of learning. As we see increasing diversification in what constitutes a learning environment, the challenge is not only to open the individual environments for deeper and closer scrutiny but also to explore bridges across new learning environments to ensure and support seamless learning. Thus we are challenged to seek alternative frameworks that have the capacity to explain the dynamic and temporal nature of learning culture which transcends specific learning environments, some-

thing that the traditional approach to researching learning environments cannot do as it is, by its very nature, "environment-bound."

The concept of *learning agency* provides a mechanism to represent these seamless learning environmental effects (Pillay et al., 2006). This notion of learning agency is consistent with the core concepts associated with actor-network theory (Law, 1992). Law uses the metaphor of "heterogenous networks" to suggest and recognise that society, including education systems and organisations, "are all effects generated in patterned networks of diverse (not simply human) materials." Further, actor-network approaches see "knowledge" as a product or an effect of those networks of heterogenous materials, rather than simply individual or social agents. For example, in our longitudinal study (Taylor et al., 2003, 2004a, 2004b), a large number of part-time students recognised themselves as not only knowledge learners but also knowledge creators for other students by drawing on their workplace experiences. They were able to move in and out of work environment (as consumers and creators) and the university environment (as learners and creators) experiencing seamless learning.

In our longitudinal study of e-learning at a university campus (Taylor et al., 2003, 2004a, 2004b), we asked students about their approaches to learning, perceptions of their learning environments, and epistemological reflections on themselves as learners. A counter-intuitive result of a mismatch between espoused learning motives and strategies emerged—students tended to have significantly lower surface strategies scores than surface motive scores; and students tended to have significantly higher deep strategies scores than deep motive scores. This meant that the students' behaviour (manifested in their learning strategies) could not be explained by their individual characteristics (learning motives). However, based on their perceptions of the learning environments and their epistemological reflections, the counter-intuitive finding was explained by the influences of the

technology-rich learning environment which included the usual ICT tools and peer networks, suggesting that individuals' approach to learning arises from mutual interactions between individual and contextual agency (ICT tools plus peers) which we labelled learning agency.

Our proposed driver of learner engagement, learning agency, is the total of the inherited ideas, beliefs, values and knowledge which guides the pragmatic action in social, cultural and professional environments. Learning agency is seen as implicit rather than explicit knowledge—it is *experienced* rather than *taught*—which makes it all-pervasive and relatively resistant to change. In our attempt to make it explicit in a learning context, we see learning agency as providing a strong sense for the design of institutional structures and their functions which in turn can impact on learner engagement in learning activities.

CONCLUSION

While this theorising deals with the recognition of the complexity and influence of a learning environment, the emergence of a knowledge society (Takeuchi, 1998) has seen an increased diversification in what are regarded as learning environments. This is due in no small way to the proliferation of ICTs in teaching and learning which have provided the opportunity to expand the range of legitimate learning environments from the traditional face-to-face modes. In this chapter, we are extending our previous theorising to address the increasingly diverse types of learning environments such as on-line learning, computer-based learning, workplace learning, institutionalised learning and their hybrids. In particular, we have argued the limitations of current theorising and understanding of learning and learning environments interpreted in terms of the reciprocal influence of agency, usually confined to the individual in the form of learner agency (Bandura, 1997). This tends to give limited attention to

the nature and influence of the environment and assumes that learning environments are isolated entities, bounded in nature. In real life contexts, learners do not stay in bounded learning environments but frequently navigate through several environments. Further, the notions of lifelong learning and seamless learning are central to a knowledge society and the extended theorising aims at accommodating these concepts.

The chapter offers a view that learning environments are a complex mix of teaching and learning tools or artefacts (ICTs), strategies (informal and formal individual and group learning), philosophy and ideology of learning (learning to learn, life long learning, seamless learning), the structural and functional aspects of discipline knowledge, and the physical design and furnishing of learning environments. The contradiction evidenced in the current public and private sector discourse towards promoting lifelong and continuous learning, both of which can presumably happen when working across several different learning environments, and at the same time encouraging a fragmented and highly contextualised approach to dealing with this complexity, needs to be challenged. Support for the above challenge can be seen in Winn's (2002) call that "educational researchers should...study which characteristics of these environments help or hinder learning" (p. 114). The notion of learning agency may provide a key to understanding the diversity and complexity of the seamless learning environments that are co-emerging with the knowledge-based society.

REFERENCES

- Bandura, A. (1997). *Self efficacy: The exercise of control*. New York: W. H. Freeman.
- Beckett, D., & Hagar, P. (2000). Making judgments as the basis for workplace learning: Towards an epistemology of practice. *International Journal of Lifelong Education*, 19(4), 300-311.

Some Insights into the Impact of ICTs on Learning Agency and Seamless Learning

- Collin, K., & Tynjälä, P. (2003). Integrating theory and practice: Employees' and students' experiences of learning at work. *Journal of Workplace Learning, 15*(7/8), 338-344.
- Csikszentmihalyi, M., & Rochberg-Halton, E. (1981). *The meaning of things: Domestic symbols and the self*. New York: Cambridge University Press.
- Department for Education and Employment. (1998). *The learning age: A renaissance for a new Britain*. Retrieved July 5, 2002, from <http://www.leeds.ac.uk/educol/documents/000000654.htm>
- Edwards, R. (1998). Flexibility, reflexivity, and reflection in the contemporary workplace. *International Journal of Lifelong Education, 17*(6), 377-388.
- Eraut, M. (2000). Non-formal learning and tacit knowledge in professional work. *British Journal of Educational Psychology, 70*, 113-136.
- Hargreaves, A. (2003). *Teaching in the knowledge society: Education in the age of insecurity*. New York: Teachers College Press.
- Harington, D. G. (2001). *The development and validation of a learning environment instrument for CSIRO Science Education Centres*. Unpublished doctor of science education, Curtin University, Western Australia. Retrieved August 13, 2004, from <http://adt.curtin.edu.au/theses/available/adt-WCU20031013.114200/>
- Jamieson, P., Fisher, K., Gilding, T., Taylor, P. G., & Trevitt, A. C. F. (2000). Place and space in the design of new learning environments. *Higher Education Research and Development, 19*, 221-236.
- Jentzsch, N. (2001). *The new economy debate in the U.S.: A review of literature* (Working Paper No. 125/2001). Freie Universität, Berlin: John F. Kennedy Institute.
- Lankshear, C. (1997). Language and the new capitalism. *The International Journal of Inclusive Education, 1*(4), 309-321.
- Latour, B. (1988). Mixing humans and nonhumans together: The sociology of a door-closer. *Social Problems, 35*(3), 298-310.
- Latour, B. (1993). *We have never been modern*. Brighton, UK: Harvester Wheatsheaf.
- Lave, J., & E. Wenger (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, UK: Cambridge University Press.
- Law, J. (1992). *Notes on the theory of the actor network: Ordering, strategy and heterogeneity*. Retrieved July 25, 2003, from <http://www.comp.lancs.uk/sociology/soc054jl>
- Luppini, R. (2003). Categories of virtual learning communities for educational design. *Quarterly Review of Distance Education, 4*(4), 409-417.
- Maxwell, J. (2003). *Innovation is a social process*. Quebec, Statistics Canada. Retrieved December 10, 2003, from <http://www.statcan.ca/cgi-bin/downpub/listpub.cgi?catno=88F0006XIE2003006>
- Newhouse, C. P. (2001). Development and use of an instrument for a computer supported learning environment. *Learning Environments Research, 4*(2), 115-138.
- Nonaka, I., & Teece, D. (2001). *Managing industrial knowledge: Creation, transfer, and utilization*. London: Sage.
- Pillay, H. (2006) *Distributed cognition: Understanding tensions embedded in workplace knowledge and skills* (Chapter 12). New York: Nova Science Publishing Inc.
- Pillay, H., Clarke, J. A., & Taylor, P. G. (2006). Learning agency in new learning environments: An Australian case study of the influence of context. In A. D. de Figueiredo & A. P. Afonso

- (Eds), *Managing learning in virtual settings: The role of context* (pp. 231-246). Hershey, PA: Idea Group Publishing.
- Pillay, H., & Elliott, R. G. (2002). Distributed learning: Understanding the emerging workplace knowledge. *Journal of Interactive Learning Research*, 13(1/2), 93-110.
- Pillay, H., & McCrindle, A. (2005). Distributed and relative nature of professional expertise. *Studies in Continuing Education*, 27(1), 69-90.
- Rifkin, J. (2000). *The age of access: The new culture of hypercapitalism*. New York: J.P. Tarcher/Putnam.
- Shapiro, N. S., & Levine, J. H. (1999). *Creating learning communities: A practical guide to winning support, organizing for change, and implementing programs*. San Francisco: Jossey Bass.
- Somerville, I. (1999). Agency versus identity: Actor-network theory meets public relations. *Corporate Communications*, 4(1), 6-13.
- Takeuchi, H. (1998). *Beyond knowledge management: Lessons from Japan*. Retrieved July 10, 2002, from <http://www.sveiby.com/articles/LessonsJapan.htm>
- Taylor, P. G., Pillay, H., & Clarke, J. A. (2003). Enriching the learning culture through peers and technology. In J. Searle, I. Yashin-Shaw, & R. Roebuck (Eds.), *Enriching learning cultures* (vol. 3, pp. 140-146). Brisbane: Australian Academic Press.
- Taylor, P. G., Pillay, H., & Clarke, J. A. (2004a). Exploring student adaptation to new learning environments: Some unexpected outcomes. *International Journal of Learning Technology*, 1(1), 100-110.
- Taylor, P. G., Pillay, H., & Clarke, J. A. (2004b). Investigating the consequences of sustained involvement in new learning environments. In J. Searle, C. McCavanagh, & R. Roebuck (Eds.), *Doing, thinking, activity, learning* (vol. 2, pp. 219-230). Brisbane: Australian Academic Press
- Teh, G. P. L. (1999). Assessing student perceptions of Internet-based online learning environments. *International Journal of Instructional Media*, 26(4), 397-402.
- Winn, W. (2002). Learning in artificial environments: Embodiment, embeddedness and dynamic adaptation. *Technology, Instruction, Cognition and Learning*, 1, 87-114.

This work was previously published in Teaching in the Knowledge Society: New Skills and Instruments for Teachers, edited by A. Cartelli, pp. 64-75, copyright 2006 by Information Science Publishing (an imprint of IGI Global).

Chapter 1.26

Learning Styles and Adaptive ICT Based Learning Environment

Zlatko J. Kovačić

The Open Polytechnic of New Zealand, New Zealand

ABSTRACT

This chapter has two aims. First, to provide an overview of learning styles research and secondly, to provide an overview of research in adaptive hypermedia learning environment systems, those where different learning styles are considered and used to create a personalized learning environment. For most distance education institutions individualization of the learning environment for each student is not an option because economies of scale are the determining factor of cost reduction. However, the latest advances in database management, artificial intelligent systems and intelligent agents provide a technological infrastructure for individualizing the learning path for every learner at a lower cost. This chapter focuses on learning styles and how we can integrate and use them as a source of adaptation in an adaptive hypermedia learning environment systems.

INTRODUCTION

Teachers and researchers have long recognized the differences between learners and the impact these differences can have on learning. Concern for these differences has been the focus for academics and practitioners for decades and led to research on learning styles, i.e., “the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment” (Keefe, 1979). Research efforts in the theory and application of learning styles have proliferated a wide spectrum of models and instruments. Coffield, Moseley, Hall, and Ecclestone (2004a), who provided the latest and the most comprehensive overview of the learning style theories and instruments, have identified and critically discussed 13 major models of learning styles among the 71 models reported in literature.

Important messages emerge from the learning style research both for educators and course designers. Teachers should identify the learning styles of their students, encourage them to reflect on their own learning styles, and provide a teaching approach and support that will cater for individual learning styles. Course designers should create a learning environment that would address differences between learners. Though the idea of individualization is not new to education many of the larger distance education institutions offer little individualization for the students because economies of scale are the determining factor of cost reduction.

In the last few decades, with the emergence of information and communication technologies (hereafter labeled ICT) and their use in education research, we have witnessed new revival of interest in the individualization of learning and learning style research. There is a strong belief that ICT will provide the necessary foundation to individualize instruction, even in further education with large class sizes and a modular curriculum. At the same time emerging ICT raises expectations, as was pointed out by Kolb, the teacher's role will change from "dispenser of information, to coach or manager of the learning process" (1984, p. 202).

In the distance education we may achieve true individualization of the learning process by using emerging technologies such as intelligent agents and artificial intelligence systems which could store relevant data into a database and generate ad hoc completely customized course material, (i.e., an individualized learning path) for every single learner, according to their individual needs and preferences. An intelligent system which uses information about learners' preferences to dynamically organize course material is labeled an adaptive learning environment. If this learning environment involves the use of hypertext and multimedia (and most recently is Web-based) then we are describing an adaptive hypermedia learning environment (hereafter labeled AHLE). Peter

Brusilovsky (1996, 2001) provided an overview of adaptive hypermedia systems from the early 1990s until now. He shows that the research on adaptive hypermedia systems in the last decade produced framework, techniques, prototyping models and authoring tools to create courses deliverable in the AHLE.

There are many different criteria for the adaptation of the learning environment to suit individual learner's needs and preferences. In this chapter we are focusing on the use and integration of learning styles as the only criteria for adaptation of the learning environment.

This chapter has four objectives: (a) to summarize and present learning style models in a systematic manner using proposed learning styles meta-models, (b) to review systematic efforts to establish and implement adaptive hypermedia systems in education, particularly those based on using learning styles as an adaptation criteria, (c) to discuss the problems and limitations of the current approach in using learning styles in adaptive hypermedia systems, and (d) to discuss the implication of the adaptive hypermedia systems based on learning styles on pedagogy, course design, and developers of an adaptive hypermedia system.

OVERVIEW OF LEARNING STYLE MODELS AND INSTRUMENTS

There is a proliferation of definitions, concepts, models, and instruments related to individual learner's preference which makes it very difficult to summarize and classify learning styles models. What makes such an effort even more difficult is that there is no clear separation between the various models, as De Bello (1990, p. 217) suggests, "there are many areas of overlap among the models."

The taxonomy of learning styles models proposed by Lynn Curry (1983) uses an onion metaphor consisting of three layers. The core,

the innermost layer of Curry's "Onion Model" deals with the most stable component of style, (i.e., cognitive personality style). Models from this layer focus on impact of personality on the ability to acquire and integrate information. Models from the middle layer are labeled as "information processing models" which concentrate on the ways learners obtain, sort, store, and utilize information. The models from this layer are more stable than the models from the outer layer ("instructional preference models") but are still modifiable by learning strategies. Finally, environmental, emotional, sociological, physiological, and psychological features of both learners and teachers are included in the models from the outer layer—"instructional preference models." Claxton and Murrell (1987) added a fourth layer, social integration, which they placed between Curry's outer two layers. Models from this layer focus on how a learner interacts with other learners during the learning process. Finally, Given (1996) included physical elements (such as visual, auditory, tactile and kinesthetic) between social interactions and environmental/instructional layers to make the metaphorical model more complete.

In this chapter we have adopted the classification proposed by Coffield, Moseley, Hall, and Ecclestone (2004a). Presenting the learning style models in a continuum, they have allocated each model to one of the "families of learning styles." This continuum is based on the extent to which the authors of learning styles models and instruments appear to believe that learning styles are fixed. They have identified the following five families of learning styles:

- Constitutionally-based learning styles and preferences
- Cognitive structure
- Stable personality type
- "Flexibly stable" learning preferences
- Learning approaches and strategies

The first family encompasses those models which consider influence of genetics on fixed inherited traits and the interaction of personality and cognition as the dominant factors. Moving along the continuum, we locate learning style models which are based on the idea of dynamic interaction between personality and experience. On the opposite side of the continuum is a family of learning styles models where the authors paid particular attention to personal factors, curriculum design, institutional and course culture and their impact on learning.

Using learning style as a source of adaptation of the learning environment raises the question of which learning style model to select and build in the AHLE system. Sampson and Karagiannidis (2002) proposed a certain number of conditions that each candidate, for use in AHLE systems among learning styles models, should be tested against. They suggested a check on the theoretical and empirical justification of the model, the suitability of the learning style model in the specific learning context; whether the model or its constructs are measurable or not; the time effectiveness in applying a particular model; does the model provide sufficient instruction about what should be adapted for each learner category and finally the cost of using a particular learning style instrument.

In this chapter we focus on those learning styles models which could be used or are already built in the AHLE systems (both prototyping and conceptual AHLE systems are considered). Most of these learning styles models belong to the middle layer of the Curry's model or to the stable personality type or "flexibly stable" learning preferences family in case of Coffield, Moseley, Hall, and Ecclestone classification. The reason for this is that the models which belong to this layer or family are more stable than the others, and do not interact directly with the environment, though they are modifiable by learning strategies (Atkins, Moore, Sharpe, & Hobbs, 2001).

We begin with the first family of learning styles (i.e., constitutionally based). The most prominent representative of this family of learning styles is the Dunn and Dunn model (Dunn, 2003) based on five dimensions that mark various preferences: environmental, emotional, sociological, psychological, and psychological. However, from the perspective of using learning styles models in the AHLE systems Del Corso et al. (2001) did not recommend the Dunn and Dunn model, because this model is focusing on less relevant aspects of learning such as the senses and environmental factors.

Next, we consider learning style models which belong to the cognitive structure family. Coffield, Moseley, Hall, and Ecclestone (2004a) provided a detailed analysis of the Riding's model of cognitive styles (Riding & Cheema, 1991) as the representative for this family. However, in the research literature about AHLE systems, Witkin's model (Witkin, Moore, Goodenough, & Cox, 1977) or better known as the Field Dependent/Field Independent model, was more frequently used than any other from this family of learning styles. Witkin's model divides learners into two groups: Field Dependent learners (externally motivated, like collaborative work and are people-oriented) and Field Independent learners (intrinsically motivated, prefer to work alone and take an impersonal approach to learning). Degrees of field dependence or field independence could be defined as a continuum with field independent at one end and field dependent at the other end. In the middle of the continuum is the group termed as field mixed who do not have clear orientation like the group of field dependent or field independent. This has a practical implication for use of Witkin's model in the AHLE system. According to Sampson and Karagiannidis (2002) criteria in case of field-mixed learners we may say that the model did not provide sufficient instruction on what should be adapted for this particular learner category.

The stable personality type family of learning styles models was rarely used in AHLE systems. The most popular learning style model which belongs to this family is the Myers-Briggs model. This model is based on psychologist Carl Jung's theory of psychological types and uses four bipolar dimensions to characterize people according to 16 personality types. Each of these types has a primary orientation toward the world, one which affects their ability to learn and to work. Del Corso et al. (2001) recommended not considering implementation of the Myers-Briggs model in the AHLE systems. According to them, this model goes beyond cognitive controls and behavior related to learning, focusing on the whole personality rather than information perceiving and processing dimensions which is the main focus of the Kolb's and Honey and Mumford's model.

The flexibly stable learning preferences family comprises, among other models, Kolb's experiential learning cycles model (1984), Honey and Mumford (1992), McCarthy (1990), and Felder-Silverman model (1988). Honey and Mumford's and McCarty's model were inspired by the Kolb's model and share basically the same pedagogical approach to learning. This family of learning styles was most frequently implemented as one of adaptation criteria in the AHLE systems. The Kolb model uses the learner's experience as a starting point in the learning process. Learners are perceived as passing through four stages of learning. Initially they are experimenting with the topic accumulating enough concrete experience to be able to reflect in the second stage on the observation gathered in the concrete experimenting stage. As a result of reflective activities, learners derive abstract concepts and make generalizations in the third abstract conceptualization stage. Finally, new concepts are subject to testing to see if they provide a solid explanation in new situations. In other words, learners begin a new learning cycle, gathering new evidence, and concrete experience. Though learners are moving through each stage, they tend to use a specific learning mode.

Therefore we can describe them as a learner with a preference for a particular mode. By looking at the quadrants, Kolb identified four types of learners: Diverger (creative, generates alternatives), Assimilator (defines problems, creates theoretical models), Converger (practical applications, makes decisions), and Accomodator (takes risks, gets things done).

Initially the Felder-Silverman model was developed as a five-dimensional model, with the following dimensions: Perception, Input, Processing, Understanding, and Organization. Later the organization dimension was omitted because Felder (1993) believes that the best approach to teaching undergraduates is always inductive and therefore his learning styles instrument does not differentiate between inductive and deductive learners. Both the Kolb's and Felder-Silverman's models are based on the same educational philosophy of John Dewey, which emphasizes the nature of experience as of fundamental importance in education.

There appears to be a close relationship between the Felder-Silverman and the Kolb model. They share the same two dimensions: processing (the preferred way learners are processing information, with two poles: actively/reflectively) and perception (the preferred way learners are perceiving information, with two poles: sensing/intuitive). However, the Felder-Silverman model also partly belongs to the second and third families of learning styles, (i.e., cognitive structure and stable personality type, because it adds two new dimensions, which address the learners' approaches to adapting and assimilating information.) These two dimensions are: input (the preferred way learners are inputting information, with two poles: visually/verbally) and understanding (the preferred way learners are adapting information, with two poles: sequentially/globally).

The last family of learning styles we are considering is labeled "learning approaches and strategies." The well-known model in this family

is the Grasha and Reichmann model (Hruska-Riechmann & Grasha, 1982). They developed a set of student learner types that indicate the likely attitudes, habits, and strategies students will take toward their work. Grasha (1996) indicates ways in which teachers can adjust their teaching styles to create better connections with various types of students. This model has three personality dimensions: (1) competitive—collaborative, (2) avoidant—participant, and (3) dependent—independent.

We would expect that when the learning environment and teaching methods are modified to cater for various learning styles, that the student outcome, (i.e., academic performance) would improve. Therefore, as an illustration of the applied learning styles research that might be relevant for AHLE systems, the relationship between learning styles and academic performance is discussed. There are many factors which influence academic performance in addition to learning styles, such as gender, age, and work experience (Dille & Mezack, 1991). While it is preferable that a student uses and develops an array of learning styles to deal with course content and the real world, most of the applied work in this area focus only on a student's currently preferred learning style. Though there have been numerous studies on the relationship between preferred learning styles and academic performance (Zywno & Waalen, 2002), the evidence remains contradictory. For example for first-year programming courses, Thomas, Ratcliffe, Woodbury, and Jarman (2002) suggest that there is a relationship between student learning style and academic performance, while Byrne and Lyons (2001) suggest that no such relationship exists. Weak evidence of a relationship and impact on academic performance has been found for the way students on an IT course are inputting and understanding the information by using the Felder-Silverman model (Kovai & Green, 2004).

IMPLICATIONS OF LEARNING STYLES RESEARCH FOR PEDAGOGY

Each of the learning styles models has its own specific implications for pedagogy. In this section we are addressing two general issues related to pedagogical implications which are relevant for all presented models: meta-cognition and “matching hypothesis.” We conclude this section with critiques of the learning style models and instruments.

Even if the idea of learning styles is not fully accepted we believe there might be a benefit from discussing the concept. Coffield, Moseley, Hall, and Ecclestone (2004a, p. 120) stated that “A knowledge of learning styles can be used to increase the self-awareness of students and tutors about their strengths and weaknesses as learners.” This self-awareness of learners and teachers is known in literature as the meta-cognition. By increasing meta-cognitive abilities learner can take full ownership of his or her learning. When we are able to understand how we learn, how deeply we learn and our reasons for learning then we can, in some situations, manipulate the learning strategy to best suit our learning styles. At the same time learners with developed meta-cognitive abilities can be expected to be more adaptive to changes in the learning environment.

“Matching hypothesis” describes the situation in education when there is congruence between teaching styles and learning styles. Whichever model of the learning styles one prefers or implements the expectation is that there is a mismatch between learning and teaching style preferences. To minimize conflict between teacher’s and student’s style, some researchers in the area of learning styles recommend teaching and learning styles be matched (e.g., Charkins, O’Toole, & Wetzel, 1985; Griggs & Dunn, 1984; Smith & Renzulli, 1984). On the other side we can argue equally well that mismatches are sometime desirable and that learners should be exposed to mul-

iple alternative teaching-learning strategies for their own benefits. Exposure to different teaching styles or deliberate mismatching is what Grasha (1996) recommends. He argued that people need to be “stretched” to learn, and such a situation he describes as a “creative mismatch” between teaching and learning style. Therefore, the issue remains whether to teach to learners’ strengths or to challenge them and expand their styles?

A mismatch can lead to poor teaching outcomes, low retention of students on courses (Felder & Silverman, 1988), and to poor academic performance (Ford & Chen, 2001). Though Felder (1993) advocates teaching strategies that incorporate all of the learning style preferences, there is still discussion on whether mismatches of teaching and learning styles should be sought or avoided and whether there is a benefit from eliminating mismatches or not. Coffield, Moseley, Hall, and Ecclestone (2004a, p. 123) for example, claim they “failed to find...hard empirical evidence that matching the styles of learner and tutor improves the attainment of the learner significantly.”

The learning styles model continues to be the subject of debate and critique. Curry (1990) identified three problems with making the learning style model the basis of educational practice. Firstly, different learning style models and instruments use different style categorization to define the learning style continuum. Even the fundamental elements such as definition of learning style are not unanimously accepted and almost every author has his or her own definition. Though there is an overlap among concepts and models it is not an easy task to classify these models or to compare them. Secondly, evidence of the reliability and validity of learning style instruments is weak. Coffield, Moseley, Hall, and Ecclestone (2004b, p. 55) go even further by saying “that some of the best known and widely used instruments have such serious weaknesses (e.g., low reliability, poor validity and negligible impact on pedagogy) that we recommend that their use in research and in practice should be discontinued.” Thirdly, the

pedagogical implications and changes in educational practices that complement particular learning styles are in some cases hard to identify or it is not clear whether the increase in performance should be attributed to other factors rather than to the implementation of a learning style model. More comprehensive critical reflection on the theory and practice of learning style is given in Coffield, Moseley, Hall, and Ecclestone (2004a, 2004b).

ADAPTIVE HYPERMEDIA LEARNING ENVIRONMENT

The birth and the rapid growth of the Internet have transformed education and the way we learn. The dominant paradigm in today's education uses a traditional hypermedia based learning environment which assumes that "one size fits all." However, since the early 1980s, with advances in artificial intelligence research, there has been a significant development of systems to provide an individualized and intelligent response to users interacting with computers. These artificial intelligence systems were based on strategies to "learn" users' interactions with the learning environment and respond accordingly. Brusilovsky (2000, 2001) described two phases in the historical development of adaptive systems. Before 1996 adaptive systems were based on pre-Web hypertext and hypermedia. The most dominant systems at that time were intelligent tutoring systems, which were from a pedagogical perspective, teacher-centered systems with the main focus in problem-solving support. After 1996 research interest moved toward Web-based adaptive hypermedia, along with a shift in pedagogy toward a student-centered learning, based on constructivist approach. In regard to the application of adaptive hypermedia in education Brusilovsky (2004b) identified three generations of AHLE systems. The research focus of the latest generation of AHLE systems is the integration of adaptive hypermedia technologies

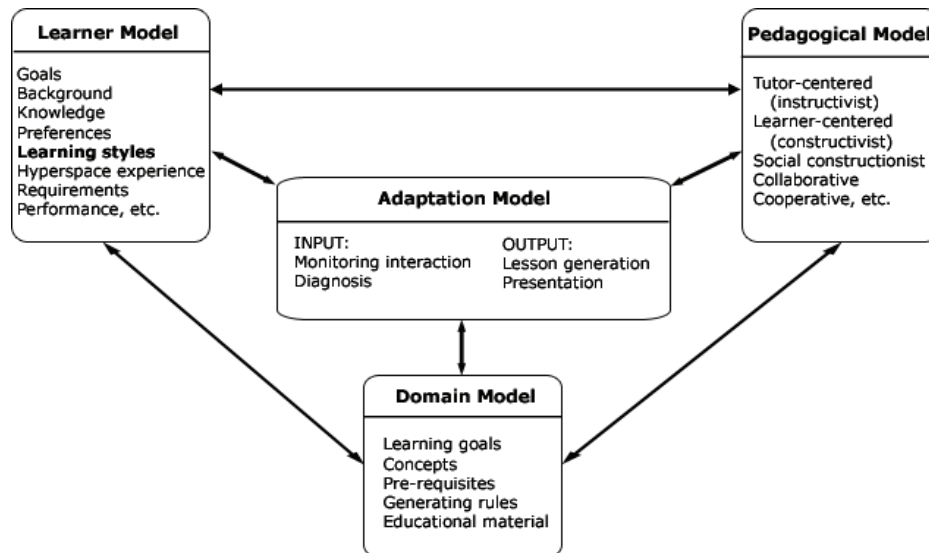
into the regular educational process, answering the challenge posed by dominant learning management systems such as Blackboard and WebCT.

AHLE systems usually provide two forms of adaptation: adaptability and adaptivity. Both terms describe personalization on the Internet. However, they are two quite different concepts dependent upon whether the learner or the system is in control of the adaptation. Kay (2001) discussed different levels of adaptation which should be considered when designing an AHLE system: (a) *adaptability*—the system is adaptable when the learner modifies the visual appearance of the learning environment; and (b) *adaptivity*—the system is adaptive when it monitors a learner's behavior and updates a learner model. Then the presentation is updated according to the learner model, which in turn is updated during browsing process.

Summarizing the various conceptual and prototyping models of the AHLE systems we came up with a generic model which encompasses most of the existing AHLE systems. The conceptual model of an AHLE system is presented in Figure 1 and consists of four sub-models:

1. Learner model: Stores information about each learner (user profile) including a learning style profile in the database. Magoulas, Papanikolaou, and Grigoriadou (2003) provided a detailed structure of the learner model (goals, knowledge, learning styles, preferences, background, and hyperspace experience). A learner's understanding about the domain in this model is typically represented as an overlay model of the domain model. This means that for every "concept" in the domain model there is a corresponding "concept" in the learner model that represents how the learner relates to that concept (De Bra, Aroyo, & Chepegin, 2004). Alternative models describing the learner's knowledge level of domain are listed in Danchak (2004).

Figure 1. Conceptual model of an adaptive hypermedia learning environment system



2. **Domain model:** Contains information content of the course, which includes also the relationship between course components (Kelly & Tangney, 2004; Wu, 2002).
3. **Pedagogical model:** Defines the roles of each person, such as instructor and learner, and stores details about pedagogical approach used. This model has not been included or discussed in most of the AHLE systems. Shute and Towle (2003) argued that existing AHLE systems concentrate more on the adaptation of the format of the content rather than on adaptive instruction. In other words, the pedagogical component of AHLE system is quite often neglected.
4. **Adaptation model:** Consists of a description of how to update the learner model by monitoring a learner's behavior and also how to generate the adaptation.

There are some variations of the presented conceptual model. Paramythis and Loidl (2004) for example, added the Group Model to the AHLE model. It captures the characteristics of groups of learners, which is important when collaborative instructional design is used.

In order to select the appropriate technology of adaptation we need to answer the following

questions: what features of the learners or their environment are used as the source of adaptation and which features of the AHLE system can be different for different learners. Most of the AHLE systems use the learner's previous knowledge of domain as a source of adaptation. Recently, learning style information has been used as a source of adaptation in AHLE systems (see Table 1). The answer to the second question brings technologies of adaptation into focus. Brusilovsky (1999, 2001) identified the following adaptive and intelligent technologies for Web-based education:

1. **Curriculum sequencing (or instructional planning) technology:** Adapting the sequence of the content to the learners' learning preferences (Brusilovsky & Vassileva, 2003).
2. **Problem solving support technologies:** The intelligent analysis of learner solutions, example-based problem solving, and interactive problem solving support.
3. **Adaptive navigation support:** Direct guidance, adaptive annotation, adaptive sorting, and adaptive link hiding and disabling. Helps the learner orientation and navigation in hyperspace by changing the appearance of visible links (Brusilovsky, 2004a; Brusilovsky, Chavan, & Farzan, 2004).

Learning Styles and Adaptive ICT Based Learning Environment

Table 1. Adaptive hypermedia learning environment systems that use learning styles as a source of adaptation

| AHLE system (working/ conceptual model); author(s) | Learning style model and author(s) | Initial identification & dynamic adaptation | Adaptation technology | Teaching/learning approaches |
|---|--|---|---|---|
| 3DE; Del Corso et al. (2001) | Honey & Mumford (1992) | Questionnaire. Learners' profiles are described on all four basic dimensions. | AP | Content is stored as a set of micro modules, specifically designed for each learning style. Teacher supervises course creation. |
| ACE; Speeth & Opperman (1998) | Model not specified. Learner's media preferences | Learner directly modifies learner model. | ANS (adaptive annotation and incremental linking), CS | Teaching strategy is modifiable by the system. |
| AES-CS; Triantafillou, Demetriadis & Pomportsis (2002) | Witkin et al. (1997) | Questionnaire. Learner directly modifies learner model. | ANS (link annotation) | Learners can switch between different instructional strategies. |
| AHA!; Stash, Cristea, & De Bra (2004) Stash & De Bra (2004) | Any could be used. Honey & Mumford (1992) Witkin et al. (1997) | Learners initially specify their learning style. System adapts learner model. | CS, AP, ANS (adaptive annotation) | Learners can switch between different instructional strategies and change attributes of the concepts in their learner model. |
| Arthur; Gilbert & Han (1999, 2002) | Any could be used. Witkin et al. (1997) | Alternative styles of instruction differ in the type of media they use. | CS | Mastery learning – dynamically adapts the instructional style according to learner's performance. |
| CS383; Carver, Howard, & Lavelle (1996, 1999) | Felder & Silverman (1988) | Questionnaire | AP | Media elements are sorted, ranked and presented according to learners' learning style |
| Danchak (2004) | 4MAT; McCarthy (1990) | Questionnaire. Naïve Bayes Classifiers and Case-based Reasoning. | AP | Reflective teaching method of instruction |
| ILASH; Bajraktarevic, Hall, & Fullick (2003a, 2003b) | Felder & Silverman (1988) | Questionnaire | ANS (adaptive annotation and hiding of links), AP | Adapt the method of navigation with special emphasis on the approaches of global and sequential learners. |
| INSPIRE; Papanikolaou, Grogoriadou, Kornilakis, & Magoulas (2002, 2003) | Honey & Mumford (1992) | Questionnaire. Direct manipulation of learner model. | ANS (adaptive annotation and hiding of links), AP, CS | Adapt method and order of presentation of multiple types of educational resources. |
| iWeaver; Wolf (2002, 2003) | Dunn & Dunn; Dunn (2003) | Questionnaire. System allows for fluctuations in learning styles. | | Learners can switch and combine media representations and system adapts dynamically. |
| MANIC; Stern & Woolf (2000) | Model not specified; Text vs. graphic | System adapts learner model. Naïve Bayes Classifiers | AP | Presentation of content objects using <i>stretchtext</i> which allows certain parts of a page to be opened or closed. |
| Peña, Narzo, & de la Rosa (2002) | Felder & Silverman (1988) | Questionnaire. Case-Based Reasoning | ANS (adaptive annotation and hiding of links), AP | |
| TANGOW; Paredas & Rodríguez (2002a, 2002b, 2004) | Felder & Silverman (1988) | Questionnaire. Learner directly modifies learner model. | AP, CS | Learning style was used to adapt the exposition-example sequencing (sensing/intuitive learners). |

4. **Adaptive presentation:** Adapts the content to learners' learning preferences.
5. **Learner model matching technologies:** Adaptive collaboration support and intelligent class monitoring—uses the system's knowledge about different learners to form a cohesive group for different kinds of collaboration, or to identify a mismatch between learners.

The most frequently used adaptation techniques in the AHLE systems are: adaptive presentation, curriculum sequencing and adaptive navigation support (see Table 1, column "Adaptation technology"). On first use of an AHLE system which uses learning style preferences as a source of adaptation, the learner has to complete a learning style questionnaire; the result from this questionnaire initializes the learner model and classifies the learner into a particular learning style group. Most of the AHLE systems assess the learning styles through psychometric questionnaires (Stash, Cristea, & DeBra, 2004). The disadvantage of this approach is that the learners are classified into stereotypical groups and assumptions about their learning styles were not updated during the subsequent interactions with the system in most of the early AHLE systems. However, in the latest AHLE systems, during the use of the system, the learner model is dynamically updated in terms of preferred learning components and changes in learning preferences. In other words, these systems assume that learning preferences are not fixed, and that a learner's learning style may change from one occasion to another. These systems do not require an initial diagnosis of a learner's learning preferences but simply pick them up from browsing behavior of the learner. Danchak (2004) suggests using two alternative techniques for dynamic adaptation of learning preferences, namely the Naïve Bayes Classifiers and the Case-Based Reasoning (see Castillo, Gama, & Breda, 2003; Funk & Conlan, 2003; Zukerman & Albrecht, 2001). These techniques could be used to dynamically update learning preferences in the learner model. Furthermore, an ideal AHLE system should provide learners

with full control over the learner model, allowing them to change their learning preferences in spite of initial classification in a particular learning style group.

Although systematic efforts have been made to evaluate adaptive systems (Weibelzahl, 2003; Weibelzahl & Weber, 2001) only a few empirical studies, mostly small scale studies conducted in experimental conditions, have been conducted that seek to prove the effectiveness of the adopted approaches based on learning styles (Papanikolaou & Grigoriadou, 2004).

CONCLUSION

Awareness about learning styles is very important both to academic staff and learners. Learners will gain an understanding of why academic staff is using different teaching approaches on the course and how they can benefit from them. Academic staff will recognize the diversity of learning styles among learners and adjust their teaching style to take account of this. The discussion in this chapter also sends a clear message to instructional designers to create a learning environment that will support the construction of knowledge in learners.

Coffield, Moseley, Hall, and Ecclestone (2004b) answering the question in the title of their study "Should we be using learning styles?" claim that there are no clear implications of learning styles research for pedagogy. They state that, for example, there is no consensus on whether the style of teaching should be consonant with the style of learning or not. However, one of the benefits that an AHLE system with learning styles could have over a non-adaptable learning environment is that it could help students to develop meta-cognition skills. An AHLE system provides learners with alternative paths through the course material based on different learning styles. Learners could reflect on the way they are learning and then decide to use an alternative path through the course, i.e., a different learning approach to the course material. In other words, AHLE systems

could stimulate learners to think more about the way they are learning and what the best learning strategy for them is. Of course an AHLE system to some extent should also expose learners to teaching styles and instructional material which is different from their preferences to increase their readiness for the real world (Felder, 1993, 1996; Montgomery & Groat, 1998).

Learning styles which belong to the stable personality type and “flexibly stable” learning preferences families in Coffield, Moseley, Hall, and Ecclestone’s (2004a) classification of learning style models, are used in AHLE systems as a source of adaptation more often than others. These models are the Felder and Silverman, Honey and Mumford, McCarthy, Dunn and Dunn, and Witkin models and provide sufficient information for AHLE systems designers to incorporate them in the system. They also fulfill most of the conditions stated by Sampson and Karagiannidis (2002) for any learning style model, which is a candidate for use in an AHLE system as a source of adaptation. Of course this does not mean that the other learning style models should not be tried in an AHLE system. This may be a possible topic for further research in this area.

Most of the AHLE systems which incorporate learning preferences as a source of adaptation use the following adaptation technologies: adaptive presentation, curriculum sequencing and adaptive navigation support to adapt learning environment to individual learning preferences. However, because of the increasing role of collaborative learning in distance education, adaptive collaborative support technologies together with learning style information should be considered for the construction of groups and implementation in an AHLE system in future development.

FUTURE TRENDS

One of the reasons why AHLE systems are not widely used as an alternative for course management systems such as WebCT and Blackboard, lies in fact that most of them are not content-free, (i.e., they are developed for a particular domain

and/or particular learning style model). In other words, domain and learning style are embedded in the code of the AHLE system. This is the area where Brusilovsky (2001, 2003b) expects future progress and the development of new architectures and authoring tools for AHLEs. He predicts that “we may expect better markup-based and form-based tools. I also expect the appearance of a new kind of ‘really graphic’ user interface design tools” (2003b). At the moment the only available content-free authoring tool is De Bra’s AHA.

The use of learning style as a source of adaptation in a new generation of AHLE systems raises the following question: How do we address the meta models of learning styles in adaptive hypermedia? (Brusilovsky, 2003a). In other words the question is whether the AHLE system is capable of addressing not only one selected learning style, but whole families of learning styles. Berlanga and Garcia (2004a, 2004b) proposed a flexible design of an AHLE system with learning preferences as a source of adaptation where learning styles approach and adaptation rules are not prescribed. They argued that different learning style approaches should be used for different knowledge and types of learners. The idea is not to set down any particular learning style, but a flexible structure where the different learning style approaches can be easily described and used to characterize the learning style of learners and activities.

Future AHLE system should provide learners with full access to the learner model. Learners should be able to choose a particular path through the course material, even if it is not the same path recommended by the system and based on their learning styles. As was recommended before, learners should be exposed to different approaches to learning to improve their meta-cognition skills and to gain an understanding of how other people in their collaborative team learn. Future AHLE systems should have built-in options similar to the computer chess game, where a player might select an opponent with certain characteristics,

for example, a defensive or offensive player.

Learning style processing may require fuzzy logic in the diagnosis (Triantafillou, Pomportsis, & Georgiadou, 2002), allowing for the fact that not all users are located at the poles of each dimension of the learning style model (for example, global and sequential poles in the case of Felder and Silverman model), but they combine the characteristics of both global and sequential dimensions. However, as they argued, it is questionable if all different shades of learning styles can be handled by an adaptive hypermedia system, or if the system should be simpler for the user's benefit. It is a matter of future research to find a trade-off between the degree of adaptation and the level of complexity of an AHLE system.

There are also other issues related to learning styles in AHLE systems that need to be addressed in the future, such as delivering an adaptive course for mobile devices (Brusilovsky & Rizzo, 2002c, 2004; Kinshuk & Lin, 2004) and creating a framework or at least adaptive navigation support, which would integrate closed corpus course material (a standard AHLE system with well-structured homogeneous course material) with open corpus Web material, i.e., all the other relevant resources on the Internet (Brusilovsky & Rizzo, 2002a, 2002b).

REFERENCES

- Atkins, H., Moore, D., Sharpe, S., & Hobbs, D. (2001). Learning style theory and computer mediated communication. In *Proceedings of ED-MEDIA 2001*, Tampere, Finland.
- Bajraktarevic, N., Hall, W., & Fullick, P. (2003a). ILASH: Incorporating learning strategies in hypermedia. In *AH2003: Workshop on Adaptive Hypermedia and Adaptive Web-Based Systems*.
- Bajraktarevic, N., Hall, W., & Fullick, P. (2003b). Incorporating learning styles in hypermedia environment: Empirical evaluation. In *AH2003: Workshop on Adaptive Hypermedia and Adaptive Web-Based Systems*.
- Berlanga, A., & García, F. J. (2004a). A proposal to define adaptive learning designs. In *Proceedings of the 2nd International Workshop on Applications of Semantic Web Technologies for E-Learning, SW-EL'04*, Auckland, New Zealand.
- Berlanga, A., & García, F. J. (2004b). An adaptive meta-model for eLearning. In *Proceedings of the 5th International Conference Human-Computer Interaction*, Lleida, Spain.
- Brusilovsky, P. (1996). Methods and techniques of adaptive hypermedia. *User Modeling and User-Adapted Interaction*, 6(2-3), 87-129.
- Brusilovsky, P. (1999). Adaptive and intelligent technologies for Web-based education. *Künstliche Intelligenz*, 13(4), 19-25.
- Brusilovsky, P. (2000). Adaptive hypermedia: From intelligent tutoring systems to Web-based education. In G. Gauthier, C. Frasson, & K. Van-Lehn (Eds.), *Intelligent tutoring systems: Lecture notes in computer science, 1839* (pp. 1-7). Berlin: Springer Verlag.
- Brusilovsky, P. (2001). Adaptive hypermedia. *User Modeling and User Adapted Interaction*, 11(1/2), 87-110.
- Brusilovsky, P. (2003a). Adaptive navigation support in educational hypermedia: The role of student knowledge level and the case for meta-adaptation. *British Journal of Educational Technology*, 34(4), 487-497.
- Brusilovsky, P. (2003b). Developing adaptive educational hypermedia systems: From design models to authoring tools. In T. Murray, S. Blessing, & S. Ainsworth (Eds.), *Authoring tools for advanced technology learning environment* (pp. 377-409). Dordrecht, Netherlands: Kluwer Academic Publishers.

- Brusilovsky, P. (2004a). Adaptive navigation support: From adaptive hypermedia to the adaptive Web and beyond. *Psychology*, 2(1), 7-23.
- Brusilovsky, P. (2004b). Adaptive educational hypermedia: From generation to generation. In *Proceedings of 4th Hellenic Conference on Information and Communication Technologies in Education*, Athens, Greece (pp. 19-33).
- Brusilovsky, P., Chavan, G., & Farzan, R. (2004). Social adaptive navigation support for open corpus electronic textbooks. In P. De Bra (Ed.), *Proceedings of 3rd International Conference on Adaptive Hypermedia and Adaptive Web-Based Systems (AH2004)*, Eindhoven, The Netherlands.
- Brusilovsky, P., & Rizzo, R. (2002a). Map-based horizontal navigation in educational hypertext. *Journal of Digital Information*, 3(1). Retrieved January 7, 2005, from <http://jodi.tamu.edu/Articles/v03/i01/Brusilovsky/>
- Brusilovsky, P., & Rizzo, R. (2002b). Using maps and landmarks for navigation between closed and open corpus hyperspace in Web-based education. *The New Review of Hypermedia and Multimedia*, 8, 59-82.
- Brusilovsky, P., & Rizzo, R. (2002c). Map-based access to multiple educational online resources from mobile wireless devices. In F. Paterno (Ed.), *Mobile human-computer interaction: Lecture notes in computer science, 2411* (pp. 404-408). Berlin: Springer-Verlag.
- Brusilovsky, P., & Rizzo, R. (2004). Accessing Web educational resources from mobile wireless devices: The knowledge sea approach. In F. Crestiani, M. Dunlop, & S. Mizzaro (Eds.), *Mobile and ubiquitous information access. Lecture Notes in Computer Science, 2954* (pp. 54-66). Berlin: Springer Verlag.
- Brusilovsky, P., & Vassileva, J. (2003). Course sequencing techniques for large-scale Web-based education. *International Journal of Continuing Engineering Education and Lifelong Learning*, 13(1-2), 75-94.
- Byrne, P., & Lyons, G. (2001). The effect of student attributes on success in programming. In *Proceedings of the 6th Annual Conference on Innovation and Technology in Computer Science Education*, Canterbury, UK (pp. 49-52).
- Carver, C. A., Richard, A. H., & Edward, L. (1996). Enhancing student learning by incorporating learning styles into adaptive hypermedia. In *Proceedings of ED-MEDIA 96, Association for the Advancement of Computing in Education*, Charlottesville, VA (pp. 118-123).
- Carver, C. A., Richard, A. H., & Edward, L. (1999). Enhancing student learning through mypermedia courseware and incorporation of student learning styles. *IEEE Transactions on Education*, 42(1), 33-38.
- Castillo, G., Gama, J., & Breda, A. M. (2003). Adaptive Bayes for a student modeling prediction task based on learning styles. In P. Brusilovsky, A. Corbett, & F. de Rosi (Eds.), *User Modeling 2003, 9th International Conference, Lecture Notes in Artificial Intelligence, 2702* (pp. 328-332). Berlin: Springer Verlag.
- Charkins, R. J., O'Toole, D. M., & Wetzel, J. N. (1985). Linking teacher and student learning styles with student achievement and attitudes. *Journal of Economic Education*, 16(2), 111-120.
- Claxton, C. S., & Murrell, P. H. (1987). *Learning styles: Implication for improving educational practices* (ASHE-ERIC Higher Education Report No. 4). Association for the Study of Higher Education. Washington, DC.
- Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004a). *Learning styles and pedagogy in post-16 learning: A systematic and critical review*. London: Learning and Skills Research Centre/University of Newcastle upon Tyne.

- Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004b). *Should we be using learning styles? What research has to say to practice*. London: Learning and Skills Research Centre/University of Newcastle upon Tyne.
- Curry, L. (1983). *An organisation of learning style theory and constructs*. Paper presented at the Annual Meeting of the American Educational Research Association, Montreal, Quebec, Canada. (ERIC Document Reproduction Service No. ED235185)
- Curry, L. (1990). A critique of the research on learning styles. *Educational Leadership*, 48(2), 50-55.
- Danchak, M. M. (2004). Using adaptive hypermedia to match Web presentation to learning styles. In *Elements of quality online education: Into the mainstream* (93-108). Sloan Consortium.
- De Bello, T. C. (1990). Comparison of eleven major learning styles models: Variables, appropriate populations, validity of instrumentation, and the research behind them. *Journal of Reading, Writing, and Learning Disabilities*, 6, 203-222.
- De Bra, P., Aroyo, L., & Chepegin, V. (2004). The next big thing: Adaptive Web-based systems. *Journal of Digital Information*, 5(1). Retrieved January 7, 2005, from <http://jodi.tamu.edu/Articles/v05/i01/DeBra/>
- Del Corso, D. D., Ovcin, E., Morrone, G., Gianesini, D., Salojarvi, S., & Kvist, T. (2001). 3DE: An environment for the development of learner-centered custom educational packages. In *Proceedings of 31st ASEE/IEEE Frontiers in Education Conference*.
- Dille, B., & Mezack, M. (1991). Identifying predictors of high risk among community college telecourse students. *The American Journal of Distance Education*, 5(1), 24-35.
- Dunn, R. (2003). The Dunn and Dunn learning style model and its theoretical cornerstone. In R. Dunn, & S. Griggs (Eds), *Synthesis of the Dunn and Dunn learning styles models research: Who, what, when, where, and so what* (pp. 1-6). New York: St John's University.
- Felder, R. M. (1993). Reaching the second tier: Learning and teaching styles in college science education. *Journal of College Science Teaching*, 78(7), 674-681.
- Felder, R. M. (1996). Matters of style. *ASEE Prism*, 6(4), 18-23.
- Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering Education*, 78(7), 674-681.
- Ford, N., & Chen, S.Y. (2001). Matching/mismatching revisited: An empirical study of learning and teaching styles. *British Journal of Educational Technology*, 32(1), 5-22.
- Funk, P., & Conlan, O. (2003). Using case-based reasoning to support authors of adaptive hypermedia systems. In *AH2003: Workshop on Adaptive Hypermedia and Adaptive Web-Based Systems*.
- Gilbert, J. E., & Han, C. Y. (1999). Arthur: Adapting instruction to accommodate learning styles. In *Proceedings of WebNet '99 World Conference of the WWW and Internet* (pp. 433-438).
- Gilbert, J. E., & Han, C. Y. (2002). Arthur: A personalized instructional system. *Journal of Computing in Higher Education*, 14(1), 113-129.
- Given, B. K. (1996). Learning styles: A synthesized model. *Journal of Accelerated Learning and Teaching*, 2(1&2), 11-43.
- Grasha, A. F. (1996). *Teaching with style: A practical guide to enhancing learning by understanding teaching and learning styles*. Pittsburgh, PA: Alliance Publishers.
- Griggs, S. A., & Dunn, R. S. (1984). Selected case studies of the learning style preferences of gifted students. *Gifted Child Quarterly*, 28(3), 115-119.

- Honey, P., & Mumford, A. (1992). *The manual of learning styles*. Maidenhead, UK: Peter Honey Publications.
- Hruska-Riechmann, S., & Grasha, A. F. (1982). The Grasha-Riechmann student learning style scales: Research findings and applications. In J. Keefe (Ed.), *Student learning styles and brain behaviour*. Reston, VA: NASSP.
- Kay, J. (2001). Learner control. *User Modeling and User-Adapted Interaction*, 11(1-2), 111-127.
- Keefe, J. W. (1979). Learning styles: An overview. In *NASSP's student learning styles: Diagnosing and prescribing programs* (pp. 1-17). Reston, VA: National Association of Secondary School Principals.
- Kelly, D., & Tangney, B. (2004). Evaluating presentation strategy and choice in an adaptive multiple intelligence based tutoring system. In G. D. Magoulas, & S. Y. Chen (Eds.), *Individual Differences in Adaptive Hypermedia. Proceedings of the Adaptive Hypermedia 2004 Workshop*, London (pp. 21-30).
- Kinshuk, & Lin, T. (2004). Application of learning styles adaptivity in mobile learning environments. In *Proceedings of the 3rd Pan Commonwealth Forum on Open Learning*, Dunedin, New Zealand.
- Kolb, D. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.
- Kommers, P., & Mizzoguchi, R. (2000). Intelligent systems/tools in training and lifelong learning. *Journal of Interactive Learning Research*, 11(3/4), 259-264.
- Kovai, Z., & Green, J. (2004). Are all learners created equal? A quantitative analysis of academic performance in a distance tertiary institution. *Journal of Issues in Informing Science and Information Technology*, 1, 965-976.
- Magoulas, G., Papanikolaou, K., & Grigoriadou, M. (2003). Adaptive Web-based learning: Accommodating individual differences through system's adaptation. *British Journal of Educational Technology*, 34(4), 1-19.
- McCarthy, B. (1990). Using the 4MAT system to bring learning styles to schools. *Educational Leadership*, 48(2), 31-37.
- Montgomery, S. M., & Groat, L. N. (1998). Student learning styles and their implications for teaching. *CRLT Occasional Papers, No. 10*. The University of Michigan, The Center for Research on Learning and Teaching.
- Papanikolaou, K. A., & Grigoriadou, M. (2004). Accommodating learning style characteristics in adaptive educational hypermedia systems. In G. D. Magoulas, & S. Y. Chen (Eds.), *Individual Differences in Adaptive Hypermedia. Proceedings of the Adaptive Hypermedia 2004 Workshop*, London (pp. 1-10).
- Papanikolaou, K. A., Grigoriadou, M., Kornilakis, H., & Magoulas, G. D. (2003). Personalizing the interaction in a Web-based educational hypermedia system: The case of INSPIRE. *User-Modeling and User-Adapted Interaction*, 13(3), 213-267.
- Paramythis, A., & Loidl, S. R. (2004). Adaptive learning environments and eLearning standards. *Electronic Journal on e-Learning*, 2(1), 181-194.
- Peña, C., Narzo, J., & de la Rosa, J. (2002). Intelligent agents in a teaching and learning environment on the Web. In *Proceedings of the IEEE International Conference on Advanced Learning Technologies (ICALT 2002)*, Kazan, Russia.
- Riding, R., & Cheema, I. (1991). Cognitive styles: An overview and integration. *Educational Psychology*, 11(3-4), 193-216.
- Sampson, D., & Karagiannidis, C. (2002). Accommodating learning styles in adaptation logics for personalised learning systems. In *Proceedings*

of the World Conference on Educational Multimedia, Hypermedia and Telecommunications (ED-MEDIA 02), Denver, CO.

Shute, V., & Towle, B. (2003). Adaptive eLearning. *Educational Psychologist*, 38(2), 105-114.

Smith, L., & Renzulli, J. (1984). Learning style preference: A practical approach for classroom teachers. *Theory into Practice*, 23(1), 45-50.

Specht, M., & Oppermann, R. (1998). ACE: Adaptive courseware environment. *The New Review of Hypermedia and Multimedia*, 4, 141-161.

Stash, N., Cristea, A., & De Bra, P. (2004). Authoring of learning styles in adaptive hypermedia: Problems and solutions. In *Proceedings of the WWW 2004 Conference*, New York (pp. 114-123).

Stash, N., & De Bra, P. (2004). Incorporating cognitive styles in AHA! (The adaptive hypermedia architecture). In *Proceedings of the IASTED International Conference Web-Based Education*, Innsbruck, Austria (pp. 378-383).

Stern, M. K., & Woolf, B. P. (2000). Adaptive content in an online lecture system. In P. Brusilovsky, O. Stock, & C. Strapparava. (Eds.), *Adaptive hypermedia and adaptive Web-based systems: Lecture notes in computer science, 1892* (pp. 227-238). Berlin: Springer-Verlag.

Thomas, L., Ratcliffe, M., Woodbury, J., & Jarman, E. (2002). Learning styles and performance in the introductory programming sequence. *SIGCSE Bulletin*, 34(1), 33-37.

Triantafyllou, E., Demetriadis, S., & Pomportsis, A. (2002). Adaptive hypermedia and cognitive styles: Can performance be influenced? In *Proceedings of the 9th Panhellenic Conference in Informatics*, Thessaloniki, Greece (pp. 510-518).

Triantafyllou, E., Pomportsis, A., & Georgiadou, E. (2002). AES-CS: Adaptive educational system based on cognitive styles. In *Workshop on Adaptive Systems for Web-based Education*, Málaga, Spain.

Weibelzahl, S. (2003). *Evaluation of adaptive systems*. Doctoral dissertation, University of Trier, Germany.

Weibelzahl, S., & Weber, G. (2001). A database of empirical evaluations of adaptive systems. In R. Klinkenberg, S. Rüping, A. Fick, N. Henze, C. Herzog, R. Molitor, & O. Schröder (Eds.), *Proceedings of Workshop Lernen - Lehren - Wissen - Adaptivität (LLWA 01)*, University of Dortmund (Research Report in Computer Science Nr. 763; pp. 302-306).

Witkin, H. A., Moore, C. A., Goodenough, D. R., & Cox, P. (1977). Field-dependent and field-independent cognitive styles and their educational implications. *Review of Educational Research*, 47(1), 1-64.

Wolf, C. (2002). iWeaver: Towards an interactive Web-based adaptive learning environment to address individual learning styles. In *Proceedings of Interactive Computer Aided Learning Workshop*, Villach, Austria.

Wolf, C. (2003). iWeaver: Towards 'learning style'-based e-Learning in computer science education. In *5th Australasian Computing Education Conference (ACE 2003)*, Adelaide, South Australia, Australia.

Wu, H. (2002). *A reference architecture for adaptive hypermedia applications*. SIKS Dissertation Series No. 2002-13. Eindhoven: Technische Universiteit Eindhoven.

Zukerman, I., & Albrecht D. W. (2001). Predictive statistical models for user modeling. *User Modeling and User-Adapted Interaction*, 11(1-2), 5-18.

Learning Styles and Adaptive ICT Based Learning Environment

Zywno, M. S., & Waalen, J. K. (2002). The effect of individual learning styles on student outcomes in technology-enabled education. *Global Journal of Engineering Education*, 6(1), 35-44.

This work was previously published in Teaching in the Knowledge Society: New Skills and Instruments for Teachers, edited by A. Cartelli, pp. 131-152, copyright 2006 by Information Science Publishing (an imprint of IGI Global).

Chapter 1.27

Behavioral, Cognitive, and Humanistic Theories: Which Theories Do Online Instructors Utilize?

MarySue Cicciarelli
Duquesne University, USA

ABSTRACT

This article presents fifteen different design theories from the behaviorism, cognitivism, and humanism schools of psychology. Information about the theories is presented as a response to three research questions. Descriptions and online learning empirical evidence of eight of the theories are illustrated first. Then, descriptions of seven additional design theories which have not yet been researched in connection with online learning are offered. Finally, results from a study that investigates how often online instructors utilize nine of the theories is presented. Conclusions are made in connection to the three research questions, and further research studies related to the topic are suggested.

INTRODUCTION

An increasing number of individuals have chosen distance education when taking a course or earning a degree because it is a flexible alternative that meets their needs (Chu & Hinton, 2001; Course-Management Systems, 2005). An online course is one type of distance education where an instructor and the students interact through an online venue, such as a course management system. When taking an online course, the course may occur at different times from different places, or it can occur at the same time from different places (Course-Management Systems, 2005; Simonson, Smaldino, Albright, & Zvacek, 2000).

There are advantages to taking an online course, and there are challenges that students and instructors must overcome. Synchronous and asynchronous discussion boards are features of a course management system that instructors make use of because these tools can be used to individualize instruction, encourage goal-based exploration, and guide students to construct new schemes of knowledge (Prester & Moller, 2001). Challenges that occur include feelings of isolation, waiting for responses to asynchronous posts, absence of impulsive discussion, and lack of non-verbal isolation (Figueroa & Huie, 2001; King, 2001; Northrup, Lee, & Burgess, 2002; Prester & Moller, 2001).

Designing effective courses is one way that instructors reduce the disadvantages (Collins & Berge, 1996; Makrakis, 1998; Prester & Moller, 2001; Williams, 2001). Instructors often use design theory to guide the development of courses so they can be more effective. Instructors may have problems in mind from past experiences with teaching online that they want to avoid, or they can recognize a problem as it is occurring and implement a strategy to help reduce the difficulty. Instructors may accept the idea of using theory to guide course design and solve problems, but they may have questions that they want answered. The purpose of this article is to answer three of the following questions that online instructors may have: (a) According to empirical evidence, what does the research show about online instructor use of different design theories? (b) According to lack of empirical evidence, which design theories have not been researched in regard to online instructor utilization of theory? and, (c) According to a recent study, how frequently do online instructors use nine of the design theories?

REVIEW OF LITERATURE

There are three schools of psychology in which theories are categorized; behaviorism, cognitivism and humanism. It is believed that one school of theory is not better than the other, and indi-

viduals are encouraged to apply the theory that is the most appropriate for the student (Joyce, Weil, & Calhoun, 2000; Pinar, Reynolds, Slatery, & Taubman, 1996; Tomei, 2007).

Behaviorism, Cognitivism, and Humanism

Behaviorism

Experimental psychologists William James and Edward L. Thorndike, questioned the use of memorization as a strategy for learning. Experiments showed that memory did not increase after the participants had memorized sets of information. These results guided a turn in research toward stimulus-response behavioral psychology. James and Thorndike believed that the environment served as a stimulus, and it could be used to change the way individuals responded. As behaviorism became more established as a part of the school of psychology, psychologists began to focus on individual's responses to feedback when they performed a task. Other behavioral psychologists that have made contributions to the field of behavior psychology include Ivan Pavlov, B. F. Skinner, Albert Bandura, and Benjamin Bloom (Joyce et al., 2000; Pinar et al., 1996).

Cognitivism

Theories that are cognitive in nature are based on learning tasks that are practical, and they are seen being used in authentic learning environments. Cognitive theorists such as Jean Piaget, Lev Vygotsky, Erik Erikson, and David Ausubel have developed theories that are not only widely accepted, but they have begun the path for the development of other cognitive theories. When instructors utilize theories that are cognitive in nature, they tend to develop learning experiences that help students make connections that are meaningful to themselves (Grabinger, 2004; Tomei, 2007).

Humanism

Theories that focus on a student's affective needs come from the humanism school of psychology. These theories attend to students' feelings, emotions, values, and attitudes. Some of the earliest work that reflected humanism came from Colonel Parker, who encouraged child centered learning in a democratic school environment. His work later influenced the progressive work of John Dewey. Theorists such as Elliot W. Eisner, Ross Mooney, and Paul Klohr supported the development of learning experiences that focused on self value. Carl Rogers and Abraham Maslow wanted educators to concern themselves less with curriculum development and give more of their attention to understanding curriculum. The work of these psychologists eventually influenced the development of other theories based on Humanism. Collective common factors of theories rooted in Humanism include the attention toward student-centered learning and individualism (Pinar et al., 1996).

ACCORDING TO EMPIRICAL RESEARCH: THEORIES SEEN BEING USED BY ONLINE INSTRUCTORS

Theories of Behaviorism

Social-Cultural Model of Learning

An online course that incorporates the social-cultural model of learning is reflective of behaviorism because patterns of communication are utilized. The social-cultural model of learning uses written and oral dialogue. Threaded asynchronous discussions, synchronous discussions and e-mail are examples of the tools implemented by instructors during the course design process. The pattern of behaviorism begins when the instructor poses a question, students respond to the question, and the instructor responds to the students' responses with positive or negative reinforcement comments.

In a study that explored Web-based online meetings, researchers found that learners wanted to interact with each other and their instructor through discussion. However, results showed that precautions need to be taken by the instructor to help promote effective discussion (Berge & Fjuk, 2006). Results from a four-year study on threaded discussions had outcomes that favored use of asynchronous discussions (Schwartzman, 2006).

In another study, researchers looked at the behavior of 96 individuals who participated in an asynchronous discussion. Results from a Myers-Briggs test were used to divide the participants into 24 groups based on personality type. There were eight introverted type groups, eight extroverted type groups, and there were eight mixed groups. Participants from the extroverted and mixed groups posted more asynchronous messages compared to the participants from the introverted groups. However, it was the participants from the mixed groups who showed a greater amount of metacognitive interaction. Online instructors are encouraged to create mixed groups because instant feedback and new ideas presented by extroverted members may stimulate introverted members, and the in-depth discussion prompted by arguments from the introverted members could further stimulate the extroverted members to increase participation (Lee & Lee, 2006).

Mastery Learning

Mastery Learning is a practice originally created by John B. Carroll and Benjamin Bloom. John Carroll's perspective holds that a student's aptitude correlates with achievement. His view of aptitude considers how long it takes for the learner to learn the material as opposed to the learner's ability to master the material. According to this view, every learner can learn as long as the appropriate materials and instruction are provided. Benjamin Bloom's work focuses on organizing the curriculum so that students have the necessary time and ability to benefit from instruction. Now that modern instructional tech-

nology has afforded educators with new choices, curriculum developers are encouraged to develop comprehensive curriculum that includes self-administering multimedia units and programmed learning procedures (Joyce et al., 2000; Pinar et al., 1996).

In a study that explores the use of strategies to engage the whole learner, mastery learning is utilized as a strategy to promote significant learning. According to the researchers, an online course should be designed so that different parts of the course encourage deep learning. The syllabus should be detailed, comprehensive, and it should contain direct instruction about interaction. Objectives should be clearly presented so they form the course structure, and the assignments should directly relate to the objectives. Finally, they talk at length about asynchronous discussions and the use of different activities. They indicate that the most effective discussions that lead to deep learning are supported with facilitative directions and rubrics because the learners know what is expected. Interactive discussion activities, discussion tasks, and reflective and exploratory discussions are said to be successful strategies that instructors can use to encourage mastery learning that is significant (Majeski & Stover, 2007).

Simulations

Learning from simulations through training and self-training is another example of a behavioral learning theory. When simulations are utilized, students take on the role of someone from a real life experience. To succeed when performing the role, students make use of concepts and skills to perform specific tasks. Instructors take the role of explaining, refereeing, coaching, and discussing the simulation experience with the students. They explain the rules, place the students into teams, and they assign roles based on student ability to ensure participation and communication between the students. When coaching, the instructor needs to be supportive, yet avoid interfering with the natural play of the simulation. Students are ex-

pected to make mistakes and adjust from those mistakes. Finally, instructors hold a discussion in which students have the opportunity to reflect and identify similarities and differences between the simulation and the real world (Joyce et al., 2000; Pinar et al., 1996).

Online role playing is not seen as a common practice in online courses. Data collected from a study on role playing that was part of an online course showed that students who participated enjoy taking part in the role plays, and they found that students considered the learning experience beneficial. Participants also indicated that the interaction made the classroom experience feel more personal. Students were seen making use of their knowledge to add to the role play experience (Lebaron & Miller, 2005).

Theories of Cognitivism

Theory of Multiple Representations

Applying multiple representations that connect to content of subject matter is thought to be a valuable practice because students can build mental representations with the information and make information meaningful to themselves. Web environments and computer mediated discussions are said to be conducive to the application of multiple representations during course design (Huang & Liaw, 2004). Researchers provide support and they raise cautions when it comes to using multiple representations during instruction. (Gfeller, Niess, & Lederman, 1999; Huang & Liaw, 2004; Moreno, 2002; Ying-Shao & Fu-Kwun, 2002).

A Web based lesson created to promote situated learning involved one hundred ten high school students from Taipei. Participants in the study were asked to connect a realistic situation with their own life. Social learning theory and multiple representations were used by the students to make connections. Results showed that when multiple representations were used along with situated learning during an asynchronous discussion that the students were able to cultivate and integrate the knowledge (Ying-Shao & Fu-Kwun, 2002). In

another study on use of multiple representations, the researcher found that students with stronger technology skills were more successful when it came to using multiple representations. Since their technological skills were stronger, they had a lower amount of cognitive overload compared to students whose technology skills were not as strong (Moreno, 2002).

Bruner's Three-Form Theory

Bruner (1990) states that there are three ways from which individuals see the world, through action, icons, and symbols. They use action to perform or demonstrate what it is they see about the world from their perspective. Icons or mental images are used to present a path, summary, or pattern. Symbolism, which is an abstract way of visualizing reality through the use of words and numbers, is the third form that individuals use. According to Bruner, these three forms of representation are founded on the theory that development must be effectively related to theories of knowledge and instruction.

Studies on the dual-coding theory show an influence on learning when visual and aural modalities are combined (Alty, 2002; Beacham, Elliot, Alty, & Al-Sharrah, 2002; Rieber, Tzeng, Trubble, & Chu, 1996). In a study conducted by Rieber et al., (1996), 52 college students interacted with a computer simulation created partly with the dual-coding theory as a framework. Visual modalities were presented as animated graphics and numeric displays were presented as aural modalities. Results were better for students who were provided with the visual and aural support compared to the students who were provided with one of the two modalities.

Moore's Theory of Transactional Distance

Moore's Theory of Transactional Distance, unlike the Web-based theories already presented, is a distance theory. Many online instructors have applied

this theory because its three dimensions have an affective influence on teaching procedures. Those three dimensions are referred to as interaction, course structure, and learner autonomy (Huang & Liaw, 2004).

Results from a study conducted by Huang (2002) showed that learners do not need to interact with other learners to develop a relationship with an instructor. The researcher found that course structure is easily implemented and adjusted in an online course, and it was found that the more technologically skilled an individual was, the better the individual was at working independently. Kanuka, Colett, & Caswell (2002) noted from a two-year study which observed 12 online university instructors that the instructors were more apprehensive about course structure, dialogue, and autonomy when they first began teaching online. Instructors who participated in the study needed to assess learners' autonomy, they needed to provide students with more feedback when the students did not have enough self-discipline to work independently, and they found that the learners wanted flexibility to be a part of the course structure.

Theories of Humanism

Theory of Immediacy and Social Presence

A model of online learning that considers social presence during asynchronous discussion to be a significant part of mediated discussion is presented. Theorists who hold that learning takes place through the interaction of three core components: cognitive presence, teaching presence, and social presence (Rourke, Anderson, Garrison, & Archer, 2001).

After a more in-depth look at social presence responses, three forms of social responses were identified and called affective responses, interactive responses, and cohesive responses (Martyn, 2004). These responses were used as indicators by Rourke et al., (2001) when analyzing content

during their exploration of computer mediated discussions and affective behaviors among participants. It was found that learners' perceptions were an important factor that instructors kept in mind when designing online courses.

Additional important factors related to social presence were found in other studies. Gunawardena and Duphorne (2002) found in a study that focused on an academic computer conference environment that comfort with participating in discussions, easiness with interacting through text, and assurance with ones self significantly impacted perceptions. Murphy (2004) found that sharing, recognition of group presence, appreciative communication between learners, and the opportunity to express feelings and emotions to be indicators of social presence in an online discussion. It is Murphy's conjecture that learners must be able to contribute their own social presence before moving to higher levels of interaction.

Cooperative Learning Theory

Five facets of the basic elements of cooperative learning help others understand how to design learning experiences that utilize the cooperative learning theory. Positive interdependence takes place when students work together, and they perceive that they are moving toward the same goal. Direct interaction occurs when students discuss what they plan to do and how to go about it. Individual accountability encourages individuals to master learning while sharing and working with others. Attaining collaborative skills involves individuals working together before they cooperate and learn. Finally, group processing takes place when the individuals in the group discuss and evaluate their work. Upon evaluation, the group members found that they work well together. Instructors who have applied this theory guide their students through each facet of the model. The more students develop, the better they work in a cooperative learning situation (Joyce et al., 2000).

A study that explored the online collaborative experiences and attitudes of twelve graduate students found, after assessing asynchronous posts, that poor communication, conflicts between members, and poor attitudes challenged the success of the online collaboration. Groups that did not have these challenges produced projects of higher quality. The researchers suggest implementing strategies to reduce the challenges so that chances for effective collaboration can increase (Thompson & Hing-Yu, 2006). Another study that investigated the impact of cooperative learning showed that cooperative learning did impact cognitive learning outcomes. Researchers found that learners become more involved with the online learning experience when they work cooperatively with others compared to when they worked independently (Riley & Anderson, 2006).

ACCORDING TO EMPIRICAL RESEARCH: THEORIES NOT SEEN BEING USED BY ONLINE INSTRUCTORS

Theories of Behaviorism

Elaboration Theory

Elaboration Theory, which is reflective of behaviorism, is a practice that is concerned with the organization of materials for a course. While cognitive aspects to this theory exist, it is also considered reflective of behaviorism because the instructor adjusts the learning environment to meet student needs. This theory holds that new learning should be presented first in the simplest form and carefully move to more complex forms of content and learning. For this reason, online instructors tend to begin with knowledge that students are already familiar with. Then, they transition to the exploration of new knowledge which helps students make the appropriate connections to help them understand the content (Huang & Liaw, 2004; Ludwig, 2000).

Direct Instruction

Direct instruction is referred to by behaviorists as “modeling with reinforced guided performance.” The focus of this model of learning involves dividing performance into goals and tasks, breaking the tasks into smaller tasks, creating training activities that directly target the objectives and ensure mastery of each task, and the inclusion of prerequisites that students have to achieve before they can go on to more advanced concepts. Critics of the direct instruction theory note that the application of this theory should be used with caution because it is not appropriate for all educational objectives and all students (Joyce et al., 2000). A study that focused solely on the use of direct instruction was not available in the literature, however there is information that suggests using direct instruction as part of an online course when presenting specific directions to students and when providing information needed to participate (Bellefeuille, 2006).

Theories of Cognitivism

Cognitive Flexibility Theory

Jonassen (2003) explains that a great deal of research looks at the presentation of problems to learners and identifies two conflicts with how problems that need to be solved are presented. First, it is a conflict when the problems are presented as structured problems because real life problems are ill-structured. The other conflict is that students do not transfer problem solving skills very well. Jonassen suggests using the cognitive flexibility theory to prohibit the conflicts.

Active learning, through discussion and the exchange of ideas, is an important aspect of learning (McAlpine & Ashcroft, 2002). For effective distance learning to take place, constructivism and cognitive flexibility need to be present. Learners should be active participants and instructors can not be distributors of information since students

process information differently. According to the researchers, students should solve problems in ways that are best for themselves (Notar, Wilson, & Montgomery, 2005).

Gagne’s Conditions of Learning

Huang and Liaw (2004) identify Gagne’s conditions of learning as an instructional learning process that is methodical and logical. Gagne’s conditions of learning is a descriptive theory of knowledge that contains five separate categories of outcomes labeled as intellectual skills, verbal information, cognitive strategies, motor skills, and attitudes. Having the ability and knowledge to categorize and use materials are characteristics of intellectual skills. Abilities that allow individuals to show “what” something is or means are verbal information abilities. Cognitive strategies have to do with the learning skills individuals own. Simple and complex movements make up an individual’s motor skills, and attitudes are the feelings that we develop as a result of interactions that are either constructive or unconstructive. Researchers note that Gagne’s work has grown into a system of nine practices: gaining attention, informing learners of the objective at hand, stimulating recall of prior learning, presenting the content, providing learning guidance, eliciting performance, providing feedback, assessing performance, and finally, enhancing retention and transfer (Gagne, 1985; Gagne, Wager, Golas, & Keller, 2005; Molenda, 2002; Smith & Ragan, 1996).

Merrill’s Instructional Transaction Theory

This theory holds that learners can be motivated by processes of transactions that help them make connections. This theory has a set of conventions to which objects of knowledge are selected and sequenced (Huang & Liaw, 2004). Identifying relationships between educational and technical factors are possible with the instructional transac-

tion theory. The instructional transaction theory consists of two facets: schemes of knowledge and procedures for applying the knowledge. Merrill's position states that for learning to take place, the learner needs to have more than one knowledge structure illustrated for anything to make sense. According to the researchers, instructional transaction theory learning consists of the object that is to be learned or the content that is to be taught. It is possible to combine the different facets of content that need to be taught and group them into one structure of knowledge. Individuals have internal representations of knowledge and structures of knowledge are external. The theory utilizes transactions as a way to categorize the content that is to be taught (Buendia et al., 2002).

It is believed that there are three data types used when a transaction of knowledge takes place. There is a knowledge base, a resource base, and there are instructional boundaries. These three facets of instructional transaction are then subdivided into more descriptive categories. A knowledge base is, for example, divided by entities, activities, and processes. Resource databases, among other possibilities, are subdivided by mediated representations of the knowledge field, presentation techniques, and communication techniques. Instructional boundaries, of which vary by situation, can be divided according to population, learning task, and the environmental situations. So, when an online instructor applies the instructional transaction theory to course design, empirical research is used to help set the categories in a knowledge base, build resource database classes, and define the parameters that are used to set the boundaries (Zwart, 1992).

Theories of Humanism

Phenomenal Field Theory

A humanistic theorist named Arthur Combs presented his phenomenal field theory with psychologist Donald Snygg. According to this theory, to understand human behavior, the time must be

taken to consider the point of view of another. They believed that if one wanted to change another person's behavior, they must first modify his or her beliefs or perception. One had to "walk in their shoes" if they wanted to understand and guide change. By taking this line of thinking, educators had to recognize that the learner needed to find meaning and understand the learning as opposed to learning and understanding the strategies (Boeree, 2007; Tomei, 2007).

Combs and Snygg felt that if they were to understand and foresee the behavior of another that they had to reach into the person's phenomenal field. Since it was impossible for them to physically look into another person's mind, they had to make inferences from what was observed. When educators utilize this theory, they cannot choose a topic of instruction, implement a strategy, and expect every child to be motivated by what has been placed before them because the information does not connect to their own lives. Instead, the educators have to get to know the learner's phenomenal self and create learning experiences that have meaning to the learner. Once instructors take this path, the student that was not motivated to learn at one time will become connected to the learning experience (Boeree, 2007; Tomei, 2007).

Self-Actualization Theory

Maslow believed that strong beliefs about one's self are connected to the thought of self-actualization. According to his thinking, individuals with strong self-actualization interacted well with others, and they found ways to develop and contribute to the world around them fairly easily. Those who did not have strong self-actualization choose to live within their environment and accept what comes their way instead of reaching into their environment and making new opportunities happen for themselves (Joyce et al., 2000; Pinar et al., 1996; Tomei, 2007).

For a person to reach the level of self-actualization, he or she has to be fulfilled at each level

of what Maslow referred to as the hierarchy of needs. The first level is the biological level. At this level, an individual's need for food and shelter must be met before the individual can move to another level. At the next level, the individual has to feel secure. Level three of the hierarchy of needs demands that the individual feel as though he or she belongs and is loved. Needs for self respect, achievement, attention, and recognition must be fulfilled if an individual is to move past the esteem level of the hierarchy. When an individual has past each of those levels, he or she has reached the final level, the level of self-actualization. At this point, the individual's ability to reach potential can take place. While each level has to be fulfilled, they do not have to stand alone and one behavior can satisfy more than one level on the hierarchy. Instructors who utilize this theory when designing and conducting a course look to see if their students needs have been met to help them understand student behavior (Joyce et al., 2000; Pinar et al., 1996; Tomei, 2007).

FREQUENCY OF DESIGN THEORIES UTILIZED BY ONLINE INSTRUCTORS

In a recent study, online instructors were asked how often they utilized nine design theories when creating an online course. Questions about the design theories were presented as part of a larger study on online instructor support for the practice of telementoring (Cicciarelli, 2006).

Methodology

During the quantitative exploratory study, based on descriptive research design, 2000 online instructors were sent a link to an anonymous contingency survey. Nine of the survey questions asked the online instructors how often, according to a Likert scale, they utilized each theory when designing an online course. Once 323 responses to the survey had been submitted, access to the

survey was turned off and the data was collected for analysis. A univariate, descriptive level analysis of frequency distributions was run for each variable. Bivariate relationships between the independent and dependent variables were examined using Spearman Rho tests, and cross-tabulations were calculated to provide a deeper look at the data.

Results According to Theory

Theory of Multiple Representations

Spearman rank order of coefficient of correlation (Spearman rho) was computed to measure the strength between the two variables. Results showed that the correlation at a .01 level was significant for a two-tailed test ($r = .113$, $p = .045$). According to cross-tabulation results, 32.6 percent of the online instructors said that they always utilize the theory of multiple representations, 32.9 percent indicated that they used the theory more often than occasionally, and 20.8 percent indicated occasional use. There were 7.3 percent who said they utilized the theory less often than occasionally, and 6.4 percent said they never made use of the theory of multiple representations.

Theory of Immediacy and Social Presence

Spearman rho results for a .01 level two-tailed test that correlated online instructor use of the theory of immediacy and social presence were significant ($r = .187$, $p = .001$). Cross-tabulation results showed that 36.8 percent always use the theory of immediacy and social presence, 36.1 percent utilize it more often than occasionally, and 15.2 percent use it occasionally. There were 8.1 percent who said they utilize the theory less often than occasionally and 3.9 percent said they never utilize the theory of immediacy and social presence when designing an online course.

Elaboration Theory

Results from a .05 level two-tailed Spearman rho test that correlated online instructor use of the elaboration theory was significant ($r = .146$, $p = .010$). Cross-tabulation results showed that 31.5 percent of the online instructors always use the elaboration theory, 41.2 percent said that they use the theory more often than occasionally, and 16.2 percent indicated that they use it occasionally. There were 6.8 percent who said that they utilize the theory less often than occasionally and 4.2 percent who said that they never use the elaboration theory when designing an online course.

Dual-Coding Theory

Spearman rho results for a two-tailed test that correlated online instructor use of the dual-coding theory was not significant ($r = .076$, $p = .179$). Cross-tabulation results showed that 23.5 percent always utilize the dual-coding theory when designing an online course, 23.5 percent more often than occasionally use the theory, and 18.3 percent occasionally utilize the theory. There were 17.7 percent who said that they utilize the theory less often than occasionally and 17.0 percent said that they never use the dual-coding theory when designing an online course.

Moore's Theory of Transactional Distance

Results from a .01 level two-tailed Spearman rho test that correlated online instructor use of Moore's theory of transactional distance was significant ($r = .233$, $p = .000$). Cross-tabulation results showed that 39.5 percent always utilize Moore's theory of transactional distance when designing an online course, 37.5 percent use the theory more often than occasionally, and 14.9 percent indicated that they utilize the theory occasionally. There were 5.5 percent who said that they utilize the theory less often than occasionally and 2.6 percent said that

they never utilize Moore's theory of transactional distance when they design an online course.

Merrill's Instructional Theory

Spearman rho results for a .01 level two-tailed test that correlated online instructor use of Merrill's instructional theory was significant ($r = .181$, $p = .002$). Cross-tabulation results showed that 22.4 percent of the online instructors said that they always utilize Merrill's instructional theory when designing an online course, 39.3 percent indicated that they utilize the theory more often than occasionally, and 21.8 percent said that they utilize it occasionally. There were 8.6 percent who said that they utilize the theory less often than occasionally and 7.9 percent said that they never utilize Merrill's instructional theory when designing an online course.

Gagne's Conditions of Learning

Results from a .01 two-tailed test that correlated online instructor use of Gagne's conditions of learning was significant ($r = .257$, $p = .000$). Cross-tabulation results showed that 28.9 percent of the online instructors indicated that they always utilize Gagne's conditions of learning when designing an online course, 42.8 percent said that they utilize the theory more often than occasionally, and 13.8 percent said that they occasionally utilize the theory. There were 9.0 percent who indicated that they utilize the theory less often than occasionally and 5.5 percent said that they never utilize Gagne's conditions of learning when designing an online course.

Cognitive Flexibility Theory

Spearman rho results for a .01 level two-tailed test that correlated online instructor use of the cognitive flexibility theory was significant ($r = .226$, $p = .000$). Cross-tabulation results showed that 30.1 percent of the online instructors indicated that

they always utilize the theory when they design an online course, 36.9 percent said that they utilize the theory more often than occasionally, and 22.4 percent said that they occasionally use the theory. There were 5.4 percent who indicated that they utilize the theory less often than occasionally and 5.1 percent said that they never utilize the cognitive flexibility theory when designing an online course.

Bruner's Three Form Theory

Results from a .01 level two-tailed test that correlated online instructor use of Bruner's three form theory was significant ($r = .169$, $p = .003$). Cross-tabulation results showed that 14.6 percent of the online instructors indicated that they always utilize Bruner's theory when designing an online course, 27.3 percent said that they utilize the theory more often than occasionally, and 26.0 percent said that they utilize the theory occasionally. There were 17.9 percent who said that they utilize the theory less often than occasionally and 14.3 percent who said that they never utilize Bruner's theory when designing an online course.

CONCLUSION

Information presented in this article focused on answering three questions that individuals interested in use of design theory may have in connection with creating an online course. The first question asked, "According to empirical evidence, what does the research show about online instructor use of different design theories?" The evidence showed that there is empirical evidence available on eight of the 15 theories presented in this article. Researchers found positive experiences and made suggestions for online instructors to follow when utilizing these theories. According to what has been presented, it would be an effective choice to frame course development with the different theories based on the course and the needs of the students.

The second question presented asked, "According to the lack of empirical evidence, which design theories have not been researched in regard to online instructor utilization of theory?" Considering that evidence on the use of these seven theories has not already been published in the literature, a signal has been made for the need for research. It would be beneficial to the field if online instructors decided to present how they utilize these theories as part of their online course, and it would be even better if researchers conducted studies that explored the use of these design theories.

Finally, the third question asked, "According to a recent study, how frequently do online instructors use nine of the design theories?" Of the nine theories presented, there were significant findings for all but one theory. This indicates that online instructors are making use of theory to support course design and it points to which theories they tend to use and how often. Other online instructors may find this helpful when they question the use of the different theories. Further research on this topic should investigate to find a description of the online instructors who indicated how often they utilized nine of the different theories when designing an online course. Researchers could also conduct a study that asked online instructors to provide a qualitative explanation of how they use design theory when creating a course. This would be a favorable way for instructors to share their work so that others could learn and possibly develop other unique ways to make use of the theories for the purpose of creating effective online courses.

REFERENCES

An abridged list of references follows. For a complete unabridged Reference page, please visit: http://academics.rmu.edu/~tomei/01_Ciccarelli_References.htm.

Alty, J. (2002). *Dual coding theory and computer education: Some media experiments to examine the effects of different media on learning*.

Behavioral, Cognitive, and Humanistic Theories

- Beacham, N. A., Elliot, A. C., Alty, J. L., & Al-Sharrah, A. (2002). *Media combinations and learning styles: A dual coding approach*.
- Bellefeuille, G. L. (2006). *Rethinking reflective practice education in social work education: A blended constructivist and objectivist instructional design strategy for a web-based child welfare practice course*.
- Berge, O., & Fjuk, A. (2006). *Understanding the roles of online meetings in a net-based course*.
- Boeree, C. G. (2007). *Donald Snygg and Arthur Combs: Personality theory*.
- Bruner, J. (1990). *Acts of meaning*.
- Buendia, F., Diaz, P., & Benlloch, J. V. (2002). *A framework for the instructional design of multi-structured educational applications*.
- Chu, H. C., & Hinton, B. E. (2001). *Factors affecting student completion in a distance learning mediated HRD baccalaureate program*.
- Cicciarelli, M. (2006). *Telementoring and computer mediated discussions: A description of online instructors' support*.
- Collins, M., & Berge, Z. (1996). *Facilitating interaction in computer mediated online courses*.
- Course-management systems. (2005).
- Figuroa, S., & Huie, C. (2001). *The use of blackboard in computer information systems courses*.
- Gagne, R. M. (1985). *The conditions of learning and theory of instruction* (4th Ed.).
- Gagne, R. M., Wager, W. W., Golas, K. C., & Keller, J. M. (2005). *Principles of instructional design* (5th Ed.).
- Gfeller, M. K., Niess, M. L., & Lederman, N. G. (1999). *Preservice teachers' use of multiple representations in solving arithmetic mean problems*.
- Grabinger, S. (2004). Design lessons for social education. In Duffy, T. M., & Kirkley, J. R., *Learner-Centered Theory and Practice in Distance Education: Cases from Higher Education 2004* (pp. 49-60).
- Gunawardena, C. N., & Duphorne, P. L. (2000). *Predictors of learner satisfaction in an academic computer conference*.
- Huang, H. M. (2002). *Student perceptions in an online mediated environment*.
- Huang, H. M., & Liaw, S. S. (2004). *Guiding distance educators in building Web-based instructions*.
- Jonassen, D. (2003). *Using cognitive tools to represent problems*.
- Joyce, B., Weil, M., & Calhoun, E. (2000). *Models of Teaching* (6th Ed.).
- Kanuka, H., Collett, D., & Caswell, C. (2002). *University instructor perceptions of the use of asynchronous text-based discussion in distance courses*.
- King, K. P. (2001). *Playing out the realities of web-based bulletin boards: Enhancing face to face learning*.
- Lebaron, J., & Miller, D. (2005). *The potential of jigsaw role playing to promote the social construction of knowledge in an online graduate education course*.
- Lee, J., & Lee, Y. (2006). *Personality types and learners' interaction in Web-based threaded discussion*.
- Ludwig, B. (2000, August). *Web-based instruction: Theoretical differences in treatment of subject matter*.
- Majeski, R., & Stover, M. (2007). *Theoretically based pedagogical strategies leading to deep learning in asynchronous online gerontology courses*.

- Makrakis, V. (1998). *Guidelines for the design and development of computer mediated collaborative open distance learning courseware.*
- Martyn, M. A. (2004). *The effect of online threaded discussion on student perceptions and learning outcomes in both face-to-face and online courses.*
- McAlpine, I., & Ashcroft, B. (2002). *Turning points: Learning from online discussions in an off-campus course.*
- Molenda, M. (2002). *A new framework for teaching in the cognitive domain.*
- Moreno, R. (2002). *Who learns best with multiple representations? Cognitive theory implications for individual differences in multimedia learning.*
- Murphy, E. (2004). *Recognizing and promoting collaboration in an online asynchronous discussion.*
- Nortar, C. E., Wilson, J. D., & Montgomery, M. K. (2005). *A distance learning model for teaching higher order thinking.*
- Northrup, P., Lee, R., & Burgess, V. (2002). *Learner perception of online interaction.*
- Pinar, W. F., Reynolds, W. M., Slattery, P., & Taubman, P. M. (1996). *Understanding curriculum.*
- Prester, G. E., & Moller, L. A. (2001). *Facilitating asynchronous distance learning: Exploiting opportunities for knowledge building in asynchronous distance learning environments.*
- Rieber, L. P., Tzeng, S. C., Tribble, K., & Chu, G. (1996). *Feedback and elaboration within a computer-based simulation: A dual-coding perspective.*
- Riley, W., & Anderson, P. (2006). *Randomized study on the impact of cooperative learning.*
- Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (2001). *Assessing social presentation asynchronous text-based computer conferencing.*
- Schwartzman, R. (2006). *Virtual group problem solving in the basic communication course: Lessons for online learning.*
- Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2000). *Teaching and learning at a distance: Foundation of distance education.*
- Smith, P. L., & Ragan, T. J. (1996). *Impact of R. M. Gagne's work on instructional theory.*
- Thompson, L., & Hing-Yu, K. (2006). *A case study of collaborative online learning.*
- Tomei, L. A. (2007). *Learning theories: A primer exercise.*
- Williams, S. W. (2001). *Experiences of web-based instruction among African-American students enrolled in training and development graduate courses.*
- Ying-Shao, H., & Fu-Kwun, H. (2002, June). *The use of multiple representations in a web-based and situated learning environment.*
- Zwart, W. J. (1992, June). *Instructional transaction theory applied to computer simulations.*

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 4, edited by L. Tomei, pp. 1-12, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.28

ICT Based Learning: A Basic Ingredient for Socio–Economic Empowerment

Hakikur Rahman

Sustainable Development Networking Programme (SDNP), Bangladesh

ABSTRACT

ICT mediated learning provides utilities for achieving the goal of education for all, and in turn acts as an enabler in reducing the digital divide, reducing poverty, and promoting social inclusion. However, the integration of ICTs in education deserves considerable investment in time and resources. Consequently, during planning to integrate ICTs in evidence-based information for making sound decisions by the end users incorporate extensive research and sharing of critical information along different phases of planning. Furthermore, implementation of ICT based learning demands in depth analysis and intelligent feedback of the processes. Technology does not improve learning in a straight way and the fundamental question remains always unanswered, in assessing the effectiveness of ICTs or assessing the effectiveness of instructional treatments that were initially (and effectively) less than perfect. This chapter has tried to critically analyze the effective role of ICT methods in learning

and put forwards several success cases of learning mechanisms that assisted in socioeconomic empowerment and at the same time, provided a few futuristic recommendations in establishing similar endeavors in promising economies.

INTRODUCTION

ICTs can increase access to information and this information helps communities to work more productively as well as in new opportunities. Increasing common people's access to ICTs should involve increasing availability of ICT infrastructure where most of them live. The infrastructure should be highly subsidized for at least a number of years so that the investment costs are not passed on to the end users (Mijumbi, 2002).

ICT can improve the learning process by making it faster, cheaper, and wider reaching that were not possible before. This form of learning can be treated as an interactive process among many entities and supporting the improvement

of this process is expected to produce better results. However, innovative processes have to be incorporated both in terms of pedagogy and technology. Pedagogy should be universal and technology should give ubiquitous access with ambient intelligence.

In the area of education and training several hundred projects with thousands of participants around the globe have produced acceptable results in the areas of general education, specialized skill development training, and life long learning and have contributed positively to horizontal issues such as standards, metadata, interoperability, and sustainability.

Among them in 2001, an ambitious project, Prometheus, was built to establish a forum for expert opinions where participants from a wide range of countries, activities, professions, cultures, and languages productively interact towards the establishment of a community of cooperation in the field of educational technology and applications. All those contributions were taken into consideration and the contributors referenced in a position paper. Its aim was to bridge the gap between research and actual use of learning technologies, content and services, through direct contribution in an open consultation process (Bottino, 2001).

In 2002, Appeal launched a project on ICT Application for Non-Formal Education Programs with the support of the Japanese Funds-in-Trust. During its first phase, five countries (Indonesia, Lao PDR, Sri Lanka, Thailand, and Uzbekistan) implemented programs and activities to empower communities through the effective use of ICT.

However, in 2003 a study in this area entitled "Quality and e-learning in Europe training" was conducted and found that through a survey among 433 teachers and trainers from public and private sectors, about 61% felt that the quality of e-learning was fair or poor (Attwell, 2005). So, investment in this sector will remain a fair trade for many investors, including the development partners.

Therefore, the shift to the information society throws new challenges for learning processes and acquisition of knowledge through learning. In a society where information is becoming a strategic raw material and knowledge a value added product, how this resource is used is critical to the performance potential of each entrepreneur. The information and communication media provide necessary technologies to make knowledge available worldwide and transform the information society into a knowledge society. However, in response to individual needs, it is becoming increasingly important to harness appropriate information and systematize knowledge. A falling "half-life" of knowledge formulates life-long learning and up-to-date information becomes critical. Hence, in times of increasing globalization and networking, flexible access to information must be guaranteed at any place and at any time (Massey, 2003).

In this context, economic freedom plays an important role, in addition to technology update and information management. The 2006 Index of Economic Freedom measures 161 countries against a list of 50 independent variables divided into 10 broad factors in terms of economic freedom. The higher the score on a factor, the greater the level of government interference in the economy and the less economic freedom a country enjoys. In the ranking the top five countries (with lower scores between 1.28 and 1.74) are Hong Kong, Singapore, Ireland, Luxembourg, and United Kingdom, whereas North Korea, Iran, Burma, Zimbabwe, Libya, and Venezuela are among the bottom five (with higher scores between 5.00 and 4.16)¹. This shows the level of ICT improvement in those countries, especially applicable to Hong Kong and Singapore in Asia.

The European Union has taken a lead role in reforming its member countries, improving their ICT situation, and establishing enhanced learning processes through ICT. The diverse e-learning visions, experiments and programs launched by individuals, organizations, institutions, nation-

states of EU are found to be potentially more efficient in fostering flexible learning than traditional methods. The dominant view of e-learning has been, therefore, purely instrumental in legitimizing its *raison d'être* as an ideal method to match the learner's choice and demand with more autonomy (Apollon, 2005).

The process of integrating ICT in the lower level of the education system involves a paradigm shift with new insights and new challenge facilitating new forms of understanding through earlier understandings to create new perspectives and interpretations. Integration should also incorporate an embedding of ICT in the institute's organizational structures and the organization of teaching (Walsh, 2002).

With the development of ICT a new brand of leaders are emerging, in instructional and transformational forms through commitment and enthusiasm for learning, working in partnership with colleagues across the curriculum to embed ICT into the learning process. These leaders have often come up very quickly through their ranks and subsequently their ICT skills have been learned on the job (Walsh, 2002).

At the same time, there is a growing interest with regards to ICTs being used to extend educational opportunities in developing countries. While many governments paid specific attention to integrate ICTs into compulsory schooling during the 1990s, more recently the focus has been shifted to post-secondary (K12) education. In essence ICTs need to be encouraged to make post-secondary teaching and learning more effective and more equitable by offering a diverse range of learning opportunities to a diverse range of learners in a convenient and cost-effective manner (Selwynn, 2003).

Henceforth, the ability to continue to learn throughout life is seen as a prerequisite to the development and sustainability of knowledge economies as countries, corporations, and communities require workers and citizens with flexible, *just-in-time* skills, competencies, and

knowledge. Particularly the need for diverse and accessible learning opportunities has drawn policy makers in many countries towards the use of ICT as an educational delivery mechanism (Selwynn, 2003).

ICT-based learning can be formal (institutionally sponsored and structured), non-formal (non-credential but still institutionally-based and structured) or informal (happens incidentally or during everyday activities). This form of learning can, therefore, take place in the office, institution, home, or community, at different times for different purposes (Selwynn, 2003).

Hence, attempting to encourage full and effective participation of all stakeholders in ICT based education now forms a central part of current educational and economic policymaking in most developed countries (Selwynn, 2003). ICT in learning processes should not merely be used to acquire knowledge and skills; the processes should be more interactive and self-directed uses of ICTs should be encouraged so that the learners can actively construct new ideas, concepts, and meaning while transforming their existing knowledge (Rosen, 1998).

BACKGROUND

Learning is the cognitive process of acquiring knowledge² or skill through study, experience, or teaching. It is a process that depends on experience and leads to long-term changes in behavior potential. Behavior potential describes the possible behavior of an individual (not actual behavior) in a given situation in order to achieve a goal³.

ICT-mediated learning is a process used to acquire data, information, skills, or knowledge. It is a form of learning that enables learning in a virtual world where technology merges with human creativity to accelerate and leverage the rapid development and application of deep knowledge⁴. ICT-based learning covers a wide set of applications and processes such as Web-based learning,

computer-mediated learning, virtual classrooms, and digital collaboration. It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio and videotape, satellite broadcast, interactive TV, PDA, mobile phone, CD-ROM, and other available technologies⁵. This chapter, specifically focuses on ICT-based learning to enable empowerment and socioeconomic development.

Empowerment is the process and practice of deriving power from within the self, or assisting others to do so through power within⁶. It is the process of equipping communities with knowledge, skills, and resources in order to change and improve the quality of their own lives and their community. Empowerment may evolve from within or it may be facilitated and supported through external agencies⁷. However, in terms of knowledge acquisition, empowerment is a consequence of liberatory learning and created within the emerging praxis in which co-learners are also engaged. The theoretical basis of this process is provided by critical consciousness; its expression is collective action on behalf of mutually agreed upon goals. Empowerment through knowledge is distinct from building skills and competencies that are being commonly associated with conventional schooling. Education for empowerment differs from schooling both in its emphasis on collective participation (rather than individuals) and in its focus on cultural transformation (rather than social adaptation)⁸.

Whereas, socioeconomics is the study of the social and economic impacts of any product or service offering, market promotion or other activity on an economy as a whole and on the entrepreneurs, organization and individuals who are its main economic actors. These effects can usually be measured in economic and statistical terms, such as growth in the size of the economy, the number of jobs created (or reduced), or levels of home ownership or Internet penetration (or number of telephones per inhabitant); and in measurable social terms such as life expectancy

or levels of education⁹. This chapter provides emphasis on raising socioeconomic capacity of the economic actors through learning: information, content and knowledge; to lead into a knowledge-based economy.

A dynamic knowledge-based economy is capable of sustainable economic growth, but to achieve it, the economy not only needs a radical transformation within it, but also a modernized education system. The Lisbon Council of European Commission (EC) envisioned this in their March 2000 meeting, while in 2002 the EC stated that by 2010 Europe would be the world leader in terms of the quality of its education and training systems. To achieve this, a fundamental transformation of education and training has been taking place throughout Europe (European Commission, 2004). ICT-based education always demands a longer term strategy which the EC has initiated in 2000¹⁰. This strategy has been taken with a 10-year work plan to be implemented through an open method of coordination aiming at coherent community strategic framework of cooperation in the field of education and training. To support the implementation of the shared objectives for education and training systems at the national level through exchanges of “good practices,” study tours, peer reviews, and so forth¹¹, EC has been working through twelve working groups since 2000.

Table 1 (*above*) shows a few initiatives taken by the European Commission to enhance the ICT-based learning in Europe. To date, the whole work has been carried out in four stages:

- First, decide upon key issues on which to focus future work.
- Second, focused on good practices and sharing policies to develop better quality education through ICT.
- Third, gather good policies and formulate recommendations learning from their problems.

Table 1. Initiatives taken by EC for ICT-based learning

| Year | Groups/Councils | Strategies Taken |
|-------------|--|---|
| 2000 | Lisbon Council | To form the most competitive and dynamic knowledge-based economy |
| 2001 | Ministers of Education | To achieve coherent community cooperation in the fields of education and training |
| 2001 | Working Group on ICT in education and training | To work on indicators and benchmarks, exchanging good practices and peer review |
| 2002 | Standing Group on Indicators and Benchmarks | Indicators and benchmarks were developed to monitor the progress |
| 2003 | Working Group on ICT in education and training | Focused on policy practices aiming at better quality education through integration of ICT |

- Fourth, gather examples to map those recommendations on good policy practices¹².

Integrating ICT in learning can mean anything from complete online training, with specific learning platforms using virtual microworlds and laboratories, to online access to and control of distant physical set ups such as cyber kiosks, or telecenters, or physics laboratories. This form of learning may also include a face-to-face situation in a laboratory with digital controls and computer-based mathematical tools. However, the question will remain: How is ICT-mediated learning taken into account by current school architecture decisions, or what are the priorities in setting up costly permanent establishments that will include such ICT-based activities?

Hence, the objectives for ICT based learning should be “to develop technologies to empower individuals and organizations to build competencies to exploit the opportunities of tomorrow’s knowledge society. This is achieved by focusing on the improvement of the learning process for individuals and organizations, and of the intertwined learning process between individuals and organizations” (The Learning Citizen, 2003, p. 2).

Table 2 (above) illustrates a few figures on non-capital investment of the European Union (EU) for learning purposes.

In this way, the ICT (specifically, the WWW, or the Internet) offers itself as a tool to increase formal education as well as “ambient” learning that may be treated as electronic-mediated learning, or e-learning. During a survey done by the Oxford Internet Institute (OII), 78% of users say they use the Internet to look up a fact, while 47% say they look up the definition of a word. Nearly 40% of the respondents say they use the Internet to find information for school, and 20% of them use it for distance learning (OII, 2005).

MAIN THRUST

Given the critical changes in education and given the potential of ICT, it is vital that policies and strategies in the area of ICT be driven by long-term educational objectives, such as:

- ICT supported learning provisions in the services sector.
- ICT inclusive educational policies.
- ICT conducive research programs incorporating solutions to problem locale.
- Optimal use of ICT for educational purposes.
- Integrating ICT in bringing fundamental transformations in education.

Table 2. Non-Capital investment for learning in EU countries (Source: *The Learning Citizen*, 2003)

| Items | Increase in 2001 | Increase in 2002 |
|--|------------------|------------------|
| Spending on training products and services | 7% | 7% |
| Raise in e-learning content | 70% | 50% |
| Growth rate of e-learning products expenditure | 17% | 23% |

Transformations with ICT can be limited to learner-centered multimedia learning, without changing the school curriculum and progressively invalidating the changes. Thus, school reform is not a spontaneous consequence of the introduction of ICT in education. Furthermore, as learners enter into education system with a growing ICT familiarity, the definition of basic skills, to be addressed by the educational integration of ICT, needs to embrace more and more higher-order thinking skills. Therefore, a global vision of ICT supported education has to be prepared for common citizens to actively take part in an increasing communication setting to improve their own values and thoughts. In this context, utilizing available utility software, exciting ICT-based e-learning materials can be developed with an absolute minimum of effort.

The main thrust of this chapter comprises of a few case studies that are being treated as success stories in the aspect of ICT mediated learning, and at the same time act as empowering tool in terms of socioeconomic development. Emphasis has been given to incorporate cases that involve ICT for community learning, and they have been portrayed with analytic approach. It is expected that these cases will be able to justify inclusion of ICTs in community learning and regional development.

CASE STUDIES

Case 1

Asia Pacific Information Network (APIN)
A regional network working to achieve information for all

Among key five areas of interests, one is to promote ICT literacy and the application of ICT in education, science, culture, and communication.

Broad aims are to:

- Encourage the development of strategies, policies, infrastructures, human resources, and tools for application of ICTs.
- Prepare policy advice to member states for use of ICT in national targets, especially for improvement of education, (APIN, 2004).

Specific focus areas are to:

- Promote ICT based learning opportunities for all.
- Enhance learning opportunities through access to diversified contents and delivery systems.
- Assist in establishing networks for learners and educators.
- Assist in promoting universal and equitable access to scientific knowledge.

ICT Based Learning

- Support the development of code of practice involving scientific information chain by using ICT.
- Strengthen capacities for scientific research, information and knowledge sharing. (APIN, 2004)

Case 2

Adult Basic Education (ABE)

Integrates the use of ICT into teaching practices for organizational realignment and empowerment

Established in 1990, ABE provided ICT supported courses in the South Wales Valleys in UK that is a post-industrial area with low levels of education, widespread illiteracy and innumeracy in adult population and growing digital divide. The program has established community based Open

Learning Centres (OLCs) dedicated to teaching basic literacy, communication, and numeric skills to adult groups. It introduced a network of personal computers with broadband Internet since 1997 and gradually led to the design and development of many innovative courses utilizing multimedia technologies. This has created increased participation of learners, tutors, and volunteers resulting in changes to the structure of learning content and techniques acting as a catalyst among the adult communities (Harris, 2002).

Table 3 shows the ICT based courses that evolved since its inception in 1997. This table not only shows the necessary modification of courses to meet the demand of the community throughout this period, but also adjusted contents that show the development trend of ICT based courses.

Table 3. ICT based ABE courses during 1997-2002 (Adapted from Harris, 2002)

| Year and Duration of Courses | Courses | Activities |
|------------------------------|---|--|
| 1997-98, 4 hrs/week | Internet Club | <ul style="list-style-type: none"> • Web browsing and searching • email • HTML authoring |
| 1998-99, 6 hrs/week | Internet Club2 | <ul style="list-style-type: none"> • Web browsing and searching • Email • HTML authoring • Computer graphics • 3D Animation |
| 1999-2000, 8 hrs/week | Internet Club3 under network | <ul style="list-style-type: none"> • Web browsing and searching • Email • HTML authoring • Computer graphics • 3D Animation |
| 2000-01, 16 hrs/week | <ul style="list-style-type: none"> • Computer Club • Creative Computation • Web workshops | <ul style="list-style-type: none"> • Web browsing and searching • Email • HTML authoring • Computer graphics • Digital Video • Computer Programming |
| 2001-02, 24 hrs/week | <ul style="list-style-type: none"> • Computer Club • Creative Computation • Web workshops • Film workshops • DTP workshops | <ul style="list-style-type: none"> • Web browsing and searching • Email • HTML authoring • Computer graphics • Digital Video • Computer Programming • Desk Top Publishing |

Case 3

Gateshead Testbed Learning Communities (GTLC)

Demonstrates how communities and individuals develop through learning and share good practices in UK¹³.

Priority areas are to:

- Build on success.
- Listen to local demands and needs.
- Recognize all aspects and levels of community learning.
- Recognize barriers and address them properly.
- Improve quality of life, not just qualifications.
- Unlock national digital resources.
- Encourage establishment of remotely based stations with subsidies.

Case 4

EdComNet (Humanistic Urban Communal Educational Net)¹⁴

Aims to enhance the participant's sense of autonomy and dialogical belonging

Based on Autonomy Oriented Education (AOE) for personal empowerment and personal growth, users of this network actively utilize Internet content and features for their learning processes to reflect and explore elements of self and the alternatives available. According to AOE, gaining knowledge is to learn as per a personal plan that stems from one's self knowledge, and it portrays one's personal interests, performance styles, and capabilities. EdComNet incorporates AOE principles and offers an empowerment tool for the European Citizen.

Case 5

EducaNext¹⁵

Supports acquisition of high skills as per demand of the European industry and need of the global market

This program supports the creation and sharing of knowledge between educators. It also enables collaboration among the participants by providing a complete package of services to support the exchange and delivery of learning resources. EducaNext acts as a collaboration facilitator and at the same time as a marketplace. It is primarily considered as a business-to-business service and enables partnerships among institutes of higher education and industry to provide the right expertise at the right time.

Case 6

Pan Asia Network (PAN) in Bhutan¹⁶

Establishment of ICT supported distance education

In 2003, PAN started a project supporting Bhutan's National Institute of Education (NIE) to establish ICT based distance education programme for educators. The project developed and tested appropriate ICT based learning support system and assessed whether ICTs improve the quality of and access to learning. The project aims to implement 16 distance education courses, including development of online tutorials, support services, counseling services, and multimedia contents. This project also emphasized the development of key performance indicators for distance educators, especially for those that may be replicated across the PAN regions (PAN, 2005).

Case 7

Scottish Workforce Empowerment for Lifelong Learners (SWELL) Project¹⁷

Promotes lifelong learning for working people in Scotland

The project has successfully facilitated new learning opportunities to more than 700 learners till May 2005 across Scotland's urban and rural labor markets. SWELL support has enabled partners to develop and deliver innovative learning solutions, by empowering "non-traditional" learners through offering new opportunities to the disadvantaged communities; learners that are remotely located, with disability, not adequately literate, and jobless. The organizational leadership has been carried out efficiently through innovation, transnationality, mainstreaming, empowerment and equal opportunity. The most successful SWELL activities have involved mainstreaming education providers to deliver a wide ranging and high quality training provision. It has contributed to a "community of learning" by equality of learning opportunities through ICT (McQuaid & Lindsay, 2005).

Case 8

S2NET in EU Region¹⁸

ICT-based learning as a tool for social inclusion

The project prepared a guide to support the target groups in the design, delivery, and evaluation of training actions for disadvantaged individuals, provided directives to develop learners' meta-competencies and train them in order to sustain an empowered attitude towards their practical lives (Dondi, 2003).

Main objectives are to:

- Encourage use of e-learning for training educators and policy makers.

- Support innovation in training and education methods using ICT based learning.
- Promote good practices in the use of ICT for real life application.
- Raise awareness on e-learning to prevent social exclusion.

Case 9

E-learning for sustainable development by IGES (Institute for Global Environmental Strategies)

Promotes community-based learning for sustainability

This project provides community learning programme on sustainable development through ICT. E-courses are designed for teachers novice in computer-based learning and these courses act as stand alone training material replacing face-to-face trainings on community learning. The course content is built based on ten years experience of the Institute of Sustainable Communities, USA in Central and Eastern Europe, USA, and Japan¹⁹.

FUTURE ISSUES

The question about the quality of ICT based learning remains opaque and fraught with difficulties. These difficulties further compounded when it comes to evaluate the quality of the use of ICT for learning en masse. However, the development of ICT based learning products and opportunities are rapidly expanding in areas of education and skill development. The media varies from intranet, Internet, multimedia, email, interactive TV, teleconferencing, video conferencing, or other computer mediated learning methods²⁰. But, until now innovative approaches have been missing to evaluate the development, growth, impact, and potential of this form of education system. Despite global efforts in diversified platforms, distance education or e-learning, or ICT

based learning has not attained a suitable state; governments remain hesitant (often mismanaged or misguided) in funding, private investors behave in unfamiliar ways, and development actors stay away from investing in this sector.

In the near future, education will be online or at least blended with online teaching and learning activities. However, the strategies should focus on constraints and normalization of educational interactions, without much restricting on initial investments. Similarly, standardization of education system should be object oriented and encouraging. Learning models should pass through technical and quality as standards, rather than just *industrialization* or *professionalization* and focus on extensive research to achieve fundamental educational objectives.

The opening to higher education should ensure better links between education and research. Higher education has to be at the forefront of knowledge production, management, and dissemination. Moreover, the use of ICT in education at all levels requires new pedagogical and organizational settings. Therefore, cross-partnership among education, social science, pure science and within different fields of research is needed.

Innovative e-learning should aim to empower the lifelong learners and vocational trainees. This form of ambient learning provides access to high quality learning materials suiting individual's demand and pace. To achieve this, ICT based learning should utilize multimodal broadband access and content management. Furthermore, the provision of content integration will allow access to new e-learning materials, as well as existing resources from those repositories (Paraskakis, 2005). There is a need to develop policies and action plans in using technological and non-technological means to address the social, economic, and cultural factors underlying educational problems. There are also clear needs to redevelop educational and pedagogical understandings on effective ICT across life long learning in its many forms (Selwyn, 2003).

CONCLUSION

Looking at the success cases around the globe, it is apparent that educational policy makers are tempted to deal with ICT based learning as a potent bridging method used to flexibilize individuals and make them adequate to the needs of the community, thus empowering them to act as an element of socioeconomic development. The main educational, social, and economic discourse related to new professional, social, and learning needs tends, therefore, to relapse recurrently into the flexibilization rhetoric, according to which the adaptability of the new demand evolves, if one adopts this perspective to a new flexibility of individual's desire (Apollon, 2005).

The development of e-learning up to this point has been largely demand driven, the two principal players being the technology and the content. Perhaps for this reason the majority of products developed in this sector have followed two basic and well-tried business models, by providing:

- Distance education to individuals, which is a technologically enhanced continuation of the previous correspondence course model;
- Online environments to permit existing educational institutions in extending their services through the use of virtual classroom.

The technology driven and network intensive nature of these *virtual classrooms* however, restricts the number of users to those who have specialist, up to date equipment and broadband access, shutting out the majority of marginal learners. Furthermore, in both models e-learning approaches are based on assumptions about the pedagogical focus and organizational structure of existing educational institutions, rather than potentially validated research (PROMETEUS, 2003).

Many recommendations floated around focusing the potential for development of more

appropriate ways of learning through ICT, but at the same time suffered the lack of a solid framework of learning theory in providing a more comprehensive and less anecdotic understanding. Only in this way can it be ensured that many positive experiences taking place already across the globe can be reproduced in other countries. There are thousands of handbooks on e-learning but they lack good validated research. In this context, intensive analysis of e-learning processes is needed and particularly there is a need for a conceptual framework for lifelong learning, and for the development of models derived from non formal settings and self organizing communities of learners (PROMETEUS, 2003).

To realize that ICT is not another passing fad or innovation, which might or might not affect learning and to be able to change the way the institutions work accordingly, is perhaps one of the most important requisites for leaders in this field. Emphasis should be given in communicating the vision, and at the same time efforts should be given for skills development and involvement of all teaching and non teaching staff who might have come through the conventional system of learning (Walsh, 2002).

ICT based education and training leads to improved learning environment. However, as with most research on education and technology the effectiveness of ICT-based mass learning is still fragmented. It is also suggested that learning with ICT leads to a more reflective, insightful learning with more empowered and democratic diffusion amongst learners (Doubler, Harlen, Harlen, Paget & Asbell-Clarke, 2003; Jeris, 2002) as well as proving to be an attractive and motivating medium of learning with basic skills (Lewis & Delcourt, 1998). Furthermore, engagement in e-learning is also leading to wider educational outcomes, such as increases in learners' self-esteem and propensity to engage in further learning. Therefore, as Kennedy-Wallace (p. 49) reminds, "whether learning online in the workplace, in college or at home, e-learning is still about learning and

culture, not just technology and infrastructure" is a true reflection of the transformation of communities in this respect.

REFERENCES

- APIN. (2004). *Report of the first statutory meeting of the Asia Pacific Information Network*. Retrieved June 17, 2006, from <http://irandoc.ac.ir/apin/constitution.html>
- Apollon, D. G. (2005, May 10-20). The shape of things to come in learning and e-learning. *Conference on e-learning*, European Commission, Brussels.
- Attwell, G. (2005). *Quality and the use of ICT for learning in SMEs, The Wales-Wide Web*. Retrieved June 17, 2006, from http://www.theknownet.com/writing/weblogs/Graham_Atwell/
- Bottino, R. M. (2001, September). *PROMETEUS position paper to the open consultation process of the European Commission*.
- Chinien, C., & Boutin, F. (2005, July 7-9). Framework for strengthening research in ICT-mediated learning. In *Proceedings of the ITHET 6th Annual International Conference*, Juan Dolio, Dominican Republic.
- Dondi, C. (2003). E-learning-me included: How to use e-learning as a tool for social inclusion. *Leornado da Vinci Programme 2000-2006*, European Commission.
- Doubler, S., Harlen, W., Harlen, W., Paget, K., & Asbell-Clarke, J. (2003, April 21-25). *When learners learn on-line, what does the facilitator do?* Paper presented at the American Educational Research Association Annual Conference, Chicago, Illinois.
- European Commission. (2004, November). *ICT in education and training. Progress Report of Working Group C on Implementation of Education*

and Training 2010 Work Programme, Directorate-General for Education and Culture, European Commission.

Harris, S. R. (2002). PD in Ponty: Design-by-doing in adult basic education. In A. Dearden & L. Watts (Eds.), *Proceedings of HCI2004: Design for Life* (Vol.2, pp. 41-44). Bristol: Research Press International.

Jeris, L. (2002). Comparison of power relations within electronic and face-to-face classroom discussions: A case study. *Australian Journal of Adult Learning*, 42(3), 300-311.

Kennedy-Wallace, G. (2002, April 16). E-learning is booming but the UK still lags behind. *Guardian-Education Supplement*, p. 49.

The Learning Citizen. (2003, April-June). *The knowledge citizen* (Forward by J. Christensen, Issue No. 5, p. 2).

Lewis, L., & Delcourt, M. (1998). Adult basic education students' attitudes toward computers. In *Proceedings of the SCUTREA 1998 Conference*, University of Exeter, Devon, UK (pp. 238-242).

Massey, J. (2003). *Lifelong learning: A citizen's views: Quality and e-learning in Europe*. Luxembourg: Office for Official Publication of the European Communities.

McQuaid, R.W., & Lindsay, C. (2005, May). *Evaluating the Scottish Workforce Empowerment for Lifelong Learners (SWELL) Project*. Final evaluation report and quarterly progress report, Employment Research Institute, Edinburgh.

Mijumbi, R. (2002, November 11-14). ICTs as a tool for economic empowerment of women: Experiences from the use of a CD ROM by rural women in Uganda. In *Proceedings of the Expert Group Meeting on Information and Communication Technologies and Their Impact on and Use As an Instrument for the Advancement and Empowerment of Women*, Seoul, Korea. UN Division for the Advancement of Women (DAW).

OII. (2005). *The Internet in Britain: A survey report of the Oxford Internet Institute on the Oxford Internet Survey (OxIS)*. Oxford, UK: University of Oxford.

PAN. (2005, November). *Connecting people-changing lives in Asia: Pan Asia networking*. Retrieved June 17, 2006, from <http://www.idrc.ca/IMAGES/ICT4D/PanAsia/PANASIAHTML/>

Paraskakis, I. (2005). Ambient learning: A new paradigm for e-learning. In *Proceedings of Recent Research Developments in Learning Technologies*, Formatex 2005. Retrieved June 17, 2006, from <http://formatex.org/micte2005/>

PROMETEUS. (2003). *PROMETEUS position paper on pedagogical and organizational aspects*. Sixth Framework on Open Consultation Process, European Commission.

Rosen, D. (1998). Using electronic technology in adult literacy education. *The annual review of adult learning and literacy* (vol. 1). Cambridge, MA: NCSALL.

Selwynn, N. (2003, November 12-14). ICT in adult education: Defining the territory. In *Proceedings of the ICT in Non-formal and Adult Education: Supporting Out-of-School Youth and Adults, OECD/NCAL International Roundtable*, Philadelphia, Pennsylvania.

Walsh, K. (2002). *ICT's about learning: School leadership and the effective integration of information and communications technology*. UK: National College for School Leadership.

ENDNOTES

¹ Index of Economic Freedom 2006, available at <http://www.heritage.org/research/features/index/index.cfm>

² wordnet.princeton.edu/perl/webwn

³ en.wikipedia.org/wiki/Learning

ICT Based Learning

- 4 www.mountainquestinstitute.com/definitions.htm
- 5 www.cybermediacreations.com/elearning/glossary.htm
- 6 www.soul-dynamics.com/glossary
- 7 www.quest-net.org/glossary.asp
- 8 <http://www.trentu.ca/nativestudies/courses/nast305/keyterms.htm>
- 9 <http://en.wikipedia.org/wiki/socioeconomic>
- 10 <http://register.consillium.eu.int/pdf/en/01/st05/05980en1.pdf>
- 11 http://europa.eu.int/comm/education/policies/2010/objectives_en.html
- 12 http://europa.eu.int/comm/education/policies/2010/objectives_en.html#information
- 13 <http://www.gatesheadgrid.org/testbed/>
- 14 http://learningcitizen.net/download/LCCN_Newsletter_N5.pdf; <http://www.calt.insead.edu/project/EdComNet/>; http://www.isoc.org.il/docs/eva_anex1.pdf
- 15 <http://www.prolearn-project.org/links/list>; http://projekte.l3s.uni-hannover.de/pub/bscw.cgi/d37280/nejdl_learntec_prolearn_final.ppt http://learningcitizen.net/download/LCCN_Newsletter_N5.pdf
- 16 http://www.pandora-asia.org/panprojects.php?main=panprojects_10.htm
- 17 <http://www.sfeu.ac.uk/>
- 18 <http://www.menon.org/publications/HELIOS%20thematic%20report-%20Access.pdf>
- 19 http://cmp.iges.net/learn/faculties/courses/index.php?CMS_Session.html
- 20 http://wiki.ossite.org/index.php?title=ICT_and_Learning_in_Small_and_Medium_enterprises._The_issue_of_learners_needs

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 39-54, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 1.29

Between Tradition and Innovation in ICT and Teaching

Antonio Cartelli
University of Cassino, Italy

INTRODUCTION

During the past few decades, the expanded use of PCs and the Internet introduced many changes in human activities and cooperated in the transformation process leading from the industrial society to the knowledge society.

Among other things, the above instruments played a special role in education, and two main phases can be easily recognized: the former one where computing and ICT were mostly used to enhance individuals' learning features (i.e., teachers mainly had the role of educational worker: planning, controlling and evaluating students' learning processes); the latter one, more recent and centered on ICT use, where teachers had to adopt situated and collaborative learning strategies, build communities of learners (CoLs), organize students' work for enhancing problem finding and solving, while helping the development of their ZPDs (zones of proximal development, meaning individuals' cognitive areas marked by the distance between the subject's knowledge/

experience in a given field and the same knowledge/experience in the best skilled individuals in the community).

The above transformation modified not only teachers' functions, but also the whole school environment and the students' role within it.

The same ICT will help teachers and professors in finding solutions to learning problems by giving them new instruments for the analysis and continuous monitoring of students' learning processes.

BACKGROUND

As already stated, computers entered very early into educational processes, often under the influence of pedagogical and psychological theories. As regards the influence of IT on individual teaching-learning processes, one of the most relevant contributions in defining the ways computers could be used in education came from Taylor (1980), who proposed three metaphors for them: tutor, tool, and

tutee. The first one refers to the computer support to teachers' work, the second one to instruments or tools autonomously used by students, and the third one to computer programming skills students must have to let problems be solved by computers. Galliani and others (1999) extended these metaphors while considering the great deal of software tools devoted to education and developed with the time. Tutor appellation describes how computer systems support or substitute (in the specific situation of auto-instruction) teachers and tutors in their work. Computer-assisted instruction (CAI), computer-assisted education (CAE), and computer-assisted learning (CAL) software are examples of the above systems. The former ones, CAI and CAE, implement into the topics to be taught the structure of the software the designer makes up (i.e., they force the user to follow a well-defined learning route within them); good examples for this kind of software are: 1) tools for theorems' demonstration or physical phenomena emulation, and 2) surveying/testing software made by questions with pre-built multiple answers or yes/no answers. CAL software, with respect to the other tools, gives more importance to learning than to teaching; that is, users can now freely move within different scenarios and can decide by themselves what to do, or can browse in a personal way the context the software proposes. Good examples for these software packages are educational games, edutainment (acronym for education-entertainment) tools, simulation systems (often used for training), and many multimedia or hypermedia tools.

A further extension of tutor metaphor comes from the results of artificial intelligence application in education and especially: intelligent computer-assisted instruction (ICAI) systems and intelligent tutoring systems (ITSs). In these systems, with respect to CAI and CAL tools, there is no pre-determined teaching route or strategy, but there are three independent modules interacting among themselves: an expert (i.e., a knowledge basis on a very specific domain), a pupil (implementing the knowledge representation of a student interacting

with the system), and a teacher (implementing the teacher behavior rules of everyday teaching and determining the didactic strategies to be adopted during the student-system dialogue).

With respect to the tool metaphor, its extended version now includes (together with the software students can use to produce information, i.e., editors or at most word processors) office automation suites and special tools for the analysis of a large amount of data and for browsing specific contexts (usually provided with authoring, co-authoring functions).

Finally, the extension of the tutee metaphor is mainly represented from tools for the creation of special developmental environments, such as the ones Papert created with LOGO.

It must be noted that Taylor's metaphors and their extensions are not the only ways for interpreting the influence of computer use in individuals' learning processes; a relevant role in the analysis of computing effects comes also from meta-cognitive hypotheses. Strictly speaking, people supporting the above hypotheses think that computer use stimulates functions' development more than learning topics so that meta-cognitive attitudes are developed by students systematically working at a computer (Cornoldi & Caponi, 1991). Furthermore hypertexts and hypermedia, due to their features, induce the development of transversal and meta-cognitive skills.

The main feature of the educational use of IT in this phase has been the introduction of computers in school and educational systems, without any great innovation in teaching and management organization (i.e., the most relevant interventions carried out by public institutions for all levels of schools were projects for teachers' training, allocation of funds for buying computing laboratories, etc.).

Radical changes in ICT influence on teaching/learning processes came from the spreading of networks and especially of the Internet (with its exponential growth in last few years). The reasons for the changes in knowledge construction hypotheses and educational effects—that is, for

the passage from individual to social analysis of educational phenomena—is mostly due to computer-mediated communication (CMC) and its role on individuals, communities, and societies.

It must also be noted that the ICT influence on education can be analyzed from two different points of view: the former one looks at the possible creation of new knowledge structures; the latter one refers to the different ways ICTs can be used in learning contexts and to innovations they can induce in the same contexts.

Regarding the first point of view, many scholars proposed new definitions and interesting ideas. Rheingold (1994) proposes the concept of virtual communities as groups of individuals who can never meet themselves or physically know one another, but who use the Net for their interpersonal communication, such as for sharing information and building new knowledge. The Lévy (1996) idea of collective intelligence is strongly dependent on the increase of the interpersonal communication speed and on the great amount of information the Net makes available. Furthermore Calvani and Rotta (1999, 2000), while collecting hypotheses from many other scholars, state that ICTs introduce new elements for knowledge structure—that is, it has no more only linear, sequential, closed, and hierarchical features; in addition, it also has hypertext and multimedia features. They state also that the Net extends the social negotiation aspects of knowledge and contributes in its distributed features supporting in this way the construction of meaningful learning in the subjects using it. Actually the results coming from knowledge management experiences suggest for networks and especially the Internet the role of the technical infrastructure on which a community memory (shared knowledge basis supporting a professional CoP) can be built (Trentin, 2004).

Regarding the second point, the Internet inherits and strengthens the results of previous distance education experiences and proposes for itself two main features: 1) repositories within which information, documents, and other infor-

mation can be found; and 2) virtual environments where individuals can interact and build learning communities.

The above features and the improvement in education/training requests from large layers of people induced further changes in educational systems and especially universities. The definition brick-and-click university, recently introduced to describe the relevance universities assign to the presence of online courses and e-learning in their didactical offer, gives an idea of the importance ICT gained in educational contexts. But the effects of ICT on universities are not only nominalistic; they also modified the places and the actors of educational processes. Regarding the places, Ardizzone and Rivoltella (2003) hypothesize the proliferation of the environments to be used for training and suggest five possible rooms: 1) the traditional classroom, where the usual presence lesson is made or special activities like knowledge exposition, rules description, and sharing of experiences are carried out; 2) tele-didactics, that is, the teaching work strongly based on audio-video channels, with synchronous-asynchronous fruition and individual-group activities; 3) the online course, with which a virtual classroom is made and the usual teaching/learning activities are carried out without the need of teacher and/or student presence; 4) the virtual group, marked by the presence of cooperative activities within online courses and by a less important function of the teacher with respect to group interactions; and 5) the students' community, where the role of social interactions and the multiplication of virtual groups strongly extend the students' interactions in cyberspace.

As for the actors of educational processes, the same authors state that together with the well-known and traditional figures of teacher/professor and student (obviously with modifications in their features and functions), another professional gains importance—the tutor (in some cases two different tutors are proposed: the discipline and the system tutors).

NEW AND OLD PROBLEMS IN TEACHING WITH ICTS

It is probably too early to say if the changes induced by ICTs in higher education (especially university education) will give the right answers and solutions to the questions and problems that knowledge society puts to individuals and society.

In the author's opinion further changes are required because many problems still unsolved ask for adequate solutions. Among them, the following ones will be analyzed: 1) the presence of preconceptions, misconceptions, and mental schemes in students' minds; 2) the possible dependence of students' meaningful learning from their learning styles; and 3) the assessment of students' knowledge and skills, and the importance that portfolios have in the evaluation process.

Preconceptions, Misconceptions, Mental Schemes, and ICTs

It is well known that people often manifest wrong ideas that can be interpreted in at least two different ways (Driver & Erickson, 1983): a) mental schemes, if only the coherence of people's ideas in the interpretation of phenomena is considered (with no reference to scientific paradigms); and b) preconceptions or misconceptions (when people's ideas are compared and evaluated with respect to the right scientific paradigms).

Studies (Cartelli, 2002) carried out all over the world with differently aged people (from students to workers, professionals, and teachers) show that:

1. Almost all disciplinary fields report the presence of wrong ideas.
2. A lot of strategies and instruments have been proposed until now to help students in overcoming the problems they meet in their study, based or not on IT strategies (like the ones described in the first part of this article), and adopting or not constructivist strategies

(supported or not by ICT). A good percentage of success has been measured in those experiences. Nonetheless they were rarely compared with traditional teaching experiences and were never used systematically or adopted on a large scale in education.

3. Wrong ideas can persist in students' minds after the above instruments and strategies have been used and the best practices have been adopted.

The author's experience in basic computer science (CS) courses led him to hypothesize that a special e-learning platform continuously monitoring the didactic process could make easier for the students the learning of the CS topics (while giving to professors a powerful instrument for the management of their teaching). The information system the author planned and carried out (Cartelli, 2003) was very similar in its features to an e-learning platform. Most notably:

1. It had a well structured knowledge tree of the topics to be taught/learned,
2. Special auto-evaluation tests, integrated within the pages of the course (they were planned on the basis of the detected wrong ideas) were available for students,
3. Various communication areas implementing virtual environments for teachers/professors, tutors, and students could be accessed from everyone,
4. A careful management of the students' evaluation and assessment tests were available for teachers, and
5. Two functions for the analysis of the students' access to the course materials and the use they made of the communication services could be used.

The management of all information in the site was guaranteed from five types of protected accesses: the system administrator, professors, tutors, students, and lastly, didactic researchers and

scholars (who could only retrieve the information on the students' access to the course materials).

The system was experimented with two different sets of students and had positive results regarding the number of students passing ending examinations; there was in fact only 20% student loss, and more than 65% of the students had positive, if not excellent scores. But a careful analysis of the data stored in the database showed some limits for the system: 1) many students still evidenced the presence of misconceptions (more than 43% of the whole population); 2) the amount of data generated by the second set of students (more than 300 subjects) made impossible the continuous monitoring of the didactic process by means of the two functions (reporting the number of single students or groups of them to the course materials and the temporal sequence of their access to the system).

Meaningful Learning, Learning Styles, and ICTs

It must be noted that until now, a unique definition of meaningful learning has never been proposed by scholars, but at least two main definitions are in fact available. The former one, credited to Ausubel (1990), is based on the following elements: a) logical meaningfulness of the topic to be learned; b) presence in that subject of special elements (subsumers), making easier the insertion of new knowledge into previous knowledge; and c) motivation to learn. The latter definition credits Jonassen (1995) with stating that knowledge construction (internal and external negotiation), context (meaningful and authentic environment), and cooperation (among students and teachers) are the basic elements for the definition of an environment leading to meaningful learning (which has to be active, constructive, cooperative, intentional, conversational, and reflexive).

Also under the hypothesis of both the above definitions of meaningful learning, no dependence

has been shown until now among the development of such a learning by students, their problems, and their performances, neither in traditional contexts nor in virtual environments, online courses, and so forth.

More recently many studies have been carried out on the possible dependence of students' success from their learning styles.

First of all the research of Kovacic and Green (2004) on a computer concepts class (at the Open Polytechnic of New Zealand) is reported here. The authors had the main aim of identifying those students requiring additional learning support and adopted for their analysis the Felder-Silverman model for students' learning styles. After having evaluated and classified the students' learning styles according to the Felder-Soloman Learning Style Index, the authors found statistically significant differences in performance between the different learner types they identified in their class—that is, students with reflective, sensing, verbal, and global learning preferences had the best performances both in in-course assessment and in final examination. The explanation the authors give for this result is in the advantage that the above type of learners receive from current teaching styles and the learning environment (course material and online students' support).

Furthermore other scholars (Kumar, Kumar & Smart, 2004) used pre- and post-tests based on the Grasha-Riechman Student Learning Styles Scale (another model for the analysis of students' learning styles) on a sample of 65 students (both graduate and undergraduate). They found relevant changes in the final presence of some types of learning styles with respect to the others in the class they analyzed. For the authors the observed changes depend on the instructional strategies and the technologies they adopted (i.e., the use of collaborative projects and course management software increased the number of collaborative, participant, and independent learning styles among students).

Students' Assessment and ICTs

Knowledge society, and lifelong learning, with the continuous improvement in education and training, put the problem of a more efficient evaluation of the knowledge and skill people obtain while attending courses. The portfolio of competences has been one of the instruments developed during the last few years having great success in certifying the students' success in educational activities. Over the last three years, there has been also a significant increase in the use of online portfolios in tertiary, secondary, primary, and professional education, to combine the benefits of traditional portfolio-based assessment with the paper-saving and other benefits of online environments. Love and Cooper (2004), while investigating the key factors necessary to design information systems for online portfolio-based assessment in tertiary, professional, secondary, and primary education, identify four weaknesses: 1) design brief omitting most of the key educational and administrative issues, and focusing mostly on identifying technical means; 2) "online portfolios" made only of a single essay, project report, or term paper presented as a Web-based electronic facsimile of a conventional document; 3) designs for online portfolio assessment systems based on an over-narrow view of value distribution that does not take all stakeholders into account; and 4) designing of online portfolio assessment systems not well integrated with overall course design processes.

In other words the authors found that online portfolio systems felt significantly short of their potential, and in many cases were inferior to conventional portfolio assessment and other more traditional assessment approaches. They suggested an alternative approach to designing online portfolio assessment systems, whose primary focus was the creation and distribution of benefits and value to all stakeholders. The main points of this alternative approach are: a) the identification of the nature and characteristics

of the educational and institutional contexts for which the online portfolio assessment systems is designed (and evaluated); b) the identification of potential benefits and increase in value for all stakeholders; c) the development of heuristics for prioritizing value distributions; and d) the development of an online system through the use of best practices in course design, the fulfillment of the requirements of the course criteria, the integration of the designing of the online portfolio system with the broader course design processes, and the focus on process automation to create and distribute increased value to all stakeholders.

CONCLUSION

The studies reported above show that ICTs can still play a relevant role in new educational fields with respect to the ones described in the background.

If further research is needed before we have solid results, it seems that the above data assign a new role to teachers/professors in the didactic process: the monitoring, analysis, and assessment of individuals' learning processes by means of the ICT.

The examples discussed above show how the improvement of the efficacy of teaching work can be obtained with the introduction of functions (based on ICT use) analyzing the students' data stored in an electronic repository so that:

1. The acquisition of the starting situation for each student can be easily detected and the didactic process can be personalized.
2. The change in the features of a student can be analyzed with respect to the ones of the whole population (by means of the comparison of suitable indices describing individual behaviors and learning styles, and the same indices describing the features of the whole population).

3. The change in the time of the features of individual students or groups of them can be detected.
4. Possible differences existing in groups of students experimenting different teaching strategies can be described, and the influence of different environments on the evolution of the teaching process can be detected.

The systematic use of ICTs in the above processes can transform teaching in an event-driven process where students' learning styles, the use of self-assessment tests, documents produced, scores obtained, and so forth lead to the complete control of the teaching-learning process. In other words, online action-research strategies have to be adopted, and teaching teams using Web technologies (together with RDBMS and the storage of the data produced from the students accessing the Web) must be developed for a complete and successful analysis of that process.

REFERENCES

- Ardizzone, P. & Rivoltella, P.C. (2003). *Didattiche per l'e-learning*. Rome: Carocci.
- Ausubel, D.P. (1990). *Educazione e processi cognitive*. Milan: Franco Angeli.
- Calvani, A. & Rotta, M. (1999). *Comunicazione ed apprendimento in Internet, didattica costruttivistica in rete*. Trento, Italy: Erickson.
- Calvani, A. & Rotta, M. (2000). *Fare formazione in Internet, manuale di didattica online*. Trento, Italy: Erickson.
- Cartelli, A. (2002). Web technologies and sciences epistemologies. In E. Cohen & E. Boyd (Eds.), *Proceedings of IS + IT Education 2002 International Conference* (pp. 225-238). Retrieved August 16, 2004, from <http://ecommerce.lebow.drexel.edu/eli/2002Proceedings/papers/Car203Webte.pdf>
- Cartelli, A. (2003). Misinforming, misunderstanding, misconceptions: What informing science can do. In E. Cohen & E. Boyd (Eds.), *Proceedings of IS + IT Education 2003 International Conference* (pp. 1259-1273). Santa Rosa, CA: Informing Science Institute.
- Cornoldi, C. & Caponi, B. (1991). *Memoria e metacognizione*. Trento, Italy: Erickson.
- Driver, R. & Erickson, G. (1983). Theories in action: Some theoretical and empirical issues in the study of students' conceptual frameworks in science. *Studies in Science Education*, 10, 37.
- Galliani, L., Costa, R., Amplatz, C. & Varisco, B.M. (1999). *Le tecnologie didattiche*. Lecce, Italy: Pensa Multimedia.
- Jonassen, D.H. (1995). Supporting communities of learning with technology: A vision for integrating technology with learning in schools. *Educational Technology*, 35(4), 60-63.
- Kovacic, Z.J. & Green, J.S. (2004). Are all learners created equal? A quantitative analysis of academic performance in a distance tertiary institution. *Issues in Informing Science and Information Technology*, 1, 965-976.
- Kumar, P., Kumar, A. & Smart, K. (2004). Assessing the impact of instructional methods and information technology on student learning styles. *Issues in Informing Science and Information Technology*, 1, 533-544.
- Lévy, P. (1996). *L'intelligenza collettiva. Per un'antropologia del cyberspazio*. Milan: Feltrinelli.
- Love, T. & Cooper, T. (2004). Designing online information systems for portfolio-based assessment: Design criteria and heuristics. *Journal of Information Technology Education*, 3, 65-81.
- Rheingold, H. (1994). *Comunità virtuali. Parlare, incontrarsi, vivere nel cyberspazio*. Milan: Sperling & Kupfer.

Taylor, R. (1980). *The computer in the school: Tutor, tool and tutee*. New York: Teachers College Press.

Trentin, G. (2004). *Apprendimento in rete e condivisione delle conoscenze*. Milan: Franco Angeli.

KEY TERMS

E-Learning Platform: An information system that schools, universities, and institutions can use for teaching (only online or supporting traditional teaching) which can have the following features (all together or individually): a) be a content management system (CMS), guaranteeing the access to didactic materials for the students; b) be a learning management system (LMS), where the use of learning objects makes easier the learning of a given topic; c) be a computer-supported collaborative learning system (CSCLS), which makes easier the use of collaborative and situated teaching/learning strategies; and d) build a virtual community of students, tutors, and professors using knowledge management (KM) strategies.

Learning Style: The personal way individuals think and learn. Also, if each individual develops a preferred set of approaches to learning, many authors suggest a well-defined set of learning models. Research seems to agree on the following elements: a) the adoption of special teaching strategies can make easier learning for students or not, depending on their learning styles; b) learning styles can evolve with individuals; and c) individuals' learning styles can be modified by special learning environments.

Mental Scheme: The set of concepts, and dependencies among them, that individuals carry out

for facing the problem of interpreting phenomena, without any reference to scientific knowledge or disciplinary paradigms.

Misconceptions (Preconceptions): Wrong ideas people manifest while explaining phenomena, with respect to scientific paradigms (i.e., people's ideas are evaluated with respect to scientific ones). The term preconception is adopted when the wrong idea appears before people meet curricular disciplines. The term misconception is used to mark the students' mistakes in phenomena interpretation.

Online Action Research: Uses the Internet for extending the features of traditional action research and its cyclical structure, based for many authors on five different phases: diagnosing, action-planning, action-taking, evaluating, and specifying learning. The Internet allows the continuous monitoring of action-research events and gives the researcher a further instrument to study phenomena and intervene on them.

Portfolio: The report collecting documents, scores, interviews, and so forth, and demonstrating the students' skills, achievements, learning, and competencies, with respect to: a) previously defined areas of skill, b) specific learning outcomes from these areas, c) appropriate learning strategies that have to be developed by the student, and d) performance indicators.

Web Technologies: The set of all instruments that allows people to use the Web and its protocols for improving communication and acquiring information. These are based on hardware, which are mostly networks of computers, and software resources, which are mostly Web servers using the HTTP protocol for communicating, interfaced with RDBMS (relational data base management systems).

This work was previously published in Encyclopedia of Distance Learning, Vol. 1, edited by C. Howard, J. Boettcher, L. Justice, K. Schenk, P.L. Rogers, and G.A. Berg, pp. 159-165, copyright 2005 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.30

Sociocultural Animation

Marcus Foth

Queensland University of Technology, Australia

INTRODUCTION

The emergence of global computer networks and the widespread availability of advanced information communication technology (ICT) since the mid-nineties has given rise to the hope that the traditional disadvantages faced by regional economies and regional communities could be alleviated easily and swiftly. Yet, the experience of both researchers and practitioners in community informatics and community development tells a different tale. Although the potential of ICT is in fact realised in some situations and locations, and does provide a means to ensure sustainability in some regional communities, elsewhere it has not achieved change for the promised better. Too many communities are still faced by a centralised structure in the context of commerce, service provision or governance and by various degrees of digital divides between the connected and disconnected, between the media literate and illiterate, between young and old, between consumers and producers, and between urban and rural.

Many attempts to close or bridge the digital divide have been reported with various degrees of success (e.g., Menou, 2001; Servon, 2002). Most

of these accounts echo a common voice in that they report similar principles of action, such as people-centred approaches, and they reflect and advocate—in most cases unconsciously—practices of sociocultural animation.

This article seeks to shed light onto the concept of sociocultural animation—a concept which is already commonplace in various forms in the arts, in education and professional development, youth work, sports, town planning, careers services, entrepreneurship and tourism. It starts by exploring the origins of sociocultural animation and draws comparisons with the current state of research and practice. It unpacks the foundation of sociocultural animation and briefly describes underlying principles and how they can be applied in the context of community informatics and developing regional communities with ICT.

BACKGROUND

Before the dominant meaning of the term “animation” was taken over by the film and computer graphics industries which ‘animate’ virtual characters, avatars and cartoons, it was—and

still is—used to describe the act of encouraging, motivating, involving, empowering, engaging real human beings. The word derives from the Greek/Latin “anima” which means “life” or “soul” and thus stands literally for the act of giving life or spirit to someone or something, or the state of being alive.

Most current accounts of sociocultural animation trace its origin back to post WW2 France where “animation socioculturelle” “was discovered as a way of invigorating democratic values lost as a result of the occupation and other wartime hardships” (Kurki, 2000, p. 162). It has also been suggested that the French colonial heritage made for an invigorating environment in which previous traditions aimed at rather dubious objectives overseas could be re-purposed mainly to animate French youth for leisure activities in, e.g., “maisons des jeunes et de la culture” (youth and cultural centres), “centres sociaux” (social centres) or “maisons de quartier” (community centres) (Cannan & Warren, 1997).

The concept of sociocultural animation spread throughout Europe in the 1970s when the increasingly self-confident community arts movement (known as “neighbourhood arts” in North America) was first being recognised and taken seriously by the established arts institutions and by public cultural policy makers. Previously, two misconceptions were prevalent: First, art is not created by “the plebs” but by few highly talented artists who create cultural works of supreme value; second, cultural development will occur in society by simply exhibiting these works. Thus, conventional arts policy at the time aimed at the “democratisation of culture” by fostering the dispersion of cultural institutions such as opera houses, theatres, galleries and museums, and by funding professional artists only (Adams & Goldbard, 1990; for an American perspective see Levine, 1988).

Advocates of “cultural democracy” opposed these notions and—initially through the work of the Council for Cultural Cooperation (CCC), part of the Council of Europe (cf. www.coe.int)—introduced a broader notion of sociocultural animation to a wider political arena. Sociocultural animation was defined as all actions which are “concerned to offer each individual the means and the incentive to become the active agent of his own development and of the qualitative development of the community to which he belongs” (Grosjean & Ingberg, 1974, p. 4). The notion of “democratising culture” was regarded as “patronising”; instead, the idea of “cultural democracy” suggests that “culture is synonymous with movement, and that each individual must not only be entitled to acquire culture, but also have full control over how that culture is defined” (Grosjean & Ingberg, 1974, p. 7).

Parallels can be drawn to today’s information society which still tries to come to terms with the vast opportunities ICT offers and to find best practices to “democratise” ICT and internet access, effective usage and the role of government itself. The foundation of sociocultural animation holds some insights and opens up perspectives which present-day community informatics researchers and practitioners may find useful and may benefit from.

THE FOUNDATION OF SOCIOCULTURAL ANIMATION

Kurki distinguishes three dimensions of sociocultural animation: “The educational goal is personal development; the social goal is to reinforce the group and the community and to increase people’s participation; the cultural dimension, in turn, aims at developing creativity and many-sided expression” (Kurki, 2000, p. 163). These three dimensions and their underlying principles and

practices are explored in the following in the context of community informatics.

The Social Dimension

Anthropologists and sociologists have created a plethora of definitions for the term “community” with the only common term of reference being “people”. The social dimension of sociocultural animation refers to a people-centred approach that is guided by the imperatives of personal and group participation (cf. Gumucio Dagron, 2001). In the field of community informatics, areas of application include sociocultural animation and ICT for developing countries (Gonzalez & Fernandez, 1990), communities of practice (Millen & Fontaine, 2003; Wenger, McDermott, & Snyder, 2002), and residential community networks (Foth, 2004), especially in the context of networked individualism (Wellman, 2001) and social networks (Watters, 2003).

The Cultural Dimension

Apart from the before mentioned prominence of sociocultural animation in European public policy making under the influence of the cultural democracy movement, it also implies a more simple and immediate cultural dimension in that it encourages people and community members to express themselves creatively through the arts. This dimension of sociocultural animation evokes the emergence of cultural heritage and gives rise to the formation of community memory. Smith (2002) illustrates the cultural dimension through the work of Brazilian theatre director and writer Augusto Boal and the “Theatre of the Oppressed” or “Forum Theatre” which is used as a way of developing creativity and eliciting an emotional response to political and economic questions from working class people.

Certain arts practices, especially dance, theatre and drama continue to play a significant role today in school education, youth and community

work. One example of this use of sociocultural animation are the Rock Eisteddfod festivals in Australia (www.rock_challenge.com.au) which combine choreography, costume and stage design, music and dance to animate not only youth but also parents, teachers and the wider community.

In the context of developing regional communities with ICT, the possibilities within the nexus of sociocultural animation and new forms of creative expression afforded by digital technology are just beginning to be explored. A prominent example in community informatics is digital storytelling which usually takes the form of a personal movie which integrates photographs, music, video, and voice (Freidus & Hlubinka, 2002). Digital storytelling workshops have been employed by both researchers (for a streaming media example, see Hartley, Hearn, Tacchi, & Foth, 2003) and practitioners (cf. www.bbc.co.uk/wales/capturewales).

The Educational Dimension

“Tell me and I forget, teach me and I remember, involve me and I learn,” a proverb attributed to Benjamin Franklin, summarises the educational dimension of sociocultural animation.

From early misuse during WW2 where forms of sociocultural animation have been applied in Germany to develop a social environment consistent and favourable with the Nazi regime and ideology (Sunker & Otto, 1997), it has now found its legitimate place in the field of social pedagogy in Germany (Moser, Müller, Wettstein, & Willener, 1999) and other European countries (cf. www.enoa.de and Lorenz, 1994), including Spain (Ander-Egg, 1997) and Finland (Kurki, 2000). In France, sociocultural animation is well established as an independent profession of “animateurs” who work in various social, cultural and educational contexts (Augustin & Gillet, 2000; Gillet, 1995; Mignon, 1999).

Effective use of ICT in a community context often requires training. The educational dimension

of sociocultural animation and the existing body of experience in participatory action learning and community media may prove valuable to better communicate the possibilities technology holds for regional development. Digital storytelling workshops are designed to allow for creative expression, but at the same time community members learn to use technology and how to make technology work for them effectively.

UNDERLYING PRINCIPLES AND PRACTICES

Sociocultural animation is “a state of mind rather than a specific action, a matter of form rather than of content” (Grosjean & Ingberg, 1974, p. 8). As such, sociocultural animation is a framework which can contain any primarily people-centred practices or methodologies. These methods are almost always directed at activating or mobilising a group or community and the members of that group or community to:

1. Embark upon a joint discovery of their own situation and reality in order to create a critical awareness of the issues and problems found
2. Analyse and diagnose reality in a dialogical fashion in order to envision the dream of a better future
3. Find ways of changing and improving reality by means of self-reflection and action
4. Constantly and continuously evaluate and assess the context and purpose of the action in order to adjust goals and direction.

Sociocultural animation can take the form of and borrow principles and practices from participatory action research (Reason & Bradbury, 2001) or ethnographic action research (Tacchi, Slater, & Hearn, 2003), yet—due to its non-academic origins—animators have in many cases foregone the academic rigour required in favour of focusing

on community action and change. This is in fact where synergies between academics and practitioners could emerge in the future: by combining the strengths of sociocultural animation—that is, activating and interacting with people—with the strengths of participatory action research—that is, analysing and interpreting reality from the different perspectives of community members with academic rigour. That said, the ethical rationale for a people-centred, solidary and democratic approach is very similar in both cases (cf. Hearn & Foth, 2005; Reason, 1998).

Sociocultural animation is usually employed by an “animator” (French, “animateur”) who can be a neighbourhood artist, a youth worker or researcher from within the community or from outside the community. If the animator is already part of the community, the initial phase of immersion and orientation may be easier to accomplish, however, animators from the outside bring the potential of seeing the community reality in a fresh and unbiased light. The key phases that a sociocultural animator goes through comprise sensitisation/animation, facilitation and progressive redundancy (Thapalia, 1996); the latter phase is to ensure continuity of the action, so the community can carry on without depending on the ongoing presence of the animator.

The animator is a catalyst, a mediator and facilitator who seeks to raise self-awareness and motivation (cf. Csikszentmihalyi, 1997; Fogg, 2003), to build confidence to increase both self-efficacy and community efficacy (Carroll & Reese, 2003), to engage community members and to encourage them to participate in self-reflection and action.

Any kind of agile, adaptive and people-centred methods of practice and evaluation (e.g., Checkland & Scholes, 1999; Mumford, 2003) employed by a sociocultural animator need to work towards a holistic representation within the contexts of both the community and the individual. In the context of the community, it is imperative to ensure that it is not only the perspectives of selected

Table 1. Cold world vs. hot world animation

| “Cold world” animation | “Hot world” animation |
|--|--|
| Works to allay symptoms of problems | Works to remedy causes of problems |
| Instrumental use of ready-made methods | Reflective use of adaptive methods |
| Works towards social cohesion and consensus to retain the status quo | Works towards personal and collective participation to create conscious solidarity |
| Top-down approach | Bottom-up approach |
| Animation is ‘social engineering’ | Animation is ‘human horticulture’ |

community members such as the opinion leaders and their individual requirements that are heard and taken into account, but also the views of the community as a whole, in order to create a vision which is supported by the entire community.

In the context of the individual community member, “the only true source of knowledge is people’s own social activity” (Kurki, 2000, p. 165). Hence, methods have to be applied that work towards capturing more than just explicit knowledge and also seek to elicit different types of tacit knowledge sources (Polanyi, 1966); that is, “from simple facts that were too obvious to be worth mentioning, to deeply ingrained skills that might be impossible to articulate, yet become visible through interaction” and creative expression (Foth, 2003, p. 35).

Table 1 is an attempt at creating a dichotomy of sociocultural animation as a heuristic aid based on two extreme types defined by Gillet (1995)—with additions by Kurki (2000) and Gilchrist (2000). These extremes oppose, yet at times also complement, each other.

CONCLUSION AND FUTURE DIRECTION

Ongoing issues and areas of discussion that are prevalent in the study and practice of sociocultural animation in the context of community informatics require further investigation and advancement. These include:

- The imperative of academic rigour in the work of sociocultural animators on the ground
- The shift of emphasis in community development from “access to technology” to “effective use of technology” for creative expression, social networking and the generation of economic assets
- Lack of clarity and guidance in the ambiguous nature of the animator who is usually employed *by* a funding body but employed *for* a community group
- Implications for public policy making and public funding programs in regards to the arts, media, ICT and community develop-

ment, especially new definitions and practical interpretations of “accountability” and “sustainability.”

Sociocultural animation holds exciting potential to be used in economic community settings. The social, cultural and educational dimensions of animation for ICT have already been exploited by businesses in what has been termed “viral marketing” (Godin, 2001; Goldsmith, 2002); however, its application for place-based social networking, community-led innovation and regional entrepreneurial initiatives is yet to be explored.

Kretzmann and McKnight point out that members of disadvantaged communities often “begin to see themselves as people with special needs that can only be met by outsiders. They become consumers of services, with no incentive to be producers” (Kretzmann & McKnight, 1993, p. 2). Far too often are regional communities given access to ICT without an existing strategy for how the technology can be effectively used to make sense in the lives of community members. Sociocultural animation represents a key concept to overcome these flaws in that it regards community members as social beings, as creative content producers and active agents of change.

Finally, this is the time to embark upon the quest to sketch and establish a new adaptation of sociocultural animation that is purpose built for the opportunities and challenges of community informatics research and practice.

REFERENCES

- Adams, D., & Goldbard, A. (1990). Animation: What’s in a name? In *Crossroads: Reflections on the politics of culture*. Talmage, CA: DNA Press.
- Ander-Egg, E. (1997). *Metodología y práctica de la animación socio-cultural*. Madrid, Spain: Editorial Humanitas.
- Augustin, J.-P., & Gillet, J.-C. (2000). *Animation professionnelle: Histoire, acteurs, enjeux*. Paris: L’Harmattan.
- Cannan, C., & Warren, C. (Eds.). (1997). *Social action with children and families: A community development approach to child and family welfare*. London: Routledge.
- Carroll, J.M., & Reese, D.D. (2003, Jan 6-9). Community collective efficacy: structure and consequences of perceived capacities in the blacksburg electronic village. Paper presented at the *36th Hawaii International Conference on System Sciences (HICSS)*, Big Island, Hawaii.
- Checkland, P., & Scholes, J. (1999). *Soft systems methodology in action: A 30-year retrospective*. New York: Wiley.
- Csikszentmihalyi, M. (1997). *Finding flow: The psychology of engagement with everyday life*. New York: Basic Books.
- Fogg, B. J. (2003). *Persuasive technology: Using computers to change what we think and do*. Amsterdam: Morgan Kaufmann Publishers.
- Foth, M. (2003). Connectivity does not ensure community: On social capital, networks and communities of place. In S. Marshall & W. Taylor (Eds.), *Proceedings of the 5th International Information Technology in Regional Areas (ITiRA) Conference 2003* (pp. 31-39). Rockhampton, QLD: Central Queensland University Press.
- Foth, M. (2004). Animating personalised networking in a student apartment complex through participatory design. In A. Bond, A. Clement, F. de Cindio, D. Schuler & P. van den Besselaar (Eds.), *Proceedings of the Participatory Design Conference*, Toronto, Canada, July 27-31 (Vol. 2, pp. 175-178). Palo Alto, CA: CPSR.
- Freidus, N., & Hlubinka, M. (2002). Digital storytelling for reflective practice in communities of learners. *ACM SIGGROUP Bulletin*, 23(2), 24-26.

- Gilchrist, A. (2000). The well-connected community: Networking to the “edge of chaos”. *Community Development Journal*, 35(3), 264-275.
- Gillet, J.-C. (1995). *Animation et animateurs: Le sens de l'action*. Paris: L'Harmattan.
- Godin, S. (2001). *Unleashing the ideavirus: Stop marketing at people! Turn your ideas into epidemics by helping your customers do the marketing for you*. New York: Hyperion.
- Goldsmith, R. (2002). *Viral marketing: Get your audience to do your marketing for you*. London: Pearson Education.
- Gonzalez, T.D., & Fernandez, F.S. (1990). Methodology for sociocultural animation in Spain's underprivileged rural areas. In J.-P. Hauteceur (Ed.), *Alpha 90: Current research in literacy*. Hamburg, Germany: UNESCO Institute for Education.
- Grosjean, E., & Ingberg, H. (1974). Animation: Implications of a policy of socio-cultural community development. *Information Bulletin of the Council of Europe*, 74(33), 1-39.
- Gumucio Dagron, A. (2001). *Making waves: Stories of participatory communication for social change*. New York: The Rockefeller Foundation.
- Hartley, J., Hearn, G., Tacchi, J., & Foth, M. (2003). The youth Internet radio network: A research project to connect youth across Queensland through music, creativity and ICT. In S. Marshall & W. Taylor (Eds.), *Proceedings of the 5th International Information Technology in Regional Areas (ITiRA) Conference 2003* (pp. 335-342). Rockhampton, QLD: Central Queensland University Press.
- Hearn, G., & Foth, M. (2005). Action research in the design of new media and ICT systems. In K. Kwansah-Aidoo (Ed.), *Current issues in communications and media research* (pp. 81-97). New York: Nova Science.
- Kretzmann, J.P., & McKnight, J.L. (1993). *Building communities from the inside out: A path toward finding and mobilizing a community's assets*. Chicago: Institute for Policy Research.
- Kurki, L. (2000). Sociocultural animation in learning. *LLinE—Lifelong Learning in Europe*, 5(3), 162-167.
- Levine, L.W. (1988). *Highbrow/lowbrow: The emergence of cultural hierarchy in America*. Cambridge, MA: Harvard University Press.
- Lorenz, W. (1994). *Social work in a changing Europe*. London: Routledge.
- Menou, M. J. (2001). The global digital divide: Beyond hICTeria. *Aslib Proceedings*, 53(4), 112-114.
- Mignon, J.-M. (1999). *Le métier d'animateur*. Paris: Syros la Découverte.
- Millen, D.R., & Fontaine, M.A. (2003, Nov 9-12). Improving individual and organizational performance through communities of practice. Paper presented at the *ACM GROUP Conference*, Sanibel Island, FL.
- Moser, H., Müller, E., Wettstein, H., & Willener, A. (1999). *Soziokulturelle Animation: Grundfragen, Grundlagen, Grundsätze*. Luzern, Switzerland: Verlag für Soziales und Kulturelles.
- Mumford, E. (2003). *Redesigning human systems*. Hershey, PA: IRM Press.
- Polanyi, M. (1966). *The tacit dimension*. Gloucester, MA: Peter Smith.
- Reason, P. (1998). Political, epistemological, ecological and spiritual dimensions of participation. *Studies in Cultures, Organizations and Societies*, 4(2), 147-167.
- Reason, P., & Bradbury, H. (2001). *Handbook of action research: Participative inquiry and practice*. London: Sage.

Servon, L.J. (2002). *Bridging the digital divide: Technology, community, and public policy*. Malden, MA Oxford: Blackwell.

Smith, M.K. (2002, June 1). *Animation*. Retrieved April 28, 2004, from <http://www.infed.org/animate/b-animat.htm>

Sunker, H., & Otto, H.-U. (1997). *Education and fascism: Political formation and social education in German national socialism*. London: Taylor and Francis.

Tacchi, J., Slater, D., & Hearn, G. (2003). *Ethnographic action research handbook*. New Delhi: UNESCO.

Thapalia, C.F. (1996). Animation and leadership. In J. Servaes, T.L. Jacobson & S.A. White (Eds.), *Participatory communication for social change* (pp. 150-161). Thousand Oaks, CA: Sage Publications.

Watters, E. (2003). *Urban tribes: Are friends the new family?* London: Bloomsbury.

Wellman, B. (2001). Physical place and cyberplace: The rise of personalized networking. *International Journal of Urban and Regional Research*, 25(2), 227-252.

Wenger, E., McDermott, R.A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Boston: Harvard Business School Press.

KEY TERMS

Action Research: A research approach which is operationalised by constant cycles of planning, acting, observing and reflecting, which

encourages the participation of local subjects as active agents in the research process, and which works hand in hand with people-centred research methodologies.

Animator: The “keeper of the vision” who is a catalyst, mediator and facilitator seeking to raise self-awareness and motivation, to build confidence to increase both self efficacy and community efficacy, to engage community members and to encourage them to participate in self-reflection and action.

Cultural Democracy: A set of related commitments to protect and promote cultural diversity, and the right to culture for everyone in society; to encourage active participation in community cultural life; to enable people to participate in policy decisions that affect the quality of their cultural lives; and to assure fair and equitable access to cultural resources and support. (cf. www.wwcd.org)

Sociocultural Animation: All actions which are “concerned to offer each individual the means and the incentive to become the active agent of his own development and of the qualitative development of the community to which he belongs” (Grosjean & Ingberg, 1974, p. 4).

Tacit Knowledge: We draw upon tacitly held knowledge to perform and act but it cannot be easily and explicitly articulated: “We can know things, and important things, that we cannot tell” (Polanyi, 1966, p. 22).

Viral Marketing: A recent contribution to the marketing mix that uses technical networks such as the Internet or mobile phone network, to start an epidemic that spreads an idea or message (“the virus infection”) through social networks.

This work was previously published in the Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by Marshall, S., Taylor, W., and Yu, X., pp. 640-645, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.31

Biographical Stories of European Women Working in ICT

Andrea Birbaumer

Vienna University of Technology, Austria

Marianne Tolar

Vienna University of Technology, Austria

Ina Wagner

Vienna University of Technology, Austria

INTRODUCTION

There is a deep gender imbalance in information and communication technology (ICT) professions which are only about 17% female (compare Valenduc et al., 2004, p. 19) and, simultaneously, an unsatisfied demand for ICT professionals at intermediate and high levels. Although varying in different sectors and countries, a gender imbalance and a skills shortage are common features of the ICT labour market in Europe. This is an obstacle to the development of the knowledge economy and the achievement of social cohesion.

The project WWW-ICT¹ implements an integrated approach to the various aspects and dimensions of gender gaps in ICT professions, covering explicative factors linked to education and training, working and employment conditions,

professional and technical culture. Most existing studies have limitations and gaps. They are often limited to classical computer professions, while WWW-ICT intends to encompass new professions linked to new communication technology, also taking into account the vocational training system. Studies of the shortage of ICT professionals are mostly centred on the demand/supply relation, while we focus more on the role of professional models and professional trajectories as a factor of integration or exclusion.

In general terms, employment in the ICT sector has been growing very markedly across the EU in recent years. The sector is increasingly dominated by specialist firms, which have taken over the provision of computing services for client companies. Computer services in the EU are dominated by SMEs; the majority of computer

services businesses are micro-businesses employing less than ten employees (Björnsson, 2001). Despite the predominance of micro-businesses, there is a huge concentration of employment in bigger companies. This is the context within which women are employed in ICT.

BACKGROUND

Under-representation of girls and women in computing is a reality and “the reasons why women are not attracted to engineering in great numbers are subtle and complex defying monocausal explanations and solutions” (Adam, 2001, p. 40).

Much of the current discourse around the gender gap in computing is grounded in the debate on women in science and technology that dates back to the early 1980s. This debate revolved around some of the fundamental theoretical difficulties of addressing gender issues. One of these difficulties is to do with a dualistic notion of the world. Criticism of a dualistic construct of gender led to an increasing interest in “difference” (rather than sameness) on the one hand.

On the other hand the first studies of practising women scientists suggested that women choose science for similar reasons as their male colleagues: for the adventure of abstract thought, for the intellectual pleasure that analysing a problem, looking for details, isolating and manipulating variables provide (e.g., Carter & Kirkup, 1990). It was argued that people with the bodies of women do not necessarily have the minds of women. Evelyn Fox Keller (1987) was among the first feminist scholars who used gender not as an empirical category but as an analytical tool to elaborate and concretise the idea of difference and dissent within the sciences. Feminists introduced notions such as polyvalence, epistemological pluralism, and partial translations into the discourse on gender and technology (Wagner, 1994).

Much of this older debate has been absorbed by Judith Butler’s notion of gender as “performed”

(Butler 1993). It has been taken up by many feminist scholars and, interestingly, extended to technology. Jennifer Croissant argues: “We gender a technology by painting it blue and handing it to a boy. We gender the boy in this interaction, providing a frame of reference for appropriate technological and masculine identity associations and expectations. We of course provide a frame of reference for the girl to whom we do not hand it. We perform with technologies. The technology, with its scripts, schemes, and codes, also performs us in that we become subject to its affordances designed or there by happenstance when we start the performance” (Croissant, 1999, p. 278).

This argumentation leads to a second difficulty of theorising about technology and gender. Assumptions about the technologies that are examined in studies of gender differences are often quite general and superficial. In an early essay on women and technology Knapp (1989) argued that women’s ways of doing and thinking are not independent of the object world. Her main criticism of studies of women’s relations to the natural and technological world was that these almost exclusively look at the subject—women—disregarding the interactive nature of appropriating a technology. Not only are computers different from other technologies in ways that may affect the ways women and men interact with them. The range of computing applications dramatically expanded during the last decade and with it the range of computing professions. Looking at gender as performance and performed and at computers as highly specialised and varied technologies, has consequences for the method of ‘measuring’ gender differences. Kay (1992) has argued, “that to fully understand whether gender differences exist in human-computer interaction, a qualitative, contextual, developmental approach should be employed to examine specific tasks. He stresses that without this comprehensive understanding, researchers will continue to identify only pieces of a very complex puzzle” (quoted in Mitra et al., 2001, p. 228). A good example of such a con-

textual approach is Linda Stepulevage's (1999) reconstructing her own making into a technology expert using the method of autobiographical narrative. She emphasises the actual everyday practices that surround technologies—"people making and doing things." Understanding this "making and doing" is tied to particular locations and contexts (Stepulevage 1999).

It has been argued that in IT as a relatively young field women would not face the same barriers for working careers existing in other fields with a traditional male dominance. Ahuja (2002) argues that this viewpoint does not "adequately take into account the variety of structural and social factors that inescapably and inevitably shape women's careers in IT throughout industry and academia" (p. 22). Noticing a lack of academic studies on gender differences in IT careers she claims that it is important to understand the role of women in the field of IT and "how or if IT differs from other professional endeavours in offering opportunities to women" (p. 21). With that aim she proposes a conceptual framework that covers social factors as well as structural ones influencing women's professional careers in IT.

METHOD

Our qualitative research is based on biographical interviews. The analysis attempts at preserving the biographical aspect of informants' narratives while at the same time looking at more general patterns across individual biographies.

The aim of a biographical interview is to develop an understanding of a person's biography or trajectory—her development as based on opportunities, choices, and individual coping strategies. Crucial concepts are developmental tasks in particular phases of one's life, individual coping strategies in relation to given structures, detours and their implication for the person's biography, transitions (changes of field of work, occupation, life situation, etc.) and life themes

(Thomae, 1996) (i.e., topics that emerge in the women's own accounts as crucial for understanding their choices).

The focus of our interviews was on the women's work biographies, with an understanding that these are inseparable from their identity and concept of a good life. Silvia Gherardi's narratives of "women travellers in a male world" come closest to this notion of biographical interviews (Gherardi, 1996). Our interviews are what Flick (1995) calls episodic interviews with a strong narrative character. The main idea is to stimulate a person to tell "stories"—significant episodes in her life that illustrate the whys and hows of important events in her biography. We interviewed 107 women (15 or 16 in each of the seven countries) who were selected according to a set of criteria (see Table 1).

LIFE STORY PATTERNS

The categories we use in our analysis of biographical (life story) patterns are not theory-based but empirical, grounded in the material itself. They reflect some of the colour the women themselves gave to their narratives. We discovered eight main patterns. Each pattern has its own characteristics and its influence on the informants' career paths in ICT.

For this article we have selected four patterns that we found among the women interviewed. These patterns represent different paths into or in ICT professions. All the women belonging to the selected examples manage their working life rather successfully and are on the whole satisfied with their jobs. This selection is due to our focus, namely to emphasise successful careers, in order to find a new quality of research and recommendations. As a lot of existing studies focus on deficiencies, we try to find out positive role models of women, who found a way to manage their professional lives in the ICT sector. To our opinion women's careers are rather defined

Table 1. Characteristics of interview partners

| | |
|----------------------|--|
| Age | from 22 to 55, highest proportion between 31 and 40 years |
| Qualification | from no ICT related initial training to university degrees in ICT and other subjects |
| Job Profiles | project management, developing, leading position, Web design, support, marketing, teaching |
| Firms | large/small companies (more/less than 100 employees) |
| Status | salaried, self-employed, full-time, part-time |
| Residence | city/countryside, different regions within the countries |

by their contents, their work practices, interests, opportunities and motivations behind than by obstacles and barriers. Positive examples in this sense give us the possibility of formulating recommendations for “agents of change” more precisely and realistically.

Straight Careers in ICT

Straight careers in ICT can be found in all the different national cultures. They are moved by strong interest in math and sciences and in some cases, looking for a field with good job prospects. This is reflected already in the first educational choices the women take: They follow a technical education from the start, studying computer science or maths or engineering. One of the women says that what she likes about her work is “solving riddles and generally the curiosity to get to the bottom of things.”

These women follow one of the predefined trajectories in ICT. They pursue a university career or very consequently climb up the career ladder in the ICT industry. They are extremely hard working. They may have a broad range of interest in their private lives but in their work they are very focused, taking extreme pleasure

in mastering the intellectual challenges of their discipline. They have high ambitions and strive to the top. The conditions for being successful—a hierarchical structure, a competitive environment, and long working hours—are accepted. One woman describes that work had become very much a life style. The definition of her identity included late working hours and socialisation over a drink.

Combining Art with Technology

In these careers, it is not technology that is in the foreground but a passion for art or journalism, with ICT entering later as an important tool and skill.

These women work in publishing or advertising. Typical of all these careers is the ease with which the women integrated ICT into their work, developing a passion for both fields, but with their artistic interests and ambitions staying in the foreground. Regarding their life style and way of working they are more artists than computer professionals.

Typically for these careers that are close to the arts is that there are no boundaries between professional work, social commitment and private life.

From the Margins to a Field of Opportunities

There are life stories in which ICT is strongly connected with moving out from one's milieu or region into promising and relatively secure jobs. While in several cases informants come from marginal regions—the countryside in the case of Austria, the South (Sicily) in the case of Italy—in a few other cases it is ethnicity which creates a potentially marginal position from which the women escape. In some cases the women rebel against their home environment. For example for one British woman of Indian ethnic origin the expectations of her parents that she would simply marry and have children in fact gave her a strong motivation to pursue her education and get a good job. However, in most cases the women stay emotionally attached to their original family offering them different kinds of support.

These women are interested in working with technology but not passionate. ICT opens a field of opportunities to these women. Entries into ICT vary. While some of the women studied informatics or something related, others encountered ICT in their first (clerical) jobs, seizing the opportunity to qualify themselves, either through learning by doing (the older ones) or through additional training. One of the prime movers of these careers is the chance to get a well paying job offering security, possibly in a large company.

Building One's Own Environment

Some informants' stories show a strong will and skill to shape their own environment so that it fits their idea of good work and a good life. This is a theme in their accounts which they address explicitly as "building". These women are very self-confident. They have clear goals and set the steps to achieve their ideas and ambitions. Their strong motivation takes them into different directions. It includes going abroad as a single woman to be exposed to other cultures, being in charge of

their own life from a quite young age on, founding their own company, carving out their own field of expertise, building things on their own, fighting for a good position.

Some but not all of them come from supporting families. Their parents and often especially the mothers encouraged them to go their own way and get independent. Many of these women also chose supporting partners with whom they share child caring responsibilities and who support their careers. However, there are also women who have to manage job, household and family on their own with no encouragement or help from other family members.

These women define themselves through the content of their work. This may also include broader interests, such as political commitments or artistic interests. Some of the women work as mentors and encourage other women in ICT.

CONCLUSION

Among our interviewees we found a great variety of jobs, entry routes, education as well as motivations and interests in working in the ICT sector. With the life story patterns we tried to capture this diversity without disassembling it into single "influential factors." For the women in our pattern of "Straight careers in ICT" the focus of their motivation is clear on technology. They like the challenges of their work and they are very ambitious. Contrary is the motivation of women who come "From the margins to a field of opportunities." For them ICT offers the chance to get out of their milieu. They usually have a quite "natural" relationship to technology, seeing it as a means to fulfil their tasks, but they are not passionate about it. Women who are "Building one's own environment" are very successful in realising their goals. They actively use the openness of the ICT sector that often lacks predefined job profiles to create their own working environment. The ICT sector is also open in another sense. This can

be seen from the experience of women who are “Combining art with technology.” These women come from other educational backgrounds and find ICT as an important tool for their work in art, graphic design, or journalism.

Our results from the interviews and case studies show that ICT professions are more varied than often assumed. By using a qualitative approach we were able to understand the motivation of women working in ICT professions from their own viewpoint in the context of their life stories. The result is a lively picture of the situation of women in the ICT sector that sheds light on the women’s motivations and needs as well as on the working conditions in the ICT sector. These insights can be used to formulate recommendations² that are based on women’s experiences from their work practices in ICT professions and that go far beyond the elimination of constraints.

FUTURE TRENDS

The ICT sector is a rather dynamic field. The permanent changes of the sector are tightly connected to the development and the growing of new jobs and new professional areas. Due to the rapid technical improvement it is a challenge to imagine future scenarios. As the ICT sector is a rich area of opportunities for men and women with different educational and qualification backgrounds we notice the necessity of continual research to analyse what is changing. It would be very helpful to improve and update the existing job descriptions and opportunities and to connect research institutions, labour market experts, and counsellors. We observe a great lack of comparable quantitative data as well as a sufficient number of qualitative studies, among them our study is just one contribution to a deeper understanding of the ICT sector. Quantitative and qualitative research should lead to better information about the chances and career options women may have in the ICT

sector and so work against the under-representation of girls and women in this area.

REFERENCES

- Adam, A. (2001). Heroes or sibyls? Gender and engineering ethics. *IEEE Technology and Society Magazine*, 20(3), 39-46.
- Ahuja, M. (2002). Women in the information technology profession: A literature review, synthesis, and research agenda. *European Journal of Information Systems*, 11, 20-34.
- Björnsson, K. (2001, November). Computer services: Strong employment growth and low labour productivity despite high labour costs and a highly-educated labour force. *Eurostat—Statistics in Focus: Industry, Trade and Services, Theme 4*.
- Butler, J. (1993). Gender is burning: Questions of appropriation and subversion. In N. Mirzoeff (Ed.), *The visual culture reader* (pp. 448-462). London; New York: Routledge.
- Carter, R., & Kirkup, G. (1990). *Women in engineering: A good place to be?* Basingstoke: Macmillan.
- Croissant, J. L. (1999). Engendering technology: Culture, gender, and work. In *Proceedings of the 1999 International Symposium on Technology and Society—Women and Technology: Historical, Societal, and Professional Perspectives* (pp. 276-281). Piscataway, NJ: IEEE.
- Flick, U. (1995). *Qualitative Forschung: Theorie, Methoden, Anwendung in Psychologie und Sozialwissenschaften*. Reinbek bei Hamburg, Rowohlt.
- Gherardi, S. (1996). Gendered organizational cultures: Narratives of women travellers in a male world. *Gender, Work, and Organization*, 3(4), 187-201.

Kay, R. H. (1992). Understanding gender differences in computer attitudes, aptitude, and use: An invitation to build theory. *Journal of Research on Computing in Education*, 25, 159-171.

Keller, E. F. (1987). The gender/science system: Or, is sex to gender as nature is to science? *Hypatia*, 2(3), 37-49.

Knapp, G. A. (1989). Männliche Technik—weibliche Frau? Zur Analyse einer problematischen Beziehung. In D. Becker, R. Becker-Schmidt, G. A. Knapp, & A. Wacker (Eds.), *Zeitbilder der Technik: Essays zur Geschichte von Arbeit und Technologie* (pp. 193-241). Bonn: Verlag Neue Gesellschaft.

Mitra, A., LaFrance, B., & McCullough, S. (2001). Differences in attitudes between women and men toward computerization. *Journal of Educational Computing Research*, 25(3), 227-244.

Stepulevage, L. (1999). A technologist in the making: days in a girl's life. In *Proceedings of the 1999 International Symposium on Technology and Society—Women and Technology: Historical, Societal, and Professional Perspectives* (pp. 211-218). Piscataway, NJ: IEEE.

Thomae, H. (1996). *Das Individuum und seine Welt. Eine Persönlichkeitstheorie* (3rd extended and improved ed.). Göttingen; Bern; Toronto; Seattle: Hogrefe.

Valenduc, G., Vendramin, P., Guffens, C. (FTU), Ponzellini, A. M., Lebano, A. (FRPS), D'Ouville, L., et al. (2004). *Widening women's work in information and communication technologies* (Final Synthesis Report, European Commission, IST-2001-34520). Retrieved February 2006, from <http://www.ftu-namur.org/fichiers/D12-print.pdf>

Wagner, I. (1994). Connecting communities of practice: Feminism, science, and technology. *Women's Studies International Forum*, 17(2/3), 257-265.

KEY TERMS

Agents of Change: Experts and institutions connected to the labour market, the educational and vocational area, industry and politics who should work against the gender imbalance in ICT following the recommendations of research projects. Agents of change are e.g. vocational advisors, counsellors, human resources managers, trade unionists, European and national institutions, social partners, public institutions, teachers, parents and students.

Biographical Interviews: Qualitative interviews, partly pre-structured with a strong narrative character; stimulates a person to tell "stories"—significant episodes of his/her life. Normally the interviewee covers several topics in his/her narration in his/her sequence.

Gender Imbalance in ICT Professions: Various aspects and dimensions of gender gaps in ICT professions, covering explicative factors linked to education and training, working and employment conditions, professional and technical culture.

ICT: Information and communication technologies.

ICT Professions: Rely on professional ICT skills in the ICT industry and in the user industries and services; characterised by the predominance of ICT knowledge; cover a range of tasks including conceptualisation, design, development, implementation, upgrading, maintenance or management of ICT systems and tools.

Life Story Patterns: Typologies drawn from biographical data of the interviews; clusters covering several criteria including career paths, background, education, etc. as well as individual life styles, coping strategies, cultural aspects, etc.; categories of the analysis are not theory-based but empirical, grounded in the material itself. They reflect some of the colour the interviewees gave to their narratives.

Life Themes: Topics that emerge in the person's own accounts as crucial for understanding their choices both in working and private life; can be drawn from biographical interviews. One person may have several different life themes.

ENDNOTES

¹ This article is based on WWW-ICT/Widening Women's Work in Information and Com-

munication Technology, a project carried out under the 5th framework programme of RTD of the EU in 2002-2004. <http://www.ftu-namur.org/www-ict>.

² Conclusions and recommendations can be found in our report (Valenduc et al., 2004).

This work was previously published in the Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 64-69, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.32

The Beijing World Conference on Women, ICT Policy, and Gender

J. Ann Dumas

The Pennsylvania State University, USA

INTRODUCTION

The 1995 Fourth World Conference on Women, Beijing, China, addressed gender equality issues in many areas of global society, including information, communication, and knowledge exchange and the associated technologies. The Beijing Declaration called for action to promote gender equality in human rights, economic autonomy, domestic responsibility sharing, participation in public life and decision making, access to health services and education, and the eradication of poverty and all forms of violence against women. The Beijing Platform for Action contained strategic objectives and actions for governments and others to implement to increase gender equality in 12 critical areas, including Section J, Women and the Media. Article 234 of the Beijing Platform Section J acknowledged the important need for gender equality in information and communication technology:

...advances in information technology have facilitated a global network of communications that transcends national boundaries and has an impact on public policy, private attitudes and behaviour, especially of children and young adults. Everywhere the potential exists for the media to make a far greater contribution to the advancement of women. (United Nations [UN], 1995, p. 133)

Section J defined two strategic objectives that address issues of access to and participation in ICT and media development:

J.1. Increase the participation and access of women to expression and decision making in and through the media and new technologies of communication.

J.2. Promote a balanced and nonstereotyped portrayal of women in the media. (United Nations, 1995, pp. 133-136)

Governments agreed to implement the Beijing Platform for Action and use gender-disaggregated data to report national progress on objectives during Beijing +5 United Nations General Assembly Special Session (UNGASS) in 2000 and Beijing +10 in 2005. This article reviews progress reported on ICT-related Section J strategic initiatives and trends for ICT and gender between 1995 and 2005.

BACKGROUND

The gender equality objectives in Section J have been rooted in international agreements among United Nations member nations since 1947. The Universal Declaration of Human Rights (UDHR) recognized that “the inherent dignity and the equal and inalienable rights of all the human family is the foundation of freedom, justice and peace in the world” (UN, 1948, p. 1). UDHR Article 19 affirms the right to communicate and “to seek, receive and impart information and ideas through any media and regardless of frontiers” (UN, 1948, p. 1). These human rights, equally inalienable for women and men, are affirmed in the international treaty Convention on the Elimination of all forms of Discrimination Against Women (CEDAW; UN Commission on the Status of Women, 1979). Prior to the Beijing conference, CEDAW was referenced in the preamble preceding the 1989 UNESCO Convention on Technical and Vocational Education, which “provides for the right to equal access to technical education and pays special attention to the needs of disadvantaged groups” (Hamelink, 2005, p. 128).

The United Nations Commission on the Status of Women organized four world conferences on women. The first was in Mexico in 1975 at the beginning of the United Nations Decade for Women and focused on equality, development, and peace with the subthemes of employment, health, and education. The second was in Copenhagen in 1980. The third, in Nairobi in 1985, produced

the Nairobi Forward-Looking Strategies for the Advancement of Women (1985), which affirmed that the:

...realization of equal rights for women at all levels and in all areas of life will contribute to the achievement of a just and lasting peace, to social progress and to respect for human rights and fundamental freedoms. (United Nations, 1985, p. 1)

Beijing 1995

The Fourth World Conference on Women in Beijing in 1995 built on the Nairobi strategies and created the Beijing Platform for Action (1995). Just prior to Beijing, the United Nations Commission on Science Technology and Development Gender Working Group (UNCSTD-GWG, 1995) compiled research on gender, science, and technology interactions, particularly on applications that serve basic needs in the developing world. Most of the case studies focused on technical change that had differentially impacted the lives of women and men, and found men benefiting more from technical change. Further analysis identified male dominance in the decision-making chain as a prime reason for gender inequalities (UNCSTD-GWG). The Beijing Platform for Action helped situate gender equality as central in the global development-policy agenda by creating a gender-sensitive policy framework for achieving development goals through action targeted to human needs. Governments agreed to the Beijing Platform for Action and committed some resources to implement the objectives of its 12 target areas and to monitor progress at 5-year intervals.

Beijing + 5

The Beijing Platform for Action Section J had affirmed the importance of gender inclusion in ICT policy development at local, national, regional, and international levels. By 2000, policies to direct the

ICT tools, so celebrated for their potential to effect change in developing nations, were only sparsely implemented toward programs for women's development. UNIFEM executive director Noleen Heyzer (2000) voiced concern that "globalization has failed to generate formal employment for women, but instead shifted their work to the informal and casual sectors." She stressed the "pressing need to assist countries to develop new frameworks that transform globalization to become pro-poor and pro-women, a globalization that is more socially accountable" and to utilize "the possibilities for connecting women and markets worldwide through the democratization of information and communication technologies and policies." She addressed the issue of the representation of women and called for greater gender equity in "expression and decision-making in and through the media and new technologies of communication."

Toward this objective, UNIFEM partnered with Cisco Systems to host the gender and ICT session at the Beijing +5 UNGASS. The session reported on women's leadership in ICT capacity building and information sharing for development. Discussion focused on best-practice action programs for the Section J objectives expanded to include ICT. New media ICT access and participation had moved toward gender equality in ICT-rich nations. In ICT-poor nations, data were less available. Many cases were reported of women's empowerment through ICTs for education, political voice and decision making, employment, and capacity development, but key obstacles of poverty and illiteracy kept most women in developing countries from ICT access and participation (United Nations, 2000).

The United Nations (2000) report on trends and statistics published for Beijing +5 identified the "need for new data on new media" (p. 100) and found new media boundaries are blurred between "genres and delivery systems" and "producers and users" (p. 100). Support for gender equality in hiring and gender sensitivity in programming was

recommended in order to address escalating trends of gender stereotyping, pornography, and other degrading images of women and girls in media. The 2000 report also found "almost no data" (p. 100) on gender portrayal in new media, including Internet broadcasts, games, and newsgroups. The report recommended the development of complex measurement instruments to do this because "representations of women cannot be separated from construction of identity, use of language and new styles of interaction" (p. 100).

Beijing +10

Ten years after Beijing, the United Nations Research Institute for Social Development (UNRISD, 2005) analysis and report on progress focused more on the broad global challenges to women's well-being than on the specific progress of Section J, Women and Media, including ICT. The Beijing +10 UNRISD report found overall "uneven progress in an unequal world" (p. 5) in part because the state, a central instrument for human rights protection, must be "democratized to deliver gender justice" (p. 258).

UNRISD (2005) reported that "market fundamentalism has reduced the legitimacy of the state as the maker of national rules about the obligations and rights of citizens" (p. 258). The report acknowledged some gender-equality gains in primary education, political representation, and reproductive rights, and the fact that there are more women in the labor market. However, ILO data in the report showed increased jobs for women in ICT and other sectors, but most were in informal and low-wage labor, so there was little overall economic progress for women since Beijing +5. ICT and economic development progressed concurrently in China and India, but without concurrent development of gender equality in education, health, and economic distribution (UNRISD).

The Beijing platform and subsequent progress assessments in 2000 and 2005 also considered

research evidence that policies, guidelines, and perhaps technologies are more gendered than gender neutral, strengthening the argument for gender-inclusive data collection and analysis:

Project-level data has well established that telecommunication and ICT are not gender-neutral. They impact men and women differentially, and in almost all cases, women have lesser access to and use of the media and lesser representation in the power and decision-making positions related to telecommunications and ICT... special attention is needed. Without it, women will have fewer opportunities to benefit from the myriad possibilities of the information age. (Hafkin, 2003, p. 1)

Nations and international organizations continue to monitor progress on the Beijing objectives, which remain a policy framework to guide the slow progress toward gender justice in ICT and other development areas.

FUTURE TRENDS

Beijing 1995, Beijing +5, and Beijing +10 have influenced the development of gender-focused research, analysis, and advocacy in ICT in the International Telecommunications Union (ITU), the UN ICT Task Force, and the 2003 to 2005 World Summit on the Information Society (WSIS). The ITU Task Force on Gender Issues (ITU-TFGI, 2001) developed “gender-aware guidelines for policy-making and regulatory agencies” intended to assist decision makers in their work to ensure that “both women and men are considered in the process” (p. 1). TFGI also found that:

...so-called gender-neutral policies or rules are not enough... women are vastly under-represented in government, business, political and social institutions; men still hold most of the management and control positions in telecommunication companies

and regulatory or policy making bodies; regulatory decisions are often made without impact analysis; and service licenses are attributed to companies without equal opportunity policies and are controlled mostly by men. The following are a set of guidelines ... They can be used to ensure that gender-sensitive analysis becomes an integral part of licensing and regulatory activities. Successful implementation of these guidelines requires the development and promotion of such policies within the institutions seeking transformation into a gender-aware environment. (p. 1)

The United Nations formed the UN ICT Task Force in 2001 to help mainstream ICT into development as a tool for digital opportunities and Millennium Development Goal (MDG) achievement. Gender inclusiveness and awareness have been evident in UN ICT Task Force policy and practice. Members are just under 20% women, and gender issues are regularly addressed in task-force work. The UN ICT Task Force has collaborated with the WSIS Gender Caucus and UNIFEM on the Kampala conference Bridging the Gender Digital Divide through Strategic Partnerships, which produced policy recommendations for gender and ICT including more research on ICT and gender issues.

Society of Women Engineers (2005) research using U.S. data showed that women in ICT education for electrical engineers, programmers, and software engineers progressed slowly from less than 10% of enrollment in the 1970s to 20% in 2000. Data showed similar ratios in these same ICT professions.

Graham and Smith (2005) found U.S. college-educated women represented only 24% of science and engineering (S&E) jobs. Women were underpaid, making 22% less than men. Though gender differentials in pay were even greater in non-S&E jobs, the authors recommended increasing S&E pay overall with policies to reduce gender earning discrimination in S&E jobs

because gender inequalities negatively impact the growing information society's need for scientists and engineers.

Women are underrepresented and underpaid in S&E fields outside the United States as well. Data for world nations ranked by the United Nations Development Program (UNDP) Human Development Index (HDI) showed that women held less than half of professional and technical jobs in 26 of the top 50 nations. A comparison of earned-income data for all of the top 50 showed that women's pay ranged between 17% and 63% less than men (UNDP, 2004).

Research has established strong links between ICT growth and economic development, and between gender equality and human development, but ICT growth alone does not necessarily lead to gender equality or human development. King and Mason (2001) compiled substantial research that demonstrated the gendered nature of poverty and its effects, and therefore the need for gender-aware programs to combat poverty. Proactive policies for overcoming gender-equality obstacles in ICT access and growth are more common in ICT-resource-rich countries. Yet it is as important in ICT-resource-poor countries. A gender-sensitive ICT policy, even with scarce ICT resources, can direct ICT applications to the needs of women, their dependent children, and the poor.

A specific policy for gender equality in ICT development is needed if ICT is to contribute significantly to achieving an end to poverty as envisioned in the 2000 Millennium Declaration's eight MDGs.

Gender equality, one of the MDGs, is central to achieving the other goals. Women and their dependent children represent more than two thirds of the world's hungry, poor, and illiterate (UNDP, 2004). Understanding this, the UNDP developed the Gender Development Index (GDI) compiled from economic, education, and health indicators using gender-disaggregated data. The GDI is used to help assess progress toward the

MDGs and the advancement of women in all areas of development. Gender-focused ICT education programs can prepare women for more skilled ICT jobs, improve local family incomes, and expand the national ICT skills base, addressing both poverty and gender inequality toward MDG achievement.

Gender research and analysis were part of the civil-society work prior to, during, and after the WSIS during the 3-year summit process. Plou (2005) described how gender relations in the ICT field sometimes reinforce old gender roles and power relationships, sometimes change them, but always require gender awareness in the developing information society. Plou says it is:

...not possible to think of new communication technologies as gender neutral. The absence of women's voices and perspectives in the information society also shows us that power relations in the new media replicate in many ways those in conventional media... Women's access to information sources and communication channels are crucial if they are to attain democratic participation, respect for their human rights and an equal voice in the public sphere. (p. 11)

Women are ICT users and content developers, particularly in new media, but are underrepresented among ICT policy makers. WSIS working groups for global policy development included Internet governance in their focus, which addressed technical standards, security, privacy, intellectual property issues, and financial mechanisms, and considered the Digital Solidarity Fund. Though women were well represented among the civil-society participants of WSIS, few women were represented among the thousands of government and business decision makers at WSIS (author's observation at Geneva WSIS; gender-disaggregated data not yet available). Even with much gender advocacy throughout WSIS, gender imbalance in policy making was still evident in the formation of

the UN Working Group on Internet Governance (WGIG), which included only 4 women of 40 members (ITU, 2005).

The WSIS Gender Caucus and the NGO Gender Strategies Working Group negotiated strongly for gender to be included as a fundamental principle for action in the policy development process. Gender Caucus convener Gillian Marcelle (2003) said:

Women's perspectives can contribute to making the difference between an Information Economy where gambling and pornography account for the most profitable applications and a true Information Society that serves human development ... making that leap will require radical transformation of the ICT sector so that all people, including girls and women of all ages, participate fully, not only as consumers but as citizens. This vision requires dramatic changes in the policies, practices and values of the ICT sector and the governance of the sector.

ICT and gender were critical issues debated and eventually included in the World Summit on the Information Society Declaration of Principles and Plan of Action. *The ITU World Telecommunications Report* (2003) focused specifically on how ICT applications could contribute to the achievement of gender equality, the empowerment of women, and the fulfillment of the other MDGs. Research and evidence show that continued attention to gender in monitoring the progress toward all the goals could help catalyze their achievement.

CONCLUSION

Gender-equality strategies, action plans, policy development, and monitoring processes were initiated through the UN decade for women, CEDAW, and the world conferences on women. The 1995 Beijing conference recognized and ar-

ticulated how creating greater gender equality in ICT access, participation, and capacity building was important to the achievement of sustainable development with gender justice. Gender-equality conditions in the rapidly changing information society are interactive with progress toward ending poverty, hunger, illiteracy, preventable disease, violent conflicts, and social isolation. ICT also plays an essential role in creating informed political participants and decision makers. The Beijing process and the ongoing evaluation of Section J objectives continue to support proactive efforts through WSIS, the UN ICT Task Force, and the MDGs to create more gender-inclusive and gender-sensitive ICT policy-making bodies capable of enhancing gender justice in the information society.

REFERENCES

- Graham, J. W., & Smith, S. A. (2005). Gender differences in employment and earnings in science and engineering in the US. *Economics of Education Review*, 24(3), 341-354. Elsevier. Retrieved August 15, 2005, from <http://www.elsevier.com/locate/econedurev>
- Hafkin, N. J. (2003, January 15-17). Some thoughts on gender and telecommunications/ICT statistics and Indicators (Document No. WGGI-2/7-E). *Proceedings of the ITU World Telecommunication/ICT Indicators Meeting*, Geneva, Switzerland (pp. 1-10). Retrieved from <http://www.itu.int>
- Hamelink, C. (2005). Human rights for the information society. In B. Girard & S. Ó Soichrú (Eds.), *Communicating in the information society* (pp. 121-164). Geneva, Switzerland: United Nations Research Institute for Social Development.
- Haqqani, A. B. (Ed.). (2004). *The role of information and communications technologies in global development: Analysis and policy recommendations* (Series 3). New York: United Nations ICT Task Force.

- Heyzer, N. (2000). *Assessing progress of the world's women: Challenges and opportunities*. Retrieved June 17, 2005, from <http://www.uni-fem.org>
- International Telecommunications Union (ITU). (2003). *World telecommunications report 2003: Access indicators for the information society*. Geneva, Switzerland: ITU.
- International Telecommunications Union (ITU). (2005). *Report of the working group on Internet governance* (Document No. 05.41622). Retrieved August 17, 2005, from <http://www.itu.int/wgig/>
- International Telecommunications Union Task Force on Gender Issues (ITU-TFGI). (2001). *Gender-aware guidelines for policy-making and regulatory agencies* (Document TFGI-4/5 E). *Fourth Meeting of the ITU-TFGI*.
- King, E., & Mason, A. (2001). *Engendering development: Through gender equality in rights, resources and voice*. Washington, DC: World Bank.
- Mansell, R. (2003). Building knowledge and capabilities for action: Capabilities for knowledge sharing. In *UNESCO World Report on "Building Knowledge Societies"* (p. 1). Geneva, Switzerland: UNESCO.
- Mansell, R., & Wehn, U. (1998). *Knowledge societies: Information technology for sustainable development*. New York: Oxford University Press.
- Marcelle, G. (2003). WSIS Gender Caucus statement to WSIS assembly. *WSIS Gender Caucus*. Retrieved July 9, 2005, from <http://www.genderwsis.org>
- Marcelle, G. (2005). *Technological learning: A strategic imperative for firms in the developing world*. Cheltenham, UK: Edward Elgar.
- Plou, D. S. (2005). What about gender issues in the information society? In B. Girard & S. Ó Soichrú (Eds.), *Communicating in the information society* (pp. 11-32). Geneva, Switzerland: United Nations Research Institute for Social Development.
- Society of Women Engineers (SWE). (2005). *Research and statistics*. Retrieved August 5, 2005, from <http://www.swe.org/stellent/idcplg>
- United Nations. (1948). *Universal declaration of human rights*. New York: Author.
- United Nations. (1985). *Nairobi forward-looking strategies for the advancement of women* (116 plenary resolution A/RES/40/108). New York: Author.
- United Nations. (1995). *The Beijing Declaration and the Platform for Action: Fourth World Conference on Women*. New York: United Nations Department of Public Information.
- United Nations. (2000). *The world's women 2000 trends and statistics: Social statistics and indicators* (Series K, No. 16). New York: Author.
- United Nations. (2003a). *WSIS declaration of principles* (WSIS-03/GENEVA/DOC/4). New York: United Nations Department of Public Information.
- United Nations. (2003b). *WSIS plan of action* (WSIS-03/GENEVA/DOC/5). New York: United Nations Department of Public Information.
- United Nations Commission on Science Technology and Development Gender Working Group (UNCSTD-GWG). (1995). *Missing links: Gender equity in science and technology for development*. Ottawa, Ontario, Canada: IDRC.
- United Nations Commission on the Status of Women. (1979). *Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW)*. New York: United Nations.
- United Nations Development Program (UNDP). (2004). *Human development report: Cultural liberty and human development*. New York: Author.

United Nations Research Institute for Social Development (UNRISD). (2005). *Gender equality: Striving for justice in an unequal world*. Geneva, Switzerland: Author.

KEY TERMS

Beijing Platform for Action. Section J, Women and the Media: Strategic Objectives J.1., to increase the participation and access of women to expression and decision making in and through the media and new technologies of communication, and J.2., to promote a balanced and nonstereotyped portrayal of women in the media (United Nations, 1995, pp. 134-136).

Millennium Development Goals: Eight goals agreed on by member states of the United Nations that address the effects of poverty and resource distribution inequities. The Millennium Declaration goals to be achieved by 2015 are the following:

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and the empowerment of women
4. Reduce child and maternal mortality
5. Improve maternal health care
6. Combat HIV and AIDS, malaria, and other major diseases

7. Ensure environmental sustainability
8. Develop global partnership for development

World Conferences on Women: International UN-sponsored conferences that addressed gender issues of human rights and equality important to local, regional, national, and international development and cooperation.

- **1975:** First World Conference on Women, Mexico
- **1980:** Second World Conference on Women, Copenhagen, Denmark
- **1985:** Third World Conference on Women, Nairobi, Kenya
- **1995:** Fourth World Conference on Women, Beijing, China
- **2000:** United Nations General Assembly Special Session on Beijing +5, New York
- **2005:** Beijing +10, New York

World Summit on the Information Society (WSIS): A two-phase international summit from 2003 to 2005 organized by the United Nations and the International Telecommunications Union to address the need for international policy and agreement on ICT governance, rights, and responsibilities. The WSIS Gender Caucus is a civil society representative of gender and IT issues.

This work was previously published in the Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 57-63, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.33

Gender Inequalities for Use and Access of ICTs in Developing Countries

Sushil K. Sharma
Ball State University, USA

INTRODUCTION

Internet, wireless, mobile, multi-media (voice, video, 3D), broadband, and other information and communication technologies (ICTs) are rapidly consolidating global communication networks and international trade with implications for people in developing countries. Extensive literature suggests that use of ICTs have a great impact on society for improving their economic means and life styles. However, various studies conducted in different regions of the world indicate that the advantages of ICTs have not reached all sections of society, particularly rural communities, and women. Women face many obstacles before they can harness the benefits of ICTs (Accascina, 2001; Alloo, 1998; The Commonwealth of Learning, 1998, 1999, 2000, 2001).

Information and technology development, adoption, and access are far from adequate in developing countries. Large scale illiteracy and disabling environments, including uncompetitive markets, restrict opportunities to harness ICTs.

For example; in India only 0.6% of the population uses the Internet and the penetration rate of the personal computer is only 1.2% (Hafkin & Taggart, 2001; Nath, 2001; World Bank Report, 2002). Information chasms follow socioeconomic divisions, particularly income and education disparities, separating well-connected elites from the less privileged who remain detached from information access and use. Most women within developing countries are on the lowest side of the divide, further removed from the information age as compared to the men whose poverty they share (Accascina, 2001; Nath, 2001; Tandon, 1998, The Commonwealth of Learning, 1998, 1999, 2000, 2001). If access and use of these technologies is directly linked to social and economic development, then it is imperative that women in developing countries be taken into consideration while developing ICT diffusion strategies. ICTs can be an important tool in meeting women's basic needs and can provide the access to resources to involve women as equal partners in socioeconomic development (Cole et al., 1994).

Addressing gender issues in the ICTs sector has shown significant results where women have been made a part of ICT use and access. For example, women have benefited greatly from South Korea's push to make higher education available online. In corporate South Korea, more than 35% of high-level IT positions are now held by women. In Africa, 70% of agricultural produce is handled by women (World Bank Report, 2002). By using farm radios, women farmers can obtain information in local languages on markets, agricultural inputs, food preservation, and storage without traveling far, or being dependent on a middleman. ICTs use and access by women can offer significant opportunities for them in developing countries, including poor women living in rural areas. However, their ability to take advantage of these opportunities is contingent upon conducive policies, an enabling environment to extend communications infrastructure to where women live, and increasing educational levels. It is now, particularly appropriate to ensure the inclusion of gender concerns in national IT policy, as most developing countries are either in the process of or about to start elaborating these policies (Accascina, 2001; Marcelle, 2000; Ponniah & Reardon, 1999; The Commonwealth of Learning, 1998, 1999, 2000, 2001).

Women face considerably higher barriers in terms of literacy, access to education and information, productive and financial resources, and time. Many of the obstacles women face in accessing and using technology are entrenched in behavioral, cultural, and religious practices. Unless explicit measures are taken to address these divides, there is a risk that ICT will increase gender disparities and that the impact of ICTs will not be maximized. Integrating gender considerations into ICT strategies and policies will enable policy-makers and implementers to address these differences, which in turn will lead to remove gender inequalities for ICTs use and access (The Commonwealth of Learning, 1998, 1999, 2000, 2001).

BACKGROUND

ICTs bring the promise of new and better jobs and businesses for women, fuller participation in the political process, communication with worlds outside the boundaries of home and community, easy access to information and resources that can change lives, and the ability to acquire education and skills and to transcend social restrictions. These all can empower and enhance the quality of women's lives in developing countries. The Internet and other ICTs are proving to be a powerful tool to empower women to inform and change global and local realities. The opportunities and the benefits as well as the challenges of new information and communication technologies, as a tool of communication and knowledge transfer to support development and advancement of women in social and economic arenas are proving critical to women's networking and political action around the world. Considering odds against women taking part in the information super highway, women's groups and even poor communities are making full use of the Internet to defend and advocate for their rights. A key strategy for women's empowerment, especially in marginal and poor communities, is to give women access to new information technology in appropriate ways that support women's everyday work and help them fight for and defend their human, social, economic and political rights (Green & Trevor, 2002).

Even as the power and potential of these technologies are recognized and celebrated in most policy circles, the fact remains that unless the poor and marginalized are actively involved they will remain marginalized. Hence, there is a need for actions that are explicitly aimed at introducing the poor/marginalized, of which women are the majority, to these technologies. The gender gap in the digital divide is of increasing concern; if access to and use of these technologies is directly linked to social and economic development, then it is imperative to ensure that women in developing countries understand the significance of these

technologies and use them. If not, lack of access to information and communication technologies becomes a significant factor in the further marginalization of women from the economic, social, and political mainstream of their countries and the world. Unless women are provided effective access to ICTs, they will be left behind in their participation in the global world of the twenty-first century.

BARRIERS FOR WOMEN OF ICT USE AND ACCESS

Most women in developing countries who use information technology use it at work. Except in upper-income enclaves, home access to a computer and the Internet is not a common. E-mail is the major ICT application that women in developing countries use. Also, since women are given roles to manage the home and kids and their school tasks, women find very little time to use ICTs for any recreational or communication purposes (Ranchod, 2000). Broadly speaking, the barriers to women's use of ICTs have been:

- General literacy and language
- Lack of technical training
- Lack of access to hardware, software or access to the technologies
- Cost of connections still high for the lower income women
- General “technophobia” among women
- Social and cultural barriers—women are still the primary care-takers for their children and carry the bulk of household responsibilities, therefore have less time to explore the uses of new ICTs
- Full Internet access is limited in the academic sector and in corporations to those who hold managerial and/or technical posts, and the number of women in these positions is relatively small compared to men

Many of these barriers arise directly from the status of national illiteracy levels and national connectivity information infrastructure. However, systemic problems of general illiteracy combined with infrastructural barriers work against women. Some of these barriers are described in detail in the next section.

Cultural Barriers

Cultural and social attitudes often discriminate against women's participation in the fields of science and technology and limit their opportunities in the area of ICT. In several countries, the most binding constraint to the diffusion of ICT is often not technology *per se*, but the culture surrounding the use of information in general. In some countries, the benefits of an open information culture, including direct exchanges among citizens, between citizens and government and internationally, has not percolated yet to a critical mass capable of creating substantial upstream changes. De-learning old habits is probably needed before embracing new ICT. Most women will not perceive the benefits of ICTs, nor will they be able to use them to their full potential, unless they can see an immediate benefit or result of participation in ICTs.

Language

Language usage also plays an important role. Although some regional information mechanisms have been created and are being maintained today, the languages used are primarily English. This exacerbates the hub-and-spoke effect. A number of initiatives are taking place to facilitate the use of ICT in local languages but so far, numbers are far behind. Lack of standardization, limits the use of the local language. English is the established language of the Internet. English is used among the more educated members of the society in India. Non-English speaking women find it hard to use ICTs due to language barriers.

Financial and Budgetary Constraints

Women are often financially dependent upon men or do not have control over household expenditures. This makes accessing ICT services more difficult. In some countries, women's seclusion from the public arena makes accessing community Internet centers difficult. The prohibitive costs are a major constraint. The costs involve the purchase of the necessary equipment, obtaining and maintaining connectivity, and usage charges.

While many women may be interested in using and accessing the Internet, the cost limit constrains them. Aside from budgetary constraints, women cited internal constraints such as culture, and attitudes.

Telecommunication Infrastructure

The majority of women who have access today for ICTs are from research institutions, governments, and some businesses. Access among poorer and rural classes is currently non-existent, but critical for women's development. The benefits from ICTs and the adverse effects that might ensue from not accessing them cannot be embraced without adequate telecommunication infrastructure. Under-developed telecommunication infrastructure remains an important impediment to the expansion of ICT use in most countries. While computer prices have declined closer to international standards, telecommunications continue to be both costly and of limited availability. In India, all electronic media, ranging from satellite television to e-mail and the Internet, are accessible only to the privileged classes and cater almost exclusively to their predominantly male culture.

Illiteracy

Given the low levels of literacy (reading and writing), let alone computer literacy in many developing countries, the opportunities presented by new digital information systems are a long

way from reaching the hands and eyes of the majority. ICT is not the answer in itself to poverty and social exclusion—design of applications, accessibility of 'access points', and the design and delivery of training in ways adapted to women's needs, concerns and purposes for usage will determine whether and how they are used by women. Approaches to training women to use ICTs need to be appropriate to their interests and usage. Women also have awareness barriers for use and access of ICTs. There are three types of awareness issues that act as obstacles to women's use of communication technologies: awareness of personal ability, awareness of the utility of communication technologies, and awareness of available resources.

Education and Training Skills Barriers

A fundamental barrier to women's use of ICTs in developing countries is illiteracy. The danger in such a situation is that ICTs will widen and deepen the gap between the haves and have-nots as economies become more and more information-based. Inequitable allocation of education and training resources often favors boys and men. Education and training opportunities are not available in developing countries to educate women in use and access of ICTs. Women are marginalized in accessing education and training due to cost and access factors resulting in tremendously uneven IT skills between men and women. Most of the women's IT skills are self-learned. Although there may be ICTs training facilities, few women take advantage of these courses due to a variety of reasons: high fees, a feeling of intimidation in joining male-dominated courses that are moreover often taught by male trainers, and the ever present demands of family responsibilities.

Measures to be Taken by Policy Makers

In order to ensure women's ability to take advantage of opportunities presented by ICTs,

gender and development policy makers need to be sensitized to ICT issues. Proactive policies and programs that meet the needs of women for use and access of ICTs. Matching the most appropriate communications technology with people's needs and capabilities is a crucial task for ICT providers. Steps must be taken to address the needs of languages and cultures through longer-term vision to make all ICTs accessible to women. This will involve significant investment and support for local content (in broadcasting and the Internet) and software design.

Increasing women's access to information and communication technologies in developing countries involves increasing availability of communication in areas where women live, most women in developing countries live in presently underserved areas. Extension of infrastructure, particularly wireless and satellite communications, to rural areas and semi-urban areas is crucial to increasing women's access to information technology. Emphasis needs to be on common use facilities, such as tele-centers, phone shops, and other forms of public access in places convenient and accessible to women. The policy makers should devise policies to improve the ability of girls and women using ICTs in developing countries. Such improvement requires interventions at all levels of education. A key strategy for women's empowerment, especially in marginal and poor communities, is to give women access to new information technology in appropriate ways that support women's everyday work and help them fight for and defend their human, social, economic and political rights. The use and access of ICTs offer many new opportunities for women in developing countries a lifeline for economic, social, and political empowerment. ICTs can be empowering for individual women and for women taking collective action. This requires core funding for women's organizations as well as investment in equipping them with ICT resources (Unpublished manuscript, 2002).

Costs are a significant barrier to usage and training for poor women, for whom household

needs will always be a first priority. All costs associated with access and training must therefore be met: transport, appropriate childcare, and/or disability or elder care, and making appropriate practical arrangements to accommodate other needs. If proper diffusion strategies are adopted for ICTs, with women in focus, they can certainly meet women's basic needs and access to resources. Removing barriers to women's ICT access offers potential to connect low income women to the democratic process, improve their access to services and resources, and strengthen their roles as community net workers (Accascina, 2001; Marcelle, 2000; The Commonwealth of Learning, 1998, 1999, 2000, 2001).

Since cost, technology expertise, repair and infrastructure issues will ensure that ICTs stay out of the reach of most individuals for the foreseeable future, alternative systems of access, delivery and information will need to be developed that are more appropriate to the situation of women. This is especially true for women, who tend to have less economic power, training, and technical expertise.

FUTURE TRENDS

Growing numbers of girls and women are doing things previously presumed to be the preserve of boys and men—computer enthusiasts, game players and, in some places, computer science courses. The ICT sector in many countries, including developing countries, is contributing to increased employment and economic opportunities for women. For instance, in the Kerala Technopark in India, women form nearly 40% of the computing work force. ICT allows access to a global market for even a small business with minimum initial investment. ICT, therefore, provides a unique opportunity to promote the growth of women-run small businesses. Women compose a significant share of micro, small, and medium entrepreneurs in developing countries. In order

for them to participate in the new knowledge-based economy, appropriate training and support to use ICTs are needed. The policy makers need to include women in policy dialogue and provide them women-friendly ICT access infrastructure. They should be provided training and testing in a structured, culturally-acceptable environment. More number of success stories of women using ICTs need to be prepared where they can be depicted as role models for young girls. Role of ICT in building positive role models is very crucial. Especially in the context of the Middle Eastern region where access to ICT has a strong male bias and Internet cafes are not women-friendly. Apart from government agencies, many other NGOs organizations need to work together to reach to women of different socio-cultural and economic considerations to attract women for participating in ICT projects. Access to loans, credit, and capital remains a barrier in ICT-based entrepreneurial activities among women.

In order to facilitate access for women from all classes and sectors, ICTs will need to be located in local institutions to which women have open and equal access, such as health centers, women's NGOs, women's employment centers, libraries, women's studies departments and institutes, and perhaps even churches. The location in these types of contexts also pertains to the practical, specific kind of information that women require as a result of their time constraints.

REFERENCES

- Accascina, G. (2001). *Information and communication technologies for development in the Arab states overview, considerations, and parallels with Asia*. Director IT4DEV Expert, ICT for Development. UNDP Regional Bureau for Arab States. Retrieved from [http://lnweb18.worldbank.org/mna/mena.nsf/Attachments/ICT+UNDP/\\$File/ICT+Arab+States.pdf](http://lnweb18.worldbank.org/mna/mena.nsf/Attachments/ICT+UNDP/$File/ICT+Arab+States.pdf)
- Alloo, F. (1998). Founder, Tanzania Media Women's Association in the Society for International Development and UNESCO. In *Women in the Digital Age—Using Communication Technology for Empowerment: A Practical Handbook* (p. 14). Society for International Development/UNESCO.
- Cole, A., Conlon, T., Jackson, S., & Welch, D. (1994). Information technology and gender: Problems and proposals. *Gender and education*, 6(1), 77-85.
- The Commonwealth of Learning. (1998). *Barriers to information and communication technologies encountered by women*. Unpublished manuscript. Retrieved from http://www.col.org/wdd/BarriersICT_Asia_papers.pdf
- The Commonwealth of Learning. (1999). *Identifying barriers encountered by women in the use of information and communications technologies for open and distance learning in the Caribbean*. Unpublished manuscript. Retrieved from <http://www.col.org/pcf2/papers%5Cphillips.pdf>
- The Commonwealth of Learning. (2000). *Identifying barriers encountered by women in the use of information and communications technologies for open and distance learning in Africa*. Unpublished manuscript. Retrieved from <http://www.col.org/wdd/>
- The Commonwealth of Learning. (2001). *Identifying barriers encountered by women in the use of information and communication technologies for open and distance learning in the South Pacific*. Unpublished manuscript. Retrieved from <http://www.col.org/wdd/>
- Green, L., & Trevor, D. L. (2002). *Women and ICTs for open and distance learning: Lessons learned from commonwealth countries in the developing world*. Unpublished manuscript.
- Hafkin, N., & Taggart, N. (2001). *Gender, information technology, and developing countries:*

An analytic study. Academy for Educational Development (AED) For the Office of Women in Development Bureau for Global Programs, Field Support, and Research United States Agency for International Development.

Marcelle, G. M. (2000). *Transforming information & communications technologies for gender equality.* Gender in Development Monograph Series #9.

Nath, V. (2001). *Empowerment and governance through information and communication technologies: Women's perspective.* International information & library review online. Retrieved from <http://www.idealibrary.com>

Pacific Institute for Women's Health. (2002). *Women connect! The power of communications to improve women's lives. Communications capacity building for African women's NGOs.* Pacific Institute for Women's Health. Retrieved from <http://www.piwh.org/pdfs/wc2002.pdf>

Ponniah, G., & Reardon, R. (1999). Women's labor in Bangladesh and Sri Lanka: The trade off in technology. *Gender, Technology and Development*, 3(1), 95-97.

Ranchod, S. (2000). *Information and communication technologies for women's equality: Access and empowerment issues—An NGO perspective.* Delivered to Global Knowledge II Women's Forum, Kuala Lumpur, Malaysia. Retrieved from http://www.globalknowledge.org.my/GKII_Women_Forum_FinalReport.doc

Tandon, N. (1998). *A survey of gender differentials in access to information and communication technologies.* Unpublished manuscript. Retrieved from <http://www.col.org/wdd/>

Unpublished manuscript. (2002). *The power of communications to improve women's lives Pacific*

Institute for women's health 2002. A report on women and information and communication technologies (ICTs) Women Connect@CDF, London, July 1999. Retrieved from <http://www.rcss.ed.ac.uk/sigis/public/backgrounddocs/woman.pdf>

World Bank Report. (2002, February). *ICT & gender—Equitable access to information and communication is fundamental for maximizing the impact of ICT.* Gender and Development Group, PREM, World Bank.

KEY TERMS

Digital Divide: The digital divide is the disparity in access to technology that exists across certain demographic groups. A term used to describe the discrepancy between people who have access to and the resources to use new information and communication tools, such as the Internet, and people who do not have the resources and access to the technology. The term also describes the discrepancy between those who have the skills, knowledge, and abilities to use the technologies and those who do not.

ICTs: ICTs include telecommunications technologies, such as telephone, cable, satellite, and radio, as well as digital technologies, such as computers, information networks, Internet and software.

Information Infrastructure: Information infrastructure refers to all telecommunications and computer networks world-wide to store, process, and disseminate information. The Internet is considered the de facto global information infrastructure right now.

Internet: The Internet is a worldwide communications network originally developed by the U.S. Department of Defense as a distributed

Gender Inequalities for Use and Access of ICTs in Developing Countries

system with no single point of failure. It is a system of interconnected networks that electronically links computers from around the world via the TCP/IP protocol.

Literacy: There are no universal definitions and standards of literacy. Unless otherwise specified, all rates are based on the most common definition—the ability to read and write at a specified age.

This work was previously published in the Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 643-648, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.34

WSIS Gender and ICT Policy

J. Ann Dumas

The Pennsylvania State University, USA

INTRODUCTION

The World Summit on the Information Society (WSIS) was organized by the United Nations (UN) and the International Telecommunications Union to address the need for international policy and agreement on ICT governance, rights, and responsibilities. It convened in two phases: Geneva in 2003 and Tunis in 2005. International representatives of governments, businesses, and civil society raised issues, and debated and formed policy recommendations. The WSIS Gender Caucus (2003) and other civil-society participants advocated for gender equality to be included as a fundamental principle for action and decision making. The voting plenary session of delegates produced the *WSIS Declaration of Principles* (UN, 2003a) and *WSIS Plan of Action* (UN, 2003b) in Geneva, with gender included in many of the articles.

Two major issues WSIS addressed in Geneva and Tunis were Internet governance and the Digital Solidarity Fund. UN secretary general Kofi Annan established the Working Group on Internet Governance (WGIG) to define Internet and Internet governance to “navigate the complex

terrain” (GKP, 2002, p. 6) and to make recommendations for WSIS in Tunis in 2005. WGIG addressed three Internet-governance functions: technical standardization; resources allocation and assignment, such as domain names; and policy formation and enforcement, and dispute resolution. Relevant issues not initially addressed by WGIG included gender, voice, inclusiveness, and other issues rooted in unequal access to ICT and to the decision-making process including governance, now shaping the information society. On February 23, a joint statement on Internet governance was presented in Geneva at the Tunis Prepcom by the Civil Society Internet Governance Caucus, the Gender Caucus, Human Rights Caucus, Privacy Caucus, and Media Caucus on behalf of the Civil Society Content and Themes Group. The statement asserts, “gender balanced representation in all aspects of Internet Governance is vital for the process and for its outcomes to have legitimacy” (WSIS Gender Caucus, 2005a).

The Digital Solidarity Fund was proposed at WSIS, and the UN Task Force on Financial Mechanisms for ICT for Development was formed. In the 1990s, official development-assistance (ODA) support declined for ICT infrastructure develop-

ment. In the new millennium, this decline has been offset by funds to integrate ICT programs into development (Hesselbarth & Tambo, 2005). The WSIS Gender Caucus (2003) statement on financing mechanisms affirmed that ICT for development must be framed as a development issue, “encompassing market-led growth but fundamentally a public policy issue.” Public finance is central to achieving “equitable and gender just outcomes in ICT for development.”

This article examines the WSIS political dynamics over the issue of gender equality as a fundamental principle for action in ICT policy. The WSIS civil-society participants, particularly the Gender Caucus, continued to advocate for gender equality as a fundamental principle for action and decision making within the multiple-stakeholder WSIS process of government delegates and private-sector representatives.

BACKGROUND

The WSIS Gender Caucus was formed at the 2002 WSIS African regional preparatory meeting. The WSIS Gender Caucus presented the following six recommendations for action to the WSIS voting plenary session in the spirit of “creating richness in the information society through inclusion, diversity and gender equality.” Gender equality must be a fundamental principle for action. There must be equitable participation in decisions shaping the information society. New and old ICTs must be accessed in a multimodal approach. ICTs must be designed to serve people. ICT empowerment for women and girls is necessary for full participation. Research analysis and evaluation must guide action. These recommendations helped inform the development of the WSIS platform for action.

Many civil-society representatives lobbied the voting delegates for the inclusion of gender equality as a fundamental principle for action in ICT policy. The WSIS Gender Caucus, the NGO Gender Strategies Working Group (NGOGSWG),

and other representatives to WSIS advocated for gender equality, basing arguments on the precedent agreements of the *Universal Declaration of Human Rights* (UDHR of 1948), Convention on the Elimination of all Forms of Discrimination against Women (CEDAW; UN Commission on the Status of Women, 1979), the Beijing Platform for Action (BPFA; UN, 1995), and the Millennium Development Goal commitments of 2000.

Global Knowledge Partnership (GKP) helped to structure and coordinate the WSIS civil-society participants at WSIS in the ICT4D civil-society forum. GKP (2002) made recommendations to the digital opportunity task force, an initiative of the G8 nations in 2000, to expand the “digital revolution” to the underserved, particularly women, rural residents, and youth in developing areas. Gender inclusion and mainstreaming were recommended:

GKP experience suggests that gender mainstreaming should be a component of every ICT project to ensure sustainability. A gender perspective must be built into plans, policy and practice, from preliminary project design through implementation and evaluation. The following case studies show that women who are involved in meaningful ICT projects improve their economic and/or social well being in the community. (GKP, 2002, p. 6)

The WSIS Gender Caucus and the NGOGSWG gender advocacy produced results in the documents of the Geneva phase of WSIS. The *WSIS Declaration of Principles* states that the common vision of the information society includes the Millennium Development Goal (MDG) challenges: “promotion of gender equality and empowerment of women; reduction of child mortality; improvement of maternal health” (ITU, 2005, p. 9).

The documents state that gender equality and sustainable social and economic development are crucial for an equitable information society. Civil-society involvement is acknowledged as key to creating broad-based acceptance and therefore

sustainable policy and plans for the information society. Civil society has also developed significant content and provision for a critical perspective. The *WSIS Plan of Action* calls for the removal of gender barriers and the development of gender-sensitive capacity building, e-learning and e-health, and early intervention programmes in science and technology that “target young girls to increase the number of women in ICT careers” (ITU, 2005, p. 45).

The WSIS Gender Caucus contributed to the UN Commission on the Status of Women’s Beijing +10 review of the platform for action. Section J: Women and Media called for gender equality in media creation and delivery. The caucus reported on how radio, telecenters, and teleconferencing had enabled experts to share knowledge with rural women in agriculture and to respond to information needs. The caucus stressed the value of these ICTs in helping to deliver services to women in health, education, agricultural extension, law, and social justice. Women’s participation helps to ensure that women benefit. Women can demand more accountable governance with transparent information access, and can participate more fully informed in public discourse. ICT can help empower women as development tools for better business, education, and governance participation. All the new ICTs and media provide connection and networking spaces where women can find voice, own and control information and knowledge, and tackle issues of everyday life, sometimes in new and innovative ways (United Nations Research Institute for Social Development [UNRISD], 2005).

Economic disempowerment and illiteracy are major issues of gender inequality that impact ICT in policy and practice. Two thirds of the world’s poor and undereducated are women. Even among the 55 countries with the highest United Nations Development Program (UNDP) Human Development Index (HDI), the ratio of estimated female to male earned income ranged between 34:100

and 74:100. Sweden was the lone exception with a ratio of 82:100. The United States ratio was 62:100 (UNDP, 2004). The income disparities exist despite the fact that gross tertiary enrollment is higher for females than males in all but six of these countries. The equalized education and training of women where it occurs has not yet equalized the ICT-sensitive process of input to the world’s knowledge resources. Political representation by women has grown since 1990, but for the 55 top HDI countries, the percentage of positions in government held by women still ranges between 0 and 38%. Sweden again was the exception with 45% women in parliament (UNDP, 2004).

Most development research and policy recommends reduced birthrates, found to promote infant and maternal health. Smaller families and improved health allow women more time for education and employment. Gender-equality advocates lobby for ICT skills training for jobs that offer women opportunities for growth from unskilled labor to small-business entrepreneurial efforts, such as the agriculture and cottage industry.

Gender-equality issues in ICT received mention in the WSIS documents, but only nominal attention in the ongoing WSIS process of policy development for Internet governance and financing mechanisms, key issues of the WSIS Tunis phase. UNIFEM continues to fund the WSIS Gender Caucus and efforts to bring greater gender equality to the information society through research, education, and policy decision making.

The WSIS Gender Caucus identified six policy issues during WSIS Geneva, and some were incorporated in the two WSIS documents. By 2005, WGIG had virtually sidelined the gender-equality issue as a fundamental principle for action without mention in the draft report to the UN secretary general. The caucus issued a statement for the June 2005 WGIG open consultation on Internet governance and the report draft:

We believe that the published WGIG outcome criteria lack the basic and fundamental criterion of gender balance and awareness and suggest that these criteria be amended to become

- *equitable distribution of resources,*
- *access for all,*
- *stable and secure functioning of the Internet,*
- *multilingualism and*
- *gender balance and equity*

... We further request that the WGIG consider gender balance as a fundamental issue in its ongoing assessment of Internet Governance mechanisms (current and future), with the aim of equal representation of women and men at all levels in any and all governance mechanisms proposed by the WGIG. (WSIS Gender Caucus, 2005a)

Sabanes Plou (2003) identified patriarchal structures that perpetuate gender-unequal power relations in the media, in ICT research and development, and in ICT labor and policy. Plou examined gender issues of ICT access, participation, and decision making in the information society. Media are the “vehicle for transmission of ideas, images and information,” and new media need “new patterns with a gender perspective” to challenge old patterns of control and decision making on access and content (p. 16).

Though ICT labor has been a source of economic growth for some, overall, women work in less skilled, lower paid, and non-decision-making positions in ICT (UNRISD, 2005). ICT access and participation depend on policy and action to address the primary gendered obstacles. Poverty requires affordable ICT. Illiteracy requires education and capability building, and a gendered approach to ICT integration into human communication systems. Patriarchal institutional structures of political, social, and economic power and relationships will continue in ICT without

policy and action initiatives for change toward gender equality at all institutional levels.

FUTURE TRENDS

UNIFEM affirmed and supported the WSIS Gender Caucus’ continued efforts to provide policy input for the development of Internet governance and the Digital Solidarity Fund financial mechanism for WSIS Tunis. UNIFEM also supported the WSIS Gender Caucus’ cooperative work on ICT gender advocacy with the WSIS NGOOSWG, the Association for Progressive Communications (APC), the World Association of Community Radio Broadcasters (AMARC), the WIN network, which coordinated the WSIS media pool, and the Global Knowledge Partnership, which coordinated civil-society WSIS participation in major WSIS process meetings.

WSIS Gender Caucus achievements during the Geneva phase of WSIS were summarized at the closing plenary session (Marcelle, 2003). The caucus advanced some important research trends including support for gender and ICT research, encouraging increased gender-disaggregated-data collection and analysis. Critical gender analysis of the ICT policies of institutions was also encouraged as another important research area. The idea of developing an archive of gender and ICT research was advanced. The caucus organized events and activities in Geneva “enabling decision makers to interact with gender advocates and scholars on alternative visions of the information society” (Marcelle). Current research and expert perspectives were shared throughout WSIS with plans for a post-WSIS “global platform for reporting back to the development community and women’s organizations” (Marcelle) in order for governments to be held accountable for the commitments made during WSIS.

Case studies of ICT for development projects that contribute to poverty elimination for women,

men, and children are also part of the ongoing research catalyzed by gender advocacy at WSIS. These include projects on “women’s applications of ICTs for mobilization, peace and conflict resolution, enterprise creation, trade, education, and health” (Marcelle, 2003).

During WSIS, UNIFEM announced the Digital Diaspora Initiative set up with an E-Quality Fund for African Women and Innovation to provide flexible funding for African women to have opportunities for capacity development and economic security in the information society.

Beyond the concrete WSIS direct outcomes, civil-society participants developed strong networks for information sharing and knowledge building through face-to-face and ICT communication forums. The WSIS Gender Caucus developed its portal (<http://www.genderwsis.org>) containing useful resources on gender-equality research and advocacy in ICT, and expanded its communications and outreach network.

The WSIS Gender Caucus, a committed group of gender advocates, continued to work with all stakeholder partners, including “governments, international agencies, the private sector and civil society ... to build an Information Society that benefits all of humanity” (Marcelle, 2003). WSIS Gender Caucus efforts support ongoing policy and action committed to gender equality and ICT applications that further the BPFA and MDGs.

The UN ICT Task Force has been “a global forum for placing ICT at the service of development” (Gilhooly, 2005) since 2001. Its mission and action plan were built on the guidance of the Millennium Declaration. It helped advance the multistakeholder discussion on Internet governance. The ICT Task Force helped to create an enabling environment toward the MDGs and to advance the practice of measuring, monitoring, and analyzing ICT impact on the MDGs. It developed an ICT strategy for knowledge creation and promoted cross-sectoral and cross-regional dialogues and partnerships. This included strengthening rela-

tionships with the research scholarship organizations International Communications Association (ICA) and International Association of Media and Communications Researchers (IAMCR). The ICT Task Force mandate was extended to 2005 to facilitate the WSIS process.

The ITU Task Force on Gender Issues (ITU-TFGI) has advanced the issues of gender mainstreaming and gender-disaggregated ICT data collection. ITU-TFGI also developed gender-aware guidelines for policy-making and regulatory agencies. The guidelines promote the establishment of gender units in regulatory bodies, gender-sensitive policy analysis, and gender-disaggregated data collection (Jorge, 2001). Research identified that women are “conspicuously absent from decision making structure in information technology in developed and developing countries” (Hafkin, 2003, p. 4), and recommended action to address the inequity.

The many cooperative gender-equality advocacy efforts have contributed to the WSIS decision making and created a policy for change. The future will unfold how these policy agreements will interact with patriarchal institutions over time to bring about real change in practice and real access to ICT with gender equality.

CONCLUSION

WSIS affirmed the MDGs to end poverty and illiteracy, two main obstacles to ICT access for women. International case studies affirm in practice how ICT applications have improved resource and service distribution for health care, education, economic empowerment, conflict resolution, and political, social, and cultural participation.

Gender equality in ICT access, power sharing, and decision making at all levels will continue as issues for dialogue, debate, and research. Active, perseverant voices for change call for humanizing the technology beyond market-economy indicators and creating an environment of cooperation

and sharing rather than competition and modification.

The argument for gender rights and equality in decision making for the information society continues to be advanced through many advocates and venues beyond WSIS. The importance of decision making was articulated well by Nobel Peace Prize winner and world leader Nelson Mandela (2004):

Our freedom and our rights will only have their full meaning as we succeed together in overcoming our divisions and inequalities of our past and in improving the lives of all, especially the poor. Today we are starting to reap some of the harvest we sowed at the end of a South African famine. Many...have spoken of a miracle. Yet those who have been most closely involved in the transition know it has been the product of human decision.

WSIS, gender, and ICT policy are integrally connected within the process of human decision making, capable of creating a world of gender justice, equality, and peace.

REFERENCES

- Gender Working Group-UNCSTD. (1995). *Missing links: Gender equity in science and technology for development*. Ottawa, Ontario, Canada: International Development Research Centre.
- Gilhooly, D. (Ed.). (2005). *Creating an enabling environment toward the Millennium Development Goals: Proceedings of the Berlin global forum on the United Nations ICT Task Force* (Document No. E/2005/71). New York: United Nations. Global Knowledge Partnership (GKP). (2002). *GKP recommendations: On issues of bridging the digital divide*. Kuala Lumpur, Malaysia: Author.
- Hafkin, N. (2003). *Some thoughts on gender and telecommunications/ICT statistics and indicators* (Document No. WGGI-2/7-E). Retrieved July 11, 2005, from <http://www.itu.int/ITU-D/gender>
- Hamelink, C. (2001). *ICT and social development: The global policy context*. Retrieved April 3, 2005, from <http://www.unrisd.org>
- Haqqani, A. B. (Ed.). (2004). *The role of information and communications technologies in global development: Analysis and policy recommendations* (Series 3). New York: United Nations ICT Task Force.
- Hesselbarth, S., & Tambo, I. (2005). Financing ICTs for development: Recent trends of ODA for ICTs. In D. Gilhooly (Ed.), *Creating an enabling environment toward the Millennium Development Goals: Proceedings of the Berlin global forum on the United Nations ICT Task Force* (Document No. E/2005/71, pp. 115-129). New York: United Nations.
- International Telecommunications Union (ITU). (2005). *WSIS outcome documents*. Geneva, Switzerland: Author. Retrieved March 3, 2006, from <http://www.int.itu/WSIS>
- Internet Governance Project. (2004). *Internet governance: The state of play*. Retrieved April 3, 2005, from <http://www.InternetGovernance.org>
- Jorge, S. (2001). *Gender-aware guidelines for policy-making and regulatory agencies* (DOC TFGI-4/5 E. ITU-BDT). Retrieved July 11, 2005, from <http://www.itu.int/ITU-D/gender>
- King, E., & Mason, A. (2001). *Engendering development: Through gender equality in rights, resources, and voice*. Washington, DC: World Bank.
- Mandela, N. (2004). Diversity: From divisive to inclusive. In *UNDP human development report* (p. 43). New York: United Nations.
- Mansell, R., & Wehn, U. (1998). *Knowledge societies: Information technology for sustainable development*. New York: Oxford University Press.

Marcelle, G. (2003). *Statement of the WSIS Gender Caucus to the WSIS plenary*. Retrieved July 8, 2005, from <http://www.itu.int>

Marcelle, G. (2005). *Technological learning: A strategic imperative for firms in the developing world*. Cheltenham, UK: Edward Elgar.

Marcelle, G., Karelse, C. M., & Goddard, G. (2000). *Engendering ICT policy: Guidelines for action*. Pretoria, Republic of South Africa: African Information Society-Gender Working Group.

Plou, D. S. (2003). What about gender issues in the information society? In B. Girard & S. O'Soichru (Eds.), *Communicating in the information society* (pp. 11-32). Geneva, Switzerland: United Nations Research Institute for Social Development (UNRISD).

United Nations. (1995). *The Beijing declaration and the platform for action: Fourth world conference on women*. New York: United Nations Department of Public Information.

United Nations. (2003a). *WSIS declaration of principles* (WSIS-03/GENEVA/DOC/4). New York: United Nations Department of Public Information.

United Nations. (2003b). *WSIS plan of action* (WSIS-03/GENEVA/DOC/5). New York: United Nations Department of Public Information.

United Nations Commission on the Status of Women. (1979). *Convention on the elimination of all forms of discrimination against women* (CEDAW). New York: UNIFEM.

United Nations Development Program (UNDP). (2004). *Human development report 2004*. New York: UNDP.

United Nations Economic and Social Council. (2005). *Third annual report of the Information and Communications Technologies Task Force* (Document No. E 2005/71). New York: United Nations.

United Nations Research Institute for Social Development (UNRISD). (2005). *Gender equality: Striving for justice in an unequal world*. Geneva, Switzerland: Author.

World Summit on the Information Society (WSIS) Gender Caucus. (2003). *Gender Caucus position on financing mechanisms*. Retrieved July 8, 2005, from <http://www.genderwsis.org>

World Summit on the Information Society (WSIS) Gender Caucus. (2005a). *Statement by the Civil Society Internet Governance Caucus, the Gender, Human Rights, Privacy and Media Caucuses on behalf of the Civil Society Content and Themes Group*. Retrieved July 8, 2005, from <http://www.genderwsis.org>

World Summit on the Information Society (WSIS) Gender Caucus. (2005b). *Statement by the Gender Caucus*. Retrieved July 8, 2005, from <http://www.wgig.org>

KEY TERMS

Beijing Platform for Action (BPFA): Action program produced during the 1995 Beijing Fourth World Conference on Women. The BPFA defined strategic objectives for action in 12 areas identified as essential to developing gender equality and compliance with the 1979 Convention on the Elimination of all Forms of Discrimination against Women. Global progress on the BPFA was reported at the 2000 Beijing +5 United Nations General Assembly Special Session (UNGASS) and the 2005 Beijing +10.

G8: Group of eight nations with the strongest economies, including, Canada, France, Germany, Italy, Japan, Russia, the United Kingdom, and the United States.

Human Development Index (HDI): An index used by the United Nations Development Program to measure development. HDI is composed of health indicators, infant and maternal mortality

and life expectancies, education indicators of literacy, and economic indicators of gross domestic product (GDP).

NGO Gender Strategies Working Group: Formed at the first WSIS Prepcom Meeting in Geneva in July 2002 as one of the subcommittees of the Civil Society Coordinating Group (CSCG). The groups currently involved in this effort are the African Women's Development and Communications Network (FEMNET), Agencia Latino Americana de Informacion, Association for Progressive Communication-Women's Networking Support Programme (APC-WNSP), International Women's Tribune Centre (IWTC), and Isis International-Manila. The working group is open to all NGOs and individuals interested in gender issues and the information society (<http://www.wougnet.org/WSIS/wsisgc.html>).

WSIS: The World Summit on the Information Society is a two-phase international summit from 2003 to 2005 organized by the United Nations and the International Telecommunications Union to address the need for international policy and agreement on ICT governance, rights, and responsibilities.

WSIS Declaration of Principles: It affirms gender equality and other MDGs:

Our challenge is to harness the potential of information and communication technology to promote the development goals of the Millennium Declaration, namely the eradication of extreme poverty and hunger; achievement of universal primary education; promotion of gender equality and empowerment of women; reduction of child mortality; improvement of maternal health; to combat HIV/AIDS, malaria and other diseases; ensuring environmental sustainability; and development of global partnerships for development for the attainment of a more peaceful, just and prosperous world. (ITU, 2005, p. 9)

WSIS Gender Caucus: Formed during the WSIS African Prepcom in Bamako in 2002 when representatives of organizations responded to an invitation by UNIFEM to contribute to ensuring that gender dimensions are included in the process of defining and creating a global information society that contributes to sustainable development and human security; they issued the WSIS Gender Caucus Bamako Statement (<http://www.genderwsis.org>).

This work was previously published in the Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 1318-1324, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 1.35

Gender ICT and Millennium Development Goals

J. Ann Dumas

The Pennsylvania State University, USA

INTRODUCTION

Gender equality and information and communication technology are important in the achievement of the Millennium Development Goals (MDGs) in policy, planning, and practice. The 2000 Millennium Declaration of the United Nations (UN) formed an international agreement among member states to work toward the reduction of poverty and its effects by 2015 through eight Millennium Development Goals:

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and the empowerment of women
4. Reduce child and maternal mortality
5. Improve maternal health care
6. Combat HIV and AIDS, malaria, and other major diseases
7. Ensure environmental sustainability
8. Develop global partnership for development

Progress toward gender equality and the empowerment of women is one goal that is important to achieving the others. Poverty, hunger, illiteracy, environmental threats, HIV and AIDS, and other health threats disproportionately affect the lives of women and their dependent children. Gender-sensitive ICT applications to education, health care, and local economies have helped communities progress toward the MDGs. ICT applications facilitate rural health-care workers' access to medical expertise through phones and the Internet. Teachers expand learning resources through the Internet and satellite services, providing a greater knowledge base for learners. Small entrepreneurs with ICT access and training move their local business into world markets.

ICT diffusion into world communication systems has been pervasive. Even some of the poorest economies in Africa show the fastest cell-phone growth, though Internet access and landline numbers are still low (International Telecommunications Union [ITU], 2003b). ICT access or a lack of it impacts participation, voice,

Gender ICT and Millennium Development Goals

and decision making in local, regional, and international communities.

ICTs impact the systems that move or inhibit MDG progress. UN secretary general Kofi Annan explained the role of the MDGs in global affairs:

Millennium Development Goals are too important to fail. For the international political system, they are the fulcrum on which development policy is based. For the billion-plus people living in extreme poverty, they represent the means to a productive life. For everyone on Earth, they are a linchpin to the quest for a more secure and peaceful world. (UN, 2005, p. 28)

Annan also stressed the critical need for partnerships to facilitate technology training to enable information exchange and analysis (UN, 2005). ICT facilitates sharing lessons of success and failure, and progress evaluation of work in all the MDG target areas.

Targets and indicators measuring progress were selected for all the MDGs. Gender equality and women's empowerment are critical to the achievement of each other goal. Inadequate access to the basic human needs of clean water, food, education, health services, and environmental sustainability and the support of global partnership impacts great numbers of women. Therefore, the targets and indicators for Goal 3 address females in education, employment, and political participation. Progress toward the Goal 3 target to eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015, will be measured by the following indicators.

- Ratio of girls to boys in primary, secondary, and tertiary education
- Ratio of literate females to males who are 15- to 24-year-olds
- Share of women in wage employment in the nonagricultural sector

- Proportion of seats held by women in national parliaments (World Bank, 2003)

Education is positively related to improved maternal and infant health, economic empowerment, and political participation (United Nations Development Program [UNDP], 2004; World Bank, 2003). Education systems in developing countries are beginning to offer or seek ways to provide ICT training as a basic skill and knowledge base.

Proactive policy for gender equality in ICT access has not always accompanied the unprecedented ICT growth trend. Many civil-society representatives to the World Summit on the Information Society (WSIS) argue for ICT access to be considered a basic human right (Girard & Ó Soichrú, 2004; UN, 1948).

ICT capability is considered a basic skill for education curriculum at tertiary, secondary, and even primary levels in developed regions. In developing regions, ICT access and capability are more limited but are still tightly woven into economic communication systems. ICTs minimize time and geography barriers.

Two thirds of the world's poor and illiterate are women (World Bank, 2003). Infant and maternal health are in chronic crisis for poor women. Where poverty is highest, HIV and AIDS are the largest and fastest growing health threat. Ninety-five percent of people living with HIV and AIDS are in developing countries, partly because of poor dissemination of information and medical treatment. Women are more vulnerable to infection than men. Culturally reinforced sexual practices have led to higher rates of HIV infection for women. Gender equality and the empowerment of women, starting with education, can help fight the spread of HIV, AIDS, and other major diseases. ICT can enhance health education through schools (World Bank).

Some ICT developers, practitioners, and distributors have identified ways to incorporate gender inclusiveness into their policies and practice

for problem-solving ICT applications toward each MDG target area. Yet ICT research, development, education, training, applications, and businesses remain male-dominated fields, with only the lesser skilled and salaried ICT labor force approaching gender equality. Successful integration of gender equality and ICT development policy has contributed to MDG progress through several projects in the developing regions. Notable examples are the South-African-based SchoolNet Africa and Bangladesh-based Grameen Bank Village Pay Phone. Both projects benefit from international public-private partnerships. These and similar models suggest the value and importance of linking gender equality and empowerment with global partnership for development, particularly in ICT.

This article reports on developing efforts to coordinate the achievement of the MDGs with policy, plans, and practice for gender equality beyond the universal educational target, and with the expansion of ICT access and participation for women and men. The article examines the background and trends of MDG 3, to promote gender equality and the empowerment of women, with particular consideration of MDG 8, to develop global partnership for development, in ICT access and participation.

BACKGROUND

The United Nations convened the Millennium Summit in September 2000, which produced the Millennium Declaration and eight Millennium Development Goals to eliminate poverty and its effects. Targets were defined for each goal to be achieved by 2015. The evaluation of national progress on each goal has been ongoing since 2000. The UNDP and the Millennium Campaign are affirming national accountability through monitoring progress on the measurable indicators for each target. The UN struggle to uphold human rights to equality and freedom from want

began with its founding mission and the United Nations *Universal Declaration of Human Rights* (UDHR; UN, 1948).

All UN member nations committed to the MDGs and targets developed through the summit. Each nation regularly reports its progress and is accountable for national achievement toward the goals.

The goal of gender equality has been advanced internationally through treaties and agreements. Arguments for gender equality in ICT policy and development were supported by the precedent agreements of the *Universal Declaration of Human Rights* (UN, 1948), the Convention on the Elimination of all Forms of Discrimination against Women (CEDAW; United Nations Commission on the Status of Women [UNCSW], 1979), the Beijing Platform for Action (UN, 1995), and then the Millennium Development Goals declared in 2000.

Development research links gender equality to the MDGs for poverty reduction. Gender equality is linked to the sustainability of development strategies. Policy to promote gender equality through institutional reform can strengthen the sustainability of economic development programs with more equal participation and resource distribution (World Bank, 2003; King & Mason, 2001). A main source of development funds, the World Bank is positioned to provide material support for gender-equality policy. In 2005, the World Summit on the Information Society reached closure with open issues on financial mechanisms, such as the Digital Solidarity Fund to expand digital rights for all.

World Bank (2003) research focused on ICT's role in addressing poverty:

ICTs have enormous potential to reach dispersed and rural populations and provide them with education and training, job opportunities, access to markets, availability of information important to their economic activities and greater participation in the political process. (p. 7)

Gender ICT and Millennium Development Goals

Research was centered on gender-based differences in how ICT was used to enable poor women and men to participate in the world economy. Gender-focused analysis has resulted in a critique of the MDG targets and assessment indications as being too focused on economic issues and not enough on social- and political-justice issues. The goal targets do not address war and domestic violence against women, a significant health threat and factor in social, political, and economic gender exclusion (Ain Tahmina, 2005).

The International Telecommunications Union, one of the earliest international organizations, was formed in 1867 in the early days of telegraph and telephone. Now an agency of the UN, the ITU facilitates the international coordination of telecommunications resources like spectrum and technical standards, and provides a forum for policy making and ICT development. The UN and the ITU convened the World Summit on the Information Society to develop a policy framework for the information society, including Internet governance. The documents *WSIS Declaration of Principles* and *WSIS Plan of Action* clearly link the purpose of ICT policy to the furtherance of the MDGs (UN, 2003a, 2003b). The UN ICT Task Force, the ITU Task Force on Gender Issues, the UNDP, and the Global Knowledge Partnership (GKP), which coordinated the civil-society segment of WSIS, have all addressed the MDGs in their plans, policies, and practice.

The ITU *World Telecommunications Report 2003* examined linkages between ICT and the MDGs, specifically articulated in Target 18 of Goal 8: “in cooperation with the private sector make available the benefits of new technologies, specifically information and communications” (ITU, 2003a, p. 71). Cooperative efforts targeting the goal help advance gender-equal ICT access and participation, and extend communication, information dissemination, and knowledge building to further the process of creating social change.

Gender equality in ICT development helping to advance progress toward MDG achievement

was the idea given at WSIS by gender advocates. The WSIS Gender Caucus (2003) presented six recommendations for action to the WSIS plenary voting session in the spirit of “creating richness in the information society: inclusion, diversity and gender equality.” The following main issues were identified and promoted by the WSIS Gender Caucus. Gender equality must be a fundamental principle for action. There must be equitable participation in decisions shaping the information society. New and old ICTs must be accessed in a multimodal approach. ICTs must be designed to serve people. ICT empowerment for women and girls is necessary for full participation. Research analysis and evaluation must guide action. These recommendations helped inform the development of the WSIS principles and platform for action (WSIS Gender Caucus).

The Global Knowledge Partnership (2002) was a major part of WSIS and recommended the following:

Include everyone in the digital revolution ... expand networks to reach underserved populations ... gender mainstreaming should be a component of every ICT project to ensure sustainability. A gender perspective must be built into plans, policy and practice, from preliminary project design through implementation and evaluation. (p. 10)

GKP recommendations included eight case studies of women involved in meaningful ICT projects that improved their economic and social well-being in developing communities around the globe. GKP recommendations to the Digital Opportunity Task Force suggested nine action points that included “[enhancing] human capacity development, knowledge creation and sharing” (p. 41). Policy goals to advance this action were the increase of Internet use in education, digital literacy with an emphasis on gender balance and youth, distance learning promotion in underserved areas, and the creation of a network of centres of

excellence for research in ICT for development (GKP, 2003).

Chen, Vanek, Lund, Heinz, Jhabvala, and Bonner (2005) reported extensive research on women, work, and poverty, and defined six strategies for intervention into the identified trend of growing and gendered gaps in economic and overall well-being between and within regions:

Generally, women in the informal economy have not had much chance to learn different types of skills. This contributes to the difficulty their organizations have sustaining themselves and influencing employers and policy makers. Building capacity and skills at the grass-roots level through partnerships with other organizations and various supportive agencies can help remedy this. It is also increasingly important for organizations, especially larger ones and networks, to learn how to use communication techniques and modern information technology to link with each other. (p. 85)

The MDG international policy has been challenged as deflecting government attention and resources from CEDAW and the Beijing Platform for Action (BPFA) strategic objectives (Ain Tahmina, 2005).

FUTURE TRENDS

Government efforts toward gender equality and empowerment through ICT receive support through partnerships for development, which bring ICT applications in education, health care, and small business.

SchoolNet Africa is an example of a successful trend in coupling gender equality and empowerment through education with ICT development policy. SchoolNet Africa is an education and ICT model operative in 31 African countries. SchoolNet represents a productive public-private global partnership for development as recommended

in the MDGs. SchoolNet Africa partnered with Microsoft and direct-to-home (DTH) satellite service provider Multichoice, based in Mauritius. International business, government, and non-governmental organization (NGO) support facilitate their network of 31 national SchoolNets. The enhanced information and knowledge exchange is building ICT skills in a new generation to participate as information-society citizens. Gender equality has been a key principle of SchoolNet Africa. The Web site <http://www.schoolnet africa.net> updates its gender watch with research and information on gender networks, advances in ICTs, and the education of women and girls (World Bank, 2003).

Grameen Bank Village Pay Phone represents a successful trend of coupling gender equality and empowerment through business with ICT development. The ICT business entrepreneurs of Village Pay Phone are primarily women, who receive microcredit to purchase cell phones and provide pay-phone service in villages. The project began in Bangladesh, and its success has inspired replication projects in 30 developing countries. (Dumas, 1999)

The women entrepreneurs represent 4% of cell-phone subscribers but 16% of the airtime. Grameen Bank founder Muhammad Yunus (2005) described the value of their work in expanding ICT access and the family economy:

Grameen Bank has provided loans to 129,232 borrowers to buy mobile phones and offer telecommunication services in nearly half of the villages of Bangladesh where this service never existed before ... Telephone-ladies play an important role in the telecommunication sector of the country, and also in generating revenue for Grameen Phone, the largest telephone company in the country. (Article 26)

Other countries have gender-inclusive ICT development. Senegal, for example, has well over 7,000 small-business phone shops or telecenters,

mostly operated by women. As local demand requires, some telecenters include computers, Internet access, duplication, printers, scanners, and fax machines (Dumas, 2002).

The UNDP (2004) report, 5 years after the commitments, found that much more work must be done in order to reach the targets and goals by 2015. The MDG campaign has brought visibility to world poverty, hunger, and health crises, as well as efforts to eliminate them. MDGs were on the agenda of the July 2005 meeting of the group of eight (G8) wealthy nations: the United States, Canada, United Kingdom, France, Germany, Italy, Japan, and Russia. Prior to the meeting, Jimmy Carter, former president of the United States, and others including the millions who participated in the LIVE 8 concerts, called on the G8 to make a greater contribution toward efforts to achieve the MDGs. During the meeting, the G8 responded to the call for expanded official development aid (ODA) to the poorest nations facing the greatest challenge to meet the MDGs. The innovative LIVE 8 concerts attracted the largest media audience in history and helped focus world and G8 attention on the MDGs.

CONCLUSION

Women are just over half of the world's population, but over two thirds of the world's poor and undereducated. Even in developed countries, women earn significantly less than men without exception (UNDP, 2004). The MDGs address the need for distributive justice to end poverty, hunger, and illiteracy in our world and bring greater peace and freedom to our collective lives. ICTs make global conversation and knowledge sharing possible, but unequal resource distribution has inhibited these communications. ICT has helped improve resource and service distribution for health care, education, economic empowerment, conflict resolution, political participation, and cultural enjoyment. Expanded access for and

participation by women and youth is needed. The world nations are still far from achieving the eight MDGs (United Nations, 2005). The gender justice goals of UDHR (UN, 1948), CEDAW (UNCSW, 1979), Beijing (UN, 1995), the MDGs (2000), and the civil-society voices of ITU (2005) can be realized with the political will to do it. Nations have made the good-faith promise to achieve the MDG targets by 2015. Their mutual commitments within the UN forum with civil society's vigilance help reinforce accountability and resolve, and keep the goals and problems they address always in public view.

REFERENCES

- Ain Tahmina, Q. (2005, August 25). Millennium development goals: Glossing over women's issues. *IPS News*. Retrieved from <http://www.ipsnews.net/print.asp?idnews=30019>
- Chen, M., Vanek, J., Lund, F., Heinz, J., Jhabvala, R., & Bonner, C. (2005). *Progress of the world's women: Women, work and poverty*. New York: UNIFEM.
- Dumas, J. A. (1999). The Grameen Bank: Development from the bank of beggars to telecommunications provider. *Pacific Telecommunications Review*, 20(3), 5-15.
- Dumas, J. A. (2002). *ICT and gender equity policy: Lessons of the Mali telecentres*. University Park: Pennsylvania State University.
- Gender Working Group-United Nations Commission on Science and Technology for Development (UNCSTD). (1995). *Missing links: Gender equity in science and technology for development*. Ottawa, Ontario, Canada: IDRC.
- Girard, B., & Ó Soichrú, S. (Eds.). (2005). *Communicating in the information society*. Geneva, Switzerland: UNRISD.

Global Knowledge Partnership (GKP). (2002). *GKP recommendations on issues of bridging the digital divide*. Kuala Lumpur, Malaysia: Author.

Haqqani, A. B. (Ed.). (2004). *The role of information and communications technologies in global development: Analysis and policy recommendations* (Series 3). New York: United Nations ICT Task Force.

International Telecommunications Union (ITU). (2003a). ICTs and the Millennium Development Goals. In *World telecommunications report 2003* (pp. 1-9). Geneva, Switzerland: Author.

International Telecommunications Union (ITU). (2003b). *World telecommunications report 2003*. Geneva, Switzerland: Author.

International Telecommunications Union (ITU). (2005). *WSIS outcome documents*. Geneva, Switzerland: Author. Retrieved March 3, 2006, from <http://www.int.itu/WSIS>

King, E., & Mason, A. (2001). *Engendering development: Through gender equality in rights, resources and voice*. Washington, DC: World Bank.

Mansell, R., & Wehn, U. (1998). *Knowledge societies: Information technology for sustainable development*. New York: Oxford University Press.

Marcelle, G., Karelse, C. M., & Goddard, G. (2000). *Engendering ICT policy: Guidelines for action*. Pretoria, South Africa: African Information Society-Gender Working Group.

Plou, D. S. (2005). What about gender issues in the information society? In B. Girard & S. Ó Soichrú (Eds.), *Communicating in the information society* (pp. 11-32). Geneva, Switzerland: UNRISD.

United Nations (UN). (1948). *Universal declaration of human rights*. New York: Author.

United Nations (UN). (1995). *The Beijing declaration and the platform for action: Fourth world conference on women*. New York: United Nations Department of Public Information.

United Nations (UN). (2003a). *WSIS declaration of principles* (WSIS-03/GENEVA/DOC/4). New York: United Nations Department of Public Information.

United Nations (UN). (2003b). *WSIS plan of action* (WSIS-03/GENEVA/DOC/5). New York: United Nations Department of Public Information.

United Nations (UN). (2004a). *Implementation of the United Nations millennium declaration report of the secretary general*. New York: Author.

United Nations (UN). (2004b). *Investing in development: A practical plan to achieve the Millennium Development Goals*. New York: UNDP.

United Nations (UN). (2005). *In larger freedom: Towards development, security and human rights for all* (Report of the Secretary General). New York: Author.

United Nations Commission on the Status of Women (UNCSW). (1979). *Convention on the elimination of all forms of discrimination against women (CEDAW)*. New York: United Nations.

United Nations Development Program (UNDP). (2004). *Human development report*. New York: UNDP.

Wikipedia. (2006). *LIVE 8*. Retrieved March 6, 2006, from http://en.wikipedia.org/wiki/Live_8

World Bank. (2003). *Gender equality and the Millennium Development Goals: Report of the Gender and Development Group*. Retrieved March 3, 2006, from <http://www.schoolnetAfrica.net/index.php?id=426>

World Summit on the Information Society (WSIS) Gender Caucus. (2003). *Recommendations to the World Summit on the Information Society*.

Retrieved August 20, 2005, from <http://www.genderwsis.org>

Yunus, M. (2005). *Grameen Bank at a glance*. Retrieved July 7, 2005, from <http://www.grameen-info.org/bank/GBGlance.htm>

KEY TERMS

Human Development Report (HDR): Annual report prepared and distributed by the UNDP on the development progress of all UN member nations. Since 2002, the HDR has included the Gender Development Index (GDI) for each nation state with available gender-disaggregated data

LIVE 8: A series of international live benefit concerts in July, 2005. They raised consciousness about the MDGs. It was held in the G8 countries and South Africa, and was seen on television worldwide by satellite (Wikipedia, 2006).

UNCSW: United Nations Commission on the Status of Women.

UNDAW: United Nations Division for the Advancement of Women.

UNDP: United Nations Development Program.

UNIFEM: United Nations Fund for Women.

WSIS: The World Summit on the Information Society is a two-phase international summit from 2003 to 2005 organized by the United Nations and the International Telecommunications Union to address the need for international policy and agreement on ICT governance, rights, and responsibilities.

WSIS Declaration of Principles (2003): The following is the vision of WSIS:

Our challenge is to harness the potential of information and communication technology to promote the development goals of the Millennium Declaration, namely the eradication of extreme poverty and hunger; achievement of universal primary education; promotion of gender equality and empowerment of women; reduction of child mortality; improvement of maternal health; to combat HIV/AIDS, malaria and other diseases; ensuring environmental sustainability; and development of global partnerships for development for the attainment of a more peaceful, just and prosperous world. (UN, 2003a, p. 1)

This work was previously published in the Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 598-602, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Section 2

Information Communication Technologies Development and Design Methodologies

This section provides in-depth coverage of conceptual architecture, enabling the reader to gain a comprehensive understanding of the emerging technological developments within the field of ICT. Research fundamentals imperative to the understanding of developmental processes within information management are offered. From broad examinations to specific discussions on electronic tools, the research found within this section spans the discipline while also offering detailed, specific discussions. Basic designs as well as abstract developments are explained within these chapters, and frameworks for implementing ICT in education, healthcare, and government are explored.

Chapter 2.1

Connecting the First Mile: A Best Practice Framework for ICT-Based Knowledge Sharing Initiatives

Surmaya Talyarkhan
Practical Action, UK

David J. Grimshaw
Practical Action, UK

Lucky Lowe
Practical Action, UK

ABSTRACT

This chapter characterises the use of information communication technologies (ICTs) to share information with people at grassroots as connecting the first mile. It examines the literature about connecting the first mile and identifies the key debates: whether solutions should be participatory or top-down, technological or social, whether they should focus on global or local information, and the overall potential of ICTs for development. The chapter synthesises the lessons from a range of practical studies to identify the factors that contribute to the success of a project. A framework of best practice is offered, divided into three dimensions: the environment, the project level, and the local level. Whilst recognising that ini-

tiatives will vary according to the local context, the authors offer the best practice framework to support practitioners in addressing the challenges of connecting the first mile and empowering marginal communities to participate effectively in the information society.

INTRODUCTION

The international development sector has focused in recent years on the need to share knowledge more effectively in support of poverty reduction efforts. Multi- and bi-lateral agencies and NGOs are increasingly putting knowledge sharing at the centre of their organisational strategies. And, in the context of a perceived knowledge divide, they

are addressing the challenge of how to respond to the knowledge needs of people living in poverty in developing countries.

Information and communications technologies (ICTs) such as the Internet, mobile phones, and radio offer opportunities to connect people to information quickly and in large numbers, transcending geographical barriers. The challenge for information providers in development is how to share information with people who have little access to ICTs, low levels of literacy, little time or money, and highly contextualised knowledge and language requirements. For many years reaching people living in poverty with information was characterised as the *last mile* problem, a term borrowed from the telecommunications field, where it referred to difficulties of improving connectivity in remote rural areas. In recent years, this *problem* has been reconceptualised in terms of *connecting the first mile*, which privileges the needs of people living in those remote areas (Paisley & Richardson, 1998). In this chapter, connecting the first mile refers to ICT-based projects aimed at sharing information at grassroots.

This chapter aims to identify best practice in development projects using ICTs to connect the first mile, through a review of existing literature and case studies. It begins with a discussion of the role of ICTs in development and an examination of the different ideological approaches adopted by authors, before drawing together a framework based on the lessons and recommendations from the literature. It concludes by examining the trends that will impact on information networking for communities at the first mile and discussing potential applications of the framework.

DEVELOPMENT AND ICTS

The concept of development has been evolving since its origins after the Second World War. Sachs (1992) dates the age of development as beginning when President Truman at his inaugu-

ration described regions in the South as *underdeveloped*. International organisations such as the World Bank and the United Nations (UN) were established to support international relations, and their agendas have influenced the discourse on development ever since.

The priorities of the international development community have shifted over the years. From a focus on economic development and growth, international bodies have begun to focus on poverty as a multidimensional phenomenon and to acknowledge the various contributory factors to poverty such as a lack of access to markets and services or vulnerability to shocks.

Communication has consistently been central to the work of development agencies, but in recent years the recognition of information and knowledge as contributing to growth, as well as the vogue for knowledge management and the massive expansion of ICTs, has highlighted the importance of knowledge for development.

Many international initiatives have been established to harness ICTs for development on a global scale, in particular since the publication of the World Development Report on Knowledge for Development (World Bank, 1998). These include the Global Knowledge Partnership (founded in 1997), the DOT-Force (created in 2000), and the UN ICT Task Force (created in 2001). The International Telecommunication Union (ITU) hosted an international summit on the Information Society in 2003, the second phase of which took place in early 2005. These initiatives aim to build partnerships among civil society, the public, and private sectors to harness ICTs for development (Chapman & Slaymaker, 2002).

There is a consensus that ICTs can play an important role in development, for example by connecting people to more accurate and up-to-date information, equipping them with new skills or connecting them to an international market. However, there is concern that the digital divide is increasing the gap between the *information haves and have-nots*, and this is the preoccupation

of many of the initiatives established to address ICTs for development.

PERSPECTIVES IN THE LITERATURE

In recent years, many studies have been published, particularly by practitioners in the development field, on the use of ICTs for development. The term *ICTs for development* incorporates a variety of different uses of ICTs, for health, e-governance, agriculture, advocacy, and many more. There is not a coherent body of literature one can search for about connecting the first mile. This framework is based on a review of case studies collected from the Eldis portal, where development practitioners publish their findings (<http://www.eldis.org>). Studies were selected according to the following criteria:

- Is there a knowledge sharing and development focus to the ICT project?
- Are the end users people at grassroots?
- Is the document a good source of information?

The studies which scored highly against each criterion were reviewed to compile the framework.

This chapter also refers to more general literature on ICTs and development selected through cross-branching from existing literature reviews and searches of academic journal databases. The database searches (on Proquest and EBSCO) found fewer articles or studies relevant to the first mile, perhaps because the majority of this research is conducted by practitioners.

The gaps that exist in the literature about connecting the first mile either represent areas where there has been little convincing evidence collected to date or where authors cannot reconcile their perspectives on the role of ICTs in development.

Previous literature reviews in this field have commented on the promotional nature of literature, the paucity of baseline and evaluation studies to date, the relatively recent emergence of frameworks for evaluation, and the emphasis on telecentre projects and literature about Africa (O'Farrell, Norrish, & Scott, 1999; Adeya, 2002).

This literature review highlights key concepts around which practitioners are polarised. An understanding of the different perspectives is essential to illustrate the different meanings of best practice in discourse on ICTs and to situate this study against an ontological background. Commentators have attempted to divide the literature in development into different factions: sceptics and pragmatists, optimists and pessimists, globalists and localists. In this study, it is suggested that authors diverge along four dimensions:

- Top-down vs. participatory solutions to development problems,
- Global vs. local solutions to development problems,
- Technological vs. social solutions to development problems, and
- Optimism vs. pessimism about the role of ICTs in development.

These different perspectives shape authors' discourse and priorities, their concept of impact, and their understanding of best practice. The rest of this section examines each perspective in turn. The clash of perspectives is illustrated for example in the terminological debate over the *last mile problem*. For some authors the term typified a top-down approach to development, viewing the delivery of technologies to people living in remote areas as a solution to development problems (Paisley & Richardson, 1998). In contrast, the concept of *connecting the first mile* starts from the needs of marginal communities and marks the connection between the local context and global information systems.

Top-Down or Participatory Solutions

ICT for development projects are criticised for failing to build on existing systems or work in a participatory way. Critics argue that top-down projects, driven by the donor agenda, fail to achieve local ownership (Aley, 2003b; Gumicio Dagrón, 2001; Lloyd Laney, 2003c). The concept of the *design-reality gap* (Duncombe & Heeks, 1999) highlights the distinction between the context in which an ICT project or application is designed and the context of its use in developing countries.

In many cases projects are driven by the donor agenda, which has a short-term horizon and may not recognise or be able to address the multi-dimensional causes of poverty due to a narrow focus on donor objectives (Stoll, Menou, Camacho, & Khellady, 2001). Gumicio Dagrón (2001) is especially critical of the role of donors and their focus on large-scale projects:

The international donor community is still reluctant to acknowledge 30 or 40 years of failures and millions down the drain because of ill-planned macro programmes. The eagerness to go fast, to show short-term results, and to extend coverage to large numbers of people has actually backfired. (p. 11)

For him, donors' concern with scale serves to multiply models that clash with culture and tradition and paralyse communication, instead of linking communities and facilitating exchanges.

Global or Local Solutions

ICTs for development initiatives often seek to increase access to a *global pool of (codified) knowledge* (Stiglitz, 1999), but have been criticised for failing to acknowledge the local context (Gomez & Casadiego, 2002; Moroow, 2002). Ballantyne (2002) highlights the emphasis on external content pushed at people living in poverty and the struggle

faced by efforts to push local content (e.g., research conducted in the South or Southern arts) onto a global stage. Many initiatives are criticised as offering one-way transfer of information (usually from the global to the local level), but failing to promote genuine, two-way knowledge sharing. For example, van der Velden's (2002) analysis of the Development Gateway suggests that the project was designed without a concept of knowledge as contextually defined, and therefore does not address the needs of key audiences:

The critique of the Bank's approach in this case indicates that knowledge needs to be presented in the appropriate context and be meaningful in the local situation in order to be useful and effective. (p. 31)

Technological or Social Solutions

There is a distinction between authors who see technology as a solution to development problems and those that seek social solutions. Articles cite particular types of technologies and applications, such as Wireless Fidelity (WiFi), open source software, low-cost devices, translation engines, as *stepping stones* toward *digital inclusion* (Primo Braga, Daly, & Sareen, 2003). This technological determinism recognises the difficulties of communicating to the local context (such as language or access barriers), but locates the potential to overcome them in new technologies, rather than in social factors. Concerns are raised by other authors (Boyle, 2002) that technology is increasingly determining the solutions sought to development problems:

What I am concerned with is the degree to which complex social development goals become seen as functional or technical problems when ICTs are introduced and how technology becomes particularly determinant in how larger goals are understood and acted upon. (p. 102)

Optimism or Pessimism

Some authors are extremely optimistic about the contribution that ICTs can make to development goals. Heeks (2002) comments on the *current prevalence of positive and technologically deterministic viewpoints*, which he sees as influenced by the climate among international development agencies:

A number of factors among agency staff may explain the emergence of this viewpoint. They include naivety about ICTs, desire for career advancement, pressure from ICT vendors, a lack of alternatives to the trends/fads of the Northern private sector, and pressure from political masters for quick solutions to development problems. The viewpoint also emanates from those seeking funds or guidance from the development agencies. They tend to mimic the views and messages of those agencies. (p. 4)

An examination of the different perspectives in the literature leads to the conclusion that different ideologies shape authors' understandings of best practice and what they conceive of as a successful project. For some authors ICTs are in themselves a contribution to development, whereas for others they need to be part of a wider development solution, a means rather than an end. Authors' perspectives determine how project impact is evaluated in the studies and how lessons are drawn for best practice. The next section examines the different approaches to evaluating the impact of projects at the first mile.

BEST PRACTICE AND IMPACT

In this chapter, impact is conceived of as the reported outcomes of the project, and best practice is taken to mean the processes that have contributed to a project's success. In order to identify examples of best practice from the literature on connecting

the first mile, in addition to understanding authors' perspectives, it is necessary to understand how they are defining impact and why they choose to view the project in a particular light. For example, the power relations inherent in development projects affect how impact is demonstrated (Stoll et al., 2001; Gumicio Dagron, 2001). Practitioners need to demonstrate success to receive further funding, donor organisations are unwilling to invest in monitoring activities by donor organisations, and 'beneficiaries' have relatively low input into the monitoring and evaluation process. Factors such as these suggest that demonstrating results can be more important than demonstrating a development impact for beneficiaries.

Practitioners and academics struggle to define a causal link between development outcomes and ICT projects. Although frameworks and targets exist that aim to model how poverty reduction can be achieved and where interventions could be successful, the contribution ICTs can make is not easily defined. The rest of this section compares authors' differing concepts of impact at the first mile — where some start from frameworks and targets to assess how ICTs contribute to development, others look to the sustainability of ICT projects or their ability to disintermediate transactions to demonstrate their success. Other authors adopt a universal access approach whereby access to information is seen as a human right and the use of ICTs is in itself a developmental outcome.

Applying Frameworks to Define Impact

The Sustainable Livelihoods Framework has been used to illustrate some of the contributions of ICT projects, for example their contribution to social capital, human capital, or improved livelihoods strategies (Batchelor, Norrish, Scott, & Webb, 2003; Chapman, Slaymaker, & Young, 2003). The World Development Report of 2000/2001 identified three priority areas for reducing poverty: increasing opportunity, enhancing empowerment,

and improving security. Some studies have taken these as ways of assessing the contribution of ICT projects to poverty reduction (Op de Coul, 2003; Cecchini & Scott, 2003). These studies group examples of projects according to the three priority areas, but little evidence is presented that, for example, increased empowerment has led to poverty reduction. In places these case studies seem to present ICT adoption as increasing opportunity in itself, which becomes a circular argument. The Rockefeller Centre has adopted a model of communication for social change (Figueroa, Kincaid, Rani, & Lewis, 2002) which theorises communication as “dialogue rather than monologue, as a cyclical process of information sharing which leads to mutual understanding, mutual agreement, and collective action” (Figueroa et al., 2002, p. 2), and develops indicators on that basis although this review has not located cases where these are used.

Defining Impact in Terms of Sustainability

Some studies evaluate ICT projects on the basis of sustainability. The emphasis on sustainability partly reflects donor concern with short-term investments, but also a more commercial approach that suggests that sustainability represents demand for a service. Batchelor et al. (2003) evaluated projects according to how sustainable they were in terms of economic sustainability, social sustainability, and institutional sustainability. In their definitions, economic sustainability is achieved when a given level of expenditure can be maintained over time, social sustainability is achieved when social exclusion is minimised and social equity maximised, and institutional sustainability is achieved when prevailing structures and processes have the capacity to perform their functions over the long term.

Economic sustainability is seen by some as a key indicator of success of a project because it is seen to reflect a genuine demand for that service.

At the same time, in many development projects, donors are funding information dissemination as a public good as Tschang, Chuladul, and Le (2002) comment: “The nature of telecentre sustainability is complicated by the point that it may initially be a public good, especially in disadvantaged areas, yet must be ultimately self-supporting” (p. 130).

A great deal of research has been published on economic sustainability, in particular with regard to access initiatives such as telecentres or information kiosks, which have high set-up and maintenance costs and customers with little spare cash. The complicated objectives of providing information services as a public good and making them self-supporting have proved extremely difficult to reconcile, and few initiatives have succeeded in covering their costs, even if they have developed viable charging mechanisms (Batchelor et al., 2003).

Authors concerned with participation tend to identify it as the locus of social sustainability, arguing that the active involvement of users minimises social exclusion and perpetuates support for the project:

The concept of establishing a dialogue with beneficiaries all along the process of conceiving, planning, implementing and evaluating a project has been gradually consolidating. At first, implementers understood that beneficiaries should be involved in the activities leading to social and economic development of a community, for the purpose of building up a sense of ownership within the community. This was at last perceived as important especially in terms of the sustainability of the project once the external inputs ended. (Gumicio Dagon, 2001, p. 10)

Institutional sustainability is primarily a question of resources and capacity building, amongst project staff and partners, empowering those institutions to take control in local development issues.

Defining Impact in Terms of “Disintermediation”

ICTs are also seen as contributing to poverty reduction through *disintermediation*, whereby local producers have direct access to the market and can therefore charge market rates for their goods without having to pay an intermediary. Op de Coul (2003) cites an example from Central America:

Agronegocios in El Salvador helps farmers to become traders as well and to establish direct contacts with buyers, instead of selling to middlemen (called “coyotes”). This is done through bi-weekly markets in the capital but also through a virtual market on the Web site where offers and demands are published. In Agronegocios centres spread around the country the farmers and their children are taught how to enter their offers and how to find possible buyers. Though the farmers in general prefer personal contacts with their customers, the virtual market has the advantage of offering “business to business” opportunities and bigger quantities can be sold. Furthermore, trade is not restricted to the province or country the farmers live in; deals with foreign traders are an option as well. (p. 7)

Although some ICT initiatives succeed in disintermediating commerce, Batchelor et al. (2003) comment that there is a need for ICT intermediation instead (although the users are less vulnerable to these intermediaries than in traditional transactions).

Defining Impact in Terms of Universal Access

Donor agencies have focused on improving access to ICTs since the early 1990s, and telecentres have been seen as playing a key role in that strategy (Etta, 2003). Practitioners and policy makers who aim for universal access to ICTs can perhaps

demonstrate impact most easily because for them access to information and ICTs in themselves can constitute a developmental impact. Therefore, indicators such as the number of people who can access the Internet in rural areas will be meaningful indicators of development for them, regardless of how useful they find the content they access.

Best Practice and Impact in this Chapter

This literature review has demonstrated that in the literature on connecting the first mile, authors have very different ideologies and evaluate project impact according to different types of outcomes. There is a strong case for working in a participatory way and connecting local and global information, as the field is littered with examples of failed initiatives that did not prove to be useful to the end users.

It is also clear that monitoring and evaluating the impact of a project is a political undertaking and that reported best practice may not represent development outcomes for the beneficiaries, but the achievement of goals set by donors or development agencies, such as sustainability or access to ICTs. Therefore, when researching best practice, the author’s definitions of impact must be considered before accepting that an experience has been valuable at grassroots.

In this chapter, the development needs of people living in poverty are prioritised over the technologies shaping current discourse. However, the next section reviews existing research and highlight the critical factors at the local level, the project level, and in the environment of the project, which make the projects successful and how projects can achieve these.

IDENTIFYING BEST PRACTICE

In the literature on connecting the first mile, best practice is described through the use of examples

of successful projects, examples of unsuccessful projects, and recommendations based on project experience. Several studies have collected a group of cases and compiled guidelines for practitioners or highlighted the lessons learned from existing projects. The success of many projects is *situated success* in the sense that the project has worked due to a particular combination of local factors such as a strong champion or good timing. This framework focuses on the processes that contribute to the success of a project, in order to make it applicable in wider contexts.

This framework divides the success factors into three levels of analysis: the local level, the project level, and the environment. The local level is the point at which end users at grassroots access information services. The project level deals with the project planning and implementation. The environment consists of all the factors that affect a project's success but are external to the project.

All of the elements in the framework have an impact on connecting the first mile and on the project as a whole. The distinction between the levels is artificial, but is a convention that helps to identify which actors are key to success and the nature of their contribution. Each level can impact on the others, for example delayed funding from donors can have an impact at the project level and local level. Project managers need to find ways to integrate the levels so that, for example, information from the local level reaches policy makers outside the project.

The sections below detail the success factors identified in the literature (i.e., WHAT elements appear to lead to successful projects) and also highlights suggested best practice (i.e., HOW practitioners can work towards these factors).

THE ENVIRONMENT

Forces external to a project, such as the regulatory context, infrastructure, or the role of donor

organisations, can play a key role in the success of the project.

Policy Environment

The policy environment can affect the day-to-day working of an ICT initiative. Batchelor et al. (2003) cite the example of ACISAM, an NGO in El Salvador that was unable to bid for radio or television space due to policy restrictions. An analysis of ICT stories collected by Infodev suggests that dealing with local authorities can be an issue if the project challenges their power:

Co-operation from local government is to be taken into account in a lot of projects. Either because project initiators need authorisation from the local government to start their project, or because the local government may even be a partner...they will not co-operate to the fullest if they feel that the empowerment coming from the project will challenge their positions of power. (Infodev, 2004, p. 1)

Studies on advocacy suggest that best practice is to research the policy environment, recognise the existing power relationships, and develop strong relationships where possible with policy makers (Lloyd Laney, 2003a). One example of good practice is the Gyandoot initiative in India, which adds value to existing policy structures by giving communities to access government services locally from kiosks.

Infrastructure

In ICT projects, the lack of local telecommunications infrastructure can be “one of the biggest challenges, especially in developing countries” (Infodev, 2004). Best practice in overcoming this challenge includes analysing telecommunications and IT infrastructure deficiencies to plan for realistic measures (Chapman et al., 2003), adopting innovative technologies such as the wireless connectivity technology used by the n-Logue project

in India (Badshah, Khan, & Garrigo, 2004), or developing more accessible devices such as the Simputer (Primo Braga et al., 2003). A most recent contribution in this aspect could be the \$100 computer that Nicholas Negroponte at MIT is designing with the ICT industry.

Relationship with Donors

The role of donor organisations can also be a determinant in the success of a project: “The initiatives having less financial problems are the ones implementing online activities and the ones whose hosting organisations have good relationships with donors” (Op de Coul, 2003).

A case study on a project in Thailand that stalled suggests it was partly due to poor donor relations:

APRTC had only been in existence for a short time and did not have the solid relationships of more established organisations. Also, its approach was unique and relatively unproven even though initial results were promising. That it was an NGO with no connection with any national government or focus on a particular country seems to have put off potential supporters. Donors seem to prefer working with government agencies or organisations closely aligned with national efforts. (Infodev, 2004, p. 12)

Practical Action’s experience would suggest that forming individual relationships with donors is important, as well as communicating project progress in a timely way. An analysis of the impact of research on policy (Crewe & Young, 2002) suggests that establishing credibility and communication, influence, and legitimacy contribute to help an organisation to achieve policy change.

THE PROJECT LEVEL

In managing a project connecting the first mile, much of the literature suggests that success de-

pends on understanding development priorities at the community level, and planning, monitoring, and evaluating to ensure that projects are having an impact on those priorities. For implementation to be successful and sustainable, there is a need to partner with other organisations and devise a sustainable business model for the project. Projects need to share best practice with other practitioners to understand how replicable a project can be.

Working with Communities

Recent articles on ICTs have made powerful arguments for participation by target groups throughout a project, from inception to evaluation and beyond:

If technologies are to be developed that suit poor end users, then these people must be a part of the design process from the outset. The principles of participatory technology development are as important as ever, whether it be designing a bull-ock-drawn plough or an electronic information technology. Poor people must be empowered to express their requirements and allowed to play a leading role in technology development. People living in poverty understand their situation better than any “external expert”. Without end-user involvement, well-intentioned outsiders will make mistakes, which poor people might not even be inclined to point out! (Aley, 2003a, p. 33)

The key to best practice at the project level is to start from communities’ development priorities (Stoll et al., 2001) and begin with a needs assessment which could draw on PRA or RRA methodologies (Bridges.org, 2004; Cecchini & Scott, 2003; Lloyd Laney, 2003c). Cecchini et al. (2003) point to the failure of an Indian e-governance initiative due to a lack of local understanding:

In Rajasthan, the state-sponsored RajNidhi e-governance program has failed to deliver, despite the fact that the software is easy to use and in Hindi,

because of extremely centralised planning that did not take local conditions into consideration. Content, in fact, lacks regular updating because of communications problems between the state and the local government. (p. 13)

Project Planning

Like any development project, a successful ICT for development project will have clear objectives, clearly identified target groups, and realistic plans for implementation (Batchelor et al., 2003; Bridges.org, 2004). An example of good practice on the ICT Stories Web site is the Jharkhand-Chattisgarh Tribal Development Programme (JCTDP), an 8-year livelihood improvement and empowerment programme targeted at resource-poor rural households in nine largely tribal blocks in the Chattisgarh state in India, which has identified its audience and developed its project plans according to their needs.

Monitoring and Evaluation

Although many initiatives are too new to demonstrate impact (Meera, Khamtani, & Rao, 2004), commentators are concerned that monitoring and evaluation indicators relate to use of technology more than to the impact for example on livelihoods (Stoll et al., 2001). There are suggestions for best practice in the literature, which ensure that in addition to data collection, the process supports learning and change. These include linking the project goals, variables, and indicators to community priorities (Stoll et al., 2001), critically evaluating efforts, reporting back to clients and supporters, and adapting as needed (Bridges.org, 2001). Best practice involves monitoring throughout the life of the project, not only once a project is completed (Lloyd Laney, 2003b).

Partnerships

Partnerships and institutional arrangements are given central importance in the literature. In order

to deliver information services to the poor, information providers need to form strong partnerships with other information providers (Batchelor et al., 2003) and organisations that promote services, and raise awareness amongst end users (Cecchini & Scott, 2003) as well as organisations offering the technological infrastructure and finance to keep the project afloat. Best practice involves selecting partners from the public, private and civil society sectors (Saravia, 2005). Bridges.org (2003) describes the case of the Satelife PDA, whereby physicians, medical officers, and medical students tested PDA devices in the context of their daily work environments. Partner organisations working on that project in Uganda included the American Red Cross, Makerere University Faculty of Medicine, and HealthNet Uganda, which provided technical support and project assistance. Medical texts were obtained from Skyscape, an online information provider.

Incentivising partners to participate in the project is crucial to success. Donor organisations are looking at public-private partnerships (Carlsson, 2002), and there is a case for businesses to partner with businesses, NGOs, and community groups already established in developing country markets to minimise risk and maximise infrastructure (Pralhad & Hammond, 2002).

Few studies make recommendations for best practice because each project will require a different set of stakeholders to be involved, but the comments from the Max Lock Centre (1999) are instructive: “The key to achieving real partnership in local development is negotiating conflicting interest, discovering overlapping interest and mutually beneficial means of achieving individual interest” (p. 1).

Partnerships with organisations at the local level are also key to the success of a project and will be discussed in detail in the next section.

Sustainability

Many studies relate best practice to how sustainable a project is. Badshah et al. (2004) highlight

Connecting the First Mile

some initiatives that have developed innovative solutions to financial sustainability:

Several projects have a self-sustaining commercial focus as the driving factor — Drishtee (India), Cabinas (Peru), Warnet (Indonesia), n-Logue (India), Telecottages (Hungary), are all based on a business model. According to Amin, one way to structure a business driven kiosk model is as a franchise and many of the successful efforts analysed have adopted this approach. (p. 223)

Tschang et al. (2002) suggest that for telecentres, returns are increased through economies of scope and scale, network externalities, vertical integration and agglomeration. They also highlight the importance of partnerships to overcome initial costs:

The high initial investment costs in equipment and infrastructure make it difficult to base expansion plans on local owner-operators' means. In-kind investment partnerships — e.g., the Indonesian government's vocational school system's partnering with local businesses to sponsor cybercafé, and private sector assistance; or the Indian Andhra Pradesh state government's scheme to involve long distance telephone companies — may be solutions to these problems. (p. 130)

The involvement of the private sector in sustainable ICT projects can often reduce costs and improve service quality and efficiency (Badshah et al., 2004). The private sector is waking up to the “bottom of the pyramid” as a potential market, and multinational corporations are adopting new business models and partnership models to exploit these markets, such as the shared access model popularised by the Grameen Bank (Pralhad & Hammond, 2002). Whereas public initiatives can be slow to recognise services that fail to meet demand, Prahalad and Hammond (2002) suggest that through competition, multinationals are likely

to bring a superior level of accountability for performance, which could benefit end users.

Therefore, best practice in developing a sustainable business model will include identifying which services are being provided as a public good and where the project could adopt a commercial model and increase returns through partnerships, in particular involving the private sector.

Building Staff Capacity

Op de Coul (2003) raises the high turnover of trained technical staff in ICT for development projects as an institutional sustainability issue. Best practice suggestions are offered by Batchelor et al. (2003):

Institutional sustainability is said to be achieved when prevailing structures and processes have the capacity to continue to perform their functions over the long term ... The studies show three mechanisms for gaining capacity: it is possible to buy-in expertise when necessary, to hire specific skilled staff or to train existing staff (or volunteers). (p. 17)

In knowledge sharing projects there can be a need to extend capacity building to partner staff such as intermediaries or technical partners.

Scaling Up Through Communication and Replication

Sharing findings with other development practitioners is important to communicate best practice (Op de Coul, 2003) and to understand the degree to which a project could be replicated in a different context (Cecchini & Scott, 2003). Besemer, Addison, and Ferguson (2003) make a convincing case for sharing findings with donors to influence policy and recommend donor dialogue as a best practice. A recognised problem with ICT for development is that most initiatives

are pilot projects, which are then not scaled up into programmes (Weigel & Waldburger, 2004), although the warnings from Gumicio Dagon (2001) suggest that concern with scale can lead to more failures. In any case, it is necessary to develop an exit strategy to ensure that projects are sustainable after funding is withdrawn (Ballantyne, Labelle, & Rudgard, 2000).

THE LOCAL LEVEL

Knowledge management theory recognises the centrality of context to meaning. For Nonaka and Takeuchi (1995), information and knowledge are context-specific: "...both information and knowledge are context-specific and relational in that they depend on the situation and are created dynamically in social interactions between people" (p. 59). Therefore taking account of the local context is crucial when sharing information at the first mile, to make sure that information can be understood and internalised by local people.

Building on Existing Systems

In the literature relating to the first mile, there is an emphasis on building on existing systems (Chapman et al., 2003; Lloyd Laney, 2003c) instead of introducing new ones and undermining the ways people currently receive information. "The ICTs revolution can undermine traditional, local communications, by supplanting them and by taking attention away from them" (Chapman et al., 2003, p. 2). Recommendations are that projects conduct research into existing information systems and design initiatives that build on these. Projects should also connect to traditional knowledge (Ballantyne, 2002) and promote local participation throughout the project.

Appropriate Materials

There is a vast amount of literature recommending approaches to designing information appropriate to the local context (Batchelor et al., 2003; Lloyd Laney 2003c; Aley, 2003a; Aley, Waudo, & Muchiri, 2004). Authors highlight the following dimensions to appropriate information: language, cultural context, information delivery channel, information format. For instance, in an assessment of WorldSpace radio, Aley et al. (2004) found that:

A common request is for more information that is appropriate to their specific context, meaning it must be locally relevant and applicable. Many people prefer information to be exchanged orally in their own mother tongue, and appreciate practical face to face demonstrations and follow-up. (Aley, 2003a, p. 5)

Therefore, best practice requires that practitioners research the information systems of their target group and understand their information needs, address local language issues, and then develop materials in the right format for use.

Appropriate Technology

The studies also highlight the need for appropriate technology to be chosen. In terms of sustainability, Batchelor et al. (2003) highlight the need for local repair and operational skills to maintain the technology. Primo Braga et al. (2003) discuss the use of low-cost technologies and free or open source software at the grassroots. Chapman et al. (2003) highlight the need for *realistic technologies* to be used that are appropriate to the local context and suggest the need to blend communications approaches, citing the example of the Kothmale

project in Sri Lanka where a community radio station browses the Internet at the request of listeners: “A combination of linking old and new technologies, use of mass media and technology sharing can reach the greatest number of people, over the largest distances and with the least infrastructure investment” (p. 28).

Schilderman’s (2002) research shows that successful examples of strengthening the knowledge and information systems of the urban poor are rarely based on a single method of communication and that incorporating traditional media can promote two-way knowledge sharing.

Information Intermediaries

Where there is little access to technology, an information intermediary can help communities to find the information that they seek. Different studies define information intermediaries in different ways. For Cecchini et al. (2003), they are the human intermediary between poor people and ICTs. For Lloyd Laney (2003), they represent the face-to-face contact which is essential in turning information into knowledge for poor people. For Raab, Woods, and Abdon (2003), they are employed to provide information: “Knowledge intermediaries are the many individuals employed by government extension systems, non-government organisations, academia and the private sector who have the responsibility to provide information and educational opportunities [for farmers]” (p. 269).

For Schilderman they are “information producers and suppliers, who do so out of duty or desire” (2002, p. 5), such as the public sector, NGOs, or religious organisations.

Cecchini et al. (2003) offer examples from rural India of best practice by intermediaries:

Successful examples of ICT projects for poverty reduction are conducted by intermediaries that have the appropriate incentives and proven track record working with poor people. In Andhra Pradesh,

ANMs have been working with poor villagers on a daily basis for years. SKS, the microfinance institution, adheres to a philosophy of reaching out to the poorest women in rural areas. In Gujarat, dairy cooperatives have been the best agent to target small farmers. If these intermediaries are grassroots-based and understand the potential of ICT for social change, they can be tremendously effective in promoting local ownership of ICT projects. In rural India, many telekiosk operators are young, educated, computer-savvy, and very attached to their communities. They are also extremely entrepreneurial. In the case of Gyandoot, successful telekiosk operators — besides offering e-government services — often create and manage database and work on data entry for private clients, offer PC training, provide voice, fax, copy, Internet and many other services. (Cecchini et al., 2003, p. 12)

In working with infomediaries then, best practice involves identifying grassroots-based infomediaries with a track record of working with poor people. There is a need to provide appropriate incentives for partnership and perhaps to find entrepreneurial infomediaries who can make a living. In ITDG’s experience of running an online service offering information for small, informal enterprises in Kenya, the infomediaries were crucial in connecting to the first mile. One infomediary sold new information to a local businessman about the availability of a peanut butter making machine for Ksh 2,500 (about US\$35), which illustrates some demand for information services at the first mile that can currently be met best through infomediaries.

Building Capacity of Infomediaries

Schilderman (2002) recommends best practice for projects with regard to infomediaries, which includes developing appropriate materials, sharing good communications practice, and capacity building:

Development agencies should sensitise state institutions towards more courteous and efficient information provision and, where resources are a real constraint, aim to provide additional resources and capacity building. Where this research has shown that smaller authorities are often better at communicating with their target population, this could be an argument in seeking wider decentralisation [...] There is furthermore a need to recognise, document and share good practice in communicating with the urban poor. Whereas many infomediaries are obviously not functioning optimally, some do exist that do well or have some exemplary projects or services, but often these are not widely known. (Schilderman, 2002, p. 49)

Infomediaries need to acquire what Ballantyne (2002) terms *adaptation skills*, for example translating information materials to suit local conditions.

Two-Way Knowledge Sharing

As the term *connecting the first mile* shows, development organisations are moving away from one-way knowledge transfer models towards the ideal of two-way knowledge sharing:

Community knowledge partnerships that can develop mechanisms to deal with the problems of connectivity and information literacy, and incorporate local and external knowledge, can directly benefit poor people. This approach could replace the traditional process of a “one-way” flow of information from a scientific, information rich core to a remote information poor community, with dynamic information sharing partnerships with a two-way flow of information at every level. (Chapman et al., 2003, p. viii)

Ballantyne (2002) comments on the importance of local content in this two-way flow and suggests that best practice in facilitating local

content creation includes valuing and motivating local content (through rights and incentives) and building the capacity of the target group in content creation. For him, best practice involves making local knowledge visible — for example by incorporating local and external knowledge into information materials and connecting the target group to policy makers.

Many of the most inspiring ICT projects have involved local appropriation of ICTs such as community radio or video, which have empowered communities to make a political impact: “Content provided through ICT should not be limited to the knowledge that can be accessed from outside sources, but rather extended to ensure that the poor have the means to speak for themselves” (Cecchini et al., 2003, p. 14).

For example, Practical Action’s Women’s Voices project (Practical Action, 2003) trained women’s groups in the slums of Nairobi in using video so they could communicate directly to policy makers about their situation and development priorities. The videos were shown to an audience of government ministers, housing directors, donors, and NGOs. Later the videos were shown on national television and won an international award, the Betinho Award for Technology and Social Justice. The women gained confidence and made contacts regionally, and now have plans for setting up a local resource centre with access to information on tenure, health, training, and job opportunities.

Chapman et al. (2003) also emphasise the importance of horizontal knowledge sharing, in particular between communities: “Knowledge transfer and sharing at a local level can have a particular impact on livelihoods because it is at this level that the majority of the poor are located within local knowledge and information systems” (p. 31).

Minimising Social Exclusion

Best practice in connecting the first mile requires that the projects be socially sustainable.

Minimising social exclusion in project planning can involve developing an understanding of the power dynamics at the local level (Michiels & Van Crowder, 2001) and focusing on marginalised groups such as women or the disabled:

Too often, agencies solely communicate with the more active members in a community, leaving others behind who may remain poorly informed, thus perhaps increasing their exclusion. Agencies should avoid that and may also have to specifically target groups that have difficulties accessing information or have particular information needs, such as female heads of households, the young, the disabled or ill, or the homeless. (Schilderman, 2002, p. 48)

For Schilderman (2002), building community social capital supports improved information sharing through social networks, which is how people living in poverty tend to get information. He distinguishes between bridging social capital, bonding social capital, and linking social capital, and suggests that best practice includes deliberately stimulating people to undertake a joint activity or action related to particular local needs and providing a space for the community to get together and meet.

Table 1 draws together the success factors and examples of best practice highlighted above into a best practice framework. The aim of the framework is to guide practitioners through the key processes that contribute to successful knowledge sharing at grassroots through ICT projects.

REFLECTIONS AND TRENDS

Lessons learned from a first generation of ICT projects have shaped thinking about how to proceed. Development agencies recognise the difficulty of creating sustainable solutions at the first mile and highlight the importance of multi-stakeholder partnerships for the success and sustainability of

ICT projects. Local appropriation is understood as necessary to the success of projects, and projects are therefore privileging participatory methodologies, capacity building, interactive solutions, local content, and knowledge. Projects acknowledge the need to understand existing information networks and power relations to support local appropriation, and methodologies are being developed to support those processes (Beardon, 2004). The monitoring of ICT projects focuses increasingly on the social or economic impact for the beneficiaries (such as increased participation in decision-making processes, increased incomes, etc.) instead of the use of the information systems. Although many lessons have been learned from pilots, few projects have yet been able to scale up their initiatives or replicate them in other contexts.

Developments in the IT industry will have an impact on information networking for marginal communities. ICT tools are becoming cheaper and more efficient, digital convergence is changing our understanding of traditional media and interactivity, and the Free/Open Source Software movement offers opportunities for developing countries to develop affordable solutions and customise them to suit local contexts. Mobile telephony is allowing many developing countries to leapfrog fixed-line telephony solutions, and innovative business models are being developed to make it affordable, for example by Grameen Telecom. As media converge, combining technologies and combining online and off-line media offer positive lessons for the future, with many commentators highlighting the importance of radio as a communications tool in conjunction with the Internet (Girard, 2001; Chapman et al., 2003).

ICT policy need to be integrated into development programmes such as Poverty Reduction Strategy Papers (PRSPs) and national strategies. To create an information society, commentators highlight the need for freedom of expression, competitive markets, independent regulators, and a universal service fund in countries (Weigel & Waldburger, 2004). Policies are required to fund

Table 1. A best practice framework

| Dimension of best practice | Success factor | Best practice |
|--|--|---|
| Environment | Working within the policy environment | Research the policy environment |
| | | Recognise power relationships |
| | | Develop strong relationships with policy makers |
| | | Work within existing policies |
| | Understanding and addressing infrastructure issues | Analyse telecommunications and infrastructure deficiencies |
| | | Plan for realistic measures |
| | | Adopt innovative technologies |
| | Building relationships with donors | Develop more accessible devices |
| | | Establish credibility, influence, and legitimacy |
| Project | Starting from communities' development priorities | Communicate project progress in a timely fashion |
| | | Work in participation with communities |
| | | Conduct a needs assessment |
| | Planning the project effectively | Involve target group in project planning and design |
| | | Define clear objectives |
| | | Identify the target group |
| | Learning from monitoring and evaluation | Plan realistically for implementation |
| | | Link project goals to priorities |
| | | Evaluate efforts critically |
| | | Empower target groups to evaluate |
| | Forging strong partnerships | Adapt the project in response to findings |
| | | Monitor regularly |
| | | Select partners with complementary strengths |
| | Developing a sustainable business model | Provide partners with incentives |
| | | Negotiate conflicting interests |
| | | Identify which services are provided as a public good and which can be commercial |
| | Building staff capacity | Involve the private sector |
| | | Buy in experience |
| | | Hire skilled staff |
| | Scaling up | Train existing staff/volunteers |
| Communicate best practice to practitioners | | |
| Share findings with donors | | |
| Local level | Building on existing knowledge systems | Develop an exit strategy |
| | | Research existing systems |
| | | Incorporate existing systems into the project |
| | | Connect to traditional knowledge |
| | Creating appropriate materials for local context | Promote local participation in the project |
| | | Research information systems of target group, literacy levels, and so forth |
| | | Understand information needs of target group |
| | | Address local language issues |
| | Using appropriate technologies for communities | Develop materials in the right format for use |
| | | Adopt technologies that local people can repair |
| | | Choose technologies that people can afford to use |
| | Working with infomediaries | Blend communications approaches |
| | | Identify grassroots-based infomediaries with a track record of working with poor people |
| | | Provide appropriate incentives for partnership |
| | | |

continued on the following page

Table 1. (cont.)

| Dimension of best practice | Success factor | Best practice | |
|----------------------------|---|---|---|
| Local level | Building capacity of infomediaries and target group | Provide training in efficient information provision | |
| | | Provide useable information resources | |
| | | Recognise, document, and share good practice in knowledge sharing at grassroots | |
| | | Build adaptation skills, such as translating content to suit local conditions | |
| | Two-way knowledge sharing | | Value and motivate local content through rights and incentives |
| | | | Build capacity of target group in content creation |
| | | | Incorporate local and external knowledge in information materials |
| | | | Connect target group to policy makers |
| | | | Promote knowledge sharing at a local level |
| | Minimising social exclusion and building social capital | | Understand power dynamics at local level |
| | | | Focus on marginalised groups |
| | | | Build social capital through joint activities and communal space |

content from minority language groups and support the design of ICT applications in local languages.

There has been so much hype about ICTs and their role in development that ICT projects appear to have taken on a life of their own, becoming an end in themselves. Just like biotechnology or nanotechnology, ICTs are just a technology, and marginalised communities need to be empowered to participate in the debates about how the technologies are used and how the use could affect their lives and livelihoods.

There is a danger that ICTs could reinvent the paradigm of development, without learning the lessons of the Green Revolution or other extension programmes, or of participatory technology development (PTD). This framework aims to offer practitioners a way of critically examining ICT projects to ensure that they are adopting best practice and putting the needs of people living in poverty first.

CONCLUSION

This chapter has examined the literature about connecting the first mile and shown that authors

are polarised around key debates: whether solutions should be participatory or top-down, technological or social, whether they should focus on global or local information and overall how optimistic to be about the potential of ICTs for development. Authors' ideological perspectives around these debates determine how they evaluate the impact of a project and what they determine best practice to be.

The best practice framework proposed in this chapter has synthesised the lessons from a range of practical studies to identify the factors that contribute to the success of a project. Recommendations for best practice are divided into three dimensions: the environment, the project level, and the local level. The framework focuses on processes that contribute to project success in order to offer lessons in a wide variety of contexts. Whether a project chooses to define impact according to poverty reduction, ICT access, or project sustainability, the processes outlined in the framework will still be relevant to the practitioner.

Further research would take a set of primary case studies from various contexts and develop the framework on the basis of their experience. Adding measurable indicators would allow practitioners to benchmark their projects against the framework.

An analysis of the lessons of previous development initiatives such as participatory technology development or the Green Revolution could offer further suggestions for best practice.

Recent research used the framework to evaluate an ICT for development project in Cajamarca, Peru (<http://www.infodes.org.pe/siru>). The project aims to share livelihoods information with local producers (predominantly agricultural producers) and connects a network of local infocentres to agricultural information providers via a central information processing unit. The exercise generated learning about the project's successes and deficiencies and also about the viability of the framework. Applying the framework helped project staff to view their activities in a more holistic way and understand the impact on the project of actors outside the information value chain, such as funders, telecommunications companies, and local government bodies. It prompted a re-evaluation of partnership models and the need for re-formatting information for rural audiences, and a reconsideration of the role of ICTs in reaching illiterate rural populations.

In the future, the framework could be used to evaluate potential projects prior to funding, so projects meeting many of these criteria could be prioritised. The framework could also be used to benchmark different projects, for example by the Ministry of Agriculture in Peru to compare the various agricultural information systems in the country. Learning from the research in Peru, it is necessary to provide practitioners with a clear explanation about the distinction between the local level, the project level, and the environment. The framework needs to be integrated with other tools (such as an information value chain or a matrix of actors and activities) in order to understand the information flows in knowledge sharing projects at the first mile, and latent and explicit demand for information.

In this chapter it has been shown that ICTs can make a valuable contribution to development outcomes, provided they are viewed as a means,

rather than an end in themselves. It is also abundantly clear that initiatives will vary according to the local context, if they are to share knowledge with local communities. It is possible, however, to generalise about the processes that practitioners can adopt to constitute best practice. In the best practice framework, the authors' aim to synthesise these processes to support practitioners in addressing the challenges of connecting the first mile and empowering marginal communities to participate effectively in the information society.

REFERENCES

- Adeya, C. N. (2002). ICTs and poverty: A literature review. Retrieved July 4, 2004, from <http://web.idrc.ca/uploads/user-S/10541291550ICTPovertyBiblio.doc>
- Aley, R. (2003a). *Pro-poor satellite broadcasting: Reality or myth?* Unpublished work.
- Aley, R. (2003b). Rural information systems: Can technology help? *BASIN News*, (25).
- Aley, R., Waudo, A., & Muchiri, L. (2004). *MicroMedia card pack*. ITDG.
- Badshah, A., Khan, S., & Garrido, M. (2004). Connected for development: Information kiosks and sustainability. Retrieved May 20, 2004, from <http://www.unicttaskforce.org/wsis/publications/Connected%20for%20Development.pdf>
- Ballantyne, P. (2002). Collecting and propagating local development content. Retrieved September 20, 2003, from <http://www.ftpiicd.org/files/research/reports/report7.pdf>
- Ballantyne, P., Labelle, R., & Rudgard, S. (2000). Information and knowledge management: Challenges for capacity builders. Retrieved November 17, 2004, from <http://www.chs.ubc.ca/lprv/PDF/lprv0075.pdf>

- Batchelor, S., Norrish, P., Webb, M., & Scott, N. (2003). Sustainable ICT case histories. Retrieved November 11, 2003, from <http://www.sustainableicts.org>
- Beardon, H. (2004). *ICT for development: Empowerment or exploitation? Learning from the reflect ICTs project*. ActionAid.
- Besemer, H., Addison, C., & Ferguson, J. (2003). Fertile ground: Opportunities for greater coherence in agricultural information systems. Retrieved August 20, 2004, from <http://www.ftpiicd.org/files/research/reports/report19.pdf>
- Boyle, G. (2002). Putting context into ICTs in international development: An institutional networking project in Vietnam. *Journal of International Development, 14*, 101-112.
- Bridges.org. (2001). Spanning the digital divide. Retrieved October 22, 2003, from <http://www.bridges.org/spanning/report.html>
- Bridges.org. (2003). Evaluation of the SATEL-LIFE PDA Project, 2002: Testing the use of handheld computers for healthcare in Ghana, Uganda, and Kenya. Retrieved November 29, 2004, from <http://www.bridges.org/satellife/>
- Bridges.org. (2004). The 8 habits of highly effective ICT-enabled development initiatives. Retrieved July 26, 2004, from http://www.bridges.org/our_approach/eight_habits.html
- Carlsson, C. (2002). How can we learn more from what we do? Evaluation and evidence-based communications for development. Retrieved October 20, 2003, from <http://www.mande.co.uk/docs/Summary%20record-FINAL.doc>
- Cecchini, S., & Scott, C. (2003). Can information and communications technology applications contribute to poverty reduction? Lessons from rural India. Retrieved June 22, 2004, from http://www.developmentgateway.org/download/181634/cecchini_scott_ICT.pdf
- Chapman, R., & Slaymaker, T. (2002). ICTs and rural development: Review of the literature, current interventions and opportunities for action. Retrieved July 3, 2004, from http://www.odi.org.uk/publications/working_papers/wp192.pdf
- Chapman, R., Slaymaker, T., & Young, J. (2003). *Livelihoods approaches to information communication in support of rural poverty elimination and food security*. Overseas Development Institute.
- Crewe, E., & Young, J. (2002). Bridging research and policy: Context, evidence and links. Retrieved July 20, 2004, from http://www.odi.org.uk/publications/working_papers/wp173.pdf
- Davenport, T., & Prusak, L. (1998). *Working knowledge*. Boston: Harvard Business School Press.
- DFID. (2005). About DFID. Retrieved April 7, 2004, from <http://www.dfid.gov.uk/aboutdfid/>
- Duncombe, R., & Heeks, R. (1999). Information, ICTs and small enterprise: Findings from Botswana. *Development Informatics*, 1-16.
- Etta, F. (2003). ICTs in Africa: The landscape for growing telecentres. Retrieved July 21, 2004, from http://web.idrc.ca/en/ev-33004-201-1-DO_TOPIC.html
- Figuroa, M. E., Kincaid, D. L., Rani, M., & Lewis, G. (2002). *Communication for social change: An integrated model for measuring the process and its outcomes* (Report No. 1). MD: Johns Hopkins University.
- Girard, B. (2001). A passion for radio. Retrieved July 25, 2004, from http://www.comunica.org/passion/pdf/chapter1_intro.pdf
- Gomez, R., & Casadiego, B. (2002). Carta a la Tía Ofelia: Siete propuestas para un desarrollo equitativo con el uso de nuevas tecnologías de información y comunicación. Retrieved November 20, 2004, from <http://www.idrc.ca/pan/ricardo/publications/Ofelia.htm>

- Gumicio Dagrón, A. (2001). Making waves: Stories of participatory communication for social change. Retrieved October 17, 2004, from <http://www.rockfound.org/Documents/421/makingwaves.pdf>
- Heeks, R. (2002). I-development not e-development: Special issue on ICTs and development. *Journal of International Development*, 14, 1.
- Hamelink, C. J. (1994). Trends in world communication, on disempowerment and self-empowerment. Penang, Malaysia: Southbound, Third World Network.
- Infodev. (2004). Keep in mind: Overall analysis. Retrieved July 29, 2004, from http://iconnect.osc.nl/stories/lbd/overall_analysis
- Practical Action. (2003). Women's voices. Retrieved September 3, 2005, from http://www.practicalaction.org/?id=womens_voices2
- Lloyd Laney, M. (2003a). Advocacy impact assessment guidelines. Retrieved November 29, 2004, from <http://www.cimrc.info/pdf/news/Impactassess.pdf>
- Lloyd Laney, M. (2003b). Making information user-driven. Retrieved April 20, 2003, from <http://www.infrastructureconnect.info/pdf/news/Userdriveninfo.pdf>
- Lloyd Laney, M. (2003c). Making knowledge networks work for the poor. Retrieved July 10, 2003, from <http://www.itcltd.com/docs/mkntp%20project%20final%20report.pdf>
- Max Lock Centre. (1999). Improving knowledge transfer in urban development: guides. Retrieved October 20, 2003, from <http://www.westminster.ac.uk/builtenv/maxlock/KTweb/KTFindex.htm>
- Meera, S. A., Khamtani, A., & Rao, D. U. M. (2004). Information and communication technology in agricultural development: A comparative analysis of three projects from India. Retrieved May 18, 2004, from http://www.odi.org.uk/agren/papers/agrenpaper_135.pdf
- Michiels, S. I., & Van Crowder, L. (2001). Discovering the "magic box": Local appropriation of information and communication technologies (ICTs). Retrieved July 14, 2004, from http://www.fao.org/sd/2001/KN0602a_en.htm
- Morrow, K. (2002). The ICT agenda: Global action plans and local solutions. *Low External Input Sustainable Agriculture (LEISA) Magazine*, 18.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company*. Oxford: Oxford University Press.
- O'Farrell, C., Norrish, P., & Scott, A. (1999). Information and communication technologies (ICTs) for sustainable livelihoods. Retrieved July 26, 2004, from <http://www.rdg.ac.uk/AcaDepts/ea/AERDD/ICTBriefDoc.pdf>
- Op de Coul, M. (2003). ICT for development case studies. Retrieved May 18, 2004, from <http://www.bellanet.org/leap/docs/BDOsynthesis.pdf>
- Paisley, L., & Richardson, D. (1998). Why the first mile and not the last? Retrieved July 26, 2004, from <http://www.fao.org/docrep/x0295e/x0295e03.htm>
- Prahalad, C. K., & Hammond, A. (2002a). Serving the world's poor, profitably. *Harvard Business Review*, 80, 48.
- Primo Braga, C. A., Daly, J. A., & Sareen, B. (2003b). *The future of information and communication technologies for development* (pp. 1-17).
- Raab, R. T., Woods, J., & Abdon, B. R. (2003). The role of e-learning in promoting sustainable agricultural development in the GMS: Educating knowledge intermediaries. Retrieved July 11, 2004, from http://www.ait.ac.th/digital_gms/Proceedings/D32_ROBERT_T_RAAB.pdf
- Sachs, W. (1992). Introduction. In W. Sachs (Ed.), *The development dictionary* (pp. 1-6). Zed Books.

Saravia, M. (2005). *Organizaciones de la sociedad civil y programas nacionales TIC: Buscando el Encuentro*. Retrieved September 3, 2005, from <http://www.itdg.org.pe/archivos/tic/Buscando-encuentro.pdf>

Schilderman, T. (2002). Strengthening the knowledge and information systems of the urban poor. Retrieved October 10, 2003, from http://www.itdg.org/html/shelter/docs/kis_urban_poor_report_march2002.doc

Stiglitz, J. (1999). *Scan globally, reinvent locally: Knowledge Infrastructure and the localisation of knowledge*. Global Development Network.

Stoll, K., Menou, M. J., Camacho, K., & Khelady, Y. (2001). Learning about ICT's role in development: A framework toward a participatory, transparent and continuous process. Retrieved August 8, 2004, from <http://www.bellanet.org/leap/docs/evaltica.doc?OutsideInServer=no>

Tschang, T., Chuladul, M., & Le, T. T. (2002a). Scaling-up information services for development: A framework of increasing returns for telecentres. *Journal of International Development*, 14, 129-141.

van der Velden, M. (2002). Knowledge facts, knowledge fiction: The role of ICTs in knowledge management for development. *Journal of International Development*, 14, 25-37.

Weigel, G., & Waldburger, D. (2004). ICT4D: Connecting people for a better world. Retrieved November 18, 2004, from <http://www.globalknowledge.org/ict4d/index.cfm?menuid=43>

World Bank. (1998). Knowledge for development (World Development Report 1998/99). Retrieved

February 8, 2003, from <http://www.worldbank.org/wdr/wdr98/index.htm>

World Bank. (2001). Attacking poverty (World Development Report 2000/2001). Retrieved August 20, 2004, from <http://www.worldbank.org/poverty/wdrpoverty/report/index.htm>

TERMS AND DEFINITIONS

Best Practice: A set of guidelines or recommendations based on a study of the most effective approaches to performing a given activity.

Information Communication Technologies (ICTs): The technologies that enable the handling of information and facilitate different forms of communication among human actors, between human beings and electronic systems, and among electronic systems (Hamelink, 1997, p. 3).

Information Sharing: The exchange or transfer of information between people or systems.

International Development: Efforts, by developed and developing countries, to bring people out of poverty and so reduce how much their country relies on overseas aid. Many different things can contribute to development which reduces poverty, such as settling conflicts, increasing trade, and improving health and education (DFID, 2005).

Knowledge: A fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers (Davenport & Prusak, 1998, p. 5).

Chapter 2.2

A Framework to Build Process Theories of Anticipatory Information and Communication Technology (ICT) Standardizing

Kalle Lyytinen

Case Western Reserve University, USA

Thomas Keil

Helsinki University of Technology, Finland

Vladislav Fomin

Delft University of Technology, The Netherlands

ABSTRACT

Standards have become critical to information and communication technologies (ICTs) as they become complex and pervasive. We propose a process theory framework to explain anticipatory standardizing outcomes post hoc when the standardizing process is viewed as networks of events. Anticipatory standards define future capabilities for ICT ex ante in contrast to ex post standardizing existing practices or capabilities through de facto standardization in the market. The theoretical framework offers the following: a) a lexicon in the form of the ontology and typol-

ogy of standardizing events; b) a grammar, or a set of combination rules, for standardizing events to build process representations; c) an analysis and appreciation of contexts in which standardizing unfolds; and d) logic yielding theoretical explanations of standardizing outcomes based on the analysis of process representations. We show how the framework can help analyze standardization data as networks of events as well as explain standardizing outcomes. We illustrate the plausibility of the approach by applying it to wireless standardization to explain standardizing outcomes.

INTRODUCTION

Over the past decade, successful standard-setting has become critical for innovation, while Information and Communication Technologies (ICTs) have become networked, ubiquitous, and complex (David, 1995; Mansell & Silverstone, 1996). ICTs are technologies dedicated to information processing; in particular, they involve the use of computers and software to convert, store, protect, process, transmit, and retrieve information (Wikipedia, 2005). Recently, traditional standard-setting mechanisms have become rife with problems: They do not respond well to the increased scope, pace, and complexity of technological and market change associated with ICTs (Garud, et al., 2002; Schmidt & Werle, 1998; Werle, 2000). This is the case, in particular, with the exponential growth of *anticipatory* ICT standards—standards that embed significant technological or process innovations into the technical specification—and which are “intended to guide the emergence of new technologies and consequently indicate far ahead in advance of the market’s ability to signal the features of products that users will demand” (David, 1995, p. 29). Anticipatory standards define future capabilities for ICTs in contrast to recording and stabilizing existing practices, or capabilities *de facto*. Failures with anticipatory ICT standardizing are common (Steinmueller, 2005; Markus, et al., 2006) and our ability to explain their failure with the existing body of knowledge is poor.

In this article we advance process theorizing of ICT standardizing—the mission of describing, revealing, understanding, and explaining processes, features, and outcomes of ICT standardizing (Weick, 1995). To this end we formulate a theoretical framework which helps formulate plausible, generalizable, and valid explanations of *why* and *how* certain ICT standardizing outcomes emerged (Weick, 1989). The framework posits that ICT standardizing can be seen as a network of events that create and coordinate the adop-

tion of institutionally-bound and contextualized technological repertoires (capabilities) among a set of heterogeneous actors. We draw upon Actor Network Theory (ANT) and Social Construction Of Technology (SCOT) studies (Howcroft, et al., 2004) to explicate these necessary theoretical constructs.

ICT standardizing is viewed in this study as collective engineering of technical specifications (David, 1995; Steinmueller, 2005; Baldwin & Clark, 2005). By drawing upon SCOT (Bijker, 1987), we view anticipatory standardizing as technology framing—sense-making—which at the same time builds durable socio-technical networks (Callon & Law, 1989; Latour, 1995). The framework analyses of event networks of such engineering, sense-making, and negotiation activities offers: a) a *lexicon* in the form of ontology and typology of standardizing events; b) a *grammar*, or set of combination rules for events to build *process representations*; c) an analysis of *contexts* in which events unfold; and d) a set of *logical rules* to yield explanations of standardizing outcomes.

The proposed framework is not a *process theory* of anticipating ICT standardizing outcomes. First, it is not a theory of anticipatory *standards* as ready-to-adopt fixed artifacts, but instead it moves towards theorizing about *standardizing as a stream of social, political and design events which connect ideas, artifacts, people, and institutions to yield a specific technical specification*. Like all process theories, it cannot be used to accurately predict standardizing outcomes, but rather to analyze why specific processes took place in the way they did, and why certain outcomes emerged (Mohr, 1982; Markus & Robey, 1988; Langley, 1999) as to anticipate outcomes of future standardization situations. Second, it is not a complete process theory, as it offers at current state theoretical constructs to compose statements to understand and explain concrete standardizing outcomes.

The remainder of the article is organized as follows: In the second section we define anticipatory ICT standardization and critically review past literature on anticipatory ICT standards to identify core concepts for our integrative framework. In the third section, we build on this review by integrating concepts from the review and developing our theoretical framework, which consists of process theories, the lexicon, the grammar, the context analysis, and the logic. We show how these concepts can account for anticipatory ICT standardizing outcomes. In particular, we illustrate the benefits of the framework by analyzing a small standardizing episode. The fourth section summarizes the main findings, compares the proposed theoretical framework with other accounts of standardization, and explores avenues of future research.

RECEIVED STANDARDIZATION THEORY

Anticipatory ICT Standardizing Defined

In general, “a standard defines a uniform set of measures, agreements, conditions, or specifications between parties (buyer-user, manufacturer-user, government-industry, or government-governed, etc.)” (Spivak & Brenner, 2001, p.16). Technology standards offer agreed upon, external points of reference to which the physical and performance characteristics of current or future technologies can be compared (Hawkins, 1995; Spivak & Brenner, 2001). For this article, we limit ourselves to anticipatory ICT standards that integrate and embed significant technological innovations¹. Such standards are very challenging to formulate and enforce as they do not just record existing practices (e.g., quality standards), or establish some new practices that need just to be coordinated (e.g., measures). Their intent is to generate new principles to existing solutions, or

to create totally new solutions. Because of this they offer significant upside economic yields and embed significant challenges related to intellectual property, scale of economic benefits and costs, and means to enforce standards and their deviations, yet also pose significant risks of failing.

We define *anticipatory ICT standardizing* as a process in which two or more actors come to agree upon and adhere in a contract to a set of publicly available original and novel technical specifications for an ICT system, service, or capability, including its parts, features, or functionality (David & Greenstein, 1990). Typically, anticipatory ICT standards emerge as multi-firm agreements about technologies, e.g., Bluetooth standard (Keil, 2002) and GSM standards (Mouly & Patet, 1991), as vertical industry standards, e.g., Markus, et al., 2006; Damsgaard and Lyytinen (2001),; as de facto standards constituting an open standard, e.g., SUN’s Java platform (Garud, et al., 2002), or as open specifications which later can become de facto standards, e.g., IETF’s RFCs (Tuomi, 2001) or W3C drafts or RFCs (Berners-Lee, 1999).

Due to its *innovative* nature, anticipatory ICT standardizing is akin to cooperative, multi-actor R&D and indicative of *collective engineering*, where standard setters create capabilities to displace existing capabilities (David, 1995), and seek thereby new markets (Gabel, 1991). Because of this, anticipatory ICT standards share four features: 1) they record and coordinate advances in information and communication technology capabilities (Mansell & Silverstone, 1996); 2) they are intended to guide future compatibility or interoperability requirements-related ICTs, including physical products, service platforms (David, 1995), or data exchange or process standards (Markus, et al., 2006); 3) they are often created in international and/or national institutional contexts to promote industry-level coordination (Hawkins, 1995); and 4) they are conveyed in public domain documents to which different parties have *open access* and can thus be influenced through institutions (Gabel, 1991).

FOUR PERSPECTIVES OF ANTICIPATORY ICT STANDARDIZING

An in-depth review of all research in anticipatory ICT standardization is beyond the scope of this article. Rather, we will in the following summarize four broad theoretical perspectives and examine how each stream has approached anticipatory ICT standardizing problems (Table 1a/b). We will discuss what specific theories have been deployed in each perspective and what are the strengths and weaknesses of each perspective

Practitioner Literatures

There is a relatively large body of practitioner-oriented literature that discusses practice-related issues relevant to ICT standardization (see, e.g., Cargill, 1989). While this literature covers the whole process of standard creation and selection, thoroughly documents standardization institutions and associated processes, and offers useful rules of thumb for approaching standardizing situations, it lacks a theoretical underpinning that limits its explanatory power to account for standardization processes and outcomes.

Economic and Management Theories of Standardization

In a second stream of research, standardization has been analyzed as an economic or managerial decision problem (Shapiro & Varian, 1998; Swann, 2000). It is driven by the following research questions: Why do producers or users choose a specific ICT standard, and what is their rational justification for such a choice? In addressing these questions, researchers use economics or management theories to explain the economic benefits of standards and identify conditions that maximize individual users' or collectives' welfare. Early economics literature focused on market-based selection (Farrell & Saloner, 1985; Farrell &

Saloner, 1986). Recent studies have also focused on explaining the dynamics of standard adoption by utilizing asymmetric switching costs (e.g., Brynjolfsson & Kemerer, 1996; Farrell & Saloner, 1988a), network externalities (David & Steinmueller, 1994), or increasing returns (Arthur, 1989). Relatively few studies have analyzed standard selection within standardization institutions, or within hybrid arrangements, such as standardization alliances (Axelrod, et al., 1995).

While the body of economics literature is large and growing, these studies suffer from a number of deficiencies when we try to understand anticipatory ICT standardizing. First, these studies focus completely on standard choice and ignore technological, social, structural, or institutional forces that shape standard creation and selection (Markus, et al., 2006; Weitzel, et al., 2006). Accordingly, a standard-to-be-selected is assumed to be a natural state to which companies and other actors respond passively. Yet, this is not the case with anticipatory standards. While economic models often provide deep insights into counterintuitive outcomes of standard choices, they are limited in analyzing relatively simple choice situations where the choice shifts fast and unpredictably. Accordingly, they are not well suited to account for outcomes of complex anticipatory standardizing that have had a significant strategic impact (Funk, 2002; Markus, et al., 2006). In addition, these studies ignore the influence of social or institutional context and the "shadow" of history that affects standard creation.

Legal and Public Policy Studies

Although most legal and public policy studies do not address the issue of standardization *per se*, many such studies have either analyzed the broader context in which standardizing takes place, or subsumed standardization as a form of regulation. This connection is obvious as regulatory environments provide the context in which standardizing takes place and standards are en-

Table 1a. Theories to analyze anticipatory ICT standarding outcomes

| Perspective | Theory | Domain/Focus/Phase | Research Question | Explanatory mechanisms | Strengths/Deficiencies | References |
|---------------------------------------|--|--|---|---|--|--|
| <i>Practitioner</i> | A-theoretical | Domain: ICT standard Focus: Any standard Phase: Standardization as a process | How are standards created and how do standardization institutions operate? | Rules of thumb, normative principles, descriptive narrative | <i>Rich descriptions of actual processes and rules of thumb</i> What should I do or how should I go about in standardizing in this situation. Lack of theoretical underpinnings, difficult to generalize | (Cargill, 1989; Schmidt & Werle 1998) |
| | Game theory: Standard creation | Domain: General Focus: Any standard Phase: Standard Creation | Selection of a type of standardization strategy | Rational expectations of firms in game setting | <i>Explains choice of body,</i> General focus, and domain, ignores nature of standardization, little emphasis on process, no explanation of technology | (Farrell & Saloner, 1988a) |
| | Game theory: Standard selection | Domain: General Focus: Any standard Phase: Standard Selection | Selection of de facto standard | Rational expectations of firms in game setting | <i>Explains choice of existing standard.</i> General focus and domain can take into account innovation by risk/ yield, no emphasis on standardization process, no explanation of technology | (Farrell & Saloner, 1986; Weitzel, et al., 2006) |
| <i>Economics</i> <i>Management</i> | Increasing returns and network effects | Domain: General Focus: Any standard Phase: Standard Selection | Selection of de facto standard | Network effects, positive externalities | <i>Explains choice of existing standard.</i> General focus and domain, with no focus on social context, no emphasis on standardization process, and no explanation of technology | (Arthur, 1989; David, 1985; Katz, 1986; Shapiro & Varian, 1998; Weitzel, et al., 2006) |
| | Asymmetric switching cost | Domain: General Focus: Any standard Phase: Standard Selection | Selection of de facto standard | Asymmetric switching cost due to installed base | <i>Explains inertia in switching between standards.</i> General focus, ignores nature of standard and social forces, no emphasis on standardization process, no explanation of technology | (Brynjolfsson & Kemerer, 1996; Farrell & Saloner, 1988b; Shapiro & Varian, 1998) |
| <i>Legal and Public Policy</i> | Theories of regulation | Domain: General Focus: Any standard but recently mainly ICT Phase: Standard as a regulation | How do intellectual property rights and antitrust law affect standards and vice versa? How can a standard be viewed as regulation? | Standard as regulation. Regulatory actors. Intellectual property rights and antitrust law | <i>Provides rich explanation of the context for standardization processes.</i> Static view of technology, fails to develop a process perspective of regulation | (Lessig, 1999a; Hosen, et al., 2003; Jarvenpaa, et al., 2003; Patterson, 2002) |

A Framework to Build Process Theories of Anticipatory ICT Standardizing

Table 1b. Theories to analyze anticipatory ICT standardizing outcomes

| Perspective | Theory | Domain/Focus/Phase | Research Question | Explanatory mechanisms | Strengths /Deficiencies | References |
|--------------------------------|--|--|--|---|---|---|
| <i>Sociology of Technology</i> | Actor Network Theory (ANT) | Domain: General Focus: Any standard Phase: Standardization as a process | How are standards created? How do standards become selected so that technologies become stable? | Enrolment into actor networks through translation Paths in networks. Passage points | <i>Explains how standards are stabilized within socio-technical networks and how they become irreversible</i> Descriptive language to explain standardization processes and outcomes as a set of translations. General theory of technology as inscriptions. Focus on structure of the actor network, downplays individual's innovative role in anticipatory standards | (Allen, 2004; Callon & Law, 1989; Faraj, et al., 2004; Hanset, et al., 1996; Howcroft, et al., 2004; Latour, 1997; Law, 1992; Mangematin & Callon, 1995; Mähring, et al., 2004; Ramiller, 2005; Walsham, 1997; Walsham & Sahay, 1999) |
| | Social Construction of Technology (SCOT) | Domain: General Focus: Any standard Phase: Standardization as a process | How do standards embody specific problem-solving strategies? How do standards reach a closure, i.e., become standard ways of defining technology? | Designer and user communities. Technology frames Closure | <i>Explains how technology is interpreted over its lifetime and how such interpretations stabilize.</i> Descriptive language to identify and analyze design choices and rationale associated with standards. Views design and use of ICT systems as a framing process. Focuses mostly on sense-making after design, little focus on sensemaking during design. No process study methodology | (Bijker, 2001; Davidson, 2002; Orlikowski & Gash, 1994; Pinch & Bijker, 1987; Sahay & Robey, 1996; Swanson & Ramiller, 1997) |

forced. For instance, legislation about intellectual property rights (Patterson, 2002; Weiser, 2003) and antitrust legislation (Sheremata, 1998; Teece & Sherry, 2003) directly influence anticipatory standardizing. By the same token, new anticipatory technological standards and their proliferation generate forces that shape regulation (Hosein, et al., 2003). This has led some scholars to suggest that standards can be viewed as a form of regulation (Hosein, et al., 2003; Jarvenpaa, et al., 2003; Lessig, 1999a, b). For instance, Jarvenpaa, et al. (2003) draw parallels between standardization and regulation by arguing that any market player that affects the ICT architecture is acting as a regulatory agent.

Although legal and public policy studies of standardization improve our understanding of how standardization processes are embedded in an institutional context, and are shaped by and contribute to enacting this context, these studies are limited in their ability to inform our understanding of anticipatory ICT standardizing. First, the institutional regulatory environment and the standardization contexts differ radically. Regulation is carried out by national or international legislative institutions based on a public mandate and force. By contrast, anticipatory standardizing takes place in a wide variety—ecology—of institutions that range from informal alliances within an industry to formal standard development organizations associated with nation states (SDOs) (Schmidt & Werle, 1998). This difference suggests that a less institution-bound theory might be needed for standardizing.

The literature that focuses on technology standards as a regulatory actor has also been criticized as static (Hosein, et al., 2003). In particular, within anticipatory ICT standardizing, a more dynamic view is needed that covers simultaneously the emergence of new technologies and the social forces—institutions—that are tied with these technologies and shape actors' expectations, channel resources, and mobilize bias (King, et al., 1994). Finally, the regulatory literature, while

emphasizing parties' incentives to create regulatory mechanisms, has failed to provide a process theory of how regulatory mechanisms themselves are created (Croley, 1998). This also weakens the suitability of this stream to explain anticipatory ICT standardizing outcomes.

Social Theories of Standardization

A fourth stream of standardization research is rooted in the sociology of technology research (Williams & Edge, 1996). The bulk of this literature draws upon either the Actor Network Theory (ANT) (Latour, 1997, 1999) or the Social Construction of Technology research (SCOT) (Bijker, 1987). For a general overview and discussion of both literatures, we refer to Howcroft, et al. (2004). Both of these literatures share an interest in examining standardization as interactions between socio-technical elements in which the technology-to-be-standardized becomes invented, introduced, invested, and stabilized (Latour, 1999). Though recently these two approaches have converged, as actor-centered analysis has been extended into broader settings of technology assessment (Sørensen & Williams, 2002), these literatures are somewhat distinct in how they account for technology creation and adoption.

In SCOT, the emphasis is on the evolution and mobilization of interpretive schemes and associated engineering skills as the technology becomes invented and stabilized. Its *leitmotif* is to explain why technology obtains a certain shape and how such shaping is socially conditioned and produced. This explanation is organized around a theory of *technology frames*—a set of community-wide, shared mental schemes “composed of... the concepts and techniques employed by a community in its problem solving” (Bijker, 1987, p.168). In particular, SCOT research has suggested the notion of *closure conditions* (Pinch & Bijker, 1987) that determine when and how technology frames stabilize. Accordingly, an investigator of standards should trace backwards from a “closed”

technology standard to situations where specific alternatives were excluded while addressing critical challenges during standard design (Hughes, 1987). This unpacking reveals why and how technological choices are made. SCOT complements economic research in that it identifies and narrates interpretive processes associated with design and foregrounds *sense-making* associated with any technical innovation—including anticipatory standards (Pinch & Bijker, 1987).

Actor-Network Theory seeks to understand why and how a technological solution was created as a carrier of a network of *both* technical and social relations. It aspires to reveal how a technology “embodies the innovator’s beliefs, social and economic relations, patterns of use, legal limits, and assumptions as to what the artefact is about” (Akrich, 1992a). ANT leads an investigator to ask the following questions: How did actors become aligned? (Callon, 1986) What reasons did they have for entering the network and how did this change their behaviors (inscriptions) (Akrich, 1992a)? To explain anticipatory standardizing, ANT would trace the designed and agreed standard back into set of “translations” (Callon, 1986) where actors became “enrolled” in a network. Though ANT theorists do not assume sequential processes in such network constructions, nearly all ANT studies explain network emergence as an orderly sequence of specific types of events (Callon, 1986). This ordering is subordinated to a movement towards an *obligatory passage point* (Callon, 1986): “a situation through which the heterogeneous actors involved... must be made to pass” (Ramiller, 2005, p.57). One such passage point, for example, would be the agreement about the final contract, while another one would be to make the technology to behave as specified in the standard.

ANT shares with SCOT the interest in revealing why standardizing followed one trajectory and thus stabilized, and by doing so excluded other alternatives. Yet, the notion of stabilization in these streams is different. In ANT, stabilization

is seen to result from an expanding enrolment that leads the actor-network to grow whereby the content and intensity of the connections in the network changes (Mangematin & Callon, 1995). The ANT literature thus provides insights into how increasingly complex socio-technical networks emerge, and how, due to intricacies of the translation *process*, the standards become *stable*, i.e., *agreed* and *irreversible*. In SCOT, in contrast, standardizing is about closing, typifying, and objectifying frames that “read” technologies-in-making.

Both ANT and SCOT have been adopted in ICT standardizing, or innovation, research. SCOT researchers have studied managers’ sense-making during IT innovation (Swanson & Ramiller, 1997), how users and designers interpret requirements (Davidson, 2002), how users make sense of the technology (Orlikowski & Gash, 1994), and how technologies maintain interpretive flexibility (Sahay & Robey, 1996). Past ANT research has studied system implementations as translations through passage points (Mähring, et al., 2004; Ramiller, 2005), and how systems create social orders (Walsham & Sahay, 1999).

Research focused on ICT standardizing has also drawn upon both strands of social theory. First, Hanseth, et al. (1996) examined how standards are inscribed during standardization processes by using ANT. Likewise, Egyedi (2005) analyzed how the institutional context of SDO affects standardization outcomes based on ANT. She investigated negotiations within an actor-network in explaining standardizing outcomes. She analyzed, in particular, the meaning, purpose, or role of the network, actors’ positions in the network, and the boundaries of the network. Likewise, Jakobs (2006) examined relationships between standardization and user-side innovation by using SCOT. He observed mutual influence between standardization and innovation sense-making in which technology standards are being developed. Likewise, Stewart and Williams (2005), drawing upon SCOT, discussed user sense-mak-

ing during innovation and suggested that “in this process, artifacts are often reinvented and further elaborated (“innofusion”)” (Stewart & Williams, 2005, p.195).

Despite their merits in explaining technology evolution, ANT and SCOT remain broad theories of technological and social orders. This makes them too general to capture critical aspects of anticipatory ICT standardizing. They suffer among others weaknesses in accounting anticipatory ICT standardizing as collective engineering in specific institutional contexts. From the ANT viewpoint this introduces a challenge in explaining who should be enrolled, why, and how, and what is the organization of the network when design is fluid, shifting, and ambiguous. Some ANT assumptions, like actors’ interests, remain relatively stable (Allen, 2004); they know within whom/what they need to enrol, and are not plausible in this context (Ramiller, 2005). During anticipatory standardizing, designers do *not* know what networks they must pull together: Designs remain ambiguous, their consequences cannot be predicted, and most relationships between the actors are up for grabs (Van de Ven, et al., 1999). Actors discover their interests dynamically by enrolling in different networks in different ways over time, and their interests emerge hand-in-hand with advances in various designs (Ramiller, 2005).

Likewise, SCOT suffers the lack of integrating individual creativity in its concept of technology frame. It is not clear what role breakthrough ideas, novel innovations, and exceptional individual talent play in the evolution of technology if technologies are directed and shaped by community sense-making. In addition, SCOT views “technology framing” primarily as a user-related sense-making around finished designs (Pinch & Bijker, 1987). Yet, as a form of innovation, anticipatory standardizing involves surprises that unexpectedly change the direction of design, and it is driven by shifting individual design-triggered framing. These shifts are produced by individual designer’s wits in framing their designs *differ-*

ently, which, in turn, will affect how they locate into social and technological networks. When designers weigh in new design options, both the design and its interpretation change, and “they are themselves transformed, ‘redesigned’ as actors, as they learn about the possibilities of the technology” (Ramiller, 2005, pp.71-72). Thus, due to both SCOT and ANT’s focus on established and fixed actor networks, or community wide “technology frames,” they are limited to accounting for how an individual designer and later a design team can shape standardizing outcomes. Although some attempts to resolve this problem have been made (Akrich, 1992; Faraj, et al., 2004), how individual cognition is currently brought to bear in understanding standardizing is limited to finished designs.

Motivation for the Proposed Process Theory Framework

ANT and SCOT together offer an excellent starting point for developing a process theory for anticipatory ICT standardizing. They both focus on processes that make technologies stable and irreversible—a goal also shared in anticipatory standardizing. However, both approaches are broad descriptive “sensitizing devices,” and do not aspire to produce process explanations that are specific to ICT standardization context. They offer little guidance how accounts of ICT standardization processes can be formulated and systematically analyzed. We believe, however, that more localized theoretical frameworks can be useful in building process theories of standardizing that are accurate and theoretically adequate to identify, analyze, and synthesize standardizing events and their connections into networks. These networks can then be used to build explanations why and how an ICT standardization outcome was produced (Langley, 1999). In what follows, we formulate a process theory framework to build anticipatory ICT standardizing theories (Weick, 1989).

A PROCESS THEORY FRAMEWORK FOR ANTICIPATORY ICT STANDARDIZING

A theoretical framework for standardizing process theories consists of a set of constructs (lexicon) and their relationships (a grammar) that help formulate process theories (a theory logic), and a set of criteria to evaluate such theories (Bacharach, 1989). A general discussion of process theories is beyond the scope of this article (see Langley, 1999; Van de Ven, et al., 1999; Pentland, 1999; van de Ven & Poole, 1995; Mohr, 1982). We just note that process theories differ mainly in types of constructs, their relationships, and the logical way inferences are made from the data (Mohr 1982; Van de Ven, et al., 1999). A problem in available process theory guidelines is that they are about broad social processes and do not take into account differences, e.g., in accounting a small project change, a disruption in a team's behavior, or a strategic change. They are mainly distinguished by the level and nature of constructs used, type of analysis method, or complexity (Langley, 1999). To build process theories of anticipatory standardizing demands, however, it is necessary that we increase the domain level detail (vertical theorizing) among constructs used and the richness in their connections (Weick, 1989). This must be reflected in the consequent choice of constructs and the ways in which we advance explanations with those constructs.

In general, we define a *process* as a set of events that unfold over time in a context (Petigrew, 1997). We call any set of such events organized over time an *episode*. Standardizing events accordingly range from imagining use scenarios to designing specifications and testing, to choosing between design options². An ICT standardizing process theory is about the types of events that unfold, how they relate, and how they explain standardizing outcomes (Markus & Robey, 1988; Mohr, 1982; Van de Ven & Huber,

1990). In short, it explains *why* and *how* an ICT standardizing outcome emerged.

We propose the following constructs following Bacharach's (1989) suggestions for theory building to build ICT standardizing process theories:

1. A *context* in which the events take place. This construct is critical for two reasons: a) most process explanations are context-dependent and the notion of context is needed for increasing internal validity, and at the same time b) context is necessary for generalizing across other situations and improving external validity of the proposed theory. Overall, context construct is needed to align with Bacharach's (1989) idea of the utility of the conceptual relationships and their explanatory potential and related assumptions.
2. A *lexicon* of event types and outcomes. The lexicon defines the content and granularity of standardizing events that will be brought to bear in explaining the outcome. This element corresponds with Bacharach's (1989) concept of theory constructs that define theory variables, and the theory's scope.
3. An *event grammar* that characterizes the nature of relationships into which the standardizing events enter. The grammar establishes a focal means of arranging events into relationships and chronicling event networks as defined by their temporal ordering, or by other relationships. This element relates Bacharach's (1989, p. 510) concept of construct relationships and criteria by which one assesses the logical adequacy of those relationships.
4. A set of *logics* to infer from the events, their networks and contextual relationships, statements how and why the process was organized as it was, and why certain outcomes emerged. This element corresponds to Bacharach's (1989) demand for theory-

based explanations that are grounded on propositions.

THE CONTEXT

Generally, a process emerges from interactions between events and a context (Van de Ven, et al., 1999). A context is instrumental in process explanations, as it relates events into nested arrangements of associated structures and processes (Pettigrew, 1997). Accordingly, we need to examine how events “of one period lead to changes in the context that affect action in the subsequent periods” (Langley, 1999, p.703). In line with this approach, we assume that standardizing events are constrained by the context, but they also shape that context by preserving or altering technological capabilities, modifying institutional arrangements, or changing the actors (Pettigrew, 1997).

During standardizing, the context can be separated into a nested structure of focal actors, the technological environment, the market environment, and the institutional environment. The technological environment includes existing and emerging ICT technologies, past design choices in deploying these technologies, and emerging technological trends. The technological environment defines what is technologically possible and desirable. Actors include firms, organizations, and individuals who are directly participating in the standardizing process. In anticipatory ICT standardizing, firms from varied industries as telecommunications equipment, telecommunications services, information technology, semiconductor manufacturing, packaged software, or many user industries participate. Organizations such as the ITU, ETSI, or other industry associations might participate actively in standardizing. The market environment includes existing or emerging markets that the standard is targeting or that might be influenced by the emergence of the standard as well as the firms and organizations or individuals operating in these markets. Finally, the institu-

tional context includes institutional arrangements as well as regulatory and legal frameworks within which the standardizing takes place. Institutional arrangements might include standardization fora, alliances, or standardization bodies in which the standardizing takes place. In particular, regulations about the telecommunications or information technology domain and anti-trust laws play an important role in shaping the standardizing.

A LEXICON OF EVENTS

We assume each such standardizing *event* accounts in some way, either directly or indirectly, for the observed outcome. This defines the profile of each event, and covers the type of outcome, its content (what the event is about), and related actors. We assume that standardizing events can be analytically distinguished based on their primary outcomes—the content—and that each event is associated with an output of a specific type (as reflected in resulting documents, ideas, artifacts, or agreements). Such output is later regarded instrumental in explaining the ensuing process and its outcomes. Events that do not have such impact can always be discarded during the process as irrelevant for the current theory building effort. An event can be triggered by other events, or by changes in the context, and such causes of events need to be identified in the event description.

In general, several different types of outputs can be related to any standardizing episode, such as a standards meeting. These episodes have multiple and diverse outputs that need to be carefully separated and associated with specific individual events. In addition, to account for the temporal dimension, each identified event must be tagged with start and end times so that they can be ordered in temporal sequences. Such baseline sequences of events offer a basis for formulating process explanations.

Traditionally, process theories have used a singular concept of an event, which is defined as

an observed change in the process state marked by a point in time. In this regard, we find current process theories to be too general, and propose here a richer domain-specific typology which classifies standardizing processes into three types of events. As our primary interest lies in understanding what goes on during standardizing while an ICT standard emerges as an “agreed upon” specification, we need a typology that distinguishes between various aspects of standardizing in the same manner as Simon (1977) distinguished between different aspects of decision making. Simon drew his distinctions based on the idea of cognitive orientations that characterize three recursive phases of decision making that completely describe decision outcomes. His cognitive orientation included a set of cognitive elements and processes that had to be foregrounded in each phase. Completeness was about finding out which types of cognitive orientations were necessary so that a decision-making process could be successfully completed. Accordingly, he proposed three decision phases 1) *intelligence*: defining a problem space; 2) *design*: structuring a problem space; 3) *choice*: searching in that space. He also demonstrated their completeness in exhaustively explaining decision outcomes.

Likewise, we will define ICT standardizing events based on their essential *cognitive orientations*. We distinguish three cognitive orientations whereby ICT standardizing can be broken down into: 1) *design*, 2) *negotiation*, and 3) *sense-making*. Here, 1) *Design* orients itself towards the creation of technical specifications and draws upon engineering principles that lay out design architectures, components, and their specifications; structural, functional and observable behavioral features (e.g., reliability) of the artifacts dominate the reasoning; 2) *Negotiation* orients itself towards reconciling technical solutions with regard to the interests of the involved actors; strategies and interests of actors and anticipations of their behaviors towards other actors dominate the reasoning, and 3) *Sense-making* orients itself

towards “reading” technical specifications in ways that relate them to the life-worlds associated with the use of produced artifacts and/or shaping institutional contexts that surround specified technology. Here, design artifacts’ relationships to users’ experience, designer’ experience and others’ life-worlds dominate the reasoning. All these types are necessary to define and produce an anticipatory standard. Design events are necessary to yield specifications that can include novel principles which are shown to work. Negotiations are needed to reach agreements between actors, while sense-making is needed to contextualize the specification and negotiation events into an unfolding business, insitutional, and user context (Weick, 1995).

In formulating the typology, we also recognize the notion of a closure and stabilization that is needed in creating the standard. Each event type distinguishes a separate dimension along which standard setters must stabilize the standardizing results. Consequently, a successful anticipatory ICT standardizing includes: 1) a *design closure*: the technical specification has been formulated and fixed completely in light of engineering goals and criteria (Simon, 1977), 2) a *negotiation closure*: actors know what has been agreed upon, and what the implications of such agreement are for their interests. Most actors are also aware that such an agreement has been achieved (Callon, 1986), and 3) a *sense-making closure*: each actor interprets the standard in relation to technological, social, and business contexts in a meaningful and stable way. The meaning of technology has become typified and institutionalized for involved actors, and they enact relatively stable technology frames (Pinch & Bijker, 1987).

Design (D-events)

Anticipatory standards emerge neither by God’s finger nor by recording existing practice. They involve spurts of innovation where technical designs are proposed, implemented, and evaluated.

Anticipatory ICT standardizing is fundamentally about *collectively engineering a new tangible (or intangible) technical artifact through a set of design events (D-Events)*. Design events echo the “science of the artificial: finding occasions for making a decision, finding possible courses of action, choosing among courses of action” (Simon, 1977). Design choices are made by selecting from alternatives that have been deemed possible during preceding D-events. Identification of D-events unpacks a standard setter’s winding cognitive process and his or her constant struggle to articulate design alternatives and make choices.

A design closure is achieved through a set of D-events which gradually produce a technical specification that is innovative, i.e., defines novel technological capabilities that can be implemented and at the same time submits to good engineering practices. Such principles include general design goals and architectural norms that state that specifications need to be simple, elegant, efficient, and involve acceptable and better trade-offs between performance, cost, and reliability, than existing solutions, etc. When engineers/ designers reach a closure, they will know collectively how the new technology will work, what its basic properties will be, and how it changes engineering, design, manufacturing, or use practices. A failure to reach a design closure involves a failure to produce technical specifications, or to produce specifications that include errors, are ambiguous, too complex, or costly to implement. This is either due to a failure to generate feasible design options or a failure to choose correctly among them.

When explaining how a design closure is reached, investigators need to come to grips with how technical specifications can actually be derived. This resembles the process of trial and error learning (March, et al., 1991). Accordingly, ICT standardizing takes place predominantly in distributed laboratories, but also covers joint work in committees where technical specifications are reviewed, revised, and modified in all minutiae (Schmidt & Werle, 1998). A large

proportion of standardizing is about “every day” engineering—arduous elicitation, elaboration, and refinement of the technical details, and arguing about design options. Accordingly, D-events are communicated in genres appropriate to these communities: technical reports, memoranda, prototype solutions, test results, etc.

The scope of design events ranges from simple design tasks, such as specifying a software or hardware interface, to decisions concerning the encompassing design architecture around which the whole standard will be built and which will affect a trajectory of future innovations and standard refinements (Baldwin & Clark, 2005). For example, the design of a wireless phone standard involved myriad design choices: articulating the architecture of the system (and its service model); specifying open and proprietary sub-system interfaces; and validating their non-functional features (reliability). But, it also involved smaller events such as specifying a speech codec or usability constraints for the interface (Manninen, 2002; Fomin & Lyytinen, 2001). The designs are path dependent in that they draw upon existing technological capabilities and factor in installed base compatibility and interoperability. Designs are also path dependent in that they build on previous technological advances and well-known solution spaces.

The collective and heterogeneous nature of standardizing designs adds *complexity* to the process and forms a significant barrier to reaching a stable design. This can be due to a great number of proposed solutions or due to the need to apply multiple conflicting design principles or requirements. This complexity is reflected in massive piles of documents and large committee sizes. For instance, a complete GSM standard already covered thousands of pages of detailed technical documents (Mouly & Pautet, 1992) and the complexity of 3G standards has grown exponentially. Standard setters must master this complexity by setting their ambitions wisely, and by applying modular designs (Simon, 1977).

Good architectural control becomes crucial as architectural decisions define critical interfaces and allow separate communities to work in parallel (Simon, 1977). Thereby multiple parallel and iterative design processes are implicated when engineers choose a modular design for standards. Likewise, higher ambitions lead to increased uncertainty and a larger number of iterations. For instance, during Bluetooth standardization, the first version of the standard was delayed since its technological implementation proved significantly more complex than expected due to its high ambition level (Keil, 2002).

Negotiation (N-events)

In the end, each standard is about excluding alternative technical specifications in light of “positive” political and economic consequences of such exclusions. Designers become negotiators when they ask how their designs will align with other actors’ interests³. Therefore—metaphorically speaking—during standardizing, a set of technical specifications transforms itself from a “pure” cognitive state—a design idea—into an institutional force to reckon with embedded in the standard. This transformation happens through negotiation between actors. In fact, great or less than great design ideas can travel to the material world only through the gates of negotiation (Suchman, 2000), and an anticipatory standard “can be conceived as a complex (socio-technical) system resulting from a long and laborious process of negotiation” (Gherardi & Nicolini, 2000). Such a negotiation result creates irreversibility as “the displacement, the creation of a link that did not exist before and that to some extent modifies the original” (Latour, 1999, p.197), while actors enter into irreversible networks (Hanseth, et al., 1996).

The standard as a negotiated order contains binding technical repertoires that are institutionally bound, recognized, and legitimate. Accordingly, *we call a standardizing event an N-event if it supports the goal of reaching an agreement*

about a specification through negotiation. Each result of N-events defines the nature, content, and form of a part or a whole set of specifications *as agreed* and thereby declares commitments, rights, and duties implicated by the agreement across standard setters, adopters, and other parties (e.g., regulators). Per definition, the final standard is established if and only if the whole specification is closed by an agreement concerning the substance of technical specifications and its implications for each actor. Moreover, all actors must recognize the agreement as legitimate. The final agreement must be preceded by a set of other N-events that gradually transform the status of non-legitimate and dis-agreed upon specifications into legitimate and agreed upon. Thus the set of final specifications create formal contractual relationships between standard setters and can also produce new regulations for standard-setting institutions. A failure to reach negotiation closure leads actors to reject technical specifications or their implications, and in so doing, break down the network.

The negotiations are also *path dependent* in that they draw upon existing contracts, contractual arrangements, and institutional practices that recognize, record, and enforce such contractual arrangements (regulatory statutes by standardization organizations, patent laws, trade secrets, etc.). Negotiations are also *path dependent* during the standardization in that they build on previous negotiation moves as well as known “negotiation spaces” in which actors have entered previously. This intrinsic connection between negotiation and network irreversibility explains also the immense difficulty of creating anticipatory standards. Standard setters can ensure the durability of technical repertoires only if the agreed upon standard will travel well across time and space. This occurs only if subsequent N-events constantly create, solidify and expand *new* actor-networks, which require either connecting to, or demolishing existing networks – both of which are extremely difficult to accomplish.

The form and content of N-events vary depending on the institutional context. Negotiations are not necessarily carried out during a single N-episode. As noted, they often refer to earlier umbrella agreements, rest on prevailing practice, or trigger a series of additional N-events across multiple institutional contexts (Schmidt & Werle, 1998). Negotiations take place often at official meetings, but often the deals are struck in hallways and in unofficial discussions (Haug, 2002). Negotiations are carried out by spokespersons who have a mandate (Latour, 1987). These include prominent engineers, strategy and IPR professionals, technology managers, and even politicians. The mandates are defined and enabled through the intermediation of rule makers and enforcers (other spokespersons, standard-setting organizations, committee chairpersons, etc.). The mandates are about technical choices, licensing, sharing of IPR, market shares and market making, enrolment of new actors, or their disconnection. Each mandate is defined by its characteristics, including the scope of technical specifications, types of contracts, IPR pool documents, etc.

Sense-Making (S-events)

Anticipatory standardizing exhibits a form of technological imagination that writes technology repertoires for the future world (Latour, 1999). Metaphorically it is “persuasive and constitutive storytelling about the future” (Suchman, 2000, p.319). By telling a different story, standard setters expand their horizons and become aware of prejudices they bring to their interpretations of current technology use (Gadamer, 1975). Such story telling is named in ways from organizing visions, futuristic scenarios, to technology fads (Swanson & Ramiller, 1997) and documented in policy and market reports, strategy formulations and technology road maps, consumer focus group reports, or memos that record ongoing conversations among standard setters (e.g., minutes).

Overall, standardizing creates and enacts meanings about designs, artifacts, design and use processes, agreements, and actors and their identities which, over time, transform and renounce standard setters’ interpretive frames about the technology (Karnoe, et al., 2005; Latour, 1992). Actors at the same time attach meanings (perspective making) to standards and make sense of others’ meaning projections (perspective taking) (Boland & Tenkasi, 1995). In so doing, they rationalize what they are doing or have been doing, and shift their cognitive strategies in relation to the technology-to-be-standardized, the actors involved, or the institutional context (Callon, 1986; Latour, 1995; Weick, 1993). This ebb and flow builds and questions technological frames and leads to the attribution of new meanings to standards, actors, and the context (Bijker, 1995).

No anticipatory standard will be agreed upon unless actors *make sense* of it and can imagine the types of repertoires embedded in it operating in a future world. In a narrow sense (no pun meant here), sense-making is about how the design meets set-up engineering criteria, such as simplicity or elegance in design. In a broad sense it embraces a broader set of cognitive tasks that help designers understand how proposed designs relate to the future social, technological, and institutional world, and how they shape and are shaped by these worlds. In the following, we will talk about sense-making in a broad sense.

After Weick (1995), we define sense-making as an actor’s interpretive response to observed and imagined changes that result from design or negotiation events, or changes in the standardizing context. *Events that read meanings into anticipatory standardizing events and actors are called sense-making events (S-events)*. Sense-making closure means that there is a set of S-events that produces a set of stable interpretive frames among the involved actors, which defines the meaning of the standard for their context. A failure to reach such a closure is common. It signals controver-

sies around what the technology is supposed to do, or how it relates to future use or institutional contexts.

S-events draw upon actors' past experience and inherited technology frames that coordinate sense-making. Therefore, anticipatory standardizing poses significant challenges when such frames diverge or break down. For instance, in the early phases of the Bluetooth standardization, participants from the computer and telecommunications industries had to pour significant efforts into formulating a joint understanding of the scope of the technology-to-be-standardized because their views on what would make the standard successful differed (Keil, 2002). Failures in sense-making generate unstable technical specifications, shifting actor identities, and a fluid institutional context, all of which can result in disagreements.

Though anticipatory sense-making is proactive, it is simultaneously retroactive. Standardizing starts with a retrospective reading of current technology that erects a context that is *path dependent*. Anticipatory standardizing becomes proactive when it attributes a *different* meaning to a not-yet-invented technology, and thus enacts a new environment (Weick, 1995). It generates mindful deviations so that the technology becomes re-defined, re-evaluated, and re-contextualized (Garud, et al., 2002).

EVENT GRAMMAR

An event's significance is produced by its place and role in an event sequence. We need therefore to combine identified events into sequences. Such networks of events connect all events to process outcomes (Pentland, 1999). Given that anticipatory ICT standardizing is highly complex, non-linear, and chaotic (Markus, et al., 2006; Nickerson & Zur Muehlen, 2006), and takes years to unfold, the event grammar—a way to connect events—has to be built on assumptions about the complexity. We therefore assume non-linearity among design,

sense-making, and negotiation events: They can be connected by relationships that exhibit circularity, concurrency, and hierarchical organization. We next extend the process analysis to event network analysis. We explore first how events will be organized into sequences and thereafter how we can infer why and how outcomes relate to such sequences.

We devise an *event grammar* that articulates multiple heterogeneous relationships between design, sense-making, and negotiation events. The grammar consists of two levels. The first level—called *binary grammar*—describes how any two events can be positioned into adjacency pairs. Second, a *choreography grammar* offers a set of principles that help string adjacency pairs into larger sequences. Overall, the proposed *grammar*—by organizing events into sequences—integrates three separate perspectives that underlie design, negotiation, and sense-making activities. In so doing, we account for a problem noted by Langley (1999): How can different theoretical perspectives be combined in process explanations? In our analysis, each event type is germane to understanding one critical dimension of anticipatory standardizing. Yet, each dimension alone is insufficient in explaining the final outcome. Utilizing multiple perspectives simultaneously and by integrating them through the event grammar, offers a feasible strategy to carry out a multi-perspective analysis and arrive at plausible process theories.

Binary Grammar

The binary grammar detects *reasons* for moving between the events and expresses their natural temporal order (before, after, and parallel). The first step in the analysis is therefore to relate any event to its preceding and/or succeeding events. Each event can thus be connected to two sets of adjacency pairs: a set of events that lead to this event, and a set of events that follow it.

Building our binary grammar rests on two main principles. First, events of *any type* can be organized into adjacency pairs based on their temporal properties (before and after). These properties arrange events into sequences that maintain chronological (topological) order. Second, any event can trigger and be triggered by any other event type. For instance, a new design can trigger sense-making about potential technology applications in the market, it might trigger negotiation about intellectual property rights regarding the design, or it might trigger additional design to integrate it into a new architecture. Third, we distinguish in each event an actor’s *choice* that shifts his or her cognitive orientation from one type of “activity” into another, or from one activity into another activity within the same type. These relationships define the “logic” of standardizing events, and will form the kernel in explaining the outcomes. We do not expect that any preceding event will *causally* determine the type or the

content of the succeeding event. Rather, any event type can trigger another type of event, subject to the outcomes of the preceding events, and actors’ conscious or unconscious choices, and the impact of contextual conditions. For instance, a technical design can trigger negotiation among actors in the same industry who share a similar understanding of its application, while the same design can trigger sense-making in a broader community that needs to relate the design to its environment as to arrive at a common understanding. Succeeding events can also be multiplied into several sub-events through decomposition. For instance, during negotiation, sense-making events might be triggered to find out how each design alternative relates to the goals of engaged actors. Negotiation can thus only continue after the sense-making in each alternative path is completed.

Table 2 classifies a space of possible event adjacency pairs. Many of the defined patterns were identified in several empirical investigations that

Table 2. Binary Relationships Between D-, N-, S- Events

| Preceding/ Following Event | D-event | N-event | S-event |
|---|--|---|---|
| D-event | <p>DD1: Decompose and refine technical specifications (Baldwin and Clark 2005)</p> <p>DD2: Test, Evaluate (Manninen 2002, Haug 2002)</p> | <p>DN1: Compromise between designs; (Haug 2002)</p> <p>DN2: Agree on final design; (Manninen 2002)</p> <p>DN3: Agree on design parameters/ evaluation criteria (Manninen 2002)</p> | <p>DS1: Justify design feature (Fomin and Lyytinen 2001)</p> <p>DS2: Evaluate use scenarios (Schmidt and Werle 1998)</p> <p>DS3: Imagine new contexts of using technology (Keil 2002)</p> |
| N-event | <p>ND1: Refine and search for a negotiated solution (Haug 2002)</p> <p>ND2: Develop a solution to counterattack existing designs (Funk 2002), (Garud et al 2002)</p> | <p>NN1: Negotiate rules; (Manninen 2002)</p> <p>NN2: Negotiate actor composition; (Garud et al 2002, Keil 2002)</p> <p>NN3: Negotiate after disagreement (Haug 2002)</p> | <p>NS1: What does a compromise mean? (Haug 2002)</p> <p>NS2: Does the negotiated standard make sense? (Garud et al 2002)</p> <p>NS3: What does the standard mean for technology evolution? (Haug 2002)</p> |
| S-event | <p>SD1: Develop a new scenario to reconsider design (Manninen 2002)</p> | <p>SN1: Change use context to negotiate design options (Faraj et al . 2004)</p> | <p>SS1: New use scenario triggers sense making of other technologies (Funk 2002)</p> |

we have listed in the table. In the table each row defines a type of the preceding event and each column a type of the following event. Overall, the table lists a set of possible event pairs and reasons why they are connected together. The table was derived based on a content analysis of empirical investigations of standardization processes as shown by the references. Within each reference analyzed we identified a set of two different types of events and then analyzed what triggered the shift from one event to the next. Overall, the table outlines a number of event pair *archetypes* and helps identify typical event pairs. For instance, a design-design event pair consists first of an earlier event that triggers a later decomposition refinement. A typical negotiation-sensemaking pair could consist of first negotiating technical commitments and then engaging actors in sense-making to explore what this compromise entails in the future market. The table is not, however, complete in the sense that the reasons for these relationships were empirically identified and additional reasons to connect events might emerge from future studies. Nor does it replace an in-depth analysis of detailed relationships between events and their context. Overall, the binary analysis demands a careful articulation how events and their contexts interact in order to find specific reasons why such moves took place.

Event Network

An event network identifies the connections among *all* standardizing events organized over time as defined by temporal and adjacency relationships. A network of events thus represents how standardizing reached a closure with respect to design, negotiation, and sense-making, and overall produced a standard, or how it failed to do so, and if so, what events “failed.” We need this level of aggregation in our analysis as event pairs alone show how events relate to one another, but not why specific standardizing results emerged. By integrating the events into a network, the

result is shown to be generated by a multi-path event sequence that takes place in a set of shifting contexts. It involves both chronological and activity-based relationships between events. By increasing the complexity of the network level analysis, we increase the accuracy in our process accounts (Weick, 1989).

In formulating an event network, we can deploy visual mapping techniques (Langley, 1999) that use graph theory to organize event pairs into networks depicting both time and activity-based dependencies between events. These graphs can be analyzed for their structural properties and at the same time they offer a holistic overview of the event networks. We build an event network in three steps. First, we aggregate events into a *temporal sequence* by sorting events into chronological chains by utilizing their start and end times. Temporal ordering creates a timeline of the standardizing process and allows us to identify both sequential and concurrent events. Second, since each event can be triggered or trigger other events, we need to aggregate event pairs into *sequences according to their functional outcomes*, i.e., their activity-based relationships. We further need to identify which events change the context, or are shaped by the context. An *activity-based ordering* creates a functional map of the standardizing processes and observes which events are decomposed into sub-events (Simon, 1977), and which events lead to other events by changing the type of the event, its content hops between types of events, or the content of the event.

In a third step, we *compare and integrate the temporal, functional, and activity-based networks*. The resulting event network describes a) temporal (x ended before y), b) functional (x produced input to y, or x needed type-y input), and c) activity-based dependencies (what types of events x lead to an event y). This network organizes events *sequentially, in parallel, and iteratively*. The outcome is not a pure sequential model that most process theories utilize (Pentland, 1999), as it integrates multiple, including iterative, connections between events.

PROCESS LOGIC

Logical Inference Rules and Deductive Process Explanations

The event networks chronicle event sequences that either lead to a standard (closure) or fail to do so. By being grammatically “correct,” the choreography conveys one logical premise to explain the observed outcome. Yet, knowing which design, sense-making, and negotiation events took place, and when and how they were related, does not explain yet what generated the pattern and its outcome (Pentland, 1999). To explain why such outcomes emerged, we need to draw upon logical and theoretical rules that are applied to the “structural characteristics” of the event network and the context (Pentland, 1999). An analogy with stories might help here to illustrate our point: grammatically correct sentences are necessary, but not a sufficient condition of telling a plausible story. To be plausible, a story requires a narrative (a story line) in addition to being composed of grammatically correct sentences. Similarly, the story of a standardizing process requires a narrative (story line) that informs why events were strung together the way they were. To accomplish this, explanations require a logical narrative from the used process representation that creates a plausible scenario of how the standardizing unfolded, and how and why a standard emerged. To create such narratives, we need theoretical and logical rules that conceptually connect events and outcomes (Pentland, 1999). Discovering these connections, however, does not yield a strong causal explanation: event sequences are *not* both necessary and sufficient conditions for producing the outcome. In contrast, we show why Y resulted in process X though there can also be other situations under which Y can be achieved.

While crafting process explanations we draw upon a set of inference rules. A *rule of inference* is a scheme for constructing valid inference. In logic, such schemes establish syntactic relations

between a set of formulas called *premises*, and an assertion called a *conclusion*. These relations are used in inference to arrive at new, true assertions. Rules also apply to semantic and pragmatic arguments, but here their formulation is more difficult and controversial (Toulmin, 1959). Yet, the discovery and use of rules and associated theoretical models that connect events, standardizing contexts and standardizing outcomes in plausible ways equates with the goal of building process theories (Pentland, 1999; Langley, 1999). In our case, this calls for formulating inferences that address the following question: Why and how was a standardization closure reached given the event sequence and the context? Formulating such an explanation poses a significant intellectual challenge since inference rules for process data are not well axiomatized as are rules of inference for variance-based explanations (Shadish, et al., 2003). For example, the validity and reliability of process explanations are difficult to establish (Pentland, 1999).

We are often left with our imagination in formulating such rules and must rely on their intuitive appeal. No wonder that Langley (1999) calls process theorizing a “synthesis” and claims that no matter how carefully we execute the process analysis, this alone does not guarantee a good result. Synthesis requires leaps of imagination to organize events into plausible narratives by inventing new worlds and logics (Weick, 1989). Langley (1999) suggests theoretical triangulation and matching of heterogeneous models as one means of developing such rules. This was already followed above in formulating rules to build up event networks. This construction by itself generates iterations between data and their explanations. Though unavoidable, we think that such iterations can be further reduced by applying some rules to analyze a given event network at any time point during the analysis.

One method of reducing iterations is to match taxonomies of generative mechanisms with produced event networks. Pentland (1999) suggests the

following mechanisms: 1) life cycle; 2) teleological (goal seeking); 3) ecological (variation, selection, and retention); and 4) dialectical “motors” (Van de Ven & Poole, 1995). Yet, these taxonomies do not provide good “meta-rules” regarding which type of explanation one should choose for a given data set. In fact, most process descriptions can be cast into multiple explanations (Pentland, 1999). For example, standardizing can be viewed as a teleological process from an actor’s viewpoint, as an ecological process from the viewpoint of a technological system, or as a dialectical process from the viewpoint of multi-actor negotiation. Many generative mechanisms can be matched with any observed process “surface structure” leading to what Langley calls the “alternative templates strategy,” where an investigator proposes “several alternative interpretations of the events based on different, but internally coherent sets of a priori theoretical premises” (Langley, 1999, p.698). This strategy is followed in our process framework in that each sequence of types of events (closure) imposes alternative explanations about the process. Yet, none of them offers a complete account, and therefore dynamic interactions between design, sense-making and negotiation, and associated local perspectives need to be accounted for in the analysis.

Inductive Inference Rules Based on the Content of Event Networks

We propose next an inductive strategy to craft process explanations. This strategy helps exclude alternative explanations by iteratively applying inference rules that explore and test internal validity threats associated with proposed explanations. These rules can be organized according to increasing complexity and generality. We differentiate between inference rules that operate on: 1) singular events, 2) binary event pair rules, and 3) event network rules.

Singular Event Rules

These rules operate on each event and seek to confirm that the event description reflects the empirical reality, and that its classification into event types and a related event profile is valid. These rules guarantee that the narrative that will follow is based on validated events and event constructs.

Rule SER1: *The description of each design, sense-making, and negotiation event needs to be complete for a valid narrative to emerge (Pentland, 1999).*

Here, complete means that each event description must fully express critical properties, i.e., input, output, type of event being applied, actors associated with the event, and context and timing of that event. Applying this rule improves the internal validity of explanations. Omitting elements leads to misleading inferences, given the complexity of anticipatory standardizing and the frequency of unforeseen events, such as new technological possibilities, or changes in the context. A more complete description helps clarify the reasoning behind an actor’s moves that underpin events. In particular, when we explain *why* actors behaved in a particular way and *why* specific events ensued, completeness is the first criterion for internal validity. In addition, a careful depiction of events in a narrative form helps detect serendipities that shaped the process trajectory (like unexpected technological discoveries).

Rule SER2: *The classification of events into design, sense-making, and negotiation events integrates alternative theoretical perspectives to account for the process and its results and helps detect multiple explanations for observed events, and excludes or foregoes proposed explanations.*

By using this rule we improve the internal validity of the explanation by urging the investigator to apply multiple theoretical perspectives to the same set of events, thereby applying and excluding alternative explanations. Multiple perspectives allow the investigator to identify additional events that might be triggered by other events. For instance, when an event is analyzed through the design, sense-making, and negotiation lenses, it might become apparent that while it is a design event, during the event, a sense-making or negotiation event is spawned that was instrumental. Particularly, when events sequences fail to reach closure, such spawned event might be the underlying reason for the failure. For example, an investigator may ask why there was no closure on sense-making. Was it because the design was so novel and incomplete that actors could not imagine the implications of its use, or was it just not designed well?

Binary Event Pair Rules

Binary event pair rules operate on event pairs and seek to validate and infer explanations of changes in actors' cognitive orientations.

Rule BEPR1: *Shifts in event types signal changes in the actors' cognitive orientation.*

When one or more standardizing events produce a standardizing event of a different type (e.g., a design event triggering a sense-making event), we can detect two reasons for this change. First, when one cognitive activity is completed, that is, the event is finalized, standardizing will continue with a new event type. For instance, once the design of a set of components has been completed, the actors might proceed to sense-making or negotiation on how to integrate these components into the system. Identifying the event pairs in which new types of events were triggered helps the investigator to trace change in cognitive orientation during different time periods.

Rule BEPR2: *Shifts in event types prior to reaching closure help identify critical events that changed standardizing trajectory.*

More important than events that trigger just new event types are events that trigger new event types before the process reaches a closure. For instance, during design the engineers might encounter technical alternatives that would force them to select through sense-making multiple new use scenarios and then to negotiate which of these scenarios help drive design. Events that trigger these different event types before a closure is reached signify situations where main challenges (Hughes, 1987, calls them "reverse salients") that emerge during standardizing were resolved by adopting a fresh approach. By applying this rule, investigators can observe critical moments in the standardizing process and identify what shifted when critical path dependency shaping and breaking events took place.

Event Network Rules

Event network rules operate whole event sequences. Here we seek to use pattern matching rules to increase the internal validity of explanations by generating all possible explanations for the observed outcome, and excluding them iteratively. Such internal validity analysis is applied to event sequences for one standardizing process at a time.

Rule WCAR1: *All event paths in the event network should be consistent with the observed process outcome.*

The first rule at the event network level is that all event paths should be consistent with the observed outcome. For instance, if a standard fails to emerge, the observed process sequence should include a failure to reach closure either in design, negotiation, or sense-making. Similarly, if a successful standard emerges, the narrative

A Framework to Build Process Theories of Anticipatory ICT Standardizing

should entail a sequence that explains closure in all three types. Event sequences that are inconsistent with the observed process states suggest omission of critical events or the omission of critical interactions with the context.

Rule WCAR2: *Deviations from the process signify important junctions in standardizing.*

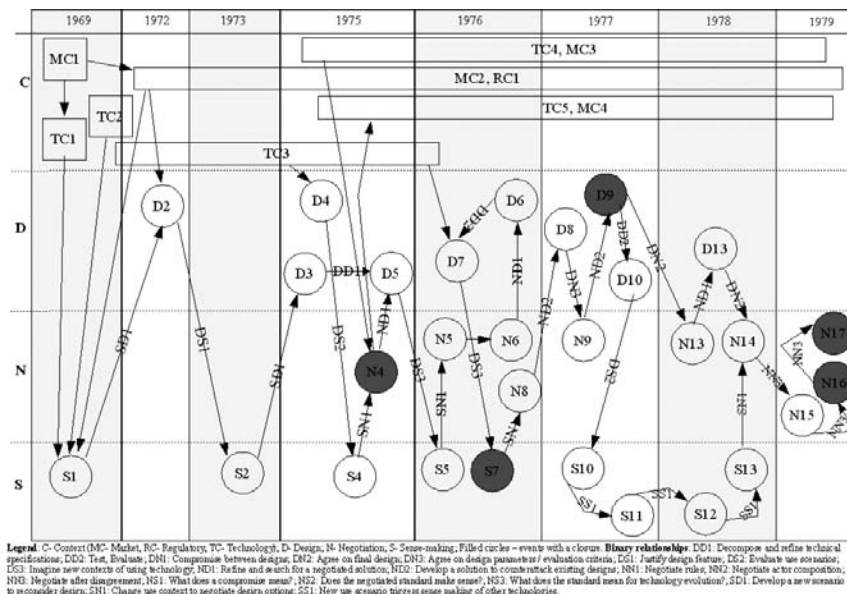
Per definition, a complete standardization plan should define activities that lead to closure in design, sense-making, and negotiation. In most cases, such completeness is lacking and difficult to achieve due to a high level of ambiguity in anticipatory standardizing. Comparing the actual event network with the planned process activities provides important insights into episodes that explain the different process outcome. It first shows the level of ambiguity and incompeteness in the original plan. Second, deviations show when the standardizing process became chaotic and therefore moved to an unanticipated trajectory. This happens often when the external environment shapes the process in an unexpected way, or the

process generates unexpected outcomes. For instance, a deviation from the plan can suggest that critical events shaped the context that triggered unforeseen sense-making or negotiation events.

DEVELOPMENT OF THE MOBILE SWITCHING SYSTEM (MTX) FOR THE NMT SYSTEM

We will next illustrate how to use the process theory framework by analyzing the standardizing of the Mobile Switching System (MTX) for Nordic Mobile Telephone (NMT) by drawing upon the rich description offered in Manninen (2002). The NMT 450 standard was published in 1979—3 years before the first NMT service—and it formed the first public standard for mobile telephony. The standardizing of a key component of the standard—its switching platform (MTX) specification—offers a vivid and interesting episode for analyzing anticipatory standardizing processes. Due to its virgin origin NMT standardization, it involved high levels of uncertainty both in terms

Figure 1. MTX event choreography



of service, architecture, and technology choices. Using Manninen's (2002) narrative as a baseline, we identified first all key events in the standardization process (Appendices 1 and 2). Then applying event rules SER1 and SER2, for each event we identified type, context, timing, actors involved, as well as input and output (preceding and following events—see Appendix B).

Having compiled the complete event list enabled us to draw a visual representation of the events and their relationships (Figure 1) for the subsequent analysis. This MTX choreography needed to be interpreted in the overall context of the NMT's mission: (1) its ambiguous scope and unclear objectives; (2) and the rapid change in digital switching capabilities during the standardization process. The graphical representation forms a matrix, where rows contain event types (context, design, negotiation, and sense-making), and the columns—timing (the start date) of each event. The process presentation shows how the MTX standardizing process was carried out through D-, N-, and S-events, and how these events connected. The final graphical representation can then be used for subsequent process analysis by applying binary and network event rules.

From the graphical representation, we can identify clusters of events that were critical in producing the final standard. To illustrate how some of these clusters can be identified we will focus next on some clusters. We can note first in Figure 1 several critical context events (market and technology change) marked by squares (e.g., MC1, MC2, TC1, TC2, TC4, and TC5). These concentrated in two intervals—at the outset of the project in 1969, and around 1975, when the digital switching technology became available and a decision had to be made about it. As shown, the project initiation context was dominated by the design and sense-making activities (S1 and D2). The MTX design choice (N4) contributed critically to the overall NMT success, since not only was closure reached in design, negotiation, and sense-making about switching, but these closures

also critically influenced other standardization activities within the NMT standardization as can be seen by analyzing the outward links from S7 or D9. Overall, multiple closures were reached which correspond to four core design issues faced with MTX development: 1) the type of network (N4), 2) the network architecture (S7), 3) the specifications for the MTX (D9, N16), and 4) the adoption of the MTX (N17).

Several insights emerge from the process analysis. When we investigate Figure 1, we can identify two periods where either D-, S-, or N-activities dominated the process. Between 1975 and 1977, we observe more design (D) and negotiation (N) activities, while after 1977 the design activity diminished and the sense-making (S) intensified. These centres of activity highlight one feature of event network analysis, i.e., what was the main focus of the process at different time periods. Figure 1 also shows how the context and the process interact, how events trigger and interact with each other, and what types of changes take place as a result (the symbols refer to Table 2 transitions above). Finally, it shows the linearity (e.g., S1, D2, and S2 events), temporal dependencies (S1 comes before S2), functional dependencies (D3 and D5), iteration (D5-D7, or N17 as a repeated attempt of N14) and decomposition in the process structure (D7 should have been followed by N9, but instead S7, N8, and D8 were triggered for the process to proceed, or failure to reach closure in N14 triggers N15 and N16).

Finally, from the methodological standpoint, we can see how the analysis follows the analysis rules outlined in Table 3, and how the application of these rules increased the reliability and internal validity of the analysis. It allowed building of a systematic explanation of process outcomes that could be described as an emerging process theory of the NMT standardizing. Specifically, graphical representation presents vividly the overall complexity of the process. Besides giving a simple yet comprehensive view of interdependencies between different events,

Table 3. Application of inductive inference rules for process analysis

| Rule | Application |
|--------------------|---|
| Rule SER1: | Each event type was derived from a detailed description of events using standardization committee minutes and interview data. Their classification is complete and all events that resulted in outcomes were identified. |
| Rule SER2 | The classification of events to event types allowed us to identify moments where new ideas of mobile telephony emerged and where these were negotiated with other players like telecommunication manufacturers. |
| Rule BEPR1 | We could observe significant shifts in standardization focus as a result of event type changes. One example is the re-thinking of service concepts after the initial design is completed—an example is a realization that the cost MTX exceeds the expectations, which results in rethinking the network structure and the number of suppliers: D6-D7-S7-N8-D8. |
| Rule BEPR2: | We observe situations where a failure to shift standardization focus leads to a successful closure—an example is the failure to start design again after D9, to which Ericsson did not yield (N16). |
| Rule WCAR1: | We could detect all observed closures based on the analysis of preceding events. |
| Rule WCAR2 | The shift to design a digital switching platform resulted in a deviation in the original standardization plan (TC1, S1, D2), but at the end defined a different capability and scope for the service (TC5, MC4, S7, D9). |

we also gain a more accurate description of the dynamics of the process (changing patterns of the event networks). We also obtain a better grasp of the dominating cognitive orientations based on which event types dominated the process at any given period of time.

DISCUSSION

This article set out to improve our understanding of anticipatory ICT standardizing by developing a process theory framework. The aim of the framework is to support generating plausible and generalizable explanations of *why* and *how* anticipatory ICT standardizing outcomes emerge. To this end, we developed a *lexicon* that consists of a typology of design, sense-making, and negotiation events, a *grammar* in the form of combination rules for events to develop *process representations* of anticipatory ICT standardizing events, *logic* rules that yield theoretical explanations based on the inductive analysis of process representations, and a discussion of the *contexts* in which standardizing unfolds.

CONTRIBUTIONS TO SOCIAL THEORIES OF STANDARDIZING

We expand process theories to explain ICT standardizing. The past years have seen a dramatic increase in the research on anticipatory ICT standards (David, 1995; Mansell & Silverstone, 1996) while we have witnessed increased problems with traditional ICT standards research (Garud, et al., 2002; Schmidt & Werle, 1998; Werle, 2000). While all recognize the increased role of *anticipatory standards*, our *actual* understanding of successful standardizing has decreased. Our article inches toward an improved understanding of anticipatory ICT standards by moving from the study of *standards* to the study of *standardizing*. This is a significant intellectual shift as it suggests that the study of standardizing is pivotal to our ability to understand this complex phenomenon.

The main contribution of this work lies in the expansion and integration of concepts derived from social theories of technology to anticipatory standardization research. Recent research in ANT and SCOT (e.g., Hanseth, 2006; Jakobs,

2006; Stewart & Williams, 2005) has begun to recognize that design, negotiation, and sense-making are all critical for understanding many standardizing processes. However, this work has remained largely fragmented. Our article addresses this weakness by developing an integrated, yet modular, framework that explicates relationships among these key concepts, and defines roles each theoretical perspective can play in explaining anticipatory ICT standardizing. Due to its complexity (Hawkins, 1995), process explanation needs to decompose the phenomenon into smaller building blocks (Hanseth, 2006). Yet, rendering a meaningful explanation of the whole and its outcomes demands an integration of these building blocks. We proposed here that design (D), negotiation (N), and sense-making (S) activities and their analytically controlled interactions offer one set of such building blocks.

The strength of this framework is that it draws on multiple streams of research on standardization in ICT: social process theories, where each is well suited to examine a specific “simpler phenomenon” in isolation. It organizes them into modular and comprehensive process accounts. The novelty of our work is not necessarily in *what* concepts we introduce, but in *how* we position them, and how we conceive them as a family of interrelated theoretical lenses. By bringing the design, sense-making, and negotiation elements together, we outline a basis for formulating rigorous, theory-based process analysis of ICT standardizing. This helps conceive each successful anticipatory ICT standard as, “a specific configuration of knowledge and industrial structure—it involves distributed knowledge, a precise definition of physical interfaces between components in a system, and an industrial structure with considerable division of labour and specialisation” (Steinmueller, 2005).

Anticipatory standardizing demands that individual designs, collective designs, and shifts in technology framing interact. Our emphasis on individual and distributed sense-making expands SCOT’s “technology framing” from a user-re-

lated activity about finished designs (Stewart & Williams, 2005) to sense-making about early designs by engineers and standard setters. This expansion is important given that anticipatory ICT standardizing embodies one key engine of ICT innovation and involves technical discoveries. Our study also goes beyond recent accounts of anticipatory ICT standardization offered by SCOT and ANT by highlighting the importance of collective engineering. Anticipatory standardizing rests on inventing genuine designs, as actors constantly generate designs and reconcile them. Focusing on the criticality of design has broader implications for Actor Network Theory studies. Anticipatory ICT standards will entail novel changes in technological capabilities and involve a high level of uncertainty. Accordingly, designers are simultaneously building multiple ambiguous and poorly understood networks, and they cannot predict consequences of their designs (Van de Ven, et al., 1999). This renders construction of actor networks an iterative process that has not been accounted for in ANT’s linear view of translation. We argue that such insight should also be reflected in process accounts. Therefore, we have outlined an iterative model of process analysis, which circumvents the limitations of linear process models.

CONTRIBUTIONS TO PROCESS ANALYSIS AND EXPLANATIONS

Our article makes a useful research contribution to process theorizing (Mohr, 1982; Langley, 1999; Pentland, 1999; Van de Ven, et al., 1999). Past research on processes has not explicitly discussed the refinement of process ontologies that are sensitive to the studied domains. For example, Langley’s (1999) excellent review focuses mainly on how process approaches can manipulate one-dimensional event data to yield process accounts. However, she never explores different *types* of events as one critical aspect

of formulating explanations. We feel that our amendment offers one useful way to improve the accuracy of process theories while keeping them still relatively simple (Weick, 1995).

Proposing a separate analysis layer of a “grammar” offers a flexible way to organize events into event sequences. The concept of grammar allows us to control how much iteration and parallelism will be allowed in process explanations. Most past process models assume a linear sequence either through successive stages, e.g., ANT’s translation model, or through linear sequences associated with a specific narrative (Pentland, 1999). While both templates are useful, the proposed expansion helps control the level of complexity and, if need be, tap into chaotic and random processes involving iteration that are frequent in innovative contexts (van de Ven, 1999). Finally, introducing a separate layer of inductive inference rules augments the narrative-based deductive “grand narratives” of process theorizing (van de Ven & Poole, 1995) with a set of validity-enhancing rules. The more complex process structures generated by our method can draw upon the improved computer-based tools that have been proposed (see, e.g., Ethno at <http://www.indiana.edu/%7Esocpsy/ESA/home.html>). We expect that such tools will help to better manage inherently complex process traces resulting from our analysis. Such more rigorous modeling of event interactions and sequences will also offer possibilities to simulate process behaviors using system dynamics, and to predict their outcomes under different contingencies⁴. Another alternative is to use emerging computational models of dynamic network analysis (Carley, 2006)

LIMITATIONS AND FUTURE RESEARCH

We emphasize that the proposed framework is not the same as a complete process theory. Rather, it offers an ontology of events and event sequences, a way to organize and represent event sequences and

a set of rules geared toward formulating plausible process explanations. As a general theoretical framework, in its current form it is not open to direct empirical validation. *We emphasize that only local theories formulated by using such a framework can be used explain standardizing processes and can thus be subjected to empirical validation.* The intellectual value of the framework lies in its domain-specific, systematic formulation of theoretical concepts that will permit investigators to craft, formulate, advance, and validate new types of empirical claims about anticipatory ICT standardizing. Such a framework hopefully will promote systematic building and validation of process theories that account for complex ICT standardizing phenomena.

Due to its modular structure, the proposed framework is not closed. In fact, any part of the framework—its lexicon, grammar, and inference rules—is open to further expansion and refinement. Such expansions are welcome when the framework is applied in local research settings. In future, we expect that the framework can be used to build process theories that approach anticipatory standardizing as a non-linear, emergent, and path-dependent process. Some recent research drawing upon our ideas suggest that this avenue is fruitful (Virilli, 2003; Mitra, et al., 2005) and they show that different standardization processes allow for design, sense-making, and negotiation events in proportions and they organize them differently over time. They also show that processes are chaotic and non-linear. Beyond these studies, we expect research in the following areas in the future: What designation of non-linearity—random or chaotic—can be detected (Van de Ven, et al., 1999) in ICT standardizing? Do specific sequences exhibit tipping effects towards a closure (Axelrod, 1984)? Can different types of event sequences be related to increasingly innovative outcomes (Autio, 1997)? What context changes create deviations from prevailing standardizing paths, and are there differences in how to respond to such deviations (Karnoe, et al., 2005)?

The framework can also be used to derive empirical accounts of some aspects of anticipatory ICT standardizing. For example, fast cycles between both D- and N-events punctuated by diffusion and experimentation resulted in successful standardization during Internet development in contrast to traditional SDO standardization where a long cycle of D events was followed by a singular N event (Abbate, 1999). Likewise, incentives and governance structures within the actors may radically shape interactions between the events (Benkler, 2001) raising the following question: How do the events shape the organization of standardizing actors? Finally, the framework can help critique and expand normative ICT standardization models that originate from product development and regulation theories (Schmidt & Werle, 1998). These models view ICT standardizing mainly as a linear refinement over one dimension: design or negotiation. Yet, our framework suggests that such models are inadequate as they prioritize design over negotiation or vice versa and ignore sense-making.

ACKNOWLEDGMENT

We are grateful to John King, Ari Manninen, Juha Knuuttila, Ping Gao, and Joel West for inspiring discussions that led to some ideas in the manuscript. Thanks go also to Dick Boland, Michel Callon, Michael Cohen, Sandeep Puro, Timothy Schoechele, Francesco Virili, Karl Weick, Youngjin Yoo, and Lynne Markus for detailed comments on earlier version of the manuscript. Apologies for remaining errors apply.

REFERENCES

Abbate, J. (1999). *Inventing the Internet*. Cambridge, MA: MIT Press.

Akrich, M. (1992). The description of technical objects. In J. Law, & W. E. Bijker (Eds.), *Shaping technology/building society: Studies in socio-technical change*. Cambridge, MA: MIT Press.

Allen, J. P. (2004) Redefining the network: Enrollment strategies in the PDA industry, *Information Technology & People* 17(2), 171-185.

Arthur, W. B. (1989). Competing technologies, increasing returns, and lock-in by historical events, *The Economic Journal*, 99(394), 116-131.

Autio, E. (1997). New, technology-based firms in innovation networks: Symplectic and generative impacts. *Research Policy*, 26(3), 263-281.

Axelrod, R. (1984). *The evolution of cooperation*. New York: Basic Books.

Axelrod, R., et al. (1995). Coalition formation in standard-setting alliances. *Management Science*, 41(9), 1493-1508.

Bacharach, S. (1989). Organizational theories: Some criteria for evaluation. *Academy of Management Review*, 14(4), 496-515

Baldwin, C. Y., & Clark, K.B. (2005). Designs and design architecture: The missing link between “knowledge” and the “economy.” *Advancing Knowledge and the Knowledge Economy*. Washington, DC.

Benkler, Y. (2001). Coase’s penguin, or, Linux and the nature of the firm. *Yale Law Journal*, 112(3), 367-445.

Berner-Lee, T. (1999). *Weaving the Web: The original design and ultimate destiny of the World Wide Web*. San Francisco: Harper.

Bijker, W.E. (1987). The social construction of Bakelite: Toward a theory of invention. In W.E. Bijker, T. P. Hughes, & T. Pinch (Eds.), *The social construction of technological systems*. Cambridge: MIT Press.

- Bijker, W. E. (1995). *Of bicycle, bakelites, and bulbs: Toward a theory of sociotechnical change*. Cambridge: The MIT Press.
- Boland, R. J. J., & Tenkasi, R. V. (1995). Perspective making and perspective taking in communities of knowing. *Organization Science*, 6(4), 350-372.
- Brynjolfsson, E., & Kemerer, C.F. (1996). Network externalities in microcomputer software: An econometric analysis of the spreadsheet market. *Management Science*, 42(12), 1627-1647.
- Callon, M. (1986). Some elements of a sociology of translation: Domestication of the scallops and the fishermen of St Brieuc Bay. In J. Law (Ed.), *Power, action and belief: A new sociology of knowledge?* London: Routledge & Kegan Paul.
- Callon, M. (1992). Techno-economic networks and irreversibility. In J. Law (Ed.), *A sociology of monsters: Essays on power, technology and domination*. London: Routledge.
- Callon, M., & Law, J. (1989). On the construction of sociotechnical networks: content and context revisited. *Knowledge and Society*, 8, 57-83.
- Cargill, C. F. (1989). *Information technology standardization: Theory, process, and organizations*. Redford, MA: Digital Press.
- Carley, K. (2006). Dynamic network analysis: Summary of the NRC workshop on social network modeling and analysis. In R. Breiger, & K. Carey (Eds.), National Research Council, Washington D.C.
- Croley, S. P. (1998). Theories of regulation: Incorporating the administrative process. *Columbia Law Review*, 98(1), 1-168.
- Damsgaard, J., & Lyytinen, K. (2001). The role of intermediating institutions in the diffusion of electronic data interchange (EDI): How industry associations intervened in Denmark, Finland, and Hong Kong. *The Information Society*, 17(3), 197-210.
- David, P. A. (1985). Clio and the economics of QWERTY. *The American Economic Review*, 72(2), 332-337.
- David, P. A. (1995). Standardization policies for network technologies: The flux between freedom and order revisited. In R. W. Hawkins, R. Mansell, & J. Skea (Eds.), *Standards, innovation and competitiveness: The politics and economics of standards in natural and technical environments*. Aldershot, UK: Edward Elgar.
- David, P. A., & Greenstein, S.M. (1990). The economics of compatibility standards: An introduction to recent research. *The Economics of Innovations and New Technology*, 1(1/2), 3-41.
- David, P. A., & Steinmueller, W.E. (1994). Economics of compatibility standards and competition in telecommunication networks. *Information Economics and Policy*, 6(3,4), 217-241.
- Davidson, E. (2002). Technology frames and framing: Socio-cognitive investigation of requirements determination. *MIS Quarterly*, 26(4), 329-358.
- Egyedi, T. (2005). *Consortium problem redefined: Negotiating 'democracy' in the actor network standardization*. Unpublished working paper, Department of Information and communication Technology, Faculty of technology, Policy and Management, Delft University of Technology.
- Faraj, S., Kwon, D., & Watts, S. (2004). Contested artifact: Technology sensemaking, actor networks, and the shaping of the Web browser. *Information Technology & People* 17(2), 186-209.
- Farrell, J., & Saloner, G. (1985). Standardization, compatibility, and innovation. *Rand Journal of Economics*, 16(1), 70-83.
- Farrell, J., & Saloner, G. (1986). Installed base and compatibility: Innovation, product preannouncements, and predation. *The American Economic Review*, 76(5), 940-955.

- Farrell, J., & Saloner, G. (1988a). Coordination through committees and markets *The RAND Journal of Economics*, 19(2), 235-252.
- Farrell, J., Saloner, G. (1988b). Dynamic competition with switching costs. *The Rand Journal of Economics*, 19(1), 123-137.
- Funk, J. L. (2002). *Global competition between and within standards: The case of mobile phones*. New York: Palgrave.
- Gabel, H. L. (1991). *Competitive strategies for product standards: The strategic use of compatibility standards for competitive advantage*. London: McGraw-Hill Book Company.
- Gadamer, H.-G. (1975). *Truth and method* (G. Barden & J. Cumming, Trans.). New York: Seabury Press.
- Garud, R., Jain, S., & Kumaraswamy, A. (2002). Institutional entrepreneurship in the sponsoring of common technological standards: The case of Sun Microsystems and Java. *Academy of Management Journal*, 45(1), 196-214.
- Gherardi, S., & Nicolini, D. (2000). To transfer is to transform: The circulation of safety knowledge. *Organization*, 7(2), 329-348.
- Hanseth, O., Monteiro E., & Halting, M. (1996). Developing information infrastructure: The tension between standardisation and flexibility. *Science, Technologies, and Human Values*, 21(4), 407-426.
- Hanseth, O., et al. (2006). Reflexive standardization: Side-effects and complexity in standard-making. *MIS Quarterly*, forthcoming.
- Haug, T. (2002). A commentary on standardization practices: Lessons from the NMT and GSM mobile telephone standards histories. *Telecommunications Policy*, 26(3-4), 101-107.
- Hawkins, R. W. (1995). Introduction: Addressing the *problématique* of standards and standardization. In R. W. Hawkins, R. Mansell, & J. Skea (Eds.), *Standards, innovation and competitiveness: The politics and economics of standards in natural and technical environments*. Aldershot, UK: Edward Elgar.
- Howcroft, D., Mitev, N., & Wilson, M. (2004). What we may learn from social shaping of technology approach. In J. Mingers, & L. Willcocks (Eds.), *Social theory and philosophy for information systems*. Chichester: John Wiley, pp. 329-371.
- Hosein, I., Tsiavos, P., & Whitley, E.A. (2003). Regulating architecture and architectures of regulation: Contributions from information systems. *International Review of Law Computers & Technology*, 17(1), 85-97.
- Hughes, T. (1987). The evolution of large technological systems. In W. Bijker, T. Hughes, & T. Pinch (Eds.), *The sociological construction of technological systems*. Cambridge, MA: The MIT Press.
- Jakobs, K. (2006). Shaping user-side innovation through standardisation: The example of ICT. *Technological Forecasting & Social Change*, 73(1), 27-40.
- Jarvenpaa, S., Tiller, L.E.H., & Simons, R. (2003). Regulation and the Internet: Public choice insights for business organizations *California Management Review*, 46(1), 72-85.
- Jørgensen, U., & Sørensen, O. (1999). Arenas of development: A space populated by actor-worlds, artefacts, and surprises. *Technology Analysis and Strategic Management*, 11(3), 409-429.
- Karnoe, P., & Garud, R. (2005). Path creation and dependence in the Danish wind turbine field. In J. Porac, & M. Ventresca (Eds.), *Constructing industries and markets*. New York: Elsevier.
- Katz, M. L., & Shapiro, C. (1986). Technology adoption in the presence of network externalities. *Journal of Political Economy*, 94(4), 822-841.

- Keil, T. (2002). De-facto standardization through alliances—Lessons from Bluetooth. *Telecommunications Policy*, 26(3-4), 205-213.
- King, J. L., et al. (1994). Institutional factors in information technology innovation. *Information Systems Research*, 5(2), 139-169.
- King, J. L., & West, J. (2002). Ma bell's orphan: US cellular telephony, 1974-1996. *Telecommunications Policy*, 26(3-4), 189-204.
- Langley, A. (1999). Strategies for theorizing from process data. *Academy of Management Review*, 24(4), 691-710.
- Latour, B. (1987). *Science in action: How to follow scientists and engineers through society* (1st ed.). Milton Keynes: Open University Press.
- Latour, B. (1992). Where are the missing masses? The sociology of a few mundane artifacts. In W. E. Bijker, & J. Law (Eds.), *Shaping technology/building society: studies in sociotechnical change*. Cambridge, MA: MIT Press.
- Latour, B. (1995). *Social theory and the study of computerized work wites*. Paper presented at the IFIP WG8.2, Cambridge, UK.
- Latour, B. (1997). *On actor-network theory: A few clarifications*. ANT Resource, Centre for Social Theory and Technology, Keele University.
- Latour, B. (1999). *Pandora's hope: Essays on the reality of science studies*. Cambridge, MA: Harvard University Press.
- Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy, and heterogeneity *System Practice*, 5(4), 379-393.
- Lessig, L. (1999a). *Code and other laws of cyberspace*. New York: Basic Books.
- Lessig, L. (1999b). The law of the horse: What cyberlaw might teach. *Harvard Law Review*, 113(2), 501-549.
- Lyytinen, K., & Fomin, V.V. (2002). Achieving high momentum in the evolution of wireless infrastructures: The battle over the 1G solutions. *Telecommunications Policy*, 26(3-4), 149-170.
- Manninen, A. T. (2002). *Elaboration of NMT and GSM standards: From idea to market*. Unpublished PhD Thesis, University of Jyväskylä.
- Mähring, M. et al. (2004). Trojan actor-networks and swift translations: Bringing actor-network-theory to IT project escalation studies. *Information Technology & People*, 17(2), 210-238.
- Mangematin, V., & M. Callon. (1995). Technological competition, strategies of the firms and the choice of the first users: The case of road guidance technologies. *Research Policy*, 24(3), 441-458.
- Mansell, R., & Silverstone, R. (1996). *Communication by design: The politics of information and communication technologies*. Oxford: Oxford University Press.
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71-78.
- Markus, L., et al. (2006). Industry-wide IS standardization as collective action: The case of the US residential mortgage industry. *MIS Quarterly*, forthcoming.
- Markus, M. L., & Robey, D. (1988). Information technology and organizational change: Casual structure in theory and research. *Management Science*, 34(5), 583-598.
- Mitra, P., Purao, S., Bagby, J.W., Umaphathy, K., & Sharoda, P. (2005). *An empirical analysis of development processes for anticipatory standards*. NET Institute Working Paper No. 05-18 <http://ssrn.com/abstract=850524>
- Mohr, L. B. (1982). *Explaining organizational behavior*. San Francisco: Jossey-Bass.
- Mouly, M., & Pautet, M.-B. (1992). *The GSM system for mobile communications*. Palaiseau,

- France: Michael Mouly and Marie-Bernadette Pautet.
- Nelson, M. L., Shaw, M. J., & Qualls, W. (2005). Interorganizational system standards development in vertical industries. *Electronic Markets*, 15(4), 378-392
- Newman, M., & Robey, D. (1992). A social process model of user-analyst relationships. *MIS Quarterly*, 16(2), 249-266.
- Nickerson, J. V., & zur Muehlen, M. (2006). The social ecology of standards processes: Insights from Internet standard making. *MIS Quarterly*, forthcoming.
- Orlikowski, W., & Gash, D. (1994). Technology frames: Making sense of information technology in organizations. *ACM Transactions on Information Systems*, 12(2), 147-207.
- Patterson, M. R. (2002). Inventions, industry standards, and intellectual property. *Berkeley Technology Law Review*, 17(3), 1-42.
- Pentland, B. T. (1999). Building process theory with narrative: From description to explanation. *Academy of Management Review*, 24(4), 711-724.
- Pettigrew, A. M. (1997). What is a processual analysis? *Scandinavian Journal of Management*, 13(4), 337-348.
- Pinch, T. J., & Bijker, W.E. (1987). The social construction of facts and artifacts: Or how the sociology of science and the sociology of technology might benefit each other. In W. E. Bijker, T. P. Hughes, & T. J. Pinch (Eds.), *The social construction of technological systems: New directions in the sociology and history of technology*. Cambridge: MIT Press.
- Ramiller, N. C. (2005). Applying the sociology of translation to a system project in a lagging enterprise. *Journal of Information Technology Theory and Application*, 7(1), 51-76.
- Robey, D., & Newman, M. (1996). Sequential patterns in information systems development: An application of a social process model. *ACM Transactions on Information Systems*, 14(1), 30-63.
- Sahay, S., & Robey, D. (1996). Organizational context, social interpretation and the implementation and consequences of geographical information systems. *Accounting, Management and Information Technologies*, 6(4), 255-282.
- Schmidt, S. K., & Werle, R. (1998). *Coordinating technology: Studies in the international standardization of telecommunications*. Cambridge, Massachusetts: The MIT Press.
- Shadish, W. R., Cook, T.D., & Campbell, D.T. (2002). *Experimental and quasi-experimental designs for generalized causal inference* (2nd ed.). Houghton Mifflin.
- Shapiro, C., & Varian, H. (1998). *Information rules: A strategic guide to the network economy*. Cambridge, MA: Harvard Business School Press.
- Sheremata, W. A. (1998). New issues in competition policy raised by information technology industries. *The Antitrust Bulletin*, 43(3/4), 547-582.
- Simon, H. A. (1977). *The new science of management decision* (rev. ed.). Englewood Cliffs: Prentice-Hall.
- Sørensen, K. H., & Williams, R. (2002). *Shaping technology, guiding policy: Concepts, spaces and tools*. Cheltenham: Edward Elgar.
- Spivak, S. M., & Brenner, F.C. (2001). *Standardization essentials: Principles and practice*. New York: Marcel Dekker, Inc.
- Steinmueller, E. (2005). *Technical compatibility standards and the co-ordination of the industrial and international division of labor*. Paper presented at NSF Academics conference on Advancing Knowledge and the Knowledge economy.

- Stewart, J., & Williams, R. (2005). The wrong trousers? Beyond the design fallacy: Social learning and the user. In H. Rohrer (Ed.), *User involvement in innovation processes: strategies and limitations from a socio-technical perspective*. Munich: Profil-Verlag.
- Swann, P. (2000). *The economics of standardization*. Final Report for Standards and Technical Regulations Directorate, Department of Trade and Industry. Manchester Business School, University of Manchester.
- Suchman, L. (2000). Organizing alignment: A case of bridge-building. *Organization*, 7(2), 311-327.
- Teece, D. J., & Sherry, E. F. (2003). Standards setting and antitrust. *Minnesota Law Review*, 87(6), 1913-1994.
- Van de Ven, A. H., et al. (1999). *The innovation journey*. New York: Oxford University Press.
- Van de Ven, A. H., & Poole, M.S. (1995). Explaining development and change in organizations. *Academy of Management Review* 20(3), 510-540.
- Van de Ven, A. H., & Huber, G. (1990). Longitudinal field research methods for studying processes of organizational change. *Organization Science*, 1(2), 213-219.
- Virilli, F. (2003). Design, sense-making and negotiation activities in the Web services standardization process. In J. King, & K. Lyytinen (Eds), *Standard making: A critical research frontier for information systems*. Proceedings of a Pre-conference Workshop at ICIS, December 12-14, Seattle, 2003, Washington, available at <http://www.si.umich.edu/misq-stds/proceedings/index.html>
- Walsham, G. (1997). Actor-network theory and IS research: Current status and future prospects. In A. Lee, J. Liebenau, & J. DeGross (Eds.), *Information systems and qualitative research*. London: Chapman and Hall, pp. 466-480
- Walsham, G., & Sahay, S. (1999). GIS for district level administration in India: Problems and opportunities. *MIS Quarterly*, 23(1), 39-66
- Weick, K. E. (1989). Theory construction as disciplined imagination. *Academy of Management Review*, 14(4), 516-531.
- Weick, K. E. (1993). The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly*, 38(4), 628-652.
- Weick, K. E. (1995). *Sensemaking in organizations*. London: Sage Publications.
- Weiser, P. J. (2003). The Internet, innovation, and intellectual property policy. *Columbia Law Review*, 103(3), 534-613.
- Weitzel, T., Beimborn, D., & König, W. (2006). A unified economic model of standard diffusion: The impact of standardization cost, network effects and network topology. *MIS Quarterly*, forthcoming.
- Werle, R. (2000). *Institutional aspects of standardization: Jurisdictional conflicts and the choice of standardization organizations*. Koeln: Max-Planck Institute for Social Science Research.
- Wikipedia. (2005). Retrieved September 9, 2005 from, <http://www.wikipedia.org/>
- Williams, R., & Edge, D. (1996). The social shaping of technology. *Research Policy*, 25, 865-899.
- Woiceshyn, J. (1997). Literary analysis as a metaphor in processual research: A story of technological change. *Scandinavian Journal of Management*, 13(4), 457-471.

ENDNOTES

¹ The list of such standards is growing but covers, among others, standards on mobile technologies. See <http://www.3gpp.org/>; Web services—see [http://www.w3.org/2002/ws/\(GSM\)](http://www.w3.org/2002/ws/(GSM))—see <http://www.gsmworld.com/index.shtml>; mobile services (OMA)—see <http://www.openmobilealliance.org/>; Interoperability and loosely coupled computing services around the Semantic Web—see <http://www.w3.org/2001/sw/>; short range communication standards (Bluetooth)—see <http://www.bluetooth.com/>; programming platform standards (Java)—see <http://java.sun.com/>; networking standards (IETF)—see <http://www.ietf.org/>; web standards (W3C)—see <http://www.w3.org/>; or vertical information standards (Rosettanet)—see www.rosettanet.org

² We could as well use the term “activity,” but because the existing literature on process theories extensively uses the term “event,” we will follow this term.

³ To engage in such events designers must do one of the following: a) signal their willingness to reach an agreement or accept another’s invitation about designs; b) accept the principal concept and scope of the agreement; c) agree on the content and technical form of the agreement; d) agree on “gives” and “takes” (commitments) in relation to the standard and its outcomes (e.g., IPRs); e) agree on how to access the agreement; and f) agree on what conformance to the agreement means.

⁴ We are thankful to one of the reviewers for pointing this out.

⁵ Further in text as PTTs.

⁶ Further in text as PTTs.

APPENDIX A

The Narrative of the MTX Development Process

The idea of a pan-Nordic cellular telephony system was conceived at the Nordic Teleconference in 1969. The decision included a plan to investigate possibilities for creating a common traffic radio system—as it was called at that time—for Nordic countries (Denmark, Finland, Norway, and Sweden). This decision (sense-making) was prompted by the market context—the growth of manual national car-telephone systems beyond expectations. The original design idea established a lasting technology context was about *creating a common and compatible Nordic auto-radio service*, which required novel market and regulatory context. Because of this, the scope of the innovation, during NMT standardizing was open for a long time and involved multiple designs over the next six to seven years while their feasibility and service quality was evaluated. The aforementioned events forming the context for the launching of the NMT project can be presented as follows:

MC1: The growth of manual national car-telephone systems beyond expectations.

Event Type: Sense-making (Market Context–MC); Timing: 1969; Input: none; Output: TC1; Actors: National PTTs⁵; Context: Growth of car-telephone systems.

TC1: Investigate possibilities for creating a common auto-radio service.

Event Type: Design (Technology Context–TC); Timing: 1969; Input: MC1; Output: S1; Actors: National PTTs; Context: Idea to create a pan-Nordic radio telephony system.

MC2: Creating a novel pan-Nordic market for the proposed common auto-radio service.

Event Type: Sense-making (Market Context–MC), Timing: 1969; Input: MC1; Output: S1, D2; Actors: National PTTs; Context: Idea to create a pan-Nordic radio telephony system.

RC1: A need for new regulatory context for the proposed common auto-radio system.

Event Type: Sense-making (Regulatory Context–RC); Timing: 1969; Input: MC1; Output: S1, D2; Actors: National PTTs; Context: Idea to create a pan-Nordic radio telephony system.

The design of the MTX subsystem formed a crucial element in the design of the NMT. Its design would largely determine the future of Nordic mobile telephony service—for example, how closely it would resemble normal telephony and how relationships between actors during mobile telephone use and installation were arranged. The architectural choice centered on the switching strategies, and whether to use digital switching platforms. This choice had not been fixed when the decision to develop the service was originally made (TC1). One reason for this was the lack of expertise among people who advocated the new radio system—radio engineers, and their inadequate knowledge of switching—which constituted a specific technology context (TC2). Because of the lack of expertise, the first system design idea (TC1) of possibly automatic switching gave way to an idea (sense-making) of an intermediary manual system (S1) (Fomin & Lyytinen, 2000).

S1: An understanding that an intermediary manual system would serve the needs.

Event Type: Sense-making; Timing: 1969-1975; Input: TC1, TC2, MC2, and RC1; Output: D2; Actors:

National PTTs; Context: Idea to create a pan-Nordic radio telephony system. Inadequate knowledge of switching of the radio engineers for the development of automatic switching system.

When the idea of developing an intermediary manual system had been accepted, possible design solutions for the manual system were proposed (D2). The NMT group made a summary of the types of exchanges (MTX), which were to be used for connectivity with fixed networks (PSTN) in the 1980s. Each of the proposed solutions was investigated for the suitability for MTX use (S2).

D2: A need to develop an intermediary manual system.

Event Type: Design; Timing: September 1972-September 1973; Input: S1, MC2, and RC1; Output: S2; Actors: National PTTs; Context: Idea to create a pan-Nordic radio telephony system. Initial MTX design scope.

S2: Inquiry about the suitability of the exchanges for MTX use.

Event Type: Sense-making; Timing: September 1973-October 1975; Input: D2; Output: N3; Actors: National PTTs; Context: Idea to create a pan-Nordic radio telephony system. Initial MTX design scope.

These events formed the first stage of the MTX development process. In 1975, the development context had changed—in 1975 automatic switching (D4) was chosen based on economic criteria (N4) (Toivola, 1992) after the NMT work group had analyzed the cost of alternative switching systems (S4). Yet, the design of an automatic switch after the decision was not something that could be easily done. At that time, cellular communication design was dominated by radio system concerns without considering the needs of switching (Lyytinen, et al., 2000) as radio engineers did not have expertise in designing automatic switches (TC3). As one switching engineer who participated in NMT development noted (Lyytinen, et al., 2000):

What the radio people were saying was that the challenge is now here on the radio side.... They didn't talk about analogue or digital switches, because they didn't have a clue about those, or microprocessor-controllers, anything....

To overcome this weakness, MTX design was carried out by expanding the actor network to Nordic telecommunication manufacturers (TC4, MC3). The design evolved between 1975 and 1978 through several cycles of design (architecture, switching capability, and service concepts), negotiation (cost, commitments and feasibility aspects), and sense-making (receiving feedback from manufacturers re-evaluating the service concept) (see Appendix B for the complete list of events).

The MTX design contributed critically to NMTs success (TC5, MC4) as it implicated several closure points for design, negotiation, and sense-making. Overall, five closures were reached which corresponded to four core design issues faced with MTX development—the type of network (N4), the network architecture (S7), the specifications for the MTX (D9, N16), and the actual adoption of the MTX (N17):

- **N4—The type of network and service concept.** The decision on an automatic digital switch was critical for the future sense-making and negotiation. When the issue was closed it affected broadly how the future service was conceived, the composition of the actor network, and added a new set of negotiations.

- **S7–The network architecture.** The Closure in the MTX sensemaking affected the whole image of the network-to-be among system developers. This closure was critically influenced by the technological expertise offered by telecom manufacturers and their market knowledge. As a result, designers re-conceptualized the network architecture. This resulted in a closure in sense-making, as the new conceptualization—an idea of a regular phone service in cars across all Nordic countries—had to be implemented in the network.
- **D9–The complete MTX specification.** The final specifications from three manufacturers were received in 1977 and the design specifications were frozen, i.e., the standard reached the design closure.
- **N16–The contract negotiation. Intensive negotiations took place around the MTX procurement.** Though specifications were frozen, the NMT group demanded changes as costs and service ideas need to be matched. The vendor—LM Ericsson—refused to make changes, closing negotiation.
- **N17–Sealing the MTX deal.** The negotiation closure was reached when the Finnish PTA finally gave in.

APPENDIX B

The Complete Event List

The Initial Context for the Commencement of the Project

MC1: The growth of manual national car-telephone systems beyond expectations.

Event Type: Sense-making (Market Context–MC); Timing: 1969; Input: none; Output: TC1; Actors: National PTTs⁶; Context: Growth of car-telephone systems.

TC1: Investigate possibilities for creating a common auto-radio service.

Event Type: Design (Technology Context–TC); Timing: 1969; Input: MC1; Output: S1; Actors: National PTTs; Context: Idea to analyze the technical feasibility of a pan-Nordic radio telephony system.

MC2: Creating a novel pan-Nordic market for the proposed common auto-radio service.

Event Type: Sense-making (Market Context–C); Timing: 1969; Input: MC1; Output: S1, D2; Actors: National PTTs; Context: Examine the need for a pan-Nordic radio telephony system.

RC1: A need for new regulatory context for the proposed common auto-radio system.

Event Type: Sense-making (Regulatory Context–RC); Timing: 1969; Input: MC1; Output: S1, D2; Actors: National PTTs; Context: Idea to anticipate the regulatory needs of a pan-Nordic radio telephony system.

Initial MTX Design Scope

S1: A inquiry to develop an intermediary manual system.

Event Type: Sense-making; Timing: 1969 to 1975; Input: TC1, TC2, MC2, and RC1; Output: D2; Actors: National PTTs; Context: Idea to create a pan-Nordic radio telephony system. Inadequate knowledge of switching of the radio engineers for the development of an automatic switching system.

D2: A plan to develop an intermediary manual system. The NMT group made a summary of the types of exchanges (MTX), which were to be used for connectivity with the fixed network (PSTN) in the 1980s.

Event Type: Design; Timing: September 1972 to September 1973; Input: S1, MC2, and RC1; Output: S2; Actors: National PTTs; Context: Idea to create a pan-Nordic radio telephony system. Initial MTX design scope.

Investigating the Suitability of the Exchanges for MTX use

S2: NMT group made preferences for the choice of suitable exchanges: AKE-13 (LM Ericsson) for Denmark, 11B, 11C (STK) for Norway, ARM (LM Ericsson) for Finland, A-205 (Teli) for Sweden.

Event Type: Sense-making; Timing: September 1973; Input: D2; Output: D3; Actors: National PTTs; Context: Idea to create a pan-Nordic radio telephony system. Investigating the suitability of the exchanges for MTX use.

D3: PTTs make their choices for exchanges: Denmark chose AKE-13, “unless there was a cheaper solution.” Norway chose AKE-13 for Oslo and Östland, separate MTX for other regions. Sweden chose A-205. Finland voiced no opinion.

Event Type: Design; Timing: September 1973 to January 1975; Input: S2; Output: D5; Actors: National PTTs; Context: Investigating the suitability of the exchanges for MTX use.

Choosing between Manual and Automatic Switching Systems

D4: NMT group considers an automatic switching system as a replacement for the manual one.

Event Type: design; Timing: 1975; Input: TC3; Output: S5; Actors: National PTTs; Context: Choosing between manual and automatic switching systems.

S4: Analyzing the development and maintenance (operational) costs of manual versus automatic switching systems.

Event Type: Sense-making; Timing: 1975; Input: D4; Output: N4; Actors: National PTTs; Context: Choosing between manual and automatic switching systems.

N4: Automatic switching system chosen based on economic considerations.

Event Type: Negotiation; Timing: 1975; Input: S4, TC4, and MC3; Output: D5, TC5, and MC4; Actors: National PTTs; Context: Choosing between manual and automatic switching systems.

Making Rough Draft for MTX Specifications

D5: NMT group started to work on MTX specifications. The specifications scheduled to be completed by May 1976.

Event Type: Design; Timing: September 1975 to June 1976; Input: D3; Output: S5; Actors: National PTTs; Context: Making rough draft for MTX specifications.

A Framework to Build Process Theories of Anticipatory ICT Standardizing

S5: In May 1976 potential suppliers were identified.

Event Type: Sense-making; Timing: May 1976; Input: D5; Output: N5; Actors: National PTTs; Context: Making rough draft for MTX specifications.

N5: Completed in June 1976, draft specifications sent to the suppliers.

Event Type: Negotiation; Timing: June 1976; Input: S5; Output: N6; Actors: National PTTs, suppliers; Context: Making rough draft for MTX specifications.

Bi-Lateral Negotiations with the Suppliers on the Technical Specifications of their Proposed MTXs

N6: Negotiations with suppliers were held in August 1976.

Event Type: Negotiation; Timing: August 1976 to October 1976; Input: N5; Output: D6; Actors: National PTTs, suppliers; Context: Bi-lateral negotiations with the suppliers on the technical specifications of MTX.

D6: On October 15, 1976, eight preliminary MTX offers received.

Event Type: Design; Timing: October 1976; Input: N6; Output: D7; Actors: National PTTs, suppliers; Context: Bi-lateral negotiations with the suppliers on the technical specifications of MTX.

D7: Evaluation of the received preliminary MTX offers. Decisions reported in December 1976.

Event Type: Design; Timing: October 1976 to December 1976; Input: D6, TC5, and MC4; Output: S7; Actors: National PTTs, suppliers; Context: Evaluation of the preliminary MTX offers for the economic and technical feasibility.

S7: The cost of MTXs was found to exceed the expectations (the smallest capacity MTX /1000-7000 subscribers/considered unsuitable). As a result, the number of ordered MTX was reduced significantly, which had a direct bearing on the network structure.

Event Type: Sense-making; Timing: December 1976 to December 1977; Input: D7; Output: N8; Actors: National PTTs; Context: Evaluation of the preliminary MTX offers for the economic and technical feasibility.

Limiting the Number of Suppliers

N8: NMT group negotiating on the number of manufacturers, which will be receiving the final MTX orders.

Event Type: Design; Timing: October 1976 to Q1 1977; Input: S7; Output: D8; Actors: National PTTs; Context: Limiting the number of suppliers for the initial MTX specifications.

D8: It was finally decided to limit the number of manufacturers to the following five: LM Ericsson, Motorola, NEC, C. Itoh, and Telefenno.

Event Type: Design; Timing: Q1 1977; Input: N8; Output: N9; Actors: National PTTs, suppliers; Context: Limiting the number of suppliers for the initial MTX specifications.

Sending Out Tender Invitations for MTX bids

N9: A tender for MTX specifications bids sent out to suppliers, requesting the bids to be received by December 1, 1977.

Event Type: Negotiation; Timing: September 1977 to December 1977; Input: D8; Output: 9; Actors: National PTTs, suppliers; Context: Tender for the initial MTX specifications.

D9: LM Ericsson, Motorola, and NEC have submitted their bids.

Event Type: Design (closure); Timing: December 1977; Input: N9; Output: D10; Actors: National PTTs, suppliers; Context: Tender for the initial MTX specifications.

Evaluation of the Bids

D10: Upon receiving bids from the manufacturers, the proposed MTX specifications are evaluated.

Event Type: Design; Timing: December 1977; Input: D9; Output: S10; Actors: National PTTs; Context: Evaluation of bids for the initial MTX specifications.

S10: A rough assessment has shown that there were shortcomings in LM Ericsson's offer, incompleteness in Motorola's offer, and minor weaknesses in NEC's offer.

Event Type: Sense-making; Timing: Q4 1977; Input: D10; Output: S11; Actors: National PTTs; Context: Evaluation of bids for the initial MTX specifications.

Re-Working the Deficiencies of the Initial MTX Specifications (Proposals)

S11: The uncertainties in the manufacturers' bids necessitated the NMT group to send a list of questions to the manufacturers in order to obtain clarifications.

Event Type: Sense-making; Timing: February 1978 to May 1978; Input: S10; Output: S12; Actors: National PTTs, suppliers; Context: Re-working the deficiencies of the initial MTX specifications (proposals).

S12: Reliability assessments were finished.

Event Type: Sense-making; Timing: December 1977 to May 1978; Input: S11; Output: S13; Actors: National PTTs; Context: Re-working the deficiencies of the initial MTX specifications (proposals).

MTX Delivery Negotiations

S13: Estimates of the costs stemming from the delay with NMT system's introduction are made. Sweden projected the loss of SEK 16 million if the NMT was delayed by one year.

Event Type: Sense-making; Timing: Q1 1978; Input: S12; Output: N14; Actors: National PTTs; Context: MTX delivery negotiations.

N13: LM Ericsson promises to ship the MTX to Sweden on May 1, 1981, to Norway on July 1, to Denmark on September 1, and to Finland on November 1.

A Framework to Build Process Theories of Anticipatory ICT Standardizing

Event Type: Neogtiation; Timing: August 1978; Input: D9; Output: D13; Actors: National PTTs, LM Ericsson; Context: MTX delivery negotiations.

D13: NMT recommends that the National Authorities to sign the corresponding contracts for the proposed MTX specifications. Denmark, Sweden, and Norway intend to sign the contract with LM Ericsson.

Event Type: Design; Timing: August 1978; Input: N13; Output: N14; Actors: National PTTs; Context: MTX delivery negotiations.

Signing a Contract for MTX

N14: All but Finnish National Authorities sign a contract with LM Ericsson. Finland considers the offer too expensive, seeks supplementary offers from LM Ericsson and NEC.

Event type: Negotiation; Timing: August 1978; Input: D13; Output: N15; Actors: National PTTs, LM Ericsson; Context: Signing a contract for MTX.

NMT Group Proposing Changes to MTX Specifications

N15: The NMT group approached LM Ericsson with the request to make changes to MTX specifications.

Event Type: Negotiation; Timing: 1979; Input: N12; Output: N16; Actors: National PTTs, LM Ericsson; Context: Choosing LM Ericsson's AXE exchange as the MTX for all Nordic countries.

N16: LM Ericsson refuses to implement the changes to MTX specifications, unless the delivery dates are postponed.

Event Type: Negotiation; Timing: 1979; Input: N15; Output: N17; Actors: National PTTs, LM Ericsson; Context: Choosing LM Ericsson's AXE exchange as the MTX for all Nordic countries.

LM Ericsson's AXE Exchange—The MTX of Choice in all Nordic Countries

N17: Reaching closure on negotiation—Finland signs the contract with LM Ericsson.

Event Type: Negotiation; Timing: 1979; Input: N14; Output: none; Actors: Finnins PTT, LM Ericsson; Context: Choosing LM Ericsson's AXE exchange as the MTX for all Nordic countries.

This work was previously published in the International Journal of IT Standards and Standardization Research, Vol. 6, Issue 1, edited by Kai Jakobs, pp. 1-38, copyright 2008 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.3

How the National E–Strategy Shapes Competitiveness in the Information Economy

Alf Neumann

University of Cologne, Germany

INTRODUCTION

The ongoing discussion on what e-strategy does and what it can do for national information and communication technology (ICT) development has brought up a variety of government functions for the ICT environment, readiness, and usage in a country. The ICT sector plays a key role in furthering the ICT development process. This paper sheds light on the connection between e-strategy and the development of dynamic ICT businesses in Tunisia. The central question is how far e-policies may not only create a supportive environment for ICT, but also contribute to sustained success and competitiveness of ICT firms.

FROM ICT TO COMPETITIVENESS

Tunisia is one of the leading developing countries regarding its achievements in information and communication technologies (ICT) and competitiveness. Recently published comparative indica-

tors illustrate some remarkable performances in both fields. Tunisia is ranked 34 in the Networked Readiness Index (NRI) which covers 82 countries (Dutta & Jain, 2003). The country holds the highest ranking in Africa and in the Arab world. In the Growth Competitiveness Index (GCI) the country is ranked 34 (Cornelius et al., 2003), and in the Microeconomic Competitiveness Index (MICI) it ranks 32nd out of 80 countries (Porter, 2003). With the exception of South Africa, Tunisia's competitive indicators outperform all African and Arab states in the rankings. Also, with regard to government efforts to successfully promote ICT competitiveness, Tunisia is clearly showing the way among poor and middle-income countries (Lanvin, 2003).

The government e-strategy defines the overall framework for national ICT development. In Tunisia the underlying e-policy framework is embedded in the national development plan, currently the Tenth Plan 2002-2006. This intends software and information technology (IT) service companies to play more of a key role in

furthering the Information and Communication Technology (ICT) development process both as suppliers of technology at the core of the Tunisian information economy and increasingly as exporters (Ministère du Développement et de la Coopération internationale, 2001). The question is, beyond all the indicators, how far the e-strategy creates not only a supportive environment for ICT, but also contributes to the competitiveness of ICT firms, especially regarding software and IT service exports.

LINKING E-STRATEGY AND COMPETITIVENESS

Through development priorities set by the government e-strategy for the information economy and society, supply and demand conditions for ICT in a country are essentially influenced by the state. According to Lanvin (2003), the influence is more or less direct on four crucial determinants of ICT supply and demand. These are human and financial resources, and domestic and international market conditions. The role of the government changes from directly producing and using technology to indirectly fostering the information economy and society as both facilitator, by providing a supportive environment for ICT, and as leader by providing visions for ICT and its role in social and economic development.

However, the e-strategy integrates a variety of policy areas, and pursues a diverse set of social and economic development goals. Thus, it does not necessarily address the development of a specific economic sector or its competitiveness. The impact the e-strategy has on competitiveness depends primarily on the overlaps between the proximate business environment of firms and the national ICT environment. The more overlaps exist, the more the national conditions achieved and envisaged for ICT can affect the pool of essential input factors including the skills and knowledge firms can draw on and the corporate

goals that determine investments. According to Porter (1990), there are four attributes determining the business environment and its eligibility to support the capabilities of firms to develop and enhance competitive advantages. These are factor and demand conditions, the presence of related and supporting industries, the context of strategy, and rivalry.

The sector that is most dependent on the e-strategy regarding the effects of competitiveness is the ICT sector itself. The role of the government which either directly or indirectly takes part in ICT development has an impact on all relevant attributes of the proximate business environment (Lanvin, 2003).

As public ICT producer and buyer, the government may provide the fundamental ICT infrastructure and generate demand for ICT on the one hand, but may stand also in rivalry to private ICT producers on the other. Therefore a key question is, how much public demand and rivalry to public enterprises may affect the competitiveness of ICT firms (Porter, 1990), especially concerning software and IT service exports.

The more a government moves towards indirect ways of influencing ICT development, the more important is the focus of the e-strategy on improvements of macroeconomic conditions for the information economy, the generation of technological expertise, and the setting of market signals to trigger dynamic ICT businesses (Lanvin, 2003).

THE TUNISIAN GOVERNMENT AS ICT LEADER

Tunisia gave a high priority to ICT in its national development plan (Ministère du Développement et de la Coopération internationale, 2001). In so doing, the government made clear that it is a visible and driving force for technological progress in the country. For instance, Tunisia together with Singapore, Taiwan, and Finland has taken the lead

in the international comparison of governmental ICT readiness (World Economic Forum et al., 2003). Regarding ICT usage, the government is also more advanced than many other countries in Europe, or Asia, such as France, Portugal, Spain, Hungary, and India (World Economic Forum et al., 2003).

LAYING THE FOUNDATIONS FOR THE INFORMATION SOCIETY AND ECONOMY

Building the ICT Infrastructure

For the period of the Ninth Plan between 1997 and 2001 the Tunisian government invested \$1.016 billion US dollars¹ in ICT infrastructure, including telephone networks, Internet backbone, and other digital communication networks. The Tenth Plan provides \$2.070 billion US dollars to advance this process between 2002 and 2006 (Ministère du Développement et de la Coopération internationale, 2001).

Despite these investments, the country still has a below-average position regarding the availability and quality of access to communication networks (World Economic Forum et al., 2003). As with many other countries, Tunisia is still working on the densification of its existing telecommunication infrastructure. However, it is important to note that significant progress has been achieved over the last years regarding access and affordability (Dutta & Coury, 2003).

The number of fixed-line and mobile phone subscribers per 100 inhabitants increased from 6.5 in 1997 to 15 in 2001. Further progress of the network densification can be expected due to the liberalization of the market for mobile communication in 2002 when the monopoly of Tunisie Telecom was broken and a second mobile provider, Orascom Telecom Tunisie, entered the market. The costs of mobile telephony are

declining constantly and the number of mobile phone subscribers is increasing significantly. For example, in 2002 there were 400,000 subscribers and by 2006 the government estimates up to 3,000,000 users (Ministère du Développement et de la Coopération internationale, 2001).

Regarding the Internet, Tunisia plays a pioneer role for the region. In 1991, it was the first country connected to the Internet in Africa and the Arab world. Currently there exist 12 Internet service providers (ISP) in Tunisia. The Internet access for individuals and businesses has been improving constantly (*factor conditions*). With 12.83 per 100 inhabitants in 2002, the number of Internet accounts still remains low internationally. Whereas, Tunisia is the most advanced country in the Maghreb region in successfully facing the densification challenge for Internet access (World Economic Forum et al., 2003).

Eventually, the question is how far the priorities concerning the extension of infrastructure to reduce the digital divide on a broad social scale stand in conflict to the infrastructure improvement with special regard to the competitiveness of ICT firms through, for example, policies that support low costs for international communication (*factor conditions*).

Government Prioritization of Software and IT Services

Public investments in ICT contribute an important share in the overall turnover of the ICT sector (*demand conditions*). The public budget for hardware, software and IT services has expanded continuously. The Tenth Plan intends to increase investment from \$668 million to \$1.296 billion U.S. dollars between 2002 and 2006. Whereas, the government puts stronger emphasis on software and IT services with an average annual budget extension of 18.6% for services compared to 12.3% for hardware (Ministère du Développement et de la Coopération internationale, 2001).

Public ICT Production

The government established various institutions to boost the ICT development in Tunisia and to support research and development (R&D) at a time when no private facilities and companies were in the position to take over these tasks of national importance. Eighty percent of software development in the public sector and in public administration are covered by the Centre National de l'Informatique (CNI) (*context of strategy and rivalry*). The Centre des Etudes et Recherche en Télécommunication (CERT) is active in the field of IT services and software development also for the public sector and public administration. As an exporter it has carried out IT consulting and IT management projects in various African and Arab countries (UNDP & CEPEX, 2004).

According to the advancing information economy in Tunisia, the dominance of public ICT producers might have to be reconsidered (Lanvin, 2003). Whereas, a call for liberalization in order to open markets and growth potentials for private ICT firms has to be seen in a trade-off to other national and sectoral development priorities of the government. An important question in this regard is, which functions and responsibilities of public producers would be appropriate to be transferred to private firms according to their capabilities and strengths?

SHAPING THE MACROECONOMIC ENVIRONMENT

Legal Framework

Tunisia was the first Arab country to join the World Trade Organization (WTO) in 1995. Regarding ICT, the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) is of particular importance. With the standardized Intellectual Property Rights (IPR) protection system, Tunisia is due to witness further integration into global

R&D (Dutta & Coury, 2003). Several national IPR-related decrees already exist. These are the trademark decree of 1936, the patents decree of 1956, and the copyright decree of 1994. From January 2005 the country is required to extend product patent protection to types of products not previously patented so extensions of the legal framework can be expected in this regard.

The government has also worked on a legal framework for e-commerce. Several laws have already been enacted. These have been adapted to the concepts on e-commerce legislation of the United Nations Commission on International Trade Law (UNCITRAL) and the European Union (EU) (World Bank, 2002). It is also important to mention the law on electronic signatures and the law on electronic commerce of 2000. Through these laws, Tunisia has achieved a more advanced and comprehensive legal framework for ICT than for example Italy, Portugal, and Hungary (World Economic Forum et al., 2003).

Supply with Capital and Finance

Efficient capital markets are essential for entrepreneurship and investments in the information economy (Raffa et al., 2002). In Tunisia, banks and the vast majority of venture capital companies show in general a preference for investment and financing projects with large enterprises in more traditional Tunisian industries such as textiles and tourism rather than in software and IT services (World Bank, 2002). This is a serious obstacle for the majority of ICT firms in Tunisia (Chaabouni & Mezghani, 2001). The availability of venture capital (*factor conditions*) is an important precondition for innovation and business development. Finance and management consultancy (*related and supporting industries*) can be necessary for the feasibility of large customer projects (UNCTAD, 2003).

Facing the disadvantage regarding the weak capitalization of firms, the government established public venture capital funds. They take part in

joint investment projects in the ICT sector together with private finance institutions. By this, the government not only might support the information economy, but this also allows banks and venture capital companies to gain experience in the field of ICT. It has to be seen how far these funds will be used by firms in the short and medium term and how they can help to change the traditional patterns of finance and venture capital provision in the long term. However, such public financial and non-financial business development support (BDS) plays a key role for getting around market inefficiencies and structural obstacles for ICT firms (UNCTAD, 1999).

BDS can have a variety of impacts on the information economy and its proximate business environment. These can be classified as direct measures undertaken to support firms either with capital (*factor conditions*) or project finance and consultancy provided to accompany specific business processes (*related and supporting industries*). Indirect impact derives from the governmental incentives for other industries to invest in ICT (*demand conditions*). For instance, the Tunisian government co-finances upgrades of IT systems in order to increase productivity and the implementation of e-commerce applications to support export businesses. As a consequence, the support policies have effectively promoted ICT investments and high technology absorption in Tunisian firms (World Economic Forum et al., 2003).

TAILORING EDUCATION POLICY

Education plays a key role in the government's e-strategy. For instance, relative expenditures for higher education increased between 1997 and 2003 from 1.27% to 1.80 percent of gross domestic product (GDP). Especially, technical studies have been vigorously promoted. The number of students in ICT-related studies increased from 3,534 in 1997 to 30,260 in 2003 (Ministère de l'Enseignement Supérieur de la Recherche Sci-

entifique et de la Technologie, 2003). Eventually, Tunisia achieved an excellent international ranking—number six—regarding the quality of math and science education (World Economic Forum et al., 2003). This way, the national human resources development in terms of quality and availability of technological expertise supports effectively an advantageous business environment for Tunisian ICT firms (*factor conditions*).

LEADING LARGE PUBLIC ICT INITIATIVES

State of ICT Cluster Development

Cluster formation is an important driver for the productivity and competitiveness of firms. Clusters foster closely linked and efficient relationships (*related and supporting industries*) up-stream and down-stream in the value chain, and among firms at the same stage of the value chain (Porter, 1998). Therefore, this is an important feature of the Tunisian e-strategy. By building technology parks, the so-called “technopôles”, the government follows the approach of the United Nations Industrial Development Organization (UNIDO) for International Business Incubation Systems (IBIS) (UNIDO, 2004).

The major project is the technology park, Elgazala, in Ariana which was established in 1999. Until 2003 the number of Tunisian and foreign ICT firms located in the park increased to 40. Similar “technopôle” projects are about to be launched over the coming years with Sakiet Ezzit in Sfax and Hammam Maarouf in Sousse.

Public research institutions are closely linked to the technology park. The Ecole Supérieure des Communications (Sup'Com) and the Institut Supérieur des Études Technologiques en Communications (ISET'Com) play a key role in driving innovation and fostering partner companies (ITU, 2002). For example, since 2001 ISET'Com is establishing enterprise incubators in order to

promote entrepreneurship in the information economy. It links research, higher education, and financial and non-financial BDS.

As outlined above, despite the governmental BDS policies and the beneficial environment that a “technopôle” offers, with the absence of sufficient finance and capital provision for the information economy on a broad basis, ICT cluster development lacks an important condition for sustained success of ICT firms (UNCTAD, 1998).

CONCLUSION

The ICT environment in Tunisia contributes to the competitiveness of ICT firms but also challenges them, especially regarding software and IT service exports. Based on the issues presented in the course of this case study, Tables 1 and 2 suggest some fundamental achievements and challenges for future e-strategy formation that might consider more competitiveness impacts on ICT firms. Again, the strategic choice of the government has to be seen in the context of national development priorities. The trade-off between social and economic development goals and possibly conflicting development goals in different sectors will result in the decisions of policy makers. Whereas, the priority has been set—software and IT service exports.

REFERENCES

- Chaabouni, P. J., & Mezghani, L. (2001). Environnement et stratégies des sociétés de service et d'ingénierie informatique en Tunisie. *Les Cahiers de l'ERGE*, 8, 38-52.
- Cornelius, P. K., Blanke, J., & Paua, F. (2003). The growth competitiveness index: Recent economic developments and the prospects for a sustained recovery. In World Economic Forum (Ed.), *The Global Competitiveness Report 2002-2003* (pp. 3-22). New York: Oxford University Press.
- Dutta, S., & Coury, M. E. (2003). ICT challenges for the Arab world. In World Economic Forum, INSEAD, & World Bank (Eds.), *The Global Information Technology Report 2002-2003* (pp. 116-131). New York: Oxford University Press.
- Dutta, S., & Jain, A. (2003). The networked readiness of nations. In World Economic Forum, INSEAD, & World Bank (Eds.), *The Global Information Technology Report 2002-2003* (pp. 2-25). New York: Oxford University Press.
- ITU. (2002, January). *Tunisia and the new information and communication technologies toward the digital culture*. Paper presented at the Arab Prep Com meeting for the World Summit on the Information Society, January 2002. Geneva, Switzerland.
- Lanvin, B. (2003). Leaders and facilitators: The new role of governments in digital economies. In World Economic Forum, INSEAD, & World Bank (Eds.), *The Global Information Technology Report 2002-2003* (pp. 74-83). New York: Oxford University Press.
- Ministère du Développement et de la Coopération internationale. (2001). *Le dixième plan de développement 2002 - 2006*. Tunis: Publications du Ministère.
- Ministère de l'Enseignement Supérieur, de la Recherche Scientifique et de la Technologie. (2003). *40 indicateurs de l'enseignement supérieur, de la recherche scientifique et de la technologie*. Tunis: Publications du Ministère.
- OECD. (2002). *Measuring the information economy 2002*. Paris: OECD publications.
- Porter, M. E. (1990). *The competitive advantage of nations*. New York: Free Press.
- Porter, M. E. (1998). Clusters and competition: New agendas for companies, governments, and institutions. In *On competition*. Cambridge, MA: Harvard Business School Press.

Porter, M. E. (2003). Building the microeconomic foundations of prosperity: Findings from the microeconomic competitiveness index. In World Economic Forum (Ed.), *The Global Competitiveness Report 2002-2003* (pp. 23-46). New York: Oxford University Press.

Raffa, M., Esposito, G., Iandoli, L., & Bruno G. (2002). Hi-tech small firms in developing countries: An exploratory analysis. In U. Füglistaller, H. J. Pleitner, T. Volery, & W. Weber (Eds.), *Umbruch der Welt - KMU vor Höhenflug oder Absturz? Radical change in the world - will SMEs soar or crash?* (pp. 333-345). St. Gall, Switzerland: KMU Verlag.

UNCTAD. (1998, June). *Promoting and sustaining SMEs clusters and networks for development* (UNCTAD document symbol TD/B/COM.3/EM.5/2). Paper presented at the expert meeting on clustering and networking for SME development, 2-4 September 1998. Geneva, Switzerland.

UNCTAD. (1999, April). *Providing sustainable financial and non-financial services for SME development* (UNCTAD document symbol TD/B/COM.3/EM.7/2). Paper presented at the expert meeting on sustainable financial and non-financial services for SME development, 2-4 June 1999. Geneva, Switzerland.

UNCTAD. (2003). *Examen de la politique de l'investissement de l'Algérie* (UNCTAD document symbol ITE/IPC/2003/9). Geneva, Switzerland: United Nations publication.

UNDP & CEPEX. (2004, January). Services informatique et services connexes. In *Offre Tunisienne de services à l'exportation* (pp. 19-27). Tunis: COMETE Engineering.

UNIDO. (2004). *Tunisie: A propos d'IBIS* [Abstract]. Retrieved March 5, 2004 from the World Wide Web at: www.unido.org/en/doc/4677

World Bank. (2002, March). *Nouvelles technologies de l'information et de la communica-*

tion en Tunisie: Création d'emploi et croissance économique - Volume II rapport technique. Washington, DC: Finance, Private Sector, and Infrastructure Network for Middle East and North Africa, & Global Information and Communication Technologies Department.

World Economic Forum, INSEAD, & infoDev (Eds.). (2003). Country profiles. *The Global Information Technology Report 2002-2003* (pp. 191-276). New York: Oxford University Press.

KEY TERMS

Digital Divide: The digital divide is the discrepancy between people who have access to and the resources to use new information and communication tools, such as the Internet, and people who do not have the resources and access to the technology. It can exist between rural and urban areas, between the educated and uneducated, between economic classes, and between more and less developed nations.

E-Strategy: The e-strategy defines the overall framework for the national ICT development. It has a social and an economic dimension. It consists of e-policies which concern the ICT environment, and ICT readiness and usage of three stakeholders in ICT: individuals, businesses, and governments.

GCI: The Growth Competitiveness Index (GCI) aims to measure the capacity of the national economy to achieve sustained economic growth over the medium term, controlling for the current level of development.

ICT Sector: The ICT sector is a combination of manufacturing and service industries that capture, transmit and display data and information electronically (OECD, 2003).

MICI: The Microeconomic Competitiveness Index (MICI) aims to assemble textured measures of the competitive environment of a nation.

NRI: The Networked Readiness Index (NRI) measures the degree of preparation of a nation to participate in and benefit from ICT developments.

ENDNOTE

- ¹ The exchange rate of Tunisian dinar to US dollar of Tuesday, 31st December 2002: 1.00 US dollar = 1.37250 Tunisian dinar.

This work was previously published in the Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by Marshall, S., Taylor, W., and Yu, X., pp. 325-330, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 2.4

An Explanatory Approach to the Political Uses of ICT Initiatives for Participation: Institutions, Context, and Characteristics of the Actors

Rosa Borge

Open University of Catalonia, Spain

ABSTRACT

Political actors use ICTs in a different manner and in different degrees when it comes to achieving a closer relationship between the public and politicians. Usually, political parties develop ICT strategies only for electoral campaigning and therefore restrain ICT usages to providing information and establishing a few channels of communication. By contrast, local governments make much more use of ICT tools for participatory and deliberative purposes. These differences in usages have not been well explained in the literature because of a lack of a comprehensive explanatory model. This chapter seeks to build the basis for this model, that is, to establish which factors affect and condition different political uses of ICTs and which principles underlie that behaviour. We consider that political actors are intentional and their behaviour is mediated by the political institutions

and the socioeconomic context of the country. Also, though, the actor's own characteristics, such as the type and size of the organization or the model of e-democracy that the actor upholds, can have an influence in launching ICT initiatives for approaching the public.

INTRODUCTION

More than a decade has passed since the invention of the World Wide Web, based on the global development of the Internet, and, although it has spread very quickly throughout our personal lives, the marketplace, and civil society, it is not developing so fast in crucial areas of the political realm. Political actors, such as parties, or political institutions, such as parliaments or governments, are reluctant to use the Internet widely for connecting with or approaching citizens. Neverthe-

less, in public administration we can see a steady use of the Internet in order to provide services and information to the public and reduce the procedures that citizens must carry out. In addition, at the local level, at least in Europe,¹ public authorities are launching ICT initiatives much more than parties or parliaments for contacting their citizens and engaging them in the affairs of the municipality.

However, even public administrations and local governments are not using the Internet as extensively as the business sector, the organisations of the civil society, or individuals in their social and personal relationships. It seems that public authorities and political structures are lagging behind in the technological transformations that are affecting the private sector and relationships among individuals. So what are the reasons for this lesser use of ICTs among political actors and inside political institutions? Few studies have been carried out to answer this question. Some authors assert that there are a number of elements ranging from organisational to cultural elements that hinder the assimilation of new technologies by political actors and institutions in contrast to private companies. Political parties and representative institutions such as parliaments are more centralised, less flexible, older, and much less dependent on the “customer-citizen” than many companies in the private sector (Kippen & Jenkins, 2004; Prats, 2005), and all these trends greatly hinder a successful integration of new technologies. Society, business, and communications have changed, among other factors, because of a wider Internet usage, but the core institutions and actors of the political system are still using primarily old technological artifacts and do not appear to be very willing to transform their unidirectional relationship with the public.

Many more studies comparing the efficient integration of ICTs in business and society with the difficulties for their deployment in the representative political system are needed. Yet, it is also very important to discern why some political

actors use the new ICTs much more frequently than others. This search for an explanation is not just of academic or scientific interest, but is also of interest to politicians, public-sector officials, or development professionals who need to understand what the constraints and factors favouring deployment of ICTs are. Technicians, politicians, or activists interested in developing ICT initiatives in a transformative way for democracy must be informed of the costs and benefits of that usage and of the incentives and hurdles that they may come across.

We suspect that similar factors to the ones considered above (organisational, cultural) are affecting differences in political uses. We also know, due to the large accumulation of knowledge in the analysis of collective behaviour, political institutions, and human agency, that the political actors’ behaviour could be analysed as intentional and, at the same time, structured by political institutions and the social and cultural context.

To this effect, the main goal of the chapter will be to introduce the basic elements for the construction of a model that explains the differences in Internet usage by different political actors. These basic elements are a number of variables that must be taken into account when attempting to explain these differences in behaviour. We will not be drawing up a complete detailed model, but rather we will provide an outline of the variables that conform the structure for explanation. We leave the definition of the interactions inside the model and the very construction of the model itself for further studies. Our contributions are to bring out explanatory variables not before considered in ICT literature, to compare the variables already studied in the literature, and to think about the constraints, incentives, and opportunities that political actors face regarding ICT developments.

Internet usages vary within each country and from country to country, and they can change rapidly. In addition, the search for explanations is very difficult since contagion and diffusion of the political uses of ICT among countries and

among political actors render the analysis without clear explanatory variables. In a time of rapid change and fast diffusion of technologies, and in an increasingly globalised world, it is difficult to determine who or what shapes the course of political action, precisely, toward the new technologies. Several analysts have found common patterns and stages in the adoption of ICT by public institutions such as public administrations,² but literature on explanations is still at the beginning, and results are sometimes partial and contradictory.³

Nevertheless, we believe that social sciences should strive to understand these new phenomena and to give insights and information to public authorities, politicians, and the public in general. Also, as we mentioned before, there are enough theories, models, and methods that can be applied to shed some light on this area and thereby increase our understanding of the issues involved.

POLITICAL USES OF ICTS: THE LADDER OF POLITICAL PARTICIPATION

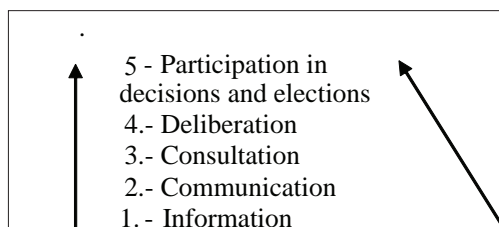
Before we can begin to develop the outline of the explanatory model, we have to define what political ICT usages means. In other words, what do we mean when we refer to different uses of ICT by political actors? There are a wide range of ICT initiatives with very different characteristics undertaken by parties, parliaments, public administrations, and the many other kinds of political organisations. ICTs are being used for facilitating internal communication and processes inside the political organisations or institutions, but in our study, we will be analysing specifically the external initiatives addressed to the public. These are the initiatives that can contribute to revitalising one of the pillars of democracy: the relationship between citizens and their representatives. We must bear in mind that many citizens are dissatisfied⁴ with the way the system of democratic representation works, and the Internet and other ICTs could be a

useful tool for bringing the public and politicians closer. In this sense, the Internet is being used to provide information to the public through Web sites, to establish channels of communication, such as online forums, and to expand channels of participation by means of surveys, elections, and consultations online.

In an attempt to order the various ICT experiences in public engagement, several classification scales have been developed by various analysts (Arnstein, 1969; Coleman & Götze, 2001; Goss, 1999; Navarro, in press; Organization for Economic Cooperation and Development [OECD], 2001). All of them range from the lowest step, which is the information level, to the participation in decision making, which is situated at the highest level. The progression on the scale depends on the extent of citizens' power in determining political decisions. Taking as a starting point the participation scale proposed by Arnstein, we outline a ladder of participation with five degrees distributed as follows.

A large number of empirical studies and reports describing ICT usages by different political actors have been carried out.⁵ These studies show that, generally speaking, political parties remain at the lower levels of participatory usage of ICT: information and less frequently, communication (Norris, 2001; Trechsel, Kies, Mendez, & Schmitter, 2003). In addition, government executives limit themselves to providing the public with information (and services) online through their Web sites (Chadwick & May, 2003). On the contrary, parliaments use ICTs more than parties and executives to

Figure 1. Ladder of citizen participation



develop bidirectional communication between the members of the parliament and their constituents (Coleman, Taylor, & van de Donk, 1999; Trechsel et al, 2003.). It is becoming common to establish channels of communication and consultation on the parliamentary Web sites to allow citizens to have their say about law projects and amendments, in what is called “open parliament.”⁶

More and more different areas of public administrations are moving toward the consultation level because they have an interest in knowing citizens’ opinions and satisfaction about public administration services and procedures (Accenture, 2005). And, much more frequently than the other political actors and institutions, city councils achieve the highest level, which is the one of deliberation and participation in political decisions and binding votings, beyond those already established by the ordinary system of elections (Borge, 2005; Clift, 2004; Coleman & Götze, 2001).

Of course, there are variations from this general rule. In countries like the USA, party candidates use the Internet widely and in a very innovative way. For example, Howard Dean raised money and attracted numerous supporters with the help of already well-established Web tools, bloggers, and Internet-based communities. He used Web tools like Meetup.com to form a support and fundraising group, and also received the support of the majority of the members of MoveOn.org. His campaign for the Democratic party’s presidential nomination was not centralized and led by a headquarters, but it was based instead on the Meetup.com site so that any supporter could coordinate meetings.⁷ As a result, he came close to winning the Democratic nomination for presidential candidate in spite of the lack of the financial support of big firms and mainstream organizations.

In addition, breaking the general rule of the lack of participatory and deliberative aims within governments, some national and regional executives use the Internet to involve their citizens in important political issues such as constitutional

reforms, controversial public policies, or the entry into international organizations. For instance, the British executive is the pioneer in using online solutions for participation in government decisions. Since 1997, it has developed a consultation policy on law proposals, government planning, and decisions, based on a combination of online tools such as forums, e-mails, live chats, and face-to-face meetings and panels.⁸ Recently, the Catalan government has also deployed a participatory process in order to get the public involved in the reform of the Catalan Statute of Autonomy. This initiative combined a very wide array of off-line and online actions. The online actions were three-fold. First, there was an e-mailbox called “The government listens to you,” where citizens could send an e-mail with their proposals, opinions, and criticisms regarding the statutory reform. Citizens were answered by the government in 24 hours. This became the most successful medium, with 4,530 e-mails. Second, an online forum where the citizens could discuss the reform was available, and third, there was a mailing list to which the citizens could subscribe in order to receive information about the events, conferences, and workshops about the statute.⁹

In conclusion, we can summarise the state of ICT usage by political actors with the following three statements:

1. Organisations from civil society and the business sector use ICT much more for contacting citizens and customers than political actors and institutions.
2. Parties, parliaments, and executives launch ICT-based initiatives mainly for information and communication, but rarely for consultation, deliberation, or participation in the decision-making process or in binding elections. By contrast, public administrations, and especially city councils, tend to develop ICT-based strategies to engage citizens in public affairs through online channels for consultation, deliberation, or participation.

3. Notwithstanding the latter rule, in a few countries, some parties, parliaments, and government executives also use the Internet for consultation, deliberation, and participation.

EXPLANATIONS OF THE POLITICAL USES OF ICTS: METHODOLOGICAL AND THEORETICAL APPROACHES

In looking for explanations for the different behaviour, the first and second statements cited above lead us to consider the diverse goals, values, and characteristics among political actors. If political parties, parliaments, and governments, in no matter what country, act differently from municipalities and public administrations, it is because they differ in their intrinsic characteristics (i.e., type of organisation), objectives, or values (i.e., models of democracy adopted). Nevertheless, in a few countries, parties, parliaments, and governments go a little further on the ladder of participation, and, therefore, the explanations must lie in the specific characteristics of countries, such as their political institutions or other contextual variables. Consequently, we compare a wide array of factors that may possibly affect ICT usages by the different political actors and in different countries.

Furthermore, an enormous variety of different technologies is combined for achieving the objectives that political actors seek when approaching the public. For instance, a combination of mailing lists, newsgroups, and areas on Web sites with documents available is frequently used for providing information to citizens. Bidirectional communication is usually developed making use of e-mail and chat rooms located on the Web site. Deliberation online is achieved using, in the first place, all the media cited above, and then by developing online forums, conferences, or bulletin boards. There are also other technological elements for consultation, for example, Web-based

forms of various kinds that are used for online petitions, surveys, and nonbinding referenda. Participation in the decision-making process, being the highest degree on the scale, is based on many of the technologies mentioned above that can be combined into different variants (deliberative e-polls, e-citizens' juries, e-citizens' panels, etc.¹⁰) with the objective of reaching a final decision that is binding for public authorities.

Therefore, the dependent variable (ICT usages by different political actors) and the independent variables (explanatory factors) are extremely varied. As regards the explanatory factors and in the case of collective political actors, the literature has concentrated mainly on the institutional factors (types of government, level of decentralisation, single-chamber or two-chamber systems, district magnitude, types of voting lists, etc.), the characteristics of the organisations (party size, ideology, longevity, whether the party is in power or in the opposition, etc.), and a large number of contextual variables (technological diffusion in the country, economic development, population, educational level, level of democratisation, etc.) that can affect ICT usages.

Given this variety, analysts trying to explain differences in behaviour between actors from different countries proceed by following two divergent methodologies. On the one hand, some authors select few cases and few explanatory variables in order to make the analysis more manageable and much more precisely addressed toward the confirmation of a specific hypothesis. Normally, they select cases on the independent variable; that is, cases are chosen for analysis taking into account which values on the independent variable could affect the dependent variable differently. This procedure assures no bias in case selection, but when the values of explanatory variables are very limited and no previous control variables are introduced, inferences will not be sufficiently sound for wide generalisation (King, Keohane, & Verba, 1994). Nevertheless, this kind of analysis can be very important in

the first stages of the study of a new phenomenon because it serves to discover the possible explanatory variables when there is no empirical evidence. For example, following this procedure of selecting a few explanatory variables and few cases (although many observations), authors such as Zittel (2001) and Costafreda (2005) have discovered the significant role of political institutions, such as the type of government (parliamentary vs. presidential system) or some elements of the electoral system (district magnitude and types of voting lists). Notwithstanding the significant assets of this methodology, the fact of having only a few cases and few explanatory variables, usually without controlling spurious or participatory variables, restrains inferences and limits conclusions.

On the other hand, another methodology also used consists of testing various types of explanatory factors in many countries and making numerous observations. This is the methodology followed by research teams like the one led by A. Trechsel (Trechsel et al., 2003) and important authors like Pippa Norris (2001). In these studies, the selection of cases is not intentional but a random selection drawn from a large population (Norris); or, if it is of a manageable size, researchers can select the entire population (Trechsel et al.). This procedure guarantees an unbiased sample of cases and, in this sense, conclusions can be generalised and are more valid than when few cases and few explanatory variables are examined (King et al., 1994). Nevertheless, in my opinion, the flaw of this method is on the side of the explanatory factors because they are analysed one after the other without a hierarchical pattern that could put order and meaning among the numerous possible explanations. The consequence is that, although the same cases are analysed, results between studies are contradictory, and explanatory variables found to be significant in reliable studies

like the ones carried out by Norris or by Zittel (2001) are found to be nonsignificant in Trechsel et al.'s work.¹¹

The absence of an organised pattern of explanations is due to poorly developed theoretical models, in this case, models able to account for the behaviour of collective actors toward new technologies, or in other words, models dealing with political actors' actions while at the same time offering insights into the sociopolitical uses of technology.

In political science and in sociology, there are several approaches and models that aim to explain the behaviour of collective political actors, and which have proven to be very successful. For example, there is the Political Opportunity Structure (POS), which explains that social movements and interest groups achieve their objectives and a power share when the institutions of the political system are accessible, porous, and open to their demands and participation (Kitschelt, 1990; Kriesi, Koopmans, Duyvendak, & Giugni, 1995). Institutional structures promote or deter collective actors from action by means of the incentives and benefits they would provide. The significance of institutions is also acknowledged by New Institutionalism (March & Olsen, 1989), where institutions are no longer passive constraints or a determining factor, but rather play an active role in establishing the preferences and interests of collective actors (Hoff, 2000).

Furthermore, regarding technological usages, some authors (Hoff, 2000; Aibar & Urgell, 2003; Welp, Urgell, & Aibar, 2005) point out that the SCOT (Social Construction of Technology) theory as formulated by Bijker (1995) is currently the most promising theory for studying the interplay between structures (institutions, organisations), culture, and behaviour toward technologies. The social constructivist approach put forward by Bijker states that the group uses of technology are

mediated by structures and culture and, therefore, they must be analysed within this context.

BASIC ELEMENTS AND PRINCIPLES FOR AN EXPLANATORY MODEL

In my opinion, a successful explanatory model would be a combination of the two theoretical approaches mentioned above: the one that recognises the relevance of institutions and the one that highlights that the usages of technology depend on the nature of organisations and the culture where technology is deployed. At this point, we will try to lay the basis for an explanatory model that combines three sets of elements:

1. The political institutions within which the collective actors must play. The research literature pinpoints the district magnitude, the type of voting list, the type of government, and the level of decentralisation.
2. The socioeconomic and technological context characterising the environment where the actors perform, that is, some aggregate characteristics of the country (for example, technological diffusion, socioeconomic development) or of the city or town (town size) where the actors act.
3. The nature of the collective political actors, which refers to their different characteristics in terms of aims, organisation, and values.

Continuing with the theoretical approaches cited above, there is an interplay between the three groups of factors that can be described as follows.

Collective actors make use of ICTs when institutions and context promote and facilitate their use, but always depending on the characteristics of the actors. This means that institutions and context impinge upon the structure of costs and benefits of collective action, but actors' preferences depend

on the objectives, culture, and organisation of the actors. We start from the assumption that collective actors are rational agents that use ICTs if they are useful for achieving their objectives and if there are enough institutional and contextual incentives for fulfilling their objectives better by means of ICTs. In contrast, collective actors will not make use of ICTs if they do not envisage their utility for achieving their objectives, and the surrounding institutions and context do not provide opportunities for meeting the actors' goals using ICTs.

The logic of the behaviour described above can be illustrated well by comparing two different actors that show opposing behaviour regarding the deployment of ICTs, as we have already mentioned in previous pages: political parties and city councils. In most countries, the former make very poor use of ICTs in order to reach out to the public (basically, providing information and establishing one-way channels of communication; Norris, 2001; Trechsel et al., 2003). The latter tend to use ICTs much more, in most countries, for involving citizens in participatory and deliberative processes (Chadwick & May, 2003, pp. 294-295; Clift, 2004; Coleman & Götze, 2001).

Taking into account the findings shown by the literature, we will detail the variables that could be the most influential within each of the three groups of elements for the case of parties and city councils.

Political Institutions

Regarding political institutions, and for the case of parties, the literature points to the district magnitude, the type of voting list (Costafreda, 2005), and the type of government (Zittel, 2001) as the most relevant variables. For local governments, we think that the most important variable could be the level of local decentralisation of the country and the consequential power share, budget, and attributions that city councils enjoy. In addition, legal enforcement and subsidies for

developing ICT channels for participation are proving to be crucial.

If the district magnitude is very small (uninominal or binominal) and the type of voting list is unblocked or open, parties will design ICT media to reach the voters better because candidates depend much more directly on the voters than in the case of proportional systems with large districts and blocked voting lists in which nomination depends on the power struggles inside the party. This is one of the reasons why parties in Chile, the United Kingdom, and Germany design their Web sites not only for informational purposes, but also for communication and deliberation (Costafreda, 2005; Trechsel et al., 2003). The same reasoning could be applied to the type of government. In presidential systems, parties and their presidential candidates have more incentives to launch ICT initiatives in order to contact and convince possible voters than in parliamentary systems in which the election of the head of the government is indirect through the members of the parliament. Also, the fact that a party or a party coalition winning in the elections in parliamentary democracies possesses the power to make and break governments imposes a rigid discipline on parliamentary majorities and on the party itself, and pushes representatives and candidates to concentrate on internal bargaining (Zittel, 2001, p.19). On the contrary, in presidential systems, parties and representatives have much more room to establish a closer relationship with their constituents, followers, and voters (Zittel, 2001, p.20). Zittel defends that this institutional feature is one of the most important explanations for the greater communicative ICT usage by U.S. parties as compared with their European counterparts.

With respect to local governments, the most important variable is the level of decentralisation of the country regarding the local level, as municipalities will tend to deploy ICT-based channels of communication and participation more frequently if they have the sufficient autonomy, legal com-

petences, and financial resources to do so. We consider that not only political decentralisation could achieve power and resources for the city councils, but also deconcentration or functional autonomy, where the central state gives up the management of some important functions and services to the local government. This would be one of the reasons why local governments in the United Kingdom, the Netherlands, and Finland have undertaken so many ICT initiatives for engaging their citizens in local public decisions. In addition, decentralisation is becoming a key political aim of Latin American governments, and new participatory bodies, including different ICTs usages, are being set up at the local level in countries such as Bolivia, Colombia, Brazil, and Venezuela.

Other important conditions for undertaking ICT initiatives are the legal framework and the financial incentives provided by other levels of government. For example, several planning schemes in the United Kingdom and several laws in Spain and Catalonia¹² compel local governments to design participatory plans that include the launching of ICT initiatives. Also, in these countries, higher level governments award subsidies to the city councils that develop participatory projects, including the use of ICTs. This has contributed enormously to the emergence of ICT-based strategies for participation in Catalonia.¹³

Socioeconomic and Technological Context

With reference to the socioeconomic and technological context, the variables commonly studied in the case of political parties (Norris, 2001; Trechsel et al., 2003) are the technological diffusion inside the country, the socioeconomic development, the population size, and the level of democratisation. These variables are characteristics of the country and must be controlled in order to see the real influence of the institutional variables. Trechsel et al. (2003) demonstrated in their study of 25

European countries, the European Union, and 144 party Web sites that economic development (measured by per capita GNP [gross national product]) and population size of the country have no significant correlation with an extensive use by parties of ICTs for communicative or deliberative purposes. Nor does technological diffusion have an impact on developing party Web sites with communication and deliberation channels (Trechsel et al., 2003, p.27). Nevertheless, Norris arrived at different conclusions. Her study encompasses 179 countries and 1,371 party Web sites. She found that the strongest and most significant indicator of the presence of all parties online is technological diffusion, followed by levels of socioeconomic development.¹⁴ Also, after controlling for socioeconomic and technological development, the level of democratisation¹⁵ in a country proved unrelated to the information or communication functions of parties. Therefore, it seems that the opposite conclusions from the two studies could be due to the number and type of cases analysed, and also to the different indicators used for measuring the variables. Norris examines countries from the whole world, while Trechsel's team focused on European countries. Consequently, in Norris' cases, there is much greater variation, which makes socioeconomic and technological development significant for explaining the deployment of ICTs. In addition, the differences in measurement of socioeconomic development (much more complete in Norris) and technological diffusion (much more complete in Trechsel et al.) could have led to different conclusions.

Leaving aside political parties, studies on e-government have shown that a country's GDP (gross domestic product) or per capita income affect positively governmental response via ICTs to citizens' demands for information and services (Altman, 2002; La Porte, Demchak, & de Jong, 2002; United Nations [UN], 2005, pp.117-118). This phenomenon occurs in both OECD and non-OECD countries. Nevertheless, this relationship is

not a perfect correlation because it can be mediated by each country's political institutions and culture, or each actor's aims and intentions. This is the case of Latin American countries, where D. Altman (2002) found that the more citizens are satisfied with democracy and have interpersonal trust, the lower the extent of e-government in each country. He argues that in Latin America, when there is a high satisfaction with the regime and interpersonal trust, politicians do not have enough incentives to promote e-government given the lack of economic resources and materialist perceptions in comparison to well-developed and post-materialist countries.

Regarding local governments, we can hypothesise that the socioeconomic development of the country or the city, and the technological diffusion in the country or city, or even the level of democratisation can affect the development of ICT strategies for communication, deliberation, and participation. Unfortunately, we do not have any information of this kind because the majority of studies on ICT usages by local governments are merely descriptive. Only municipality size has been analysed, although by means of simple cross-tabulations, that is, without considering relationships with other possible explanatory variables. The results show, for example, that in Catalonia, the majority of municipalities with under 20,000 citizens have not already deployed interactive spaces with their citizens on their Web sites, although in the last 2 years, these small municipalities have made a big effort to open up informative Web sites and provide access via broadband (Observatori de la Societat de la Informació [OBSI], 2004). Larger municipalities have more technical and monetary resources for implementing ICT strategies for communication with their citizens and for participation. Yet, management and politics are not so complicated in small local governments and therefore reforms toward participation or communication by means of ICTs could be more affordable and manageable once a minimum population threshold is surpassed

(for example, in Catalonia, the threshold could be situated at 20,000 inhabitants). Also, the lack of resources could be overcome through digital platforms shared by several city councils, as is being done in Catalonia or in Emilia-Romagna (Italy).¹⁶

Characteristics of the Collective Actors

In relation to the characteristics of the collective actors, we considered three variables: actors' objectives, the models or discourses on e-democracy held by the actors, and the type of organisation. These three factors are intertwined since models or discourses on e-democracy depend on actors' aims (Hoff, 2000), and at the same time, the type of organisation could condition those aims (Strom, 1990). Nevertheless, in order to simplify our outline of an explanatory model, we will focus on how objectives, models, and organisation independently affect behaviour toward ICTs.

Objectives

The literature on party behaviour within the rational-choice approach has stated three models of party behaviour based on their objectives or aims: (a) vote seeking, (b) office seeking, and (c) policy seeking (Strom, 1990). These objectives or aims could also be shared by other political actors such as local governments. Therefore, the idea is that parties and local governments will launch different ICT initiatives depending on their objectives. Of course, having one of the objectives does not preclude the others. In addition, we have to take into account that parties' or local governments' aims are featured by institutional and organisational constraints (Strom, 1990). For example, vote-seeking behaviour will be more likely to be found in majority systems (small-district magnitudes, two-party systems, low-fragmentation policies) or when parties are expected to win a large share of the vote (close to 50% in multiparty systems)

where strategic party interaction disappears and voting power leads directly to policy influence and office benefits (Strom, 1990, p. 592). Parties with these goals will develop attractive Web sites in order to "sell" the candidate and party, but will also use party Web sites and candidates' Web sites more extensively for mobilising their followers, engaging new and young voters, and contacting constituents, as is already happening in the United Kingdom and the USA.

We could hypothesise that local governments are more focused on carrying out their policy goals. Yet, they certainly want to stay in office and, therefore, they need to maintain their voters and gain more. Local governments, mostly driven by the aim of achieving votes and renewing incumbency, will not risk engaging in deliberative or participatory experiences based on ICT initiatives as the results of those experiences are uncertain in terms of gaining votes. By contrast, local governments that are mainly policy seekers will tend much more to engage citizens and networks of actors in the policy process (by means of ICTs or others) since involvement of the interested public and organised actors could guarantee an easier implementation of policies (Goss, 2001; Sabel & O'Donnell, 2000). However, just as in the case of parties, the preferences of city councils for one or the other objective depend on the incentives and constraints that local authorities will face in the institutional setting: for example, whether the central state, the regional government, or other institutions provide technical or financial support for developing participatory devices based on ICTs, or whether a legal obligation exists for city councils to deploy informative and participatory channels. As we saw before, these would be some of the incentives and constraints faced by, for example, Catalan or British municipalities.

Models of Democracy and Role of the ICTs

Very closely related to the actor's objectives are different models of democracy in which ICTs

play or could play a role. These models are pursued or assimilated by the political actors, and are showed and expressed in the discourses, strategies, and actions of the actors. Parties or city councils defend or have assimilated, more or less explicitly, different models of democracy and the role of ICTs.

There are several important studies on e-democracy models (Bellamy, 2000; Hagen, 2000; Van Dijk, 2000). These models are necessary to evaluate how ICT developments could transform the political processes and are useful for making sense of the role of ICTs inside the democratic system. They are formed by a combination of different crucial features (norms, values, institutions) that characterise the political system and the use of ICTs. Among the different studies, Bellamy's, with Hoff, Horrocks, and Tops (2000), creation and explanation of the models stands out. The main features of the models are the view on citizenship, the dominant democratic value, the political nexus, the central form of political participation, the main political intermediary, the dominant procedural norm, and the typical ICT application. The models are the consumer, the demo-elitist (or neo-corporatist), the neo-republican, and the cyberdemocratic model (Hoff et al, 2000, p.7.). Applying these models to specific cases, Tops, Horrocks, and Hoff (2000) have determined that parties are closer to the consumer model (representative democracy where the citizen is a customer who has to be well informed and deserves good public services), while local governments defend more often a neo-corporatist (pluralist democracy based on welfare policies) or a neo-republican (participatory democracy based on a strong and autonomous civil society) model of democracy. Nevertheless, the cases studied by Tops et al. are only three countries (Denmark, Great Britain, and The Netherlands) and a few parties and ICT experiences (electronic citizen card, electronic public service delivery, closed-circuit television) taking place in those countries. Therefore, more case studies are needed in order to generalise with respect to the position of the actors.

Type of Organisation

Characteristics of their own organisation affect the behaviour of collective actors. In the case of parties, Strom (1990, p. 593) identifies several organisational properties that influence party behaviour. Among these, we have selected two that may possibly affect the deployment of ICTs by parties: organisational form (capital or labour intensive) and intraparty democracy.

Party organisations are very intensive in capital when they rely on advertising technology, marketing tools, and monetary resources for the electoral campaign, for gathering information about the electorate, or for implementation of party policy. They are also the parties that receive the largest amount of money from private donations. By contrast, labour-intensive parties rely more on activists to develop these functions and they get less money from private donations. Nevertheless, in recent years, even leftist parties are shifting toward greater reliance on capital and technology as it has become a more successful strategy for mobilising supporters and getting votes (Strom, 1990, p. 575). Therefore, we can hypothesise that capital-intensive parties use ICTs widely and Web sites mainly for campaigning, while labour-intensive parties do not use so many ICT resources but frequently include participatory channels on their Web sites. For example, in Spain, analysis of party Web sites shows that capital-intensive parties like the Partido Popular or *Convergència i Unió* have developed highly attractive Web sites from a marketing point of view and have used other technical devices for the campaign, such as mobile phones, videoconferences, instant messaging, and so forth. On the contrary, labour-intensive parties like *Iniciativa per Catalunya* or *Izquierda Unida* have displayed well-constructed interactive spaces and recruitment channels on their Web sites that larger parties have not developed (Borge & Alvaro, 2004).

The same reasoning could be applied to centralised parties vs. decentralised ones. The latter

are internally more democratic and participatory, and therefore ICTs could be used for building deliberative and participatory channels. Decentralised parties transfer decisions on policy and programmes to party conferences, congresses, and committees, and the candidates for office are usually elected by means of primaries. This organisational profile could favour uses of ICTs for participatory and voting purposes. For example, in 1996, the Democratic Party in Arizona held primary elections using three channels: postal mail, the Internet, and ordinary voting. Forty-one percent of the votes were cast by Internet, and the level of participation increased sevenfold (Gibson, 2001).

Moreover, other organisational factors have been studied as possible influences on party usages of ICTs: party size and party ideology (Norris, 2001; Trechsel et al., 2003). Ideological orientation (left-right) does not have an impact on more Internet-based usages (Norris, 2001, p. 170; Trechsel et al., 2003, p.26). Only party size (major-minor) has a significant impact. Yet the difference is very small: Among the 179 countries analysed by Norris (2001, p. 156), about one third of all fringe electoral parties had developed a Web site compared with 47% of minor parties and over one half of all major parties. Trechsel et al (2003, p.26). also found that the difference in ICT introduction between major and minor parties is not important. Both authors believe that whatever political force—major or minor, left or right, incumbent or challenger—when an actor gains some initial advantage by innovating with ICT, in a short time its competitors will catch up. (Norris, 2001, p.170; Trechsel et al.,2003, p.17)

The variables mentioned above are suited specifically for parties, but we think that there is one that can clearly affect ICT usages by city councils: local government size, that means, the resources and staff available. Municipality size has been analysed in previous pages and is closely related to local government size. As we stated before, larger municipalities have more technical

and monetary resources and more personnel for implementing ICT-based strategies for communication and participation. But local politics in a small town could be more manageable and the lack of resources can be overcome through digital platforms and digital know-how shared by several city councils. Therefore, mayors from small or medium-size cities that are also policy seekers could choose and afford the implementation of ICT tools for connecting with the public or for engaging citizens in policy decisions.

CONCLUSION

In the preceding pages we have tried to put some order into an area of research that is changing rapidly and that has been analysed without a systematic explanatory approach: ICT usages by political actors for connecting and engaging the public. Political actors use ICT in a very different manner depending on the type of political actor (we have examined the contrast between parties and city councils) but also on the characteristics of the country. Therefore, taking into account the findings of the literature, which are only parts of the explanatory puzzle, we have developed the basis for an explanatory model of different behaviours.

We consider that collective political actors are intentional and their behaviour is affected by the political institutions and the context in which they act. The basic elements of the model are political institutions such as the type of government, the level of decentralisation, the district magnitude, and the type of voting list; the socioeconomic and technological context; the objectives and models of e-democracy that actors hold; and the type of organisation. Consequently, part of the explanation is rooted in the contextual level and the other pertains to the level of the actors. We consider that this is the necessary combination for understanding the different political behaviours in ICT development.

The background logic is that political actors will use ICTs for achieving their objectives if there are enough institutional incentives and a favourable context for doing so. Some political institutions (district magnitude, type of voting lists, type of government) favour ICT uses for communication and deliberation in the case of parties, but other institutional features (level of decentralization, legal enforcement and subsidies) affect much more municipalities when it comes to developing ICT initiatives for participation and deliberation. Also, there are contextual variables such as the size or dimension that seem to affect municipalities much more than parties. In any case, when institutions and context are controlled and equal, that is, when we compare actors from the same country, some characteristics of collective actors such as actors' objectives (vote seekers or policy seekers) or e-democracy models adopted arise as explanatory.

Specifically, as we have shown, political parties are encouraged to make use of ICT devices if the electoral system is a majoritarian one (especially with small district magnitudes and unblocked and open voting lists) or if the type of government is presidential. Local governments are more affected by the level of decentralization, the financial incentives, and the legal framework. A high level of decentralization and legal and financial measures in favour of participation are crucial for the city councils to use ICTs in participatory strategies. On the other hand, the variables characterising the socioeconomic and technological context have been analysed by several authors and public institutions, and the results are that technological diffusion in the country and socioeconomic development affect the assimilation of ICT media by parties, governments, and public administrations throughout the world. In the case of municipalities, their small size hinders the development of interactive Web sites, though this problem can be solved by creating digital platforms jointly. Regarding the nature and aims of political actors, we arrived at the conclusion that the parties and

local governments that focus mainly on gaining or maintaining votes and that are defenders of a consumer model of e-democracy will not undertake ICT initiatives for deliberation or participation. On the contrary, city councils and parties mainly driven by policy achievement or a demo-elitist or neo-republican model will be more open to developing these techniques. Moreover, organisational properties such as organisational form (capital- or labour-intensive type of party), intraparty democracy, and party or local government dimensions can condition the deployment of ICTs for communicative and participatory purposes. Labour-intensive, decentralized, and internally democratic parties, as well as medium or large city councils will tend to develop these communication and participation techniques more than capital-intensive, centralised parties or small city councils.

In conclusion, professionals, officials, and politicians willing to deploy ICT tools for approaching the public must bear in mind the constraints and circumstances that they will face. In addition, they must be explicitly aware of their objectives and values in relation to the role of citizens in the political process. Therefore, the set of variables related throughout the chapter must be taken into account.

We leave for future research the building of a more defined and complete theoretical construct of explanations that can be applied to other political actors apart from parties and local governments. In fact, we have not fully specified the relationships between the explanatory variables and the implications of the conditions established, but we have outlined the crucial principles and elements that should structure an explanatory model of ICT usages by political actors.

ACKNOWLEDGMENT

I greatly appreciate the comments and revisions made by Ana Sofía Cardenal, Yanina Welp, and

Joseph Hopkins from the Open University of Catalonia; Josep María Reniu from the University of Barcelona; plus those made by several anonymous reviewers.

REFERENCES

Accenture. (2005). *Leadership in customer service: New expectations, new experiences*. Retrieved December 29, 2005, from http://www.accenture.com/Global/Research_and_Insights/By_Industry/Government/LeadershipExperiences.htm

Aibar, E., & Urgell, F. (2003). *La provisión de servicios en línea en el e-gobierno: Un estudio de caso sobre un proyecto de ventanilla única interadministrativa*. Paper presented at the Sixth Congress of the AECPA, Barcelona, Spain.

Altman, D. (2002). Prospects for e-government in Latin America: Satisfaction with democracy, social accountability, and direct democracy. *International Review of Public Administration*, 7(2), 5-20.

Arnstein, S. (1969). A ladder of citizen participation. *Journal of the American Institute of Planners*, 1, 216-224.

Bellamy, C. (2000). Modelling electronic democracy: Towards democratic discourses for an information age. In J. Hoff, I. Horrocks, & P. Tops (Eds.), *Democratic governance and new technology* (pp. 33-53). London: Routledge.

Bijker, W. E. (1995). *Of bicycles, bakelites and bulbs: Towards a theory of sociotechnical change*. Cambridge, MA: The MIT Press.

Borge, R. (2005). La participación electrónica: Estado de la cuestión y aproximación a su clasificación. *IDP Revista de Internet, Derecho y Política*, 1. Retrieved December 20, 2005, from <http://www.uoc.edu/idp/1/dt/esp/borge.pdf>

Borge, R., & Alvaro, A. (2004, February). *Partidos políticos e Internet en España: ¿Herramienta de democratización o arma electoral?* Paper presented at the Sixth Basque Congress of Sociology, Bilbao, Spain.

Brugué, J. (2005, September). *Participación y nuevo estatuto de autonomía para catalunya*. Paper presented at the Seventh Congress of the AECPA, Madrid, Spain.

Chadwick, A., & May, C. (2003). Interaction between states and citizens in the age of the Internet: "e-Government" in the United States, Britain, and the European Union. *Governance: An International Journal of Policy, Administration, and Institutions*, 16(2), 271-300.

Clift, S. (2004). *E-government and democracy: Representation and citizen engagement in the information age*. Retrieved December 29, 2005, from <http://www.publicus.net/articles/cliftegov-democracy.pdf>

Coleman, S., & Götze, J. (2001). *Bowling together: Online public engagement in policy deliberation*. London: Hansard Society & BT. Retrieved December 20, 2005, from <http://bowlingtogether.net/about.html>

Coleman, S., Taylor, J., & van de Donk, W. (1999). *Parliament in the age of the Internet*. Oxford, United Kingdom: Oxford University Press.

Contini, F., & Fabri, M. (Eds.). (2001). *Justice and technology in Europe: How ICT is changing the judicial business*. Amsterdam: Kluwer.

Costafreda, A. (2005). *Determinismo institucional versus determinismo tecnológico: TICs y representación política en Chile y España*. Unpublished doctoral dissertation, Institut de Ciències Polítiques i Socials, Barcelona, Spain.

Dalton, R. J., & Watenberg, M. P. (Eds.). (2000). *Parties wPartisans: Political change in advanced industrial democracies*. New York: Oxford University Press.

- Espuelas, J. M. (2005). Avaluació del funcionament del Web del nou estatut. *Papers sobre Democràcia Electrònica*, 43. Retrieved December 20, 2005, from <http://www.democraciaweb.org/informeestatut.pdf>
- Gibson, R. (2001). Elections online: Assessing Internet voting in light of the Arizona democratic primary. *Political Science Quarterly*, 116(4), 561-583.
- Goss, S. (1999). *Managing working with the public in local government*. London: Kogan Page.
- Goss, S. (2001). *Making local governance work: Networks, relationship and the management of change*. Houndmills: Palgrave MacMillan.
- Hagen, M. (2000). Digital democracy and political systems. In K. L. Hacker & J. Van Dijk (Eds.), *Digital democracy* (pp. 54-69). London: Sage.
- Hoff, J. (2000). Technology and social change: The path between technological determinism, social constructivism and new institutionalism. In J. Hoff, I. Horrocks, & P. Tops (Eds.), *Democratic governance and new technology* (pp. 13-32). New York: Routledge.
- Hoff, J., Horrocks, I., & Tops, P. (2000). Introduction: New technology and the crises of democracy. In J. Hoff, I. Horrocks, & P. Tops (Eds.), *Democratic governance and new technology* (pp. 1-10). New York: Routledge.
- Kaase, M., & Newton, K. (1995). *Beliefs in government* (Vol. 5). New York: Oxford University Press.
- King, G., Keohane, R. O., & Verba, S. (1994). *Designing social inquiry: Scientific inference in qualitative research*. Princeton: Princeton University Press.
- Kippen, G., & Jenkins, G. (2004). The challenge of e-democracy for political parties. In P. M. Shane (Ed.), *Democracy online*. (pp.253-265). New York: Routledge.
- Kitschelt, H. (1990). New social movements and the decline of party organization. In R. J. Dalton & M. Kuechler (Eds.), *Challenging the political order: New social and political movements in Western democracies*. (pp. 179-208) London: Polity Press.
- Kriesi, H., Koopmans, R., Duyvendak, J. W., & Giugni, M. G. (1995). *New social movements in Western Europe: A comparative analysis*. London: UCL Press.
- La Porte, T. M., Demchak, C. C., & de Jong, M. (2002). Democracy and bureaucracy in the age of the Web: Empirical findings and theoretical speculations. *Administration & Society*, 34(4), 411-446.
- March, J., & Olsen, J. (1989). *Rediscovering institutions: The organizational basis of politics*. New York: Free Press.
- Navarro, M. (in press). Defining and measuring e-democracy: A case study on Latin American local governments. In M. Gascó (Ed.), *Latin America online: Cases, successes and pitfalls*. Hershey, PA: IDEA Publishing Group.
- Norris, P. (2001). *Digital divide: Civic engagement, information poverty and the Internet worldwide*. Cambridge, United Kingdom: Cambridge University Press.
- Observatori de la Societat de la Informació (OBSI). (2004). *Enquesta sobre l'adopció de les tecnologies de la informació i la comunicació a l'administració local de catalunya*. Retrieved September 20, 2006, from http://www10.gencat.net/dursi/pdf/si/observatori/Informe_TIC_ajuntaments_2003.pdf
- Organization for Economic Cooperation and Development (OECD). (2001). *Citizens as partners: Information, consultation and public participation in policy-making*. Paris: PUMA, Author.
- Prats, J. O. (2006). Nuevas tecnologías, democracia y eficacia de las instituciones políticas. *Papers*, 78, 151-168.

Putnam, R., Leonardi, R., & Nanetti, R. Y. (1994). *Making democracy work: Civic traditions in modern Italy*. Princeton: Princeton University Press.

Sabel, C. F., & O'Donnell, R. (2000). *Democratic experimentalism: What to do about wicked problems after Whitehall*. Paper presented at the OECD Conference on Devolution and Globalisation, Glasgow, Scotland. Retrieved September 20, 2006, from <http://www2.law.columbia.edu/sabel/papers/glasPO.html>

Strom, K. (1990). A behavioral theory of competitive political parties. *American Journal of Political Science*, 34(2), 565-598.

Tops, J., Harrocks, I., & Hoff, P. (2000). New technology and democratic renewal. In J. Hoff, I. Harrocks, & P. Tops (Eds.), *Democratic governance and new technology* (pp. 173-184). New York: Routledge.

Trechsel, A. H., Kies, R., Mendez, F., & Schmitter, P. C. (2003). *Evaluation of the use of new technologies in order to facilitate democracy in Europe* (Scientific and Technological Options Assessment Series, 116 EN Working Paper No. 10). Retrieved September 20, 2006, from http://c2d.unige.ch/int/OverviewInstits/Main_Report_final%201.pdf

United Nations (UN). (2005). *UN global e-government readiness report 2005: From e-government to e-inclusion* (UNPAN 2005/14). New York: Author. Retrieved September 20, 2006, from <http://unpan1.un.org/intradoc/groups/public/documents/un/unpan021888.pdf>

Van Dijk, J. (2000). Models of democracy and concepts of communication. In K. L. Hacker & J. Van Dijk (Eds.), *Digital democracy* (pp. 30-53). London: Sage.

Welp, Y., Urgell, F., & Aibar, E. (2005, September). *La e-gobernanza: Propuesta para el análisis*. Paper presented at the Seventh AECPA Congress, Madrid, Spain.

Wong, W., & Welch, E. (2004). Does e-government promote accountability? A comparative analysis of Websites openness and government accountability. *Governance: An International Journal of Policy, Administration, and Institutions*, 17(2), 275-297.

Zittel, T. (2001, April). *Electronic democracy and electronic parliaments*. Paper presented at the Joint Sessions of Workshops of the ECPR, Grenoble, France.

ENDNOTES

¹ Contrary to what is occurring much more frequently in Europe, an analysis of 17 Latin American municipalities carried out by M. Navarro (in press) shows that these local governments have only deployed online channels for information.

² Most public administrations have undergone three phases in the process of ICT assimilation: first, introduction of ICTs only for administrative routines and for facilitating internal communication and management; second, attempts to digitalise all the internal processes and to provide online all the information and services to the citizens; and third, the change of focus onto the demand side (the citizens' needs and interests) and toward digitalisation only if added value is achieved (Accenture, 2005; Chadwick & May, 2003; Contini & Fabri, 2001; Welp, Urgell, & Aibar, 2005).

³ Literature on explanations about different political uses of ICTs will be analysed in the following pages.

⁴ Since the 1970s, many indicators have shown that there is a certain degree of crisis in the representative democratic system, such as, the growing distrust toward main political institutions, politicians, and parties; the drop in membership of political parties and trade

- unions; the fall in electoral participation; the increased disaffection for political issues; and the steady rise of nonconventional participation (Dalton & Watenberg, 2000; Kaase & Newton, 1995; Putnam et al., 1994).
- ⁵ Most of them are case studies (Chadwick & May, 2003; Coleman, Taylor, & van de Donk, 1999; Costafreda, 2005; Hoff, Horrocks, & Tops, 2000; Zittel, 2001), although there are also comparative analyses of countries (Altman, 2002; La Porte, Demchak, & de Jong, 2002; Norris, 2001; Trechsel et al., 2003; Wong & Welch, 2004).
- ⁶ Examples of open parliaments are the Scottish (<http://www.scottish.parliament.uk>), the Catalan (<http://www.parlament-cat.net> and <http://www.democraciaweb.org>), and the Basque (<http://www.parlamento.euskadi.net>) Parliaments. The British Parliament (<http://www.parliament.uk>) cannot be considered an open parliament since it does not allow citizens' participation every time there is a law project or other parliamentary initiatives, but it provides the e-mail addresses, Web sites, and blogs of members of parliament so citizens can contact them and participate in the channels established by each of them.
- ⁷ Today, the official site of Howard Dean, called "Democracy for America" (<http://www.democracyforamerica.com>), is dedicated to recruiting, promoting, and funding progressive candidates at all levels of government and to keeping alive the network of people that was set up for the campaign for the 2004 nomination. In that sense, local meetings are still organised through the Meetup.com.
- ⁸ The first initiative of this kind was the Web site "Have Your Say," in which citizens were encouraged to inform themselves and discuss about the government's Freedom of Information White Paper (<http://www.foi.democracy.org.uk/html/about.html>).
- Nowadays, the UK government has opened a consultation line for specific policies and laws through its own Web site <http://www.direct.gov.uk/D11/Directories/PublicConsultations/fs/en>.
- ⁹ This participatory process is already closed, but two large reports on that experience are located on the Web site of the Catalan government: <http://www16.gencat.net/idi-gol/cat/documents.htm>. In addition, more analysis about the results of this experience can be found in Espuelas (2005) and Brugué (2005).
- ¹⁰ For a good description of different technologies and methods for online communication, deliberation and participation see Coleman & Götze (2001) and Clift (2004).
- ¹¹ For example, in Trechsel et al. (2003), the different types of government (presidential vs. parliamentary systems) does not have any effect on the online presence of legislatures in 35 European countries. However, as we stated before, Zittel (2001), following the most different-case approach, which included three countries, found that the legislatures in the presidential system use Internet technology more for communication purposes in contrast with the much more passive and unidirectional uses of the parliamentary systems.
- ¹² In 2003, a new law was passed in Spain to modernize the local government (Law 57/2003). That law requires local governments to deploy channels and mechanisms for favouring the citizens' participation in local affairs.
- ¹³ In 2005, the Catalan government enacted, for the first time, an order for providing financial aid to local plans to increase public participation and for the development of ICT-based initiatives for consultation and participation at the local level (ORDRE REP/119/2005).
- ¹⁴ Technological diffusion is measured by the

An Explanatory Approach to the Political Uses of ICT Initiatives for Participation

proportion of the population online and socioeconomic development is measured by the Human Development Index from the United Nations Development Program (Norris, 2001, p.166).

¹⁵ The level of democratisation refers to the indicator of Political Rights and Civil Liberties figured out by the Freedom House Annual Survey (Norris, 2001, p.166).

¹⁶ These digital platforms for electronic communication and participation can be consulted at <http://www.e-consensus.org/consensus> and <http://www.regionedigitale.net>. More information about the Catalan platform and the specific experiences carried out are available at Borge (2005).

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, and M. Acevedo-Ruiz, pp. 293-312, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.5

B2B E-Commerce Diffusion: The Efficacy of Institutional Discourse

Kim Virborg Andersen

Copenhagen Business School, Denmark

Helle Zinner Henriksen

Copenhagen Business School, Denmark

ABSTRACT

The chapter explores the role of institutional discourse on B2B e-commerce diffusion. Using the case of EDI in the Danish business environment, the analysis demonstrates a lack of active industry involvement and severe implications of the absence of large users in the policy forum for the national EDI-strategy. Government branches and business associations formulated by and large the visions and strategies without direct involvement of the successful EDI-players or companies that were the intended adopters. As a possible consequence, the EDI diffusion has evolved by the same companies exchanging still more messages and type of documents whereas the number of new companies adopting EDI has been fairly limited. The policy implications of the Danish EDI-case could be to have a more focused involvement of intended adopters of similar and future technologies that has high policy saliency.

INTRODUCTION

During the last decades, governments and business associations throughout the world have recognized the significance of information and communication technologies (ICTs) for businesses and public administration. The result has been institutional initiatives aiming to support diffusion of ICT among businesses and public agencies (e.g., Teo, Tan, & Wei, 1997; Klein, 1995; Damsgaard & Lyytinen, 2001). The Singapore NII initiatives (Neo, King et al., 1995; Wong, 1996), the Malaysian Information Rich Society plan (Raman & Yap, 1996), the Japanese Super Information Highway, the Al Gore Information Highway, and the European Information Society policy documents (Commission, 2001; Brousseau, 2002) are some recent examples of governmental interest in ICTs. B2B e-commerce has been an important part of the policy plans and has been given a high degree of policy saliency with various institutional initiatives to fuel development and uptake.

The objective of this chapter is to focus on institutional initiatives used to promote diffusion of EDI in the Danish business community. EDI is the ICT application presented in this chapter. We view EDI as a technology construct rather than as a business imperative (Markus & Robey, 1988; Sampler, 1996). A particular action plan that focused on diffusion of EDI in the Danish business community and the public sector (Ministry of Research and Information Technology, 1996a) is assessed by comparing actual uptake of EDI to the underlying discourse, which originally drove the action plan. It is our claim that an analysis of the content of the EDI agenda and its underlying discourse will be of value to governments, especially due to the continuous use of action plans for regulating diffusion of a given technology. In the context researched in this chapter, there are three reasons for paying particular interest to the analysis of the discourse embedded in the EDI agenda.

First, the Danish context is significant because *relations between market and government are unique* compared to other nations where market forces play a much more critical role. The Danish practice of ICT adoption and exploitation is stimulated by early coordination and commitment from both government and business associations to help fuel adoption and exploitation of ICT as a competitive instrument (Andersen, Bjørn-Andersen, & Dedrick, 2003a) in line with the Porter (2001) terminology. The case presented in this chapter also reveals the reverse side of a close interplay between government and industry. Following this approach, we are not only facing the challenge of getting the important domestic players on board; the global industry players and their (proprietary) standardization work are equally challenging.

Second, the Danish case is of interest since *the role of ICT in governmental units' own operations has been just as important as using ICT to gain competitive advantage*. The urgency of government to ensure accessibility, transparency,

efficiency, and accountability in its operations has pushed the use of ICTs. Although we find similar motives in other countries, the Danish governmental sector is unique due to its employment of one-third of the total labor force and its reallocation of 70% of the GDP. To reduce the burden of administrative costs in the public sector, the motivation to use ICT in its communication with the private sector has been very strong.

Third, an *early acknowledgment of digital divide issues* (Dybkjær & Christensen, 1994; Bjørn-Andersen, Earl, Holst, & Mumford, 1982) and policy commitments to address the issues, also in the business community, form the third interesting aspect of the Danish approach to regulation of B2B e-commerce. It has been a deliberate policy decision to target micro and small businesses based on an economic growth model where *demand pressure tends to come from the SMEs rather than the MNCs* (Andersen et al., 2003a).

In the following we summarize the major ICT research perspectives and the significance of institutional regulation of diffusion of ICT, we present a framework for analysis of the Danish EDI Action Plan, and we define the central elements presented in the chapter. The next section focuses on the policy context, which fueled the EDI Action Plan. After describing the seven key elements in the Danish EDI Action Plan, we evaluate the outcome of the plan in the respective business sectors. The chapter concludes by discussing the implications of the substantive findings from the institutional regulation attempts on EDI.

FRAMEWORK AND DEFINITIONS

The literature on institutional regulation related to ICT diffusion reveals a discrepancy in relation to the effects of coordinated efforts made by industry and trade associations and governmental units. This discrepancy is reflected in the body of literature focusing on institutional (especially

governmental units) interventions (Lai & Guynes, 1997). Changes in the remote environment (e.g., regulation) and industry structures (Gregor & Johnston, 2001) are viewed as the most powerful causes for ICT adoption (King et al., 1994). Findings from this line of research indicate that deliberate institutional interventions or decisions to refrain from interventions play a vital role in technology diffusion. This position has been challenged by Johnston and Gregor (2000) who argue that "... deliberative coordinated action by an industry as a whole, or units purporting to represent such a group position, may be severely limited in effectiveness." The objective of this chapter is to analyze the nature of the type of deliberate coordinated action. Johnston and Gregor (2000) refer to.

To analyze the action plans with respect to EDI diffusion, we make use of a two-by-two matrix (see Table 3) representing institutional involvement (low-high) and degree of EDI diffusion (low-high) in an attempt to categorize data on diffusion from different business sectors and public sector agencies. The intention is not to provide data on businesses or public sector agencies that have adopted EDI or to assess companies' use of EDI, but rather to illustrate the relative priorities with respect to EDI adoption in different business sectors and public sector agencies.

The categories in Table 3 indicate how a group of potential adopters engaged themselves in institutional efforts initiated by the partners involved in the national action plan for EDI. Institutional involvement is here defined as the decisions and non-decisions (Bachrach & Baratz, 1963) taken by governmental units, ministries, and business and trade associations to influence the content of the EDI Action Plan agenda (Laswell, 1936). In our view, the EDI Action Plan is primarily a pedagogical intervention rather than an economic incentive or normative action (Eckhoff, 1983; Henriksen, 2002). We also regard the EDI Action Plan as a discursive forum and leveler rather than as actions per se (Habermas, 1986).

THE POLICY CONTEXT

At the European Community scene, IT became a major part of the 5th IST Framework with an outset in the Bangeman report (1996) and the Key Action II program line on e-commerce within the Information Society Technology program. A very visible indication of the European policy commitment to fuel e-commerce diffusion was the creation of a new Directorate Generale (DG), namely the DG Information Society (DGXIII). A key priority for the EU with respect to EDI policies in the mid- to late 1990s was to push the UN/EDIFACT standard. Other key priorities were diffusion of ICT, primarily to SMEs, by forming networks of excellence and uptake measures. In particular, the 5th Framework for R&D activities in the EU had the rapid uptake of EDI among SMEs as a cornerstone. During the late 1990s, the challenge for the EU with respect to e-commerce policies was to instigate the IST policies to help push the e-commerce uptake. Yet, facing global competition (primarily from the U.S.) with the prospect of undercutting European competition and thereby losing jobs in the EU, diminished the eagerness to use information technology to open global market competition. Thus, the strong emphasis on European technologies and projects that had an internal EU focus appear to present a policy flavor rather than programs that increase international presence within Europe. EDI and in particular EDIFACT seemed in line with these motives.

At the Danish political scene, owing to a change of government in 1992 from a right-wing to a center-left-wing government, the small Social Liberal Party (Radikale Venstre) came into power as parliamentary support to the Social Democratic Party. The Social Liberal Party played a major role in promoting research and IT policy (see, for example, Dybkjær & Christensen, 1994). An EDI Action Plan was launched in Denmark at a time when there were strong environmental demand drivers for standards (Andersen et al., 2003a).

Apparently, it played a crucial role that the newly appointed Minister of Research and IT, Mr. Frank Jensen from the Social Democratic Party, felt an urgent need to position his ministry. Mr. Jensen was regarded as the crown prince within the Social Democratic Party. It was important for him to demonstrate results that would merit a move to more prestigious policy fields and enable a rapid political career. He launched a strong push towards deregulation of the telecommunication sector, and tried to ensure that all business sectors and micro-companies would be provided with opportunities to enter the Information Society. Other central policies advanced by the Ministry of Research and IT in the mid-1990s included standardization and dissemination of e-commerce to SMEs.

Building consistent agendas was difficult throughout the 1990s in part because IT issues were relatively new on the Danish political scene and also since none of the ministers for IT and research held their office for more than two years. The IT ministers during the mid- to late 1990s already had an active political career, or they were not viewed as key persons in the Social Democratic Party, nor using the position as minister for the IT field as a platform for improving their political position.

DANISH MODEL FOR E-COMMERCE DIFFUSION

The forerunners of the EDI Action Plan from 1996 were two policy statements published by the government and prepared for the Danish Parliament. The first statement, "From Vision to Action—Info-Society 2000" (Ministry of Research and Information Technology, 1995) was used as a lever to create awareness of the information revolution's significance. It was stated that the movement towards the Information Society was a public movement affecting everybody. Similar to initiatives in Italy (Kumar, Dissel, & Bielli,

1998) and Hong Kong (Damsgaard & Lyytinen, 1998), the strategy for the EDI Action Plan should be based on a Danish model, ensuring that market forces should not be the only factor determining this development. Although the statement primarily focused on building a strong infrastructure, it also stressed the public sector's obligations to engage in the movement. However, the role of Danish companies was by no means underestimated. It was acknowledged that the opportunities created by the Information Society would be a great challenge to Danish companies. The policy statement pointed out:

Danish companies must not only effectively introduce new technology for rationalization purposes, it certainly also means that they must be able to transform new technology into new products to respond to special customer requirements.

It was suggested that if companies adopted EDI, it "would result in considerable rationalization gains and a closer interplay between organizations." However, there were no specific directives showing how to achieve the rationalization gains and a closer interplay between organizations. It was announced that the Ministry of Research and IT, the Ministry of Business and Industry, the Danish EDI Council, and the relevant industry and trade associations were about to launch a campaign to further the use of EDI and e-mail in businesses and public administration. However, it was decided to publish another political IT statement before launching the EDI Action Plan.

The next political IT statement, published in 1996, was named "The Info-Society for All—The Danish Model" (Ministry of Information Technology and Research, 1996c). The statement announced:

...this new technology presents a number of opportunities and problems, which demand political consideration and action. A cohesive, aggressive strategy for how we wish to form developments in Denmark is necessary.

Included in the potent strategy was the EDI Action Plan. The 1996-policy statement stated:

The importance of a fast, effective, and consistent implementation of, e.g., EDI could hardly be overestimated.

First and foremost, it argued that technological landmarks such as EDI would give Denmark an international lead, improving efficiency of working procedures and the development of new products and production processes.

The EDI Action Plan aimed at providing the necessary conditions for companies and the public sector to reap the gains enabled by EDI. The authors of the EDI Action Plan acknowledged that the growing globalization of commerce made it essential for Denmark to follow the trend of doing business electronically across borders. The parties involved in the EDI Action Plan agreed that EDI as such was not a novelty. However, the diffusion of IT in the Danish society and the decrease in software and hardware prices were likely to create a fertile environment for diffusion of EDI. It was recognized that most Danish companies had a sufficient level of experience and know-how of IT to implement EDI. When the EDI Action Plan was launched in 1996, 50% of the Danish companies in the industry segment exchanged data via telephone or network technologies. Especially exchange of electronic messages to financial institutions had a high diffusion rate among Danish companies (Hørluck, 1996). The relatively new Internet had already been adopted by one out of five companies, and it was reported that 30% of all businesses planned to adopt the Internet in the near future (Ministry of Information Technology and Research, 1996b).

Thus, the time appeared to be ripe for a coordinated effort to spread electronic communications from a few sectors to all sectors in industry and trade. Based on this broad agenda, the EDI Action Plan was launched to the business community and the public sector. The foreword to the EDI Action Plan stated:

The plan is to provide dynamism and accelerate growth. This will be achieved through the public sector joining forces with a large number of commercial organizations to create joint solutions. By this approach, we will avoid a situation in which everyone waits for everyone else, or in which the approaches chosen are not coherent.

To create the necessary dynamics and consistency, seven initiatives were formulated. The initiatives aimed primarily at supporting the diffusion of EDIFACT-based transactions between private companies and the public sector. There were high expectations to the public sector's capacity in relation to development and implementation. It was clear that the public sector had to take the lead and show a best practice. By the time the EDI Action Plan was formulated, EDIFACT was considered the dominant standard framework for safe interchange of data between computers in different companies. Although some of the international companies used ANSI X.12 as well, the battle on standardization was more concerned with proprietary standards versus EDIFACT than with discussing EDIFACT versus other standards. The policy consensus was that the development of EDIFACT standards would facilitate B2B e-commerce diffusion.

The EDI-agenda had three major objectives:

- End-to-end integration of data from business-to-business, thus eliminating costly reformatting of data and speeding up business cycle times.
- Long-term focus on the use of standards such as EDIFACT within organizations to provide them with security in operations within an increasingly inter-organizational business environment.
- The use of VANS initially to achieve a more "open" data exchange, and format and transport media allowing greater flexibility of choice, costs, and value-addition for large and small organizations.

There was a general process of negotiation between the participants involved in the formulation of the EDI Action Plan, with the goal of strengthening the application of e-commerce in a B2B relationship. The target was to establish technical, organizational, and educational facilities for EDIFACT-based communication in all business sectors, including the financial sector and the public sector’s exchange of data with private companies before the end of 1998. The aim was to propagate the application of EDIFACT-based communication within all relevant areas by the year 2000 (Ministry of Research and Information Technology, 1996a).

In the introduction to the EDI Action Plan, it was acknowledged that the project was ambitious and would require involvement from several business sectors and institutions. The timeframe for the adoption and implementation of EDI was short. It was expected that the use of EDIFACT-

based communication could be tested and diffused among all relevant sectors by the year 2000. As initiatives one to four in Table 1 show, it was expected that EDI could be implemented by 1998. The means to meet this end included awareness campaigns arranged by the Danish EDI Council. Another approach dealt with making the necessary arrangements to execute public procurement via EDI. However, it was the adopters that carried the main responsibility for acting according to the recommendations in the EDI Action Plan. This strategy was in accordance with the IT policy statement from 1996 entitled, “The Info Society for All—The Danish Model,” which stated:

One decisive feature of ‘the Danish model’ is that without grandiose plans, but precisely through dialogue and effective action, we are in a position to implement the necessary infrastructure quickly and to remove the barriers to it.

Table 1. Content of the EDI Action Plan from 1996 (Source: Adapted from Ministry of Research and Information Technology (1996))

| Initiative | Policy consensus |
|---|---|
| 1. Establishment of EDI standards in all sectors | No later than 1998, the EDIFACT standard must be established in all industries and sectors, for all commercial documents of significance, such as orders, invoices, payment messages, transport notes and registration of real property. The goal is to ensure the availability of a vital prerequisite for companies’ options to participate in the electronic marketplace within trade, manufacturing, transport, finance, etc. |
| 2. EDI for public procurement contracts | Through forthcoming EU framework agreements, the public sector will include its suppliers’ ability to participate in fully electronically-based document interchange as an integral part of its tendering conditions, no later than 1998. |
| 3. Handling EDI in public-sector financial systems | By the end of 1998, public-sector financial systems will be able to handle all relevant commercial documents in EDIFACT format. |
| 4. EDIFACT-based interchange of administrative information with the public sector | In order to ease the administrative burden on companies, the opportunity must be created before the end of 1998 for companies operating in areas in which serviceable standards exist to undertake EDIFACT-based electronic reporting to the public sector. And initiatives will be aimed at areas in which there is a need for new standards. |
| 5. Development of EDI software | A number of initiatives are being aimed at software developers. These initiatives are intended to promote the development of a range of EDI software products destined for the market. The price and functionality of these products must satisfy the needs of all types of companies, regardless of an individual company’s level of ambition concerning the use of EDI. |
| 6. Legislation on digital signatures and electronic documents | New legislation on digital signatures will prepare the way for ensuring that the use of electronic communications is just as secure and clear-cut as the use of conventional communication on paper. |
| 7. Danish EDI Council as initiator and coordinator | The Danish EDI Council will assume a central initiating and cross-sectorial role in the implementation of the action plan. |

This attitude can historically be linked to the long and successful tradition of establishing cooperative dairies and abattoirs in the 19th century. The cooperative movement led to a social and economic lift for a large number of small and often impoverished farmers. The establishment of cooperative dairies and abattoirs improved the quality and quantity of the production benefiting the export of agricultural products to, e.g., Great Britain, which at that time was engaged in industrialization. From a political point of view, the cooperative movement is seen as an important factor in the development of parliamentary democracy. The parallel to the cooperative movement clearly reflected the expectations to the industry and trade associations and individual organizations.

Although the individual initiatives had to be carried out by the industry and trade associations in concert with individual organizations' action plans, the EDI Council was appointed as a coordinating unit. The ministries involved provided limited financial resources. The two ministries granted DKK 24.6 millions (about US\$3.5 million). DKK 18 million (about US\$2.7 million) were earmarked for the EDI Council's information initiatives and DKK 6.6 million (about US\$0.8 million) were made available to projects dealing with standardization issues. The EDI Council would administer the funds.

But although the EDI Council was appointed to monitor implementation of the EDI Action Plan, it had no fiscal authority in relation to the private or public sector. The active role played by the EDI Council mainly resulted in support of several projects and provision of information and publications on EDI to the business community. In their efforts to propagate information about EDI in the business community, the EDI Council presented a definition of EDI to support a shared understanding of the term:

The term EDI is defined as the exchange of structured, electronic messages. This exchange is conducted with a minimum of human interac-

tion. A requirement for defining an electronic exchange as EDI is that messages are exchanged in a standard agreed upon in advance. The format may be an individual proprietary standard or an international standard, e.g., EDIFACT.

The definition includes the elements outlined in the contemporary definitions used in academia by Hansen and Hill (1989) and Pfeiffer (1992). In this context, it is very interesting that the Danish business and administration environment was exposed to this definition. Compared to the EDI Action Plan, the EDI Council broadened the definition by including proprietary standards. The EDI Action Plan on the other hand favored the EDIFACT standard and encouraged organizations to adopt this standard.

The two IT policy statements focused on building a telecommunication infrastructure to support the Internet, and to gain the benefits and opportunities embedded in this means of transportation of information. The EDI Council's definition of EDI solely outlines the electronic exchange of messages connected to EDI, whereas the means of transportation was considered less relevant. In a similar manner, the degree of organizational integration is subject to individual interpretation, mentioning a minimum of human interaction as the ultimate goal.

THE OFFICIAL ASSESSMENT OF THE EDI ACTION PLAN

In 1998 the EDI Council evaluated the outcome of the EDI Action Plan. It was acknowledged that although a number of initiatives had been implemented within different sectors, including development of low-cost EDI software, the diffusion of EDI had failed to progress at the pace expected in the EDI Action Plan. The first initiative, establishing EDI standards, was based on information obtained from the business associations. The initiative was close to

implementation in sectors related to mortgage, shipping, and insurance. However, sectors such as industry and trade progressed at a slower pace and the EDI Council expected that the objective of standardization would be fulfilled by 1999. The EDI Council realized that especially SMEs had not implemented EDI as much as expected. In relation to standardization issues, the EDI Council realized that the XML (eXtended Markup Language) standard presented a promising alternative to EDIFACT. It was also suggested that the Internet might be an attractive means of transportation of EDI messages in terms of cost and simplicity. According to an assessment made by the EDI Council, the fifth initiative in the EDI Action Plan, development of EDI-software, had had a slow start. One major problem from the beginning was the failure to consider the different needs of the participating organizations. For instance development of EDI-software had failed to consider price and functionality in relation to individual organizations' needs and levels of ambition for EDI usage. However, remedial action had been taken by the business associations initiating a number of pilot projects.

In the overall evaluation document of the EDI Action Plan prepared by the EDI Council, it was concluded that the EDI Action Plan had been a success. One of the reasons for its success was the wide support it had elicited from the business associations. According to the managing director of the EDI Council, the criterion for success was to provide business and administration with the

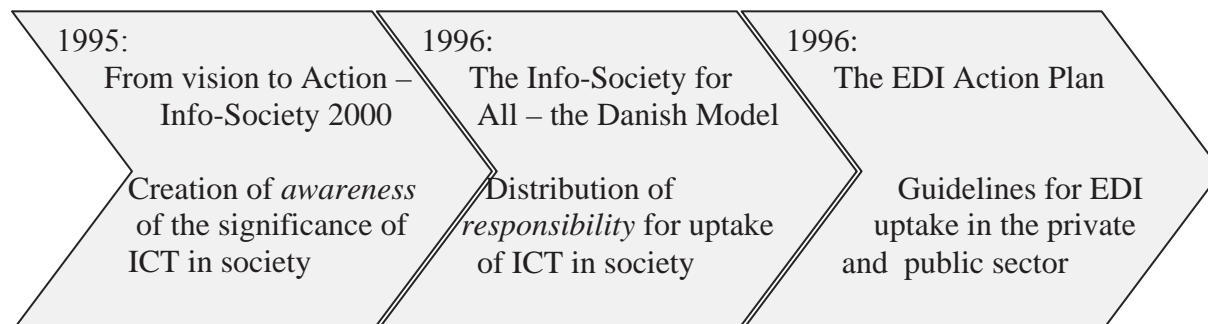
necessary opportunities and tools for EDI application. Thus, the objective was to create the opportunities to use EDI rather than to convince as many organizations as possible to adopt EDI.

EDI IN THE DANISH BUSINESS ENVIRONMENT

From the mid-1990s, when the issue of EDI adoption caught attention due to awareness campaigns launched by governmental units and professional business associations, and due to the launch of the EDI Action Plan, the national statistical bureau has made yearly surveys of the usage of EDI. Over time data from the surveys suggest that the usage of EDI has decreased. However, this downtrend is not supported by contemporary research conducted in academia.

Although there appears to be a decrease in the number of users during the period 1995 to 2001, Andersen and colleagues (2000) found continuous growth in the number of EDI messages sent via third-party vendor companies. There was a substantial growth in the number of EDI messages exchanged, ranging from an annual growth of 34% to 46%. The same study also revealed that the growth in bytes transmitted during the same period increased by the same rates, indicating that larger messages are exchanged. Finally, the study found an increase in assigned EAN numbers. This suggests a growth in EDI users if it is assumed that there is a positive correlation

Figure 1. Overview of the two policy statements and the EDI Action Plan



between the number of assigned EAN location numbers and the number of companies that are able to send and receive EDI messages. Thus, the study by Andersen indicates that the EDI traffic has increased from 1995 to 2001. However, with the exception of the health sector (Johansen, Andersen, & Krogh-Meibom, 2002), the financial sector (Bjørn-Andersen & Andersen, 2003) and the logistics/freight and agricultural sectors (Andersen, Juul, Korzen-Bohr, & Pedersen, 2003b), there has not been a general spread of EDI to the business community at large.

Studies of digital data exchange within the steel and machinery industry (Henriksen, 2002), the textile & clothing industry (Hjarup, 2001), the industry in general (Hørluck, 1996; Petersen, Petersen, & Kespersen, 2002), the retail sector (Juul & Andersen, 2001, 2002), and the public sector (Andersen & Juul, 2002) support the picture that digital exchange of orders and invoices has been the exception rather than the norm during the mid-1990s and up to the present time. But nothing seems to support the tendency presented by the Danish National Statistical Bureau that there has been a decrease in EDI usage among Danish businesses.

ANALYSIS AND DISCUSSION

In 1996 when the EDI Action Plan was launched, large companies had already adopted EDI (Andersen et al., 2000; Hørluck, 1996), but SMEs hesitated. One reason for the low level of adoption of EDI among SMEs could be that they lacked sufficient knowledge of the innovation. Another explanation could be that the SMEs did not recognize the business potential of EDI. A third and perhaps more plausible explanation might be rooted in issues related to critical mass, pressure, and power (Henriksen, 2002; Markus, 1983). However, it is a fact that the EDI traffic—viewed as number of messages and number of bytes exchanged—increased from 1996 and in the years ahead (Andersen et al., 2000), but it did not create

a large EDI landslide. A landslide could have been expected when considering that the industry and trade associations initiated several EDI projects as a result of their involvement in formulating the EDI Action Plan. The midway evaluation in 1998 of the EDI Action Plan prepared by the Danish EDI Council documented that several efforts had been made to meet the demands, but that the goals so far had not been reached.

In the EDI Action Plan there were no economic or normative interventions (Henriksen, 2002). Contrary to the TradeNet in Hong Kong, the adoption of EDI was not enforced. One natural consequence of the Danish EDI Action Plan could have been to force private businesses to report their figures to, e.g., the Inland Revenue Service via EDI messages. This would have been highly relevant since the EDI Action Plan aimed at making the public sector a locomotive for EDI adoption. Since all Danish businesses communicate with the Inland Revenue Service, it would have created a broader scope for EDI communication. The Inland Revenue Service was among the few public sector agencies that actually utilized the opportunities created by EDI usage (Andersen et al., 2000). However, no enforcement was used to involve private businesses in the exchange of EDI messages.

Another approach to the creation of a large-scale diffusion of EDI could have been a strong encouragement of the public sector to perform its procurement electronically. Part of the reason why mandatory e-procurement was not implemented was the lack of technological readiness at both demand and supply side. The municipalities, for example, had in general a low level of adoption and diffusion of EDI. But perhaps the most likely explanation for the low diffusion rate of EDI is the fact that the public sector was not managed in a top-down style. About one-third of the employees in the Danish governmental sector are employed in central government and two-thirds at the local level in the 275 municipalities and 14 counties. Local government has a large degree of autonomy, and various management reforms

Table 2. Companies using EDI 1996-2001

| Year | Percent of companies using EDI | Company size covered in the survey (number of employees) | Sample size (response rate in percent) | Reference |
|------|--------------------------------|--|--|--|
| 1996 | 33 | 5+ | 387 (20) | Ministry of Information Technology and Research (1997) |
| 1998 | 28 | 10+ | 1.815 (61) | Ministry of Information Technology and Research (1999) |
| 1999 | 36 | 10+ | 1.092 (29) | Ministry of Information Technology and Research (2000) |
| 2000 | 15 | 5+ | 3.357 (67) | Statistics Denmark (2001) |
| 2001 | 18 | 5+ | 3.327 (66) | Statistics Denmark (2002) |

in the 1980s and 1990s in the public sector have decentralized budgets and procurement to each public institution. Any ideas of making e-procurement mandatory in the public sector were therefore in direct conflict with the overall management agenda for the public sector. This is a paradox since the management reforms introduced in the 1990s had the overall aim to increase efficiency and effectiveness. However, the means to achieve the objective of decentralization and autonomy at the institutional level prevented a central, top-down-led strategy for e-procurement. Formulated more sharply: the overall management discourse prevented an effective introduction of an e-commerce agenda in the public sector (Andersen et al., 2003b).

Although financial resources were used as direct subsidies to support the diffusion of EDI in the Danish business community, the resources were somewhat limited and not allocated to individual businesses. The financial support was given to projects such as the TradeDocument Project (Henriksen & Andersen, 1999; Henriksen, 2002) initiated by the two major Danish trade and industry associations. Therefore, it can be argued that the economic incentive for adoption of EDI was absent in the EDI Action Plan with respect to individual businesses. The initiators of the EDI Action Plan relied more on a pedagogical approach (Eckhoff, 1983). Through information campaigns by the Danish EDI Council and the associations supporting the EDI Action Plan, the advantages of EDI were communicated to the

potential adopters. Thus, this communication process became a central issue in the adoption and diffusion of EDI in the Danish business environment. Focusing on the communication aspect, one issue is how the information about the innovation is communicated.

Another issue is how the innovation is presented. The message can be communicated via mass-communication networks or through interpersonal relations (Rogers, 1995). In the EDI Action Plan, both types of communication channels were used. The EDI Council and the professional business associations communicated their message about EDI and its advantages at the same time as the government presented its information campaigns on the advantages of the innovation via publications, newsletters, and social arrangements. This second issue—how the innovation is presented—is however even more relevant in this context. Two different types of information are involved in the communication process: signaling and know-how (Attewell, 1992). According to Attewell, signaling refers to communication about the existence and potential gains of a new innovation, whereas know-how refers to knowledge transfer in relation to the innovation. “The technical know-how is relatively immobile, and often has to be recreated by user organizations” (Attewell, 1992, p. 7). This places a heavy burden on potential adopters, since different organizations have specific needs requiring different skills and development before adoption can take place.

The first policy statement on technology from

1995 suggested that EDI adoption could lead to “considerable rationalization gains and a closer interplay between organizations.” In the EDI Action Plan, EDI was described as a tool that could give Denmark an “international lead and improve the efficiency of working procedures and development of new products and production processes.” Efficiency was an attribute connected to the innovation, whereas the traditional innovation attributes (Rogers, 1995) played a secondary role. However, the statements formulated by the business community might be even more significant. They argued that EDI adoption would result in increased efficiency, cost reduction, and competitiveness leaving the impression that the investment would pay off. This suggests that the information communicated on EDI belonged to the category of signaling rather than to the category of know-how. This is problematic in a business environment like the Danish, where the majority of businesses are SMEs, which generally have limited resources available for further investigation of innovations being offered.

An issue that played a minor role in the policy statements was the cost of EDI. One of the seven initiatives in the EDI Action Plan explicitly mentioned development of EDI software as an objective, but the cost of hardware, integration of EDI software, and implementation of EDI in organizations was not mentioned in the statements. It is generally acknowledged that to gain full advantage of EDI, organizations must integrate their internal systems with the external IOS (Riggins & Mukhopadhyay, 1999). In a survey from 1996 on EDI adoption among members of the Confederation of Danish Industries, it was found that the two highest scoring items in terms of barriers related to EDI implementation were cost of EDI and the uncertainty of realizing actual advantages from EDI (Hørluck, 1996). The third highest scoring item in the survey was related to the lack of standardization of trade data standards. Apart from serving as a tool for creating awareness of EDI, the EDI Action Plan

aimed at introducing the EDIFACT standard in the Danish business community and the public sector, but the cost of EDI was not a major issue in the EDI Action Plan.

As mentioned earlier, the aim of this chapter is to focus on the institutional initiatives deployed to promote the diffusion of EDI in the Danish business community. One outcome of this analysis is a mapping of the degree of institutional involvement in the formulation of the EDI Action Plan versus the rate of EDI adoption. Appendix A provides a list of institutional involvement at different governing levels. Based on insights gained from the research projects reported in Appendix B and the data summarized in Appendix A, Table 3 presents a qualitative mapping of the variables, institutional involvement, and EDI adoption in selected businesses and public sector agencies.

The Inland Revenue Service was involved in formulating the EDI Action Plan and was eager to gain the benefits that most likely would result from an increased EDI usage (Andersen et al., 2000). Based on information from the Inland Revenue Service, its EDI usage is assessed to be high in both dimensions in Table 3. On the other hand, representatives from the municipalities did not play an active role in formulation of the EDI Action Plan, nor did they pursue EDI adoption and implementation at any significant level with respect to EDI usage in their daily transactions both in relation to the public and private sector.

The professional business and trade associations played an active role in formulating and operationalizing the EDI Action Plan (Henriksen, 2002; Henriksen & Andersen, 1999). However, they did not succeed in influencing adoption and diffusion among their members. Our assessment is therefore that the trade and business associations’ institutional involvement was high, but the degree of adoption among their members was low.

A number of associations did not take an active part in formulation of the EDI Action Plan. These associations are clustered in the upper right corner of the two-by-two matrix in Table 3. Nonetheless,

Table 3. Institutional involvement and adoption of EDI for different industry segments

| Institutional involvement | Degree of EDI adoption | |
|---------------------------|---------------------------------|---|
| | Low | High |
| Low | Municipalities | The financial sector The MedCom project The agricultural sector (DLF) Transportation and logistics |
| High | Business and trade associations | The Inland Revenue Service |

these associations represent some of the business sectors that have been most successful in utilizing EDI in Denmark (Andersen et al., 2000). This leaves the impression that critical mass and power, rather than institutional initiatives and institutional discourse, determined the rate of adoption in the Danish business community.

One of the fascinating issues concerning the Danish scene is the public sector’s role as a player in the EDI Action Plan. The Danish EDI Action Plan was not solely a governmental plan. The business associations were deeply involved in the formulation of the EDI Action Plan, and a great responsibility was laid on the business associations in order to fulfill the plan. However, the institutions in the public sector acted as major players in fulfillment of the plan. That is especially the case with respect to single units such as the Inland Revenue Service. This important insight into the role of government might however not include the traditional top-down command and the concept of “government” versus “market.” The successful EDI initiatives originate at lower levels of government and in the market where they have managed to spiral and gain success despite a lack of policy saliency. One explanation for this outcome of the EDI Action Plan could be the consensus in the formulation of the action plan between the public sector and the private sector. However, the consensus among the business associations and the governmental players did not eliminate the obstacles to the fulfillment of the EDI Action Plan. The outcome of the plan raises the question whether the resources should have been prioritized differently. On the one hand, major Danish companies such as Maersk,

Danfoss, Grundfos, and FDB have not benefited from the EDI Agenda. They have all managed well without the EDI Action Plan and have been able to influence their suppliers and shipping agents to adopt EDI—often in a proprietary format—regardless of the political agenda’s content. On the other hand, the EDI Agenda has helped to stimulate a range of EDI projects that otherwise might not have been implemented. These projects were especially targeted at the majority of Danish businesses—SMEs, which through this exposure were provided with the necessary information to consider the relevance of EDI in their businesses. If we subscribe to this last point of view, then it might only be a matter of time before a B2B e-commerce landslide takes place.

CONCLUSION

In this chapter the focus has been on institutional initiatives on diffusion of EDI in the Danish business community and the public sector. In our analysis we assessed the EDI Action Plan and found that an active use of the public sector was a dominant market demand driver in the diffusion of B2B e-commerce. Especially the attempt to streamline the internal processes in the public sector protrudes in the content of the EDI Action Plan. However, the lack of active industry involvement, apart from the business associations, stands out. Whereas the EDI Action Plan received active support from single public sector agencies and organizations, the plan had only indirect support from individual companies.

Mapping the degree of institutional involvement and the degree of EDI adoption, we found that most of the large users of EDI did not get involved in the EDI Action Plan. The majority of the institutions involved had limited market power and could be interpreted as the least-likely adopters of EDI. The market leaders and advanced EDI users were following their own e-commerce agenda, not paying particular attention to the goal of EDIFACT diffusion outlined in the EDI Action Plan.

Our interpretation of the analysis in this chapter is that the lack of direct representation will condition the future orientation and decision making in terms of current and future policy programs on diffusion of ICT: the lack of industry involvement has not made the outcome of the EDI Action Plan useless. Yet, it has led to a very limited adoption and diffusion of B2B e-commerce, especially among SMEs and public sector institutions, which were the target audience for the EDI Action Plan. The statistics indicate that it is the same industries that exchange more and more messages and types of messages (Andersen et al., 2000) and that large companies, which often are old and well established (Petersen et al., 2002) adopt ICT, regardless of campaigns initiated by institutions, as long as there is a potential for profit. Given these ex-post observations, the EDI Action Plan, with its focus on development of global standards for SMEs, is an attempt to obstruct the extensive use of proprietary standards introduced by those large companies, which hold the necessary power to set the EDI agenda.

REFERENCES

- Andersen, K.V., & Juul, N.C. (2002). E-handelsstrategier i den offentlige sektor. In K.V. Andersen (Ed.), *Digital genopbygning af den offentlige sektor* (pp. 114-126). Copenhagen: DFH Publishers.
- Andersen, K.V., Bjørn-Andersen, N., & Dedrick, J. (2003a). Governance initiatives creating a demand-driven e-commerce approach: The case of Denmark. *Information Society*, 19.
- Andersen, K.V., Bjørn-Andersen, N., & Juul, N.C. (1999). *EDI-anvendelsen i dagligvarehandlen*. Working paper, Department of Informatics, Copenhagen Business School.
- Andersen, K.V., Juul, N.C., Henriksen, H.Z., Bjørn-Andersen, N., & Bunker, D. (2000). *Business-to-Business E-Commerce, Enterprises Facing a Turbulent World*. Copenhagen: DJØF Publishers.
- Andersen, K.V., Juul, N.C., Korzen-Bohr, S., & Pedersen, J.K. (2003b). E-procurement and fragmented institutional endeavors. *Proceedings of the Bled Conference of E-Commerce*.
- Attewell, P. (1992). Technology diffusion and organizational learning: The case of business computing. *Organization Science*, 3, 1-19.
- Bachrach, P., & Baratz, M.S. (1963). Decisions and non-decisions: An industrial framework. *American Political Science Review*, 57.
- Bjørn-Andersen, N., & Andersen, K.V. (forthcoming). *The financial sector and e-commerce in Denmark: The case of Nordea*. CRITO, University of California at Irvine.
- Bjørn-Andersen, N., Earl, M., Holst, O., & Mumford, E. (1982). *Information Society for Richer for Poorer*. North-Holland.
- Brousseau, E. (2002). *EU E-Commerce Policies*. CRITO, University of California at Irvine.
- Commission. (2001). *eEurope 2002—Accelerating E-Commerce*. Brussels: European Commission.
- Damsgaard, J., & Lyytinen, K. (1998). International trade and the speed of light: Building an electronic trading infrastructure. In T. Larsen, L. Levine & DeGross (Eds.), *Information Systems: Current Issues and Future Changes*. IFIP Press.

- Damsgaard, J., & Lyytinen, K. (2001). The role of intermediating institutions in the diffusion of electronic data interchange (EDI): How industry associations intervened in Denmark, Finland, and Hong Kong. *The Information Society, 17*, 195-210.
- Dybkjær, L., & Christensen, S. (1994). *Information Society 2000*. Copenhagen: Ministry of Research and Information Technology.
- Eckhoff, T. (1983). *Statens styringsmuligheter. Særlig i ressurs—og miljøspørsmål*. Oslo: Tanum-Norli.
- Falch, M. (1994). *EDI I transportsektoren*. Center for Teleinformation, Denmark Technical University.
- Gregor, S., & Johnston, R.B. (2001). Theory of interorganizational systems: Industry structure and processes of change. *Proceedings of the 34th Hawaii International Conference on Systems Sciences*.
- Habermas, J. (1986). *The Theory of Communicative Action*. Polity Press.
- Hansen, J.V., & Hill, N.C. (1989). Control and audit of electronic data interchange. *MIS Quarterly, 13*, 403-413.
- Henriksen, H.Z. (2002). *Performance, pressures, and politics: Motivators for adoption of interorganizational information systems*. Samfundslitteratur, Copenhagen. Available online at: <http://www.cbs.dk/staff/hzh/Dissertation.htm>.
- Henriksen, H.Z., & Andersen, K.V. (1999). Internet-based EDIFACT trade documents for Danish SMEs: An analysis of the pre-implementation phase. *Proceedings of the 12th Bled Electronic Commerce Conference*.
- Hjarup, S. (2001). *Distributed multimedia technologies and value chain structuring—An economic theory of communications*. PhD Dissertation, CTI, Danish Technical University, Lyngby.
- Hørlück, J. (1996). *EDI and Danish Companies*. Copenhagen: Confederation of Danish Industries.
- Johansen, I., Andersen, K.V., & Krogh-Meibom, F. (2002). Sundhedsdatanetværket medcom: Når samspillet mellem den private og offentlige sektor er bedst. In K.V. Andersen (Ed.), *Digital genopbygning af den offentlige sektor* (pp. 86-101). Copenhagen: DFH Publishers.
- Johnston, R.B., & Gregor, S. (2000). A theory of industry-level activity for understanding the adoption of interorganizational systems. *European Journal of Information Systems, 9*, 243-251.
- Juul, N.C., & Andersen, K.V. (2001). *Digitale værktøjer i danske virksomheder anno 2001* (pp. 16-23). Medlemsinformation, Emballage & Transport, Teknologisk Institut.
- Juul, N.C., & Andersen, K.V. (forthcoming). *Digitale værktøjer i danske virksomheder anno 2002*. Medlemsinformation, Emballage & Transport, Teknologisk Institut.
- King, J.L., Gurbaxani, V., Kraemer, K.L., McFarlan, F.W., Raman, K.S., & Yap, C.S. (1994). Institutional factors in information technology innovation. *Information Systems Research, 5*, 139-169.
- Klein, S. (1995). The impact of public policy on the diffusion and implementation of EDI: An evaluation of the TEDIS program. *Information Economics and Policy, 7*, 147-181.
- Kumar, K., Dissel, H.G.V., & Bielli, P. (1998). The merchant of Prato—revisited: Toward a third rationality of information systems. *MIS Quarterly, 199-225*.
- Lai, V.S., & Guynes, J.L. (1997). An assessment of the influence of organizational characteristics on information technology adoption decision: A discriminative approach. *IEEE Transactions on Engineering Management, 44*, 146-157.
- Laswell, H.D. (1936). *Politics: Who Gets What, When, How*. New York: McGraw Hill.

- Markus, L.M. (1983). Power, politics, and MIS implementation. *Communications of the ACM*, 26, 430-445.
- Markus, L.M., & Robey, D. (1988). Information technology and organizational change: Causal structure in theory and research. *Management Science*, 34, 583-598.
- Ministry of Information Technology and Research. (1995). *From vision to action—info-society 2000*.
- Ministry of Information Technology and Research. (1996b). *Danske virksomheders brug af IT 1996*.
- Ministry of Information Technology and Research. (1996c). *The info-society for all—the Danish Model*.
- Ministry of Information Technology and Research. (1997). *Danske virksomheders brug af IT 1997*.
- Ministry of Information Technology and Research (1999). *Danske virksomheders brug af IT 1998*.
- Ministry of Information Technology and Research (2000). *Danske virksomheders brug af IT 1999*.
- Ministry of Research and Information Technology (1996a). *Electronic commerce in Denmark—a national EDI action plan*.
- Neo, B.S., King, J.L., et al. (1995). *Singapore TradeNet (B): The Tale Continues*. Harvard Business School Case (No. 9-193-136). Boston, MA: Harvard Business School.
- Petersen, B., Pedersen, T., & Jespersen, A.H. (2002). *E-business i industrien (E-business in the industry)*. Copenhagen: Danish Confederation of Industries.
- Pfeiffer, H.K.C. (1992). *The Diffusion of Electronic Data Interchange*. Heidelberg: Physica-Verlag.
- Porter, M.E. (2001). Strategy and the Internet. *Harvard Business Review*, 63-78.
- Raman, K.S., & Yap, C.S. (1996). From a resource rich country to an information rich society: An evaluation of information technology policies in Malaysia. *Information Technology for Development*, 7(3), 109-131.
- Riggins, F.J., & Mukhopadhyay, T. (1999). Overcoming EDI adoption and implementation risks. *International Journal of Electronic Commerce*, 3, 103-123.
- Rogers E.M. (1995). *Diffusion of Innovations*. New York: The Free Press.
- Sampler J.L. (1996). Exploring the relationship between information technology and organizational science. In M.J. Earl (Ed.), *Information Management: The Organizational Dimension* (pp. 5-22). Oxford University Press.
- Statistics Denmark. (2001). *Danske virksomheders brug af informationsteknologi 2000. Serviceerhverv*, (13).
- Statistics Denmark. (2002). *Danske virksomheders brug af informationsteknologi 2001. Serviceerhverv*, (16).
- Teo, H.H., Tan, B.C.Y., & Wei, K.K. (1997). Organizational transformation using electronic data interchange: The case of TradeNet in Singapore. *Journal of Management Information Systems*, 13, 139-165.
- Wong, P.-K. (1996). *Implementing the NII Vision: Singapore's Experience and Future Challenges*. CRITO, University of California at Irvine.

This work was previously published in Social and Economic Transformation in the Digital Era, edited by G. Doukidis, N. Mylonopoulos, and N. Pouloudi, pp. 56-76, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

APPENDIX A

Table A. Government and business association players involved in the formulation of the EDI Action Plan. Source: (Ministry of Research and Information Technology, 1996)

| Sector | Government Department | Government council/association | Government agency | Professional association |
|----------------------------|--|--|--|--|
| Governmental sector | Danish Ministry of Education And Research Ministry of Finance, Agency for Financial Management and Administrative Affairs | <i>Association of National Procurement Officers</i> <i>National Association of Local Authorities</i> Local Government Computing Data Association (KMD) | <i>The Inland Revenue Service</i> <i>Danish Armed Forces</i> Statistics Denmark National Procurement Ltd. City of Copenhagen | |
| The financial sector | | | | Danish Bankers' Association Danish Insurance Association Association of Danish Mortgage Banks |
| The industry sector | Danish Ministry of Business and Industry | | | Confederation of Danish Industries Danish Federation of Crafts and Small Industries <i>IT Business Association</i> |
| Whole sales | | | | Danish Chamber of Commerce |
| Health care | | Association of County Councils in Denmark Copenhagen Hospital Cooperation | | Danish Pharmaceutical Association |
| Retail | | | | Danish Commerce and Service Association |
| Agriculture | | | | Agricultural Council of Denmark |
| Transportation & logistics | | | DSB | Danish Ship Owners' Association EDI Transport Denmark EAN-Denmark |
| Construction & housing | | | Danish Royal Palaces and Properties Agencies | Danish Contractors' Association EDI-Byg (construction) |
| Others | Danish EDI Council Danish Data Association | | | |

Legend: Players highlighted with italics are those associations, which indicated that they supported the EDI Action Plan. The other players were directly involved in formulating the EDI Action Plan.

APPENDIX B

Table B. Research on Danish EDI and B2B e-commerce initiatives by industry sector 1995-2002

| Industry sector / segment studies | | EDI examples & initiatives | Sources |
|-----------------------------------|---|---|---|
| Governmental sector | Health sector | MedCom (Letter of discharge, prescriptions, laboratory request and results) | Johansen et al., 2002 |
| | Municipalities National government | E-procurement | Andersen and Juul, 2002 |
| The financial sector | | Home- and officebanking Interbank clearing | Bjørn-Andersen and Andersen (forthcoming) |
| Industry | Danish Association of Industries of Consumer Products (DLF) | EDITEX | Hørlick, 1996 Petersen et al., 2002 Andersen et al., 1999 |
| | Steel and machinery industry | TradeDocument Project | Henriksen, 2002 |
| | Textile & Clothing Industry | | Hjarup, 2001 |
| Whole sales | Steel and machinery | TradeDocument Project | Henriksen, 2002 |
| Retail | Grocery sector | | Damsgaard and Lyytinen, 2001 |
| | Suppliers to the retail sector | Le@n | Andersen et al., 1999 Juul and Andersen, 2001; Juul and Andersen, 2002 |
| Transportation & logistics | | | Falch, 1994 |

Chapter 2.6

Enabling Strategy Formulation by ICT: A Viable Systems Approach

Dirk Vriens

University of Nijmegen, The Netherlands

Jan Achterbergh

University of Nijmegen, The Netherlands

ABSTRACT

In this chapter the role of ICT for competitive intelligence is approached from the perspective of strategy formulation. The authors hold the view that competitive intelligence can be seen as knowledge necessary for the process of strategy formulation. To determine the role of ICT, it is proposed to examine (1) the process of strategy formulation, (2) the knowledge relevant for the process of strategy formulation and (3) the knowledge processes in which the intelligence relevant for the process of strategy formulation is produced and processed. If these three elements are clear, the role of ICT for competitive intelligence can be reformulated as the support of ICT for the knowledge processes, producing and processing the necessary intelligence for strategy formulation. In the chapter, the process of strategy formulation

and the knowledge it requires will be described by using the Viable Systems Model of Stafford Beer. It results in an “ICT-architecture” for supporting the knowledge processes, producing the relevant knowledge for strategy formulation.

INTRODUCTION

An adequate intelligence function is indispensable for (re)formulating strategies in a world that is getting both “larger” as new markets are opened up and “smaller” as (information and communication) technologies develop to spot these markets and profit from them. To remain viable, organizations need to identify and define their relevant environments, to scan them for opportunities and threats, to use these scans for formulating their strategies, and to act on these strategies. The con-

tribution of business or competitive intelligence to strategy formulation (and implementation) is a key factor for organizational viability.

Because of the importance of business or competitive intelligence (BI or CI) for organizational viability, a lot has been written lately about its goals and main processes (e.g., Fuld, 1995; Kahaner, 1997; Vriens & Philips, 1999; Cook & Cook, 2000). Vriens and Philips (1999), for example, define competitive intelligence as “a process of gathering and processing information about the environment to support the process of strategy formulation.” In this definition, the function of delivering relevant “external” information is central. Others, however, see BI as a process that (also) delivers “internal” information to support formulating strategies (e.g., Dresner, 1989). In this latter category, authors point, for instance, to the information provided by means of the balanced scorecard or by data warehouses.

For (re)formulating strategies, both internal and external information (and their integration) is needed. Competitive intelligence seems to be the label, in literature as well as in practice, for a function in organizations that covers the supply and processing of information for strategy formulation.

Competitive intelligence activities can be supported by information and communication technology (ICT), and most authors agree on the importance of ICT for these activities (e.g., Fuld et al., 2002; Philips & Vriens, 1999; Kahaner, 1997; Cook & Cook, 2000). Several studies show the use of ICT in competitive intelligence activities. Vriens and Hendriks (2000), for instance, show how Web-enabled technologies may enable data-collection. Teo and Choo (2002) give an overview of how the Internet can be used for CI activities, and several authors discuss the possibilities for the electronic ‘outsourcing’ of search activities (e.g., Kahaner, 1997).

However, in spite of the awareness of the importance of ICT for CI, it remains unclear how the link between CI and ICT should be designed.

This link is the main focus of this chapter. The chapter sets out to describe the link between ICT and the process of supplying and processing information for strategy formulation. With such a description, designers of the CI process can select proper ICT support and they can judge whether the employed ICT applications support this process appropriately.

To describe the link between ICT and CI, it is necessary to define the process of strategy formulation—otherwise, it is impossible to determine the contribution of the CI process. Next, it is necessary to determine what ‘intelligence’ is needed in the process of strategy formulation. For us, as for other authors (see e.g., Kahaner, 1997), intelligence as a “product” is knowledge relevant for strategy (re)formulation. We will therefore approach this question from a “knowledge” point of view. If it is clear what knowledge the process of strategy formulation needs, the processes that produce and process this knowledge may be acknowledged. In knowledge management literature, these processes are normally labeled “generation,” “storage,” “dissemination” and “application” of knowledge (see e.g., Davenport and Prusak, 1998; Achterbergh & Vriens, 2002). Given these processes, the role of ICT in supporting them may be defined. This last step then defines ICT for CI as support tools for the processes in which knowledge relevant for strategy formulation is generated, stored, disseminated and applied.

This chapter reformulates the role of ICT for CI as the role of ICT in the knowledge processes involved in strategy formulation. It seeks to define this role of ICT in four steps. These steps are: (1) presenting a model of the process of strategy formulation, (2) deriving the knowledge relevant for the process of strategy formulation, (3) identify the knowledge processes in which the relevant knowledge for strategy formulation is processed and produced and (4) use the previous steps to arrive at an understanding of the role of ICT in the process of strategy formulation. To deal with these four issues, we organize the chapter as follows.

In the following section we unfold the process of strategy formulation. To do this, we use the Viable System Model of Beer (1979, 1981). This is followed with a section discussing the derivation of the necessary knowledge domains for the process of strategy formulation. Next, we describe the knowledge processes that produce and process the relevant knowledge for strategy formulation. The chapter then uses this model to identify ICT support for strategy formulation. The last section will conclude with recommendations for using the model to derive relevant ICT for CI.

STRATEGY FORMULATION: A VIABLE SYSTEM PERSPECTIVE

Strategy formulation aims at developing and selecting goals and plans that secure the adaptation of the organization to its environment (see for instance, Johnson & Scholes, 1999). These goals and plans may refer to specific product-market-technology combinations for which the organization hypothesizes that they ensure a stable relation with its environment. The process of strategy formulation, then, needs to generate such goals and plans, needs to reflect upon their appropriateness and needs to select certain goals and plans to guide the behavior of the organization. Moreover, it is a continuous process. Goals and plans can be seen as hypotheses about “what will work” as a means to adapt and survive. Therefore, they should be monitored constantly, and revised if necessary. In short: strategy formulation is a continuous contribution to maintaining organizational viability.

Although many authors deal with the process of strategy formulation, we choose the Viable System Model of Beer (1979, 1981) to define this process more closely. We select the VSM because Beer explicitly unfolds the functions required for the viable realization and adaptation of the organization’s identity. Since strategy formulation

particularly aims at organizational adaptation, we can directly use the functions described by the VSM specializing in adaptation to define strategy formulation. Based on the VSM, an explication of the process of strategy formulation in terms of the functions necessary for organizational viability is possible. A further reason for using this model is that it is an offset for deriving systematically the knowledge-domains necessary for strategy-formulation. Moreover, the model allows for an identification of these knowledge domains at many (recursive) organizational levels. Designers of the CI process can thus use it to identify the relevant knowledge domains at a corporate level, at the level of the business unit or at the level of a team. Beer’s model thus provides a background for defining strategy formulation and for identifying the necessary knowledge domains for strategy formulation. In this section we introduce the VSM and use it to define strategy formulation. In Section Three, we describe the relevant knowledge domains.

Stafford Beer developed the VSM to provide a model of the functions that are needed for organizational viability. An organization is viable if it is able to maintain a separate existence in its environment (Beer, 1985, p. 113). To be viable, an organization must have the potential to adapt and realize its identity and mission. This potential crucially depends on the realization of five (related) functions. According to Beer (1985, p. 115), these five functions and their relations are necessary and sufficient conditions for organizational viability. Below, we describe these five functions and their relations. We refer to a company called “Energeco”—a company specialized in supplying eco-energy—to illustrate these functions.

Function 1: Primary Activities

Function 1 of an organization as a viable system consists of the collection of its primary activities. These primary activities constitute the system’s

“raison d’être” (Espejo et al., 1996, p. 110). For example, the raison d’être of “Energeco” is to service its environment with eco-energy. “Energeco” has three primary activities: supplying solar, tidal, and wind energy. These three primary activities constitute its Function 1.

The existence of a collection of primary activities as such is insufficient to maintain the viability of an organization. Somehow, these primary activities must be forged into the larger whole of the organization. To this purpose, four additional functions are required: coordination, control, intelligence, and policy.

Function 2: Coordination

In organizations, primary activities may depend on shared resources. People, machines, shared in- or output markets, or output of other primary activities, are examples of shared resources. These dependencies make the primary activities interdependent. To give an example, specialists in high voltage energy are a shared resource between “Energeco’s” business units. Now suppose that there is no coordination between these business units. In this case, the allocation of high voltage specialists to a project in the business unit “Solar Energy” may require a revision of the allocation of these same specialists to a project in the business unit “Wind Energy.” Without a function that supports the coordination of these interdependencies, the business units “Solar Energy” and “Wind Energy” may become entangled in a process that oscillates between allocating and revising the allocation of these specialists to projects. It is the task of Function 2 to prevent these oscillations. Function 2 facilitates the coordination of interdependencies between function one activities, hence its name: *coordination*. Examples of Function 2 activities are the introduction of quality standards, the design and implementation of shared planning systems, or the introduction of a common language to discuss coordination problems.

Function 3: Control

The primary activities and coordination are necessary, but not sufficient for the viability of an organization. Each primary activity can still pursue its own goals without contributing to the realization of the identity and mission of the viable system as a whole. For this reason, Beer (1985, 1999f) argues that there must be a third function ensuring synergy and cohesion between primary activities. He calls this function “control.” Its task is to translate the identity and mission of the viable system (e.g., supplying eco-energy) into goals for the primary activities (e.g., supplying wind, solar and tidal energy) and to control the realization of these goals. In this way, control takes care of the contribution of the primary activities to the realization of the identity and mission of the viable system.

Control has three instruments to discharge for its task. First, it gives direct command to and receives direct reports from the management of the primary activities. Second, control can audit the management of the primary activities. The aim of these audits is to stay aware of problems facing the management of the primary activities and to help in finding solutions to them. Third, control ensures the synergy of the primary activities by controlling the coordination effort by Function 2.

Control not only focuses on the realization of the identity and mission of the viable system; it is also involved in the adaptation of this identity and mission. Because of control’s knowledge about the modus operandi and problems of the primary activities, its second task is to review proposals for innovation produced by the intelligence function (see below) and to assess whether these proposals are realistic given the potential for change of the primary activities. For this purpose, control is involved in a continuous discussion about the feasibility of proposed innovations.

Function 4: Intelligence

Functions 1 to 3 are necessary for the realization of the identity and mission of viable organizations, yet they are not sufficient for organizational viability. Viability also means adaptation. To make adaptation possible, a fourth function is required. Beer calls this function intelligence. It is the task of intelligence to scan the environment of the organization for relevant developments and to initiate adaptation to keep the identity and mission aligned with them (doing the right thing, instead of doing things right, Espejo et al., 1996). For instance, developments in production technology may introduce the possibility of cost-effective, large-scale production of eco-energy from biomass. Intelligence should pick up these developments, assess them, and if relevant, translate them into proposals for innovation.

Function 5: Policy

The addition of the intelligence function seems to complete the list of functions required for the realization and adaptation of a viable organization's identity and mission. According to Beer (1985, p. 258ff), this is not the case. The reason for this is the particular focus of the control and intelligence function. Control focuses on the *realization* of identity and mission of the organization, while intelligence focuses on initiating *adaptation*. If it is supposed that the interaction between control and intelligence is not coordinated, three problems may occur. First, interaction is too loose. In this case, proposals for innovations are not assessed in terms of the organization's potentials for change and existing potentials for change cannot be exploited by innovations. Both the realization and adaptation of the organization's identity and strategy may slowly stop. In the second and third problem, interaction between control and intelligence is intense, but one of the functions

dominates the other. If intelligence dominates control, the organization runs the risk of "innovatism." Innovative products or technologies are proposed and introduced that do not match the potential for change of the primary activities. If control dominates intelligence, the organization runs the risk of "conservatism." Proposals for innovation are rejected because of an obsession with current markets, products and production technologies.

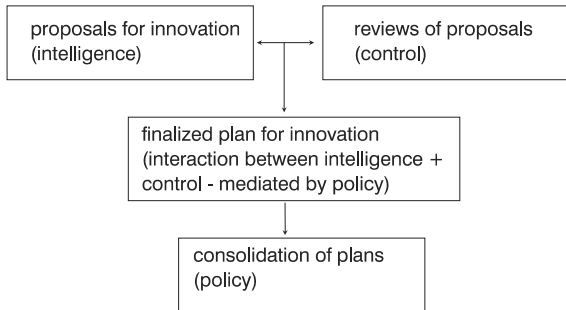
To counter these problems, Beer introduces a final function he calls policy. Policy has the tasks of coordinating the interaction between control and intelligence and consolidating its results in a (re)definition of the identity and mission of the organization in such a way that they fit developments in its environment as well as in its own potentials for change. Policy provides closure to the adaptation and realization cycle. As such, it completes the list of functions necessary and sufficient for viable organizing.

The Process of Strategy Formulation According to the VSM

The VSM not only describes the functions needed for viability. It also describes the interactive relations that should exist between them and the characteristics these relations should have. For this purpose, it divides the functions into two groups: functions that contribute to the *realization* of the organization's strategy and functions that contribute to its *adaptation*.

The first group consists of the primary activities, coordination and control. This group deals with the *realization* of the organization's identity and strategy. The second group consists of control, intelligence, and policy. This group deals with the *adaptation* of the organization's identity and strategy: its task is "inventing the organization" (Espejo et al., 1996). Together, control, intelligence, and policy attempt to keep

Figure 1: The process of strategy formulation according to the VSM



the organization aligned with relevant developments in its environment.

Keeping the organization aligned with relevant developments in its environment can be seen as the core objective of strategy formulation. In fact, the interplay between the VSM functions control, intelligence and policy describes the process of strategy formulation. Intelligence generates plans for adaptation and control reviews them. A discussion about the (adequacy of these) plans between intelligence and control (mediated by policy) should lead to a finalized plan for adaptation. Finally, such a plan should be consolidated by policy. Figure 1 depicts the process of strategy formulation according to the VSM (and its associated VSM functions).

Because strategy formulation is captured by the functions control, intelligence, policy, and their relations, we not only describe these relations, we also characterize them in terms of periodicity, detail, and potentials for standardization. These characteristics are relevant for designing supportive measures (among which are ICT applications) for the process of strategy formulation, as will become apparent in the last section. Table 1 summarizes and characterizes the relations between the functions in this group.

The VSM recommends that control and intelligence are highly interconnected and of similar complexity. The interaction between them should be continuous, intense, detailed, and balanced. Discontinuities in the interaction between intelligence and control harbor the danger of slowing down the innovation process. Feedback by control on plans for innovation or suggestions for intelligence activities by control may come too late if interaction between control and intelligence is not organized on a regular basis. Only loose and aggregate interaction between intelligence and control may lead to a culture of estrangement between ‘innovators’ and ‘makers’. To deal with the many and complex issues related to innovation requires an intensive and detailed discussion of these issues. As has been argued, unbalanced interaction between intelligence and control can lead to either “innovatism” or “conservatism,” which is detrimental to organizational viability.

Table 1. Relations between functions focused on adapting the organization’s identity and strategy

| Related functions | Relation | Normative characteristics of relation | | | |
|---------------------------------|---|---------------------------------------|--------|-----------------|--|
| | | Periodicity | Detail | Standardization | Focus on |
| Intelligence—Control | Generating finalized proposals for innovation | Continuous | High | Low | Balancing and integrating proposals for innovation and potentials for change |
| Policy—Intelligence and Control | Balancing contributions by intelligence and control | Continuous | Low | Low | Supporting interaction between intelligence and control |
| | Consolidating proposals for innovation | Irregular intervals | Low | Low | (Re)defining the organization’s identity and strategy |

It is the task of the policy function to manage the interaction between intelligence and control. For this purpose, policy should focus on the process of interaction. It should minimize intervention in its content.

To summarize: Beer asserts that there are five functions necessary and sufficient for organizational viability. These have been introduced shortly. Three of them are used to define the process of strategy formulation (intelligence, control and policy). Given this description of strategy formulation, the next section deals with the knowledge required in that process.

KNOWLEDGE DOMAINS FOR STRATEGY FORMULATION

Now that we know what functions are involved in the process of strategy formulation—or as the VSM puts it: the process of adapting and innovating organizations—we can take the next step. If ICT is to make its own contribution to this process, we need to specify the (domains of) knowledge the policy, intelligence, and control functions need to contribute to the process of strategy formulation. These domains of knowledge specify what knowledge should be generated, shared, stored and applied for strategy formulation, and are

thus an offset to define the contribution of ICT to strategy formulation.

The Control Function: Knowledge Domains Required for Strategy Formulation

The control function performs two main activities. It manages the synergy of Function 1 activities and reviews proposals for innovation made by the intelligence function. Since only the second activity is relevant for the purpose of this chapter, we concentrate on this activity.

To execute this activity of reviewing proposals for innovation, control needs knowledge about these proposals. Moreover, knowledge is required that allows for the translation of these proposals into new goals for existing or new business units. These new goals have to be related to the current goals of the business units that are involved. From this confrontation, the gap between the desired and the current goals of these business units can be established. To assess this gap, knowledge is required that supports its translation into the reorganization capacity required from the business units to bridge the gap. Moreover, knowledge is required about the actual capacity for reorganization of the business units involved. From the confrontation between the required and the

Table 2. Function Three and related domains of knowledge

| Function | Related domains of knowledge |
|------------------------------|---|
| F3: function three (control) | For reviewing F4 proposals: Organizational goals Proposals for innovation made by F4 Desired goals for F1 based on proposals for innovation Expected performance of the primary activities (goals for F1 activities) Gap between desired and current goals for F1 Required capacity for reorganization of F1 activities Modus operandi of F1 activities Actual capacity for reorganization of F1 activities Gap between required and actual capacity for reorganization Review of proposals for innovation Finalized plans for adaptation of organizational goals (a joint F3 and F4 product) Regulatory measures to counter the imbalance between F3 and F4 (see function 5) |

Table 3. Function Four and related domains of knowledge

| Function | Related domains of knowledge |
|----------------------------------|---|
| F4: Function Four (Intelligence) | Organizational goals Goals set by, performance and modus operandi of F1 activities Developments in the relevant environment of the organization Reviews by F3 of proposals for innovation Regulatory measures to counter the imbalance between F3 and F4 (see Function 5) Finalized plans for adaptation of organizational goals (a joint F3 and F4 product) |

actual capacity for reorganization, proposals for innovation by the intelligence function can be reviewed. This review is communicated with the intelligence function. This process of communication between control and intelligence results in finalized plans for adaptation of organizational goals. Table 2 lists the knowledge domains needed by control to review proposals for innovation made by intelligence.

The Intelligence Function: Knowledge Domains Required for Strategy Formulation

It is the task of the intelligence function to initiate adaptation in such a way that the activities of the organization are aligned with relevant developments in its environment. To be sensitive to these developments, Function 4 needs knowledge about goals and the performance of the organization. Against this background, developments can be assessed as opportunities and threats (such as economic and scientific developments, advances in production technology and innovative business concepts). Dependent on an assessment of these developments, intelligence may propose the implementation of new organizational goals or activities or the improvement of old ones (cf., Beer, 1979). To formulate the proposals for innovation that may be reviewed by the control function, intelligence also needs knowledge about goals and the actual modus operandi of the business units that are involved in these plans. Proposals for innovation also may have an internal drive (e.g., intelligence searches

for ways to improve primary business activities) and proposals for innovation should somehow either fit into the activities of these business units or be a meaningful complement to them given the core business of the viable system as a whole. To finalize the proposals in a way that is acceptable to the organization, intelligence requires feedback from control. This feedback adds to the knowledge base of intelligence required for the formulation of plans. Table 3 lists the knowledge required by the intelligence function to produce proposals for innovation.

The Policy Function: Knowledge Domains Required for Strategy Formulation

It is the task of the policy function to balance the discussion between control and intelligence about the adaptation of goals and to consolidate the results of this discussion.

To assess imbalances in the discussion between control and intelligence, the policy function needs knowledge about norms for a balanced relation between control and intelligence. It also needs to know about the relative contribution of control and intelligence to the discussion about the proposals for adaptation. Against this background, actual imbalances can be established. To assess these imbalances, policy needs knowledge about their causes. To perform measures that counter imbalances, the policy function needs knowledge about actual imbalances, their causes, and about experiences with the implementation and effectiveness of actions that counter imbalances.

Table 4. Function Five and its related domains of knowledge

| Function | Related domains of knowledge |
|---------------------------|---|
| F5: Function Five, policy | For balancing purposes: Norms for balance between F3 and F4 Proposals by F4 and their reviews by F3 (relative contribution of F3 and F4 to the discussion on adaptation) Actual (im)balance between F3 and F4 Causes of imbalance between F3 and F4 Experiences with regulatory measures to counter the imbalance between F3 and F4 Regulatory measures to counter the imbalance between F3 and F4 For consolidation purposes: Finalized plans for adaptation of organizational goals (a joint F3 and F4 product) Organizational goals |

The consolidation of the results from the discussion between control and intelligence, i.e., finalized proposals for innovation, requires knowledge about these plans. In the VSM, it is specified that policy should minimize its interference in the substance of this discussion (Beer, 1979). Still, to consolidate proposals for innovation made by control and intelligence, policy requires an overview of the organization, its goals and relevant developments in the environment. This overview should not be an in-depth knowledge about every possible detail (control and intelligence deal with detail). It should be an informed feeling for the dynamic interplay between the organization and its environment (Beer, 1979). Table 4 lists the knowledge required by the policy function to balance the discussion about innovation between intelligence and control.

It should be noted that the knowledge domains listed in Tables 3 to 5 only refer to the knowledge that is directly necessary for viability. They do not refer to knowledge that supports producing or processing viable knowledge. An example of supportive knowledge is knowledge about methods to scan the environment. This knowledge supports the production of knowledge about relevant developments in the environment—the viable knowledge in Function 4. Other examples of supportive knowledge are knowledge about how to formulate a strategy, about how to plan,

or about how to operate a particular machine. From the knowledge domains listed in the tables, supportive knowledge can be derived.

PRODUCING AND PROCESSING KNOWLEDGE FOR STRATEGY FORMULATION

This key question of this chapter is how to derive the role of ICT in strategy formulation. To this end, the previous sections unfolded a view on the process of strategy formulation and relevant knowledge domains for this process. Strategy formulation could be captured by the ongoing interaction between the functions of control, intelligence and policy. Relevant products in this process are proposals for innovation, reviews of these proposals, and finalized plans for innovation and their consolidation. To deliver these products, knowledge from several domains should be produced and processed. The question for this section is how the knowledge in these domains is produced and processed. Once it is clear what knowledge processes contribute in producing and processing the relevant knowledge for strategy formulation, the role of ICT in supporting these knowledge processes can be identified.

The question for this section is by means of which processes knowledge in the knowledge

Table 5. Functions, knowledge domains, and knowledge processes for strategy formulation

| Knowledge domains | F1 | F3 | F4 | F5 |
|--|-----|-----|-----|-----|
| goals set by, performance and modus operandi of the primary activities in F1 | G,A | A | A | |
| organizational goals | A | A | A | G,A |
| proposals for innovation made by F4 | | A | G,A | A |
| desired goals for F1 based on proposals for innovation | | G,A | | |
| gap between desired and current goals of F1 | | G,A | | |
| required capacity for reorganization of F1 activities | | G,A | | |
| actual capacity for reorganization of F1 activities | | G,A | | |
| gap between required and actual capacity for reorganization of F1 activities | | G,A | | |
| reviews by F3 of proposals for innovation | | G,A | A | A |
| finalized plans for adaptation of organizational goals (a joint F3 and F4 product) | | G,A | G,A | A |
| regulatory measures to counter the imbalance between F3 and F4 | | A | A | G,A |
| developments in the relevant environment of the organization | | | G,A | |
| norms for balance between F3 and F4 | | | | G,A |
| actual imbalance between F3 and F4 | | | | G,A |
| causes of imbalance between F3 and F4 | | | | G,A |
| experiences with regulatory measures to counter the imbalance between F3 and F4 | | | | G,A |

domains should be “produced and processed” so that the process of strategy formulation can take place. Several authors on knowledge management identify four relevant processes for producing and processing knowledge in general: generating, sharing, retaining and applying knowledge (cf., Achterbergh & Vriens, 2002; Nonaka & Takeuchi, 1995; Leonard & Barton, 1995; Davenport & Prusak, 1998; Bukowitz & Williams, 1999).

Generating organizational knowledge can be done by acquiring external knowledge (e.g., buying, renting or even stealing knowledge) (cf., Davenport & Prusak, 1998) or by means of knowledge creation in a process of learning (Davenport & Prusak, 1995; Nonaka & Takeuchi, 1995). The aim of the process “knowledge sharing” (or dissemination) is to make sure that (existing) knowledge gets to the right place in an organization. To keep knowledge available, some kind of “organizational memory” is needed. The process of “retaining knowledge” refers to the process of storing knowledge and making retrieval possible. The last process is the application or use of knowledge. The other three knowledge processes are subsidiary to applying knowledge.

These four knowledge processes can now be linked to the process of strategy formulation, as formulated according to the VSM. According to the VSM the functions of intelligence, control and policy contribute to strategy formulation. This contribution involves the application of knowledge in the knowledge domains to arrive at the four core products of strategy formulation: proposals for innovation, their reviews, the finalized plans for innovation, and their consolidation. For example, the intelligence function applies its knowledge about environmental developments to produce its proposals for innovation. The knowledge applied by each function is generated either by that function or by one of the other functions of the VSM. In the latter case, knowledge must be shared between functions. For instance, the intelligence function cannot adequately make proposals for innovation when the knowledge about organizational goals and performance is not shared with it. Likewise, the control function cannot review proposals if knowledge about them is not shared. Applying, generating and sharing knowledge requires the retention of knowledge. The policy function, for instance, benefits from storing knowledge about

Table 6. Functional knowledge domains tied to organizational units

| Knowledge domains | Organizational units | | | | | |
|--|----------------------|---------|-----|-----|-----|-----|
| | production | Control | R&D | M&S | ... | BoD |
| goals set by, performance and modus operandi of the primary activities in F1 | G,A | A | A | A | | |
| organizational goals | | | | | | |
| proposals for innovation made by F4 | A | A | A | A | | G,A |
| desired goals for F1 based on proposals for innovation | | A | G,A | G,A | | G,A |
| gap between desired and current goals of F1 | | G,A | | | | |
| required capacity for reorganization of F1 activities | | G,A | | | | |
| actual capacity for reorganization of F1 activities | | G,A | | | | |
| gap between required and actual capacity for reorganization of F1 activities | | G,A | | | | |
| reviews by F3 of proposals for innovation | | G,A | | | | |
| finalized plans for adaptation of organizational goals (a joint F3 and F4 product) | | G, A | G,A | G,A | | G,A |
| regulatory measures to counter the imbalance between F3 and F4 | | | G,A | G,A | | G,A |
| developments in the relevant environment of the organization | | | G,A | G,A | | G,A |
| norms for balance between F3 and F4 | | | | | | |
| actual imbalance between F3 and F4 | | | | | | |
| causes of imbalance between F3 and F4 | | | | | | |
| experiences with regulatory measures to counter the imbalance between F3 and F4 | | | | | | |

the measures it considered to support the discussion between intelligence and control, the reasons why some of them were chosen and the success of these measures.

Table 5 provides an overview of the relation between the five functions in the VSM, the knowledge domains and the application and generation of knowledge in these domains. Based on this table, it is possible to draw conclusions about sharing and storing knowledge. In the table we only included the relevant knowledge for strategy formulation. However, some of this knowledge is generated by Function 1, and this is the reason of its inclusion in the table. For the complete table, we refer to Achterbergh and Vriens (2002).

The first column of Table 5 summarizes the knowledge domains listed in Tables 3 to 5. In this column, we eliminated all redundant entries. Columns two to five indicate whether knowledge in a specific knowledge domain is generated (G) and/or applied (A) by a specific function. Table 5 is reminiscent of the create-use matrices used in information analysis (e.g., Jackson, 1988).

The table makes apparent that some knowledge may be generated by more than one function. For

instance, the finalized plans for adaptation are a joint product of control and intelligence.

Knowledge in the domains listed in Table 5 is generated and applied for either of two reasons. The first reason is to directly contribute to the process of strategy formulation. For instance, making and reviewing proposals for innovation directly contributes to this process. The second reason for generating and applying knowledge is to regulate knowledge processes that directly contribute to the viability of the organization. For instance, knowledge about measures to counter imbalances in the discussion between control and intelligence is generated and applied to regulate the discussion that results in a direct contribution to the viability of the organization: proposals for innovation.

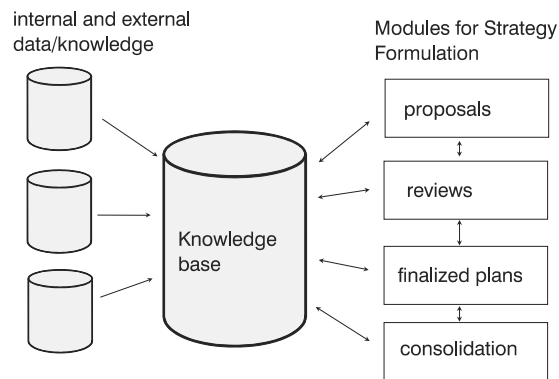
From Table 5, conclusions can be drawn about sharing and storing knowledge. Direct and regulatory knowledge should be shared between functions if it is applied by more than one function. In Table 5, this is indicated by more than one A in a row. For instance, control should share knowledge about its reviews of the proposals of intelligence with intelligence. Knowledge should

be retained in such a way that it can be retrieved by the functions that apply it. Moreover, some knowledge is only generated and applied by one function. This knowledge should be retained in a function-related database. For instance, a database could be designed to support the balancing efforts of the policy function.

Thus far, the discussion focused on the three functions relevant for strategy formulation. We did not yet link these functions to organizational units or individuals. The discussion focused on functions because this enabled us to abstract from the specific organizational embodiment of the functions. Moreover, the model is a recursive model, and can be applied at many organizational levels: at the corporate level, at the level of a business unit and even at levels below that. However, for a practical application of the model (such as deriving ICT support for the process of strategy formulation), it is necessary that designers of ICT make a choice for the level of recursion (e.g., a specific BU) and specify the organizational units and/or individuals that are engaged in realizing the functions. In this specification more than one individual and/or more than one unit may be involved in the realization of one function, and more than one function may be realized by more than one unit and/or individual.

An example of a specific mapping is given in Table 6. This table maps the knowledge domains relevant for strategy formulation onto organizational units. In the columns, for some knowledge domains, it is indicated which units are involved in the generation (G) and application (A) of that knowledge domain. More than one G may appear in the rows, because the generation may be either a joint effort of several units, or the result of several units engaged in the generation of different knowledge in the knowledge domain. For instance, the organizational units “Research & Development,” “Marketing & Sales” and the Board of Directors may all be involved in the generation of knowledge about the environment of the organization—but all with regard to dif-

Figure 2. Outline of an architecture of an information system supporting strategy formulation



ferent aspects of that environment. These three units may also embody Function 3 activities—and review (parts of) the proposals.

To summarize, Table 5 captures the relation between the knowledge needed for strategy formulation and the application and generation of this knowledge in the three VSM functions. (Table 6 further specifies this in that it ties the functional activities to organizational units.) It thus indicates which relations exist between knowledge domains, and hence makes apparent what knowledge should be shared among functions for which reasons. Finally, it indicates what functional knowledge could be clustered and retained in a “functional” knowledge base. This table can be used as a start for deriving possibilities for ICT support for strategy formulation—the topic of the next section.

THE ROLE OF ICT IN STRATEGY FORMULATION

The question for this section is how ICT can support the process of strategy formulation. To answer this question we use the theory from the previous sections to formulate an “ideal” func-

tional architecture for ICT support. Designers of ICT support for strategy formulation may use this architecture to select ICT applications. To be able to select these applications, however, one needs selection criteria. In this section we first present the “functional support architecture.” Then, we discuss selection criteria, and finally we show how designers may use these criteria to select ICT applications to realize the support architecture.

An Architecture for ICT Support of the Process of Strategy Formulation

In the previous sections it became apparent that knowledge from several knowledge domains should be generated, stored, shared and applied to take the steps in the process of strategy formulation: formulating proposals for innovation; reviewing them; making finalized plans for innovation and consolidating them. We use this description to give an outline of an architecture for an information system supporting the process of strategy formulation. This outline is presented in Figure 2.

This information system consists, ideally, of several modules and knowledge and/or databases. The “modules” (at the right in Figure 2) are applications helping to generate the products of the process of strategy formulation. With the help of these modules, the knowledge from the knowledge domains is applied to produce the proposals, reviews, and (consolidated) plans. The information system further consists of a central knowledge base in which the knowledge in the knowledge domains necessary for strategy formulation (see Sections Three and Four) is stored. This central knowledge base, in turn, may receive knowledge from other internal and external knowledge and/or databases. Below, we discuss the modules and knowledge bases in more detail:

1. **The “Proposal” Module:** The goal of this module is to help produce a list of proposals for innovation. The main product is,

therefore, a list of innovation proposals and their justification. To produce this list, one should have access to the knowledge in the relevant knowledge domains. This knowledge may be available (in the knowledge base) or it should be generated. To generate this knowledge (e.g., about technological trends or about trends in sales) the module should have access to external and internal information. For instance, it may have access to a data warehouse by means of a front-end tool or it may have access to external online databases (such as the Lexis-Nexis or Dow Jones database). Further, the module may have access to a database consisting of previously rejected or accepted proposals. The proposals for innovation produced with this module are stored in the central knowledge base.

2. **The “Review” Module:** The input for this module consists of the proposals for innovation. The output is a list of accepted and rejected proposals and the reasons for their acceptance or rejection. To make this list, the module should apply the knowledge in the central knowledge base. This knowledge may be available or may have to be generated. To generate the knowledge, access to several internal and external databases may be required. For instance, to get a clear view on the consequences of a certain innovation for the current production structure, it may be that internal information is required. Also, (external) data on the results of the current pmc’s may be an input for rejecting or accepting innovations. The review module may benefit from a database with (a classification of) reasons for acceptance or rejection.

3. **The “Finalized Plans” Module:** This module is mainly a means for the communication about the proposals for innovation (and their reviews) in order to arrive at a finalized plan. It overarches the proposal and review

module. By means of this module, results of the review module are communicated and used as input for revising the proposals (with the aid of the proposal module). The revised proposals are, in turn, used to produce new reviews (with the aid of the review module), etc. This module should (1) facilitate the communication about the proposals and (2) ensure the finalization of an innovation plan. To these ends, this module could make available to its users:

- the rules for interaction (such as discussion format and deadlines);
- criteria for imbalance in the discussion;
- a monitoring function regarding the imbalance;
- rules/incentives for countering this imbalance;
- an overview of the history of the discussion (as well as an overview of previous discussion).

Implementation could be by means of several Intranet applications (such as a kind of internal discussion site).

4. **The “Consolidation” Module:** This module has as its output the consolidation of (a specific selection of) the innovations on the finalized list of innovations. To make this selection, the argumentations used in the previous modules should be scanned and valued. Its main goal is to communicate the results of the strategy formulation process to relevant parties in the organization. It should communicate (1) the selected innovations, and (2) the reasons for their selection (and possibly their consequences for the current way of “doing business”). It may benefit from a database with (previously successful) communication formats.
5. **The “Central Knowledge Base”:** This module consists of all the knowledge in the knowledge domains relevant for strategy formulation. This knowledge should be stored and made available.

Above, an outline of an architecture for an information system supporting the process of strategy formulation is given. It shows how support should be focused on the products of strategy formulation. Moreover, the focus of the support is on the four knowledge processes involved in the production of proposals, reviews, plans and consolidations. That is, application of knowledge leads to the four products (and to new knowledge). For this production, knowledge from the knowledge domains should be generated, stored and/or shared. This knowledge is (partly) stored in the knowledge base. The knowledge may be generated by using the four modules and/or by using internal/external databases. Furthermore, knowledge from the knowledge domains may be shared by using connections between the modules.

The description of the architecture states the functionalities of the different “modules” in it and how they should be connected. The question for the next two sections is how to realize this support architecture by selecting (or building) proper ICT tools.

Criteria to Select ICT Applications

To determine whether an ICT application is suitable for supporting strategy formulation, we need selection criteria. Since the ICT applications should be tied to the production and processing of knowledge relevant for strategy formulation, ICT should be tailored to the characteristics of the knowledge it should help to deliver and of the knowledge processes it should support. These two types of characteristics make up two classes of criteria. Therefore, before we select supportive ICT applications, we first need to specify these classes of criteria.

As a basis for formulating requirements to ICT applications supportive of strategy formulation, we only take into account criteria intrinsically related to the knowledge and the knowledge processes (generation, sharing, storage, and application) needed to realize the process of strategy formulation. Extrinsic criteria—for instance,

criteria pertaining to costs—will not be taken into account. Moreover, the criteria to characterize knowledge and knowledge processes are chosen in such a way that—in combination—they actually can function as requirements to ICT applications. In combination, they point at some and exclude other types of ICT applications as effective tools to generate, share, store, or apply the knowledge to arrive at the products of strategy formulation.

The first class of criteria relate to the characteristics of the knowledge in question. That is, this knowledge can be:

1. Tacit or explicit (see for instance Nonaka & Takeuchi, 19xx, for this distinction). Tacit knowledge normally refers to knowledge that is not codifiable, while explicit knowledge is. Tacit knowledge, by definition, defies codification by ICT. However, ICT may be used to refer to sources of tacit knowledge—e.g., in the form of a knowledge map (cf., Davenport & Prusak, 1998).

If the knowledge is explicit, further relevant distinctions for the use of ICT are:

2. The knowledge is more or less standardizable. This criterion refers to the “uniqueness” of knowledge. Can the knowledge, for instance, be cast in a priori fixed standard formats (such as number of products under development of competitor X) or not? This clearly is important for the choice of ICT applications.
3. The knowledge is more or less aggregate. Does the knowledge refer to individual facts (client X bought Y at day Z) or to insights at a higher level of aggregation (all clients in a certain period bought so and so much of Y)? It is important to know at what level of aggregation ICT applications should help deliver knowledge. (To be sure, a great deal of ICT applications is, of course, capable of handling more than one level of aggregation.)

4. The knowledge is different in “size” (it may be that it refers to just a few rules or facts such as “Competitor X opens a production facility in region Y,” or it may cover a large knowledge-area).

These characteristics are important in selecting or building any type of ICT application for supporting knowledge processes. However, to support the process of strategy formulation as put forward in this chapter, these characteristics are also important in designing or selecting ICT applications that support the interaction between functions (see Table 1), because, as has been argued, the VSM prescribes different levels of detail for different relations.

The second class of criteria refers to knowledge process characteristics. The knowledge processes:

1. Can be more or less structured. The structuredness of a knowledge process refers to the traditional dimension of “structured versus unstructured tasks” (e.g., Simon, 1961). For instance, predicting trends in the environment may be seen as generating knowledge regarding the knowledge domain “developments in the relevant environment of the organization.” This generation is not very well structured. It is not clear a priori what counts as input for such a decision and it is not clear how and when to label certain environmental events as a trend. Therefore, predicting a trend is an unstructured activity.
2. Require more or less frequent communication. For instance, to produce a finalized plan of innovation, frequent communication is required between representatives of intelligence and control. In this communication process knowledge is shared, generated and applied. The VSM prescribes the level of communication between functions (see Table 1).

Table 7. knowledge characteristics: an example

| SF activity | Knowledge domain | Tacit | Explicit | |
|-------------|-----------------------|--------|-------------------------------|----------------------|
| | | | Potential for standardization | Level of aggregation |
| Proposals | A: ... | Yes | | |
| | B: environment | | | |
| | B.1 Competitors | No | High | |
| | B.2 ecological Trends | Mainly | | |
| | C ... | No | Moderate | |

- Require communication between few or many parties, more or less proximate in space and/or time. Who is involved in the process of strategy formulation can be made apparent by means of matrices such as those given in Table 6. The required frequency of communication, the number of parties involved and the nature of their (lack of) proximity co-determine the selection of ICT applications.

A METHOD FOR SELECTING ICT APPLICATIONS FOR STRATEGY FORMULATION

Given the “architecture of ICT support” for strategy formulation (based on the functions and knowledge domains involved in strategy formulation) and given the criteria to characterize the knowledge and knowledge processes involved, we can now specify how a designer can formulate requirements to select (or build) proper ICT applications. This method consists of three steps: (1) determining the relevant knowledge characteristics, (2) determining the knowledge process characteristics and (3) selecting ICT support for the process of strategy formulation.

Before a designer can take these steps, however, some preliminary requirements should be

met. The method presupposes that the designer has an insight into the products of the process of strategy formulation and its associated knowledge domains. The designer also needs to know which organizational units are involved in the production of the relevant knowledge for strategy formulation. A designer thus requires tables like Tables 5 and 6. In these tables the knowledge domains are given and tied to the process of strategy formulation and to organizational units.

Step 1: Establishing Knowledge Characteristics

The designer should for each activity in the process of strategy formulation specify the knowledge characteristics of the required knowledge in this domain. To this end, a designer may use Tables 2 to 6. If a knowledge domain comprises knowledge that is too heterogeneous for such a characterization, the designer should decompose the knowledge domain into sub-domains and try again.

For instance, to produce proposals for innovation one needs knowledge “about developments in the environment” (see Table 3). However, this knowledge is rather diverse. It may comprise facts about competitors or models about the impact of ecological trends. Knowledge about competitors, in turn, (in terms of facts like net sales volume, product portfolio, etc.) may have different charac-

teristics than knowledge about “the impact of ecological trends.” The latter may be less codifiable and standardizable. A designer should recognize these different types of knowledge, and identify their different characteristics (i.e., codifiability, standardization, level of aggregation).

The result of this step can be presented as a table providing an overview of characteristics of the knowledge that should be generated, shared, stored, and applied to realize the products in the process of strategy formulation in question (Table 7 gives some examples of knowledge types and their characteristics for the strategy sub-process “making proposals for innovation”).

In the table, A, B, etc., refer to knowledge in certain knowledge domains relevant for the strategy sub-process “making proposals for innovation.” B may, for instance, refer to “knowledge about the environment.” B1 and B2 may refer to its re-specification into the specific knowledge-types “knowledge about competitors” and “impact of ecological trends”—which may have different knowledge characteristics. A designer should

make such tables for all activities in the process of strategy formulation.

Step 2: Establishing Knowledge Process Characteristics

In this step, the designer should specify the characteristics of generating, sharing, storing and applying the knowledge specified in the previous step. To this end, the designer needs an overview of the involvement of control, intelligence, and policy in processing the knowledge needed to realize strategy formulation (Tables 2 to 5). Moreover, the designer needs to link this knowledge with the organizational units producing or processing it (Table 6). Given these prerequisites, the designer can, for all the knowledge processes regarding the knowledge in each knowledge domain, specify the process characteristics.

The main activity of the designer, then, is to determine for all classes of knowledge in the knowledge domains (1) the structuredness of generating, applying, sharing and storing the

Table 8. knowledge process characteristics: an example

| SF activity | Knowledge domain | Knowledge process | Structure | Frequency | Parties involved | Distance in space/ time |
|-------------|-----------------------|-------------------|-----------|-----------|---|--|
| Proposals | B1: competitors | Generating | High | Regular | BU X1; Dep. Y; Empl: ... BU X2 Dep. Y, Z Empl. ... | ... |
| | | Applying | Medium | | | |
| | | Storing | High | | | |
| | | Sharing | High | | | BU X1 and BU X2 are in different countries |
| | B2: Ecological trends | Generating | | | | |
| | | Applying | | | | |
| | | Storing | | | | |
| | | Sharing | | | | |
| | ... | ... | | | | |

particular knowledge, (2) the required frequency of generating, applying, sharing and storing the particular knowledge, (3) the parties involved in generating, applying, sharing and storing the particular knowledge, and (4) the proximity (in time, space) of those parties.

The result of this step can be expressed in the form of Table 8. This table, again, only refers to a few knowledge domains regarding the activity “making proposals for innovation.”

In the table, B1 and B2 are, as before, classes of knowledge in the knowledge domain B, “knowledge about the environment.” Class B1 refers to factual knowledge about competitors and B2 to knowledge about the impact of ecological trends. To illustrate this step, only B1 is considered. Factual knowledge about competitors may refer, for example, to the sales volume of a specific customer. The generation of these facts may be highly structured and occur at a regular basis by scanning certain external information sources. The individuals involved in the generation of these facts may be dispersed among different departments in different business units. In the table, it is indicated that certain employees from business unit X1 of department Y and from business unit X2 of departments Y and Z are involved. The application of this factual knowledge for producing proposals for innovation may be less structured, and may be carried out centrally. For knowledge sharing it may be important to know that the parties involved are located in different countries.

In this way, for all classes of knowledge in the different knowledge domains, the characteristics of the knowledge processes may be derived. In some cases, the knowledge processes will share the same process characteristics. In other cases, the designer will have to discriminate between processes to adequately describe the process characteristics. For instance, it may be the case that *generating* knowledge requires the involvement of only a few parties that are proximate to each other in space and time, while *sharing*

the generated knowledge involves many parties distant in space from each other.

Step 3: Selecting ICT Support of the Process of Strategy Formulation

The identification of proper ICT support is based on (1) the support architecture (paragraph 5.1) and (2) the requirements derived from the knowledge and knowledge characteristics (from the previous two steps). This means that the functionalities of ICT applications should match (parts of the) support architecture and the desired requirements. For instance, an application may be built that has (some of) the functionalities of the four modules from the architecture (discussed earlier). Moreover, this application should be designed to deal with the knowledge (process) characteristics.

To arrive at a list of possible ICT applications supportive of the process of strategy formulation (referring to the support architecture and to the derived knowledge and knowledge process requirements), three sub-steps can be given:

1. Express desired ICT support;
2. Analyze current ICT support;
3. Select ICT applications for strategy formulation based on the gap between desired and current ICT support.

Ad. 1 Express Desired ICT Support

To express the desired ICT support, a designer should refer to the support architecture and to the requirements from the previous two steps. Ideally, one may try to find one or more ICT applications realizing the whole support architecture. This means that such applications should have the functionalities as described earlier. The knowledge and knowledge process requirements further specify how ICT applications can be used to support strategy formulation.

With regard to the knowledge requirements, the dimension of tacit versus explicit knowledge

is important. For instance, if it is found that certain knowledge is mainly tacit, specific ICT applications should be used to deal with that kind of knowledge. A suitable application in this case might be a “knowledge-map” (Davenport & Prusak, 1998). Such a map does not try to capture the knowledge, but only refers to the knowledge carriers. For knowledge domains with knowledge that is highly standardizable, other applications may be used. Many authors on the subject of knowledge management give clues on how to match certain ICT applications to certain characteristics of knowledge (e.g., Davenport & Prusak, 1998).

The knowledge process requirements also further specify how ICT applications may support strategy formulation. For instance, these requirements make apparent what parties are involved and what the periodicity of the interaction of these parties is. This knowledge may be used to define access and to design the interaction between parties or applications.

Ad. 2 Analyze Current ICT Support

In this step, the desired functionalities from the support architecture and the knowledge and knowledge process requirements can be used to analyze the adequacy of existing support applications. A designer may draw up a list of current applications and judge to what extent they contribute to the support functionalities and to what extent they meet the requirements. From this analysis, it may, for example, be concluded that:

- the knowledge in the current knowledge base is incomplete;
- there are no applications supporting the generation of a specific kind of knowledge;
- there is no support of the interaction between intelligence and control activities;
- a data warehouse is not tailored to the specific demands of strategy formulation;

- the full range of functionalities is not covered by current applications;
- sharing knowledge that should be shared among “modules” is not supported;
- knowledge is not accessible for the right people.

This list of mismatches between desired and current ICT support should be used in the next step.

Ad 3. Select ICT Applications

Based on the gap between current and desired support of the process of strategy formulation, and based on knowledge about possible ICT tools, a first list of ICT applications may be given. This list may be used for a final selection. In this selection, additional criteria (such as costs or fit in overall ICT architecture) may be used. The final list may be used to plan the development and or purchase of ICT applications (see Turban et al., 2002, for considerations regarding planning of ICT in general).

CONCLUSION

In this chapter, we approached the link between ICT and CI from an angle differing from most treatments. We “redefined” CI as the relevant knowledge used in strategy formulation and proposed to identify the role of ICT for CI as support tools for the knowledge processes involved in the process of strategy formulation. To identify the nature of such tools and to direct the selection of applications that could act as support tools for the knowledge processes involved in strategy formulation, we (1) presented a model of the process of strategy formulation, (2) derived the knowledge relevant for the process of strategy formulation, (3) identified the knowledge processes in which the relevant knowledge for strategy formulation is processed and produced, and (4) used this “theory”

to arrive at an understanding of the role of ICT in the process of strategy formulation.

The model we used for describing the process of strategy formulation is the Viable System Model of Beer. This model is also the point of departure for deriving the relevant knowledge for strategy formulation and the knowledge processes in which this knowledge is produced and processed.

Given the overview of the knowledge needed to be produced and processed for strategy formulation, we formulated—in two steps—a method for tying ICT to the strategy formulation. In the first step we gave an outline of a general architecture of a system supporting the knowledge processes for strategy formulation. This architecture stated the general functionalities of (parts of) a support system. In the second step we discussed how, using the theory from the rest of the chapter, a selection of actual ICT applications for strategy formulation may be supported.

The approach in this chapter presents a different perspective on strategy formulation and the use of ICT for it. It also puts CI software in a different perspective; the approach enables the integration of both external and internal oriented ICT tools for producing intelligence through their support of the knowledge processes in formulating strategies.

REFERENCES

- Achterbergh, J.M.I.M. & Vriens, D. (2002). Managing viable knowledge. *Systems Research and Behavioral Science*, 19, 223-241.
- Beer, S. (1979). *The Heart of Enterprise*. Chichester, UK: John Wiley & Sons.
- Beer, S. (1981). *Brain of the Firm*. Chichester, UK: John Wiley & Sons.
- Beer, S. (1985). *Diagnosing the System*. Chichester, UK: John Wiley & Sons.
- Bukowitz, W.R. & Williams, R.L. (1999). *The Knowledge Management Fieldbook*. Edinburgh: Pearson.
- Cook, M. & Cook, C. (2000). *Competitive Intelligence*. London: Kogan Page.
- Davenport, T.H. & Prusak, L. (1998). *Working Knowledge*. Boston, MA: Harvard Business School Press.
- Espejo, R., Schumann, W., Schwaninger, M., & Bilello, U. (1996). *Organizational Transformation and Learning*. Chichester, UK: John Wiley & Sons.
- Fuld, L.M. (1995). *The New Competitor Intelligence*. Chichester, UK: John Wiley & Sons.
- Jackson M. (1988). *Jackson System Development*. New York: Prentice Hall.
- Johnson, G. & Scholes, K. (1999). *Exploring Corporate Strategy* (5th edition). Hertfordshire: Prentice Hall.
- Kahaner, L. (1997). *Competitive Intelligence*. New York: Touchstone.
- Leonard-Barton, D. (1995). *Wellsprings of Knowledge*. Cambridge, MA: Harvard Business School Press.
- Nonaka, I. & Takeuchi, H. (1995). *The Knowledge Creating Company*. New York: Oxford University Press.
- Teo, T.S.H. & Choo, W.Y. (2001). Assessing the impact of using the Internet for competitive intelligence. *Information & Management*, 39, 67-83.
- Turban, E., McLean, E., & Wetherbe, J.C. (2002). *Information Technology for Management* (3rd edition). New York: Wiley.
- Vriens, D. & Hendriks, P.H.J. (2000). Viability through Web-enabled technologies. In M. Khosrowpour (Ed.), *Managing Web-Enabled Technology*

Enabling Strategy Formulation by ICT

gies in Organizations: A Global Perspective (pp. 122-145). Hershey, PA: Idea-Group Publishing.

Vriens, D. & Philips, E.A. (1999). Business intelligence als informatievoorziening voor de strategievorming. In E.A. Philips & D. Vriens (Eds.), *Business Intelligence*. Deventer: Kluwer.

This work was previously published in Information and Communication Technology for Competitive Intelligence, edited by D. Vriens, pp. 85-113, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.7

Media Life Cycle and Consumer–Generated Innovation

Yuichi Washida

Hakuhodo Inc.

The University of Tokyo, Japan

Shenja van der Graaf

LSE, UK

Eva Keeris

Utrecht University, The Netherlands

ABSTRACT

This study examines the innovation in communication media, based on empirical survey results from five countries. First, the authors create a general framework of the media life cycle by exploring the replacement of communication media used in daily life. The shift from voice communications to mobile e-mailing is at the forefront of the media life cycle in the personal communication area. This framework also implies future media replacements in other countries. Second, by comparing two empirical surveys, done in 2002 and 2003, of communication means used among Japanese family relations, the authors

discover that certain consumer clusters lead in the innovation of communication media. This framework and discovery can be useful to deal with the vacuum between conventional media studies and the latest information technology.

DIFFUSION OF NEW COMMUNICATION MEDIA

The wide and rapid diffusion of the use of e-mail and mobile phones, called cell phones or currently smart phones in the U.S., has entirely changed the paradigm of human communications. We use e-mail and mobile phones as a part of our

everyday life. These two communication means, major products of information and communication technologies (ICTs) during the last two decades, are gradually replacing some conventional communication means, such as physical mailing or talking on fixed phones. These replacements can also change human behavior and may create new social norms and cultures. Obviously, the driving forces behind these replacements are the massive marketing activities of dot com companies and telecom operators.

However, there has been a relatively small number of social science researches on these areas because the technology changes so rapidly. Relentless and endless change of information technology is problematic for academic social science research, when it faces cutting edge technology. That kind of technology always threatens to overturn the conventional social context with rather destructive ways, and then it is difficult for scholars and academic researchers to examine the actual impact of each technology. But, we should not think that a new communication means supported by such a new technology is not a suitable subject for academic research. Looking at it from the viewpoint of social norms and cultural transition, even the newest communication means can be examined scientifically.

The most important point in the examination of the communication means and new technologies is, we believe, the innovation processes that occur while these technologies diffuse among users or consumers. Investigating the changes of interpretation in our society for each communication means and its technology is especially significant from a social scientific viewpoint. According to a common framework of innovation analysis, such as Rogers' (1995), innovation is not merely a technological matter, but the diffusion of a new understanding and behavior toward the technology. Moreover, Von Hippel (1988) examined a lot of examples in which certain user communities can act as sources of innovations. In fact, in some cases suppliers follow the innovations

created by users, instead of creating innovations by themselves. By investigating such innovation processes, we can examine the evolution of social norms and emergence of new cultures rather than merely tracing superficial trends of ICTs.

In this chapter, we would like to focus on the role of each user cluster throughout the innovation process that has taken place since new ICTs began affecting human communications. Inevitably, there are many different usage patterns by consumer cluster, such as age, class, family relation, and gender, with new electronic communication means, as well as those within conventional, face-to-face, communication means. Especially, the gender effects on the new communication usage should be considered more. As a matter of fact, many people point out that most ICTs have been developed by males, and thus, principles of these technologies have obviously been "masculine." Rogers also pointed out that especially in the ICT area in the middle 1980s, there was a significant difference of usage and innovation patterns by gender (Rogers, 1986), due to the gap of mathematical performance between male students and female students.

However, in the late 1990s, the situation began to change. Especially when useful graphical user interfaces (GUIs) were introduced into the ordinary consumer market, ICTs became much friendlier to all kinds of people. The wider the penetration of these new communication means has grown, the more supported they have become by ordinary people including women, instead of by masculine techno-fanatics. Based on these intuitive observations, we think that a certain kind of gender study in these areas will have a particular importance.

CENTRAL QUESTION AND HYPOTHESIS

In this article, we focus mainly on the case of Japanese mobile phone usage. The Japanese mobile

phone penetration rate is now approximately 70%, which means the diffusion process has already reached the “majority” stage (Rogers, 1995). In the majority stage, we can see an interesting target-switch phenomenon from male-dominant user clusters to female-dominant ones in Japanese high-tech sectors (Washida, 2005). Moreover, after this target-switch phenomenon, Japanese mobile phone services achieved greater technological innovations. This observation implies that today’s prominent innovations of Japanese mobile phone products are driven by the requirements of female users. We would like to call this type of phenomenon *consumer-generated innovation* or *the demand side innovation*, with which we can theoretically define that certain types of technological innovations emerge among users, in other words, the demand side, not the supply side.

In neoclassical economics, however, scholars have thought that all innovations are supplied by producers, and consumers can only choose good products that consist of good technologies and are sold at appropriate prices. This perspective is one of the most basic views in neoclassical economics, in which almost all of the neoclassical economic theories, such as supply and demand curves theory, the economical equilibrium theory, and a series of the marginalism theories, are built. We can say that these theories are some of the fundamental settings of today’s capitalism, especially in the 20th century. Moreover, these perspectives and economic theories have deeply influenced the major ideas in conventional media studies. Therefore, in conventional media studies, new technologies that created new media have been considered a “given” element in society. In fact, most innovations in mass media, such as broadcasting technology, writing narratives for various broadcasting programs, creating sounds and visual images, and acting in mass media, were “supplied” by a very limited number of people, compared with the millions of people making up the audience in a society. In other words, in

mass media, making innovations has been highly centralized.

However, today’s rapid development in the ICTs brings a new stage in media history. The ICT innovations are much more distributed, therefore, not only a small company, but also every ordinary user can make an innovation by adding a new meaning or value to a new technology. Although this characteristic of ICTs is intuitively apparent, few researchers empirically validate the emergence of this new stage of media history. We should say that the distributed characteristic of ICTs and their demand-side innovation effects can be important elements of the innovation in the big picture of media transition history.

The major purpose of this chapter is to examine the innovation process carried by the demand side, and explore the trajectory of near-future media transition. Which medium in which country emerges in the forefront of the media history in taking a global overview of media innovation? How social norms have been compiled in ICT usages? Who actually leads the current ICT innovation in our society? What is the difference between male users and female users? To examine potential answers for these questions, we have conducted two series of empirical surveys. The technical hypothesis for the surveys is addressed in two steps.

First, for Method 1 to identify which medium in which country is at the forefront of the media transition, we have compared frequencies of use of several electronic communication means by country. By examining the result of Method 1, we could learn which electronic communication means is dominant in each country, and which confirmed that mobile phone usage in Japan is in a unique circumstance. Based on the results of Method 1, we concluded that current increase of Japanese e-mailing use via mobile phones should be considered as the forefront of the global media transition. Second, for Method 2 to validate that a certain type of innovation emerges on the de-

mand side, we surveyed, in both 2002 and 2003, the usage patterns of communication means in Japanese families. By comparing these two-year results, we could see changes in usage patterns during the period and distinguish which user cluster has led the change. Moreover, by adding ethnological analyses toward such Japanese usage patterns, we concluded that emerging Japanese female usages led major ICT innovations during the period. Details of both methods are explained in the following sections and appendix.

METHOD 1: COMPARATIVE SURVEY ON COMMUNICATION MEDIA ENVIRONMENT

Method 1 consists of an international comparative survey program, named Media Landscape Survey 2003-2004 (MLS), which includes comparative surveys in the U.S., The Netherlands, Sweden, South Korea, Japan, and China. All six surveys used the same questionnaire translated into each language. The survey targeted people age 15-34. The major purpose of the survey was to examine the communication media environment in each country. The total sample size was 2,578 (details of the surveys are included in the appendix). In each survey we asked respondents about several aspects of communication behavior using fixed phones, mobile phones, e-mailing, instant messaging, and Web logs. Regarding mobile phones, we asked them about both the call usage and the e-mail usage. We also asked respondents whether they used online game sites and music file-sharing sites.

Based on MLS, in Method 1, we compared the usage of several communication means in five countries (the United States, The Netherlands, Sweden, South Korea, and Japan), but not in China. MLS is basically done for those who are interested in using various digital communication means in their daily lives. The five countries are relatively well developed in terms of digital communications, which are common enough to represent “ordinary”

life in each country, while China is still developing. For instance, the penetration rate of PCs in China is approximately 5%; therefore, we have to say Chinese results in MLS do not represent “ordinary” Chinese lifestyle to any certain extent. Thus we exclude Chinese data in Method 1.

The purpose of Method 1 is to take an overview of each communication means usage and to map them. By doing so, we try to investigate the meanings of each communication means in the social norms and culture. As we focus on mobile phones in this article, we identify the meaning of mobile phones in the various communication environments. Of course, every country has a unique society and culture that is reflected in each country’s usage pattern. However, by comparing five developed countries’ results, we can see some general macro tendencies.

RESULT OF METHOD 1

Tables 1-3 show percentages for each communication means usage per day and by country. In Table 1, we can see the daily usage of calls on fixed phones for personal purposes. In many countries 40-70% of ordinary people make fixed phone calls at least once a day, but not in Japan. Also, Table 1 reflects the same information on mobile phone calls, and we find that the overall tendency is very similar to that of fixed phones. Generally speaking, fixed phones and mobile phones compete with each other, and their usages seem to cannibalize one another. But it is interesting that in our survey, call usage on fixed phones and on mobile phones actually tends to be in direct proportion to one another, rather than in inverse proportion.

As shown previously, people in Japan do not make as many phone calls as do people in other countries. Of course, being a well developed country, Japan does not suffer from a weak telecommunication infrastructure. Obviously, the low usage of phones to make phone calls indicates that

Table 1. Usage of personal calls on fixed phones and mobile phones per day in each country (in %)

| Country | Number of respondents | Frequency of usage More than once a day |
|--|-----------------------|---|
| Personal Calls on Fixed Phones | | |
| Netherlands | 177 | 41.0 |
| Sweden | 351 | 72.9 |
| USA (East Coast) | 850 | 62.1 |
| Japan | 400 | 12.6 |
| South Korea | 400 | 47.0 |
| M | 2178 | 47.1 |
| SD | 2178 | 21.7 |
| Personal Calls on Mobile Phones | | |
| Netherlands | 177 | 63.3 |
| Sweden | 351 | 61.1 |
| USA (East Coast) | 850 | 74.9 |
| Japan | 400 | 31.8 |
| South Korea | 400 | 80.7 |
| M | 2178 | 62.4 |
| SD | 2178 | 18.6 |

Note: All numbers of data above are verified to have significant differences against the mean with the significance level $p < .05$, in the parametric statistical test -Dunnnett test (multiple comparison).

in Japan voice communications are now being replaced by other communication means.

Therefore, we must determine what other communication means are replacing phone calls in Japan. The most conceivable answer is a variety of text messaging services. Table 2 and Table 3 show the daily usages of e-mailing services via PCs, instant messaging, and e-mailing services via mobile phones, respectively.

Table 2 reflects the usage of regular e-mailing services via PCs and PDAs. E-mailing services have been developed based mainly on PC-based networks. In MLS, we classified e-mailing via PDAs as a variation of regular e-mailing services because in many cases of PDA-based e-mailing usage, users are connected by the same type of network as PC-based ones, even though the physical shape of PDA usage is similar to the usage of mobile phones. Interestingly, Table 2 shows a cul-

Table 2. Usage of personal e-mailing via PCs or PDAs, and instant messaging per day in each country (in %)

| Country | Number of respondents | Frequency of usage More than once a day |
|---------------------------------|-----------------------|---|
| Emaining via PCs or PDAs | | |
| Netherlands | 177 | 68.8 |
| Sweden | 351 | 65.7 |
| USA (East Coast) | 850 | 74.8 |
| Japan | 400 | 42.8 |
| South Korea | 400 | 32.8 |
| M | 2178 | 56.9 |
| SD | 2178 | 17.5 |
| Instant Messaging | | |
| Netherlands | 177 | 29.0 |
| Sweden | 351 | 39.8 |
| USA (East Coast) | 850 | 41.4 |
| Japan | 400 | 11.5 |
| South Korea | 400 | 50.8 |
| M | 2178 | 34.5 |
| SD | 2178 | 19.2 |

Note: All numbers of data above are verified to have significant differences against the mean with the significance level $p < .05$, in the parametric statistical test -Dunnnett test (multiple comparison).

tural or historical difference of writing behaviors among Western countries and Eastern countries. In Western countries, word processing culture has a long history, reflected in the wider usage of PC-based e-mailing. Conversely, Eastern countries have a long history of handwriting and relatively short history of word processing, and thus e-mail usage in Eastern countries is less popular, although South Korea and Japan have very high penetrations of PCs and Internet usage.

Therefore, according to our data, we cannot say PC-based e-mailing services are effectively replacing Japanese voice communications. Also, Table 2 shows the usage of instant messaging. It is a relatively new, PC-based text messaging service, by which users can see a message automatically as soon as it arrives. Because of its convenience and quickness, instant messaging is becoming popular especially among heavy Net users. Moreover,

Table 3. Usage of personal e-mailing/SMS via mobile phones per day in each country (in %)

| Country | Number of respondents | Frequency of usage More than once a day |
|------------------|-----------------------|---|
| Netherlands | 177 | 28.4 |
| Sweden | 351 | 36.7 |
| USA (East Coast) | 850 | 5.1 |
| Japan | 400 | 51.0 |
| South Korea | 400 | 18.3 |
| M | 2178 | 39.9 |
| SD | 2178 | 22.0 |

because instant messaging is usually used among “trusted” relations, it can relatively keep users away from spam mails and virus mails. The five countries in MLS are all well developed regarding Internet connectivity; Table 2 shows that 30-50% of Net users in these countries are using instant messaging, except those in Japan. Only in Japan, the percentage of the instant messaging usage is approximately 10%. Here again, we cannot say that Instant messaging, also a PC-based text messaging service, is replacing Japanese voice communications.

Finally, Table 3 shows the usage of mobile e-mailing services, or short messaging services (SMS). Here we find a popular use of it in European countries and especially in Japan. In the U.S. and South Korea, the usage of mobile e-mailing is not very popular, even though penetrations of mobile phones are not low in these two countries, per se. Interestingly, comparing Table 3 with Table 1, we can see the average shapes of mobile phone usage by country. In the U.S. and South Korea, voice communication is much more superior to mobile e-mail communications, while in Japan mobile e-mail communication is entirely dominant. In The Netherlands and Sweden, both voice and e-mail communications are equally popular. Based on this understanding, we can say that in Japan the frequent usage of mobile e-mail communication—in

this case more than 60% of total respondents—is replacing voice communication.

THE MEDIA LIFE CYCLE

Summing up these survey results, we can envision a framework for the life cycle of a variety of communication media. When a new communication medium appears and becomes popular, an old one becomes obsolete and begins to decline. The important point here is finding a phenomenon of usage decline, rather than merely an emergence or increase of a new medium usage, because a declining phenomenon directly means a replacement of media, and the replacement implies the existence of the media life cycle. In other words, if we observe a declining phenomenon among consumer behaviors, it proves that there emerges a replacement of medium and its technology by other new media and their new technologies. We can define the media life cycle as this alternation of media and their technologies.

In our MLS, the declining phenomenon is seen in the case of Japanese voice communication. We have also found that mobile e-mail communication is becoming the alternative of voice communication. At this point, we cannot see any other declining phenomenon in the other countries. This strongly implies that Japanese society stands at the forefront of the media life cycle due to the wide penetration of mobile e-mail communication.

It is interesting, however, that PC-based text messaging services, such as regular Internet e-mail services and instant messaging, do not seem to replace any other old communication medium, even though many analysts have pointed out that the Internet has started to replace some conventional mass media. For instance, it is true that certain kinds of newspapers, magazines, and music CDs are now in danger of decline due to the massive penetration of the Net media. How-

Figure 1. The framework of the media life cycle

| | Mass Media one-way-based communication: basically one-to-many | Personal Communication Media interactive-based communication: basically one-to-one |
|--|---|--|
| Generation A: (before the 20th century) The initial shape of public communication system with paper | Mass print media (include newspapers and magazines) | Physical mail |
| Generation B: (the 1st half of the 20th century) Telecommunication with voice and sound | Radio broadcasting | Calls on telephones (include both fixed and mobile) |
| Generation C: (the 2nd half of the 20th century) Transferring rich contents with multiple-channels | TV broadcasting (includes cable TV) | Email via PCs (include instant messaging) |
| Generation D: (beginning of the 21st century) Allowing users to establish communication completely on-demand | Internet portals (include news groups and file sharing) | Email via mobile phones |

ever, in the personal communication arena that we see in MLS, instead of the mass media arena, the Internet is not a threat for conventional communication media at this point. In other words, there is coexistence between the Internet and conventional communication media.

Comparing mass media and personal communication media, we can also generalize the media life cycle to be a wider map of media transitions, as in Figure 1, which includes a variety of media and technologies we use in our everyday life. The two columns, which follow, represent mass media and personal communication media, respectively, and the four rows represent four generations of media, chronologically. By nature, mass media is based on a one-way communication, from one supplier to many audiences, while personal communication is based on an interactive communication among "one-to-one" relations.

First, Generation A indicates a primitive shape of public communication in each arena, which mainly consists of paper and ink. We can classify various print media, such as newspapers and magazines in mass media and physical mail in the

personal communication media. The technology that supports Generation A media was invented several 100 years ago. These media were widely developed as public communication services long before the 20th century. However, because Generation A media are very useful and efficient in many ways, most of them survive as a part of the basic social infrastructure and coexist with new generation media even now.

Second, Generation B indicates the emergence of telecommunications with relatively simple voices and sounds in the early 20th century. We classify radio broadcasting in the Generation B mass media, and calls on telephones in the Generation B personal communication media. The basic technologies that developed the Generation B media were invented at the end of 19th century, but the public communication services for ordinary consumers using these technologies began in the early 20th century. Telecommunications enabled us to communicate, and therefore to overcome any time lag, even when there is a considerable distance between communicators. Inevitably, this was one of the most important developments of the 20th century.

Third, Generation C indicates that we can communicate a great variety of content, such as visual images, movie images, and high quality stereo sounds, through multichannel information distribution systems. TV broadcasting systems and e-mail via the Internet are classified in this category. Thanks to advanced telecommunication techniques and broader bandwidth of transmission networks, we can exchange rich content among ourselves. This revolutionary media environment gave birth to an extremely creative visual culture in the late 20th century. The visual culture is so impressive that it has overshadowed the former generation media. Actually, radio broadcasting began to decline under the influence of TV broadcasting, and physical mail began to decline due to a massive increase in e-mailing. However, as previously mentioned, e-mailing has not begun to replace voice communications at this point.

Finally, Generation D enables us to access rich content whenever and wherever we want. In this sense, Generation D is the second wave in the process of being able to overcome distance and time as Generation B did. However, we need to examine carefully what the difference is between TV broadcasting and Internet portals, or between e-mail via PCs and e-mail via mobile phones.

Let us start with Internet portals and TV broadcasting. When we compare newsgroups in Internet portals with conventional news on TV, what is the actual benefit from it? The answer may be its chronological nonlinearity and ubiquity of news content. From a news list of Internet newsgroups, we can obtain any news in any order we want to see it, while we have to obey the program schedule of broadcasting stations if we want to receive the same content from conventional TV news programs. In general, TV news programs are designed in a chronological order. Consequently, we have to behave synchronously when we depend on TV news. Conversely, if we regularly obtain information from Internet newsgroups, we are free from such synchronicity, using our limited time resources more efficiently. Moreover, Internet

newsgroups are also free from geographic limitations. By nature, conventional TV news programs focus on individual regions and countries, limiting the scope of news content. However, we can watch and read all countries' news simultaneously with Internet portals.

Next, let us examine the actual benefit from using mobile e-mail instead of regular e-mail via PCs. We find the same benefit: a chronological nonlinearity and ubiquity in communicating with others. We can receive and send mobile e-mail immediately, wherever we are. This does not mean that we are only free from geographical limitations of Net accessibility, but also from chronological limitations of communication. As many mobile e-mail users know, constant and seamless connection between friends and family consequently dispels a feeling of time lag between sending and receiving and creates a comfortable feeling of "always being linked." In general, when we send e-mail via PC, we cannot expect the receiver to immediately read it, because the receiver is not necessarily in front of a PC. But in the case of mobile e-mail, especially in Asian and European countries, we can expect the receiver to see the e-mail immediately, even though the receiver may not reply to it instantly. This difference of expectation in the receiver's behavior makes the sender feel more connected. It is curious that the loss of communication time lag leads us to a loss of chronological limitation of e-mailing behavior, even though the actual transaction of e-mail exchange in mobile e-mail is more chronological than regular e-mail via PCs. However, it is unfortunate that in the U.S., due to the low penetration rate of mobile e-mail usage at this point, ordinary U.S. people have not experienced this feeling yet.

One may think these benefits from Generation D are not absolute technological improvements but merely false benefits in the users' minds. However, from the viewpoint of social norms, we believe that the benefit in the user's mind is the most important thing. Users have spontaneously

changed the meaning of communication and its technology from *interactive* to *on-demand* in the case of Internet portals, or, from *wireless* to *ubiquitous* in the case of mobile e-mail.

Of course, the framework of the media life cycle shown in Figure 1 may seem to be overly generalized to some extent, and we can be more careful to examine each medium's specific meaning in each period. However, by having a macro viewpoint as in this framework, and especially by observing the replacement of a conventional medium by a new medium, we can understand the meaning of each technology in our society.

CONVENTIONAL MEDIA STUDIES AND ICTS STUDIES

To maintain the theoretical history of media usages, the analysis of the newest media, such as the Internet and mobile phones, is not sufficient at this point. We hope that our framework of the media life cycle can be helpful to fill this vacuum to some extent. One of the most typical of conventional media analysis frameworks is Harold Innis's (1951). He classified various media into two categories, time-binding media and space-binding media, by using the terminology *media bias*. The time-binding media includes manuscripts and oral communications, and are favorable to relatively close communications in a community, while the space-binding media includes all of print media, mass media, and probably current ICTs, and are concerned with today's wide variety of commercialism. Innis and Marshall McLuhan, Innis's colleague at The University of Toronto, thought that media and technologies were "given," and media, per se, could be messages to our society. This approach is so-called *media determinism*, and is a popular approach in media studies, journalism, and critical studies even now. This approach is quite useful to compare the magnitude of influences of various media regardless of the content of each communication. In fact, we can

see a variety of examples in which current critical media researchers use a theoretical framework that can be evaluated as a natural evolution of Innis's approach. For instance, Chesbro and Bertelsen (1996) show a media comparison framework using three categories of media classification, oral culture, literal culture, and electric culture, and explore each characteristic of these three types.

The approach of media determinism has been, of course, significant since we have observed the history of media, especially the evolution of mass media and its culture, during the decades in the middle and latter 20th century. But it is also obvious that such types of frameworks are no longer efficient enough to classify the current vast number of emerging media that includes advanced mass media and ICTs. Media determinists think that all kinds of media must be extensions of the human body, in other words, ways of self-expression. In this perspective, technology is always defined as a "given" thing, and thus it is hard to examine the degree of participation of ordinary people within the technological innovation. In the ICT area, innovation and user participation are both indispensable aspects to examine its social impact. Therefore, we have to think that media determinism is not sufficient to become a basis of our media life cycle framework.

On the other hand, Rogers (1986) has also tried to build a new framework of media classifications based on his diffusion theory. He thinks media and technologies should be "variables" in human and organizational communications, instead of a "given" thing (p. 121). This approach is more efficient to include any emerging technology, because we can add a "variable" of communications on the same framework when one new medium emerges. In this article, we basically adopted his approach and tried to widen the map to include the latest situation by adding current ICT analyses. However, Rogers did not sufficiently analyze the dynamics of technological replacements in the media innovations, because in the 1980s and the beginning of the 1990s, no ICT was powerful

enough in our society to encompass the conception of the media life cycle. As we showed with a variety of empirical survey results, today we can observe a clear signal of the replacement phenomena between old and new media. Therefore, we can build this media life cycle framework in this article.

By using our framework of the media life cycle, we can foresee the future changes of our communication behavior, both in the sphere of mass media and the sphere of personal communication. In the sphere of personal communication, mobile e-mailing is now replacing voice communications through telephones. In other words, Generation D media can replace Generation B media, while Generation D media can coexist with Generation C media. At this point, this replacement phenomenon appears only in Japan. But in the near future we may observe a similar transition in other countries in proportion to the technological innovation in mobile e-mailing. On the other hand, in the sphere of mass media, we do not observe a similar phenomenon at this point. But according to this theory, Internet portals (Generation D in the sphere of mass media) can replace radio broadcasting (Generation B in the sphere of mass media) in the near future in proportion to the technological innovation. For example, the distribution of new songs from music creators to ordinary listeners, one of the important functions of radio broadcasting, is now being replaced by MP3 music file sharing through a certain kind of Internet portal. In fact, the current MP3 controversy has been caused by a threat against new technology among present media business, not by any theoretical correctness, or any change of the ways of self-expression among music creators. In other words, the anticipation of the media replacement between Generation D and B even in the mass media sphere is already shared widely among many people.

Table 4. Communication rate, using electric communication means in daily life, with family members in Japan (in %)

| Person with whom the respondent communicates | Communication rate in each year | |
|--|---------------------------------|----------------|
| | 2002 (n = 89) | 2003 (n = 200) |
| Mother | 82.9 | 81.0 |
| Father | 57.3 | 55.0 |
| Sister | 48.0 | 45.0 |
| Brother | 47.3* | 31.5* |
| Spouse | 43.7* | 29.0* |
| Cousin | 10.9 | 15.5 |
| M | 48.4 | 42.8 |
| SD | 21.2 | 21.1 |

Note: All numbers of comparison data between 2002 and 2003 above are tested by the parametric statistical test –T-test. *p < .05.

METHOD 2: A COMPARISON OF 2002 WITH 2003 IN JAPAN

Our next goal is to distinguish the exact user cluster that leads to innovation in the media life cycle. In this section, we especially focus on Japanese mobile e-mail usage as a good example of the forefront of media innovation. By investigating the forefront of the innovation in detail, we can understand what the innovation of media is.

We conducted a small, preliminary survey in 2002 that had the same questions as the MLS in 2003. Both surveys asked respondents about electronic communications with family members, all of which can represent typical communication patterns in a daily life. By comparing the two-year survey results, we can empirically distinguish one user cluster from another to determine who led the innovation from voice communications to mobile e-mailing. The preliminary survey was taken only by Japanese people aged 18-29. Then we selected a similar respondent bracket in MLS to compare results as precisely as possible.

Table 4 indicates the comparative results of the same question, in the preliminary survey in 2002 and MLS in 2003, regarding the communication rate with six family members using electronic communication means. Here it excludes any face-to-face communication. Due to a slight difference between survey methodologies from 2002-2003, the reactions in 2003 seem to indicate a reluctance to provide information. But, as a whole, we find little difference between the two survey results. The order of the surveyed family members by the communication rate in both survey results is completely the same, and the communication rates themselves have not changed greatly during 2002

and 2003. It is interesting to note the correlation between the order of family members surveyed and the descending level of their response rate. We can say that, in general, the condition of Japanese communications, using electronic means, among family members has remained unchanged.

On the assumption that the general condition of Japanese communications is unchanged, in Method 2, we wanted to see whether there was any local change in the usage rate among family members during the period. If we could observe that, we would be able to identify the forefront of media replacements along with the media life cycle framework. In other words, who led it, and how did they do this?

Table 5. Comparison of communication media usage between 2002 and 2003 in Japan (in %): Male

| Person with whom the respondent communicates | Communication rate | | Number of respondents | |
|--|--------------------|-------|-----------------------|------|
| | 2002 | 2003 | 2002 | 2003 |
| Calls on fixed phones | | | | |
| Mother | 38.7 | 33.2 | 31 | 78 |
| Father | 43.5 | 32.1 | 23 | 56 |
| Brother | 10.0 | 10.3 | 20 | 29 |
| Sister | 6.3 | 24.4 | 16 | 41 |
| Calls on mobile phones | | | | |
| Mother | 45.2 | 42.3 | 31 | 78 |
| Father | 47.8 | 44.6 | 23 | 56 |
| Brother | 60.0* | 24.1* | 20 | 29 |
| Sister | 37.5 | 24.4 | 16 | 41 |
| SMS or email via mobile phones | | | | |
| Mother | 12.9 | 20.5 | 31 | 78 |
| Father | 4.4 | 10.7 | 23 | 56 |
| Brother | 25.0 | 48.3 | 20 | 29 |
| Sister | 50.0 | 39.6 | 16 | 41 |
| Email via PCs or PDAs | | | | |
| Mother | 3.2 | 1.3 | 31 | 78 |
| Father | 4.4 | 9.3 | 23 | 56 |
| Brother | 5.0 | 10.3 | 20 | 29 |
| Sister | 6.3 | 4.9 | 16 | 41 |

Note: All numbers of comparison data between 2002 and 2003 above are tested by the parametric statistical test -T-test. *p < .05.

Table 6. Comparison of communication media usage between 2002 and 2003 in Japan (in %): Female

| Person with whom the respondent communicates | Communication rate | | Number of respondents | |
|--|--------------------|-------|-----------------------|------|
| | 2002 | 2003 | 2002 | 2003 |
| Calls on fixed phones | | | | |
| Mother | 39.5 | 42.9 | 35 | 84 |
| Father | 28.6 | 29.6 | 28 | 54 |
| Brother | 0.0 | 5.9 | 22 | 34 |
| Sister | 11.1 | 10.2 | 25 | 49 |
| Calls on mobile phones | | | | |
| Mother | 44.2 | 28.6 | 35 | 84 |
| Father | 53.6 | 31.5 | 28 | 54 |
| Brother | 27.3 | 26.5 | 22 | 34 |
| Sister | 14.8 | 8.2 | 25 | 49 |
| SMS or email via mobile phones | | | | |
| Mother | 14.0 | 25.0 | 35 | 84 |
| Father | 7.2* | 33.3* | 28 | 54 |
| Brother | 36.4 | 52.9 | 22 | 34 |
| Sister | 59.3 | 73.5 | 25 | 49 |
| Email via PCs or PDAs | | | | |
| Mother | 2.3 | 1.2 | 35 | 84 |
| Father | 10.7 | 3.7 | 28 | 54 |
| Brother | 36.4* | 11.8* | 22 | 34 |
| Sister | 14.8* | 2.0* | 25 | 49 |

Note: All numbers of comparison data between 2002 and 2003 above are tested by the parametric statistical test -T-test. *p < .05.

Table 7. Means and standard deviations in Tables 5 and 6 (in %)

| Male | | | | | | |
|--|-------------------------------|------|------|------|-----------------------|------|
| Person with whom there-spondent communicates | Means and Standard Deviations | | | | Number of respondents | |
| | 2002 | | 2003 | | 2002 | 2003 |
| | M | SD | M | SD | | |
| Mother | 25.0 | 17.4 | 25.0 | 12.0 | 31 | 78 |
| Father | 25.0 | 20.7 | 25.0 | 15.0 | 23 | 56 |
| Brother | 25.0 | 21.5 | 25.0 | 15.6 | 20 | 29 |
| Sister | 25.0 | 19.2 | 25.0 | 12.4 | 16 | 41 |
| Female | | | | | | |
| Person with whom there-spondent communicates | Means and Standard Deviations | | | | Number of respondents | |
| | 2002 | | 2003 | | 2002 | 2003 |
| | M | SD | M | SD | | |
| Mother | 25.0 | 17.4 | 25.0 | 15.0 | 35 | 84 |
| Father | 25.0 | 18.4 | 25.0 | 12.1 | 28 | 54 |
| Brother | 25.0 | 14.9 | 25.0 | 18.2 | 22 | 34 |
| Sister | 25.0 | 19.9 | 25.0 | 29.1 | 25 | 49 |

RESULT OF METHOD 2

In this section, in order to make all analyses simple and clear, we examined the survey results based on communications with four major family members, mother, father, brother, and sister, and by four typical electronic communication means; calls on fixed phones, calls on mobile phones, e-mail via PCs and PDAs, and e-mail via mobile phones. Table 5 and Table 6 indicate usage rates for all combinations of family members by communication means. Table 5 shows changes between 2002 and 2003 among male respondents, and Table 6 shows the same result among female respondents.

In Table 5, we notice that calls on mobile phones to brothers significantly decreased during the period of 2002-2003, while there seemed to be no significant change in other respects. On the other hand, in Table 6, we find a couple of significant changes and some interesting tenden-

cies in female usages; calls on mobile phones to both parents tended to decrease, while e-mail via mobile phones with both parents and sisters tended to increase. E-mailing via PCs and PDAs significantly decreased. The means and the standard deviations are indicated in Table 7.

Table 8 focuses on the increase or decrease of each communication means by measuring the average usage rate of each communication means in total amount of usage with four family members. The average usage rate of a communication means x , $AUR(x)$, is defined as:

$$AUR(x) = \frac{1}{n} \sum_{h=1}^4 u(x, h) \tag{1}$$

where $u(x, h)$ is the response number of the communication means x with the family member h ($h \leq 4$), and n is the sum of each number of effective respondents for four questions: communication with mother, father, brother, and sister. The number of $AUR(x)$ indicates the average degrees of presence for the communication means x when a person communicates with all family members. By comparing the $AUR(x)$ in 2002 with that in 2003, we can directly understand the change of presence for the communication means x in ordinary life during the period.

With regard to calls on fixed phones, there is no significant change. In Method 1, we argued that in Japan, calls on fixed phones are already less popular than those in other countries. However, the result of Method 2 implies that the decline of calls on fixed phones in Japan is not the most current incident. Conversely, it is interesting that, among female respondents, calls on mobile phones significantly decreased, which implies that the forefront of the voice communications decline has started shifting from fixed phones to mobile phones.

On the other hand, we can find very important differences by gender with e-mail communications. With regard to mobile e-mail, we can find a significant increase among female respondents,

Table 8. Change of communication media usage pattern between 2002 and 2003 in Japan (in point)

| Communication means | Communication rate | | | |
|--------------------------------|--------------------|-------------------|-------------------|-------------------|
| | Male | | Female | |
| | 2002 (n = 90) | 2003 (n = 204) | 2002 (n = 110) | 2003 (n = 221) |
| Calls on fixed phones | 27.8 | 27.9 | 22.7 | 26.7 |
| Calls on mobile phones | 47.8 | 36.8 | 36.4* | 24.4* |
| SMS or email via mobile phones | 20.0 | 25.5 | 27.3* | 42.1* |
| Email via PCs or PDAs | 4.4 | 5.4 | 14.5** | 3.6** |
| M | 25.0 | 25.0 | 25.0 | 25.0 |
| SD | 15.6 | 11.5 | 7.9 | 13.7 |

Note: The numbers of respondents in this table indicate the sum of each number of respondents for four questions (communication with mother, father, brother, and sister). All numbers of comparison data between 2002 and 2003 above are tested by the parametric statistical test -T-test under the total numbers of respondents. *p < .05, **p < .01.

while e-mail via PCs among female respondents is significantly in decline. Among male respondents, we cannot find significant change of e-mailing behavior via either mobile phones or PCs.

As a whole, this result of Method 2 strongly implies that women in Japan lead the shift of the communication media cycle from voice communications to mobile e-mailing. Among male respondents, we can only observe a tendency of decrease regarding calls on mobile phones, but among female respondents we can observe both a tendency of decrease and a tendency of increase. This fact means that among male respondents the replacement of communication media has just started recently, but among female respondents the replacement is already in progress. Thus, female respondents are in a more advanced stage of the media life cycle.

From an ethnological viewpoint, this tendency has been argued widely in the Japanese mobile

phone industry. Since the late 1980s and the beginning of the 1990s, Japanese social ethics regarding female lifestyles have drastically changed and been liberated, as many women are encouraged to have full-time jobs, instead of staying home as housewives. Mobile phones are considered very useful tools to maintain family communications even though women go out frequently. Young girls are ordinarily allowed to stay with their friends until late at night if they make calls or e-mail via mobile phones to their mothers. The sense of “always being linked” caused by a wide penetration of mobile phones is becoming a new social norm in Japan. Many Japanese sociologists say that this new social norm concerning mobile phone usage may generate a new shape of family relations in Japanese society. Japanese women are no longer tied to their family and houses, and owning mobile phones encourages this new ethic. That is why, for women, mobile phones are considered as a symbol of freedom of lifestyle.

CONCLUSION AND DISCUSSION

In this chapter, we started our exploration from the rapid and wide penetration of new communication means such as mobile phones and e-mailing through the Internet. Based on an empirical survey in five countries, (MLS), we examined one of the forefront phenomena of the media life cycle in Japan, in which voice communications are gradually being replaced by mobile e-mailing communications. This discovery of media replacement from an old one to a new one in the Japanese personal communication sphere, and the framework of the media life cycle imply other future media replacements, such as those in different countries or those in different spheres.

Next, we explored deeper details of the media innovation by examining a case of Japanese mobile e-mailing usage. The most significant finding is that, during the period between 2002 and 2003, ordinary female users clearly led media innova-

tions, instead of, for instance, techno-fanatic male users. This implies that certain types of media innovation in Japan have been generated by consumers, in other words, demand side, in which consumers can generate the innovation by choosing appropriate usage of new media in their daily lives, instead of creating new products or developing technologies.

Integrating two conclusions, we can say that the media life cycle is now being processed toward the next stage by the demand side, and during this process, new social norms with the new technology are generated among consumers. In this fashion, we can observe that the media innovation with new technologies is not deterministic, and mobile e-mailing can replace the conventional voice communication by phones, which is an unexpected trajectory of the ICT future for some techno-fanatic analysts.

ACKNOWLEDGMENT

We appreciate the great contributions by Mr. Akira Odani, Mr. Masao Morinaga, Dr. Michael Bjorn, Mr. Erik Kruse, Mr. Kyu-Chol Ban, and Searchina Research Institute, to conduct the MLS 2003. We would also like to thank Dr. Nicholas Jankowski for his giving us important suggestions to our research.

REFERENCES

Chesbro, W., & Bertelsen, D. (1996). *Analyzing media: Communication technologies as symbolic and cognitive system*. New York: The Guilford Press.

Innis, H. (1951). *The bias of communication*. Canada: University of Toronto Press.

Rogers, E. (1986). *Communication technology: The new media in society*. New York: The Free Press.

Rogers, E. (1995). *Diffusion of innovations*. New York: The Free Press.

Von Hippel, E. (1988). *The sources of innovation*. New York: Oxford University Press.

Washida, Y. (2005). Collaborative structure between Japanese high-tech manufacturers and consumers. *Journal of Consumer Marketing*, 22(1), 25-34.

FURTHER READING

Amor, D. (2002). *Internet future strategies: How pervasive computing services will change the world*. Upper Saddle River, NJ: Prentice Hall.

Angus, I. (2000). *Primal scenes of communication: Communication, consumerism, and social movement*. State University of New York Press.

Brock, G. (2003). *The second information revolution*. Cambridge, MA: Harvard University Press.

Coates, K., & Holroyd, C. (2003). *Japan and the Internet revolution*. Hampshire, UK: Palgrave Macmillan.

Cohen, A. (2003). Real time and recall measures of mobile phone use: Some methodological concerns and empirical applications. *New Media & Society*, 5(2), 167-183.

Dittmar, H., Long, K., & Meek, R. (2004, March). Buying on the Internet: Gender differences in on-line and conventional buying motivations. *Sex Roles: A Journal of Research*, 50(5/6).

Frank, L., & Heikkila, J. (2001). Diffusion model in analyzing emerging technology-based services. In B. Schmid, K. Stanoevska-Slabeva, & V. Tschammer (Eds.), *Towards the e-society, e-commerce, e-business, and e-government* (pp. 657-668). Boston: Kluwer Academic Publishers.

- Fransman, M. (2002). *Telecoms in the Internet age: From boom to bust to...?* New York: Oxford University Press.
- Fredrick, C. (1999). Feminist rhetoric in cyberspace: The ethos of feminist usenet newsgroups. *The Information Society*, 15, 187-197.
- Gill, R. (2002). Cool, creative, and egalitarian? Exploring gender in project-based new media work in Europe. *Information, Communication & Society*, 5(1), 70-89.
- Gladwell, M. (2000). *The tipping point: How little things can make a big difference*. Boston: Little Brown & Co.
- Harding, S. (1986). *The science question in feminism*. Ithaca, NY: Cornell University Press.
- Henwood, F. (1993). Establishing gender perspective on information technology: Problems, issues, and opportunities. In E. Green, J. Owen, & D. Pain (Eds.), *Gendered by design? Information technology and office system*. London: Taylor & Francis.
- Katz, J. (2003). *Machines that become us: The social context of personal communication technology*. New Brunswick, NJ: Transaction Publishers.
- Martinson, A., Schwartz, N., & Vaughan, M. (2002). Women's experiences of leisure: Implications for design. *New Media & Society*, 4(1), 29-49.
- Owen, J., Vega, Y., & Tucker, D. (2003). Investigation of the effects of gender and preparation on quality of communication in Internet support group. *Computer in Human Behavior*, 19, 259-275.
- Reponen, T. (2003). *Information technology-enabled global customer services*. Hershey, PA: Idea Group Publishing.
- Rommes, E., Oost, E., & Oudshoorn, N. (1999). Gender in the design of the digital city of Amsterdam. *Information, Communication & Society*, 2(4), 476-495.
- Sekizawa, H., Washida, Y., & Bjorn, M. (2002). *Situation marketing*. Japan; Joong Ang M & B, South Korea: Kanki Publishing.
- Shade, L. (1998). A gender perspective on access to the information infrastructure. *The Information Society*, 14, 33-44.
- Singh, S. (2001). Gender and the use of the Internet at home. *New Media & Society*, 3(4), 395-416.
- Soukup, C. (1999). The gendered interactional pattern of computer-mediated chatrooms: A critical ethnographic study. *The Information Society*, 15, 169-176.
- Spilker, H., & Sorensen, K. (2000). A ROM of one's own or a home for sharing?: Designing the inclusion of women in multimedia. *New Media & Society*, 2(3), 268-285.
- Tamblyn, C. (1994). She loves it, she loves it not: Women and technology. In *Proceedings of the ISEA '94* (CD-ROM), Inter-Society for the Electronic Arts, Amsterdam, The Netherlands. Retrieved from <http://www.isea-web.org/eng/index.html>
- Turkle, S., (1995). *Life on the screen: Identity in the age of the Internet*. New York: Simon and Schuster.
- Turow J., & Kavanaugh, A. L. (2003). *The wired homestead: An MIT press sourcebook on the Internet and family*. Cambridge, MA: MIT Press.
- Van Zoonen, L. (2002). Gendering the Internet: Claims, controversies and cultures. *European Journal of Communication*, 17(1), 5-23.
- Washida, Y., Bjorn, M., & Kruse, E. (2004). Analysis of diffusion patterns of knowledge and

Media Life Cycle and Consumer-Generated Innovation

new technology among Japanese early adopters: An ethnological study of product penetrations. *Proceedings of IAMOT 2004* (CD-ROM), International Association for Management of Technology, Coral Gables, FL. Retrieved from <http://www.iamot.org>

Yoshimi, S. (2000). *Media Jidai no Bunka Shakai Gaku - Cultural and social studies in media era*. Tokyo: Shinyo Sha.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 280-305, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

APPENDIX

The Source of Method 1

Survey name: *Media Landscape Survey 2003-2004* (MLS)

Survey countries, the effective sample populations: 850 samples in the U.S. (east coast), 400 samples in Japan, 177 samples in The Netherlands, 351 samples in Sweden, 400 samples in South Korea, and 400 samples in China (Shanghai area): total 2,578 samples

Respondents: ordinary people who are interested in digital communications, aged 15-34

Sampling procedure: Internet panel survey method, provided by professional survey companies, was used in the U.S., Japanese, Swedish, South Korean, and Chinese surveys. In The Netherlands, a multi-stage recruiting method was used. In the United States, parental permissions had been taken to conduct the survey among respondents aged 15-18.

Response rate: Due to the nature of Internet surveys, it is difficult to fix the precise response rates. However, the average response rate in this Internet survey system is reported as 15-25%. In The Netherlands, the response rate was 25.3%.

Survey date: Oct. 2003 to Mar. 2004

Measurement of reliability: All numbers of data in Method 1 are verified that they have significant differences against each average with the significance level $p < .05$, in the parametric statistical test—Dunnnett test (multiple comparison).

The Source of Method 2

Survey in 2002 (preliminary survey):

Respondents: Men and women aged 18-29 living within a 40km radius of the Tokyo metropolitan area

Sample population: 89 respondents (40 males and 49 females)

Setting and sampling procedure: Self-administered questionnaire mailed and left with members of a predetermined panel.

Response rate: 100% (predetermined)

Period: January 2002

Survey in 2003 (in MLS):

Respondents: Men and women aged 20-29 living in Japan

Sample size: 200 respondents (100 males and 100 females)

Setting and sampling procedure: Internet survey

Response rate: Due to the nature of Internet survey, it is difficult to fix the precise response rate. However, the average response rate in this Internet survey system is reported as 15-25%.

Period: November 2003

Measurement of reliability: All numbers of comparison data between 2002 and 2003 in Method 2 are tested by the parametric statistical test—T-test.

Chapter 2.8

Participatory Design and Creativity in Development of Information and Communication Technologies

Nette Schultz

Technical University of Denmark, Denmark

Lene Sørensen

Technical University of Denmark, Denmark

Dan Saugstrup

Technical University of Denmark, Denmark

ABSTRACT

This chapter presents and discusses a new design framework for involving users at an early stage in a mobile ICT development project. A user-centered design process, in which participatory design principles are combined with creativity techniques, is used in order to create scenarios as a communication tool between users and system designers. The theoretical basis for the framework is described, leading to a new participatory design and creativity framework. Empirical insight into how the framework has been developed and used in practice is presented based on the experiences and results from a large ICT development project within the field of mobile communication. Finally,

the value of applying creativity as part of a participatory design process is discussed.

INTRODUCTION

Many information and communication technology (ICT) projects have experienced a gap between the system design itself and the needs and visions expressed when users have been introduced to the system developments. Within the field of human-computer interaction (HCI), several design methods and techniques have been developed to involve users in the design process and to bridge the gap between what users want and what is technically possible. Employing participatory design

methods, like PICTIVE (Muller, 1991), means that users are actively involved in the design process, aiming at gathering user requirements and reflecting them in system design. The design process very much depends on how designers collaborate with users. There are several challenges in this process: the vocabulary used between designers and users, and to what extent user requirements are expressed in usable and understandable terms for the designers. Often, it is difficult for users to express their ICT design needs, especially when referring to a future state. On the other hand, designers have a technological insight that may take the ICT system designs and services much further than anticipated by the users. Finding the right balance between the two is a challenge.

In developing familiar applications that directly interact with users (e.g., Web pages) the traditional tools for deriving user needs are methods such as contextual inquiries, participatory design meetings, focus-group meetings, surveys, and interviews (Zappen & Harrison, 2005). All these methods possess advantages and limitations that have to be taken into consideration when using them. However, when addressing mobile, wireless technologies and networks, the tradition has so far been to develop these applications without paying much attention to user needs—in other words, a technology-driven development approach.

This chapter addresses mobile and wireless ICT development and presents a framework for how user requirements can be derived from users regarding design of technology, applications, and services within this area. A basic idea is to apply the principles from participatory design and focus on scenarios in particular as the technique for establishing designer/user communication. The use of scenarios is commonly used within ICT development and design, often presented as narratives about how people use technology in different situations and attempting to explain what, when, and how events and actions take place.

When using scenarios for innovation and identifying challenging technological ideas, it is fruit-

ful to build these on creative thinking. Creativity is needed to support users in thinking ahead of and beyond their present needs, and to identify needs and situations in which current technology does not adequately support users. There is no firmly established scenario technique for ICT project design and developments (Alexander & Maiden, 2004, presents different techniques), and the aspect of creativity is traditionally not directly part of this process. Little research has been carried out in linking creativity and participatory design. Most theories of creativity are linked to either the individual or a group of people working together (Kazanjian, Dradin, & Glynn, 2000). In this chapter, creativity is used as an active component in setting up user-centred scenarios and is thus an effective factor in identifying user requirements—focusing on both the individual and the team creativity of a group of users.

The overall purpose is to present a participatory design and creativity framework developed in order to support and produce user-centered design in the development of innovative mobile, wireless ICT systems within the IST EU project “My personal Adaptive Global Net” (MAGNET, 2004). The framework has been built upon scenario construction and a set-up of successive workshops developed through practical project work.

The MAGNET project has a strong emphasis on user centrality, personalization, and personal networking. The end goal of the project has been to enable commercially viable personal networks that are affordable, user-friendly, and beneficial for all kinds of users in all aspects of their everyday lives. It addresses research issues within personal distributed environments, where users interact with a multitude of entities in their near vicinity, although potentially anywhere. These systems are defined as personal networks and constitute a category of distributed systems with very specific characteristics (Niemegeers & Groot, 2002). The concept of personal networks is related to personal communication environments, consist-

ing of a large number of devices, which can all interconnect independently of time and place. They enable a collaborative environment within a distributed network setting, which supports users in both their professional and private activities. Figure 1 illustrates a generic set-up for a personal network and communication environment that can be interconnected through different ad hoc or infrastructure-based networks.

The specific design process addressed is the process of developing personal network services and applications, progressing through system layers from the top layer consisting of devices, user interfaces, and functionality and down through the layers to hardware components. By involving users in the development process, the written system requirements specifications for networks and platforms, which induce constraints and limitations on the final services and applications, can be anticipated and already addressed when defining the first specifications. In this process, it is important to remember that “users” is a broad concept covering not only end users but also other stakeholders such as service providers, service operators, and different types of communities. In the present context, users will be understood as end users.

The chapter is divided into the following sections. First, the relevant theory within the fields of mobile systems development, participatory design, and creativity is discussed as the theoretical basis for a new participatory design and creativity framework. The new framework is then described with specific focus on different workshops structured according to creativity and participatory design principles. The practical implementation of the framework is illustrated by the MAGNET project. Focus is on how the theoretical framework has been applied to a specific case study dealing with improving the handling of health care related situations. The chapter concludes with reflections on both the theoretical framework and the practical experiences the application has provided for understanding the use of this framework.

MOBILE SYSTEM DEVELOPMENT

In the past decade, mobile system developments have been researched extensively from an engineering system development and organizational point of view. However, during the last couple of years, a new perspective has emerged—the user perspective, which as the name implies focuses

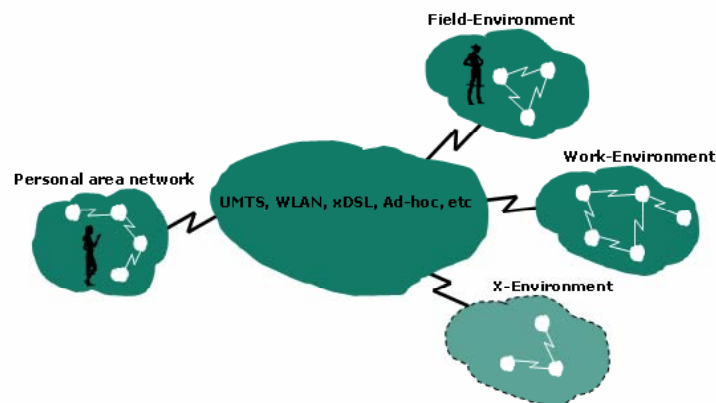


Figure 1. A personal network illustrating the user and how (s)he communicates with other environments

on user perspective and involvement. This means actively involving users, drawing social aspects into the development process, and creating a high level of user acceptance and usefulness in practice. Based on early research concerning nomadicity, mobility concepts, and later mobile system development literature, the present section briefly describes some of the important developments in this area and gives a short overview of important research carried out within the field.

Today, the combination of mobile computing and communication is rapidly changing the way we think about information processing and communication in general, and it is taken for granted that access to computing and communication is necessary from all locations, for example, office, home, and so forth, but also while in transit and when arriving at unfamiliar destinations.

The basis for some of these ideas and concepts has been discussed by computer scientist Kleinrock (1996a, 1996b), who describes and outlines the essence of nomadicity (nomadic computing and communications). This he defines as the system support needed to provide a rich set of computing and communication capabilities and services to nomads in a transparent, integrated, and convenient form as they move from place to place. From an engineer's perspective, this approach and concept are more or less based on making computers and computer communication systems mobile. According to Kleinrock, nomadic computing and communication described from a system perspective should support capabilities that enable independence of: location, motion, computing platform, communication device, and communication bandwidth, meaning that specific mobile computing environments should automatically adjust to the processing power, communication, and bandwidth available at any given time.

User Needs and Requirements

The overall viewpoint on mobile system development is mainly related to user needs and require-

ments and, more specifically, to design studies and HCI perspectives. In general, the number of wireless communication technologies and communication devices, services, and applications has increased dramatically over the last decade, albeit most of these developed and designed based on what was technologically possible with little attention being paid to specific user needs. However, during the last couple of years, increasing attention has been allocated to actually defining real user needs and designing and developing services and applications accordingly within the limits of the available technology. The big challenge within mobile system development and design is to develop mobile services and applications that actually support users in their everyday lives and also support professional working environments.

In a review of mobile HCI methods, Kjeldskov and Graham (2003) found a bias towards engineering systems using applied approaches and evaluating them, if at all, only in laboratory settings. Furthermore, they identified some gaps in the commonly used research approaches; for instance, action research, case studies, and basic research were identified as being applied rarely. The bulk of papers researched fall within the category of applied research (56 of 102 papers) and lab experiments (32 of 102 papers), whereas the remaining categories—case studies, field studies, action research, basic research, and normative writings—account for only 14 papers altogether. Based on their findings, Kjeldskov and Graham suggest a change of research focus within the area of mobile HCI in order to achieve a better understanding of the limits on design and application.

From a different perspective, Krogstie, Lyytinen, Opdahl, Pernici, Sian and Smolander (2004) explore the challenges in developing mobile information systems at the conceptual and logical levels and with a special focus on mobile knowledge workers and a user-oriented perspective. A major characteristic of mobile knowledge workers is the required ability to communicate and

interact either synchronously or asynchronously with different information systems and persons independently of time and location. According to Krogstie et al. (2004), one of the main challenges regarding future mobile information systems is related to user orientation and personalization. Specifically, the separation of content and medium is very important in relation to delivering a maximum level of user personalization, as the systems should automatically adapt to the preferences of the user.

PARTICIPATORY DESIGN

Applying user-centered design to mobile system development does not necessarily mean that users actually participate in the design process. There are many different methods and techniques within interaction design that aim at a successful transition from the identification of user needs and requirements to the development of the final product. Using participatory design means that users are actively involved in the design process phase where new design ideas are generated. Users may be involved at different levels: the focus here is on the beginning of the design process dealing with scenario construction, low-fidelity prototyping, and simple mock-ups with the overall goal of capturing and exploring user needs and requirements.

Human Values

Participatory design in accordance with the Scandinavian approach has been centred on democracy issues and was, as described in Ehn (1988), developed in close collaboration with trade unions. Activity theory used as a high-level framework for understanding of the design process, as described in Kuuti (1996), was linked together with participatory design in Bødker, Greenbaum, and Kyng (1991). The definition of functional organs and mediation from activity theory means that all human experience is shaped by the tools and

sign systems we use. This leads directly to users being actively involved in the design process. Participatory design is used in order to ensure that the finally developed applications and services will be adaptive to the users and not the other way around. In accordance with an activity theory framework (Kuuti, 1996), it is important to consider carefully how to set up a participatory design process because the results will be greatly influenced by how this is done.

Asaro (2000) presents a discussion of the different approaches to the participatory design process. Here, the conclusion seems to be that the technological rationalization perspective, including joint application design (Carmel, Whitaker, & George, 1993) and contextual design (Beyer & Holtzblatt, 1998), and the socialist and humanist perspectives—putting the sociotechnical (Mumford, 1987) and Scandinavian (Kensing & Blomberg, 1998) approaches under the same hat—have converged. The different approaches to the participatory design process have altogether converged to form a current heterogeneous field claiming the twin goals of increasing efficiency and increasing democracy. In the present context, the use of participatory design is not only aiming at more efficient and usable products but also at human values. However, focus has shifted from the original ideas of Scandinavian participatory design, in which democracy and workers' rights were at issue, to the private emotional life of the user. Today, new possibilities within ubiquitous computing and attentive environments and threats of surveillance and emotional manipulation and persuasion (Fogg, 2003) call for engineering designers who are able to perceive, understand, and communicate personal feelings and emotions. This new paradigm also calls for new experimental ways of prototyping using external cognitive aids developed as a language within the design team.

It is important to stimulate communication and learning in multi-disciplinary teams. A shared design language using external cognitive aids such as pictures and different kinds of elements

for prototyping can be used with inspiration from Muller (1991), where the PICTIVE approach guides the users with the help of predefined elements, and from Gaver, Dunne, and Pacenti (1999), where the content of cultural probes is obtained by getting the users to create their own personal stories. During a participatory design workshop, the users are asked to envision future possible products within a case. This may be rather difficult for many users, and with inspiration from future workshops (Jungk & Müllert, 1987), the approach of starting with the present can be used as a good way of initiating the development of a shared communication language within a team.

Team Work

We design the products, and the products shape our living; therefore, engineering designers must be able to contribute to the connection between human values and technology. Design tools as external cognitive aids are good to have, but the primary source of success is the team members: engineers, designers, users, and other stakeholders. A good engineering designer is curious, open-minded, and creative while having technical, design process and teamwork skills. It is challenging to facilitate team development in order to achieve a creative and innovative blend of human values and technology in the design process. One approach in developing ICT products for the future is to use development methods that facilitate creativity, human values, user participation, and heterogeneous design teams. Furthermore, it may be necessary to accept design processes that might seem somewhat unstructured while in the exploration phases. Within design teams, the agreement of a code of cooperation is also important (FoundationCoalition, 2002). This may be predefined or formulated by the team itself. It is essential that team members get to know and trust one another, and feel secure and at ease. They must also be able to recognize and handle the trade-off that can exist between designers and

participating users.

A team member must be able to understand the trade-offs inside the team, and this is commonly achieved by the use of transparency. The ability to see things from the point of view of other people is important. The concept of cognitive congruence, that is, the ability to understand and express ideas and solutions at the same level of knowledge, is also important when communicating with users, stakeholders, or other team members. These team skills are closely related to two of Howard Gardner's multiple intelligences (Gardner, 1983), the so-called interpersonal and intrapersonal intelligences. Interpersonal intelligence is the ability to understand the feelings of others, observe what is going on in a group, behave in an open and social manner, and communicate with people at an appropriate level. This intelligence is closely related to cognitive congruence. Intrapersonal intelligence is the ability to look within oneself, recognize whether emotions belong to oneself or another person, and situate these emotions where they belong. The ability to exhibit transparency is closely related to this intelligence. A person with an accurate view of him or herself possesses this skill. It is therefore necessary to spend time on the facilitation of such an environment. It does not just occur because people are put together in a team, but requires that team members learn to connect with one another in an open and positive framework.

CREATIVITY

All innovation begins with creative ideas. Successful implementations of new products or services depend on a person or a team's ability to come up with a good idea in order to develop that idea beyond its initial state (Amabile, Conti, Coon, Lazenby, & Herron, 1996). The following descriptions focus on the theoretical perspectives and techniques used, completely or partly, for the proposed framework.

Creativity is a broad concept not easily defined and often based on combinations between theoretical foundations and beliefs of the user of the concept (see Pope, 2005). Here, we apply the definition presented by Amabile et al. (1996), in which “creativity is seen as the production of novel and useful ideas in any domain”. Innovation is defined as the successful implementation of creative ideas within an organization, project, or given situation. This means that the starting point for any innovation is creativity exercised by individuals and teams.

Within the literature, Torrance (Millar, 1997) stands out with his research on creativity as a process; he views each individual as creative, and this creativity can be enhanced or blocked in many ways. Torrance believes that all persons are born creative, and it is possible to use activities, methods, and motivation to maintain and even increase a person’s creativity.

When it comes to being creative in problem solving (and design can be seen as a problem solving process), research dates back to Wallas (1926), where he described a model for the process of the individual’s creative thinking. This process has four phases:

- **Preparation:** The problem is defined and a starting attempt is made to solve the problem.
- **Incubation:** The problem is left while thinking about something else and doing something else.
- **Insight:** The person experiences (often suddenly) an insight into solving the problem.
- **Verification:** The solution is tested and can be accepted by others.

Behind this process lies the idea that creativity comes from the unconscious, leading to sudden insight, and that analytic thinking and creativity are complementary.

In an organizational context, models have been developed for the creative process that focuses

systematically on the combination of techniques in order to generate ideas and techniques for analyses and selection of alternative solutions. The models have clear similarities to the Wallas model presented earlier. One such model can be seen in Leonart and Swap (1999).

Creativity Techniques

From characterizing and researching creativity, it is a step to actually enhancing and supporting creativity. There are a large number of different methods and techniques to increase and support creativity in different situations (see, for example, Higgins 1994). One of the central principles in working with creativity is the principle of divergent and convergent thinking. Divergent thinking is characterized by the generation of as many ideas as possible regarding a specific problem or theme. After some time (and a lot of ideas produced), it can be constructive to look at the ideas produced and select a few promising ones to work on. In the divergent phase, techniques such as brainstorming and picture stimulation can be used. In the convergent phase, more structure, systematic thinking, and patterns must be recognized as well as rules and prioritizations (Vidal, 2003). In the framework that follows, the focus is on techniques supporting divergent thinking, and, as such, it is relevant to consider some details on brainstorming and picture stimulation techniques.

Brainstorming is perhaps one of the most successful and often used creativity techniques. Brainstorming was introduced by Osborn (1953) as an element of creative problem solving to stimulate the generation of ideas and facilitate their expression. The technique is excellent for strengthening fluency, imagination, and communication skills (Goff, 1998) and can be used any time there is a problem or gap and within groups or with individuals. Brainstorming generates and stimulates enthusiasm as well as spontaneity and creativity (Goff, 1998) and is often used in combination with other techniques.

The picture stimulation technique (Vidal, 2003) encourages participants to think in completely different terms. The participants look at a particular problem from different and sometimes contrasting perspectives. Pictures are used to stimulate ideas and thoughts that break away from the normal way of thinking. This technique will enhance the production of original ideas and tends to break up established paradigms (Vidal, 2003).

Creating a Creative Environment

Amabile (1989; Amabile et al., 1996) has focused much of her research on the work environment and how it affects creativity. Many factors can be identified within organizations (as well as in the individual) that may inhibit and even block creativity. Therefore, it is also important to focus on the work environment when creativity is needed. There are no specific rules for setting up a creative environment, but often it is necessary to establish physical work environments that encourage participants to relax, move around, and work in other ways than they customarily do. All aspects that stimulate the brain to become creative can be included—such as pleasant surroundings, music, good food, opportunities to walk around and sit in different positions, and being able to have a general overview of the ideas produced. These principles have been brought into the design of the workshops that are described in the creative framework.

A PARTICIPATORY DESIGN AND CREATIVITY FRAMEWORK

In the following, the participatory design and creativity theories described previously will be used and explored in relation to the MAGNET project, in which the new participatory design and creativity framework was developed and applied in order to derive valid user requirements

for personal networks. The MAGNET project focuses on three case studies which together cover different societal themes relating to areas such as “health care”, “business and working life” and “the home and private sphere”. The following is based on the case study associated with health care, more specifically, on identifying situations in which personal networks will potentially be able to improve the monitoring and management of diabetes.

The collection of data in MAGNET was mainly based on qualitative methods, especially from workshops, in order to gain some insight into the information and communication patterns within the different case studies. In general, the aim of using qualitative research methods is to gain firm empirical knowledge of a social or natural phenomenon and to construct a coherent, internally consistent argument from sequences of empirical data in the form of texts, perceptions, and social acts (Denzin & Lincoln, 2000).

Within the participatory design and creativity framework, scenarios are the preferred tool for communication between users and designers. An example of another use of scenarios is the closely related IST project MobiLife (www.ist-mobilife.org). There is, however, no specific way in which to develop scenarios so that they represent the user’s wishes optimally and, at the same time, address the technology issues needed for the designers. Alexander and Maiden (2004) present different scenario developments for different purposes in the systems development life cycle. Here, focus is on developing a scenario construction method which can: involve users, actively, in parts of a design process; ensure that the scenarios focus on relevant information such as user requirements in different situations, user needs, relevant user interfaces, and device interaction, as well as the social implications of the use and development of technology; link user requirements and needs with technical specifications and be based on possible and expected trends in society that may influence user needs and technological possibili-

ties and developments.

The overall principle for scenario construction is the participatory design process, which focuses on interaction between users in particular situations and technicians and engineers designing future technologies and applications. Scenarios are used as the central communication tool between the users and the technical designers—and for deriving user needs and requirements. Scenarios create a possible picture of how the users anticipate themselves in the future using one or more technologies, applications, or services. The scenarios can include both aspects of wishful thinking and also situations that the users have not necessarily evaluated positively or negatively. In order to ensure that the scenarios will provide valuable input for technologies designed for the future, scenario construction focuses on providing a general overview of trends and situations that could be part of the future while at the same time freeing users from the present-day state of technology. Since the users have to think about the future, it is essential that they are able to do so. Therefore, the design methodology includes workshops based on creativity methods that encourage users to fantasize and extend their world to possible situations in the future. There are two types of workshops that together generate the information needed—the user workshop and the expert workshop. The user workshop includes users and their wishes for the future. The expert workshop, with technical developers and engineering designers as participants, works with these ideas to make sure that user needs and visions are brought to a state in which, technology-wise, they are challenging and interesting and may be discussed in terms of possibilities and limitations for the technical design.

In the following, scenarios will be defined (based on Van der Heijden 1996) as: ... *a descriptive set of plausible and possible different futures*. These futures are based on users representing different situations using a particular technology or service. It is assumed that the scenarios

focus on longer-term ICT developments (5 years or more). In order to create scenarios that are usable for the design process, the scenarios must be relevant, likely, transparent, and coherent (Godet & Roubelat, 1999).

Scenario Construction in the MAGNET Project

The application of the participatory design and creativity framework made some practical demands on how to construct the scenarios. A scenario template was applied consisting of various steps in which descriptions and trends from the present time as well as expectations for the future were mixed together into scenarios. The approach used in the MAGNET project was based primarily on Schwartz (1991) and Van der Heijden (1996) and adapted for use as a communication tool in an ICT development project. Central to this scenario template is the direct representation of users and technicians/engineers as part of the scenario construction process through the application of participatory design principles and using creativity to focus on innovative ideas. The outcome of the scenarios is a mixture of narratives that can form the basis for creating use cases (Unified Modeling Language, UML), mock-ups of low-fidelity prototypes of devices, and pictures and graphs showing technical requirements based on the user needs and requirements.

Since the personal network architecture was to be developed over the coming years, it could be expected that trends in society would have an impact on the usage and acceptance of low fidelity devices, transmission possibilities, and the architecture itself. In order to obtain insight into expected trends, a questionnaire was therefore designed and structured according to the STEEP methodology (Johnson & Scholes, 1999). STEEP is short for Society, Technology, Economy, Environment, and Policy. For each factor, a number of questions were posed to shed light on the recipi-

ents' expectations of future developments within that particular area. The questionnaire was sent to all MAGNET participants (technical as well as non-technical). The questionnaire resulted in a number of statements and expectations that not only provided support for the project idea in the anticipated direction, but also revealed some expectations that could limit the idea or change its perspective. One such example was the concern about technology use and the potential risk of increasing the number of "throw away" devices. This could lead to thinking in terms of more recyclable products and an increased focus on battery lifetime and alternative fuels. The results of the questionnaire were used as input to the workshops in the form of questions.

Workshops and Results

In the participatory design and creativity framework, the creative user workshops are an essential part of user centricity. This is where the participatory design and creativity methods and techniques are fully intertwined. A conceptual text-based scenario landscape relating the case study must be created prior to a creative user workshop. This will be the first story users are told and acts as a prototype to be developed further during the workshop before finally becoming a complete scenario landscape. The scenario landscape should be understood as a conceptual, physical paper landscape showing different situations and pictures of how users think about the future. During a workshop, the users will be given additional external cognitive prototyping aids in the form of so-called image elements consisting of pictures, words, or short sentences. They are produced for each workshop on the basis of the case study's conceptual scenario landscape, the environmental trends (identified in the questionnaire), case study context, human activities, and important high-level user requirements. Pictures and perhaps a word will typically represent the

related contexts and human activities.

At the creative user workshop for the "health care" case study, it was decided to divide the scenario landscape into four phases, each representing different life cycles and disease treatment for a diabetic person. The four phases were: babies, teenagers, adults, and elderly people. The image elements and questions used represented predefined contexts and user situations, as well as user requirements. Predefined contexts and user situations covered: shopping, education, travel, community, collaborative work, surveillance, emergency, health care, society in general, transportation, and home. Each of these contexts was represented by a number of pictures intended to stimulate the participants in remembering and discussing their needs and requirements in these situations. They covered areas such as: usability perspectives, personalization, user experience, user interface, economy, ethical issues, security, and legal issues. These requirements were presented as questions to the participants by the facilitator at different times during the workshop. The first activity in the workshop was a shared user evaluation of aids and devices available today. The purpose was to start at a level that was familiar to users so that they could feel at ease and gain confidence in contributing to the workshop. It was also a way of establishing and acknowledging a common, shared design language that was understandable for non-engineers. The predefined conceptual landscape scenario and its life cycle phases were then introduced during a fantasy journey. The fantasy journey was a short guided meditation and was used in order to stimulate the participants' creativity while thinking about the future. Construction of the life landscape scenarios took place within teams. The participants were divided into two teams, each containing users with diabetes, health care personnel, men, and women. Each team was placed around a table where image elements were placed together with plenty of prototyping materials. They were asked to physically place pictures, notes, and other

Figure 2. A landscape scenario is under construction



prototyping material on large pieces of white paper and to describe their thinking about different situations. A landscape scenario created by one of the teams is shown in Figure 2. After the workshop, all ideas presented were analyzed and used as the basis for describing four narrative user scenarios of important situations and ideas from each life cycle phase.

After the creative user workshop from the “health care” case study, the expert workshop was held. Its purpose was to discuss different technological solutions to support the visions expressed in the user scenarios. This meant that the experts had a more specific task and that the teamwork atmosphere was stimulated more than the general creativity in the first workshop. The second workshop started with a lecture about diabetics and open discussions concerning important technical aspects to consider, focusing on core activities that were interesting for the project. The experts were then divided into two teams equally representing the project’s working groups and based on specific technological expertise and company profiles. The teams were guided by the facilitators and note takers and each given two different user scenarios, which they were given

time to read. The teams started the prototyping of a conceptual system architecture based on the specific user scenarios they had been introduced to. The teams were sequentially given questions based on subsets of previously defined, high-level system requirements. This continued until all requirements had been dealt with. The teams were encouraged to add possible sub-scenarios to the user scenarios. This was facilitated by brainstorming on activities and tasks from user scenarios accompanied by suggestions for possible new activities and tasks in the given context. Finally, the teams had to select and explore the most important/interesting activities and tasks. The results from the expert workshop were conceptual personal network architectures based on user needs and requirements expressed in user scenarios. These were then used to formulate “rich” scenarios that would sum up the findings of both workshops and be a mixture of narratives, use cases, graphic network schemes, requirements specifications, and tables containing quantitative parameters.

Within the project, creative user workshops and expert workshops have been conducted for three case studies. All workshops ended with an

open informal plenum evaluation of the workshop day, and in general the participants were satisfied with the results and felt that the day had been meaningful. Starting with the creative user workshop, the comments from the users were mainly about the process and techniques that had been applied. Some comments revealed that the process was confusing in the beginning, but by the end, a structure actually appeared in the landscape scenarios. Other comments were about the fantasy journey as being really interesting and something never tried before. The fantasy journey created a special atmosphere of awareness seldom seen before in ICT project workshops or meetings. The internal evaluation among the engineering designers was also positive; all felt that the workshops had been successful and useful. However, it was clear that it was important to find the right persons for the different workshop roles (facilitators and note takers), and that these persons were well prepared. Regarding the expert workshops, participants found the workshops interesting, and no one answered the direct question as to whether they felt that some of the activities were silly or meaningless in the affirmative.

The principles and techniques from creativity theory were applied most comprehensively in the creative user workshops. The application of the creativity techniques allowed for the participants to be surprised and to establish a common basis for discussing the future ICT ideas on the same premises. The use of the image elements introduced common and even perhaps overly divergent thinking in the scenario landscape. Many ideas were expressed using only the image elements, and no other ideas for the use of new technologies came up. However, the image elements did support the participants in thinking about new technologies and ideas they were not used to considering—or were not even aware of—within this particular context.

The brainstorming techniques were easily applied, and all participants were able to use them. The participants had never tried a fantasy

journey before. The application of this technique was perhaps the most challenging aspect for them. Whether the journey actually supported their creative thinking is difficult to assess. However, the participants were asked immediately after the fantasy journey to start their work on the scenario landscape, and this process was relatively easy for most of them. The participants subsequently expressed their positive (and surprised) attitude to the fantasy journey, and it would appear that this journey did support the creativity process.

It must be mentioned that the expert workshop participants were in a sense eager to evaluate the ideas expressed at the creative workshops only from a technically demanding point of view. However, the users did not express many innovative and technically challenging ideas, which was a disappointment to the experts. On the other hand, these experts perhaps never really understood that their task was to create technological challenges based on the users' ideas, and that they were allowed to elaborate on the users' ideas and create new ideas. In this process, the lack of focus on creativity in the expert workshop may have been an important factor for its outcome. Another issue that could be raised in this connection is the lack of open-mindedness exhibited by the participants on arriving at the workshop. The expert workshop participants were clearly reluctant, and some irritation was even expressed about the exercise before it started. After the workshop, most participants were more positive, but during the process the atmosphere was more forced and less relaxed than in the creative user workshops. It may be that the results of the workshops (and the mixing of participatory design and creativity techniques) could have been even more beneficial, if it had been possible to overcome the reluctance of expert workshop participants. It must be emphasized that in the course of the expert workshop, a teamwork atmosphere was built up during the day and that in itself can be seen as a substantial achievement. Furthermore, the experts did express a growing understanding for the user visions expressed,

which in itself supported a better link between the user-centricity and the technological perceptions and visions of the project.

During the workshops, participants were able to establish a shared communication language and feeling of ownership and responsibility for the created prototypes. All users participating in the creative user workshops contributed to the process. The participants in the expert workshop communicated well together even though they had different technological competences and were very different multi-, inter-, and trans-disciplinarily. At the creative user workshops, the core human activities in each case study were illuminated through the landscape scenarios. Based on this, user scenarios were composed and passed on to the expert workshops for further elaboration and inquiry into technical issues raised. The results from the expert workshop were conceptual personal network architectures, fulfilling the user needs and requirements in the user scenarios, and new sub-scenarios, putting additional focus on specific technological development issues. These results have then been used as a basis for deriving use cases and a final requirements specification.

The final applications and services have not been developed yet, so it has not been possible to evaluate whether the project results will be ultimately usable and make a difference. Internally in the project, however, the results based on the design framework have been used as a basis for deriving system requirements in other parts of the project. Future work will focus on how to take the participatory design and creativity approach into usability evaluations of the applications to be developed. When dealing with mobile ICT usability testing, the traditional highly controlled laboratory user testing has too many drawbacks not only in relation to real human behavior but also to changes in context. New valuable insights may therefore be obtained from exploring a complementary but very different approach.

CONCLUSIONS AND DISCUSSIONS

In this chapter, a new participatory design and creativity framework has been presented and described through a project case study within the area of mobile ICT development. The framework is based on methods and techniques from participatory design and creativity and consists of scenario construction carried out through workshops. The set-up of successive workshops has been useful in regard of generating ideas and building a “bridge” between the user focus and the technical focus represented in the project. In particular, the expert workshops have played a role in building up the team atmosphere that is necessary for major ICT projects.

The participatory design and creativity framework has to be evaluated in terms of its contribution to the real world—and the MAGNET project. The theoretical base constitutes a mixture of techniques and principles from different fields, and it is only in its practical application that it can be really tested. Three primary areas reveal something about performance and how well the framework worked in a real application. These are: workshop participants’ feedback, the experience from the mix of techniques that was used in the MAGNET project, and the extent to which the results have been useful for the project in respect of the implementation of ideas. The user and expert evaluations stated clearly that the participants felt that they had established a shared design language in the workshops. The internal project evaluation and use have shown that a transition medium between the successive workshops and the system requirements specification has been established. It is not yet possible to measure the level to which the methodology has facilitated the generation of innovative design ideas. However, both users and engineering designers found the participatory design and creativity methods and techniques useful and meaningful, which indicates that they did work together stimulating each other’s approach. Participatory design, teamwork,

and creativity have many things in common, and during the workshops, it was often very difficult to say whether participatory design or creativity was the dominating approach as a combination of both blended together in the applied techniques.

The research conducted within the MAGNET project showed that creative techniques such as brainstorming and picture stimulation were useful, easy to apply, and well received by the workshop participants. The techniques worked in two almost contradictory ways: as a source of stimulation and, at the same time, a tool for structuring thoughts and ideas. The brainstorming that was used to support fluency and volume of ideas worked both in the discussion of today's use of technology and in the construction of future landscape scenarios. However, the brainstorming session could easily have turned out to provide overly general ideas that would not necessarily be useful for the project. The image elements were used both to stimulate the participants into thinking in particular directions and to generate new ideas based on the pictures and elaborating on them.

The methods used could not have been applied without proper input from the team facilitators and note takers to structure the overall process. In the user workshops, the note takers were allowed to take a more active role and support the creation of ideas in the teams—without being dominating in any way. This clearly also stimulated the participants in thinking about future technologies and situations where technology could support them. In all workshops, it has been clear that the incubation phase was an important factor. The breaks during the workshops functioned as relaxing phases in which the participants on one hand relaxed from the “job” they were asked to do, and on the other hand “working” (perhaps unconsciously) with ideas, sometimes producing new ideas when returning from the breaks.

There is no doubt that the proper evaluation of the new design framework ought to take place repeating the framework in different projects and with different participants. This evaluation is

based on user and expert workshops held as part of the same project. However, a final evaluation of the framework cannot be performed before the project has concluded, and the results have been implemented. Then it will be possible to see the value of the ideas and the user interaction that were generated in the project design phase. Applications have been produced with a direct link to the users, since they also contributed to testing these. By looking at this whole process, we could learn something more about the value of using participatory design and the creativity techniques. However, the need for envisioning a new personal network concept together with users has clearly indicated a necessity for incorporating creativity techniques more explicitly in more traditional participatory design methods.

Using participatory design principles is challenging for all ICT projects in the sense that the engineering designers do not necessarily believe that this kind of user involvement is a good idea. However, the application of participatory design principles and creativity techniques in MAGNET has provided an understanding of new aspects that has been acknowledged by some of the engineering designers. The new participatory design and creativity framework presented here addresses many valuable aspects of technology project development. One often-overlooked aspect is the need for teamwork skills to establish a team spirit atmosphere. The experience within the MAGNET context is that the framework ideas support the development of teamwork skills, and perhaps that it in itself will increase the possibility of successful future development projects.

ACKNOWLEDGMENTS

Acknowledgments should be given to all of the user and MAGNET expert participants in the workshops, especially to the diabetic persons and staff from Aalborg University. The research was carried out within the IST MAGNET project, FP6-IST-IP-507102, www.ist-magnet.org.

REFERENCES

- Alexander, I. F., & Maiden, N. (2004). *Scenarios, stories, use cases. Through the systems development life-cycle*. Chichester: John Wiley & Sons.
- Amabile, T. M. (1989). *How work environments affect creativity*. Paper presented at the IEEE International Conference on Systems, Man and Cybernetics, November 14-17.
- Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *Academy of Management Journal*, 39(5), 1154-1184.
- Asaro, P. M. (2000). Transforming society by transforming technology: the science and politics of participatory design. *Accounting Management and Information Technologies*, (10), 257-290.
- Beyer, H., & Holtzblatt, K. (1998). *Contextual design: Defining costumer-centered systems*. San Francisco: Morgan Kauffman.
- Bødker, S., Greenbaum, J., & Kyng, M. (1991). Setting the stage for design as action. In J. Greenbaum, & M. Kyng (Eds.), *Design at work: Cooperative design of computer systems* (pp. 139-154). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Carmel, E., Whitaker, R., & George, J. (1993). PD and joint application design: A transatlantic comparison. *Communications of the ACM*, 36(4), 40-48.
- Denzin, N. K., & Lincoln, Y. S. (2000). *Handbook of qualitative research* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Ehn, P. (1988). *Work-oriented design of computer artifacts*. Stockholm: Arbetstlivscentrum.
- Fogg, B. J. (2003). *Persuasive technology: Using computers to change what we think and do*. Amsterdam; Boston: Morgan Kaufmann Publishers.
- FoundationCoalition. (2002). Preparing a new generation of engineers. Retrieved June 15, 2005, from <http://www.foundationcoalition.org>
- Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.
- Gaver, B., Dunne, T., & Pacenti, E. (1999). Cultural probes. *Interactions*, (Jan + Feb).
- Godet, M., & Roubelat, F. (1999). Creating the future: The use and misuse of scenarios. *Long Range Planning*, 29(2), 164-171.
- Goff, K. (1998). *Everyday creativity*. Stillwater: Little Ox Books.
- Higgins, J. M. (1994). *101 creative problem solving techniques: The handbook of new ideas for business*. Winter Park, FL: New Management Pub. Co.
- Johnson, G., & Scholes, K. (1999). *Exploring corporate strategy* (5th ed.). London; New York: Prentice Hall Europe.
- Jungk, R., & Müllert, N. (1987). *Future workshops: How to create desirable futures*. London: Institute for Social Inventions.
- Kazanjian, R. K., Dradin, R., & Glynn, M. A. (2000). Creativity and technological learning: The roles of organization architecture and crisis in large-scale projects. *Journal of Engineering and Technology Management*, 17, 273-298.
- Kensing, F., & Blomberg, J. (1998). Participatory design: Issues and concerns. *Computer Supported Cooperative Work*, 7(3-4), 167-185.
- Kjeldskov, J., & Graham, C. (2003). A review of mobile HCI research methods. Paper presented at the *5th International Mobile HCI*, Udine, Italy, September 8-11 (pp. 317-335).
- Kleinrock, L. (1996a). Nomadic computing, information network and data communication. Paper presented at the *International Conference on Information Network and Data Communication*, Trondheim, Norway, June (pp. 223-233).

- Kleinrock, L. (1996b). Nomadicity: Anytime, anywhere in a disconnected world. *Mobile Networks and Applications*, 1(4), 351-357.
- Krogstie, J., Lyytinen, K., Opdahl, A. L., Pernici, B., Sian, K., & Smolander, K. (2004). Research areas and challenges for mobile information systems. *International Journal of Mobile Communications*, 2(3), 220-234.
- Kuuti, K. (1996). Activity theory as a potential framework for human-computer interaction research. In B. E. Nardi (Ed.), *Context and consciousness: Activity theory and human-computer interaction* (pp. 17-44). Cambridge, MA: The MIT Press.
- Leonart, A. D., & Swap, C. W. (1999). *When sparks fly*. Boston, MA: Harvard Business School Press.
- MAGNET. (2004). *MAGNET Technical Annex*. Retrieved June 15, 2004, from <http://www.ist-magnet.org>
- Millar, W. (1997). *E. Paul Torrance - "The creativity man"*. New Jersey: Ablex Publishing.
- Muller, M. J. (1991). *PICTIVE – An exploration in participatory design*. Paper presented at the Computer-Human Interaction Conference, Australia, April 27-May 2.
- Mumford, E. (1987). The collective resource approach to systems design. In G. Bjerknes, P. Ehn, & M. Kyng (Eds.), *Sociotechnical systems design: Evolving theory and practice* (pp. 59-76). Brookfield, VT: Avebury.
- Niemegeers, I., & Groot, S. M. H. d. (2002). From personal area networks to personal networks: A user oriented approach. *Personal Wireless Communications*, 22(2), 175-186.
- Osborn, A. (1953). *Applied imagination*. New York: Schreiberners.
- Pope, R. (2005). *Creativity, theory, history, practice*. London: Routledge.
- Schwartz, P. (1991). *The art of the long view*. New York: Currency Doubleday.
- Van der Heijden, K. (1996). *Scenarios: The art of strategic conversation*. Chichester: John Wiley & Sons.
- Vidal, R. V. V. (2003). *Creativity and problem solving* (No. 2002-3). Kgs. Lyngby: Technical University of Denmark.
- Wallas, G. (1926). *The art of thought*. London: J. Cape.
- Zappen, J. P., & Harrison, T. M. (2005). Intention and motive in information-system design: Toward a theory and method for assessing users' needs. In P. Van der Besselaar, & S. Koizumi (Eds.), *Digital cities 2003* (pp. 354-368). Berlin; Heidelberg: Springer-Verlag.

This work was previously published in Designing for Networked Communications: Strategies and Development, edited by S. Heilessen and S. Jensen, pp. 75-96, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.9

ICT and Developing Social Capital

Kate Sutcliffe

Gulf Savannah Development Inc., Australia

INTRODUCTION

Regional Overview

The Gulf Savannah region (Invest Australia and Gulf Savannah Development, 2003) of north Queensland covers 186,000 square kilometers, an area 80% the size of Victoria. The population of 8,000 live in small towns or Aboriginal communities dispersed across the region and on the large cattle stations and mine sites.

Traditionally, the region has relied on cattle, mining, and fishing for its economic base. Tourism is now fast becoming the leading industry for the area, with around 60,000 plus travelers a year visiting the region. While the basis for this assessment is partly anecdotal and gleaned from local government calculations, a recent study (Greiner et al., 2004) arrives at a figure of around 22,000 visitors per annum for two towns (Karumba and Normanton) in one Shire (Carpentaria). The Savannah Way, a themed adventure-drive linking Cairns on the eastern seaboard with Broome on the Indian Ocean traverses the Gulf Savannah region and was recently launched by the federal

Minister for Small Business and Tourism, the Hon. Joe Hockey MP. This destination is now attracting an increased visitation, estimated to be around 14% (Sutcliffe & Olsen, 2004) and provides potential niche enterprise opportunities for small business in the communities.

The beef road network developed by the federal government of Prime Minister Bob Menzies during the 1950s provides a skeletal transport framework for freight, stock, and people, but many sections are rendered impassible during the annual wet season. The road from the east coast to the largest town, Normanton on the Gulf of Carpentaria, a distance of some 700 km, was only sealed in late 2000. The western Gulf, however, is still isolated in the wet season, with the unsealed roads becoming impassible. In the past, long distances and poor roads inhibited travel across the region, and in many communities, vehicle ownership remains low, with more than 20% of dwellings having no vehicle (RIRDC, 2004). Air services link the major Gulf centres with the east coast and the major mining town of Mt. Isa. Until 2002, the cost of air travel was prohibitive and beyond the means of most residents, however,

the route is now subsidised by the Queensland Government in order to make the service more accessible for the community.

Before 2001/2002, Gulf telecommunications relied on antiquated and difficult-to-maintain land lines that were frequently damaged by fire and failed in inclement weather. Power supplies were unreliable, with brownouts a common occurrence, leading to equipment damage and failures. Use of ICT was limited, and few residents owned or could use a computer. In 2001, areas of the Gulf were reported as having the lowest proportion of people using computers at home, with less than 5% indicating usage (RIRDC, 2004). Historically, the limited transport infrastructure and the lack of reliable telecommunications and power services presented major barriers to development of the regional economy. Small business, local government, and essential services survived year to year with little change in ownership or business operations.

Inadequate communication, isolation during the wet season, and the long distances to travel over poor roads led the region to be regarded as a frontier outpost by governments of all levels and political hues for decades. To an extent, this isolation has shaped the way the communities regard governments and bureaucracies, creating a spirit of self-reliance and a measure of cynicism in response to government overtures, a factor to be considered for an e-democracy program in the region.

Demographics and Socioeconomic Features

The socioeconomic condition of the Gulf ranks it as one of the more disadvantaged regions in Australia. As reported in the *Social Atlas of Rural and Regional Australia* (RIRDC, 2004), incomes are lower than the state average, there is little secondary industry, and there is a dearth of investment capital. Home ownership is 20% below the nonmetropolitan average, and there is a

heavy reliance on public housing. Unemployment is high, with a dependence on the Community Development Employment Program and on government funding, grants, and subsidies. Recent data indicate the number of people on income support and pensions exceeds wage earners in several centres (ABS, National Regional Profile, 2004). Education standards are below par with those of urban areas, with schooling to Grade 10 available in just two centres. Due to the remoteness of the region, locally delivered training is difficult to access. Accommodation for rental is in short supply, with privately owned dwellings rented being more than 20% below the nonmetropolitan average (RIRDC, 2004), which is a hindrance to business development and expansion and results in overcrowding in some areas.

Community Social Capital

Gulf Savannah Development presented a detailed evaluation of the social capital of the Gulf region at the 2003 SEGRA (Sustainable Economic Growth for Regional Australia) conference (Sutcliffe et al., 2003). Isolated for decades and with a small population, informal networks between family and neighbours were vital for coexistence and support in times of need. As a result, the bonding social capital that developed between families and neighbours of the small communities is very strong. This has been further reinforced by the lack of fluidity in population composition, with new arrivals largely engaged to carry out specialist roles as teachers, police, and local government executives. This social environment gives strength to individuals within the community but is not necessarily conducive to acceptance of change or innovation. Newcomers not privy to the body of shared knowledge and experience feel like outsiders, a fact raised by participants at a series of capacity-building workshops delivered across the region by GSD during 2003.

The bridging social capital or the links to and between organisations and groups tends to reflect

the close bonding within the community. Each centre supports a number of small organisations comprising groups of like-minded people, often with the same key members. A common complaint is that the same people attend all the meetings and do all the work.

On the other hand, the linking social capital, the hierarchical and institutional networks from the region to external agencies, institutions, and bodies of influence in areas of higher education, professional groups, commerce, and industry require strengthening to broaden the sources of information flow to the region.

The implications for governance, regional competitive advantage, and business development were clear. To address this imbalance, GSD turned to the use of ICT as a tool to encourage communities and businesses to develop networks outside the region, to interact with governments and organisations with a view to generating knowledge of and trust in institutions beyond their immediate environs.

Existing Regional Governance and ICT

The level of trust within a community can be an indicator of the social capital of that community, whether trust is viewed as an element of social capital or as an outcome of social capital (Productivity Commission, 2003). All tiers of government have a role to play in building the social capital of a region, a key aspect of which is to build trust and confidence in governance at all levels. In the Gulf, Commonwealth and state agencies do not have permanent offices, apart from police, courts, health, and education personnel, and they are essentially outsiders looking in. For the most part, the local population sees them that way, and interaction between residents and the higher levels of government is sporadic.

Governance is essentially delivered by the five Gulf region Shire Councils. Populations are small, ranging between 350 and 1,800 people, resulting

in a low rates base and limited resources, which makes governance and community development over vast areas difficult.

Traditionally, Council activity concentrated on the three Rs—roads, rates, and rubbish. These functions are being added to as Councils play an increasing regulatory role in planning, public health, and the environment, and in developing management responsibilities in the whole area of community and social development, such as health, alcohol and drugs, community safety, and transport infrastructure (House of Representatives, 2003).

As a result, increasingly, the Councils in the region are being called upon to deal with high-level interaction with State and Commonwealth Governments, private enterprise, and the broader community. This has dramatically raised the performance bar for elected representatives and local government employees.

The Gulf local governments have reasonably sophisticated and well-managed IT communication systems for internal communications and external communications with agencies. However, e-communication between the Councils and the wider Gulf community are not advanced, with reliance on more traditional means of contact, such as newspapers and public fliers.

Currently, local government use of ICT to link with the community involves basic information provision but does not extend to development of e-democracy or any form of citizen involvement, such as surveys, data gathering, etc. It is an untapped resource for the ongoing development of social capital in the future.

WINDS OF CHANGE

Post 2000: What a Difference a Road Makes

The final sealing of the 700 kilometres of road between the Gulf region and the east coast cre-

ated a reliable, almost all-weather, physical link between the Gulf communities and the major centres of Cairns and Townsville, and that had a profound impact on visitation to the area. Data from the Main Roads Department road counters between two of the northern Gulf towns indicated an increase of 70% usage in the first few months. The Gulf immediately became more accessible; there were increasing numbers of travelers, with visitation extending over a longer period each ensuing year. The psychological barrier to traveling to the region was steadily being dismantled.

Residents were now readily able to travel out of the region, and business and tradespeople from outside the area could deliver services faster and with less wear and tear on vehicles. This had an impact on local businesses, forcing them to be more competitive. With the greater mobility of local residents, local businesses found themselves competing with their counterparts in larger provincial towns. This presents a challenge in any region, and those unwilling to face it generally vacate the field and leave opportunities for newcomers.

Telecommunications Revolution: Networking the Nation

When the Australian Government sold almost 50% of its stake in the national carrier Telstra, a proportion of the proceeds was channeled into a program to deliver more equitable telecommunications services to remote, rural areas. This program, Networking the Nation (NtN), was a catalyst for change. In 2001/2002, Gulf Savannah Development applied to NtN for funding to deliver mobile phone technology to the five key towns across the region. Additionally, for those people outside the limits of mobile phone coverage, subsidies were available for satellite phones and through a one-off offer made by Telstra and IBM, people could purchase computers and connect to broadband at a very low cost. Over 170 properties in the region took up this offer. The satellite phone subsidy will be available until 2007.

The Queensland Government also embarked in previous years on a program of community engagement, establishing regional community forums for residents along the eastern seaboard. In 2001, GSD sought to use its networks to develop a similar forum, a Gulf E-Forum, based on the Internet as a means of communication. GSD used funding available under the Queensland Community Skills Development Program to design an e-democracy project, which involved creation of an interactive Web portal (www.the-gulf.info) and basic training for Gulf residents in ICT, Internet, and e-mail use.

One of the key findings from the project was the presence of a significant number of people with no ICT access, who were not computer literate and lacked keyboard skills. This digital divide needed to be addressed. To move toward meeting this challenge, GSD is delivering a “Technology Survival Skills” program funded by the Queensland Government, which encourages those people without a computer to join small social groups to learn basic skills in ICT technology. This will enable them to access the public Internet services in each town.

IMPACTS AND OUTCOMES

Community Engagement

Improved communication is overcoming the tyranny of distance and counteracting isolation in business, governance, and social life, providing avenues for expanding networks and broadening the knowledge base for individuals and communities. This changes the dynamics of communities and challenges established views and platforms.

In terms of the regional economy, businesses have greater confidence to compete on a more level footing in a wider global market, with distance no longer being the huge barrier to access knowledge, trading, and markets. Likewise, governments can

more readily access residents and organisations, which were previously too far away to contact or interact with on a regular basis.

In the short term, we are starting to see citizen engagement at a basic level—increased use of e-mail, involvement in business forums, posting articles and calendar events, and responding to news items on the Gulf Web portal. There has been limited community input with regard to government service delivery and service requirements, e.g., in areas of health and telecommunications. Agencies have posted news items about future visits and services, and there has been a positive response to these. However, at a more advanced level of being able to influence policy, the uptake is relatively slow. For example, a survey on the Web site seeking views on the sale of the remainder of national telecommunications carrier, Telstra, a hot topic in the national media, attracted minimal response.

Businesses are using e-mail and the Web at a more sophisticated level and more frequently, with e-commerce becoming the rule rather than the exception. E-marketing and packaging of tours and taking bookings over the Web are all now commonplace, and many Gulf businesses have their own Web sites.

Changes to Social Capital Networks

In the relatively short term, we have seen practical changes in the way people communicate, a willingness to challenge the status quo and seek better services, especially in ICT. Businesses and residents are seeing the value in networking and linking to people, regions, and organisations outside their towns and shires.

Networks are developing slowly, such as the Savannah Way Visitor Information Centre (VIC) Cluster, which will provide a link for the Information Centres and tourism businesses across the Gulf region and into the Northern Territory and Western Australia. Evidence of change includes the following:

- Efficiency in business through small business banking, faster ordering, and bookings
- Enhanced competitiveness in business, as tourists and travelers have access to local operators' information on the Web
- Improved flow of information, as increased use of e-mail cuts costs of operations and overcomes slow mail delivery
- Interaction with government and agencies has been enhanced as the flow of information from the region has increased
- Improved access to global information with many businesses now trading on the Internet

FUTURE ACTIONS AND OBJECTIVES

Future activities and trends will see the region building on the changes taking place:

- Continuation of development of the concept of a community e-forum and e-governance for the region through the Gulf Web portal (www.the-gulf.info) and surveys and chat rooms.
- Identification and support for local champions to act in a mentoring role and ongoing skills enhancement to help bridge the digital divide and at the same time ensure that the traditional forms of communication are retained.
- Increased involvement of local elected representatives in community forums, more citizen engagement and online debate, and encouragement of their use of ICT to disseminate their views on local issues
- Continuing to build the social and economic capital of the region.
- Linking the e-forum to regional development processes, business development, and citizens' futures to ensure ongoing

and sustainable capacity building—e.g., encouraging Gulf residents to engage with the Queensland Government’s “Action Tracker” for the Gulf Regional Development Plan (GRDP). The Action Tracker is linked to the Gulf Web portal and enables any person to access the Regional Plan and check on the extent of work undertaken by government agencies to deliver the planning strategies.

SUMMARY

The work accomplished to date identified an existing digital divide between those with computers and those unlikely to have ready access to ICT. As we progress down the path of e-governance and e-commerce, the need to build the capacity of all residents to access the new technology is paramount if we are to ensure equality of access in a democratic society.

Improvements in ICT infrastructure teamed with the delivery of training and capacity-building programs to encourage people to maximise benefits from that infrastructure are paying dividends across the region. From our observation, Gulf residents are using ICT to a far greater extent to access knowledge and relay information and comments on a range of issues. Communities and businesses are expressing a preference to interact with all levels of government and conduct business by e-mail and Internet rather than by traditional telephone or postal services.

The social capital of communities will transform as residents become increasingly confident in the global environment and have the knowledge and skills base to deal with external agencies, governments, and institutions. This is a process of empowerment and a positive influence for the region, setting the community on the road to e-governance, e-commerce, and an increasing capacity to be innovative and have the assurance to build community enterprises.

ICT is enabling communities to be more competitive, broadening horizons, contributing to community debate beyond their immediate region and, consequently, playing a role on a far bigger stage.

REFERENCES

Australian Bureau of Statistics. (2004). *National regional profile, (Councils of Burke, Carpentaria, Croydon, Doomadgee, Etheridge, Kowanyama, Mornington Island)*, updated March 2004.

Department of Agriculture, Fisheries and Forestry. (2004). “*Country matters—Social atlas of rural and regional Australia; Bureau of rural science*.” Canberra: Australian Government, Rural Industries Research and Development Corporation (RIRDC).

Greiner, R., C. Mayocchi, S. Larson, N. Stoekl, & R. Schweigert. (2004). *Benefits and costs of tourism for remote communities—Case study for Carpentaria Shire in North West Queensland*. CSIRO Sustainable Ecosystems: Townsville and Tropical Savannas CRC: Darwin.

House of Representatives Standing Committee on Economics, Finance and Public Administration. (2003). *Rates and taxes—A fair share for responsible local government*. Canberra.

Invest Australia and Gulf Savannah Development. (2003). *Gulf Savannah Queensland, development potential, inside intelligence regional profile*.

Productivity Commission. (2003). *Social capital: Reviewing the concept and its policy implications*. Review Paper, AusInfo, Canberra.

Sutcliffe, K., Richardson, M., & Lawrence, G. (2003). *Investing in social capital—It pays*. Sustainable Economic Growth for Regional Australia (SEGRA) Conference.

Sutcliffe, K., & Olsen, M. (2004). *The Savannah way—Growing the future of Northern Australia*.

3rd National Tourism Futures Conference, Townsville, Australia.

KEY TERMS

Capacity Building: Building the skills, commitment, and confidence of community members to develop networks to influence what happens around them in their environment and give them the capability to contribute to shaping and planning their community's future.

Citizen Engagement: A two-way process through which a government or agency can develop an understanding of citizens' concerns and needs and respond to them, conversely enabling citizens to develop an appreciation of how they can positively contribute to and influence the future of their community and region.

Competitive Advantage: Defines a place's or region's attribute(s) with the potential to place it in a leading position in any field (generally used with regard to commercial or economic activity), such as a natural or environmental icon that may give a region a competitive advantage in terms of tourism, or a mineral deposit in terms of mining.

A region or place needs to identify and capitalise on distinctive assets and capacities to realise its competitive advantage.

Digital Divide: The gap created between those using ICT and those who do not, for a range of reasons, including a lack of access to ICT as a result of social or economic factors; lack of technical and keyboard skills to use ICT; lack of basic skills or computer literacy skills to understand the requirements and interpret the information of ICT.

E-Democracy: A qualitative term to describe the use of ICT as a medium in which to engage the community to participate in and contribute to the governance process generally, and to facilitate and enhance the capability of a citizen to have a say in the impact of governance on themselves and their communities.

E-Governance: A term to describe the delivery of the governance process using ICT rather than conventional and traditional means.

Regional E-Forum: A community and citizen engagement process linking government agencies and community, using ICT as the means of communication, and extending across and involving a region.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 337-341, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 2.10

A Taxonomy of Stakeholders: Human Roles in System Development

Ian F. Alexander

Scenario Plus, London, UK

ABSTRACT

Systems engineers have often paid too little attention to the nature of the so-called “users” of products under development. These are better called stakeholders, as many roles are involved, and few of those are in direct contact with the developed products. A simple and robust conceptual framework for classifying development stakeholders — a taxonomy — is proposed. The taxonomy is product centric, with concentric “circles” denoting broad categories of stakeholders. Within these, generic “slots” describe typical classes of stakeholders; these are subdivided into “roles,” which are expected to vary at least in name with the domain. Examples are given, and a popular template is reanalysed using the framework. The taxonomy has immediate value in identifying and validating stakeholder roles in requirements elicitation, helping to ensure that key viewpoints are not missed, and hence reducing the risk of instability and failure during development.

INTRODUCTION

Motivation

The structure of stakeholder roles and their relationships such as surrogacy have been very little investigated in the requirements world (though much more extensively in the political, ethical, and information systems worlds — one reason for believing that an attempt at an interdisciplinary look at stakeholders may be worthwhile). Requirements work almost inevitably involves dealing with stakeholders of widely varying kinds, and hence demands a commensurately wide range of elicitation techniques. The first step in identifying which techniques should be applied is therefore to identify the stakeholder composition for a new project, and this in turn demands a suitable taxonomy of stakeholders.

Too many projects focus their attention too closely on the product — perhaps especially when that is software — to the exclusion of non-

operational roles, and often even of secondary operational roles such as maintenance. I suspect this is due to “inside-out thinking” where the system is seen as important, and the user as secondary. Such thinking is a hangover from the past. When I was at university, an IBM 360 mainframe occupied the only air-conditioned tower on the campus. Students were permitted to approach only the card reader with a deck of punched cards; only trained operators were allowed upstairs to see the computer itself. This was truly a priestly hierarchy (in Greek, *hieros* is holy, *arches* is ruler) of operator roles. As Christopher Locke writes, “Even the word ‘users’ is an artefact of the [command-and-control] mentality” (Levine, Locke, Searls, & Weinberger, 2000). It is time to move on from treating “the user as a computer peripheral” (in Julian Hilton’s words). The system is made for man, not man for the system.

Many industrial development problems seem in practice to be caused not so much by a failure to write requirements, as by a failure to perceive that specific stakeholders’ viewpoints are relevant. That failure causes whole groups of requirements, typically those related to scenarios involving the missing stakeholders, to be missed.

A similarly unhappy result is obtained when one stakeholder, for example, a software developer, assumes one scope for a product, while another stakeholder, for example, a purchaser, assumes another. For instance, when a developer assumes that it will be sufficient to design, code, and test a piece of software, but the purchaser hopes to have everything set up and that the operators are trained, then the points of view of the installer, the trainer, and to some extent that of the operators have not been adequately considered and made explicit. Legal disputes and financial losses are then likely.

It seems likely that stakeholder composition is a good predictor of project risk; hence, it should be cost effective to characterize projects at their initiation according to their likely stakeholder impact (and to other variables, such as safety

relatedness, technological innovation, similarity to previous projects, and so on).

In addition, maintaining a model of stakeholders throughout a development allows changes in stakeholder composition to be modeled explicitly, leading to appropriate changes in requirements.

Stakeholder surrogacy has powerful and paradoxical connotations in requirements engineering. It is almost a dogma that projects should seek out ever-closer dialogue with stakeholders — consider the current fashion for integrated project teams, facilitated workshops, rapid prototyping, agile development with user stories, and so forth. Yet all the time, the obvious truth is glossed over: that it is remarkably rare to be able to talk to many stakeholders in the flesh. Every requirements engineer knows that the basic answer to the client organization’s boss who says, “I know everything that happens in my department; ask me,” is, “Well, that’s fine, but can I see if the people on the shop floor know of any small issues?” To put it more formally, standardized procedures, no matter how critical¹ and how carefully defined in writing, are always modified when operationalized “on the shop floor.” Therefore, it is essential to talk to stakeholders directly — without intermediaries — to find out what actually happens. Yet, requirements engineers are themselves intermediaries! Stakeholder surrogacy is accordingly discussed at some length below.

Worse, many kinds of stakeholders are inaccessible: They may be distant geographically, separated by contractual and procedural barriers, hidden within organizations (with cultural barriers), simply unaffordably expensive to contact given scarce project time and resources, or not yet in existence (for future products).

The naive “go and talk to the users” — whoever may be meant by that phrase — is therefore far from helpful as advice. This paper considers what we mean by stakeholder roles in development projects, and it offers both a theoretical framework for classifying them and some practical suggestions for making use of that knowledge.

A Taxonomy of Stakeholders

It may be that the approach can be applied outside system development, for example, to model political and business stakeholder structures, but that is beyond our scope.

Structure

The remainder of this paper is structured into sections as follows.

- Research Review
- The Proposed Taxonomy
- Applying the Taxonomy in Practice
- Discussion: Features and Limitations of the Taxonomy
- Conclusion

RESEARCH REVIEW

The focus of this paper is on the place of stakeholder analysis in system development, and perhaps especially in requirements elicitation. However, the subject of stakeholders is far wider than that. This section therefore attempts to set the current work in its system-engineering context, and briefly also in the wider onion circles of information systems research and business studies. These literatures are voluminous, so references are confined to key papers on each topic.

This research review section is organized by topic as follows.

- Stakeholder Analysis
- Onion Models
- Taxonomies and Hierarchies
- Goals and Viewpoints
- Human Aspects of System Development
- Surrogacy

The logic of this should become apparent, but in essence, the information systems and other literatures on stakeholders are briefly introduced; the background to the paper's use of onion models and a taxonomy of stakeholders is sketched; existing

work related to stakeholder classification in the requirements engineering and usability fields is examined; and finally, since stakeholder surrogacy seems to be significant in system development, research on surrogacy is explored.

Stakeholder Analysis

Mason and Mitroff (1981) helped to introduce stakeholder analysis to business practice. Their definition is, "Stakeholders are all those claimants inside and outside the firm who have a vested interest in the problem and its solution," (p. 43) and, "[They] are the concrete entities that affect and in turn are affected by a policy" (p. 95). They suggested ways of identifying stakeholders, including considering standard demographic groups (age, sex, etc.) for relevance, asking people who they consider to be the key stakeholders, and studying accounts of ethnographic fieldwork to discover who seems to have a valid interest.

An authoritative account of business stakeholders can be found in Donaldson and Preston (1995). The paper describes a corporation "as a constellation of co-operative and competitive interests possessing intrinsic value" (p. 66). It states that the stakeholder theory is descriptive of the corporation, instrumental in helping people to examine stakeholder management practices, normative in establishing that stakeholders deserve attention, and managerial in recommending attitudes, structures, and practices. However, it considers the corporation as the system of interest, and does not look at software or product development.

Pouloudi (1999) examines the concept of stakeholder and its use in information systems development. The paper is an excellent introduction to the extensive information systems literature on stakeholders, and it analyses some of the weaknesses of the concept (including it being "almost a cliché," quoting from D. Willets). For our purposes here, one key point is that it does not make sense to treat human and nonhuman actors symmetri-

cally: They are simply different. Pouloudi notes the discomfort of Vidgen and McMaster “about assigning anthropomorphic properties to nonhuman resources,” and states that

I do not subscribe to the symmetrical treatment of humans and non-humans or the treatment of non-humans as stakeholders, although it is interesting and indeed necessary to consider the way in which non-humans — including...information systems — “inscribe, represent, and speak for” the interests of stakeholders. (p. 13)

In the taxonomy presented here, all stakeholders are human; interfacing systems are represented by humans responsible for them, that is, in accordance with Pouloudi’s approach. Pouloudi has also studied stakeholder identification, for example, in a medical context (Pouloudi & Whitley, 1997). This is a very different context from that of system development, but the paper is of interest for its clear thinking and practical approach.

Sharp, Finkelstein, and Galal (1999) suggested a simple recursive procedure, starting from an initial contact person, and asking each interviewed person who might be worth speaking to. The procedure terminates when no new names arise or when the new names are found not to be relevant. The paper described a simple method for identifying stakeholders starting from the initial point of contact (which might typically be the project sponsor). This is one of the few papers to address the issue directly, and its suggestion is sensible. However it is not a substitute for a template (based on a taxonomy); the method could be time consuming and it is likely to reveal only the stakeholders that everybody knows already. To be fair, the method of asking each interviewee who else might be relevant is almost an obvious good practice during requirements elicitation. The paper also pointed out that stakeholder classes (slots) should be characterized by their relationships to the system, to other stakeholders, and by the priority to be given to each stakeholder’s

view. These dimensions are used here, though they are rough guides at best (along with the time that each slot might be relevant).

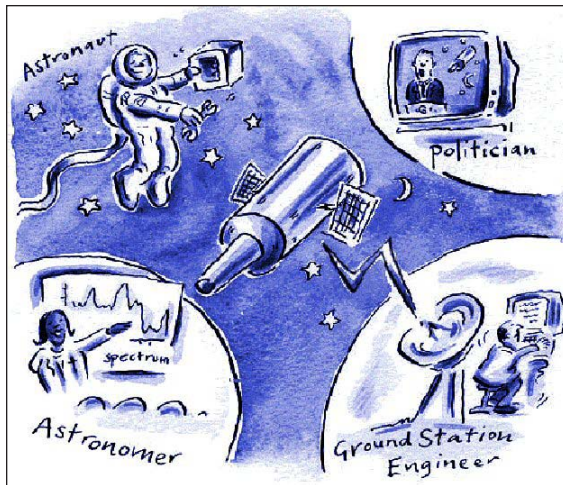
Robertson and Robertson (1999) distinguish clients, customers, and other stakeholders including subject-matter experts, marketing people, product managers, and so on, and attempts to prioritize them: “the principal stakeholders are the users, clients, and customers” (p. 35). However, the general effect is a flat, unstructured list of many interested parties. The Volere template (by the same authors) similarly proposes a flat list of roles as one axis of a matrix to organize which kind of stakeholder to consult for which “class of knowledge” (Volere, 2004). The taxonomy proposed in this paper offers a richer and more-explanatory structure, and suggests the significance of key roles and their interactions.

The work by Alexander and Stevens (2002) contains a chapter on identifying stakeholders (pp. 19-26). It also distinguishes “users” from clients, suppliers, managers “who are concerned for the system to succeed” (and by implication, other people with that concern), and regulators, and it briefly discusses the role of people in the development organization (p. 7). The variety of roles is illustrated with a cartoon of stakeholders in a space telescope project (p. 20), which shows an astronaut carrying out maintenance, a ground station engineer operating the spacecraft, an astronomer discussing the data produced by the telescope, and a politician gaining political benefit from the system (Figure 1). The discussion of these roles makes clear that these represent different viewpoints, not necessarily conflicting. This was a sensible and pragmatic position, but the proposed taxonomy looks far more deeply at the structure and possible conflicts between stakeholders.

There is much pragmatic wisdom in dealing with stakeholders in Peter Checkland’s many writings, for example, Checkland and Scholes (1990). He does not write on the whole focus on the development of products or services, and

A Taxonomy of Stakeholders

Figure 1. Space telescope stakeholders (Alexander & Stevens, 2002)



indeed he seems to believe that that is the easy part of the problem! For example, he says

It now seems that, in the future, the computer project managed through a “project life cycle” will increasingly become the occasional special case in which some uncontentious and relatively mechanical administrative procedures are computerized. Where perceptions and meanings, and hence tasks, are more problematical, the “project” approach needs to be complemented by a process for the continuous rethinking of organizational tasks and processes... (Checkland & Scholes, 1990, p. 312)

While we may readily agree with Checkland’s emphasis on process rather than project, and take his advice on (human) “perceptions and meanings” and “rethinking” as a hint to keep up to date with our stakeholder analysis, we do not think that software only implements uncontentious mechanical procedures. Indeed, major products such as enterprise resource planning tools can have a powerful and sometimes deleterious impact on organizations (note that we consider the customization of such COTS tools for an organization to be a kind of development project).

Another worker — both researcher and practitioner — who helped to pioneer sociotechnical design is Enid Mumford. In her long career and her many writings (e.g., Mumford, 1996), she emphasized a humanistic and ethical approach to the people whose work was affected by process redesign and automation. She talks more often about specific people, individuals, clerks, groups, staff, and so on, rather than using generalities like stakeholders. However, much of her work was precisely about paying more attention to the different groups of people involved in or affected by a project. For example,

At these meetings a large number of organizational problems emerged and she [Mumford] suggested to the clerks that they should think about how these might be solved.

She then forgot about this request and fed-back the results of the survey to the members of the technical design group. They subsequently designed what they thought was an excellent socio-technical system, called a meeting of all the clerks, described their proposed system and sat back and waited for the applause. To their astonishment there was silence. Then one of the senior clerks stood up...He then produced an excellent blue-print for a work structure that solved most of the office’s efficiency and job satisfaction problems.

...The author learnt a very important lesson from this experience...This is never to underestimate a group’s abilities. (Mumford, 1996, p. 87)

Onion Models

Peer: (Pulls off several layers at once.)

*What an enormous number of swathings!
Isn’t the kernel soon coming to light?*

(Pulls the whole onion to pieces.)

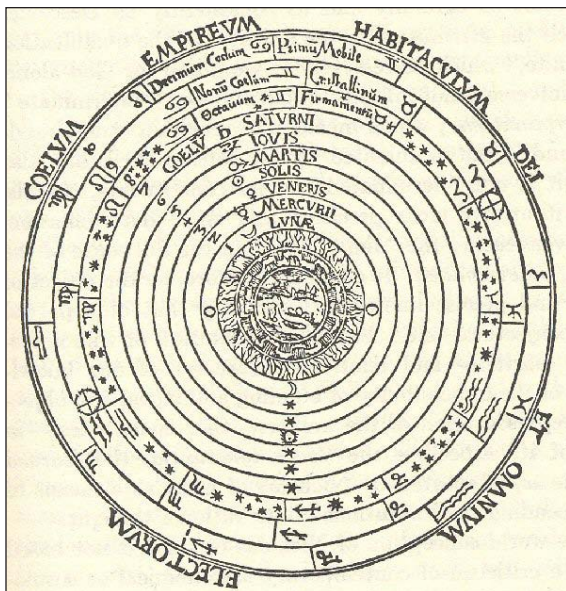
*I'm blest if it is! To the innermost centre, it's nothing but swathings-each smaller and smaller.
- Nature is witty!*

(Throws the fragments away.)

Peer Gynt, Act 5, Scene 5, by Henrik Ibsen (1867/1992)

Onion models have been used for centuries to indicate hierarchical spheres of influence. Alexandre Koyré's wonderful *From the Closed World to the Infinite Universe* (Koyré, 1957/1968) uses the beautiful 11-layered onion diagram of Peter Apian's 1539 *Cosmographia*, a pre-Copernican model of the universe, on its cover (Figure 2). Apian has the imperfect and changeable Earth at the centre and *Coelum Empireum Habitaculum Dei et Omnium Electorum* (i.e., the Empyrean heavens, the dwelling place of God and all the elect) as the outermost, perfectly unchangeable layer.

Figure 2. Apian's onion diagram of the universe (Koyré, 1957/1968)



This implied a fixed frame of reference for each class of beings in the Great Chain (Lovejoy, 1936/1990), very far from the dynamic situation-dependent stakeholder webs of Coakes and Elliman (1999) who describe the role of stakeholders in managing change. Their term, stakeholder webs, has entered popular currency, perhaps by association with fashionable terms like World Wide Web and semantic web, and may have done much to get people thinking about stakeholders in software development.

Their webs are drawn as cobwebs with radial lines and concentric ellipses. This makes them look something like onion models, but,

The importance of the web is not in the exact labelling of sectors and boundaries but in seeing the web as a continuum. The sectors and labels shown in [a figure] are not a prescriptive or a priori model for all webs but...the groupings that emerged from the case study. (p. 9)

Thus, the Coakes and Elliman stakeholder web is expected to be different for each examined system: There is no recognizable taxonomic pattern common to different developments. Somewhat in contradiction to this, Figure 1 of their paper illustrates the choice of the system boundary, based on Midgley (1992), which shows concentric circles labeled "Technical System Boundary," "Organizational Boundary" outside that, and finally "Human or Total System Boundary" on the outside (Figure 6). Within the technical system boundary are three items linked by bidirectional arrows: computer information system, whose boundary is labeled "Automation Boundary," direct system users, and system designers. Within the organizational boundary is a text label "Executive and wider Management, Other Divisions and business activities." Within the human or total system boundary is a text label "Shareholders, Clients, Government, and other Stakeholders, beyond the organizational boundary" (p. 6).

A Taxonomy of Stakeholders

Figure 3. A stakeholder web (Coakes & Elliman, 1999)

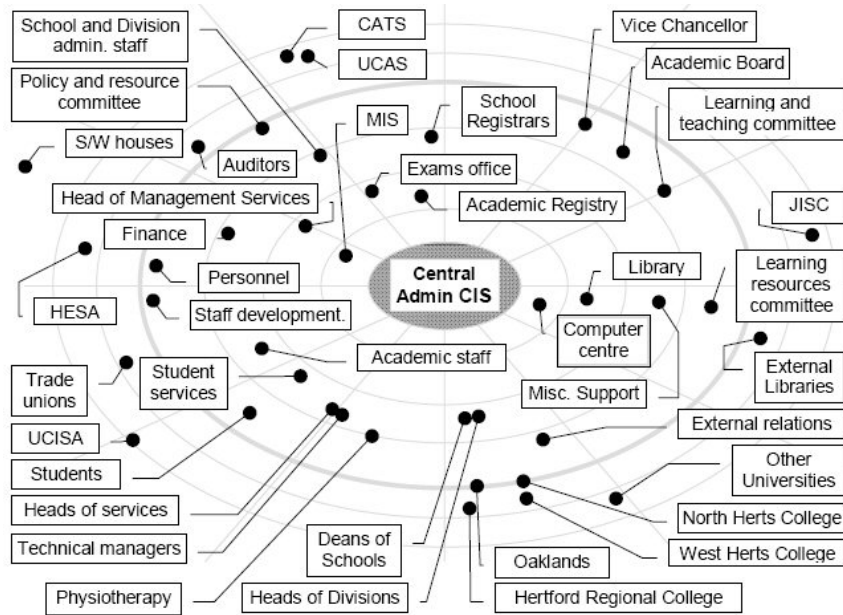
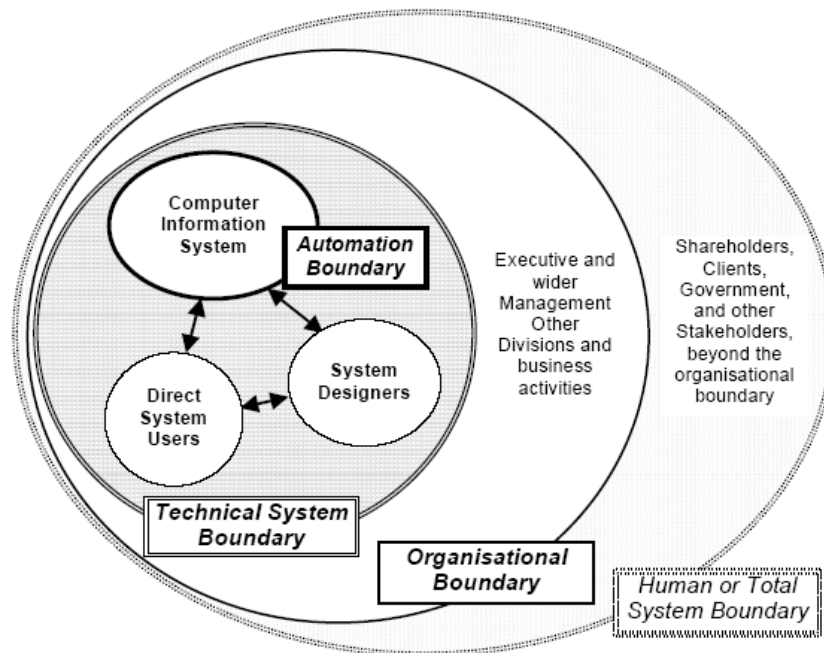


Figure 4. Midgley's onion (Coakes & Elliman, 1999)



This is clearly a rudimentary onion model. We can make the following assignments.

- computer information system is (an example of) our kit or product
- direct system users are our normal operators (but see criticism of the term “users” below)
- System designers are our developers, who seem oddly placed within the technical system, given that they may have no part in the system’s daily operations. It looks as if the operational boundary is here confounded with the boundary of all matters engineering and technical. The figure is criticized by both Midgley and Coakes and Elliman, who argue that the “critical setting of the system boundary” needs to be “determined by examining the viewpoints of stakeholder groups...rather than technical issues” (p. 6). However, the automation boundary remains important as a contractual and developmental reality; while the figure is clearly defective as regards to the technical system boundary, it can be corrected by removing the system designers from it, and inserting any other types of operators that may be needed, as is argued below.
- Similarly, executives and management may loosely correspond to our functional, financial, or political beneficiaries, but there is no reason why the organizational boundary should fit neatly within the total system boundary if this is taken to mean our wider environment with respect to a specific kit or product: Some parts of the organization’s management may be involved, others not. Simply because some deadwood paper-pushers are within the organization does not make them valid stakeholders: That way madness lies.
- Again, shareholders, clients, and government can reasonably be equated with our financial beneficiaries, purchaser (perhaps client is a

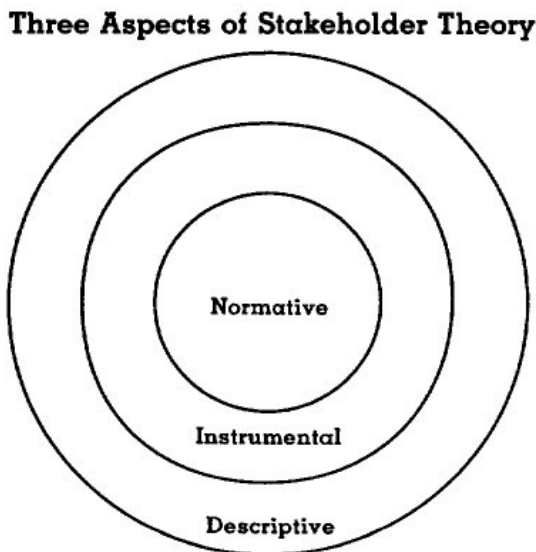
slippery term), and political beneficiary (or perhaps regulator, depending on the situation).

Coakes and Elliman (1999) are probably right, therefore, to reject the Midgley (1992) onion model, but a more-carefully considered model may overcome their objections. Designers and developers do not belong inside the technical system boundary — in any case, since it contains people, it must be sociotechnical. The organizational boundary is the wrong one to choose (unless, of course, it is the organization rather than a product or development which is your focus), and the human or total system boundary does seem rather vague. On the other hand, there is usually a containing system (in our terms, see “Structure of the Onion Model”) that makes use of the results or outputs of the (sociotechnical) system that we are developing — otherwise, why would anyone pay to develop it? — and there are indeed stakeholders such as shareholders and the government who may have an interest in aspects of the system, while not themselves playing any part in its development or operation. The problem with a stakeholder web formed afresh for each new system is that it offers little guidance, whereas the engineers working on yet another telemetry system (say) are immediately aware that what they are doing is very similar to what they did on previous projects. Coakes and Elliman throw out the baby with the bathwater.

A modern onion model related to stakeholders can be found in Donaldson and Preston (1995, p. 74). However, their model’s circles, starting from the centre, are the normative, instrumental, and descriptive aspects of stakeholder theory (Figure 8). These

are nested within each other...The external shell of the theory is its descriptive aspect; the theory presents and explains relationships that are observed in the external world. The theory’s descriptive accuracy is supported, at the second

Figure 5. A wholly different onion model (Donaldson & Preston, 1995)



level, by its instrumental and predictive value; if certain practices are carried out, then certain results will be obtained. The central core of the theory is, however, normative. (p. 74)

The Donaldson and Preston onion model is thus used to help visualize the structure of the theory, not the relationships of the stakeholders and a product under development.

Hirschheim and Klein, 2003) reflect on the state of information systems research in a long and discursive paper. In a nutshell, they wonder whether information systems can effectively mediate social dialogue, and if so how the field would have to be structured. Understanding organizational stakeholders better would form an important part of that program. The authors refer to “immediate,” “external,” and “societal” stakeholders, implying something like an onion structure, though not exactly the one described here. Immediate roles, for instance, include “a managerial elite and their masters, the shareholders” (p. 271), though it is not clear if in fact the shareholders are immediate or one-jump removed by being the masters of the managerial elite. If

the latter, then there might be a reasonable match with the onion model given here: managers are functional beneficiaries and shareholders are financial beneficiaries. However, the focus of the paper is not on products, but on information systems professionals, themselves.

Taxonomies and Hierarchies

The general subjects of taxonomy and hierarchy are far too broad to be addressed here in any detail. Susan Leigh Star has written engagingly about classification (e.g., Bowker & Leigh Star, 1999). She states that classification systems should exhibit consistent principles, mutually exclusive categories, and completeness. It is hard to make any such classification of stakeholders; while the roles listed here seem to be usable consistently, and are mutually exclusive, one person can play several roles and it is impossible to be sure that new roles will not arise, so completeness is unattainable. Any taxonomy of stakeholders must be tentative at best.

Under the heading of “Hierarchical Structure,” Jackson (1995, pp. 92-95) wittily makes the point that one taxonomy can only do one job; very often several different hierarchies are needed. Indeed, one of the key principles of Jackson’s JSD and JSP methods is to make sure that your representations adequately span the problem. You may need one data structure that understands files (file start - data - file end) and another that understands transactions recorded within those files (start event - more events - end event). Either on its own is insufficient: A transaction might, for instance, span two files. Analyzing stakeholders by their relatedness to a product is only part of the story.

Goals and Viewpoints

Two areas of requirements engineering related to stakeholder analysis are goal modeling and viewpoint analysis.

A goal is an intention that a stakeholder has for a development project (or more widely, for a business, or indeed, for a lifetime), for example, that it will make preparing accounts easier. Goals may interact positively or negatively; achieving one goal may make it easier or harder to achieve another. Such interactions can easily be modeled graphically, making conflicts easy to visualize. Hence, modeling goals and their interactions is one way to explore the relationships between stakeholders with different needs. What goal modeling is not designed to do is to identify or classify the stakeholders themselves, though it can explore their social and operational interactions (and even their beliefs). Goal modeling is therefore, like most other approaches, likely to discover operational (“Our System”) roles rather than those in the wider circles of the onion model. There is extensive literature on goals; a good starting point is Yu and Mylopoulos (1998).

Negative interactions can also be intentional and dynamic, in which case they may more directly be modeled as negative scenarios or misuse cases (Alexander, 2002). This approach has the merit of considering threats, risks, and hazards, whether caused intentionally or not, and how to mitigate them. It will therefore put the spotlight on negative stakeholders as well as normal operators. However, this approach, too, tends to direct attention mainly to operational issues.

A viewpoint is either the perspective that a given stakeholder has on a development project or its product, for example, that they will continue to have an interesting job and a decent salary, or the projection (e.g., of requirements) onto the system from the position of a given stakeholder role, for example, an employee’s. Analyzing viewpoints helps to discover whole groups of requirements, can indicate possible conflicts, and, hence, can help to create better and more stable specifications.

A readable introduction to viewpoints is in Kotonya and Sommerville (1998). It describes a method of viewpoint-oriented requirements development (VORD), explicitly a stakeholder-

centered approach. As well as describing a method for discovering viewpoints and resolving stakeholder conflicts, it presents a simple taxonomy of “abstract viewpoint classes” (p. 219), classifying viewpoints into direct and indirect. These do not correspond exactly to our operational and non-operational. Instead, direct includes the system (our interfacing systems, see “Structure of the Onion Model” below) and the operator (our normal operator). Indirect is divided into engineering (maintenance and standards; we consider maintenance to be operational, while standards mean the regulator), regulatory, organization (procurer, policy, and training) and environment. A further paper by the same team (Sommerville, Sawyer, & Viller, 1998) describes the PreView approach in which viewpoints are treated as projections onto a system. One stakeholder viewpoint then naturally corresponds to a substantial set of requirements.

Multiview (Avison & Wood-Harper, 1990) is a well-respected approach to system design based on the idea of multiple stakeholders’ views on the system, and on choosing appropriate tools and techniques according to the problem situation thus defined; as such, it owes something to soft systems methodology (Checkland & Scholes, 1990). Both “soft” and “hard” aspects are considered: human exploration and sociotechnical analysis on the soft side, information analysis and specification on the hard side. This is obviously sensible and practical. However, it does not attempt to classify stakeholder roles. Multiview 2 went further in several ways, including a “systemic stakeholder analysis” within its organizational analysis, and using ethnography in the sociotechnical analysis (Bennetts & Wood-Harper, 2000). However, it did not attempt a taxonomy of stakeholders.

Human Aspects of System Development

There is extensive literature on human aspects of system development. It seems, however, to focus

A Taxonomy of Stakeholders

quite naturally on the user (by which is generally meant our normal operator) at the expense of all other roles. This is no place for a full literature survey, but a good starting point is Sutcliffe (2002), which approaches requirements engineering from a background in human-computer interaction and has an extensive bibliography.

Sutcliffe distinguishes customers, users, managers, software engineers, system testers, and system maintainers — ‘Maintenance personnel are rarely consulted in requirements analysis yet they depend on accurate requirements documentation more than most’ (p. 17) — and it could be added, they have more to contribute than most, too. These roles are notably concentrated on in “Our System,” but to be fair, they are said to be those that can write requirements. Stakeholders are further classified (pp. 56-57) as follows.

- **primary** stakeholders “who will actually operate the system” (our normal operators, and possibly also our maintenance operators, equivalent to UML actors)
- **secondary** “users who will not actually operate the system but will consume its output and depend on its operation for successful completion of their work.” The astronomer of Alexander and Stevens (2002; see above) would be an example (our functional beneficiary). Note the typical awkwardness and circumlocution necessitated by overloading the term users to mean both operator and beneficiary.
- **tertiary** “senior managers who rarely consume the system output directly but make use of information for planning and strategic control of the business.” This seems to denote either our functional beneficiary or our political Beneficiary.

Sutcliffe’s classification is interesting but limited to thinking about people who receive information outputs. However, the book also describes more-general stakeholder analysis

methods, somewhat surprisingly quoting the ruggedly practical and pioneering Gause and Weinberg (1989) rather than the more academic Kotonya and Sommerville (1998), which one might have expected.

Surrogacy

Surrogacy has apparently scarcely been researched as a requirements engineering issue. It is mentioned briefly in some of our own earlier work on stakeholders (Alexander, 2003) and in a practical way on the Scenario Plus stakeholders template (Scenario Plus, 2004).

Damian and Zowghi (2002) state that a business management department acted as a surrogate stakeholder: “Hence BM became a surrogate customer for the developers in Australia and the need for effective collaboration with DM group emerged as critical in order to meet commitments made to the customers.”

The point is not developed further, but it is clear that in the context of using technology to support requirements engineering (RE) across sites on different continents (America, Australia, Europe), the issue of who you can actually speak to, and whether they fairly represent who they claim to, is highly significant.

A set of guidelines (Kitapci & Bhuta, 2003) for using the EasyWinWin (requirements negotiation) tool and approach (Boehm, Grünbacher, & Briggs, 2003) tantalizingly mentions appointing “one of the team members as a surrogate customer if the customer would not be using the EasyWinWin tool.” However, the significance of surrogacy is not considered.

Surrogacy is also occasionally mentioned in nonrequirements work on stakeholders (i.e., to do with steady-state business, not with system development). For instance, Wood (1999) writes, “The Chief Executive Officer acts as the surrogate employer of teachers, but it is unclear who is responsible for the teacher relationship.”

Similarly, Younkins (2001) expresses the sentiment,

The corporation should be managed for the benefit of its stakeholders and the groups must participate in decisions that affect their welfare. Such participation is indirect with managers having surrogate duty to represent the stakeholders' interests. Managers are said to have a fiduciary relationship to stakeholders and must act in the interests of the stakeholders as their agents.

The focus of such work is, however (in both these examples), on the political and social significance of stakeholder responsibilities, not on surrogacy as such.

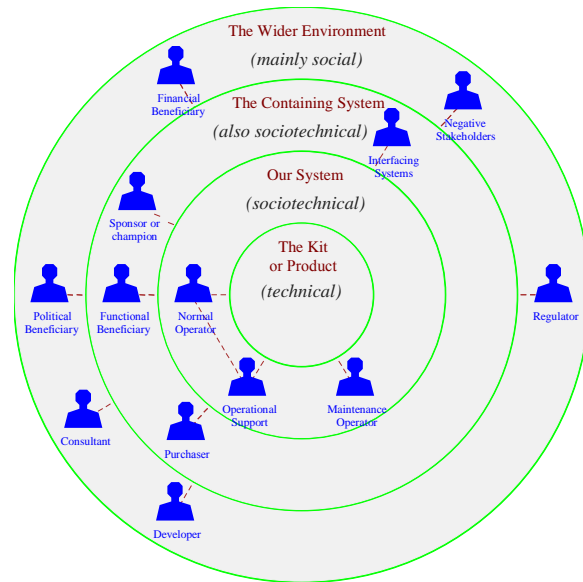
Donaldson and Preston (1995) begin, interestingly, with a quotation from E. Merrick Dodd, Jr., writing in the *Harvard Law Review* of 1932. Dodd does not use the term stakeholder, but he is plainly thinking of the same concept: "If the unity of the corporate body is real, then there is reality and not simply legal fiction in the proposition that the managers of the unit are fiduciaries for it and not merely for its individual members, that they are...trustees for an institution [with multiple constituents] rather than attorneys for the stockholders." Both the concept of stakeholder and the importance of surrogacy are evident from this early discussion.

Potts (1995) does not explicitly mention surrogacy, but does consider the relationship of customer and developer and some of the misunderstandings that can arise across the gap between them, for example, the contractual interface and hence the supplier-purchaser roles that are created (with inevitable surrogacy). His talk's provocative title also led requirements people to reflect on the nature of the stakeholder-developer interface.

THE PROPOSED TAXONOMY

A project's stakeholder sociology can be modeled graphically on an onion diagram (Figure 6). This

Figure 6. Onion diagram of product stakeholders



deceptively simple-looking model documents a wealth of information about a project. It presents a view of the project that is centered on its product, and serves as an overview of our stakeholder taxonomy.

The onion diagram displays a customizable set of named slots (silhouette icons), containing stakeholder roles, in three or more circles centered on the kit or product. For example, pilot is a role (not shown) in the normal-operator slot in the "Our System" circle, where product is an aircraft.

Structure of the Onion Model

This section introduces and defines the terms used in the onion model and the associated taxonomy of stakeholders. The onion model consists by default of a set of three concentric circles. Each circle logically contains the circles drawn inside it. (The term "annulus" may be used where it is desired to refer to the contents of a circle without those of the circles it contains.) Other circles may be added, most likely by subdividing the default circles.

Figure 7. Viewpoints as attributes of traceable slot and role objects

| ID | Stakeholder Slots and Roles | Brief Summary of Viewpoint | Polar Angle |
|-------|-------------------------------------|--|-------------|
| SH-37 | 2.1 The Wider Environment | | |
| SH-55 | 2.1.1 Consultant | gives advice | 150 |
| SH-56 | 2.1.1.1 Tools and Techniques | advises on efficient use of technology | |
| SH-65 | 2.1.1.2 Environmental Impact | advises on likely impact of product on the environment | |
| SH-39 | 2.1.2 Financial Beneficiary | stands to profit from system | 240 |

Hence, a circle denotes a subset of entities in the world relevant to a development project. Those entities are slots and circles.

The innermost ring (not strictly a circle) denotes the kit, a conveniently short term for the equipment or product under development, whatever its nature, for instance, software or electronics hardware. This could be a one-off piece of custom financial software, or a mass-market product such as a handheld information device. It could equally well be the tangible equipment for a large system such as a railway line: the system with its many human operators would of course be more than just that equipment. The innermost ring thus differs from true circles in not containing stakeholders.

A slot is a class of roles that is drawn by default (empty if necessary) in an onion diagram. In effect, it is a prediction or suggestion that roles of a certain kind may be important in a project. For example, the normal operator is a default slot in the “Our System” circle. The existence of the slot is a prediction that in any system, there will probably be one or more normal-operator roles. The slot might remain empty in a supposedly “wholly automatic” system, though such a system might still have other human roles such as an installer, configurer, and maintainer within the “Our System” circle.

A slot is said to be empty in an onion model when it contains no roles. For example, take a product like a distress-signal flare. This product

is fired by a sailor to attract rescuers; whether it succeeds or fails, it is then disposed of. No maintenance work of any kind is carried out on it, so it has no maintenance operator, and that slot is empty.

A role is a class of stakeholders with a distinct relationship to the product under development. For example, in a passenger aircraft, both pilot and flight engineer are roles within the normal-operator slot.

A role is said to be a surrogate if it is conducted on behalf of another role that cannot speak directly for itself. For example, a product manager acts as the purchaser of a new type of product until such time as the product can be sold on the mass market; then the consumers buy instances of the product (or not) for themselves. As another example, the regulator acts as a government-sponsored voice on behalf of the public to ensure safety and so forth. Surrogacy is discussed in more detail below.

A role is said to be negative if it is associated with viewpoints opposed to the successful completion of the product’s development or its coming into service, or its successful operation. Viewpoints, statements of the points of view of stakeholders in a role with respect to the product, do not appear in the onion model as such, but can be documented briefly as text attributes of role objects in an associated database (Figure 12) or in full as sets of requirements (not shown) linked to role objects. It may be useful to document generalized viewpoints as attributes of slot

objects, summarizing a group of more-specific role viewpoints. Tool support is discussed below (“Tool and Template Support”).

In this example, consultant is a slot in the “Wider Environment” circle, containing two currently defined roles. Other attributes include viewpoint text (here with very brief examples); “Polar Angle” specifies where icons should appear on the diagram, and so on. Traceability links (indicated by triangles) can be inserted between stakeholder roles and detailed viewpoint requirements, and so forth.

A stakeholder is an individual person or other legal entity able to act like a person (e.g., a limited company, an industry regulator, a registered charity) playing one or more roles. Note, however, that in accordance with common usage, we loosely describe both slots and roles as stakeholders when the class-instance distinction is not of immediate concern.

It would also be possible to limit the definition to “individual person”; this would have the advantage of avoiding possible confusion between Company XYZ as a stakeholder and the Company XYZ containing system as a circle. Furthermore, while a suitably placed individual (e.g., the chairman, the press relations officer) can legitimately represent the voice of a company as a corporate legal entity, that individual cannot legitimately claim to speak for each of the many roles within the company as far as their viewpoints and requirements are concerned. There are thus some dangers associated with treating legal entities as stakeholders, but there are obvious advantages. For instance, if a conservation body chooses to oppose a development, its negative stakeholding can reasonably be treated as a single voice, in accordance with its legal status.

Circles

The four default circles used in the onion model are the following.

1. “The Product” or “The Kit”: the item under development, for example, a software program, a consumer electronics device, an aircraft, or a communications network.
2. “Our System”: the product plus its human operators and the standard operating procedures or rules governing its operation.
3. “The Containing System”: our system plus any human beneficiaries of our system (whether they are involved in operations or not).
4. “The Wider Environment”: the containing system plus any other stakeholders.

Other circles may be introduced as necessary. For example, an additional circle might be created outside “The Containing System” to divide stakeholders relatively closely involved with the project from those more distantly involved in the wider environment. That might be helpful when a product forms a component of a subsystem within a larger system. For example, when our product is a control box for a train (the containing system), we might wish to consider a “Wider System” circle, namely, a railway line with stakeholder roles such as line controller, and even a “System Environment” circle, namely, a complete railway network with roles such as network timetable scheduler, as distinct from the wider environment which might include stakeholder roles such as the general public and the government.

The “Kit” or “Product” circle is considered to be the part of our system that can be sold, so it does not contain humans. All the other circles contain stakeholders. This does raise an interesting problem of consistency: Since it is a purely relative matter which system in the real world we consider to be our system, it is perfectly possible for somebody else to treat our system as a component part of their product. What is happening here, however, is that they are focussing attention only on the machine (nonhuman) aspects of our system for the purposes of product development. Of course, the stakeholders do not disappear, but

A Taxonomy of Stakeholders

they will either be treated as insignificant from the (larger) viewpoint, or they will be promoted to the rank of stakeholder in the larger product.

For example, if the larger product is a train, its normal operator is a driver. Our component product, the train's control box, is also operated by the driver, who only appears once in the model outside the product, the train, as one would expect. The fact that the driver also operates a subproduct of the train (the control box) does not make the driver a part of the product. Thus, at the level of detail of the larger viewpoint, there is no need to consider separate subproduct stakeholders. In general, therefore, as long as one considers just one system at a time, there is no problem of consistency. A shift of viewpoint to consider a larger or smaller product rightly causes a change in the perspective of the onion model.

One might ask whether distance from the kit means less influence on the requirements for it: This would be a simple application of the spatial metaphor of the onion diagram. (See "Visual Metaphors" for a fuller discussion of visual metaphor.) However, there seems to be no reason to believe this. On the contrary, the approach here emphasizes that stakeholders who never see the kit may be crucially important to a development project. As Coakes and Ellison (1999) say of their stakeholder web diagrams,

The...diagram is not intended to depict stakeholders from some judgmental position such as degrees of power, influence, or interest. In particular, care must be taken not to interpret distance from the central [product] as an indication of importance. Some of the most influential stakeholders may be remote from the organization. (p. 11)

A well-known example is the occasion where English Heritage stopped a rail resignaling project the day before it was to launch as an attractive redbrick Victorian railway viaduct would have been demolished. No knowledge of signaling or interest in it was necessary. It may be that dif-

ferent stakeholder slots come with presumptions about their likely (default) importance, but that is a weaker claim.

The Slots of the Onion Model

The onion diagram by default displays the following slot icons in the named circles. Other slots may be added as necessary. In each case are defined, based broadly on the framework of Sharp et al. (1999),

- the nature of the roles in the slot with respect to the kit,
- the most likely interactions with stakeholders in other slots,
- the stage(s) in development that the slot is most likely to be relevant, and
- the likely priority (relative importance) of stakeholders in the slot.

Note that the following are what are considered to be the bare minimum of slots, not an exhaustive taxonomy.

Our System

- **Normal Operator:** role that involves giving routine commands and monitoring outputs from the product, whether these are via a human-computer interface or not.

Normal operators interact directly with the product with other operators (e.g., maintenance, operational support) and with functional beneficiaries (e.g., providing them with processed information and receiving instructions from them).

Operator requirements are relevant throughout development, but especially during user-interface design.

Operability requirements are always important, perhaps especially so for mass-market products (where operability is a selling point) and for control systems (where safety is involved).

- **Maintenance Operator:** role that involves maintaining the product, such as servicing hardware, and diagnosing and fixing faults. (The so-called maintenance of software involves changing the design of the product, and is the responsibility of our developer slot; it is not maintenance in our sense.)

Maintenance operators interact with the product and with normal operators.

It is worth noting that now that outsourcing is in fashion, maintenance people may be contractors. If so, there is a contractual boundary that crosses the “Our System” circle (and others outside it). This can easily act as a “geological fault line,” impeding communications and possibly rupturing if anything goes wrong. For example, some organizations outsource their computer and network administration (maintenance operations) while retaining normal operation of the equipment in house. This typically creates bureaucratic delay and difficulty, which in turn creates tension between the two roles. It may be helpful to draw contractual or other boundaries on the onion diagram, and to annotate these with their significance for the project.

Maintenance is often not considered until late in projects; however, maintainability needs to be designed in, whether as built-in test and diagnostics, internationalized error messages, accessibility of equipment, or spares holdings. Requirements for these need to be in place early in a development.

Maintenance requirements are often more important than they seem. The whole-life cost of many products — from cars to jet engines — depends much more on the cost of maintenance than may be realized. Similarly, maintainability requirements such as the time to repair or replace components can significantly affect quality of service.

- **Operational Support:** role that involves advising normal operators of a product about

how to operate it. These roles are very close to operations, but support rather than conduct productive use of the product itself. We have chosen to include them in our system for two reasons:

1. they behave as operational staff in their daily work and
2. like maintenance operators, they help to keep the system fully operational (enabling the normal operators to continue working effectively).

Operational support people such as help desk staff and trainers interact mainly with normal operators. They are maintenance for the humans involved, rather than just for the product. The comments on outsourcing under “Maintenance Operator” can also apply here.

The priority of support probably deserves to be higher than it is on many projects. As with maintenance, good support raises operational effectiveness and availability. Clearly it is secondary to other slots such as normal operator and functional beneficiary.

Support needs to be considered when preparing manuals and training materials, that is, relatively late in the project; however, supportability may also need to be evaluated earlier, for example, when designing software to yield intelligible error messages and so forth.

Containing System

- **Functional Beneficiary:** role that benefits from the results or outputs created by the product. For example, an astronomer benefits from the astronomic data captured by a space telescope, though he or she cannot operate the instrument directly. Since products are or should be designed to produce results, this is an important slot.

They interact with operators, giving them instructions and receiving information and any other

A Taxonomy of Stakeholders

benefits that our system is designed to provide.

Functional requirements form the centerpiece of most specifications. They need to be available early and are used throughout development, for example, in design and for specifying functional tests. They are of the highest importance.

- **Interfacing System:** role responsible for neighboring systems that have electronic or other interfaces to and from the product. Such systems behave much like human operators in terms of demanding specific capabilities from the product, but naturally, the interfaces are precisely defined as protocols and so forth.

They interact with operators and/or the product; any other interactions they may have are most likely but not necessarily outside our scope.

Interface requirements form a crucial part of the definition of many developments. They are required from the start. Shifting interfaces and scope are serious risks to projects.

- **Purchaser:** role responsible for having the product developed. There are certainly several of these, ranging from product manager (with knowledge of what can be sold) to procurement (responsible for obtaining a contract with a supplier). In the case of a mass-market product, the purchaser is a product manager, a surrogate role, acting on behalf of millions of consumers who will, if all goes well, ultimately buy the product. Purchasers interact with developers and consultants, and (to obtain requirements) with beneficiaries and marketing, also.

The purchaser's input is required from the start, and is critical in getting development started and ensuring that funding for it is not withdrawn. It always has high priority (possibly more than it deserves, but that is out of the control of those working on a project).

- **Product Champion** (aka “**Sponsor**”): role responsible for initiating development of the product, for obtaining funding for it, and for protecting the development from political pressures and funding cuts. The role requires positional power within the purchasing organization (e.g., the company creating a mass-market product). The product champion is perhaps the best person for the requirements engineer to meet with first; an effective champion can indicate the scope and purpose of the development, the opportunities and threats, and can suggest who the key stakeholders are. All of this helps to cut the risk to the project.

A product champion's effectiveness is clearly related to the ability to interact with other stakeholders, especially beneficiaries and negative stakeholders (including those within the organization).

The product champion is critical from before the start of a development, and remains important throughout. The role does not necessarily or even desirably contribute to product requirements: It functions mainly at a political rather than a technical level.

Wider Environment

- **Negative Stakeholder:** any role that could be harmed by the product physically, financially, or in any other way that might be found justifiable by the authorities (e.g., a court of law, a regulator), or conversely that could attempt to harm the product. For example, negative stakeholders could be householders living close to the route of a planned railway, a nature-conservation body with interest in land threatened by such a route, activists opposed to pollution that might be caused by a product under development, employees finding their decision-making abilities reduced by “intelligent” software, employees

that perceive their tasks being oversimplified or made too complex, or groups feeling that collaboration or communication would be made more difficult.

- **Hostile Agent** (a special kind of negative stakeholder and possibly a distinct slot): any role that actively seeks to hinder or harm the development and operation of the system. Actively means using some degree of intelligence and creativity to oppose the system. Examples include military enemies, political and commercial spies, hackers, spammers, virus writers, thieves, and fraudsters. Clearly the degree of harm intended by such agents varies from complete destruction through malicious pleasure to unauthorized acquisition of assets (with essentially unintended harm as a side effect).

Negative stakeholders may interact with regulators, beneficiaries, and with any roles in the wider environment able to wield influence, for example, the press, politicians, or other pressure groups.

Hostile roles can be treated as a kind of negative stakeholder, or may perhaps be promoted to a slot in their own right. Hackers and virus writers are obvious hostile roles. Competitors, too, could be considered: Their relationship could be anything from passive victim to active threat. In the case of military systems, the enemy's expected behavior and capabilities are naturally a primary consideration.

Negative roles are important from before the start of a development, and then whenever issues like security, marketability, and environmental impact are considered. These affect requirements and design. Security may demand special effort in system testing.

- **Political Beneficiary:** any role in public office or private business that can benefit in terms of power, influence, and prestige through the success of the product. For ex-

ample, a space agency's management could benefit politically from a successful space mission.

Interaction with other roles is usually infrequent and typically indirect, for example, via senior management (purchaser, functional beneficiary, etc.).

Political forces within an organization can also be negative (see the discussion of product champion above). It might be worth representing the political opponent, though such explicitness can be dangerous, as Checkland mentions (Checkland & Scholes, 1990): "There is an unavoidable political dimension...to any human affairs which entail taking deliberate action...[D]elicate judgements are usually required...if the results (of political analysis) are all bluntly made public, then those results can themselves easily become a potent commodity of power in the 'real' politics of the situation. There is potentially an infinite regress here in which the politics of the situation forever escapes open analysis" (pp. 50-51).

Political roles are important (see "Sponsor," above) throughout a development and indeed, from before it begins.

- **Financial Beneficiary:** any role that can benefit financially from the success of a product, for example, shareholders and directors in a company making a mass-market product

They often interact weakly with other roles, except perhaps with the product champion and other senior beneficiaries.

Development staff perhaps need to consider financial beneficiaries directly only rarely; project and program management may be more concerned. Perhaps the most usual situation is that financial beneficiaries are represented by surrogate roles such as line management. Conversely, financial beneficiaries are likely to take a direct interest only

A Taxonomy of Stakeholders

in the largest of developments. They are important at the main gates in a development.

- **Regulator:** any role responsible for regulating the quality, safety, cost, or other aspects of the product for example, aviation authorities, health and safety executives, rail regulators, radio regulators, and financial service authorities

The regulator is most likely to interact with senior developers. Regulators act as surrogates for the public, interacting with developer and beneficiary roles as necessary; for example, the aviation authorities certify components on receipt of a satisfactory safety case supported by evidence from the development organization's safety officer.

In the case of a software product, we could view standards organizations like ISO as nonstatutory (voluntary, not enforcing) regulators.

Regulators impose requirements that act as qualities and constraints (rarely as functions). These are important in defining the requirements for a product, and again for acceptance and certification. In the case of safety-related products, they are of crucial importance.

- **Developer:** any of the many roles (requirements engineer, analyst, designer, programmer, tester, safety engineer, security engineer, electronics engineer, metallurgist, human factors engineer, project manager, etc.) involved directly in product development. Note that none of these roles are operational unless tied into operations via a maintenance contract, in which case the affected people have hybrid developer-maintenance roles.

Developers interact mainly with each other (often adopting surrogate customer roles in the process; see discussion below), but also contractually with purchasers. Ideally, developers in the form of requirements engineers and analysts

would interact with *all* other roles, but this is rare and often impossible for reasons of time and restrictions on access, for example.

Developer roles are mainly involved once development has started; it may be helpful to involve a developability opinion (a consultancy role) before that, and to keep developers involved (via maintenance) during operations. Clearly the priority of a developer's requirements is secondary to those of the beneficiaries, though manufacturability is an important consideration for mechanical products such as jet engines.

Suzanne Robertson suggests (personal communication, March 18, 2004) that it may be helpful to create an extra circle for development project responsibility. It may be best for this not to be a concentric circle—in a way, development is another world from operational usage. Developers are in the outermost circle from the point of view of the product, but intimately involved from the point of view of development. Hence, it may be an oversimplification to try to force the two taxonomies into one. However, as she says, drawing a development circle “highlights the necessity to have adequate representation of the ongoing maintenance operator and operational support roles and [to separate] real maintenance from new development.”

- **Consultant:** any of the many roles (marketing expert, software expert, business analyst, management specialist, etc.) involved in supporting some aspect of product development, characteristically from outside the development organization. Internal consultancy is possible but problematic, as it is hard to speak out in the face of political pressure within the organization (except with the help of a sponsor; see above).

Consultants may interact mainly with the product champion, purchasers, or developers, depending on when they were hired, by whom, and for what purpose.

For priority and timing, see the comments on the developer.

- Supplier:** a role involved in the manufacture and provision of components, whether custom or commoditized, for the product. In the case of custom components, this is close to a developer role, initially. During system operations, both custom- and commoditized-component suppliers have a role closer to maintenance, supplying whatever is needed to keep the system operational.

Suppliers are important in product manufacture, maintenance, and sometimes in development. In extreme examples such as the manufacture of a jet engine's intercase (a complex, three-dimensional casting), the supplier is critical to development, as the lead time for the manufacture of the component is comparable to the lead time for the entire engine development. Hence, suppliers may need to be involved very early in a project, possibly even before it begins.

APPLYING THE TAXONOMY IN PRACTICE

Requirements Elicitation

The simplest and most essential use of a taxonomy of stakeholders is as a guide to the likely kinds

of people to interview, observe, and invite to workshops to help gather the requirements for a project. As stakeholders are successively identified and brought into the project, an onion model and associated database can be used to document their roles, contact details, viewpoints, and ultimately, their requirements. The onion model then gives a direct visual report on the progress of stakeholder discovery and provides pointers to slots that require further investigation.

Characterizing the Project

The nature of the stakeholder taxonomy for an individual project determines the kind of stakeholder involvement that will be necessary during the life of the project. One application of the taxonomy is therefore to characterize the project in terms of the requirements elicitation approach and the degree of stakeholder participation that should be selected. This is one of several characterization dimensions, each of which can help to reduce risk. Other dimensions include whether and how far safety is involved, how complex the interfaces are, and how new the needed technology is.

Elicitation techniques vary widely, from interviewing and holding workshops through ethnographic fieldwork to having market surveys, prototyping, and product trials. Most requirements textbooks describe a range of such techniques (e.g., Alexander & Stevens, 2002; Kotonya & Sommerville, 1998; Robertson & Robertson, 1999).

Figure 8. Eliciting from operational roles (outer circles suppressed)

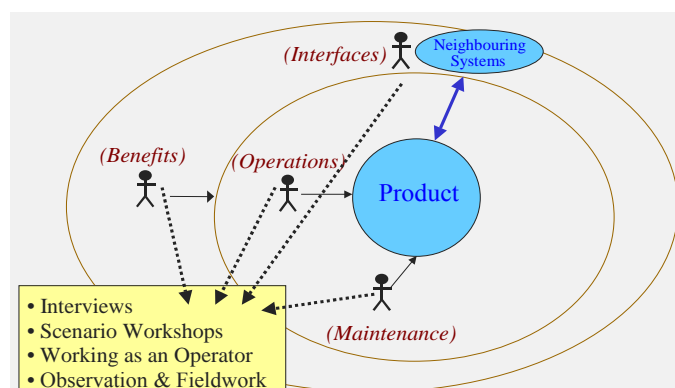
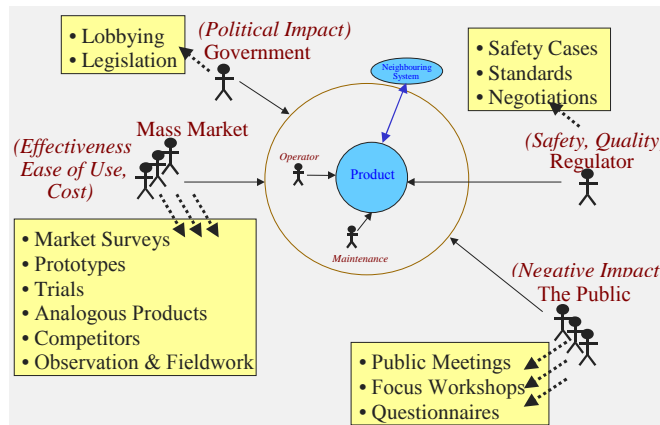


Figure 9. Eliciting from nonoperational roles



Textbooks with a user-centered orientation offer a still-wider range (e.g., McGraw & Harbison, 1997; Sutcliffe, 2002). The choice of techniques is in practice, however, strongly driven by the stakeholder roles involved. Figure 14 illustrates some common elicitation approaches for operational stakeholders.

Characterization can be carried out by assessing which kinds of stakeholders are likely to be most significant in a project, and then assigning the most appropriate development life cycle to respond adequately to those stakeholders. For example, if the operational needs are simple but meeting regulatory demands is long and complex (e.g., for a jet engine), then the life cycle must focus on achieving certification with careful attention to verification and the gathering of evidence for the regulator.

Conversely, if regulation is minimal but operational needs are rigorous (e.g., for a portable consumer product), the life cycle must focus on satisfying users (i.e., hybrid normal operators-functional beneficiaries) in that the product is suitable through involvement with the development, which will presumably be iterative to permit it to respond to user reactions.

Checking for Stakeholder Problems

Checking for Empty Slots

A tool that records details of slots, roles, and stakeholders can readily detect empty slots. These might indicate forgotten stakeholders or, for example, a missing sponsor, threatening project success.

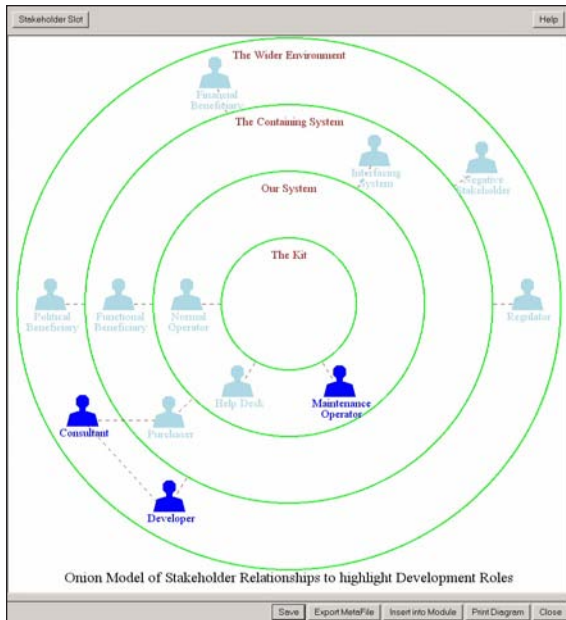
Checking for Multiple-Filled Slots

Similarly, a tool could readily detect slots populated by more than one role. This is sometimes acceptable, but could indicate sources of conflict. For example, conflict is likely if two departments (e.g., international marketing and product development within a multinational carmaker) both believe they are funding and therefore have control of a development project.

Checking Traces to Use Case Actors

A tool that in addition records traces between items such as requirements could detect any system roles not traced to use case actors, and thus documents them in operational scenarios, and

Figure 10. Onion-model tool displaying current status of stakeholder slots



vice versa. Lack of traceability could indicate a disconnection between stakeholder analysis and implementation work.

Analyzing/Visualizing Contractual Fault Lines

An onion diagram shows a product and layers of its environment as concentric circles. Contractual boundaries (see the discussion on maintenance, above) may not coincide with these circles. A diagram with overlaid boundaries may help stakeholders to visualize the risks inherent in outsourcing or otherwise sharing responsibilities.

Tool and Template Support

The taxonomy presented here has, as described above, several possible practical applications. These do not necessarily require tool support: Onion diagrams and hierarchies can be created quite easily in ordinary office software, on paper,

or on flipcharts, provided that traceability is not required.

When models must be maintained for extended periods during which a steady trickle of change must be accommodated, tool support with configuration control and traceability to requirements becomes essential.

Requirements Database Tool

A tool (Figure 10) supporting some of the applications mentioned above has been implemented in a requirements-traceability tool environment (Telelogic DOORS) and is available for free download (Scenario Plus, 2004). This both demonstrates the feasibility of building such a tool, and allows workers to experiment with uses of the approach in a controlled environment (e.g., with a complete audit trail). Figure 8 incidentally illustrates part of the tool's (very straightforward) data model.

The tool permits the creation and editing of an onion-model diagram. As illustrated, the tool also acts as a display of the status of the model, making it apparent which slots are filled and which are empty. The tool manages a conventional document-like data structure (a formal module, see Figure 12) in which each slot, role, and stakeholder is represented as a separate object within a hierarchy. Details of each stakeholder are held as a database record within the object; these include name and contact details as well as a text summarizing the stakeholder's viewpoint. Objects can be given (bidirectionally navigable) traceability links to any other objects (e.g., requirements) in the database. Hence, the tool enables the requirements engineer to provide traces from any number of requirements, use cases, actors, and so forth directly to stakeholders.

Tools can readily calculate metrics on the status of the onion model. For example, the number of system slots that are not linked to use case actors gives a measure of the completeness of coverage of known human operators in the use case model.

Figure 11. Fragment of the stakeholder template

| The Scenario Plus Stakeholder Template | | Word-Processing Version |
|--|--|-------------------------|
| 3. Stakeholder Roles | | |
| 3.1 Beneficiary | | |
| 3.1.1 Functional Beneficiary | | |
| Stakeholder: | Viewpoint: | |
| John Smith | wants to see accurate weekly & monthly sales figures and forecasts | |
| 3.1.2 Financial Beneficiary | | |
| Stakeholder: | Viewpoint: | |
| | | |

Clearly the same information architecture could also serve as the basis for other forms of stakeholder analysis including conflict detection and resolution. These do not necessarily demand tool support, but they do require systematic handling, for which a tool can be beneficial. Small projects may instead choose to apply a simple template of likely stakeholder roles, discussed in the next section.

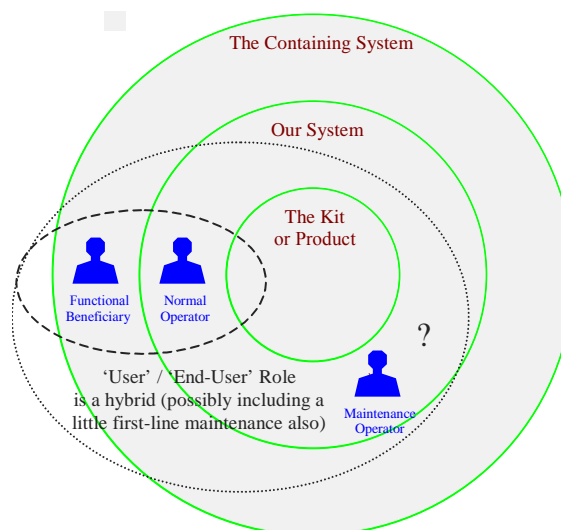
The Scenario Plus tools could in principle be implemented in any automated software or system development environment that supports traceability between items and provides a suitable application-programming interface. The hybrid hierarchical-tabular data structure of DOORS' formal modules was very convenient for implementation, but stakeholder information could certainly be represented without it.

Stakeholder Template

A document template (Figure 11) based on the onion model and in a choice of formats suitable for popular word-processing and spreadsheet tools is available for free download (Scenario Plus, 2004). While there are clear advantages for large projects to work within a traceability tool environment, smaller projects can benefit from stakeholder analysis and other forms of modeling using simpler tools.

Customizable templates such as Scenario Plus and Volere (2004) allow stakeholder analysis to take place in essentially any development environment, including, indeed, those without any special modeling tools whatsoever. The analysis could take place in Word or Excel, with an onion diagram in PowerPoint or CorelDraw. Clearly there are advantages for larger projects to work with traceability and configuration management tools so as to keep track of changes more reliably.

Figure 12. User as a hybrid role across two or more slots



DISCUSSION: FEATURES AND LIMITATIONS OF THE TAXONOMY

User: A Hybrid Role

One slot that is not provided is the user. We consider this term to be both dangerously overloaded and confusing. It has many loose meanings in colloquial engineering parlance, including

1. all stakeholders,
2. all stakeholders other than us, the developers (this meaning verges on the derogatory, and should be avoided),
3. any stakeholder who gets any benefit from the product, and
4. any stakeholder who operates the product.

However, perhaps the most widespread meaning is an interesting hybrid of two of our slots: normal operator and functional beneficiary (Figure 12). For example, consumer electronics companies speak of users. They seem to mean the people who both push the buttons on their products, and who enjoy the resulting entertainment (music, video, games, etc.). This user-consumer role seems necessarily to combine the roles of operator and functional beneficiary, and, of course, the role of consumer and mass-market-product purchaser—not to be confused with the important surrogate role of purchaser adopted by product managers and procurement departments—is not far away, either. Indeed, if changing the batteries is considered to be a maintenance operation, then the role is multiple hybrid.

Popular variant terms such as end user do not clarify the situation. End user seems sometimes to mean the actual operator of the product, as opposed to the purchasing organization that is paying for its development, in which case its slot is normal operator. At other times, the implied slot is functional beneficiary, as when astronomers are called the end users of a scientific satellite because

Figure 13. UML only explicitly addresses stakeholders inside our system with its use case actors



they make use of the data it collects. In any case, we may ask, “The end of what?” with respect to the chain of beneficiaries on the left of the onion model, and indeed to the shifting perspectives of the onion models drawn with respect to different products within a system-subsystem hierarchy.

Therefore, the terms user and end user have little value, may be harmful in diverting attention away from nonoperational stakeholders, and should not be chosen as fundamental taxonomic units.

Overlapping Taxonomies

Clearly, this model is productcentric, though by intention people focused. It is possible to create processcentric models (around the developer and development activities, the business processes and system usage), and as argued in “Research Review,” most of the requirements literature seems to be tightly productcentric to the exclusion of most kinds of stakeholders.

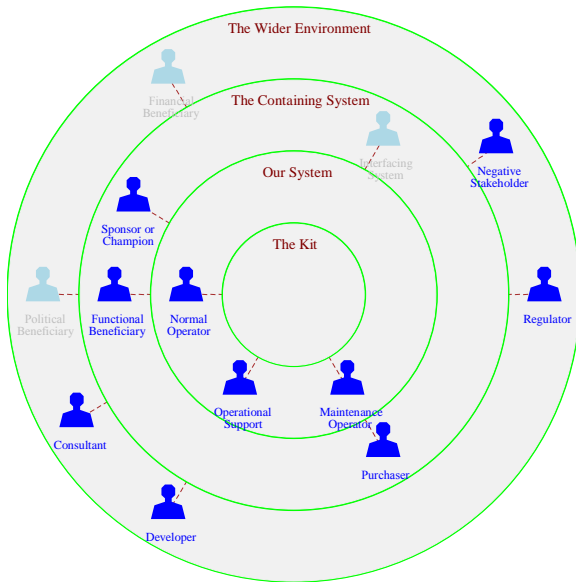
It is unwise to try to make a single taxonomy or hierarchy do too much (Jackson, 1995); the aim here is to provide a practical way of discovering and remembering the viewpoints necessary to a development’s success. Other models may be needed to cover business processes that stakeholders are involved in. Other hierarchies may be needed to suit other purposes such as defining company responsibilities. More is said on the dangers of reading too much into the model in “Visual Metaphors,” below.

A Taxonomy of Stakeholders

Table 1. Classification of Volere stakeholder roles into the onion model

| Onion Model tailored for Volere | All 37 Stakeholder roles defined in Volere.co.uk template | Volere Row No. |
|---------------------------------|---|----------------|
| The Wider Environment | | |
| Financial Beneficiary | — none — | |
| Negative Stakeholder | Opponents of project/product | 38 |
| | Public Opinion | 41 |
| Developer | Packaging Designer | 28 |
| | Manufacturer | 29 |
| | Project Management | 32 |
| | Business Analysts | 33 |
| | Requirements Engineers | 34 |
| | Technical Designers | 35 |
| | Technical Systems Architect | 36 |
| | Organisational Architect | 37 |
| | Testing Specialists | 42 |
| Consultant | Business/Subject Experts | 11 |
| | Future Ideas Specialists | 12 |
| | Current System Specialists | 13 |
| | Sales Specialist | 17 |
| | Marketing Specialist | 18 |
| | Aesthetics Specialist | 19 |
| | Graphics Specialist | 20 |
| | Usability Specialist | 21 |
| | Safety Specialist | 22 |
| | Security Specialist | 23 |
| | Cultural Specialist | 24 |
| | Legal Specialist | 25 |
| | Environmental Specialist | 26 |
| | Standards Specialist | 40 |
| Financial Specialists | 44 | |
| Negotiation Specialists | 45 | |
| Regulator | Auditors | 43 |
| Political Beneficiary | — none — | |
| The Containing System | | |
| Interfacing System | — none — | |
| Purchaser | Customer | 10 |
| Functional Beneficiary | Client | 9 |
| Champion / Sponsor | Protectors of Project/Product | 39 |
| Our System | | |
| Maintenance Operator | Product Installer | 30 |
| | Maintenance Specialist | 27 |
| Normal Operator | Clerical User | 14 |
| | Technical User | 15 |
| | Potential User | 16 |
| Operational Support | Training Staff | 31 |

Figure 14. Onion model of Volere stakeholder roles



Several slots (greyed out) remain unfilled. Several other slots (especially consultant, developer) are heavily populated (see Table 1).

Usage-Centric Taxonomy

We have chosen to emphasize the range of roles across onion model circles as a counterbalance to the prevailing emphasis on (software) product usage to the exclusion of almost all other roles. For example, the unified modeling language’s (UML) “actors” are chiefly normal operators; the narrowness of the UML framework (Fowler & Scott, 1999) often causes even maintenance operators to be forgotten, while the surrounding context of other stakeholders able to contribute requirements is essentially undescribed (Figure 13). On the other hand, starting from an onion model, any operational role (in the “Our System” circle) is a candidate UML actor.

Readers from other backgrounds accustomed to paying attention to a myriad of stakeholder groups may find the need to counteract excessive actor-fixation parochialism; perhaps the most that can be done here is to assure them that it does seem

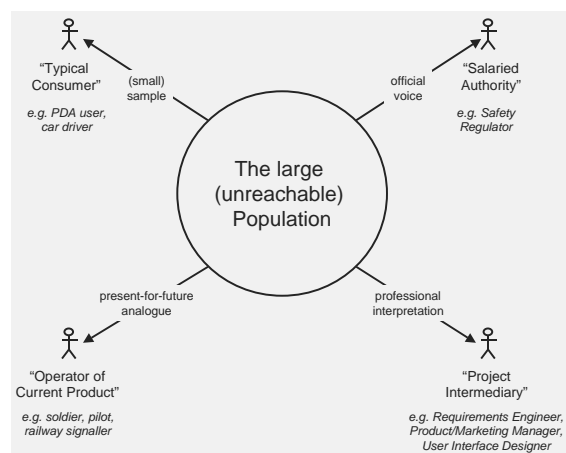
to be a problem. The current unhappy emphasis on security requirements, in response to threats as diverse as hacking and terrorism, may however be helping to make even the most software-fixated developers aware that stakeholders do matter.

Developer- or Requirement-Centric Taxonomy

The Volere template (Volere, 2004) contains an interesting and useful list of stakeholders, certainly far more comprehensive than most others in the literature. These are not easy to map into our taxonomy from the stakeholder role names alone: For instance, should maintenance specialist be treated as a maintenance operator role or as a consultant role? It could clearly be either. However, the list seems rather developer oriented; most of the roles appear to fall into the developer and consultant slots (Table 1).

The numerous consultant roles in the Volere list—their names ending in “Specialist” or “Expert”—make sense if seen from the point of view of a classification of nonfunctional requirements: Perhaps the thinking ran, “Here are some usability and some security requirements; we better consult some appropriate specialists about these” (i.e., the knowledge, role, person triangle was the driver for discovering requirement-related knowledge;

Figure 15. Four kinds of stakeholder surrogacy



A Taxonomy of Stakeholders

Table 2. Stakeholder surrogacy relationships

| Type of Surrogate Stakeholder | Example | Relationship with Stakeholder Population | Advantages | Risks |
|-------------------------------|--|---|--|--|
| 'Typical Consumer' | Car drivers paid to give opinion of new models of car | statistical sample | is a real operator/ beneficiary of the product | may not be typical; danger of mis-sampling |
| 'Operator of Current Product' | Soldier helping to define military equipment needs 25 years into the future | present-for-future analogue in the domain | is a real operator of analogous products | analogy may not hold in future environment; obsolescence |
| 'Project Intermediary' | Requirements Engineer writing other people's requirements; Product Manager purchasing development of product on behalf of both consumers and financial beneficiaries (e.g. shareholders) | professional interpretation | familiar with engineering development | misinterpretation through lack of domain knowledge; over-technical focus (bias towards technology); invented requirements (Potts 1995) |
| 'Salaried Authority' | Aviation Authority (Safety Regulator) checking safety on behalf of public | official voice | statutory position; enforcement of requirements enshrined in law | remote from population and product operations; bureaucracy |

S. Robertson, personal communication, March 18, 2004)). Thus, it appears that the Volere template is perhaps more-specifically requirementcentric than developercentric. On the other hand, the negative and champion slots are rightly stated to be project- and productcentric.

The resulting onion diagram (Figure 14) shows that (for all the length of the Volere stakeholders list) several slots remain unfilled, perhaps surprisingly including the one for stakeholders responsible for interfacing systems.

Several other slots are only weakly represented; for example, the auditor is the sole (and rather doubtful) role in "Regulator."

Volere's customer and client are slippery terms; in this analysis they are assumed to correspond roughly to our purchaser and functional beneficiary, respectively. Client can, however, also include financial beneficiary.

Surrogacy

One aspect of stakeholder sociology that is brought out clearly on an onion diagram is surrogacy: the

representation of one stakeholder's viewpoint by some other person. Surrogacy has (when it has been considered at all) always been seen as a dangerous obstacle to successful requirements work. It is therefore remarkable that stakeholder surrogacy (Figure 15) is both central to RE and scarcely discussed in the RE literature (see "Research Review").

Figure 15 describes some of the surrogacy issues around requirements engineering as a whole, and stakeholder sociology in particular. It is immediately apparent that the different stakeholder-surrogate relationships each have their own advantages and risks. These are briefly analyzed in Table 2.

Other forms of surrogacy are also involved, given that both in development projects and in ordinary work (using the developed products), people are usually working on behalf of other people.

Combinations and intermediate types can also be identified. For example, environmental pressure groups and "not in my backyard" campaigners may create leaders who, though unofficial

and unpaid, may act almost as regulators, being invited to meetings and having their (negative) opinion sought.

The history of computing can be seen as a steady retreat from the assumption that we know how to program what we want done in machine language: Successively more human-oriented languages and tools (such as assembly language, Fortran, visual programming, databases) have been invented to fill the gap.

The history of requirements can be seen as a steady retreat from the assumption that we know how to say what we want done in atomic “shall” requirements: Successively more stakeholder-oriented documents and diagrams (such as user requirements, concepts of operations, use cases, goal models) have been invented to fill the gap.

The roles people play — what they do and what they want to do — thus seem to be becoming increasingly important to our discipline of RE. Our “machine codes”, individually prioritized and traceable requirements, will not simply disappear. But like hexadecimal, the writing of requirement text is moving steadily into the background as more abstract representations of what people want are invented and adopted in practice.

A user requirement has the general form

<named stakeholder role> wants <result>.

If the gold standard for RE is to create requirements like this, claiming that specific stakeholders (we will pass over the class-instance issue for a moment) want that result more or less personally for their own work (by which we include leisure uses of consumer products, etc.), then surrogacy is a rampant anomaly. All that surrogate stakeholders can give us are statements of the general form

<named surrogate role> believes that <named role> wants <result>.

Law statements of this kind are called “hearsay evidence”, which is rarely admissible in court.

But our surrogates often cannot even claim to have heard anyone else expressing their requirement, however distantly. In the clear-cut case of the procurement of military equipment on behalf of as yet unborn soldiers, there can be no claim even to hearsay evidence: The requirements are wholly invented.

Surrogacy thus interferes with the core trend and practical process of RE: the move towards gathering requirements directly from real stakeholders. Yet, as Figure 24 indicates, surrogacy cannot readily be avoided (even when the unreachable population is not especially large). Perhaps this is one of the fundamental limitations on the engineering of requirements, systems, and software.

Suzanne Robertson comments that it can help to invent a surrogate, for example, Erik the systems analyst. Erik could then be consulted on his needs:

Whenever we were stuck (should this be in or out, more or less detailed) we went and talked to Erik. Yes really, on our notice board we had a photo of him clipped from an SAS airline magazine. He looks like a good journeyman systems analyst; he works for a company that makes fruit juices. Medium height, pleasant expression, Scandinavian glasses. (S. Robertson, personal communication, March 18, 2004)

Without the surrogate, they would never have been able to finish the job.

Visual Metaphors

An onion diagram inherently embodies a set of visual metaphors, and these are exploited more or less consciously to give a feeling for stakeholder relationships in a development project. Metaphors inevitably break down at some point, so some caution is required. Attention is drawn to the limitations of the onion model below.

A Taxonomy of Stakeholders

The most immediate of these visual metaphors is the feeling of successive (indeed recursive) containment of one onion within another. As Peter Checkland and others have emphasized, there are always many systems to consider (Checkland & Scholes, 1990). This leads to practical issues of project scope. The scope of a system of people and equipment is always larger than the scope of the equipment or product alone, so it is essential to be clear about the existence of the two boundaries (e.g., Robertson & Robertson, 1999).

A circular diagram inevitably announces that something is in the centre of attention, and in a development, that is rightly the product; at the same time, it shows that people are all around it and have importance. It also suggests the metaphor of closeness for relatedness, and, for example, developers are shown close to purchasers for this reason. Distance could suggest that stakeholders in the outer circles are less important, but this is not intended. Indeed, negative stakeholders, regulators, and political beneficiaries are all able to “stop the show” and must be considered essential.

We also habitually make use of other spatial metaphors; supporting roles seem naturally to find a place below the product, while interfacing systems and regulators can go off to the side somewhere.

A cautionary note should be sounded here: A naive reading of the onion model with the equation of outer equals higher in the system or company hierarchy, with regulator in the outermost circle, would imply the equation of regulator equals responsibility for the highest level of system. This is simply wrong. As Michael Jackson cautions (Jackson, 1995; also see “Research Review”), there may be many overlapping hierarchies. Three that are often important in thinking about system development are as follows.

1. the scopes of the product and the systems that contain it. This is the primary and intended meaning of the onion diagram. The

operational stakeholders are those inside the system, as explained below.

2. the organization (e.g., company) hierarchy, with the workers inside at the bottom and the managers and directors outside toward the top. This is not what is intended here. Managers may or may not be stakeholders in a development; nonoperational company workers and executives are not automatically assumed to be relevant.
3. the structure of the organization and stakeholder relationships involved in accepting or rejecting a development, for example, the relationship of the regulator with the developer. This structure is secondarily suggested by the onion diagram, but this does not mean that questions like, “Which level of system is the regulator in?” make any sense. The regulator is in a system — that of the political and legal framework of a country or the world — but that is certainly not the same as any onion circle of any ordinary development project.

The onion has its uses in helping people to think about multiple scopes and the need to involve people outside the development team, but it cannot do everything.

Another metaphor that seems quite natural (though perhaps mixing oddly with onions) is that of the chain of command, where a person makes use of a system under their command as an instrument to achieve a political goal. They do this by instructing an immediate subordinate—some at the adjacent or immediately contained level—to carry out some operation. That person in turn may achieve their goal (a successful operation) by instructing an operator to use a piece of equipment to deliver a specific result. The chain metaphor could also be represented as a scale from higher to lower if you like the idea of a great chain of being from God to man to animals (Lovejoy, 1936/1990); I have chosen to make it the rather

more-egalitarian left to right (with the slight suggestion that actions, like writing, may proceed in that direction).

CONCLUSION

The trend in system specification away from the machine toward human users leads to a natural end point in modeling and analyzing the nature, goals, and viewpoints of human stakeholders. While there has been some academic interest in goal and viewpoint modeling, the stakeholders themselves seem largely to have been overlooked within systems and software engineering (though quite the reverse in soft systems and information systems research).

The onion model diagram has an attractive and intuitive simplicity about it, organizing a substantial amount of complexity in analysis of stakeholder sociology and relationships. This is part of a wider interest in and intention to improve the attention that practising engineers pay to stakeholders, including surveys and a reconsideration of development life cycles and project information models (Alexander & Robertson, 2004). The default onion model with three circles and the basic slots is often in itself helpful in projects, but it is readily tailored for more complex situations with additional circles and slots. Ralph Young has adopted the approach in his new book (2004), and Suzanne and James Robertson are similarly doing so in their latest book (2004). Needless to say, it is also pressed into service in my forthcoming book (Alexander & Maiden, 2004).

Tool support is available, but the approach can be applied with nothing more than a hand-drawn diagram and a textual hierarchy of headings for circles, slots, roles, and if desired, named stakeholders.

The analysis of stakeholders does not presuppose any particular development approach, and

while it is clearly suitable for an object-oriented worldview with use cases and their actors, it can equally be added to conventional or agile development.

This paper has presented a simple but, it is hoped, generally applicable and readily customized taxonomy of stakeholders, and has suggested some uses for it. If it contributes to encouraging even a few projects to think a little more deeply about who their stakeholders are and what they want, it will have succeeded.

ACKNOWLEDGMENT

I am grateful to Isabel Ramos for her suggestions and encouragement for this paper, to Andrew Farncombe for his clarity on terminology and multiple hierarchies, to Sabina Malfatti for drawing my attention to the onion layers in Peer Gynt, and to Suzanne Robertson for her continuing enthusiasm and support. I would also like to thank the anonymous reviewers for their perceptive comments and suggestions, especially on the voluminous information systems literature, and the editor, Bernd Stahl, for his measured criticism and direction.

REFERENCES

- Alexander, I. (2002). Initial industrial experience of misuse cases in trade-off analysis. *IEEE Joint International Requirements Engineering Conference, 9-13 September 2002, Essen, Germany*, 61-68.
- Alexander, I. (2003, April). Stakeholders: Who is your system for? *Computing & Control Engineering, 14*(1), 22-26.
- Alexander, I., & Maiden, N. (Eds.). (2004). *Scenarios, stories, use cases through the system development life-cycle*. John Wiley.

A Taxonomy of Stakeholders

- Alexander, I., & Robertson, S. (2004, January/February). Understanding project sociology by modeling stakeholders. *IEEE Software*, 21(1), 23-27.
- Alexander, I., & Stevens, R. (2002). *Writing better requirements*. Addison-Wesley.
- Avison, D., & Wood-Harper, A. T. (1990). *Multiview: An exploration in information systems development*. Oxford: Blackwell Scientific Publications.
- Bennetts, P. D. C., & Wood-Harper, A. T. (2000). *Software process improvement through the lens of multiview 2: The development of a contingent factors model*. Tenth Conference on Business Information Technology, Manchester, UK.
- Boehm, B., Grünbacher, P., & Briggs, B. (2003, May/June). Developing groupware for requirements negotiation: Lessons learned. *IEEE Software*, 46-55.
- Bowker, G. C., & Leigh Star, S. (1999). *Sorting things out: Classification and its consequences*. MIT Press.
- Checkland, P., & Scholes, J. (1999). *Soft systems methodology in action* (New ed.). John Wiley.
- Coakes, E., & Elliman, T. (1999, July). Focus issue on legacy information systems and business process engineering: The role of stakeholders in managing change. *Communications of the AIS*, 2(1).
- Damian, D. E., & Zowghi, D. (2002). The impact of stakeholders' geographical distribution on managing requirements in a multi-site organization. *Proceedings of the IEEE Joint International Requirements Engineering Conference, Essen, Germany, September 2002*, 319-328.
- Donaldson, T., & Preston, L. E. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications. *Academy of Management Review*, 20(1), 65-91.
- Fowler, M., & Scott, K. (1999). *UML distilled: A brief guide to the standard object modeling language*. Addison-Wesley.
- Gause, D., & Weinberg, G. (1989). *Exploring requirements: Quality before design*. Dorset House.
- Hirschheim, R., & Klein, H. K. (2003). Crisis in the IS field? A critical reflection on the state of the discipline. *Journal of the Association for Information Systems*, 4(5), 237-293.
- Ibsen, H. (1992). *Peer Gynt*. Theatre Communications Group. (Original work published 1867)
- Jackson, M. (1995). *Software requirements & specifications: A lexicon of practice, principles and prejudices*. Addison-Wesley.
- Kitapci, H., & Bhuta, J. (2004). *EasyWinWin negotiations: Guidelines and EasyWinWin report*. Retrieved April 20, 2004, from http://sunset.usc.edu/classes/cs577a_2003/assignments/Team/EasyWinWin%20Negotiations.htm
- Kotonya, G., & Sommerville, I. (1998). *Requirements engineering: Processes and techniques*. John Wiley.
- Koyré, A. (1968). *From the closed world to the infinite universe*. Baltimore & London: The Johns Hopkins University Press. (Paperback reprinted from 1957)
- Levine, R., Locke, C., Searls, D., & Weinberger, D. (2000). *The ClueTrain manifesto: The end of business as usual*. London: FT.com.
- Lovejoy, A. O. (1990). *The great chain of being*. Cambridge, MA: Harvard University Press. (Paperback reprinted from 1936)

- Mason, R., & Mitroff, I. (1981). *Challenging strategic planning assumptions: Theory, cases, and techniques*. New York: John Wiley & Sons.
- McGraw, K., & Harbison, K. (1997). *User-centered requirements: The scenario-based engineering process*. Lawrence Erlbaum Associates.
- Midgley, G. (1992). The sacred and profane in critical systems thinking. *Systems Practice*, 5(1), 5-16.
- Mumford, E. (1996). *Systems design: Ethical tools for ethical change*. Macmillan.
- Potts, C. (1995). Invented requirements and imagined customers: Requirements engineering for off-the-shelf software (Invited workshop introduction paper). *Proceedings of RE'95: Second International Symposium on Requirements Engineering, York, England*. IEEE Computer Society Press. Retrieved April 20, 2004, from <http://www.cc.gatech.edu/fac/Colin.Potts/pubs/1995/re95/re95InventedReqsOTS.pdf>
- Pouloudi, A. (1999). Aspects of the stakeholder concept and their implications for information systems development. *Proceedings of the 32nd Hawaii International Conference on System Sciences, Volume 7, January 5-8 1999, Maui, Hawaii*. Retrieved April 20, 2004, from <http://www.computer.org/proceedings/hicss/0001/00017/00017030abs.htm?SMIDENTITY=NO>
- Pouloudi, A., & Whitley, E. A. (1997). Stakeholder identification in inter-organizational systems: Gaining insights for drug use management systems. *European Journal of Information Systems*, 6(1), 1-14.
- Robertson, S., & Robertson, J. (1999). *Mastering the requirements process*. Addison-Wesley.
- Robertson, S., & Robertson, J. (2004). *Requirements-led project management*. Addison-Wesley.
- Scenario Plus. (2004). *Scenario Plus Web site* (onion model tool for Telelogic DOORS, stakeholders template for Microsoft Word, etc.). Retrieved April 20, 2004, from <http://www.scenarioplus.org.uk>
- Sharp, H., Finkelstein, A., & Galal, G. (1999). Stakeholder identification in the requirements engineering process. *DEXA Requirements Engineering Process Workshop*, 387-391.
- Sommerville, I., Sawyer, P., & Viller, S. (1998). *Viewpoints for requirements elicitation: A practical approach*. Proceedings of Third IEEE International Conference on Requirements Engineering.
- Sutcliffe, A. (2002). *User-centred requirements engineering, theory and practice*. Springer.
- Volere. (2004). *Volere stakeholder analysis template*. Retrieved February 20, 2004, from <http://www.volere.co.uk>
- Wood, D. (1999). *Trends in stakeholder management & measurement in the public sector*. Retrieved April 20, 2004, from <http://www.navigate.co.nz/newsreti.htm>
- Young, R. R. (2004). *The requirements engineering handbook*. Artech House.
- Younkins, E. W. (2001, Spring). Morality and character development: The roles of capitalism, commerce, and the corporation [Electronic version]. *Journal of Markets & Morality*, 4(1), 94-111. Retrieved April 20, 2004, from http://www.acton.org/publicat/m_and_m/2001_spring/pdf/mm-v4n1-younkins.pdf
- Yu, E., & Mylopoulos, J. (1998). Why goal-oriented requirements engineering? *Requirements Engineering Foundation for Software Quality Workshop 1998*. Retrieved April 20, 2004, from <http://www.cs.toronto.edu/pub/eric/REFSQ98.html>

FOOTNOTE

- ^{1.} For instance, I am assured that this is as true in air-traffic control as it is in other domains (D. Bush, personal communication, 2003).

This work was previously published in International Journal of Technology and Human Interaction, Vol. 1, Issue 1, edited by B. Stahl, pp. 23-59, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.11

A Practitioner–Centred Assessment of a User–Experience Framework

John McCarthy

University College Cork, Ireland

Peter Wright

University of York, UK

Lisa Meekison

Anthropologist and Freelance Consultant, Canada

ABSTRACT

In this article we outline a relational approach to experience which we have used to develop a practitioner-oriented framework for analysing user experience. The framework depicts experience as compositional, emotional, spatio-temporal, and sensual, and as intimately bound up with a number of processes that allow us to make sense of experience. It was developed and assessed as part of a participative action research project involving interested practitioners. We report how these practitioners used the framework, what aspects of experience they felt that it missed, and how useful they found it as a tool for evaluating Internet shopping experiences. A thematic content analysis of participants' reflections on their use of the frame-

work to evaluate Internet shopping experiences revealed some strengths and some weaknesses. For example, certain features of the framework led participants to reflect on aspects of experience that they might not otherwise have considered, such as, the central role of anticipation in experience. The framework also captured aspects of experience that relate to both the sequential structure of the activity and its subjective aspects. However, it seemed to miss out on the intensity of some experiences, and participants sometimes found it difficult to distinguish between some of the sense-making processes, for example, interpreting and reflecting. These results have helped to refine our approach to deploying the framework and have inspired an ongoing programme of research on experience-centred design.

INTRODUCTION

As computers migrate from work to leisure and family life, new perspectives and conceptual tools are required to understand human activity and the participation of technologies in activity. Developments such as the World Wide Web, virtual reality, and cyberspace; the penetration of computers into homes, cars, and games; and the integration of information and communications technologies resulting in wireless, mobile, and ubiquitous computing suggest a revision of how we construe both people and technology. A person's attachment to the mobile phone is not just functional, it is also aesthetic (Katz & Aakhus, 2002; Taylor & Harper, 2002), and their use of the Internet is as much an expression of their sociality as it is a mark of their productivity (Markham, 1998; Turkle, 1995). Interacting with computers is now as much about play, fun, entertainment, community, and personal identity as it is about goals, tasks, and work. It is as much about children playing with cyberpets, teenagers gender swapping, and elderly people socialising on the Net, as it is about the middle-aged executive managing knowledge assets (Jordan, 2000; Blythe, Monk, Overbeeke, & Wright, 2003; Norman, 2004). As Kuutti (2001) characterised it, the user, who started out in the 1970s as a cog in a rational machine and became a social actor in the 1990s, is now a consumer.

The transition that Kuutti described points to the fact that people need to be able to *live* with emerging technologies, not just *use* them. Therefore the focus for designers has to move beyond usability to *experience*. The general impact of an emphasis on experience with technology can be seen in the popularity of works such as Turkle's (1995) analysis of "life on the Internet," in which she explored the social meaning of computers, the cultures of computing, and the impact of the Internet on our sense of self. The specific impact can be seen in attempts to understand and act

on the concept of *user experience* in consumer arenas such as electronic commerce (for example, see Pu & Faltings, 2000; Lee, Kim, & Moon, 2000). However, while the notion of designing for 'user experience' is gaining currency (Garrett, 2002; Laurel, 1991; Shedroff, 2001), conceptual development of user experience is only beginning (Dourish, 2001; McCarthy & Wright, 2004).

Our contribution to the conceptual development of user experience in this article is to report an action research assessment of the use of a framework for analysing user experience (Wright & McCarthy, 2003). The aim of the assessment is to explore whether the practitioners who collaborated with us in this research can make use of the framework and, if so, to identify what they gain from its use. It is hoped that their experience with the framework will inform and refine our understanding of user experience and of the framework. Before we report the assessment, we will first outline our general approach to experience and then briefly describe the framework.

CONCEPTUALISING EXPERIENCE

Although it is clear that the turn to experience in technology design reflects an attempt to engage with the experience of people using technology, the concept 'experience' is elusive and difficult to specify. In dictionaries (see the *Oxford English Dictionary*, for example) and in social scientific discourse, experience has often been defined and used in ways that reduce it to subjective feelings, behaviour, or knowledge (Dewey, 1925, 1934; Bruner & Turner, 1986). In contrast, Dewey's (1925, 1934) pragmatist philosophy was geared towards a clarification that would end the tendency to reduce experience. He argued that experience is the irreducible totality of people acting, sensing, thinking, feeling, and meaning-making in a setting, including their perception and sensation of their own actions. Experience, he wrote:

...includes what men do and suffer, what they strive for, love, believe and endure, and also how men act and are acted upon, the ways in which they do and suffer, desire and enjoy, see, believe, imagine—in short, processes of experiencing...It is 'double barrelled' in that it recognises in its primary integrity no division between act and material, subject and object, but contains them both in an unanalyzed totality. (Dewey, 1925, pp. 10-11)

According to Dewey, then, experience is the continuous transaction between people and their environments, which includes sensations, thoughts, feelings, and values. Seeing experience as the dynamic interrelationship between people and environment, or as the continually changing texture of their relationship, effectively makes person and environment a whole, or as Dewey put it, “an unanalyzed totality.” This holism is pivotal to pragmatic conceptualisation of experience, arguing that there is no point in trying to understand person and environment as separate from one another. In Dewey’s two major works on experience, *Experience and Nature* (1925) and *Art as Experience* (1934), the starting point is the creature living in an environment, neither of which could exist in quite the same way without the other. His approach, which has also been described as natural humanism, sees continuity between human experience and all other animal experience. This is clearest in the weight he gives to sensory and affective sense making. For him, the sense we make of our experience has its roots in the feelings of fear, recognition, threat, or joy that accompany a sound, smell, or sighting. In this context, Dewey (1925) argues that, “Feelings are no longer just felt. They have and they make sense” (p. 258). In and of themselves, feelings are the immediate meaning of an event or situation: the feeling of warmth and friendliness in a friend’s house or in a chat room; the feeling of excitement at meeting a person or trying out a

new system for the first time. The weight given by Dewey to predominantly pre-linguistic sensory and affective sense making has been borne out in more recent times in the neurosciences and evolutionary psychology (e.g., Damasio, 1999; Donald, 1991, 2001).

Taking account of the emergence of language, community, and values, Dewey (1925, 1934) viewed emotion, an elaboration of sensory and affective sense making, as the pivotal moment in human experience, the quality of the dynamic interrelationship described above. According to Dewey, the paradigmatic experience is an aesthetic experience in which any sense of alienation from other people and the environment is overcome, and in which the natural human need for a sense of meaning and value is satisfied. For him, the unity of aesthetic experience is a felt or emotional unity. Therefore a central feature of Dewey’s approach to experience is the idea of unifying emotion holding experience together and giving it an aesthetic quality. He argues that emotion “selects what is congruous and dyes what is selected with its color, thereby giving qualitative unity to materials externally disparate and dissimilar” (Dewey, 1934, p. 42). So even though a day’s hill walking comprises many disparate elements and will inevitably have good and not-so-good parts, according to Dewey, its emotional quality gives it an experiential unity that shapes our perception of the event as it unfolds, and our memory and recounting of it afterwards.

Dewey (1934) identifies a number of conditions necessary for a fulfilling experience. They are:

- A sense of anticipation about the experience and of continuity between that anticipation, the experience as it unfolds, and reflections on it afterwards
- A sense that each part of the experience accumulates into something meaningful for the person (e.g., planning the walk, driving to the start, the less interesting part through

- scrubland, the challenge of the climb, the great views from the hill, etc.)
- Some level of tension (e.g., about the difficulty of the climb or whether the views from the top will match expectations)
- A sense of fulfilment

These conditions can be seen as an analytic tool to be used when we encounter problems with the unfolding of an experience — what went wrong, why we lost interest, why others got restless, and so forth. In parentheses above, we have referred to aspects of a countryside walk to clarify the conditions for a fulfilling experience. Using these conditions as an analytic tool would facilitate enquiry into the experience of irritation or frustration that might accompany encountering a dead-end midway through the walk. Dewey's conditions suggest that such frustration is due to being unable to complete the walk and fulfil anticipated experiences of the climb or the view from the top, and now anticipating the anti-climax of telling fellow walkers about this frustrated attempt. Often there is little that can be done about such frustrations on a country walk, and natural or man-made obstacles become part of the discourse of communities of walkers. This should not be the case with interactions with technology that has been designed for use by people. Attention to user experience in design should minimise such occurrences, and Dewey's conditions may help in this regard.

Although the sensory and affective are the starting points of Dewey's conceptualisation of experience, his theory also embraces the sense we make of immediate qualitative experiences in the longer stretch of our life experience, and addresses the relationship between the immediate and long-term aspects of experience. And although the immediate sense of surprise, warmth, sleaze, or comfort that we have when we enter a new situation or when we engage with a new technology is transitory, it can also be vivid or intense.

Indeed Hickman (1998), commenting on Dewey's theory of experience, suggests that it is precisely the impact of something vivid but transitory in a situation that makes us pursue that situation again in the future. For example, for hill walkers the vivid but transitory experience of the view from the top may make them want that experience again. It becomes a project, and hill walking becomes an interest pursued in reading and discussion as well as in the actual activity itself. In the process, elements of our experiences and situations become known, not just had. As they become known they enter into the realms of community and cultural sense making, where we bring the resources of community and culture to bear on our appropriation of experience. Through imagination — for instance, imagining how friends might feel about a walk I have just done or indeed about my shopping on the Internet — experience becomes expressive and meaningful in a way that can be shared with others. The meanings appropriated through such imaginative acts can find their way into present interaction, colouring the immediate quality of another experience.

Bakhtin (1986, 1993) provides an account of the relationship between experience and meaning-making that is complementary to Dewey's. Bakhtin's work is useful when considering how the immediate quality of experience is made personal. In terms of ongoing experiences of technology, Bakhtin's work shifts our focus from the immediate quality of an experience to the sense we make of an experience in terms of our experience of our selves, our culture, and our lives.

Bakhtin's central contribution in this area is the idea of dialogicality. Dialogically, any account of experience, including a person's own account to themselves of an experience of buying through the Internet, is social, plural, and perspectival. In Bakhtin's terms, it is *interanimated* with the discourses of others. For example, my sense of myself as someone who supports small local bookshops is interanimated by discourses on global

capitalism, the importance of choice provided by small specialist booksellers, and the centrality of a personal relationship in choosing which books to buy. These discourses however might be accommodating of an Internet bookseller who appears to try to develop a buyer-seller relationship with me based on an understanding of my reading preferences, provides specialist choices, and seems to support small specialist booksellers. If my book-buying activity moves from the small local bookshop to an Internet store that presents itself as engaging meaningfully with some of these discourses and that has other qualities of interest to me also, for example speedy completion of an order, my sense of my self is subtly changed through dialogue with that bookseller.

This relational subjectivity can also be seen in the reflections of filmmakers and writers. Writers and filmmakers practise their craft under the influence of a practical understanding of experience and how they might influence or help create experience. Boorstin (1990), a Hollywood script writer, argues that the filmmaker must be able to experience the film in the way the public will, but in addition must know what it takes to ensure that the public will construct just that experience. He demonstrates how filmmakers deploy technical knowledge of how an audience responds to different kinds of framing, lighting, rhythm, and character — different combinations of which can make a second very long or short and a relationship warm or claustrophobic — to help the viewer create a particular cinematic experience. He argues that one of the sensibilities of great filmmaking is, having deployed technical knowledge and experience, to see like the audience, always anew and open to surprise.

Our aim in drawing together the writings of philosophers such as Dewey and Bakhtin and reflective practitioners such as Boorstin is to try to understand experience to help designers and evaluators create fulfilling interactive experience. This review has enabled us to conceptualise ex-

perience as an irreducible, dynamic interrelationship between person and environment, in which meaning has sensory, affective, and emotional dimensions, as well as the cognitive and socio-cultural aspects that we are used to dealing with in psychology and the social sciences. We have also seen that it may be useful to distinguish between the immediate experience that a person has and the meaning of that experience as it becomes known and thereby appropriated personally and communally. The dialogical dimension added by Bakhtin's work draws our attention to the ways in which immediate experience is associated with personal, social, and cultural sense-making processes, specifically relational aspects of interpretation and reflection, and communal processes such as telling others of our experiences. Implicit in much of the foregoing is a sense of experience unfolding across time and space. This can be seen in both the transitoriness of the immediate experience and in the spatio-temporal relations between the immediate and the lifelong.

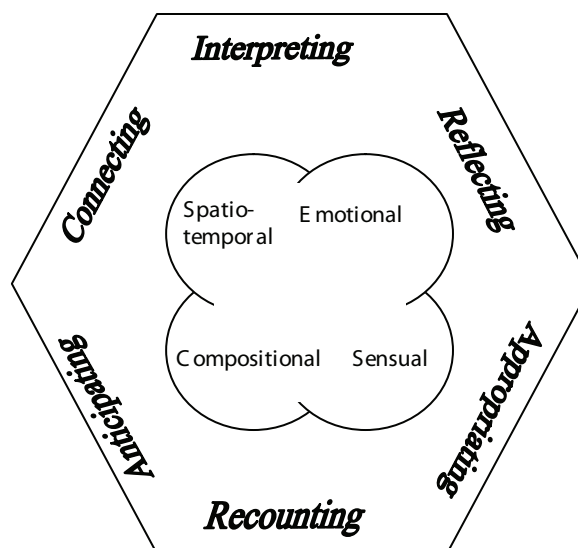
The pragmatist literatures on experience that we have trawled offer a very rich account of experience, with some of the characteristics that we have just summarised emphasised more in the work of one writer or another. In order to appropriate these literatures for use in the design and evaluation of rich person-technology experiences, it may be useful to make explicit those aspects of experience that we judge most relevant to the task. To do this we have constructed a framework, based on the above work, which pulls together a set of concepts that may be useful as tools to evaluate user experience with emerging technologies. Taking a pragmatic orientation to theories and concepts as tools to be used, the value of this framework can only be assessed in terms of its value in enriching interactive experience. Therefore in the next section we describe the framework, and then take a first step in using it and—together with a team of e-commerce practitioners — assessing its use.

USER-EXPERIENCE FRAMEWORK

The framework that we present in this section represents an attempt to model experience in a way that designers and analysts of interactive systems would find useful. It is derived from the literatures reviewed in the previous section; the provenance of each element in those literatures has already largely been established. For example, Dewey's concern for a holistic approach and the equal weight he gave to affective and intellectual sense making is manifest in our characterisation of four intertwined threads of experience. Some of Boorstin's perspectivalism is reflected there too. In terms of sense making, Dewey's concepts of anticipation, reflection, and the pre-linguistic sense of meaning are echoed in our account of the sense-making processes. Bakhtin's concern for unity as an active accomplishment is reflected in our characterisation of appropriating, reflecting, and recounting. But more subtly, what we have tried to do in our presentation of these threads and processes is to understand Dewey through Bakhtin's dialogical lens. Thus, self-other relations as continually constructed permeate the framework.

Earlier, when we described Dewey's (1934) conditions for a fulfilling experience, we briefly demonstrated how the conditions could be used as an analytic tool to explain why a particular hill-walking experience might be frustrating. The framework we present here is intended to perform similar work for people's experiences with interactive systems by helping to explain why, for example, particular interactive experiences are satisfying and others frustrating. So although there may be more elegant ways of describing experience, such as the narrative, analogical approaches used in ethnography (see for example Anderson, 1994; Geertz, 1993; Orr, 1990), our hope is that the explicit separation and classification of aspects of experience in the user-experience framework will prove useful in the design and evaluation of

Figure 1. Threads of experience and the sense-making processes



interactive systems without losing too much of the relational, holistic approach to experience from which the framework is derived.

The framework is composed of two simple lists. The first, the four threads of experience, describes the major aspects or components of experience that we draw from the literatures reviewed earlier. The second identifies six sense-making processes associated with meaning in the same pragmatist accounts of experience.

Four Threads of Experience

Following Dewey and Bakhtin, we propose that the braid of experience is made up of four intertwined threads: the compositional, the emotional, the spatio-temporal, and the sensual.

The *compositional thread* is concerned with relationships between the parts and the whole of an experience. Looking at a painting, composition refers to the relations between elements of the painting and their implied agency, and between viewer, painting, and setting. In an unfolding interaction involving self and other, in a novel, play, or technologically mediated communication,

it refers to the narrative structure, action possibility, plausibility, consequences, and explanations of actions. In Internet shopping, the choices that are laid out for us can lead us in a coherent way through ‘the shop’ or can lead us down blind alleys. Attention to the compositional thread evokes questions like: “What is this about?” “What has happened?” “Where am I?” “What will happen next?” “That doesn’t make sense?” “I wonder what would happen if...?”

The *sensual thread* of experience is concerned with our sensory engagement with a situation, which orients us to the concrete, palpable, and visceral character of experience, the things that are grasped pre-reflectively in what Dewey (1934) refers to as the immediate sense of a situation. For example, the look and feel of a mobile phone, the garish colours and grating sounds on a Web site, and the sense of warmth and welcome in a room. Whether or not sensual attraction to an object (e.g., a mobile phone or a Web site) is welcome depends on our needs, desires, and what we value at that particular time. Such attraction could be unwanted and lead to frustration or disgust, or it could complement the emotional content of the experience.

This *emotional thread* refers to judgments that ascribe to other people and things importance with respect to our needs and desires. Our frustration, anger, joy, and satisfaction acknowledge our need for others or the other in our struggle to achieve emotional unity. We can reflect on our own emotional aspect of an experience, and we can through empathy relate to the emotional aspects of others’ experiences. Relating to a character in a movie is an obvious example, but we might also empathise with the artist or designer who creates an artefact even though that person is not materially present in the situation.

We need to distinguish between the sensual and emotional threads, since we can engender emotions associated with achievement through the exercise of control over sensations such as at-

traction, fear, or anxiety. Although I might get an immediate thrill from buying the most beautiful mobile phone in the shop, it may cut against my commitment to not being conned by surface features and advertising. My decision not to buy the most beautiful phone and instead to buy a plainer one that is half the price but just as good may leave me with a strong feeling of self-satisfaction. Here the sensory and emotional threads interact to shape the experience, the actions chosen, and the sense we make of them.

An intense emotional engagement can make our sense of time change. A frustrating experience can leave us perceiving space as confined and closeting. Space and time pervade our language of experience. We talk about needing space to settle an emotional conflict and of giving people time. Time may speed up or slow down, pace may increase or decrease, spaces may open up or close down. Space and time may be connected or disconnected. In our construction of the *spatio-temporal thread* of an experience, we might distinguish between public and private space, and we may recognise comfort zones and boundaries between self and other, or present and future. Such constructions affect experiential outcomes such as willingness to linger or to re-visit places, or our willingness to engage in exchange of information, services, or goods.

Making Sense in and of Experience

According to Dewey (1925, 1934) and Bakhtin’s (1986, 1993) ideas on experience described above, people actively construct or make sense of experience. Bakhtin’s emphasis of the dialogical in sense making suggests that making sense of experience is reflexive in that we always view experience from a personal perspective, whether it is the first person or the third person, or whether it is by recounting an experience to oneself or for others. This is central to what it means for something to be an experience. For both Dewey

and Bakhtin, there can be no experience without self and other, or subject and object, interacting reflexively. As indicated earlier, we have extracted the following six sense-making processes from Dewey and Bakhtin's work as an explication of processes that may be useful for understanding people's experiences with technology. There is no implication of linear or causal relations between these processes. It is conceivable, for example, that in anticipation of some future planned action, we reflect on the consequences of that action engendering a certain sensual response. Or it could be that how we recount our experience to others may change how we reflect on it.

Anticipation or expectation is a continuous process in experience. When visiting the Web site of a well-known company for the first time, we bring expectations, possibilities, and ways of making sense that we associate with prior experience with the brand. Although anticipation suggests something that is prior to the experience, it is important to remember that it is not only prior. The sensual and emotional aspects of anticipation, and our expectation of the compositional structure and spatio-temporal fabric of what follows, shapes our later experience. It is the relation between our continually revised anticipation and actuality that creates the space of experience.

Connecting refers to the immediate, pre-conceptual, and pre-linguistic sense of a situation encountered. In the spatio-temporal aspect, this may be an apprehension of speed or confusing movement or openness and stillness, for example. Sensually, connecting may engender an immediate sense of tension or perhaps a thrill of novelty. Emotionally and compositionally, connecting may engender nothing more than a sense of relief or anticipation at something happening.

Interpreting an unfolding experience involves discerning the narrative structure, the agents and action possibilities, what has happened, and what is likely to happen. The process of interpreting may evoke a sense of the thrill of excitement or

the anxiety of not knowing. At an emotional level, we may feel frustration or disappointment at thwarted expectations, or we may regret being in this situation. On the basis of our interpretation falling short of our anticipation, we may reflect on our anticipation and alter it to be more in line with our interpretation. From a spatio-temporal aspect, the questions are: Can we make sense of the experience in space and time? Do we know where we are, where we've been, and where we have to go?

At the same time as interpreting, we may also make judgements about the experience as it unfolds — *reflecting*. We may try simply to make sense of the things that are happening and how we feel about them, or wonder whether there is progress or movement towards completion. From an emotional aspect, we may relate events to motivation and whether we achieved any sense of fulfilment. How does the experience tally with our anticipation and how do we feel about being in this situation and this time? From a sensual perspective we wonder why we are anxious or bored. This is like an inner dialogue that helps us to meaningfully recount our experience to others, the anticipation of which may help us to reflect. "I wonder what Tom would think of this?"

By *appropriating*, we mean making an experience our own by relating it to our sense of self, our personal history, and our anticipated future. If it turns out to be an experience we identify with or want to experience again, the centre of our personal universe may have shifted slightly. Moreover, by imagining the experience in the context of a past and a future, we may give it a meaning that is more personal to us. Does our sensual "white knuckle ride" of the theme park or the unique sense of immersion in undifferentiated colour when, as a first-time scuba diver, we descend into "the blue" change who we are, make us rethink how we want to be and want to be seen? Do the compositional aspects of the experience relate positively to our sense of self or not? Do

we feel it is morally right or socially acceptable to go shopping at a virtual supermarket? Is the experience of using a video phone one in which new possibilities for action in our everyday life become apparent, or is it yet another concession to an undesirable technological future?

Recounting is fundamentally dialogical, as it involves telling others or ourselves about the experience. Like reflecting and appropriating, it takes us beyond the immediate experience to consider it in the context of other experiences. Recounting gives us the opportunity to savour the experience again, to find new possibilities and new meanings in it, and this often leads us to want to repeat the experience. And as a dialogical process of meaning making, recounting facilitates our accommodation to the valuative responses of others. As we tell the experience, it can change depending on the moment-to-moment response of the other.

Earlier on, we reviewed literature on experience in an attempt to begin to provide a sound basis for conceptualisations of user experience in people-technology relations. In this section, we have shaped some of the ideas from above into a framework that we hope will be of use to designers and evaluators of interactive systems who are concerned with the quality of experience people have with their systems. Next we will report an action research assessment of the use of the user-experience framework in a commercial setting which was designed with some e-commerce practitioners to assess the use of the framework by themselves and their colleagues.

INTERNET SHOPPING AT VIRGIN

An Action Research Study of the Framework in Use

This study was carried out with the support of Siegelgale, a leading international branding and

e-commerce consultancy, and Virgin. Virgin was chosen because participants in the study were familiar with the company, already having had Virgin shopping experiences, and because, at the time, Virgin had an ideal mix of shops and services for our purposes. For example, they had a strong online presence, including several purely Internet-based offerings, bricks-and-mortar stores, a WAP service related to Virgin Radio, and multiple products and services.

The aim of the study was to explore with practitioners, who were involved in evaluating online and offline shopping experiences, their use of the user-experience framework. The practitioners became involved in this research because they felt that an understanding of user experience would help them in their work. In the spirit of participatory action research (Rapoport, 1970; Wadsworth, 1998), some of the participants were involved in devising the assessment process, and all of them were free to choose a Virgin shopping activity that was of some interest to them when assessing the framework. Moreover, the research was intended to help authors and participants refine their understanding of user experience and of the usefulness of the framework in their work. Specific research questions were:

1. What kinds of insights into Internet shopping experiences would the framework elicit?
2. What aspects of Internet shopping experience would it miss?
3. How useful would it be as a tool for helping make sense of experience?

Method

The method employed was qualitative action research in which participants were required to have and record 'Virgin experiences'. Because it was conceived as an exercise in participatory action research and design (Schuler & Namioka, 1993), in which those who are likely to use a tool

participate in its development, participants had the freedom to explore and critique the framework in a setting close to real-world use. Therefore within the constraints of practicality and availability, they were allowed to select their own Virgin shopping experiences.

In this study, the user-experience framework was used to guide participants' sense making with a view to understanding the kinds of insights it elicits, the aspects of experience it misses, and the extent to which participants felt it helped them to make sense of their shopping experiences. The user-experience framework suggests two possible starting points for enquiry: the threads of experience and the sense-making processes. We chose the sense-making processes because we thought they provided the more accessible starting point. Each process was unpacked for the participants in the form of a list of questions that suggested what aspects of sense making that process was intended to explicate. The full list of questions is available in Appendix 1.

The study was designed to collect data at three points:

1. Baseline data was collected in the initial interview in which participants' impressions of Virgin, their expectations of what shopping with Virgin would be like, and the sources of those expectations were elicited.
2. Participants made contemporaneous notes on their shopping experiences. It was suggested to them that they use the sense-making processes part of the framework to structure these notes. The resulting notes are the primary source of data on the experience of Internet shopping and on the framework as a resource for making sense of the experience.
3. After participants handed in their notes, we held individual debriefing sessions with them in which we asked them questions about their experience to elicit an oral recount-

ing of the experience. In the debriefing, participants were also asked to comment on the usefulness of the framework as they had employed it as a tool for eliciting accounts of interactive experiences.

Participants

Seven employees of Siegelgale, two men and five women aged between mid-twenties and mid-thirties, volunteered to take part in this study. They were all graduates and regular users of a variety of information and communication technologies, particularly Internet and phone-based services. In keeping with the participatory action research approach of this study, they were all also involved in the design and/or evaluation of e-commerce, and were therefore in a position to judge whether the framework would help them in their work.

Procedure

During the first meeting with all the participants at their workplace, they were each briefed individually on the aims and objectives of the research and on the idea of making sense in and of experience. They were also specifically introduced to the sense-making processes identified in the framework. These processes were explained to them with the aid of a set of questions for each process that expressed what was meant by the particular process. These questions were intended to illuminate each of the processes and to clarify the differences between them. The questions are listed in full in Appendix 1.

Once the participants felt comfortable with the concepts in the framework, we asked them to choose some Virgin services that they would like to experience. Most elected to have three experiences, although some chose two. The full list is in Table 1. We completed this first interview by asking participants what they felt about Virgin, what they anticipated their experiences would be like, and how those expectations had formed.

Table 1. Shopping experiences that participants chose to attempt

| Participant | Virgin Shopping Experiences to be Attempted |
|-------------|---|
| 1 | Make enquiries at virginmoney.com |
| | Buy books and records at virginmega.com |
| | Buy books and records at a traditional bricks and mortar Virgin Megastore |
| 2 | Find the price of a flight at virgin-atlantic.com |
| | Make an enquiry at virginmoney.com – how much do I need to save to retire at 60? |
| | Buy a CD at a traditional bricks and mortar Virgin Megastore |
| 3 | Upgrade phone at virginmega.com |
| | Find out details about phone handsets at a traditional bricks and mortar Virgin Megastore |
| | Find Virgin shop locations from Virgin WAP |
| 4 | Listen to music and buy a CD from Virgin WAP |
| | Check music schedules, gigs etc. on Virgin WAP |
| | Buy a CD at a traditional bricks and mortar Virgin Megastore |
| 5 | Get information on buying mutual funds at virginmoney.com |
| | Check availability of CDs by a particular group and buy one that I don't have at virginmega.com |
| 6 | Check availability and price of two CDs and possibly buy them at virginmega.com |
| | Make enquiries about mortgage quotation and debt consolidation at virginmoney.com |
| | Buy a CD at a traditional bricks and mortar Virgin Megastore |
| 7 | Buy books and records at virginmega.com |
| | Buy books and records at a traditional bricks and mortar Virgin Megastore |

The participants engaged in their respective shopping experiences over a maximum period of four days. They were permitted to approach the experiences in whatever order suited them and to complete them in the time that suited them within the four days, from one sitting to a number of sittings over the full time allowed. They were required to make contemporaneous notes on their experiences and were encouraged to use the framework of the six sense-making processes to structure these notes. Having completed their shopping experiences, they then handed in their notes, and we conducted one-on-one debriefing sessions that gave them the chance to give an oral recounting of their experiences. We also asked them to describe what it was like to use the framework and the methodology to order the events and feelings of their experiences.

Thus, at the conclusion of this research, we had three sets of data to analyse: the initial interviews,

the participants' records of their experiences, and the content of the debriefing. The analysis consisted of a thematic content analysis of the records of the initial interview, final debriefing, and of the participants' contemporaneous notes.

Analysis of Data

Initial Interviews: Expectations and Prior Perceptions

In the initial interviews, participants expressed a variety of opinions about what they expected their Virgin experiences to be like. Participants identified their anticipations as stemming from a number of sources, listed in Table 2.

The majority of the participants were well disposed to Virgin prior to their participation in the research, as can be seen from Table 3, in which the Virgin attributes they identified are listed.

Table 2. Sources of expectations about Virgin experiences identified by participants

| |
|---|
| Prior experiences with the same Virgin service in the same channel. |
| Prior experience with the same service in a different channel. |
| Prior experience with a different service in the same channel. |
| Prior experience with a different service in a different channel. |
| Other peoples' narratives about Virgin experiences. |
| The name of the service, especially if it appeared descriptive (for example, Virgin Money). |
| Advertising. |
| Experiences with different products and services (for example, the online bank Egg) overlaid with assumptions about Virgin. |

Table 3. Attributes of Virgin identified by participants in the initial interview

| | |
|--------------------------------|--|
| Positive Attributes Identified | User friendly with a "feel good" factor; Entertaining; Funky; Modern; Colourful; Young; Honest; Fun; Informal; Good customer service; Fresh; Provocative; Anti-establishment; Innovative |
| Negative Attributes Identified | Gimicky; Cheap; Appearance-driven |

Contemporaneous Notes: Shopping Experiences

Positive expectations notwithstanding, it was clear from analysis of the contemporaneous notes that some participants had had difficulty achieving some of their objectives for their various experiences. Their troubles stemmed from the following causes:

- *Inaccurate expectations of the service.* While this occurred in several instances, there was a particular problem with virginmegastore.com. One participant noted that the site was "not as rewarding [an] experience as I'd hoped for, it was more of an information site as opposed to a interactive site." A number of participants assumed that it would be both an informational and a transactional site, but found instead it was a promotional 'magazine-like' site. This caused much irritation.
- *The services, be they online or bricks and mortar, had usability problems.* At virginmoney.com, for example, while one participant sailed through the registration

process, two others had numerous difficulties. resulting in error messages and general confusion. Further, at Virgin Megastore, one said that it took a long time to find a store plan that would inform him where he could find the books section. Thus, by the time he found the section, he already felt that he had wasted time and was unwilling to spend more time browsing.

- *There was poor localisation, resulting in confusion about the real-world location of online services.* All of the participants read the Virgin brand as British, and thus expected access to all of the services linked to the virgin.com site. Those who went from there to virginmegastore.com were perplexed by the fact that they landed on a U.S.-based site with, for example, a U.S. and Canadian store locator, but no information at all about British stores. One participant commented that the site was "not that useful to me as it is very U.S. oriented." Worse, it often took participants a few minutes to figure this out, time they later considered "wasted."

- *There was no clear reason given on the site for participants having to register—which was a requirement for obtaining information and services. This was only relevant for virginmoney.com, which demanded registration to access anything more than the most basic information on the site. Participants didn’t understand why they had to register just to use goals calculators and so forth, and often chose to leave the site and perform the same tasks elsewhere, where they would not have to register. One commented as follows in her notes:*

“Oh! They want me to register now. I’m confused...can’t I just look at financial planning stuff? I don’t want to register yet. I’m going to leave.”

In the context of the foregoing comments, it is worth noting that many aspects of Virgin sites and services have been changed since this study to improve usability.

Participants assigned responsibility for failing to achieve their objectives to a number of different sources, which are listed in Table 4.

Those participants who started out well disposed to Virgin were the most likely to trace the responsibility for their difficulties to a source other than Virgin. Nevertheless, if these particular participants subsequently had problems achieving their objectives in the course of another Virgin experience, they were apt to feel particularly let

Table 4. Sources of responsibility for failing to achieve objectives identified by participants

| |
|---|
| <p>‘Bugs’ and/or limitations inherent to the channel (this was especially the case for WAP). The service in and of itself.</p> <p>A particular articulation of the service, e.g. the Virgin Megastore on Oxford Street versus the one at Piccadilly.</p> <p>The participants themselves.</p> <p>Virgin.</p> |
|---|

down, as if a trusted friend had betrayed them. Participants blamed themselves in the instances where they realised they had inaccurate expectations of the service to start with, and tended to readjust their objectives to what they perceived the service offered. For example, most participants expected virginmegastore.com to be transactional, but promptly set themselves other goals when they felt that it was not. However, if participants found their new objectives thwarted as well, they tended to shift blame to the service, stating that their expectations were being poorly managed and thus their time wasted. For example, one participant wrote, “The Web site visit was so bad that I might relish recounting the experience to friends...”

Although the participants’ accounts highlighted where Virgin is delivering poor or fragmented customer experiences, they also indicated where Virgin is ‘getting it right’, that is, providing consistent experience, creating and meeting expectations, and even creating the new or wonderful. Particular successes included:

- *Participants generally knew they were in a Virgin environment.* The consistency of the Virgin look and feel, the tone of voice, ‘hip or trendy’ design, and the positioning of the logo all contributed to making participants feel that they were in the right place.
- *Some services, such as Virgin Atlantic, are delivering a consistent service across touch-points, leading to a seamless experience.* For example, one participant reported, “The va.com site seems to try to make the potentially dull site more fun, with simple perks and design features, much like the airline itself.”
- *Even where some Virgin offerings fail to provide a consistently good experience across touch-points, one may stand out for its excellence and save the experience as a whole.* One participant was attempting to get information on switching to Virgin,

and on upgrading to a Nokia tri-band phone. Having found neither the Virgin shops nor virginmobile.com helpful, she started to despair that Virgin was “all hype and no substance.” However, she then tried the Virgin Mobile call centre, where she had a remarkably different experience. She didn’t have to wait for service, and the salesperson was well informed, friendly, and easy to speak to. Thus her final impression of Virgin was “cool and upbeat.”

- *On occasion, Virgin was able to elicit strong and positive emotional responses from the participants.* For example, one participant commented that the site “made me feel good, happy feeling...Felt comfortable straight away because felt like I was in a familiar environment — reflects what I know about Virgin.”

Participants’ responses to Virgin point to several conditions that help create these strong feelings:

- a. If customers perceive themselves to be in control of the experience, they feel “relaxed and empowered,” and are more likely to trust the service provider. Crucially, they may also be more likely to invest time.
- b. Beautiful, “fresh” design — be it online or in-store — is affective and thus effective. It also makes a strong first impression and has the power to generate excitement.
- c. Innovation, novelty, and humour, which appear to participants as key aspects of the Virgin brand, can create difference and enchantment. For example, one user was charmed to find “Pardon?” written on the package of the ear plugs supplied by Virgin Atlantic, when she had previously flown with them and three out of three participants mentioned VirginMoney.com’s exhortation to read the small print on the site — “be-

cause it came from our lawyers...[and was] expensive.”

- d. Participants responded warmly to those touch-points that appealed to their curiosity and offered them the chance to play, be it with in-store listening consoles in the Virgin Megastores or interactive calculators on VirginMoney.com.

Final Debriefing and Interview: Evaluating the Framework

Analysis of data from the debriefing and final interview suggests that the framework was useful for evaluating shopping experiences. There was a general consensus that the framework was useful in both online and offline settings, and that it provided a process for evaluating experience, especially the consistency of experience across multiple channels. The main comments of participants on the value of the framework include the following:

- *It was helpful to address the issue of anticipation at the outset, as what one expects and hopes will happen sets the stage for what does happen.* Indeed, several participants said that this was a subject worthy of investigation in its own right, especially as it pertains to attempts to create a totality of experience across multiple touch-points.
- *A particular strength of the framework is that it provided the means to capture both factual (e.g., “this happened, then this happened”) and subjective aspects of experience.* In their contemporaneous notes, all participants had included records of events that had happened while shopping and some comments on their feelings about how those events unfolded. In the debriefing, a number of participants commented that the framework had been a useful reminder to attend to both aspects in their notes. One commented that the frame-

- work was good at “capturing both factual as well as subjective aspects of experience.”
- *The framework dealt with experience in depth.* Some participants said that they felt the framework was embracing enough to cover the full gamut of their thoughts, feelings, and actions during the experience. For example, one participant said that the framework was “good for capturing expectations and emotions, capturing of fact and being conscious of separation.” Though, as we shall see later, some also felt that the framework did not always capture the highs and lows of experience.
 - *The framework not only provides the means to analyse experience, it could implicitly guide strategists and designers as they create purpose-built user experiences.* By delineating the threads and the sense-making processes of an experience, the framework provides a tool for designers to look at experiences from a user’s perspective. This means thinking about not just what users see, but additional factors including other sensory stimuli, location, sense of time, visceral reactions, emotional connections, and the way users may relate a given experience to other experiences.
 - *The framework does not always capture the highs and lows of experience.* A weakness of the framework noted by one of the shoppers was its failure to address the kinds of high points and low points that can become the focus of attention in recounting. This comment seemed to reflect a sense that the framework lacked explicit attention to the intensity of emotions and feelings.
- While our questions concerning ‘Anticipating’ adequately covered issues such as the perception of the company and the expectations of the channel, some participants felt we overlooked the *feelings* attached to tasks, such as the excitement of arranging air travel, or the trepidation surrounding WAP. Participants found these feelings so significant that, despite the fact that the framework itself inherently accommodates such emotional factors, they suggested that they should be emphasised in the method.
 - Some participants were unsure about the separation of some elements such as ‘Interpreting’ and ‘Reflecting’. This suggests that, while appropriate in the framework itself, it is too strange for users to try to interrupt the flow of experience to gauge such nuances in their own reactions.
 - Some participants felt that being primed by knowledge of the sense-making processes in advance helped them to think about what should be noted but other did not. There was also some disagreement about whether to use the framework to sensitise users to aspects of experience or as an analytic resource for evaluation.

CONCLUSION

In designing this study, we wanted to get a sense of what insights practitioners would get into shopping experiences. We also wanted to know what aspects of experience the framework might miss and how useful participants would find it as the tool for evaluating experience. The thematic content analysis of participants’ contemporary notes on their shopping experiences indicated a number of ways in which their shopping experiences were more or less satisfactory. These were summarized above. Discussing these observations with participants suggested a number of issues. They include:

One of the main aims of the case study was to determine if people could work with the framework in order to articulate user experiences. Our participants’ experiences with the framework suggest that certain issues need to be resolved for future use. These include:

- Expectations are an important factor in shaping a person's experience. It is the relationship between a person's expectations and their actual experience that affects the emotional quality of the interaction, leading for example to disappointment, surprise, satisfaction, and so on.
- The issue of localisation highlights the fact that people enjoy feeling that they know where they are, and that where they are is where they expect to be. For example, links to shops that, without warning, take people from a British site to an American can be disorientating.
- People may be reluctant to provide personal information without a clear rationale or an obvious benefit to them. They may for example assume the reason is unwanted follow-ups and marketing.
- Poor usability can still be a problem, even on professionally designed sites, leading to erosion of trust in the service provider.
- People consider Internet services as part of a broader relationship with a company or organisation and seem to value consistency across touch-points.
- An emotional commitment to an Internet shopping service depends upon, among other things, customers: perceiving themselves to be in control of the experience; finding their curiosity and playfulness aroused by the site; and feeling that the site is novel and appealing.

Although not all of these findings are novel, what they suggest is that the framework was successful in allowing the participants to identify and articulate important design factors. We also asked the participants to reflect on the experience of using the framework as a tool for analysis. When reflecting on their use of the framework, participants picked out certain features that led them to think about aspects of experience that

they might not otherwise have considered. For example, they had not considered the role that anticipation and expectation plays in how we make intellectual and emotional sense of an experience, and how this might be included in an empirical evaluation of experience. In many accounts of user experience, it is assumed that the experience begins when we log onto a site and ends when we press the 'confirm' button. The framework helped participants to expand their consideration of experience in both directions—to what goes on before the interaction and to what goes on after it, for example the way in which through reflection and recounting we may or may not decide to go back to a site for a second or subsequent visit.

The participants valued the way in which the framework helped them relate the affective aspects of interaction to behavioural aspects of the experience such as what they had to do and in what order. The affective aspects allowed them to think about issues such as sense of time, visceral reactions, and emotional connections between different experiences in ways that were more insightful than other approaches. They also felt that the framework provided a 'commonsense' account of experience that could be used by other types of practitioners such as designers and business analysts for whom a user perspective is of value.

The participants also had some critical comments on the framework that fell into two categories: ones that pointed up some limitation of the framework as it stood and ones that would have liked the framework to be able to do extra work that it was not originally designed for. For example, some participants had difficulty separating the sense-making processes 'Interpreting' and 'Reflecting'. Although we still believe that there is a distinction between these two processes that is worth preserving in the framework—between the activity orientation of Interpretation and the evaluative orientation of Reflection—it is clear that we shall need to make the difference

between them much clearer to future users of the framework. Another comment — that the framework did not capture the highs and lows or intensity of experience — seems to ask the framework to do analytical work that it was not originally intended to do. In response we would suggest that the emotional thread identified in the framework accommodates aspects of the intensity of experience without, however, attending to its measurement, which was not our intention for the framework, but which might be a subject of future research.

Any such critical comment notwithstanding, the most positive outcome from our perspective is that, despite participants finding some aspects of the framework difficult to work with, they were consistently able to generate the kind of data that would allow designers and analysts to understand user experience and to use that understanding in designing better interactive experiences.

While the strength of this study was the participatory action orientation that led us to test the framework with practitioners in a practical setting, it had some limitations that would need to be addressed in further evaluation of the framework. The main weaknesses relate to the method used to deploy the framework in this study, that is, asking participants to relate their experiences to the six sense-making processes. It required an a priori introduction to a technical element of the framework that might have better been employed to explain experience already had. It may have also implied that more weight should be given to the sense-making processes than to the threads, resulting in a sense that the intensity of experience was underplayed. Another aspect of the method was that it required participants to make contemporary notes on their experiences. It is arguable that this could have contributed to shaping the experiences as more reflective than they might otherwise have been.

Because the framework is open rather than prescriptive, it provides fertile ground on which to develop alternative methods of deployment. These would likely be project dependent, although we do already have some ideas about how to create more elegant and participant-friendly methods. One possibility for this would be to ask participants to focus on describing the ‘threads’ rather than the sense-making processes of experience. Contrary to our original expectations, the threads may be more immediately accessible to participants than the sense-making processes. Another would be to partner with participants during the course of their experiences, asking them the kinds of questions that were used in this study to explain the sense-making processes, but freeing them from the burden of contemporaneous note taking. This might create a more natural situation, something akin to a socially shared experience. A third possibility would be to ask participants to generate a ‘stream of consciousness’ narrative of their experience in real time or retrospectively, or even to send text or voice messages to the researcher, and for researchers and participants together to use the framework to explain and evaluate the experiences recounted.

Our experiences of working with Siegelgale and of developing and assessing the framework in a practitioner-centred way has led us to further action research projects concerned with experience-centred design. These will address some of the shortcomings of the current study. In these projects we have a long-term involvement with a number of companies involved in experience-centred design. The literature on experience-centred design that has appeared while we have been engaged in the study reported here (e.g., Garrett, 2002) strongly confirms our view that a richer conceptualisation of experience and related methods are required in order to improve design practice. In our current projects we are working closely not only with users but also with

designers, developers, and consultants to analyse experience-centred design practice and how this practice impacts on user experience. This involves participation in design meetings and working on a one-to-one basis with designers and developers to understand experience design practice and to identify how the user-experience framework can be used to improve that practice. Our work with users in this project involves us bringing accounts of user experiences back to the designers to help them reflect on the relationship between their design decisions and user experiences. In these projects the framework is used as a critical lens on user experience and experience design. In the process the framework is again being assessed and refined.

ACKNOWLEDGMENT

We would like to thank two anonymous reviewers and the associate editor Professor Marchewka for their help in making this a much clearer and more useful article than it might otherwise have been. We would also like to thank Siegelgale and Virgin for their participation and support, and the EPSRC for funding a visiting fellowship (GR/S18799/01) that supports the collaboration between Peter Wright and John McCarthy.

REFERENCES

- Anderson, R.J. (1994). Representation and requirements: The value of ethnography in system design. *Human-Computer Interaction*, 9, 151-182.
- Bakhtin, M. (1986). *Speech genres and other late essays*. Austin, TX: University of Texas Press.
- Bakhtin, M. (1993). *Toward a philosophy of the act*. Austin, TX: University of Texas Press.

Blythe, M., Monk, A., Overbeeke, C., & Wright, P.C. (Eds.). (2003). *Funology: From usability to user enjoyment*. Dordrecht: Kluwer.

Boorstin, J. (1990). *Making movies work: Thinking like a filmmaker*. Beverley Hills, CA: Salaman James Press.

Bruner, E.M. & Turner, V. (Eds.). (1986). *The anthropology of experience*. Urbana: University of Illinois Press.

Demasio, A. (1999). *The feeling of what happens: Body, emotion and the making of consciousness*. London: Vintage.

Dewey, J. (1925). *Experience and nature*. LaSalle, IL: Open Court.

Dewey, J. (1934). *Art as experience*. New York: Perigree.

Donald, M. (1991). *Origins of the modern mind*. Harvard, MA: Harvard University Press.

Donald, M. (2001). *A mind so rare*. New York: Norton.

Dourish, P. (2001). *Where the action is: The foundations of embodied interaction*. Cambridge, MA: MIT Press.

Garrett, J.J. (2002). *The elements of user experience: User-centred design for the Web*. Indianapolis: New Riders Publishers.

Geertz, C. (1993). *The interpretation of cultures: Selected essays*. London: Fontana Press.

Hickman, L.A. (Ed.). (1998). *Reading Dewey: Interpretations for a postmodern generation*. Bloomington: Indiana University Press.

Jordan, P. (2000). *Designing pleasurable products: An introduction to the new human factors*. London: Taylor and Francis.

Katz, J.E. & Aakhus, M. (Eds.). (2002). *Perpetual contact: Mobile communication, private talk,*

public performance. Cambridge: Cambridge University Press.

Kuutti, K. (2001). *Hunting for the lost user: From sources of errors to active actors—and beyond*. Paper presented at Cultural Usability Seminar, Media Lab, University of Art and Design, Helsinki, 24 April 2002. Retrieved from http://mlab.uiah.fi/cultural_usability/papers/Kuutti_paper.html

Laurel, B. (1991). *Computers as theatre*. Reading, MA: Addison-Wesley.

Lee, J., Kim, J., & Moon, J.Y. (2000). What makes Internet users visit cyber stores again? Key design factors for customer loyalty. *Proceedings of CHI 2000* (pp. 305-312), The Hague, Amsterdam. New York: ACM Press.

Markham, A. (1998). *Life online: Researching real experience in virtual space*. CA: AltaMira Press.

McCarthy, J. & Wright, P. (2004). *Technology as experience*. Cambridge, MA: MIT Press.

Norman, D. (2004). *Emotional design: Why we love (or hate) everyday things*. New York: Basic Books.

Orr, J. (1990). Sharing knowledge celebrating identity: War stories and community memory in a service culture. In D.S. Middleton & D. Edwards (Eds.), *Collective remembering: Memory in society*. Beverley Hills, CA: Sage Publications.

Pu, P. & Faltings, B. (2000). Enriching buyers' experiences: The SmartClient approach. *Proceedings of CHI 2000* (pp. 289-296), The Hague, Amsterdam. New York: ACM Press.

Rapoport, R.N. (1970). Three dilemmas in action research. *Human Relations*, 23(4), 499-513.

Schuler, D. & Namioka, A. (Eds.). (1993). *Participatory design: Principles and practices*. Hillsdale, NJ: Erlbaum.

Shedroff, N. (2001). *Experience design*. Indianapolis: New Riders.

Shusterman, R. (2000). *Pragmatist aesthetics: Living beauty, rethinking art* (2nd edition). Lanham, MD: Rowman and Littlefield.

Taylor, A.S. & Harper, R. (2002). Age-old practices in the new world: A study of gift-giving between teenage mobile phone users. *Proceedings of CHI 2002*. New York: ACM Press.

Turkle, S. (1995). *Life on the screen: Identity in the age of the Internet*. London: Phoenix.

Wadsworth, Y. (1998). What is participatory action research? *Action Research International*, (November). Retrieved from <http://www.scu.edu.au/schools/gcm/ar/ari/ari-papers.html>

Wright, P.C. & McCarthy, J.C. (2003). A framework for analysing user experience. In M. Blythe, A. Monk, C. Overbeeke & P.C. Wright (Eds.), *Funology: From usability to user enjoyment*. Dordrecht: Kluwer.

This work was previously published in International Journal of Technology and Human Interaction, Vol. 1, Issue 2, edited by B. Stahl, pp. 1-23, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

APPENDIX A

Questions Supplied to Participants to Help Clarify the Sense-Making Processes

The following questions were devised with two of the participants as a way of clarifying what each of the sense-making processes mean in terms of the user experience framework. For example, the questions listed under 'Anticipating' are intended to clarify a variety of aspects of anticipating an experience, specifically in this case an experience of Internet shopping. During the first meeting with the participants in which they were briefed individually on the aims of the research, they were specifically introduced to the sense-making processes in the framework. At this point the questions listed below were used to help explain the sense-making processes. During the rest of the study, participants had a list of these questions to refer to. However they were not expected to answer these questions per se; rather they were to use them to guide the notes they made on their shopping experiences.

Anticipating

- What do you expect will happen?
- What do you think you will be able to do?
- Describe what you imagine will happen as you begin your task.
- Does your sense of who Richard Branson is and/or what he stands for affect your sense of what to expect at all? If so, please explain.
- What expectations do you have based on previous Virgin experiences with the same service/channel or different service/channel?
- What expectations do you have based on completing the same tasks in the past with different companies or brands (or sites/stores/airlines)?
- What expectations do you have based on something someone else has described about this service, this channel, or Virgin as a brand?
- What is going on in the environment around you that might affect your anticipation, e.g., fighting down Oxford St. and hoping for peace in the Megastore, furtively trying to shop for a mortgage while at work, etc.

Connecting

- What is your first impression?
- When/how do feel that the experience actually starts?
- What do you first apprehend of the experience?
- Colours, tempo, movement, salespeople, etc.
- How do spatio-temporal factors affect this, and why?
- What does this first impression make you feel?

Tension, Thrill of Novelty, etc.

- Is there anything in particular that immediately engages you or puts you off (e.g., colour, sound, images used, etc.)?
- What sensual/sensory and emotional factors of this experience or episode allow a connection with the brand or create a feeling of disconnectedness with your expectations of the brand?

Interpreting

- How are you making sense of what you are finding?
- Do you feel that the experience is living up to what you anticipated? Please explain.
- Do you feel that there is a logical and coherent order to what is happening?
- Have you “settled into” a response or feeling about what the experience is offering?
- Do you know where you are, where you’ve been, and where you have to go, e.g., do you know what you have to do next? What cues provide this guidance?
- Are there bottlenecks somewhere? Why?
- How aware of time are you? Is it taking a long time to do what you want, or is time racing by?
- Is there a clear end point?
- Could you accomplish your task within a reasonable amount of time?
- How does the composite of these elements affect your interpretation of the brand?

Reflecting

- What are you feeling about the experience?
- Are your feelings about the experience consistent throughout, or do they change?
- Do you feel motivated to continue or frustrated at what’s going on? Do you wish you could shorten or prolong the experience? Why?
- Who do you feel is in control—you or Virgin or someone/something else?
- Do you trust the information or service you’re getting? Why/why not? Is anything happening to enhance or undermine that trust? Please explain.
- Do you feel a sense of ongoing engagement?
- If this experience is indeed different to what you expected, how do you feel about that? Do you feel inclined to give a little leeway to the service/brand/channel? Why or why not?
- Do you feel that the experience is being directed at you? Why/why not?
- Do you feel a sense of fulfilment or achievement at the conclusion of the experience? Why/why not?
- How is the experience consistent or inconsistent with the values you associate/d with the brand?
- Do you feel the brand is fulfilling its promise?

Appropriating

- How are you making sense of this experience within a larger framework of experience, e.g., with Virgin or with the channel?
- Did it fit in with how you like to do things?
- How did it change or deepen your impression of the brand/service/channel?
- Was there any aspect of it that made you feel uneasy? Please explain.
- What aspects did you find particularly rewarding?
- Was there anything that surprised you? If so, what was it and why?
- Did the experience remind you of anything and, if so, what?

Recounting

- How would you describe the overall experience?
- What were the most memorable things about it?
- Do you feel much inclined to describe it to anyone? Does it make a good story?
- Are there any bits you particularly enjoy remembering?
- How do others react to your story?

Chapter 2.12

Different Levels of Information Systems Designers' Forms of Thought and Potential for Human-Centered Design

Hannakaisa Isomäki
University of Lapland, Finland

ABSTRACT

This article describes a study clarifying information systems (IS) designers' conceptions of human users of IS by drawing on in-depth interviews with 20 designers. The designers' lived experiences in their work build up a continuum of levels of thought from more limited conceptions to more comprehensive ones reflecting variations of the designers' situated knowledge related to human-centred design. The resulting forms of thought indicate three different but associated levels in conceptualising users. The separatist form of thought provides designers predominantly with technical perspectives and a capability for objectifying things. The functional form of thought focuses on external task information and task productivity, nevertheless, with the help of positive emotions. The holistic form of thought

provides designers with competence of human-centred information systems development (ISD). Furthermore, the author hopes that understanding the IS designers' tendencies to conceptualise human users facilitates the mutual communication between users and designers.

INTRODUCTION

As information systems (IS) increasingly pervade all aspects of everyday life, of utmost importance is how applications of IS are adjusted to human action. In particular, in current information systems development (ISD) it is essential to take into account human characteristics and behaviour; that is, to humanise IS (Sterling, 1974). In the same vein, Checkland (1981) argues that ISD should be seen as a form of enquiry within

which IS designers' understandings regulate an operationalisation of their intellectual framework into a set of guidelines for investigation that require particular methods and techniques for building the system. Regarding the humanisation of IS, a notion concerning the nature of the human being is a crucial element of the intellectual framework. As a consequence, within this kind of enquiry, the way humans are taken into account in ISD is dependent on the operationalisation of the IS designers' conceptualisations of users. With respect to human-centeredness, attention should be paid to the fundamental qualities of people without any explicit or implicit domination of the other elements of IS, such as data, formal models and technical appliances, or managerial belief systems that treat humans instrumentally. This is necessary in order to conceptualise humans in their own right, and thus avoid the reduction of humans to something that exists only in relation to particular instrumental needs and purposes (cf. Buber, 1993).

Of essential importance is the nature of IS designers' insights into human characteristics and behaviour that are essential with respect to the IS-user relationship. The most crucial insight regarding human-centred design is to be able to conceptualise users as active subjects comprised of physical, cognitive, emotional, social and cultural qualities, an insight which is the prerequisite for design that promotes subsequent user acceptance and satisfaction. Yet conspicuously absent from contemporary IS literature are empirical studies investigating IS designers' conceptions of the human users, which have been studied more intensively two decades ago when the systems designers' inadequate view of the user has been stated to be one reason for the behavioural problems often experienced while implementing IS (Bostrom & Heinen, 1977; Dagwell & Weber, 1983). Also, the lack of knowledge of human needs and motivation on the part of the systems designers has been claimed to cause IS imple-

mentation failures (Hawgood, Land & Mumford, 1978). Further, Hedberg and Mumford (1975) have defined the nature of the view of human being held by systems designers as an essential factor in the IS design process. The systems designers' view of the user is also included in some studies as one of the targets of value choices during the ISD process (Kumar & Bjørn-Andersen, 1990; Kumar & Welke, 1984) and is therefore defined as a value rather than an insight in these studies. Dagwell and Weber (1983), in their replication study, rely on Hedberg-Mumford's definition of the concept but also refer to Kling (1980). "we know very little about the perceptions that computer specialists have of the users they serve and the ways in which they translate these perceptions into concrete designs (p. 47)." Bostrom & Heinen (1977), in turn, define systems designers' assumptions of people as one of the system designers' implicit theories or frames of reference. These previous works do not take an explicit stance toward the definition of the concept "conception," and do not align the nature of conceptions in detail. For instance, from where do conceptions derive their origins, and what is the nature of those conceptions? In a more recent study, Orlikowski and Gash (1994) discuss their definition of the IS designers' views. They elaborate the concept "*frame of reference*" by comparing it to the concept "*schema*" (Neisser, 1976, pp. 9-11), "*shared cognitive structures*" or "*cognitive maps*" (Eden, 1992, pp. 261-262), "*frames*" (Goffman, 1974, pp. 10-11), "*interpretative frames*" (Bartunek & Moch, 1987, p. 484), "*thought worlds*" (Dougherty, 1992, p. 179), "*interpretative schemes*" (Giddens, 1984, pp. 29-30), "*scripts*" (Gioia, 1986, p. 50), "*paradigms*" (Kuhn, 1970, p. 43), and "*mental models*" (Argyris & Schön, 1978). They end up by defining their own meaning for the concept frames as a general concept of shared cognitive structures, not especially regarding humans.

This article describes a study which aims to clarify IS designers' conceptions of users of IS

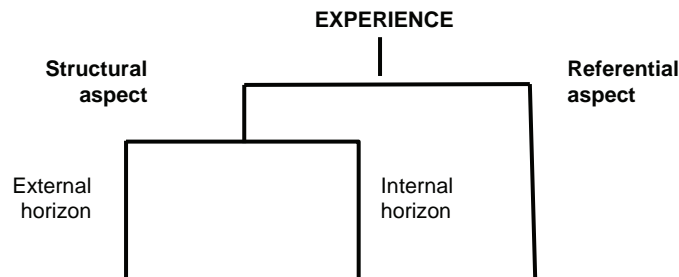
by drawing on in-depth interviews with 20 IS designers. The analytical choices carried out in this study regard IS designers' conceptions of users as experiences inherent in their lifeworlds, particularly during the different phases of ISD. The lived experiences build up conceptions that form a structure of meaning, which incorporates a continuum of levels from more limited understandings to more comprehensive notions; that is, different levels of thought reflecting variations of the designers' situated, practical knowledge. In this way the development of IS is understood as knowledge work. It is an intellectual and personal process which takes its form according to the conceptions of the performers of the process. IS designers are then applying the ISD methodologies according to their own observations and thinking (Avison & Fitzgerald, 1994; Hirschheim et al, 1995; Mathiassen, 1998). Then the most important tool for ISD, and a key resource in contemporary IT companies, is the IS designers' thought and insight (Nonaka & Takeuchi, 1995; Quinn, 1992). Particularly with respect to the humanisation of IS, designers' conceptualisations of the human users are seen as knowledge that reflects the designers' competence in humanising IS. In this way, IS designers' conceptions may be seen as intellectual capital that mirrors the know-how, practices, and accumulated expertise of practitioners within a particular profession (Kogut & Zander, 1992).

In what follows, first, the assumptions informing this study are presented by introducing the interpretative approach referred to as phenomenography. Second, the resulted forms of thought are presented and discussed. The IS designers' conceptualisations presenting their mental schemes of the human user result in three forms of thought, revealing both context-centred and human-centred understandings of what humans are. These three levels of understanding indicate that IS designers tend to conceptualise uses in terms of technology, business and work, and that seldom are users taken into account according to their human qualities. Finally, the different levels of conceptualisation are discussed in relation to human-centred ISD.

DIFFERENT LEVELS OF UNDERSTANDING

This study merges with the principles of phenomenography, which is a qualitatively oriented method of empirical research for investigating the different ways in which people experience aspects of reality (Marton, 1981; Marton & Booth, 1997). Essentially, phenomenography is about individual meaning construction, which results in a conception. The primary focus is on the structure of the meaning of conceptions, which are seen in the light of the phenomenological notion accord-

Figure 1. The analytical distinctions of an experience (Marton & Booth, 1997)



ing to which person and world are inextricably related through a person's lived experience of the world (e.g., Husserl, 1995; Merleau-Ponty, 1962). Our intentionality is seen as qualitatively varying foci on the horizon of our life worlds. While experiencing the world, individuals form conceptions, including qualitative dissimilarities, which are inherent in the intertwined referential and structural aspects of an experience. Different levels are due to the way the structural aspect and the referential aspect merge with each other. Then an experience is specified by the analytical distinctions of a structural aspect and a referential aspect (Figure 1). The structural aspect denotes how a particular phenomenon is both discerned from its environment and how the phenomenon's parts relate to each other as well as to the whole phenomenon. That which surrounds the phenomenon experienced, including its contours, is its external horizon. The parts and their relationships, together with the contours of the phenomenon, are its internal horizon. The referential aspect signifies the meaning of the conception. These two aspects are dialectically intertwined and occur simultaneously within an experience. Thus, people create conceptions with respect to the structural aspect's external and internal horizons of a phenomenon that are dialectically merged with the referential aspect of that particular phenomenon.

On the one hand, conceptions differ in terms of content, and on the other hand, they differ in terms of the extent of the form that a certain phenomenon is experienced, as a part of that phenomenon, or more as a whole. When detached parts of a phenomenon are the focus of thought instead of relating the parts meaningfully to the whole phenomenon, the meaning of the phenomenon is understood in a way that refers to a more narrow view. Respectively, when the focus of thought is more comprehensive regarding the whole meaning of a phenomenon instead of on separate parts of it or even the surroundings of the phenomenon, the more explanatory conceptions are. Further,

the more explanatory power conceptions have, the better they support competent action with respect to the phenomenon in question (Sandberg, 2000). Based on these differences, conceptions form a structure of meaning, which incorporates a continuum of levels from more limited understandings to more comprehensive notions. The qualitative variation in the ways that IS designers conceptualise users reflects their different conceptions of users, and simultaneously forms different levels in the designers' understandings, reflecting variations of their situated, practical knowledge as forms of thought. These forms of thought, in turn, suggest different levels of competence in humanising IS, because the subjective conceptualisations of IS designers refer to their intention of action (Säljö, 1994).

The interview method is accomplished with respect to phenomenographic principles. To promote multiple interpretations within individual designers, first, opening questions with varying perspectives into the different phases of ISD, such as planning, design, implementation, use and maintenance, was incorporated in the interview framework. Second, to sustain the connection between the designers' reflection and the actual work within ISD phases while the in-depth interviews aimed at achieving mutual and authentic understanding that proceeded from the interviewees' expressions. The interviews were taped at the designers' workplaces to maintain the work practice orientation and to facilitate the expression of the connection between the respondents' immediate experiences and the subsequent conception. Second, the respondents represent a variety of geographical location, age, gender, educational background and work experience. They came from various different application areas of IS practice, such as e-commerce, tele and media communications, groupware, health care systems, office automation and insurance systems.

The analysis of the interview data was carried out against the phenomenographical theory. Since

phenomenography does not offer grounds for defining the content of conceptions within data, a coding paradigm was developed from the data in order to facilitate the identification and categorisation of meanings in the data (Glaser & Strauss, 1967; Tesch, 1990; Strauss & Corbin, 1990). The development of the coding paradigm was based on the phenomenographical principle regarding the intentionality of conceptions. Conceptions are context-dependent and every experience is described in content-loaded terminology (Säljö, 1994.). That is, the descriptions are carried out in terms of the nature of the situational experiences in question. Consequently, the meanings are to be found in accordance with the underlying assumptions concerning the intentional nature of ISD. In addition, since it is assumed in phenomenography that the meanings of the respondents' mental acts exist in the data and are constitutive of the data (Walsh, 1994), the way meanings are understood in this study should also be in accordance with the types of intentionality existing in the data. Thus, the coding paradigm was finalised by bracketing away any preconceived ideas of what the IS designers' views might be like (Francis, 1993), and letting the analysis be informed by the underlying assumptions of intentionality in ISD.

First, the data includes utterances that describe various actions and objectives concerning ISD. These expressions indicate intentionality as defined by Hirschheim et al. (1995, p. 16). They state that "IS development is intentional, to the extent it reflects a planned change. It is based on developers' intentions to change object systems towards desirable ends", and go on to say that (1995, p. 17) "intentions in systems development are expressed by objectives. These are related to general value-orientations and represent what 'one ought to do' or 'what is good'." From this it can be concluded, in the first place, that intentionality in ISD is expressed by intentional action. That is to say, IS designers' descriptions of the actions and means they are involved with when developing an

IS reveal the meanings they give to the phenomena they deal with concerning ISD. This notion is in accordance with the principle of contextuality in phenomenography, which denotes that people's conceptualisations are not detachable, either from their context or the content of the task at hand. This stance also reinforces the interpretative nature of phenomenographical analysis in that the researcher must see the designers' action as inherently meaningful (cf. Schwandt, 2000). In the second place, as Hirschheim et al. (1995) point out, intentions are expressed by objectives of ISD. Consequently, it is an appropriate way to define that the way the IS designers understand the human user of an IS is revealed through descriptions in which the respondents' focus of reflection is on the objectives of ISD. That is to say, in addition to the actions and means the designers refer to, the IS designers' intentions to change object systems toward desirable ends reveal the meanings they give to the phenomena they deal with concerning ISD. These desirable ends or objectives represent the things that are regarded most important in ISD. In this way, the IS designers' descriptions of action, means and objectives also implicitly indicate value orientations included in the process of ISD. Therefore, the described actions and objectives represent the things that are regarded important, and thus reveal the referential aspect in terms of intentionality as an implied value orientation. This means that the initial referential aspects of conceptions may be found in utterances in which the designers refer to their way and means of building systems and the objectives of their actions.

Second, the data includes descriptions in which the respondents' thoughts are attached to human objects. These descriptions of people indicated human features and also value orientations toward people. Often these descriptions also included expressions which indicated emotionally toned reactions. These kinds of expressions within the data indicate intentionality that is in accordance

with Uljens (1991), who states that the process of qualitative individuation of a mental act has been done when an object and a psychological mode, referred to as an attitude, is shown. In other words, how a particular object of thought is experienced denotes the respondents' attitudes toward the phenomenon that is being reflected on. In brief, the inherent meaning of an utterance may be seen as the correlation between the what- and how-aspects in that they are not detachable from each other, but are interrelated in a particular logical way, indicating what a particular phenomenon is, in what it is revealed, and what kind of values and attitudes are related to it. As described above, the search for the meanings in the data, data analysis, was initiated by establishing a coding paradigm, which suggests that the meanings in the data are found in utterances in which the designers refer to their actions, means, and objectives concerning ISD, as well as to human characteristics.

The subsequent analysis procedures followed the idea, firstly, of iterating between the meaning (referential aspect) of single statements, their surrounding statements, and the data as a whole, and second, iterating between the features that reveal different levels in these meanings (structural aspect). The analysis appreciates the phenomenological notion of "Lebenswelt" in that the continuum of levels from more limited forms of thought to more comprehensive understandings reflects associative connections within the designers' conceptions rather than direct, law-like logical relations between them (cf. Husserl, 1995). The analysis revealed the designers' conceptions as different levels of understanding, which appear as the separatist, functional, and holistic forms of thought. These forms of thought reveal three different levels of understandings incorporating both context-centred and human-centred notions. In the descriptions associated with the context-centred conceptions, the designers' focus of reflection is on technology, work, and business. The human-centred conceptions deal with knowledge, emotions,

and the designers' selves. The following description delineates the specific contents of the conceptions as parts of the three forms of thought by highlighting some exemplary conceptions.

THE SEPARATIST FORM OF THOUGHT

The most partial way in which the IS designers conceptualise humans is through the separatist form of thought. It demonstrates how IS designers see humans within the affordances and constraints of contemporary IS and their development as separated from fluid and coherent interactions. Within this form of thought, the user is positioned outside the IS designers' awareness through objectivist conceptualisations. An objectivist pattern is evident in the context-centred separatist conceptions, which reflect understandings according to which reality exists independent of humans and can thus be understood independent of humans (cf. Lakoff, 1987; Orlikowski & Baroudi, 1991). In this case, when discussing human-centred issues of ISD, the designers' focus of reflection is directed to technology, job titles, and market mechanisms. For example, within the conception of "*the human being displaced by technology*" IS designers refer to humans in terms of technology:

R: What are these requirements and wishes like? Could you tell me more about them?

DI6: Well, because it is a question of – let's say – a feedback channel that our company offers as a product to its clients, it means that if the client purchases, for instance, a datanet-based customer network, they have datanet and router accesses through which they operate between their networks and use the whole telecommunication network. Then there are a lot of this kind of usability issues, response times and load percentages, or in a way, how it (telecommunication network) sort of behaves, what happens there.

In the above interview extract, the designer considers the customers' needs as a piece of software—"a feedback channel"—and the main point that emerges is how this item of software works with the functions of a telecommunications network. The designer's train of thought becomes focussed on technology instead of human-centred issues and needs, such as how the software is built in regard to the humans that will be using it. In the same vein, within the conception of "*the human being as a market*" the designers make use of expressions which show their intention is to build products that are profitable and, therefore easy to sell. Yet they do not base their intentions upon human features, such as spontaneous and mood-related online behaviour that could be a prerequisite for selling their products (e.g., Hoffman & Novak, 1996; Bellman et al, 1999):

D5: It is more reasonable to develop a mass product which has a lot of users. The point here is that then it can be copied and sold.

In contrast to notions that emphasise understanding human consumption behaviour, the IS designers adhere to the idea that humans are simply a featureless mass of consumers who form a market for IT products. Because the above conception does not incorporate any human characteristics, but refers to a mass market, it is thereby making a clear distinction between the market and the features of the people assumed to form that market. For this reason, the conception appears as objectivist. This conception also implies a predisposition according to which the current development of IS as an industry is that of a rational institution which produces mass culture by reducing humans to members of a mass (cf. Slater, 1997). Furthermore, humans become separated attitudinally from IS and their development due to a presumed lack of technological knowledge, and thus are forced to encounter disparaging attitudes. The separatist human-centred conception of "*the technology-illiterate human being*"

produces accounts according to which the most distinct characteristic of humans is that they are ignorant of technology, specifically computers, software and ISD methodologies. In particular, this illiteracy is seen as a contrast to the literacy of the IS designers:

R: Have you ever wondered why people behave in that way — that they cannot say what they want from the system?

D17: I think that it's because they don't know how these [IS] are defined. If one doesn't know these methods, one can't do it. That is the biggest reason, not that they aren't willing to say what they want but they don't have the know-how.

Beath and Orlikowski (1994) report similar findings in their analysis of a relatively new representative of the ISD methodologies' rationalist tradition, information engineering (IE). According to the analysis, the IE text creates and sustains both implicitly and explicitly a dichotomy between users and IS designers by characterising the users as technologically ignorant in regard to the use of technology. When operationalised, these characterisations are likely to generate nonviable and unsatisfactory interactions between users and IS designers. It seems also that the designers do not consider the weaknesses in users' knowledge and thought as an issue that deserves to be taken into account in design. However, when humans are included in the design considerations, the weaknesses in people's thinking should be understood as natural flaws in human cognitive behaviour that can be appropriately guided, or even prevented by adequate design (Kirs, Pflughoeft, & Kroeck, 2001; Norman, 1989; Robillard, 1999). The idea then is that designers should have awareness of and be able to recognise these erroneous tendencies in users in order to carry out IS planning and design with the express aim of preventing people from committing faulty actions during computer use, rather than conceptualising users as technologically ignorant.

Moreover, negative emotions and physical stress symptoms have the effect of separating humans from IS. The conception of “*the computer anguished human being*” reveals views acknowledging that IS cause negative emotional arousal in users. These reactions are manifested as negative attitudes, resistance, fear and discomfort in situations where people are confronted by plans for the future use of computers or in situations in which individuals are using computers:

R: How in your mind do people learn to use software?

D6: ... I have also met users who have so much fear of the user interface that they don't dare to explore or try anything, they just do what is familiar and safe.

These conceptualisations are consistent with statements concerning the widespread existence of technophobia (Brosnan, 1998a). Besides being an obviously unpleasant and undesired experience, negative emotions, such as anxiety and fear, make people's behaviour withdrawn and elusive by narrowing their action (Fredrickson & Branigan, 2001), as well as decreasing the quality of their performance (Brosnan, 1998b).

In brief, within the separatist form of thought, the human being becomes separated from viable interactions with both the IS designers themselves and IS. This is due to a tendency to an objectivist conceptualisation, which blurs the designers' thought to such an extent that people are no longer recognised as humans. The overall narrative style of this form of thought is reminiscent of the style of a nomothetic science reflecting technical, strategic views aiming at controlling the IS-related social system with the technical system (cf. Deetz, 1996). Further, people become separated from the development of IS due to disparaging attitudes inherent in designers' assumptions that users are technologically ignorant. Moreover, this form of thought brings to the fore human characteristics,

such as negative emotions, which are seen as an obstacle to a viable IS-user relationship.

THE FUNCTIONAL FORM OF THOUGHT

The functional form of thought consists of conceptualisations in which humans are seen to act in an insubstantial manner, adapting to the external functions of technology, work tasks and the way the IS designers themselves use computers. Within this adaptive response, positive emotions are required in order to create and sustain viable interactions with IS. In this way, the IS-user relationship is seen as functional: the action of people is seen as determined by their external environment, and the role of human emotion is to facilitate this process. The different conceptions that build up this form of thought reveal a behaviourist understanding of the human being.

For instance, the conception of “*the invisible human being*” denotes humans as using IS in an insubstantial manner. Typical of this conception is the belief that there is a user who uses an IS. Yet the user is not characterised further but is assumed just to use the system:

R: If you think of a situation where you are creating an application, who do you think you're making it to?

D16: Hm.....

R: Do you think of certain types of people or how does it show that you are making it for people?

D16: I don't think of particular types of people but I think that the human being is in some sense always a part of the system. If it is a system that has a user interface so there must be somebody who uses it. Even if it is a system that runs by timer initiation, there must be a user interface, too, for setting the timer parameters in the system, so there must be somebody to use it, too. To my mind there is always someone using the systems, they (systems) are not fully automated.

A functioning relation between people and IS is thus acknowledged, but this does not include any features originating from the mental, social or cultural human modes of being. In other words, humans and their behaviour are understood as purely physical-organic responses to technology, as established in the tenets of Skinnerian behaviourism (Skinner, 1938, 1991). Similarly, the IS designers' conception of "*the human being behind the process of work*" denotes humans in conformity with behaviourist thinking. Within this conception individuals are seen in terms of their work tasks or organisational work processes. Characteristic of these conceptualisations is that the people performing the tasks are not portrayed further, but are assumed merely to use IS according to the external task flows:

R: How would you define users' needs?

D8: They consist of the utilising organisation's needs at all levels, beginning with what the people need in order to continually do their work tasks, and ending with the things that the organisation expects from the system, what can be abstracted from the process and be used to develop and control action.

Here, human action is seen as a series of direct responses to external work tasks issued to people. Zuboff's (1988) well-known distinction between "automating work" and "informating work" highlights the difference between implied behaviourist and nonbehaviourist assumptions concerning human action in computerised work (pp. 9-10). Automating work refers to deploying technology in ways that increase the self-acting and self-regulating capacities of technical systems, which are expected to minimise human intervention. Because human intervention is minimised and machines perform the work tasks, interactions between individuals and computers become determined by the structure and sequence of computerised workflows to which, in turn, humans are supposed to respond. Zuboff's term

of automating work, thus, implies a behaviourist assumption of humans and their behaviour.

Quite the opposite is suggested by the term informating work, which adds to the automating view of work in that information technology can be used to automate, but at the same time, it has the ability to translate the automated activities into a form that renders work processes, objects, events and behaviours visible, knowable and sharable for people (Zuboff, 1988). That is to say, within the interaction of humans and computers, people actively observe, interpret and share the information which is mediated to them by IS. They do not just respond like marionettes to the information offered by IS, but actively construct their own conceptions of the computer-mediated tasks they are given and act according to their own interpretations of the particular situation. Thus, in order to accomplish fluid and coherent interaction designs between humans and computers in regard to particular tasks, the users' mental models, especially those concerning the tasks submitted to them, should also be designed (Norman, 1989; Preece, 1994).

Also typical of the functionalist form of thought is that the role of human emotion is to facilitate people's adaptation to technology. Within the conception of "*The techno-enthusiast human being*" the designers depict positive emotions, such as enthusiasm, as essential features in humans:

R: Do you think there are common features in those people for whom you have built systems?

D17: Well, at least during very recent years, it has been enthusiasm.

In particular, positive emotional reactions in people are seen to be induced by technology. Positive feelings are especially seen as a prerequisite for the successful use of IS. These conceptualisations reveal a functional understanding of positive emotions. Whereas negative emotions are associated with specific tendencies,

such as an urge to escape or to avoid disquieting things, positive emotions seem to spark changes in cognitive activity in addition to producing behavioural tendencies (Fredrickson & Branigan, 2001). Therefore, the IS designers' accounts of positive emotions as a prerequisite for the use of computers imply an understanding of the role of human emotional features in promoting successful functioning.

To sum up, within the functional form of thought humans and their behaviour are understood from a behaviourist stance, which renders human substance only as physical and organic by nature, denoting that the movements of people can be explained by the laws of mechanics (Wilenius, 1978). However, this form of thought adds to the previous separatist way of thinking in so far as humans are actually depicted as performing tasks with computers, whereas in the separatist form of thought the conceptualisations either totally omit human features or humans are seen as unable to use computers. In addition, the human emotional feature that is recognised in this form of thought appears as positive — even though functional — in nature. This way of thinking acknowledges humans as users, and therefore is more developed than the previous separatist form of thought.

THE HOLISTIC FORM OF THOUGHT

The most developed form of thought by which the IS designers conceptualise humans as users of IS is the one characterised as holistic. Its holistic quality is revealed in several ways. First, unlike the preceding forms of thought, the designers recognise a number of human characteristics. Second, these observed human features are often seen to coexist or intertwine with each other. Third, these conceptualisations suggest that the relationship between users and designers, as well as the IS-user relation, is a reciprocal process, including characteristics typical of human behaviour.

To begin with, the conception of “*the human being reflected in technology*” reveals the specific goal of constructing computer interfaces with human-like features: the interaction between people and computers is then envisaged as enriched with dialogues conveying both the rational and emotional meanings of the information in question (e.g., Nakazawa, Mukai, Watanuki & Miyoshi, 2001). Respectively, the depictions of various human features in technology reveal understandings suggesting human features built into technology render the interaction between users and IS as resembling the interplay of cognitive, emotional and social aspects that occur between humans:

R: What kind of user interface do you think that people would want to use?

D4: I strongly believe that 3D interfaces are coming. They could offer kind of human-like facial features as agents, which would bring a human sense to the systems. The third dimension could also be utilised so that interfaces become tangible and accessible.

Further, the context-centred conception of “*the human being as an organisational learner*,” which highlights people as organisations which learn about their own work processes, refers indirectly to learning, which stresses both cognitive and social human features. Collective cognitive features are referred to as an organisation's ability to form new insights into its work processes and to guide the deployment of IS effectively (Robey, Boudreau & Rose, 2000). A social dimension is also implied when it is assumed that people learn as an organisation:

D8: Needs are prone to change rapidly, especially after the implementation of the system, because they teach an organisation a lot about itself, and an organisation's self-knowledge increases and usually needs change in a more clever direction. Then there very quickly happens a sort of 'learn-

ing leap', which is often experienced as if the system is not valid at all although it is a question of the organisation's increased knowledge of its own activity.

Within the conception of “*the knowledge sharing human being*” the designers open up their view of learning by specifying mutual understanding between users and designers as essential. “*It is important to be able to explain things so that we understand each other.*” The capability of taking another’s perspectives into account form the core of this conception, which highlights knowledge sharing as a particularly important instance within the processes of organisational learning. Knowledge sharing is the link between individual and group learning, and signifies the expansion of individuals’ cognitive maps into shared understandings (Crossan, Lane & White, 1999). In particular, the ability to take the perspective of others into account is an indispensable prerequisite for knowledge sharing (Boland & Tenkasi, 1995). Buber (1993) ascertains that, in order to be able to take others’ perspectives into account fully, one has to treat others as equal human beings and respect the current circumstances of others. In these kinds of relationships positive emotional features, such as care and joy, need to be acknowledged and combined with cognitive and social abilities (Fredrickson & Branigan, 2001)

Moreover, the conception of “*the emotionally coping human being*” refers to an ability to regulate in a successful way both negative and positive subjective feelings in computerised situations. In this way, the designers see emotional coping in the light of positive outcomes (cf. Folkman & Moskowitz, 2000, pp.648-649):

D8: ... a skilful user always has such peace of mind and attitude. She or he kind of has a better tolerance for stress, and an ability to cope with contradictions in a better way than others. For some reason this kind of attitude leads to a par-

ticular resourcefulness and an ability to utilise the system in a more natural way, compared to a person who has some negative emotional features, fear or hostility towards the system, and who then ends up having difficulties with the system due to her/his heavy attitude.

A cognitive aspect is seen as inherent in emotional coping in that it requires that individuals’ recognise their different emotional experiences. However, in addition to these internal cognitive-affective features, emotion regulation refers to the external social and cultural factors that redirect, control, and shape emotional arousal in such a way that an individual is able to act adaptively in emotionally activating situations (Pulkkinen, 1996). While ISD is often seen as a stressful process which requires an ability to endure changing emotional experiences, such as interest and frustration (Newman & Noble, 1990) in recurrent situations of failure and subsequent success (Robey & Newman, 1996), it is understandable that the designers regard people who are able to regulate their emotions successfully as skilful.

Briefly, the holistic form of thought is comprised of conceptualisations that regard humans as cognitive, emotional, social and cultural creatures. The conceptions belonging to this form of thought embody similar basic human modes of being, as shown above. However, the aforementioned basic modes of being emerge in these conceptions as different behavioural affordances. The cognitive mode of being is seen as intellect, reasoning, learning, reflection, understanding and awareness of something. Similarly, the emotional mode of being is conceptualised as empathy, stress, tranquillity, commitment, contentment and a feeling of mastery. Further, the social mode of being is referred to as a need for communication, group learning, interpersonal power and connection, as well as knowledge sharing. These behavioural affordances are seen as incorporated in technology, appearing between humans, or within the interaction of humans and IS.

THE FORMS OF THOUGHT IN ISD

The IS designers' forms of thought revealed in the results of this study are regarded as important tools for ISD, and are seen to have implications for the ways that humans are taken into account as users within the different situations of ISD. These different situations refer to the phases of ISD such as planning, design, implementation, use and maintenance. The phases are cyclical and intertwining (e.g., Beynon-Davies, Carne, Mackay, & Tudhope, 1999). Planning refers to initiation and requirements analysis actions, including client contacts and definition of user requirements. During this phase the greatest degree of interaction occurs between users and designers (Newman & Noble, 1990). In order to accomplish requirements analysis, the designers should understand many human issues in addition to technical ones (Holtzblatt & Beyer, 1995). Design denotes procedures where requirements are refined and turned into specifications and finally software. Then technical reliability and maintainability of the system, user interface's applicability for the intended purpose of the system, as well as the aesthetical appearance of the system, are designed (Smith, 1997). Winograd (1995) emphasises that, in addition to technical requirements, the properties of a user interface should meet with the social, cognitive and aesthetic needs of people. Especially within new ubiquitous technological environments, the design of IS-user relationship should focus, in addition to social and cultural features, on individuals' perceptual, cognitive and emotional space (Stephanidis, 2001).

How would the designers then perform according to their forms of thought? The strength of the designers utilising a separatist form of thought would be technical knowledge, especially the ability to fluently conceptualise issues of design in accordance with objective definitions, a skill that is needed in creating formal specifications. However, the validity of objectifying design issues is dependent on the focus of such definitions. From

a human-centred perspective, valid definitions would require being theoretically sensitive to human activity and deriving second-order conceptions from that activity (see Walsham, 1995), rather than creating objectivist conceptualisations, which overlook humans and their behaviour. An obvious disutility would be a tendency to treat users as technologically ignorant, which implies incompetence in social relationships with users.

The designers embracing the functional form of thought possess technical knowledge, and value such knowledge in users. They tend to focus on formal job descriptions, external work tasks and individuals' task productivity. A deficit from a human-centred perspective would be the tendency to overlook human issues and to focus instead on the functional purposes of IS; that is, external task information regarding an organizations' process improvements. Often such conceptualisations are regarded to yield Tayloristic designs, which underestimate the social context. However, they possess competence in functional and technical systems design. Their strength would be increased social competence to fulfil the demand for mutual understanding, which is regarded of utmost importance in ISD (cf. Heng, Traut, & Fischer, 1999).

The designers building upon the holistic form of thought emphasise clients' satisfaction, which ensures sustainable customer relationships and regard mutual understanding during ISD as essential between users and designers. Their strength would be increased social competence fulfil the demand for mutual understanding, which is regarded of utmost importance in ISD (e.g., Klein & Hirschheim, 1993; Lyytinen & Ngwenyama, 1992). It seems also likely that they have competence in IS planning which aims at the improvement of organisational processes and are identified as functional, such as sales and purchasing processes, and emphasise mutual understanding. Also, they understand how to maintain customership instead of just visioning economic gains or focusing on people's task productivity.

Besides possessing technical competence, these holistic designers would be able to consolidate definitions of formal and external work tasks into human issues. A particularly significant capability would be to understand the process of organisational learning, which is essential in order to adjust the evolving requirements during the process of ISD. Moreover, they value balanced emotional behaviour, and thus intuitively grasp the possible dangers of relying on superfluous emotional behaviour.

With respect to the humanisation of IS, a holistic conception is required in ISD. It is then assumed that the human being is actualised in intertwined physical, cognitive, emotional, social and cultural qualities, and that these qualities are fundamentally different. Without the simultaneous existence of all of the qualities, it is not possible to consider a creature as a human. Yet the qualities cannot be reduced from one quality to another, but rather need to be understood as a whole (Rauhala, 1983). Considering the human being as an actor, as a user of an IS, the whole of a human being is understood as an active subject adjoining to IS. Then the IS-user relationship consists of human action involving explicit and tacit affordances that emerge dynamically in the interaction between humans and IS. In other words, the static characteristics of humans and technology take on a new form within their intertwining activity, which is shaped according to the affordances that, on the one hand, the human substance embodies, and which, on the other hand, the properties of IS support or ignore. Consequently, understanding humans and their behaviour as users of IS requires insight into these emerging human experiences appearing within the affordances and constraints of contemporary IS and their development. Especially at present when the IS are no longer merely tools for personal and professional instrumental productivity, but also (re)constituting and mediating different social structures and practices (e.g., Orlikowski, 1992; Orlikowski, 2000), IS acts as social spaces that are

important growing social and cultural reference points for users and, thus also for IS designers. Design that takes into account the consequences of the form and functions of IS to users' social qualities, such as self-identity, is indeed and necessary if contemporary IS development aims at high-quality and usable systems (Greenhill & Isomäki, 2005).

In summary, the resulting forms of thought indicate three different but associated levels of intellectual competence in conceptualising humans as users of IS. The separatist form of thought provides designers predominantly with technical perspectives and a capability for objectifying things. However, it is worth noticing that the validity of objectifying design issues is dependent on the focus of such definitions. From a human-centred perspective, valid definitions would require being theoretically sensitive to human activity and deriving abstracted conceptions from that activity rather than creating objectivist conceptualisations, which overlook humans and their behaviour. The functional form of thought focuses on external task information and task productivity, nevertheless, with the help of positive emotions. The holistic form of thought provides designers with competence of human-centred ISD, even though all the aspects of the richness of the human condition are not revealed. It seems the designers are intellectually more oriented toward designing IS for objectified, streamlined organisational processes consisting of external work tasks, and that this orientation challenges the human-centred orientations.

REFERENCES

Avison, D.E., & Fitzgerald, G. (1994). Information systems development. In W. Currie & R. Galliers (Eds.), *Rethinking management information systems: An interdisciplinary perspective* (pp. 250-278). Oxford: Oxford University Press.

- Beath, C.M., & Orlikowski, W. (1994). The contradictory structure of systems development methodologies: Deconstructing the IS-user relationship in information engineering. *Information Systems Research*, 5(4), 350-377.
- Bellman, S., Lohse, G.L., & Jordan, E.J. (1999). Predictors of online buying behavior. *Communications of the ACM*, 42(12), 32-38.
- Beynon-Davies, P., Carne, C., Mackay, H., & Tudhope, D. (1999). Rapid application development (RAD): An empirical review. *European Journal of Information Systems*, 8, 211-223.
- Boland, R.J., & Tenkasi, R.V. (1995). Perspective making and perspective taking in communities of knowing. *Organization Science*, 6(4), 350-372.
- Bostrom, R.P., & Heinen, J.S. (1977). MIS problems and failures: A socio-technical perspective. Part I: The causes. *MIS Quarterly*, 1(3), 17-32.
- Brosnan, M. (1998a). *Technophobia. The psychological impact of information technology*. London: Routledge.
- Brosnan, M. (1998b). The impact of computer anxiety and self-efficacy upon performance. *Journal of Computer Assisted Learning*, 14, 223-234.
- Buber, M. (1993). *Sinä ja minä [I and Thou]*. Juva: WSOY.
- Checkland, P. (1981). *Systems thinking, systems practice*. Chichester: Wiley.
- Cotterman, W.W., & Kumar, K. (1989). User cube: A taxonomy of end users. *Communications of the ACM*, 32(11), 1313-1320.
- Crossan, M.M., Lane, H.W., & White, R.E. (1999). An organizational learning framework: From intuition to institution. *Academy of Management Review*, 24(3), 522-537.
- Dagwell, R., & Weber, R. (1983). System designers' user models: A comparative study and methodological critique. *Communications of the ACM*, 26(11), 987-997.
- Deetz, S. (1996). Describing differences in approaches to organization science: Rethinking Burrell and Morgan and their legacy. *Organization Science*, 7(2), 191-207.
- Folkman, S., & Moskowitz, J.T. (2000). Positive affect and the other side of coping. *American Psychologist*, 55(6), 647-654.
- Francis, H. (1993). Advancing phenomenography: Questions of method. *Nordisk Pedagogik*, 13, 68-75.
- Fredrickson, B.L., & Branigan, C. (2001). Positive emotions. In T. Mayne & G. Bonanno (Eds.), *Emotions: Current issues and future directions* (pp. 123-151). New York: Guilford Press.
- Glaser, B.G., & Strauss, A.L. (1967). *The discovery of grounded theory. Strategies for qualitative research*. London: Weidenfeld and Nicolson.
- Greenhill, A., & Isomäki, H. (2005). Incorporating self into Web information system design. In A. Pirhonen, H. Isomäki, C. Roast, & P. Saariluoma (Eds.), *Future interaction design* (pp. 52-66). London: Springer-Verlag.
- Hawgood, L., Land, F., & Mumford, E. (1978). A participative approach to forward planning and systems change. In G. Bracchi, & P.C. Lockermann (Eds.), *Information systems methodology. Proceedings of the 2nd Conference of the European Cooperation in Informatics* (pp. 39-61), Venice, Italy. Springer-Verlag.
- Hedberg, B., & Mumford, E. (1975). The design of computer systems: Man's vision of man as an integral part of the system design process. In E. Mumford, & H. Sackman (Eds.), *Human choice and computers* (pp. 31-59). Amsterdam: North Holland.
- Heng, M.S.H., Traut, E.M., & Fischer, S.J. (1999). Organisational champions of IT innovation. Ac-

- counting, *Management and Information Technology*, 9(3), 193-222.
- Hirschheim, R., & Klein, H.K. (1989). Four paradigms of information systems development. *Communications of the ACM*, 32(10), 1199-1216.
- Hirschheim, R., Klein, H.K., & Lyytinen, K. (1995). *Information systems development and data modeling. Conceptual and philosophical foundations*. Cambridge University Press.
- Hoffman, D.L., & Novak, T.P. (1996). Marketing in hypermedia computer-mediated environments: conceptual foundations. *Journal of Marketing*, 60(3), 50-68.
- Holtzblatt, K., & Beyer, H.R. (1995). Requirements gathering: The human factor. *Communications of the ACM* 38(5), 31-32.
- Husserl, E. (1995). Fenomenologian idea. Viisi luentoa [The phenomenological idea. Five lectures] (Himanka, Hämäläinen & Sivenius, Trans.). Helsinki: Loki-kirjat.
- Kirs, P.J., Pflughoeft, K., & Kroeck, G. (2001). A process model cognitive biasing effects in information systems development and usage. *Information & Management*, 38, 153-165.
- Klein, H.K., & Hirschheim, R.A. (1993). The application of neo-humanist principles in information systems development. In D.E. Avison, T.E. Kendall, & J.J. DeGross (Eds.), *Human, organizational, and social dimensions of information systems development* (pp. 263-280). Amsterdam: Elsevier.
- Kling, R. (1977). The Organizational Context of User-Centered Software Designs. *MIS Quarterly* 1(4), 41-52.
- Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities and the replication of technology. *Organization Science*, 3(5), 383-397.
- Kumar, K., & Bjørn-Andersen, N. (1990). A cross-cultural comparison of IS designer values. *Communications of the ACM*, 33(5), 528-538.
- Kumar, K., & Welke, J. (1984). Implementation failure and system developer values: Assumptions, truisms and empirical evidence. In *Proceedings of the 5th International Conference on Information Systems* (pp. 1-12), Tucson, AZ.
- Lakoff, G. (1987). *Women, fire and dangerous things*. University of Chicago Press.
- Marton, F. (1981). Phenomenography: Describing conceptions of the world around us. *Instructional Science*, 10, 177-200.
- Marton, F., & Booth, S. (1997). *Learning and awareness*. Mahwah, NJ: Lawrence Erlbaum.
- Mathiassen, L. 1998. Reflective systems development. *Scandinavian Journal of Information Systems*, 10(1/2), 67-118.
- Merleau-Ponty, M. (1962). *Phenomenology of perception*. London: Routledge.
- Nakazawa, M., Mukai, T., Watanuki, K., & Miyoshi, H. (2001). Anthropomorphic agent and multimodal interface for nonverbal communication. In N. Avouris, & N. Fakotakis (Eds.), *Advances in human-computer interaction I. Proceedings of the PC HCI 2001* (pp. 360-365), Athens, Greece.
- Newman, M., & Noble, F. (1990). User involvement as an interaction process: A case study. *Information Systems Research*, 1(1), 89-110.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford University Press.
- Norman, D.A. (1989). *Miten avata mahdottomia ovia? Tuotesuunnittelun salakarit* [The psychology of everyday things]. Jyväskylä: Gummerus.
- Orlikowski, W.J. (1992). The duality of technology: Rethinking the concept of technology

- in organizations. *Organization Science*, 3(3), 398-427.
- Orlikowski W.J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science*, 11(4), 404-428.
- Orlikowski, W.J., & Baroudi, J.J. (1991). Studying information technology in organizations: Research approaches and assumptions. *Information Systems Research*, 2(1), 1-28.
- Orlikowski, W.J., & Gash, D.C. (1994). Technological frames: Making sense of information technology in organizations. *ACM Transactions on Information Systems*, 12(2), 174-207.
- Preece, J. (1994). *Human-computer interaction*. Harlow, UK: Addison-Wesley.
- Pulkkinen, L. (1996). Female and male personality styles: A typological and developmental analysis. *Journal of Personality and Social Psychology*, 70(6), 1288-1306.
- Quinn, J.B. (1992). The intelligent enterprise: A new paradigm. *Academy of Management Executive*, 6(4), 48-63.
- Rauhala, L. (1983). *Ihmiskäsitys ihmistyössä* [The conception of the human being in human work]. Helsinki: Gaudeamus.
- Robey, D., Boudreau, M.C., & Rose, G.M. (2000). Information technology and organizational learning: A review and assessment of research. *Accounting, Management & Information Technology*, 10(1), 125-155.
- Robey, D., & Newman, M. (1996). Sequential patterns in information systems development: An application of a social process model. *ACM Transactions of information systems*, 14(1), 30-63.
- Robillard, P.N. (1999). The role of knowledge in software development. *Communications of the ACM*, 42(1), 87-92.
- Säljö, R. (1994). Minding action. Conceiving the world vs. participating in cultural practices. *Nordisk Pedagogik*, 14, 71-80.
- Sandberg, J., (2000). Understanding human competence at work: An interpretive approach, *Academy of Management Journal* 43(1), 9-25.
- Schwandt, T., (2000). Three epistemological stances for qualitative inquiry. Interpretivism, hermeneutics, and social constructionism. In Denzin, N.K. & Y.S. Lincoln (Eds.) *The handbook of qualitative research* (2nd ed.). Thousand Oaks, CA: Sage, 189-213.
- Skinner, B.F. (1991). *The behavior of organisms: An experimental analysis*. Acton, MA: Copley. Originally published in 1938.
- Slater, D. (1997). *Consumer culture and modernity*. Malden, MA: Blackwell.
- Smith, A. (1997). *Human computer factors: A study of users and information systems*. London: McGraw-Hill.
- Stephanidis, C. (2001). Human-computer interaction in the age of the disappearing computer. In N. Avouris, & N. Fakotakis (Eds.), *Advances in human-computer interaction I. Proceedings of the PC HCI 2001* (pp. 15-22), Athens, Greece.
- Sterling, T.D. (1974). Guidelines for humanizing computerized information systems: A report from Stanley House. *Communications of the ACM*, 17(11), 609-613.
- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage Publications.
- Tesch, R. (1990). *Qualitative research: Analysis types and software tools*. New York: Falmer Press.
- Uljens, M. (1991). Phenomenography: A qualitative approach in educational research. In L. Syrjälä, & J. Merenheimo (Eds.), *Kasvatustut-*

kimuksen laadullisia lähestymistapoja. Oulun yliopiston kasvatustieteiden tiedekunnan opetusmonisteita ja selosteita 39 (pp. 80–107).

Walsh, E. (1994). Phenomenographic analysis of interview transcripts. In J.A. Bowden, & E. Walsh (Eds.), *Phenomenographic research: Variations in method* (pp. 17-30). The Warburton Symposium. Melbourne: The Royal Melbourne Institute of Technology.

Walsham, G. (1995). Interpretive case studies in IS research: Nature and method. *European Journal of Information Systems*, 4(2), 74-81.

Wilenius, R. (1978). *Ihminen, luonto ja tekniikka* [The human being, nature and technology]. Jyväskylä: Gummerus.

Winograd, T. (1995). From programming environments to environments for designing. *Communications of ACM*, 38(6), 65-74.

Zuboff, S. (1988). *In the age of the smart machine: The future of work and power*. New York: Basic Books.

This work was previously published in International Journal of Technology and Human Interaction, Vol. 3, Issue 1, edited by B. Carsten Stahl, pp. 30-48, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.13

A Method to Quantify Corpus Similarity and its Application to Quantifying the Degree of Literality in a Document

Etienne Denoual

ATR—Spoken Language Communication Research Labs, Japan

CLIPS—GETA—IMAG, Joseph Fourier University, France

ABSTRACT

Comparing and quantifying corpora are key issues in corpus-based translation and corpus linguistics, for which there is still a notable lack of standards. This makes it difficult for a user to isolate, transpose, or extend the interesting features of a corpus to other NLP systems. In this work, we address the issue of measuring similarity between corpora. We suggest a scale between two user-chosen corpora on which any third given corpus can be assigned a coefficient of similarity, based on the cross-entropy of statistical N-gram character models. A possible application of this framework is to quantify similarity in terms of literality (or, conversely, orality). To this end, we carry out experiments on several well-known corpora in both English and Japanese and show that the defined similarity coefficient is robust in terms of language and model order variations. Compar-

ing it to other existing similarity measures shows similar performance while extending widely the range of application to electronic data written in languages with no clear word segmentation. Within this framework, we further investigate the notion of homogeneity in the case of a large multilingual resource.

INTRODUCTION

Be it in corpus linguistics or data-driven automatic translation, statistical or example-based, corpora not only are useful tools but key elements of the discipline. Paradoxically, little work has been done on automatically characterizing such sets, and attempting a meaningful comparison is often a perilous task. Typically, we will read that such corpus is made of “casual speech transcripts,” “mildly spontaneous utterances,” or “highly

scenarized oral language.” However, such tags will be of little use to the user seeking to better understand how his or her system performs and how to transpose its specific features to another task.

In the following work, we try to fill this void with a method to position a corpus relatively to two others, which we use as references. As an experiment, we apply this method in particular to measuring the literality (and, conversely, the orality) of a corpus. First, we examine the notion of corpus similarity, and then we suggest an information theory-based measure of similarity using statistical N-gram character models. Our framework is then tested on the particular case of evaluating the literality of several corpora.

CORPUS SIMILARITY

We are regularly provided with a wider range of corpora to use as tools in analysis or machine translation, and while we get more data every day, it becomes harder to quickly grasp the nature of what we study. Kilgarriff (1998) and Killgarriff and Rose (2001) investigated the similarity and homogeneity of corpora and pinpointed the need to find appropriate measures for them, without which it is difficult to discuss the relevance of one’s findings or port them to another domain. They then proceeded to compare Known Similarity Corpora (KSC) using perplexity and cross-entropy on words, word frequency measures, and a χ^2 -test, which they found to be the most robust. However, as acknowledged in Kilgarriff (1998), using KSC requires that the two corpora chosen for comparison are sufficiently similar so that the most frequent lexemes in them almost perfectly overlap. Whereas intuition would hint at this being true for very large corpora, Liebscher (2003) shows by comparing frequency counts of different Google group corpora that it is not the case. Furthermore, while this measure gives us an idea of the similarity of such corpora to each other, it

does not rank several corpora in similarity (i.e., it gives us no idea of the distance in similarity between them. Measuring similarity by counting word/lexeme frequencies introduces further difficulties; this assumes that the word is an immediate, well-defined unit, which is not the case in Chinese (Sproat & Emerson, 2003) or Japanese (Matsumoto et al., 2002), for instance, where word segmentation is still an unsolved issue.

How do two corpora relate to each other? Perhaps it would be easier and more intuitive to answer the following question: If I define a scale between two reference corpora, where in between does this third corpus fit? Biber (1988, 1995) identifies a set of seven dimensions by counting linguistic features in text samples and shows that a document of text can be assigned a score on any dimension. We will use this property along with information theory to define a scale of similarity between two corpora on which any given third corpus can be assigned a similarity coefficient, with no need of prior linguistic feature selection.

QUANTIFYING SIMILARITY

N-gram Cross-Entropy

Entropic measures performed on characters have the obvious advantage of being blindly applicable to any electronic data without the use of any prior linguistic knowledge (thus eliminating the bias of segmentation errors in languages where the word unit is not clearly defined). In this study, we turn our attention to cross-entropy in terms of N-grams of characters. Dunning (1994) showed the interest of character-based models for language identification in a way that the required training and test sets are surprisingly small in order to achieve good results, achieving a 99.9% accuracy in identifying English from Spanish with only 50K bytes of training and 500 bytes of test text. He further shows that the accuracy of classification only improves with longer test data.

The cross-entropy $H_T(A)$ of an N-gram model p constructed on a training corpus T , on a test corpus $A = \{s_1, \dots, s_Q\}$ of $s_i = \{c_1^i \dots c_{|s_i|}^i\}$ sentences with a sentence of $|s_i|$ characters is:

$$H_T(A) = \frac{\sum_{i=1}^Q \left[\sum_{j=1}^{|s_i|} -\log p_j^i \right]}{\sum_{i=1}^Q |s_i|} \quad (1)$$

where $p_j^i = p(c_j^i | c_{j-N+1}^i \dots c_{j-1}^i)$. The recurrent idea in this work is to construct several N-gram character models using reference training corpora and then use these language models to estimate the cross-entropy in terms of bits per character (bpc) needed to encode a test corpus.

A Coefficient of Similarity

Definition

More than just categorizing or clustering corpora, we wish to quantify similarity. We therefore define a scale of similarity between two corpora on which to rank any third given one. This is done by letting the user select two corpora— T_1 and T_2 —which the user chooses to be his or her references, and use them as training sets to compute N-gram character models. We estimate their cross-entropies on a third test set, T_3 , which we will respectively name $H_{T_1}(T_3)$ and $H_{T_2}(T_3)$ according to the notation in Equation 1. We also estimate both cross-entropies of each reference for each model according to the other one (i.e., $H_{T_1}(T_2)$) and $H_{T_2}(T_1)$, $H_{T_2}(T_1)$ and $H_{T_1}(T_2)$ in order to obtain the weights W_1 and W_2 of references T_1 and T_2 :

$$W_1 = \frac{H_{T_1}(T_3) - H_{T_1}(T_1)}{H_{T_1}(T_2) - H_{T_1}(T_1)} \quad (2)$$

$$W_2 = \frac{H_{T_2}(T_3) - H_{T_2}(T_2)}{H_{T_2}(T_1) - H_{T_2}(T_2)} \quad (3)$$

After which we assume W_1 and W_2 to be the weights of the barycentre between our chosen references. Thus, we define:

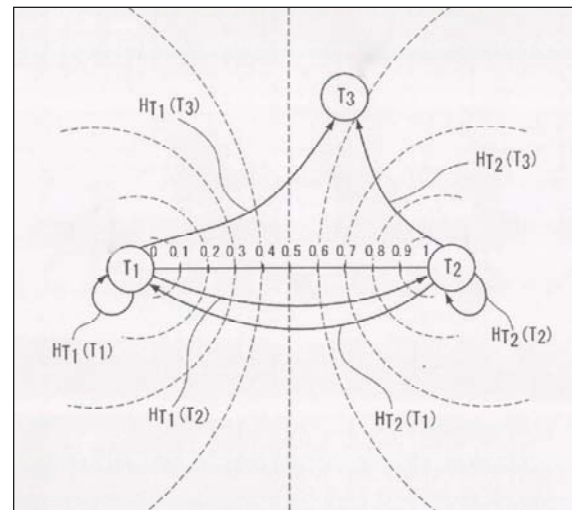
$$I(T_3) = \frac{W_1}{W_1 + W_2} = \frac{1}{1 + \frac{W_2}{W_1}} \quad (4)$$

to be the similarity coefficient between reference sets one and two, corpus T_1 and corpus T_2 , respectively.

Meaning

Given the previous assumptions, $I(T_1) = 0$ and $I(T_2) = 1$; furthermore, any given corpus T_3 then will be awarded a score between $I(T_1) = 0$ and $I(T_2) = 1$. Here we consider two corpora that are similar when one of them can be completely predicted given the knowledge of the other one (i.e., given a language model constructed on the other one). This idea is extended to three corpora, two of them being references, the third one being studied.

Figure 1. Method overview: Dashed lines show coefficient equivalences (0 is oral, 1 is literal)—the point \otimes will be explained in “Statistical Aspects” section



Degenerate Cases

As can be seen on the schematic representation in Figure 1, $I(T_3)$ may take but three values (0,1/2,1) when the size $n - l$ of the models history length gets close to infinity. Let B be the standard value in bits needed to encode a character in a chosen coding system, then:

- If T_3 tends to be most similar to T_2 and most dissimilar to T_1 ; that is, if with a long history length, $n - l$, T_3 is completely determined by a language model trained on T_2 , but is completely undetermined by a language model trained on T_1 , then:

$$\lim_{n \rightarrow \infty} H_{T_1}(T_3) = B, \lim_{n \rightarrow \infty} H_{T_2}(T_3) = 0 \quad (5)$$

T_1 and T_2 are assumed to be dissimilar, therefore:

$$\lim_{n \rightarrow \infty} H_{T_2}(T_1) = \lim_{n \rightarrow \infty} H_{T_1}(T_2) = B \quad (6)$$

In the same manner, a model used to predict the very corpus it was constructed upon will yield a null uncertainty for long history lengths:

$$\lim_{n \rightarrow \infty} H_{T_1}(T_1) = \lim_{n \rightarrow \infty} H_{T_2}(T_2) = 0 \quad (7)$$

We can therefore simplify the expressions of W_1 and W_2 :

$$\lim_{n \rightarrow \infty} W_1 = \lim_{n \rightarrow \infty} \frac{H_{T_1}(T_3) - H_{T_1}(T_1)}{H_{T_1}(T_2) - H_{T_2}(T_2)} = \frac{B - 0}{B - 0} = 1 \quad (8)$$

$$\lim_{n \rightarrow \infty} W_2 = \lim_{n \rightarrow \infty} \frac{H_{T_2}(T_3) - H_{T_2}(T_2)}{H_{T_2}(T_1) - H_{T_2}(T_2)} = \frac{B - 0}{B - 0} = 0 \quad (9)$$

Consequently, if the size $n - l$ of the history length gets close to infinity then:

$$\lim_{n \rightarrow \infty} I(T_3) = 1 \quad (10)$$

- Conversely, if T_3 tends to be most similar to T_1 and most dissimilar to T_2 ; that is, if, with a long history length, $n - l$, T_3 can be completely determined by a language model trained on T_1 , but is completely undetermined by a language model trained on T_2 , then:

$$\lim_{n \rightarrow \infty} W_1 = 0, \lim_{n \rightarrow \infty} W_2 = 0, \lim_{n \rightarrow \infty} I(T_3) = 0 \quad (11)$$

- If T_3 tends to be as much similar to T_2 as it is to T_1 :

$$\lim_{n \rightarrow \infty} H_{T_1}(T_3) = \lim_{n \rightarrow \infty} H_{T_2}(T_3) = H \quad (12)$$

Therefore:

$$\lim_{n \rightarrow \infty} W_1 = \frac{H}{B} = \lim_{n \rightarrow \infty} W_2 \quad (13)$$

$$\lim_{n \rightarrow \infty} I(T_3) = \frac{1}{1 + \frac{H/B}{H/B}} = \frac{1}{1+1} = \frac{1}{2} \quad (14)$$

We have shown here that when the size $n - l$ of the history length gets close to infinity, then I may take only one of the three values (0,1/2,1).

A Word on Corpus Homogeneity

Comparing non-homogeneous corpora, for instance, concatenated texts of various sources or corpora of different sizes could seem vain, for as of this date, we do not know of a satisfying definition of corpus homogeneity nor of any influence of homogeneity on computation. Intuitively, however, a corpus made of a collection of software manuals should be more homogeneous than one gathering mixed sentences from both telephone transcriptions and literature pieces (Kilgarriff & Rose, 1998).

In our first approach, in order to bypass this problem, we first ensure that our corpora individually originate from the same background (i.e., one is a collection of newspaper articles only; another is a collection of telephone transcripts only). We thus divide each reference corpus in n randomly selected blocs of equal size, compute cross-entropies using these blocs as test-sets, and average the results, a process usually referred to as “ n -fold cross-validating,” which ensures that results are not artifacts of accidentally selecting unrepresentative testing data (Charniak, 1993).

In our second experiment, we will specifically address the issue of homogeneity in the case of a large multilingual resource.

QUANTIFYING LITERALITY AMONG CORPORA

Training and Test Data

An experiment was carried out on both English and Japanese, with the hope of distinguishing and ranking similarity irrespective of the language used. In order to validate the previously described framework, we chose to set up a scale of literality between two corpora of contrasting origins:

- As a reference for orality, we used for both English and Japanese the SLDB (Spontaneous Speech Database) corpus, a multilingual corpus of raw transcripts of dialogues described in Nakamura, et al. (1996).
- As a reference for literality, for the English language we used a part of the Calgary¹ corpus, familiar in the data-compression field, containing several classical and contemporary English literature pieces², and for the Japanese language, a corpus of collected articles from the Nikkei Shinbun newspaper³.

Test data was chosen in both English and Japanese with the hope of measuring the literality of

two corpora originating from the same domain but having a hearsay reputation of differing slightly in terms of orality. Those two multilingual corpora are the C-STAR⁴ part of an aligned multilingual corpus, the Basic Traveller’s Expressions Corpus (BTEC⁵), and the Machine-translation-Aided bilingual spoken Dialogue corpus (MAD). Both collections of sentences are from the tourism and travel domain, with MAD being a collection of realistic but clean transcripts of dialogues and BTEC being a collection of sentences from travel handbooks. MAD has the reputation of being more oral than the BTEC. This is precisely what we wanted to measure.

To further validate our measure, we also wished to test it on other corpora from specific backgrounds:

- For the English language, the TIME⁶ corpus (a collection of newspaper articles of *Time* magazine from the 1960s) and the corpus of Spoken Professional American-English⁷ (SPAЕ), a collection of transcripts of meetings and interactions in professional settings.
- For the Japanese language, a corpus of collected articles from the *Mainichi Shinbun* newspaper (MAINICHI) and a corpus of clean transcripts of broadcasts from the NHK news.

All corpora are assumed to be already segmented into sentences, represented by successive lines of electronic data. A particular interest in this study is to stress that entropic measures do not require the use of segmentation at a specific level to be applied. By shifting to a larger unit, this study also could be performed on unsegmented paragraphs or even completely unsegmented documents, although the amount of data required to train the language models undoubtedly would rise in the process. To limit the quantity of required data, calculations were performed independently on each line and averaged.

In the following section, we outline for each corpus basic statistical figures and then compute cross-entropies and the derived literality coefficient.

Statistical Aspects

Statistical aspects for each corpus are shown in Figures 2 and 3 for English and Japanese respectively. Three corpora — SPAE, TIME, and Calgary, the reference for written expression — have notably superior Words/Sentence ratios than the three others — MAD, BTEC, and SLDB, the reference for oral expression.

Word segmentation ambiguity in the Japanese language has been the subject of intense research (e.g., [10]) and is a complex issue. Therefore, we preferred to focus on character counts here. As well as with English corpora, characters per sentence scores for Japanese language corpora that we assumed more literal (NHK, Mainichi, and Nikkei) are usually higher than the ones we previously assumed to have a more oral content. However, the character per sentence score for SLDB (oral reference) is comparable to the one of the Mainichi, making it difficult once again to reach a reliable classification.

Figure 2. Statistical aspects of several English corpora

| English Corpora | SLDB | MAD | BTEC | SPAE | TIME | Calgary |
|----------------------|--------|--------|---------|--------|--------|---------|
| Word/Sent. (Mean) | 11.27 | 9.29 | 5.94 | 23.34 | 23.17 | 20.21 |
| Word/Sent. (Std.dev) | 6.85 | 5.83 | 3.25 | 26.43 | 15.32 | 15.18 |
| Char/Sent. (Mean) | 64.51 | 44.86 | 31.15 | 126.11 | 131.74 | 107.70 |
| Char/Sent. (Std.dev) | 35.95 | 27.57 | 17.02 | 140.71 | 92.38 | 84.69 |
| Char/Word | 5.72 | 4.83 | 5.24 | 5.40 | 5.68 | 5.33 |
| Total Characters | 1,037K | 475K | 5,026K | 223K | 1,515K | 757K |
| Total Words | 181.2K | 98.5K | 964.2K | 41K | 264.5K | 142.2K |
| Total Sentences | 16,078 | 10,601 | 162,318 | 1,759 | 11,416 | 7,035 |

Figure 3. Statistical aspects of several Japanese corpora

| Japanese Corpora | SLDB | MAD | BTEC | NHK | Mainichi | Nikkei |
|----------------------|---------|--------|---------|--------|----------|---------|
| Char/Sent. (Mean) | 32.61 | 26.87 | 14.45 | 65.39 | 37.73 | 44.21 |
| Char/Sent. (Std.dev) | 22.22 | 14.07 | 7.12 | 39.16 | 31.88 | 28.34 |
| Total Characters | 20,806K | 290K | 2,426K | 2,772K | 2,740K | 2,772K |
| Total Sentences | 84,751 | 10,612 | 162,318 | 66,512 | 71,647 | 253,016 |

Entropy

Language models for N-grams ranging from N=2 to 16 were computed for the two references in each language. Cross-entropy was then computed and averaged on randomly selected, non-overlapping blocks of approximately 250,000 characters for each corpus. Results for the English language are shown in Figure 4 and for the Japanese language in Figure 5.

While N-gram orders of 4 to 6 generally achieve the lowest bits per character ratios (apart from the cross-entropy computed on the training set, for which prediction performance is optimal), all numbers rise and stagnate as the order increases. This is due to the fact that for higher orders, unrecognized N-grams increase exponentially and lead to the familiar problem of training data sparseness. Drawing from the field of data compression, where history length

Figure 4. Cross-entropy against the oral reference SLDB (on the left) and the literal reference Calgary (on the right) respectively, for the English language

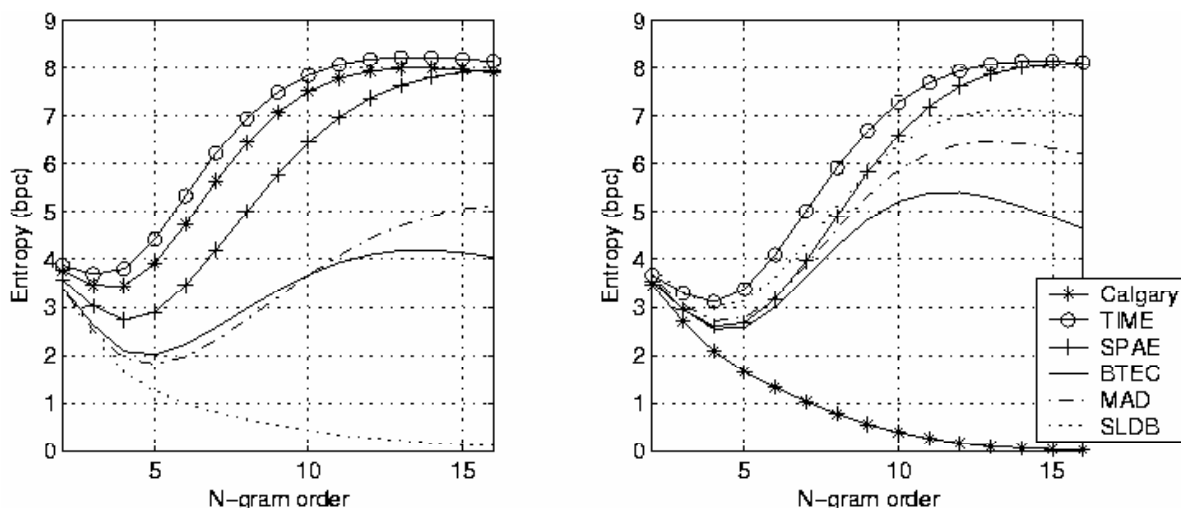
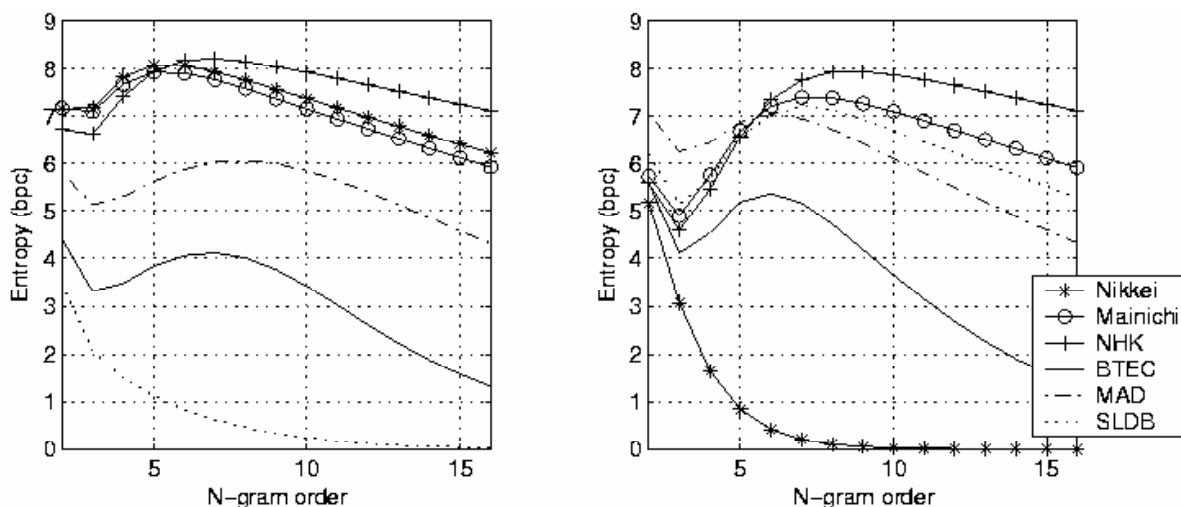


Figure 5. Cross-entropy against the oral reference SLDB (on the left) and the literal reference Nikkei (on the right) respectively, for the Japanese language



is an active area of research, we will assume, as in Teahan and Cleary (1997) and Dunning (1994), that a history of 3 to 7 characters gives meaningful results.

Meeting the intuition, the cross-entropy of SLDB against itself is the minimum (the accuracy of a language model predicting the corpus it was constructed on cannot be beat).

It is not necessary for the other reference to yield the highest values. For example, on the left of Figure 3, TIME yields the highest values and, therefore, will be in the situation of point ⊗ in Figure 1. Its projection will be within the interval [SLDB,CALGARY].

A Literality Coefficient

We then compute the literality coefficient for each corpus: Figures 6 and 7 show the variations of this coefficient for different N-gram orders, for English and Japanese language, respectively. According to our choice of references, a score of 0 corresponds to being closely similar to the oral reference, the SLDB corpus, whereas a score of 1 corresponds to being closely similar to the literal reference, the Calgary book corpus for English, or the Nikkei newspaper corpus for Japanese.

Figure 8 shows values for 5-gram character models.

Both MAD and BTEC yield lower literality scores than TIME and SPAE, and NHK and Mainichi in English and Japanese, respectively. MAD indeed yields the lowest literality scores for the English language, which would tend to confirm its reputation of being slightly more oral in content than the BTEC, both being usually referred to as oral corpora. It is not that obvious for the Japanese language, where the figure is less stretched out and where we are hard-put to reach a conclusion on literality.

For the English language, the TIME and SPAE have close values for orders of 3 to 5. However, the TIME seems to have a slightly higher literality score for all N-gram orders superior to 4. We

Figure 6. Literality coefficient for the English language. (0 is oral as in SLDB, 1 is literal as in Calgary)

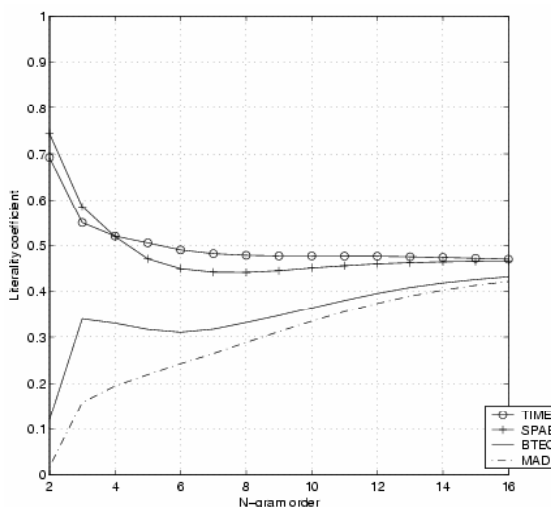


Figure 7. Literality coefficient for the Japanese language. (0 is oral as in SLDB, 1 is literal as in Nikkei)

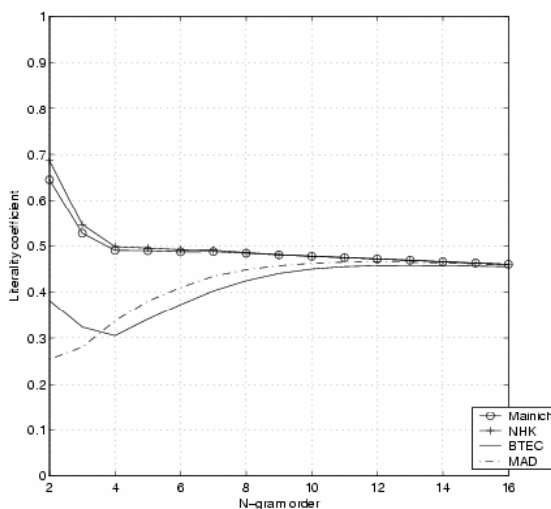


Figure 8. Coefficient of literality for 5-gram character models

| | MAD | BTEC | SPAE/ NHK | TIME/ Mainichi |
|------------|------|------|--------------|-------------------|
| Eng | 0.22 | 0.32 | 0.47 | 0.51 |
| Jpn | 0.38 | 0.34 | 0.49 | 0.49 |

may assume that, indeed, the TIME's degree of literality is superior to SPAE's, which should intuitively be true, considering that the TIME is made of written journalistic texts, whereas SPAE is made of transcripts of formal, professional conversations.

For the Japanese language, while differences in literality are clear between dialogue transcript corpora such as MAD and BTEC and news corpora such as NHK and Mainichi, we are hard-put to reach any decision at all when it comes to differentiating transcripts of highly scenarized, redactional content (NHK) from pure newspaper articles (Mainichi). We assume that the scale contraction phenomenon in the case of the Japanese language (and, conversely, scale stretch in the case of the English language) is due to the fact that we are unable to use a corpus of contemporary literature in the Japanese language. Classification seems robust to N-gram order variations, and all indexes converge to values between 0.4 to 0.5 for N superior to 14 for English, and as soon as N exceeds 7 for Japanese, according to our discussion about degenerate cases in the third section.

Measuring Homogeneity Inside a Large Multilingual Resource

Having characterized a corpus among others by measuring similarity, we would like to profile a single corpus more particularly. Indeed, if similarity is an intercorpus measure, then intuitively, homogeneity should be an intracorpora one. We want to apply our literality coefficient to subsets of a same corpus to try to characterize its homogeneity in literality. As such, homogeneity will be characterized by the internal variations of the previously defined similarity coefficient.

In this second experiment, we specifically address the issue of homogeneity within a large multilingual resource, the Basic Traveler's Expressions Corpus.

To this end, the resource was cut into a number of subsets, each of which was scored on the previously defined literality coefficient, using the same reference corpora as in the previous experiment (SLDB for orality and Calgary or Nikkei for literality). As we increase the number of subsets (analogically to increasing smoothing

Figure 9. Literality coefficient variation within the BTEC in English and Japanese, respectively, for 10 and 100 subsets. As previously, the coefficient is computed on 5-gram character models.

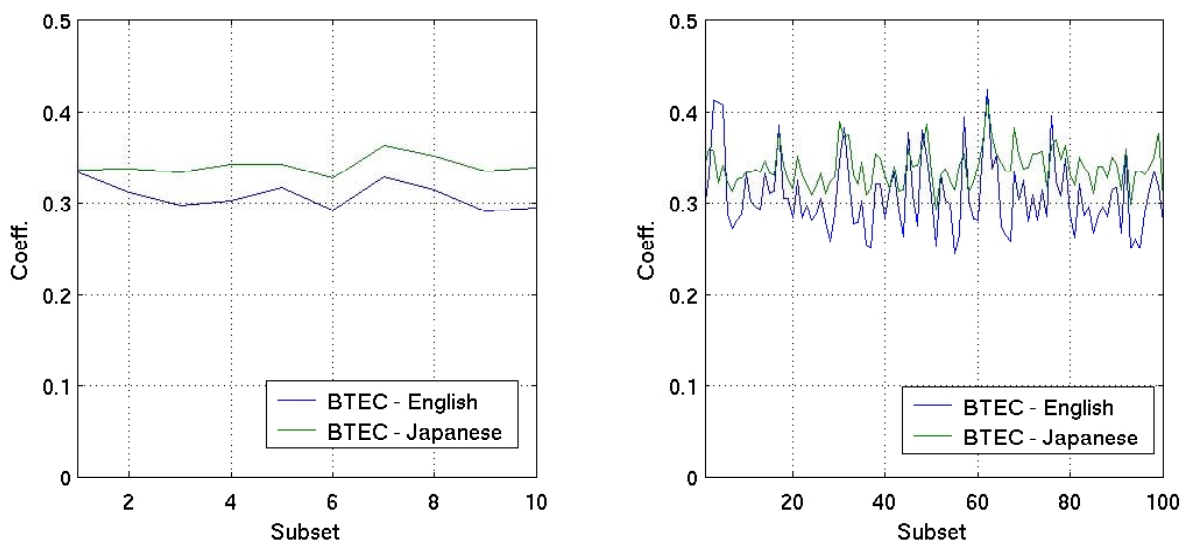


Figure 10. Correlation and standard deviations for an increasing number of subsets

| Subsets | 10 | 50 | 100 | 500 | 1000 |
|--------------|-------|-------|-------|-------|-------|
| Correlation | 0.59 | 0.61 | 0.70 | 0.69 | 0.67 |
| Std dev. Eng | 0.014 | 0.031 | 0.053 | 0.063 | 0.075 |
| Std dev. Jpn | 0.008 | 0.016 | 0.022 | 0.031 | 0.037 |

resolution), we aim at having a better idea of the local variations of the coefficient and of the ideal tradeoff between a high number of small subsets (less smoothed and, therefore, more detailed; less data and, therefore, less significant) and a low number of large subsets (more smoothed and, therefore, less detailed; more data and, therefore, more significant).

The experiment is conducted on the aligned BTEC corpus in both English and Japanese languages. Figure 9 shows the variation of the coefficient for 10 and 100 subsets in both languages. Figure 10 shows the correlation between English and Japanese values, and the standard deviation in both languages for an increasing number of subsets.

Correlation between English and Japanese values appears to rise and stagnate around a moderately high value of 0.7, the optimum being found at an order of around 100 subsets (each subset, therefore, containing roughly 1,600 sentences); which tends to show that, indeed, literality in both languages of the same resource does tend to vary in a similar way, although differences inherent to the languages and their structure rule out the possibility of ever exceeding a certain maximum value in correlation. A more appropriate and accurate subdivision of the corpus remains to be investigated; knowing that the BTEC is a concatenation of sentences taken from various travel phrasebooks, one might assume that there could be differences in style between the various handbooks.

On the other hand, standard deviation provides us with a useful quantification of overall

homogeneity in that it accounts for the average intracorporal variations of the literality coefficient. As predicted, standard deviation increases as the number of subsets increases and their sizes diminish.

A COMPARISON WITH OTHER EXISTING SIMILARITY MEASURES

As mentioned in the second section, a number of similarity measures have been investigated that make use of linguistic feature counts such as the frequency lists of words or lexemes. Such methods assume that the word is a well-defined unit, or they rely on the use of segmenters when dealing with languages in which text is not segmented into words. We wish to compare our method to two measures, based on feature frequency computation, that have been applied previously to English corpora in the past literature: Chi Squared and Log-likelihood. Both measures are symmetric and compare one document to another via their feature frequency lists. The output number is interpreted as an interdocument distance.

Similarity Measures in Previous Works

The Chi Square measure (χ^2), as in Kilgarriff (2001): the number of occurrences of a feature that would be expected in each document is calculated from the frequency lists. If the sizes of documents A and B are N_A and N_B , respectively, and feature w has been observed with a frequency of $o_{w,A}$ in A and $o_{w,B}$ in B , then the expected value $e_{w,A}$ is:

$$e_{w,A} = \frac{N_A(o_{w,A} + o_{w,B})}{N_A + N_B} \quad (15)$$

and likewise for $e_{w,B}$ for document B . The χ^2 value for the document pair A and B is then computed as follows :

$$\chi^2 = \sum_{i=1}^n \frac{(o_i - e_i)^2}{e_i} \quad (16)$$

with the sum over the n features.

The log-likelihood measure (G^2): Dunning (1993) showed that G^2 is a better approximation of the binomial distribution than χ^2 , especially for less frequent events. It was shown to work well with documents of various sizes and to allow the comparison of both frequent and rare events. G^2 is the sum of the log-likelihoods G_w^2 of all n features w :

$$G_w^2 = 2(a \log a + b \log b + c \log c - (a + b) \log(a + b) - (a + c) \log(a + c) - (b + d) \log(b + d) - (c + d) \log(c + d) + (a + b + c + d) \log(a + b + c + d)) \quad (17)$$

a , b , c , and d being defined for each feature by the contingency table given in Figure 11, so that in the end:

$$G^2 = \sum_{i=1}^n G_i^2 \quad (18)$$

Both measures yield a value that is interpreted as the interdocument distance between two documents. Such distances, in turn, can be transposed in the view of our framework so as to define similarity coefficients based on χ^2 and G^2 (i.e., character cross-entropy $H_T(A)$ is replaced in our framework by χ^2 or G^2 measures).

Figure 11. Contingency table for feature w in documents A and B

| | | |
|----------|--------|--------|
| | Doc. A | Doc. B |
| w | a | b |
| $\neg w$ | c | d |

Evaluation

In order to compare our method with the alternative similarity coefficients based on G^2 and χ^2 we use the method of Known Similarity Corpora (KSC) as in Kilgarriff (2001). The comparison will be performed on Japanese, a language without clear word segmentation, so that text data will have to be previously run through an analyzer when using G^2 and χ^2 distances. To allow a fair comparison, our method will be applied on raw unsegmented data. We construct three sets of KSCs with the previously described SLDB, BTEC, and Nikkei corpora; slices of 10,000 words (or their equivalent in unsegmented data) are drawn out from each corpus and randomly rearranged so that each KSC set includes different mixes of one pair of corpora. For instance, the KSC set of SLDB and BTEC includes a subset *s10b0* containing 10 slices of SLDB and zero slices of BTEC (100% SLDB, 0%BTEC), a subset *s9b1* of 9 slices of SLDB and one slice of BTEC (90% SLDB, 10% BTEC), and so forth. Each subset is made of 10 slices and is, therefore, the equivalent of 100,000 words of data, on which we can produce a number of Gold Standard assertions such as “*s10b0* should be ranked with a lower coefficient than *s9b1* because all of its data come from the corpus SLDB” (if we assume that corpora more similar to SLDB get low coefficients and, more similar to BTEC, high coefficients). Each KSC set is made of 11 subsets of 100,000 words of data. The equivalent of 500,000 words of data is left out to be used as references for distance/entropy estimation in our framework. As in [3], frequency lists include the 500 most frequent features in each document (preliminary experiments having shown that best results were achieved for 320 to 640 features).

Once KSC sets have been prepared, they are scored on the three coefficients and ranked accordingly. The ranks are then compared to the gold standard rankings through the computation of Kappa coefficients, and Spearman rank order

correlations. Results are shown in Figure 12.

The KSC method has the following limitations to its validity: first, it does not compare different languages varieties but rather mixes of the same varieties; second, the size of slices may be too small to allow a fair comparison, as one corpus used in a KSC set might include highly heterogeneous parts. All three measures display very high correlations with the Gold Standard rankings. This only tends to confirm their validity as similarity indicators, at least when dealing with mixes of the same varieties of language. The best scores differ, depending on the KSC sets, showing no superiority of one measure on the other two. However, our method could be applied to Japanese data with no prior preprocessing, such as word segmentation, which makes its range of application wider than any measure relying on linguistic features such as words or lexemes.

DISCUSSION AND FUTURE WORK

This work does not state a way in which orality and literality should be defined in an absolute way. It suggests a way to rank corpora in their similarity to each other on a user-definable scale. Ranking is automatic and fast, and does not rely on the counting of any linguistic feature. Classification is only relative to the choice of references and, therefore, should be task-oriented. It is clear that this method of evaluating similarity is not limited to the sole application of quantifying literality. A wise choice of references should prove its capacity to rank other criteria correctly. This should be the subject of a future study.

Different corpora should have similar conventions in their levels of transcription and punctuation to be fairly and impartially compared and to avoid biased results when dealing with transcripts of oral conversations compared to strict written conventions. An approach at corpus homogeneity in the case of a large multilingual resource is proposed here, opening the way to

a future study on the general quantification of homogeneity within a large corpus. Comparing our approach to other existing similarity measures shows similar performance, while extending widely their range of application to electronic data written in languages with no clear word segmentation.

Let us point out once again that it is critical that computational linguistics and corpus-based machine translation have more standards at their disposal for comparing corpora and profiling very large datasets, as we should be able to make a faster and finer link between system performance and corpus features. This is the key to a better understanding of how a corpus-based system behaves and how to isolate and port its qualities to other systems.

CONCLUSION

By defining a coefficient of similarity between corpora and by applying it to the differentiating and ranking of literality, we have both tested and confirmed our assumptions on corpora of contrasting sources, having the reputation of being oral or literal. Ranking is robust to the N-gram model order variations and is more contrasted for values of N between 3 and 7. We have shown here a general way of relatively classifying and ranking corpus similarity with the user being free of choosing his own references. This opens the way to a task-oriented characterization of corpora, allowing a better understanding and porting of corpus-based systems.

ACKNOWLEDGMENT

The author wishes to thank the anonymous reviewers for their helpful comments and suggestions. This research was supported in part by the National Institute of Information and Communications Technology.

REFERENCES

Biber, D. (1995). *Dimensions in register variation*. Cambridge: Cambridge University Press.

Biber, D. (1988). *Variation across speech and writing*. Cambridge: Cambridge University Press.

Cavaglia, G. (2002). Measuring corpus homogeneity using a range of measures for inter-document distance. In *Proceedings of the LREC* (pp. 426-431).

Charniak, E. (1993). *Statistical language learning*. Cambridge, MA: MIT Press.

Dunning, T. (1994a). Accurate methods for the statistics of surprise and coincidence. *Computational Linguistics*, 19(2), 219-41.

Dunning, T. (1994b). *Statistical identification of language*. New Mexico: CRL New Mexico State University.

Kilgarriff, A. (2001). Comparing corpora. *International Journal of Corpus Linguistics*, 6(1), 1-37.

Kilgarriff, A., & Rose, T. (1998). Measures for corpus similarity and homogeneity. In *Proceedings of the 3rd Conference on Empirical Methods in Natural Language Processing* (pp. 46 – 52), Granada, Spain.

Liebscher, R. A. (2003). New corpora, new tests, and new data for frequency-based corpus comparisons. *Center for Research in Language Newsletter*, 15(2).

Matsumoto, Y., et al. (2002). *Morphological analysis system ChaSen version 2.2.9 manual*. Japan: Nara Institute of Science and Technology.

Nakamura, A., Matsunaga, S., Shimizu, T., Tonomura, M., & Sagisaka, Y. (1996). Japanese speech databases for robust speech recognition. In *Proceedings of the ICSLP, Volume 4, 96*, (pp. 2199-2202). Philadelphia, PA.

Sproat, R., & Emerson, T. (2003). The first international Chinese word segmentation bakeoff. In *Proceedings of the Second SIGHAN Workshop on Chinese Language Processing*, Sapporo, Japan.

Teahan, W. J., & Cleary, J. G. (1997). Applying compression to natural language processing. In *Proceedings of the 6th Applied NLP Conference (ANLP-1997)*.

ENDNOTES

¹ The Calgary Corpus is available via anonymous ftp at <ftp.cpcs.ucalgary.ca/pub/projects/text.compression.corpus>.

² Parts are entitled book1, book2, and book3.

³ The use of classical Japanese literature is not appropriate, as (older) copyright free works make use of a considerably different language. In order to maintain a certain homogeneity, we limit our study to contemporary language.

⁴ See <http://www.c-star.org>.

⁵ A summary of the abbreviations used in this article to refer to the different corpora, along with typical utterances and any further information, can be found in the Appendix.

⁶ See <http://www.time.com>.

⁷ See <http://www.athel.com/cspa.html>.

This work was previously published in International Journal of Technology and Human Interaction, Vol. 2, Issue 1, edited by B. Strahl, pp. 51-66, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.14

Digital Access, ICT Fluency, and the Economically Disadvantaged: Approaches to Minimize the Digital Divide

Ellen Whybrow

University of Alberta, Canada

ABSTRACT

The digital divide is a complex phenomenon inextricably linked to income security and not easily addressed through programs that provide simple solutions of training and access. This chapter details the importance of digital access and fluency as they relate to economic disadvantage and explores a variety of models that are used to address the problem. The chapter argues that programs addressing digital divide issues require a multi-faceted approach to address a variety of needs that exist as a result of the condition. While there may be a clash between community, educational, and employer groups, the chapter proposes an alliance model of stakeholders working towards common goals as well as their own organizational interests.

INTRODUCTION

The rapid increase of information and communication technologies (ICTs) has irrevocably changed the nature of educational and work environments in Western countries in the past decade. As recently as the mid-1990s, the use of technology in most post-secondary programs was limited to the use of PowerPoint for instructional delivery and word processors for assignments. In a few short years, ICT tools such as course management systems, synchronous capability, the Internet, and wireless devices, have provided students new conditions with which to obtain, manage, communicate, and construct knowledge. Graduates of educational programs bring these skills to the workplace, making access to emerging technologies and the cultural capital needed to be fluent in

their use a prerequisite for academic, social, and future vocational success (Wilhelm, Carmen, & Reynolds, 2002; Pew Research Center, 2002).

A continuing dilemma in the field of adult education is the issue of access and equity for students from economically disadvantaged backgrounds. Levine and Nidiffer (1996) found that post-secondary enrollment rates have improved in the previous half-century for all students with barriers to education, with the exception of those students with economic barriers. ICT is constantly evolving and continues to be costly for students who are economically disadvantaged and, in many cases, have had limited or superficial access to these tools (Statistics Canada, 2003; Wilhelm et al., 2002; US Department of Commerce, 2000). As proficiency with ICT is increasingly linked with job and income security (Krahn & Lowe, 2002), becoming proficient beyond the basic use of these technologies has become a key requirement for economically disadvantaged adults to realize vocational and therefore economic aspirations. How educators and the society that they serve accommodate the economically disadvantaged is a key question to those who consider the accessibility of education to be a core value.

Education has long been viewed as a means to equalize social and economic disparity within society. Access to and equity in education are the characteristics that facilitate such equal opportunity. However, educational organizations are limited in tackling such a complex problem. Instead, the answer lies in alliances of various organizations—both public and private—working towards common goals while fulfilling their own organizational interests. The focus of this chapter is to explore the relationship between economic restructuring, the economically disadvantaged, and the need for ICT fluency in this new and ever-changing environment. The chapter will review quantitative and qualitative data describing the phenomenon and will synthesize various approaches developed in response. Finally, the

chapter will suggest directions for program response and areas for further research.

BACKGROUND: DEFINING THE POPULATION AND ACCESS BARRIERS

One of the challenges in undertaking a review of this nature is defending its relevance. Colleagues see technology ubiquitously in use throughout educational institutions and know that student loan programs and scholarships open doors for the disadvantaged to obtain an education, which increases job opportunities once completed. The solution is simple: if you are poor, get an education and the technical skills you will need to get a job. What is less obvious is that there are links between technology and economic restructuring happening at national and global levels which impact personal job and income security for the poor and increasingly the middle class.

What is evident from the literature is that there is no clear or universally accepted definition of who is economically disadvantaged or poor. Some countries like the U.S. use an absolute measurement, which defines poverty as a state in which a person is unable to provide even the most basic needs of food, clothing, and shelter. Other countries such as Canada and Britain use relative measurement, which defines poverty at a specific level compared to median income (Dickens & Ellwood, 2003). These definitions come under criticism from various factions; absolute measures may indicate that poverty has fallen (Institute for Research on Poverty, 2002) or been eliminated (Sarlo, 1992), while relative measures indicate an increase (Dickens & Ellwood, 2003). What is easier to identify is that certain groups are at a disadvantage economically regardless of the criteria used; visible minorities, single-parent families, particularly those headed by women, the educationally deficient, and those living in large

metropolitan or rural areas have higher rates of poverty (Institute for Research on Poverty, 2002). Absolute measurements would obviously exclude people who can afford technology access, while relative measurements mean that people can own technology or have home access and still fall within a definition of being poor. For the purposes of this review, relative definitions and the term “economically disadvantaged” will be used from this point forward.

Some futurists have reviewed the progress of other technologies and predicted that the issues of the digital divide will fade away of their own accord as ICTs proliferate everyday life (Sargent & Tucker, 1997). The Pew Research Center (2003) has found that although Internet access has increased for Americans (58% had home access in 2002 compared to 49% in 2000), its growth has been slowing since late 2001; the report draws comparisons to the adoption rate of the telephone which slowed during the Depression. The report’s survey indicates that a sizeable number of people remain offline and Internet cost is a substantial disincentive for some of the offline population. While it is logical to make historical comparisons to other technologies, this chapter argues that ICT differs substantially from previous technologies such as the telephone. ICT, referring to electronic media consisting of hardware and software, and telecommunications technology such as the Internet go beyond simplistic two-way audio connections to allow for place- and time-independent communication, as well as research, knowledge construction, and management functions. ICT tools also differ from other technologies because they are constantly evolving, making the requirements to continually upgrade hardware and bandwidth important. In a previous report, Pew (2000) reports that, while US Internet access had increased dramatically, half of all Americans remain offline and 57% of non-users have no plans of acquiring access. Many of these non-users (39%) cite cost as a disincentive to going online.

It is also important to emphasize that access can mean more than access to hardware. Mitchell (1999) notes that access involves general connectivity that is available in your surrounding community, as well as what you can pay to service your home. It also involves the cultural aspect embedded in software design. The language and relevance of most information is targeted at the well-educated middle class. These features also pose additional access barriers, which are far less quantifiable than variables such as ownership or home Internet access, but important to note nevertheless.

ICT AND ECONOMIC DISADVANTAGE: THE POLARIZATION OF THE WORKFORCE

Not being online or technically proficient has economic consequences. The obvious is that information, such as job postings, is increasingly available exclusively online. However, there are other reasons related to the restructuring of Western economies that make being a technology “have-not” significant. Technology has produced patterns of work that “deskill” or eliminate human labour (Shalla, 1997). Krahn and Lowe (2002) have analyzed computer use, income, and working patterns that exist within the Canadian economy and have arrived at the succinct label of “Good Jobs/Bad Jobs.” This is a condition in which companies, in efforts to compete globally, have increasingly moved to a structure revolving around a small core group of highly paid workers who are supported in their creation, communication, and management functions by a periphery of part-time or contracted unskilled, semi-skilled, and even skilled workers. Highly paid staff are more likely to use computers and use them in advanced ways. Their use of computers means that they are more likely to be

developing transferable skills. Peripheral workers, although many may use computers, tend to use technology to process data, rather than to create or manage information. This raises the issue of enskilling and deskilling (pp. 289-292). Those who use computers in advanced ways along with other advanced skills improve their employment prospects, while those whose use of technology is marginal or automated find their career prospects limited. This polarized workforce is increasingly a worldwide phenomenon. In the US, Goode and Maskovsky's (2001) collection of ethnographic studies note the effects of this polarized workforce and the corresponding decline in wages and job security for low or semi-skilled people.

The polarization described above can affect a broad spectrum of people including many in the middle class (Ehrenreich, 1990). Lack of technology access, a problem more prevalent among the economically disadvantaged, makes the problem more acute because there are fewer chances for self-directed study. It can be argued that providing access through schools, libraries, and community centres provides a remedy for deskilled or unskilled workers. To a certain extent this is true. If we examine studies of disadvantaged and at-risk children, special programs to provide technology home access are associated with increased school performance; the question remains whether it is logical to assume that similar programs for adults increase skills important for work. A.T. Kearney's (2002) study of children's technology access and its relationship to career preparation for technology-related careers shows that access is only part of the issue. In a workforce survey of youth in the Silicon Valley, it was found that while school (99%) and home (86%) computer and Internet access were very high, youth from lower socioeconomic backgrounds were much less interested in obtaining the education needed to take advantage of the region's major economic activity. As with other characteristics, social networks were extremely important in determining

the educational and career path of youth. It is reasonable to assume that adults seeking retraining to improve economic prospects also have the same influences and limitations.

EXPERIENCES OF DIGITAL "HAVE-NOTS"

The connection between technology literacy and economic security was well-entrenched in the minds of many participants in a qualitative study of economically disadvantaged adults pursuing post-secondary education (Whybrow-Howes, 2000). For those most concerned with changing their economic circumstances, it was important not only to be computer literate, but also to study in a computer-related field to take up a more secure role in the knowledge economy. Interviews with the participants—most of whom were disadvantaged by relative and not absolute measurements—indicated that adult students planning to go back to school were able to save for technology purchases and did not find the cost unreasonable. Those students who were not able to purchase computer systems relied primarily on institutional labs or other community services. Access was most difficult for non-computer owners in highly technologically intensive programs. Since many in the study were, at best, recent computer owners, they often perceived their literacy as substantially behind the literacy of fellow students. As with children, social networks were important in filling in access and literacy gaps, although these networks were not always reliable in achieving these goals.

Stanley (2003) notes the psychosocial issues of relevance, fear, and self-concept that hinder the acquisition of computer literacy. Cost was, in many cases, a minor issue that was used to justify rather than explain one's lack of computer literacy. Some participants in her study put off ICT purchases because they did not see it as relevant to their lives

and lacked an understanding of the potential of ICT to expand social, educational, and economic opportunities. Many did not “see” themselves as computer users, who were perceived as not part of their culture or sub-culture. Many participants did purchase ICTs only to avoid their use because they did not want to appear incompetent or not being able to learn in front of their families or partners. Her research indicates “ownership does not always accurately reflect computer literacy” (p. 409).

SOLVING THE PROBLEM

For many educators interested in social justice issues, the problems associated with the economically disadvantaged, the phenomena of a polarized workforce, and the need for ICT proficiency remains difficult and, at times, seemingly unsolvable. While action at the individual level is always important, in general, complex problems require multi-faceted solutions and a coordination of efforts on the part of individuals, educational institutions, communities, and governments. A review of the literature indicates three general models with which to address ICT and the economically disadvantaged. All models have strengths and weaknesses, and these will be reviewed. Finally, a fourth model will be proposed which builds upon

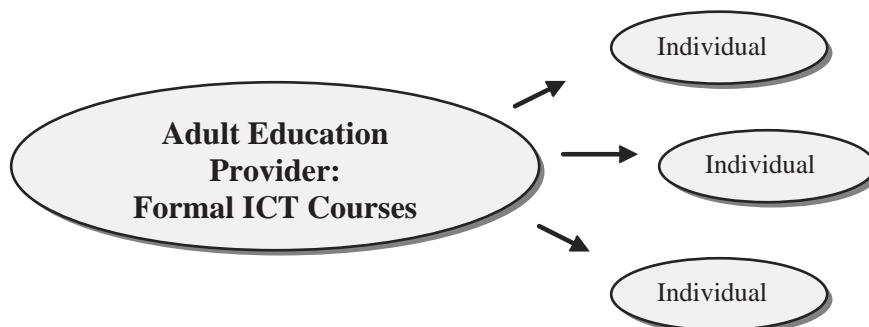
the strengths of all models to provide multiple partnerships, formal and non-formal educational opportunities, and the ability to produce more meaningful changes.

Formal Education: The Computer Course Model

The most basic and easily categorized response is the “computer course.” It is a unit that is easily described, scheduled, and delivered to clients. The service provider may be a community college, non-profit organization, or adult education centre. The “course” is usually marketed to individuals, and its successful completion leads to either more courses, certification, or both.

The blueprint of the course is curriculum. A variety of curriculum responses to the phenomenon of ICT and the economically disadvantaged have been proposed and implemented through the years. Early pre-“Internet” literature focused on the notion of computers as keys to equity, access, and quality (Congress of the US, 1993; Guthrie, Garms, & Pierce, 1988). This point of view states that information technologies provide low-cost learning opportunities, which, in turn, lead to greater educational access for all, and increased equity for those most marginalized in education through expanded individualization and interaction. Computer programs that address a wide range

Figure 1.



of instructional and remedial needs allow students to work at their own pace until mastery of concepts is achieved. However, literature of the day also suggests substantial evidence that students in low socioeconomic schools receive inferior computer instruction, which emphasizes drill and practice, transmission methods, and lower-order thinking skills, while students from high-income schools spend more time making judgments, inferences, and evaluation of the content. "Affluent students are thus learning to tell the computer what to do, while less affluent students are learning to do what the computer tells them" (Watt, as quoted by Resta, 1992, p.122).

The traditional view of technology as a transmitter of knowledge is still very prevalent. Features of this approach are skill-based modules to acquire technology skills, carefully packaged Web-based, or CD-based materials to learn other content and traditional tests. An example of this approach is the European Computer Driving license, which has been widely adopted in the European community and is being used through programming in some countries to certify "the skill level achieved by socially disadvantaged people" (European Centre for Development, 2001, p. 17). Payne (2002), in his review of work-based skills, notes national and international political support for these easily understood approaches, but also notes the approach leads to a decontextualization of learning without specific relevance to the learner. While a computer driving license provides an easily recognizable qualification, it is this writer's viewpoint that it will not fundamentally change the economic conditions in which people find themselves.

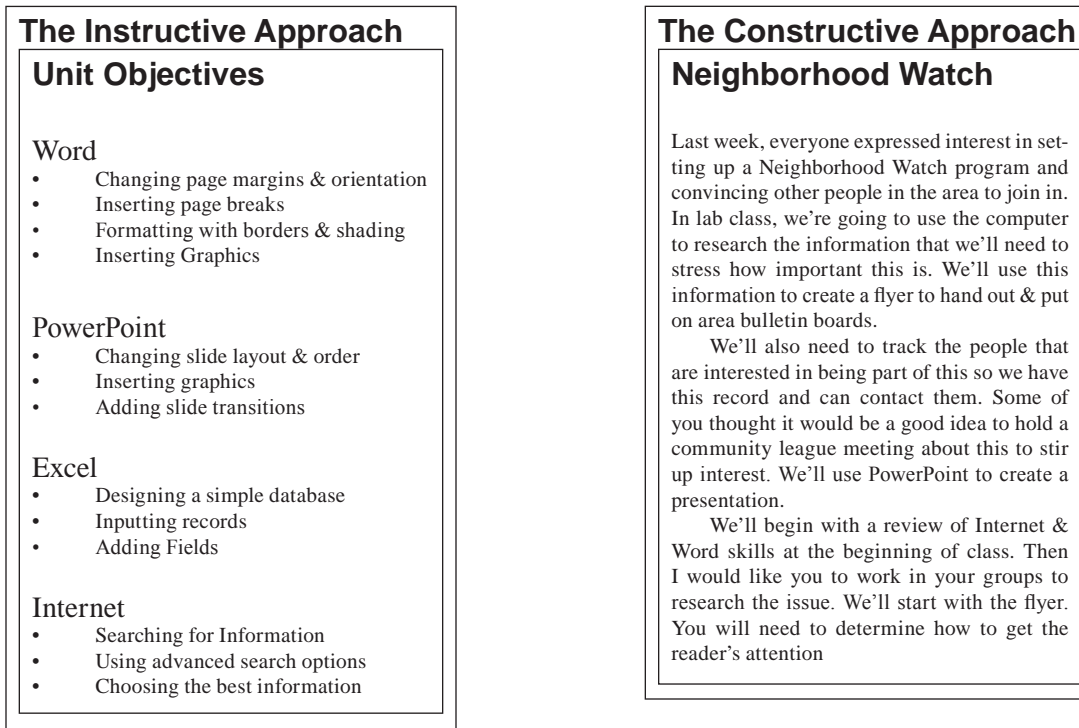
Kozma and Wagner (2003) have noted the features of instructive and constructive curriculum approaches to ICT and the economically disadvantaged. Instructive approaches, which emphasize direct instruction, allow explicit progression, frequent feedback, and coverage of basic skills. Instructive approaches are often packaged as

computer-assisted instruction and can frequently be purchased off the shelf or from publishers, which provides an easily incorporated resource for adult education programs. This approach meets the formal academic and linguistic needs of the disadvantaged by providing early success, obvious mastery of skills, and frequent assessment. These features of the instructive approach are useful, but limited to basic skill development. If we define ICT fluency as the development of advanced skills to create, communicate, and manage complex problems, then the instructive approach has boundaries in terms of creating these opportunities for learning.

Constructive approaches provide skills acquisition by rooting learning in real-world problems. Students work individually or in teams on projects that require the acquisition and use of ICT skills to solve problems that are meaningful to them. Constructive approaches build on ill-structured learning projects to encourage the application of ICT to problem solving. This in turn encourages "higher-level skills, such as the ability to search for information, reason with models, analyze data, and communicate ideas" (p. 12). Constructive approaches address not only specific academic and linguistic needs, but are more suited to addressing the social dimension important to working with the disadvantaged. Kozma and Wagner identify the need to create supportive learning communities through collaborative projects, as well as the need to connect learners with "outside community resources" (p. 9). A comparison of the instructive and constructive approaches is detailed in Figure 2. Both approaches cover the same skills.

There are definite advantages to the instructive approach. Students and instructors know what is being covered, instruction is provided in a manageable and step-by-step approach. More importantly, the curriculum is also easily understood by funders, employers, and the students themselves. However, it is the constructive ap-

Figure 2.



proach that provides a more memorable learning experience by focusing on task-oriented learning experiences. Skills are covered through working towards solutions of real-world problems. This poses obvious planning and instructional challenges, and a learning environment in which the instruction and goals are continuously negotiated. The lack of linearity is somewhat disconcerting to instructors and students alike. Students may finish a course without a clear understanding of what they know. If their goal in enrolling is to improve employment prospects, this is an additional disadvantage. Despite its disadvantages, the constructive approach holds numerous advantages. Studies at the post-secondary level that use a problem-based, interactive approach show positive outcomes in increased student learning (Springer, Stanne, & Donovan, 1999). It is reasonable to assume that the same holds true with non-traditional learners. The approach also provides a community learning experience,

which may reduce anxiety about acquiring new skills and provide learners with a social network of computer users within their culture. In this sense, it is the approach that most likely can be used to fulfill the social needs identified by Kozma and Wagner (2003, pp. 18-20). The authors note that both approaches can be blended to maximum effect; a constructive approach can be the primary methodology, with a regular checklist review and conventional mastery-based testing to keep students focused on what they are learning. Linking to external standards or testing is an important feature to build into an ICT program, as it provides benchmarks for students to aim for as well as a recognizable certification.

Non-Formal Education: Post-Secondary/Community Centre Partnership Model

While the delivery of formal courses is appealing to many economically disadvantaged individuals, the onus still remains on the individual to seek out and enroll in formal offerings. This may leave out those with scheduling, transportation, and childcare barriers. Others may be intimidated by or simply uninterested in enrolling in courses if they perceive themselves as not fitting in with the culture of the other students. Stanley (2003, p. 414) notes that local community centres can play an important role in educational delivery by minimizing barriers. They can also create learning experiences that extend beyond the formal confines of the course structure to a learning environment that provides a range of non-formal opportunities that embed technology literacy in the heart of the community. Partnerships between adult education providers and community centres allow each entity to build on its expertise and expand the opportunities available to people beyond what one service provider can deliver.

As with the Computer Course model, the partnership model may also market formal education to low-income communities. A limited example of this is the approach certain educational organizations have taken in marketing their programs in low-income areas. Roach (2000) reports the efforts community colleges in the Washington area have taken to become more visible to economically disadvantaged communities. Some have established satellite campuses or restructured curriculum to provide less theory and more practical training to

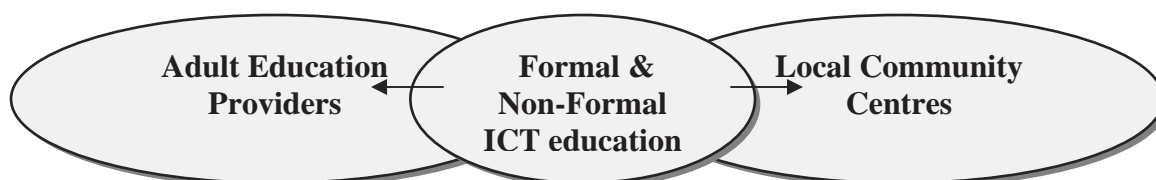
suit the needs of employers in the area. Minority student groups provide support and networking opportunities for low-income students once admitted to these programs.

These efforts, however, do not constitute a true example of a partnership. The efforts are still conventional educational organizations marketing formal course-based learning opportunities to individuals in these communities. Such efforts will provide opportunities to those who are already motivated to change their circumstances, and have academic and personal skills, as well as the support to reach long-term goals. In some communities, this may only be a few individuals. The problem still remains of the larger community. How do we ensure ICT access and meaningful educational opportunities that will minimize economic disparity and maximize social mobility?

The partnership model, in its truest form, implies reciprocity between partners. The educational institution that provides ICT expertise receives opportunities to research or to provide its on-campus students real-life experiences in civic participation rather than theoretical academic review. Partner low-income communities receive ICT hardware, software, ICT expertise, and a variety of educational opportunities, which range from formal course offerings to less-structured opportunities. Educational opportunities flow both ways (Figure 3).

The Chronicle of Higher Education (2002) reports “service-learning programs” that are run from Florida’s Miami-Dade Community College, whose faculty and students have contributed 280,000 hours to various agencies in South Florida. This commitment has led to the

Figure 3.



development of a Technology and Learning Center in the low-income community of Overtown, and provided computers and Internet access, computer literacy courses, and a variety of after-school or summer camp opportunities. A key component to this project is an understanding that the educational institution does not solve problems for the community, but sees itself as creating “problem-solving capacity” with its partner organization.

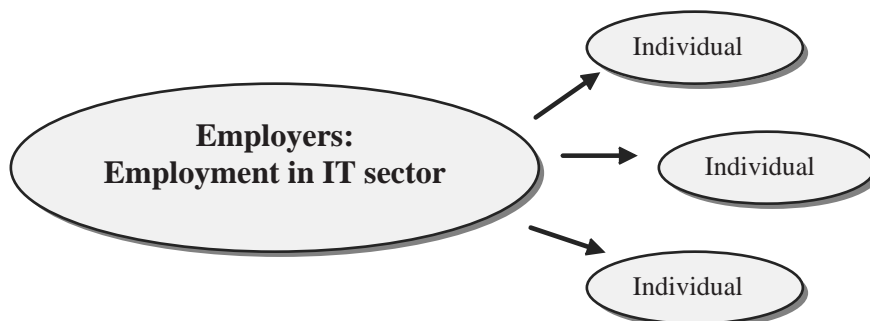
Not all educational/community partnerships are of a front-line nature. MIT (Schön, Sanyal, & Mitchell, 1999) has been supporting the work of community activists since the 1970s through a Community Fellows Program (CFP). Each year, 12 to 15 activists and organizers from urban low-income communities come on campus for a year to reflect and reorganize work in their respective communities. Since the 1990s, the CFP has become increasingly focused on technology as an educational, organizational, and income-generating tool within their communities. MIT realizes many benefits from this program such as research opportunities, meaningful engagement experiences for its Department of Urban Studies and Planning, and dialogue with its CFP fellows.

One result of MIT’s commitment to community engagement is the Computer Clubhouse concept (Resnick, Rusk, & Cooke, 1999). The clubhouse seeks not only to teach basic computer skills among low-income youth, but also to provide conditions in which participants become producers rather than consumers of ICT. Radical

constructivist principles of learning are central to this mission. Developing learning communities where youth and adult mentors collaborate with others on projects of interest is a key feature of the clubhouse. Roles are not set. A youth participant may become a mentor on certain projects where he or she is the clubhouse expert. On other projects, the youth or adult mentor may become the learner in this dynamic environment. Curriculum is negotiated through “design experiences” (pp. 268-271) that encourage creative expression and problem solving. Sample projects include online art galleries, robotics, or programming computer games. Such projects engage youth in ways formal education fails to do and provide a deeper learning experience that is interdisciplinary by nature.

While the computer clubhouse focuses on youth, another MIT initiative encompasses the entire community to engage empowerment and activism. Shaw and Shaw (1999) report the results of a computer network system placed in a low-income community by the MIT media laboratory. The effect of simultaneous chat and discussion board forum, which was leading edge at the initiation of the project, demonstrates the capacity of low-income communities to use ICT for community improvement. Parental involvement in schools increased, community projects were organized, and dialogue around a variety of topics exploded among residents who largely did not know their neighbors in a decayed and dangerous urban environment.

Figure 4.



Employer Recruitment: The Job Training Model

Non-formal education is a possible solution to pull back disadvantaged youth from the hinterland of unemployment, poverty, or worse. Other partnerships keep ICT available and meaningful for the larger community. However, certain adults require more direct and quick intervention. These may be individuals who are already motivated. Others may be those from the middle class who have fallen on hard times and need a helping hand to get back in the workforce. In these cases, the partnership model may not adequately meet immediate learner needs. Stanley (2003, p. 9) also notes that although economically disadvantaged people would benefit from an ICT curriculum that creates “pathways” to careers, many service providers dealing with this group are not equipped resource-wise or through their own social networks to provide these opportunities.

An obvious context within which to structure ICT approaches for the economically disadvantaged is to link technology skills to current and emerging workforce needs. There are compelling reasons to do this. Khirallah, McGee, and Goodridge (2001) report the need for IT workers; 77% of 500 US companies surveyed see the digital divide as a key issue. Some companies such as Hewlett Packard and Cisco Systems have digital divide programs in place to encourage science and technology interest among children and see this as a long-term strategy to influence education to fill future needs. Adults are more immediately focused on career aspirations, so initiatives that promote economic relevance are important. Other types of linkages are employment initiatives that connect the disadvantaged to minority workforce associations or minority-owned companies. Roach (2000) reports employer interest in recruiting minorities into the IT industry. Associations of IT-based companies have actively recruited minority applicants and created summer internship programs through advertising in low-income

communities or specialized recruitment programs. Other companies work with African-American colleges to offer “internships, workshops, scholarships, and seminars.” Some employers have banded together to form their own partnerships to sponsor training for the disadvantaged. Finally, minority-owned companies can play an important role by providing role models of success in the IT industry, mentorship, and an avenue for networking.

Holistic Initiatives: Multiple Alliance Model

Employer initiatives to recruit and train economically disadvantaged individuals provide immediate solutions, particularly to those who become employed as a result. As noted above, these initiatives meet the needs of some but not others. These types of projects are geared to industry needs and are dependent on the health of specific industries. It would appear that these initiatives are primarily in effect where the IT industry is predominant and experiencing a labour shortage. This has the effect of making large initiatives specific to a geographical region or cycles of economic activity. This also leads to questions about long-term benefits of such programs. A crucial question is whether the training and subsequent employment enskill or deskill the individual. Selwynn (2003, p. 8) notes the “narrowing of adult education...around business and industry-friendly skills and competencies...” and calls for emancipatory goals for ICT adult education that provide learners with opportunities to use ICT to their own advantage. However, programs of an emancipatory focus or those that stress critical pedagogy can lose momentum among participants and funders if they fail to create recognizable certification, employment, or change.

In the previous models, the various service providers and potential employers of economically disadvantaged individuals are restricted to offering disparate pieces. Missing from these

disconnected opportunities are the motivations and goals of the economically disadvantaged, both as individual participants and as members of their respective communities. Each of the players in previous models brings its expertise to the problem. Adult education and post-secondary institutions provide ICT expertise and formal courses, and seek enrollment in these. Employers provide immediate job opportunities and want a pool of qualified workers from which to draw. Both surround the larger hub of the community centre, which provides access to a community of learners and potential employees. Yet each of these entities is limited to a certain extent to these domains. Linking through formal alliances allows each to build on the strength of others. More importantly, an alliance allows momentum toward political solutions.

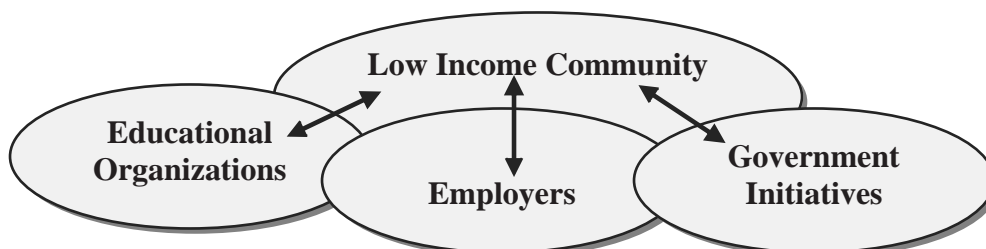
Conservative policies towards digital divide issues as exemplified by the Bush administration focus on market force correction rather than social programs (Powell, 2001). However, others debunk the power of market forces and call for government intervention to address disparities. To a certain extent, the mixture of educators, community groups, and industry are an unlikely alliance. Selwynn (2003, pp. 13-14) notes, "It is naïve to imagine the effective development of ICT-based adult education without the involvement of the IT industry and other private sector actors..." but acknowledges the clash between "private interest and public good." Kozma and Wagner (2003, p. 25) see the involvement of "national, state or provincial and local governments..." that provide focused job training as well as resources that address larger

issues of "community environments." This may involve direct funding to special needs programs, but may also involve indirect incentives such as tax credits to encourage industry involvement. Industries that sell IT infrastructure have a vested interest in such initiatives and can be recruited as partners. Khirallah et al. (2001) report certain IT industries have either developed educational programs or installed infrastructure at partner schools and homes. Such industry involvement, if harnessed and encouraged to the larger community, has reciprocal benefits to business and the general public. An alliance model allows each player to contribute its specific expertise and in so doing, meet some of its own objectives.

CONCLUSION

It is unlikely that any of the models described will be successful without leadership from the economically disadvantaged themselves. As a group, they exist without any unifying characteristics other than their disenfranchisement from the mainstream. Some are from the middle class and have fallen on some hard times and simply need some support to re-establish themselves. The situations of others is more dire, and it is debatable whether educational assistance of any kind is really helpful beyond programs that focus on children or youth. The extent to which the cultural capital of technology is a barrier to the educational and vocational aspirations of those on the wrong side of the digital divide is not entirely clear, and descriptions of economically disadvantaged adults'

Figure 5.



experiences in this changing environment are not extensively detailed in the literature. Research of a qualitative nature could more extensively inform program development. Extensive long-term quantitative evaluation of the success of formal education ICT courses and job training initiatives to produce long-term economic improvement is needed, as well as the evaluation of the impact of non-formal community-based initiatives.

While post-secondary institutions can provide services and formal courses, they are unable to completely respond to such a complex problem. It remains the role of community leaders to organize their constituents and network with service providers in education, the government, and industry sectors to make a case for action. Ultimately, all players have an interest in working towards the goal of economically healthy communities.

REFERENCES

- A.T. Kearney & Silicon Valley Network. (2002). *Joint venture's 2002 workforce study: Connecting today's youth with tomorrow's technology careers*. San Francisco: A.T. Kearney. Retrieved June 18, 2004, from www.atkearney.com/shared_res/pdf/Workforcestudy_S.pdf
- Congress of the U.S. (1993). *Adult literacy and new technologies: Tools for a lifetime*. Washington, DC: Office of Technology Assessment. (ERIC Document Reproduction Service No. ED361473).
- Dickens, R. & Ellwood, D. (2003). *Whither poverty in Great Britain and the United States? The determinants of changing poverty and whether work will work*. Retrieved January 23, 2004, from www.nber.org/books/bcf/dickens-ellwood3-10-03.pdf
- European Centre for the Development of Vocational Training. (2001). *National actions to implement lifelong learning in Europe: A contribution to the consultation process launched by the European Commission Memorandum*. Retrieved February 1, 2004, from europa.eu.int/comm/education/policies/lll/life/life/country_en.pdf
- Ehrenreich, B. (1990). *Fear of falling: The inner life of the new middle class*. New York: Perennial Library.
- Goode, J. & Maskovsky, J. (Eds.). (2001). *The new poverty studies: The ethnography of power, politics, and impoverished people in the United States*. New York: New York University Press.
- Guthrie, J.W., Garms, W.I., & Pierce, L.C. (1988). *School finance and education policy: Enhancing educational efficiency, equality and choice*. Englewood Cliffs, NJ: Prentice-Hall.
- Institute for Research on Poverty. (2002). *Who was poor in 2002?* Retrieved January 15, 2004, from www.ssc.wisc.edu/irp/faqs/faq3.htm
- Khirallah, D.R., McGee, M.K., & Goodridge, E. (2001). Divided we fall. *Information Week*, (830).
- Kozma, R. & Wagner, D. (2003, November). *Reaching the most disadvantaged with ICT: What works?* Paper presented at the National Center for Adult Literacy. Retrieved January 22, 2004, from www.literacyonline.org/ICTconf/OECD_KozWag_final.pdf
- Krahn, H.J. & Lowe, G.S. (2002). *Work, industry, and Canadian society* (4th edition). Toronto: ITP Nelson.
- Levine, A. & Nidiffer, J. (1996). *Beating the odds: How the poor get to college*. San Francisco: Jossey-Bass.
- Mitchell, W.J. (1999). City of bits hypothesis. In D.A. Schön, B. Sanyal, & W.J. Mitchell (Eds.), *High technology and low-income communities: Prospects for the positive use of advanced information technology*. Cambridge, MA: MIT Press.

- Payne J. (2002). *Basic skills in the workplace: A research review*. Retrieved January 26, 2004, from www.lsda.org.uk/files/pdf/1426.pdf
- Pew Research Center. (2003). *The ever-shifting Internet population: A new look at Internet access and the digital divide*. Retrieved January 16, 2004, from www.pewinternet.org/reports/pdfs/PIP_Shifting_Net_Pop_Report.pdf
- Pew Research Center. (2002). *The Internet goes to college: How students are living in the future with today's technology*. Retrieved January 9, 2004, from www.pewinternet.org/reports/toc.asp?Report=71
- Pew Research Center. (2000). *Who's not online: 57% of those without Internet access say they do not plan to log on*. Retrieved January 3, 2004, from www.pewinternet.org/reports/toc.asp?Report=21
- Powell, M. (2001, March 29). *Agenda and plans for reform of the FCC*. Hearing before the Subcommittee on Telecommunications and the Internet. Retrieved January 9, 2004, from energycommerce.house.gov/107/hearings/03292001Hearing144/print.htm
- Resnick, M., Rusk, N., & Cooke, S. (1999). The computer clubhouse: Technological fluency in the inner city. In D. Schön, B. Sanyal, & W. Mitchell (Eds.), *High technology and low-income communities: Prospects for the positive use of advanced information technology*. Cambridge, MA: MIT Press.
- Resta, P. (1992). Organizing education for minorities: Enhancing minority access and use of the new information technologies. *Education and Computing*, 8(2), 119-127.
- Roach, R. (2000). Capitalizing on the digital divide. *Black Issues in Higher Education*, 16(27).
- Sargent, N. & Tucker, A. (1997). *Pandora's box?* (Companion Papers on Motivation, Access and the Media). Leicester, England: National Institution of Adult Continuing Education. (ERIC Document Reproduction Service No. ED423441).
- Sarlo, C.A. (1992). *Poverty in Canada*. Vancouver, BC: The Fraser Institute.
- Schön, D., Sanyal, B., & Mitchell, W.J. (Eds.). (1999). *High technology and low-income communities: Prospects for the positive use of advanced information technology*. Cambridge, MA: MIT Press.
- Selwyn, N. (2003, November). *ICT in non-formal youth and adult education: Defining the territory*. Paper presented at the National Center for Adult Literacy. Retrieved January 22, 2004, from www.literacyonline.org/ICTconf/OECD_Selwyn_final.pdf
- Shalla, V. (1997). Technology and the deskilling of work. In A. Duffy, D. Glenday, & N. Pupo (Eds.), *Good jobs, bad jobs, no jobs: The transformation of work in the 21st century*. Toronto: Harcourt Brace Canada.
- Shaw, A. & Shaw M. (1999). Social empowerment through community networks. In D. Schön, B. Sanyal, & W. Mitchell (Eds.), *High technology and low-income communities: Prospects for the positive use of advanced information technology*. Cambridge, MA: MIT Press.
- Springer, L., Stanne, M.E., & Donovan, S. (1999). Effects of small-group learning on undergraduates in science, mathematics and engineering, and technology: A meta analysis. *Review of Educational Research*, 69(1), 21-51.
- Stanley, L.D. (2003). Beyond access: Psychosocial barriers to computer literacy. *Information Society*, 19(5), 407-416.
- Statistics Canada. (2003). *Digital divide in schools: Student access to and use of computers*. Retrieved November 29, 2003, from www.statcan.ca/Daily/English/030623/d030623b.htm

Digital Access, ICT Fluency, and the Economically Disadvantaged

The Chronicle of Higher Education. (2002). Community service—learning initiatives bridge the gap between America’s technology haves and have-nots. *The Chronicle of Higher Education*, 48(43), A28.

U.S. Department of Commerce. (2000, October). *Falling through the Net, toward digital inclusion: A report on Americans’ access to technology tools*. Washington, DC: National Telecommunications and Information Administration. Retrieved January 5, 2001, from www.ntia.doc.gov/ntiahome/digitaldivide/

Whybrow-Howes. (2000). *Technology access and equity issues for financially disadvantaged adult learners*. Unpublished Master’s Thesis, University of Alberta, Edmonton, Alberta, Canada.

Wilhelm, T., Carmen, D., & Reynolds, M. (2002). *Connecting kids to technology: Challenges and opportunities*. Retrieved November 29, 2003, from www.digitaldividenetwork.org/content/stories/index.cfm?key=244

This work was previously published in Technology Literacy Applications in Learning Environments, edited by D.D. Carbonara, pp. 233-249, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.15

Delivering More Effective Community Consultation and Support for Regional ICT Programs

Lynne De Weaver

Southern Cross University, Australia

Allan H. Ellis

Southern Cross University, Australia

ABSTRACT

This chapter looks at the role of language and the community consultation process in overcoming the digital divide by facilitating the uptake of information and communications technologies (ICT) in small regional communities in Australia. It focuses on one of the ‘telecentre’ programs funded by State and Federal governments in Australia—the Community Technology Centre at New South Wales (CTC@NSW) program. The authors look at some of the key issues that emerged in communities that applied for CTC@NSW grants when a more culturally relevant consultation process, based on Maslow’s Hierarchy of Needs, was developed and implemented. This consultation process was successfully used in tar-

geted regional communities to build social capital, facilitate regional economic development, and empower communities through the use of ICT. The chapter also includes projects that demonstrate the diversity of ICT usage in the communities that received funding to establish a CTC.

INTRODUCTION

Federally funded programs in Australia, such as Networking the Nation, have provided millions of dollars to Australian regional communities to help them gain access to a range of ICT products and services. The Community Technology Centre at New South Wales (CTC@NSW) was one such program, with grant funding being made avail-

able to communities in partnership with the NSW State Government. A new consultation model was developed by De Weaver in order to increase the understanding and uptake of information and communications technology (ICT) products and services in small regional communities in New South Wales. Using the CTC@NSW program as a case study, the chapter will focus on this consultation process and how it was used to achieve successful outcomes for some of the communities that participated in the program. It will also highlight underlying language and technology issues that arose when small rural and regional NSW communities applied for CTC@NSW grants.

One of the major challenges of facilitating effective community consultation at a statewide level was in presenting information about the benefits of ICT products and services in a way that was relevant to all communities. In many instances, 'Communities don't know what they don't know'. This proved to be the case in many of the communities that sought grant funding through the CTC@NSW program. A recent report from a regional research forum (2004, p. 8) stated, "...regional development policy in Australia is 80 years old, but despite this, and the research issues in the last 40 years in particular, what we know is substantially less than what we don't know." Hearn et al. (2004, p. 7) identified lack of ICT knowledge in regional Australia as a further complicating factor and states, "Advocates of ICT projects can mis-specify and under resource the social and human infrastructure required. It is necessary that citizens are able to not only access that technology but that they also possess the skills to use and the resources to access them."

Finally, the chapter looks at the consultation process and methodology used by De Weaver, in her role as regional coordinator for the CTC@NSW program, in achieving successful ICT strategies and outcomes for the regional communities in which she worked. It also highlights the importance of using 'plain English' in the consulta-

tion process and in dealing with the underlying resentment that may exist in various stakeholder groups when their needs are misunderstood or inadequately addressed.

BACKGROUND

The CTC@NSW began its operational phase in March 2001. Its original charter, as shown on its Web site (July 20, 2004), was "...to establish up to 55 Community Technology Centres (CTCs) in regional NSW communities, with populations of less than 3000, to help them gain access to a range of technology services for local businesses, students, community organizations, individuals, and identified special groups within these communities." The specific goals of the CTC@NSW program were to:

1. Assist local communities to establish a network of sustainable CTCs across rural and remote NSW
2. Promote community development and networks of interests in rural and remote NSW
3. Encourage community demand for information technology (IT) services in rural and remote communities
4. Encourage existing telecentres to join the CTC support network

By June 2003, the CTC@NSW program had achieved its goals with a total of 83 fully funded CTCs serving over 100 NSW communities. The CTC network included 50 newly funded CTCs with a further five CTCs in the planning stage, plus 33 telecentres that had been funded by an earlier federal government program. The momentum for establishing CTCs came from the communities themselves, and involved a lengthy community consultation process. The first step in this process was to help communities determine their eligibility through the preparation of an

expression of interest (EOI). Following approval of an EOI, a regional coordinator was assigned to the 'approved' community so work could commence on their application. CTC applications were for seed funding rather than an out right grant. Communities had to determine how much they could apply for *after* they had completed their 3 year business plan. This plan was also the key component against which applications would be evaluated by the Canberra based CTC Funding Panel that met three times a year. Consultation with communities usually lasted from 4 to 6 months, although for some, it was an even longer process if their first application proved unsuccessful.

A wide range of motivational factors needed to be incorporated into the community engagement and consultation process in order to ensure the best possible outcomes for applicant communities. However, as Pigg and Crank (2003, p. 25) stated in their paper, which looked at similar programs in rural American communities, "Community capacity to successfully capture the advantages engendered via the deployment of ICTs is not particularly unique to the technology. Key agents of change must work together with local residents to actively support and engender an atmosphere for collective action towards improvement for their rural communities." Maslow's five-stage Hierarchy of Needs, as re-framed by Chapman (2002, p.1), provided an excellent model to promote collective action as his concept of self-actualization related well to the challenges and opportunities that ICT presented to the small, regional communities involved in the CTC@NSW program. It was this reframing that provided the conceptual framework for the new Hierarchy of Community Needs and offered the structure, understanding, and the methodology by which collective action could be taken to meet the identified ICT needs of individual communities as they sought funding for a CTC.

While there are many definitions for the term 'community', the authors have used the definition given by the American Society of Association

Executives (2001, p. 2), that defines communities in two related ways:

- Community as social glue—providing 'stickiness' or connection
- Community is also what people do for each other—to create a Web of social relationships.

De Weaver used Action Research (AR) as her methodology throughout the 2 years of fieldwork she undertook as the Northern Rivers Regional Coordinator for the CTC@NSW program. It was the cyclical nature of AR, for example, planning, action, and review that enabled her to achieve better outcomes in each of the communities in which she worked, as she was able to build on the insights gained from the critical reflection component of AR when she commenced work in new communities. Action Research was especially effective in this regard because as Dick states (2001, p. 21) "Action Research... pursues both action (change) and research (understanding) outcomes. It achieves change through its participative approach often in conjunction with other change processes."

THE HIERARCHY OF COMMUNITY NEEDS CONSULTATION MODEL

Although much has been written about community consultation per se, when the consultation incorporates explaining the benefits of ICT, identification of needs, and dealing with technical usage issues, a whole new dimension of complexity is added to the process. Aslin and Brown (2004, p. 3) state:

Good community engagement can be achieved by using a wide range of tools and techniques, not by applying a simple recipe or prescription applicable to all situations... The engagement process is part

of furthering another process: decision-making for a particular purpose.

This proved to be the case in the process of applying for a CTC grant and it was Maslow's Hierarchy of Needs in its re-framed five-stage model that formed the basis of the new consultation model that evolved. Maslow's 'Needs', as explained by Chapman (2002, p. 4), consist of:

Biological and Physiological needs including basic life needs. Safety needs including protection, order, etc. Belongingness and love needs including work groups. Esteem needs including status, responsibility, reputation and self-actualization including personal growth and fulfillment.

While Maslow's theory is often closely linked to pedagogy or psychology it also has important applications in understanding what motivates communities to apply for capacity building grants such the CTC@NSW program. This view was reflected by Chapman (2002, p. 6), when he stated that:

Abraham Maslow developed the Hierarchy of Needs model in 1940-50's USA, and the Hierarchy of Needs theory remains valid today for understanding human motivation, management training, and personal development...we must satisfy each in turn, starting with the first, which deals with the most obvious needs for survival itself. Only

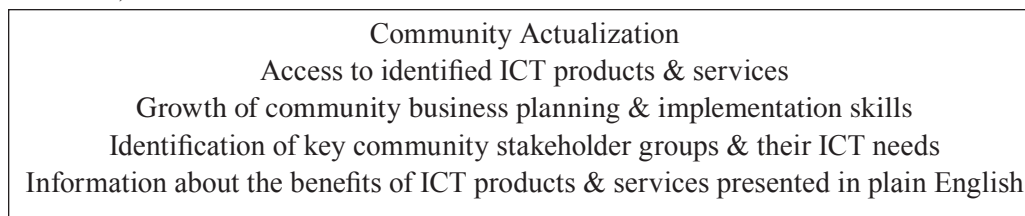
when the lower order needs are satisfied are we concerned with higher order needs.

However, for community consultation in the CTC@NSW program to be effective, it was necessary to reframe Maslow's model while adhering to his core values so that it became a new hierarchy of community ICT needs consultation model as shown in Figure 1.

Just as in Maslow's Hierarchy of Needs, the most basic need in many small regional communities is for survival itself as banks, businesses, and governments withdraw services from them in the name of economic rationalism. These communities are then faced with the need to explore alternatives and find out if ICT has a role to play in helping them build capacity and overcome the loss of face-to-face and shop front services that have had such a negative impact on their quality of community life. While Plowman et al. (2003, p. 135) believe that:

Governments have started to respond to the strong expressions of dissatisfaction of rural people concerning the decline of social and economic fabric in rural communities attempting to develop programs for the reversal, or at least the amelioration, of the observed trends....governments are increasingly calling on the presumed self-help capacities of rural communities for them to become 'partners' with government in developing and delivering programs for rural communities...however the

Figure 1. Hierarchy of community needs consultation model (Derived from De Weaver's unpublished monthly progress reports prepared in her capacity as regional coordinator for the CTC@NSW program from 2000-2002.)



depth and breadth of resources, particularly the human and social capital, may not be sufficient to allow communities to respond to, and participate effectively in, such programs.

ASSESSING NEEDS REQUIRED INFORMATION IN PLAIN ENGLISH

It is important to consider how a community's ability to access government funded programs to satisfy its most basic 'survival' needs is often challenged by the bureaucratic and technical nature of the language used in grant applications. De Weaver and Lloyd (2005, p. 4) noted that "...applicant communities had to come to grips with the technology driven and corporatized language of ICT applications, a 'literacy for technology' issue emerged that needed to be addressed." They also needed to understand how access to ICT funding could help their communities survive in a global marketplace. In one community, when a survey was circulated to determine the type of ICT services that residents required, some of the answers gave a clear indication that they first had to deal with a 'literacy in technology' issue. For some, ICT meant being able to have public access to a facsimile machine in order to fax in their benefits claim forms while for others it meant having a public pay phone outside the general store or being able to get mobile telephone coverage. But, for the more sophisticated, access to high-speed bandwidth was a key driver because it meant more cost effective access to national and international markets for their products and services.

In order to understand the implications of what ICT might offer a community, members of that community had to be able to articulate their needs. Wolstenholme (1995, p. 27), provided insight into this stage when she stated, "Action and interaction by members of a community in the pursuit of shared interests is probably the strongest force within a community. It is a way of achieving things for the community...Com-

munity action is the important source of power for any change which is likely to promote the well-being of a community." Information about the CTC@NSW program was therefore imparted and gained in a variety of ways including: media releases, community surveys, free information sessions to explain how the Internet worked, how small businesses could take advantage of online services to do their banking, pay taxes, seek regulatory assistance, and more. The use of the Internet to help high school and tertiary students with their studies by providing access to a vast array of information databases was often seen as a highly desirable outcome for applicant communities. The aim of all these activities was not only to raise awareness of greater access to ICTs but also to explain ICT features in terms of consumer benefits using plain English.

The importance of using plain English to empower people was expounded by Fairclough (Cope & Kalantzis, 2000, p. 163) when he stated, "We are living through a period of intense social and cultural change which is pervasive and universal in its global, national, and local effects...these fundamental changes are changes in languages, different dialects, different genres, and different discourses." Fairclough believes that the language issues of marketization and globalization also arise out of these changing discourses. He also says (Cope & Kalantzis, 2000, p. 164), "The processes of marketization are in part linguistic in nature: they involve a marketization of language, in the sense that the language of areas like public services are being colonized by the language of the market."

It was also interesting to look at the language issue from the perspective of social researchers. In this aspect, Carson and Gelber (2001, p. 5) commented on the community consultation process by stating that, "The achievement of the specific goal of achieving better communication and participation faces a number of obstacles, on a range of levels. At a macro level, those who decide which services should be provided are not

the same people who actually provide the service.” This was indeed the case in the CTC@NSW application, as it was written by bureaucrats who operated in a different paradigm than that of the communities. This implies that the language used in these applications often posed a significant challenge for the communities. In fact, of the 26 communities in the Northern Rivers region of NSW that had initial meetings with regard to the preparation of an EOI, only 7 went on to apply for grant funding, all the rest indicated that they either did not feel that they had the skill or time to deal with its complexity and that they found the wording in the documents too confusing.

For communities that went on to apply, not only did they have to deal with ‘literacy’ issues in order to apply for a CTC@NSW grant but they also had to deal with technical literacy issues as well. Luke and Gilbert (1993, p. 5) provided insight into this when they stated, “To refer to ‘technology’ in association with ‘literacy’ can signal a number of discourses concerning literacy, technology, and various combinations thereof...technology *for* literacy, literacy *for* technology, literacy *as* technology, and technology *as* literacy.” For example, in the technology section of the CTC application, those communities that wanted to use Apple Macs had to deal with information such as:

It is recognized that there is a strong rationale for using Apple Macs particularly in the multimedia field...In recognition of this, and the fact that most CTCs will be running PC based infrastructure, the question then becomes how to integrate the Macs into a PC based network. Although there are a number of ways of doing this, and this has become somewhat simpler since the release of OS 10.1, we still recommend the Macs only be linked to the network via an IP address...

The above was perhaps one of the more glaring examples of the complexity of the language used in a CTC application. It was also one of many such instances. The authors concur with the findings of

Shepherd (1998, pp.19-20) about other Australian regional development programs, “Project documents are peppered with buzzwords...required by financing organizations that must account for their spending or lending in the most up-to-date or fashionable terms. Buzzwords are often used by people with little understanding of what they might mean so they take on a hollow, artificial tone...language can also easily prevent understanding. Frequently outsiders and insiders think of a phenomenon in quite different ways. If the outsider has power to impose his or her thinking, unfortunate consequences many follow.” All of which tend to impede a community’s path to actualization and empowerment.

The culture of communities was also a major variable in achieving successful outcomes. In working with some of the applicant communities in Northern New South Wales, it was found that coastal communities, that had recently experienced an influx of well educated ‘sea changers’ had the greatest propensity to successfully complete their applications. On the other hand, many of the more rural, in-land communities that had been undergoing a steady outward migration of their younger, better educated, more productive citizens, for a variety of reasons, did not even complete their EOI. This outcome reflects Shepherd’s earlier work (1998, p. 204), when he stated:

The likelihood is that the rich and non-marginalized will always be more articulate and dominant in any community or grouping. So outsiders can play an especially critical role in creating space for poor people, economically and environmentally, in terms of rights, access to services, and control over assets and services which the poor can provide to the rest of the community; and politically, by ensuring their inclusion in associations, helping them build networks and coalitions which will protect positions gained.

Effective community consultation needs to give people who live in rural and remote regions

not only a voice but also the capacity to deal with issues arising out of inappropriate communication which can fuel misunderstanding and misinformation in these communities and prevent them from gaining access to the resources they need to ensure that their basic community needs for ICT are met.

IDENTIFICATION OF STAKEHOLDER GROUPS AND MEETING THEIR NEEDS

The establishment of a truly representative ‘application committee’, one that could speak for all the various stakeholder groups was another challenge for applicant communities. Unfortunately, it was found that the groups that had the most to gain were often the most inarticulate. Luke and Gilbert (1993, p. 43-44) spoke of this when they wrote about literacy issues in an Australian context and said “A group without access to literacy in our society is relatively powerless, unless trusted “brokers” exist to act on their behalf. By examining literacy pedagogy in cross-cultural contexts, it is possible to see a new approach emerging that challenges both traditional and progressivist theory and practice.”

The consultation practice employed in applicant communities also needed to build trust so that communities were able to identify their needs in a non-confrontational, safe environment to enable them to move up to the next stage in becoming empowered. However, needs varied considerably from one community to the next, and the key to unlocking those differences was in identifying and engaging all the relevant stakeholders as well as building on their strengths. This view also reflects the earlier work of Wolstenholme (1995, p. 15) when she stated:

While traditional rural identity remains largely intact, there appears to be a move away from idealizing the more Spartan existence of tradi-

tional country life. People were questioning their rural ideology and comparing their lifestyles with those in the city. They wanted access to more resources ...

In this context, identifying the strengths of an applicant community as well as its key stakeholder groups posed a great challenge. But the greater challenge was in finding members from these groups who could work together as a committee to complete the application. This idea was also put forward by Aslin and Brown (2004, p. 4) in another regional Australian project, when they stated, “Recognizing that a wide range of stakeholders exists means facing the likelihood that local and more distant interests may be in conflict, as local communities often have to bear the personal and immediate consequences of decisions being made...Done well community consultation can feel real, committed, integrated, and influential.” At the same time, further consideration must also be given to meeting the needs of all the various stakeholder groups so that linkages can be established to identify *their* needs in order for them to be integrated with those of the community at large. Furthermore, it is not enough to say that ‘youth needs’ should be met if they are not represented on the application committee. They need to be given a voice along with other stakeholder groups. The formation of sub-committees enabled diverse groups to have their own meetings and report back to the main Committee on a regular basis thus keeping applications on track.

It is of interest to note that Collits (2000, p. 30) also reminded that, “Communities have finite resources at their disposal for economic development projects and some difficult choices.” This was evident in the CTC’s final report, as those ‘finite resources’ extended to the skills and commitment of the people in the communities that participated in the CTC@NSW program. The CTC program’s final report (2004, p. 3), highlighted, “Lack of available time from community members and other local issues, such as drought, often hindered

progress with the application for seed funding and the development and establishment of Centres.” It was the people from the various stakeholder groups that provided the membership of the CTC Application Committee and it was their skills and vision that ICT could serve as a catalyst for growth in their communities that proved to be the most significant determinant in the success of an application.

BUSINESS PLANNING AND IMPLEMENTATION SKILLS

The selection and composition of the CTC Application Committee and its sub-committees, proved to be the critical factor in achieving successful outcomes. While these committees needed to include people from the various stakeholder groups, they also had to have members with the requisite business acumen, marketing and computer skills as the business plan portion of the application was a complex spread sheet full of macros to reflect various equipment requirements and usages scenarios over three years. However, the committees that achieved the best outcomes all had a ‘Dorothy’ as a member. Dorothy said at the onset of the application process in her community, “I don’t know much about ICT but I know how to make a good cup of tea, get people to attend meetings and do what they said they’d do.” She was certainly right. What was Dorothy’s motivation in wanting to get a CTC into her community? She wanted to do something to help keep the young people in her community from drifting away to Sydney or Brisbane and she saw ICT as a means of slowing their departure.

However, committees needed to prepare sound business plans and have access to the skills that would enable them to run a community owned and operated business. They needed to understand the implications of cash-flow on their business and what ICT could and could not deliver in their community. They also needed to take advantage

of the many products and services that the CTC@NSW program could offer through its technical and business support staff. The right balance of skills on these committees enabled them to stay focused so that they could gain access to the ICT products and services needed in their communities

ACCESS TO IDENTIFIED ICT PRODUCTS AND SERVICES

The ICT products and services sought by the various communities varied significantly from one community to the next and were dependent on what had been identified in the consultation process. The other major variable was the actual delivery of broadband services to these communities as this was often limited by geographic location. This was also supported by Hearn et al. (2004, pp. 4-5), “...market failure occurs, especially in rural, regional, and remote areas where the costs of setting up and maintaining ICT services can be very high. These factors make government support of ICT initiatives necessary...in the current policy context, government funds are limited. Consequently, greater financial responsibilities are being foisted onto local communities.” However, when a community decided to build on its identified strengths, it was far more likely to achieve its goals even with limited funding.

In a discussion paper produced by the Australian Government, *The Role of ICT in Building Communities and Social Capital*, (2005, p.1) it states:

As the use and impact of ICT increases, so does the prospect that ICT can play a role in shaping the nature of community development and contributing to the building of social capital...There is a greater variation in the needs and demands of communities and the role of ICT in meeting these.

However, this also suggests that, if government policy-makers determine that building social capital and community capacity should be seen as major outcomes of the uptake of ICT in small rural communities, why is ongoing federal funding and support so hard to come by? Communities will only remain empowered if their basic survival needs are met, because empowerment equates to greater social capacity with the flow-on benefit of diversity and innovation through the uptake of ICT. The following projects reflected the diversity of community needs that were met through the establishment of CTCs in several Northern Rivers communities.

Project One

Alive and Driving project was a program that one CTC initiated for learner drivers in its community. During the application process this community had identified lack of public transport as a major issue compounded by the fact that many young people were not very safe drivers. Moreover, there had been a horrific road accident that claimed the lives of three young people from this community that galvanized them into action. The CTC Committee instigated a driver-mentoring program that could give learner drivers access to a car and supervisor so that they could gain the 50 hours of driving experience they needed to sit for their NSW driving test. Learners paid a \$50 membership fee for the first 10 hours access to a car as well as petrol costs during their driving session. After this they could pay a further \$50 that enabled them to access as many hours as required until they got their license. This project was supported by funding received from the Australian Government under its regional partnership program, the Myer Foundation, and through partnerships with organizations and volunteers from the local community. But all the research to gain access to this funding was done using ICT, something that would not have been possible prior to the opening of its CTC.

Project Two

Another Northern Rivers community wanted to use the equipment in its CTC to create a virtual museum. They wanted to gain access to the technology that could assist them in preserving their community's rich and varied history. They used their funding to acquire the equipment they needed to scan and digitize old photographs and documents, record and preserve interviews with World War Two veterans. They also wanted to be able to catalogue and map the graves at the local cemetery and provide facilities for local residents to research their family histories. Currently they are seeking accreditation with museums Australia. Their virtual museum is now fully functional and they continue to work hard to enrich the content in their virtual museum.

Project Three

In early 2005, another CTC in the Northern Rivers was awarded a grant from the NSW Premier's Department Office for Women to conduct a training course specifically designed to help women learn filmmaking, computer, and marketing skills. The project, "Reeling in Women's Stories," saw 16 women of all ages create a 'Short Bytes Film' based on stories relating to womanhood. The participants undertook 14 free workshops to learn new computer and film making skills that included story boarding, filming, producing, and editing and marketing techniques. At the conclusion of the course, they held a movie night at the local cinema to showcase their combined efforts. The event was well attended by people of all ages from the local community.

Project Four

The Australian Taxation Office (ATO) has also worked with a number of CTCs to help deliver its regional and remote service delivery program. The online ATO products and services that are

available through this service are designed to minimize time spent managing tax affairs as well as enable businesses to gain access to information regarding taxation by learning how to access information from the ATO Web site.

A Few Other Projects

CTCs also provide free access to the NSW government portal, which has been designed as a one-stop entry point for accessing information on a variety of government services as well as a place to pay bills to government departments.

During 2005 Senior's Week, 50 CTCs across NSW worked in partnership with the NSW Department of Ageing, Disability, and Home Care (DADHC), and the Country Women's Association of NSW to promote and organize activities for Seniors Week. The 'TechnoSeniors' project was designed to promote the use of ICTs by seniors throughout the week at participating CTCs, these activities included, amongst other things, beginners and intermediate computer classes. This partnership with DADHC saw nearly 3000 participants attend Senior Week activities at the CTCs and 'TechnoSeniors' is now set to become an annual event.

Although not all CTCs have access to videoconferencing facilities, many of those that did participated in youth week celebrations in 2005 through a *young people and work videoconference* sponsored by the Office of Industrial Relations and Work Cover. This Videoconference provided an opportunity for young people in rural communities to have their say on issues affecting them, such as work safety, pay, and conditions. Additionally, many CTCs also host a range of school holiday programs where kids can learn new computer skills, create videos and sound files, and access the Internet in a safe environment.

The CTC Association Web site, <http://www.ctca.net.au> can provide additional examples of other ICT based programs that are helping

communities in the CTC network to remain empowered.

COMMUNITY ACTUALIZATION: SUCCESSFUL ICT OUTCOMES

While the communities mentioned have achieved only some of the goals articulated in their CTC applications, they all have built greater social capital in their communities through their CTC. Their CTCs have also played an important role in their ongoing regional economic development initiatives. The achievements of these communities are representative of what other small NSW communities have achieved through their continued participation in the CTC network. They also highlight the social implications of what access to ICT can facilitate in small regional communities. Hearn et al. (2004, p. 14) state, "...local needs and interests must be addressed...It can be extrapolated that success in attaining these goals necessitates the community having effective opportunities to be involved in deciding on the project(s) to be pursued...it is essential the community 'owns' the initiative.... the strengths and resources of the community should be identified and be used effectively to advance the community." This has also proved to be the case in many of the CTCs located throughout regional New South Wales.

ISSUES ARISING

In the chapter, *The Role of ICT in Building Communities and Social Capital* (2005, p. 4) published by the Australian government, it states; "ICT has a use in the development of community engagement and building social capital. Communities are at different stages of this process and do not always recognize the vast potential of ICT. When it is recognized, barriers may exist in the form of financial support, leadership, professional facili-

tation, technological development, and support and vision.” It continues (2005, p.7) “Governments and communities have committed major resources to ICT projects and programs to foster community development and to assist with networking across groups. However, there has been comparatively little research in Australia of the actual and potential use of ICT as an enabler of community and social capability.” An inhibitor of such research may be linked to the 3 or 4 year government funding cycles of ICT programs, like the CTC@NSW. This has been the case in the communities that were successful in their CTC applications, and are now expected to be able to manage their community owned and operated businesses, even though many of those staffing the CTC are volunteers. However, it is worth noting that if their original cash flow projections were not accurate, the first thing they usually cut is the salary of the CTC manager, and from that point onwards business productivity goes into decline and the long term viability of the CTC becomes a major issue. Although Plowman et al. (p. 8) states, “...No town has a ‘right’ to survive. To survive a town needs to be flexible and adaptable, to provide amenities and services to its members and to those outsiders which interact with it. Atrophy or decline awaits those towns that are not innovative or adaptable.”

However, becoming or remaining an innovative town is a very big challenge indeed, as many observers and writers have pointed out, homogeneity; conservatism, and conformity exert a constant pull. Towns that strive to be innovative in their use of ICT need to be supported, and as shown in the previous examples from the CTC@NSW program, non-traditional uses of ICT can go a very long way towards building greater social capital in these communities. Gray and Lawrence (2001, p. 206) stated, “...new initiatives in telecommunications, transport, health, education, culture, and the environment alongside eliminations of the forces depleting social capital as they bolster inequality...will also be achieved by identifying

mechanisms which aid and reward regions in their quest for sustainability.”

SOLUTIONS AND RECOMMENDATIONS

It is important that successful communities remain empowered, as well as funded, if they are to obtain ongoing access to the many products and services that ICT can deliver. It also means remaining focused on the many challenges of running a small business, including cash-flow, meeting consumer demand and expectation, and building a loyal base of customers. In many cases, it may also mean seeking further assistance with funding not only for a CTC manager who can continue to work with all community stakeholders, but also to assist in upgrading equipment as technologies and applications change.

More creative funding strategies need to be implemented at every level of government because building social capital is not a one-off project, but something that needs to be continually nurtured. The whole process of applying for grants and/or additional ‘top-up’ funding should be re-thought with wider, more community oriented criteria applied because as Gray and Lawrence (2001, p. 112) stated, “It has been acknowledged that regional telecommunications users are disadvantaged. Service providers are reluctant to invest outside the more profitable metropolitan markets and existing government policies to redress this problem are not working.”

Unfortunately, a creative opportunity was overlooked when the federal government’s launched its *Clever Networks* program on August 31, 2006. The following was downloaded from the DCITA Web site (November 30, 2006), “The *Clever Networks* program, part of the \$1.1 billion ‘Connect Australia’ package, will deliver innovative broadband services to communities in regional, rural and remote Australia. *Clever Networks* will fund broadband applications and

leverage broadband infrastructure to foster innovative service delivery for communities. Broadband development activities will complement the delivery of these services by assisting communities to enhance their understanding and use of broadband. Delivering innovative broadband services to Australian communities will encourage economic growth, increase productivity, foster innovation and increase quality of life.”

However, nowhere in the *Clever Networks* application is there opportunity or encouragement for ‘top-up funding’ from communities that had received earlier grants from the federal government to establish the CTC@NSW, and other similar state-wide programs such as the Western Australian Telecentre Network (WATN) and the Tasmanian Communities Online (TCO) program. The Western Australian Telecentre Network is the oldest of these networks and commenced operation in 1991 and is still growing. While the TCO Program, which was funded in 1998, continues to provide significant economic and social benefit to the 64 regional communities it serves.

Programs such as the CTC@NSW, TCO, and WATN could provide ideal venues for demonstrating broadband delivery of ICT. Federal funding, if cleverly used, could also promote the cross-fertilization of ideas and programs that use broadband delivery to facilitate the use of ICT in new and challenging ways. More importantly this type of ongoing funding would encourage small communities to continue broadening their approach to the uses of ICT.

Additionally, government funding should be delivered based on innovation and thus reward communities that continually strive to remain empowered through being innovative. Once communities become empowered by using ICT as a means of meeting their needs, they should be given the opportunity to share their ideas and programs with other ‘networked’ communities through a ‘building on success’ type program

FUTURE TRENDS

There will be continued erosion of face-to-face services in remote and regional areas due to the economic rationalist policies of government brought about by the range of forces associated with globalization. This means that there will be an ongoing demand by people living in regional areas to increase their skill base, so that they can have more equitable access to a greater range of products and services delivered via ICT. It also means that communities that have access to the latest ICT have the potential to become catalysts for regional growth and those communities that have the drive, as well as the capacity to survive, will be empowered and enabled to do so.

Empowered communities will continue to build on the strengths that lie in connecting communities to technology and information dissemination. They will continue to work with governments as well as explore and develop new e-business solutions for their communities. They will also explore opportunities to work with and support the micro and home based businesses that are a growing economic force in many regional and rural areas. CTCs in these empowered communities will continue to secure venue hire from both government and commercial enterprises in order to meet local needs. CTCs will also continue to promote and support computer literacy programs and serve as a one-stop shop for the delivery of more and more local, state, and federal government programs. New and innovative uses for ICT will come from these empowered communities as they use ICT to meet their needs, and at the same time remain connected to wider national and international communities.

CONCLUSION

Preliminary research indicates that a whole of government approach is essential if ICT is to serve as a catalyst for regional economic growth as well as

assist in the building of social capital. De Weaver and Ellis (2006, p. 9) state, “Governments need to leverage the investment they have already made in programs such as the CTC@NSW if they are to pay more than just ‘lip service’ to the goal of regional economic development...”

It is also important to consider that while there are significant stages involved in delivering effective community consultation, it remains an ongoing challenge to ensure that communities that have become empowered as they gained access to ICT products and services will remain committed to what they can achieve as an empowered community. In order to do this, the CTCs in each and every community must be run as financially sound businesses with management committees that can continue to provide the skills and support required to keep these community-owned and operated businesses viable. The long-term success *and* empowerment of communities that are part of the CTC and other similar Networks will also be predicated on continuing to build on the social capital that they have achieved to date.

Additional research undertaken by the authors will again use Action Research to assess whether or not the communities funded by the CTC program have remained viable.

FUTURE DIRECTIONS

The authors are also exploring the experiences of other communities in establishing similar ICT based programs.

Preliminary research has shown that as various government agencies and departments in Australia have rolled out other ICT programs designed to promote regional economic development in rural and remote communities through access to information and communication technology (ICT) programs, the language used in the documentation that supports these programs has often put up unnecessary barriers in the targeted communities and inhibited them from applying for funds.

How rural and remote communities actually engage in, and undertake, the process of applying for these programs is, to a large extent, dependent on their language and business skills. Not only are there social and political implications to be considered by governments in the design and roll-out of these programs, there are also technology and communications issues that need to be addressed in order to achieve more equitable access to these programs.

We believe that:

- The documentation that accompanies ICT based programs designed to deliver services in rural and remote areas should be written in plain English and be devoid of technical jargon. Where acronyms are used they should be clearly defined and examples given.
- Applied sociolinguistics principles need to be introduced and employed in all government grant applications programs for targeted populations.
- Glossaries of terms, which include appropriate examples, should be included in all documentation for funding programs that deal with services and/or products that are outside the usual frame of reference of people who live in rural and remote areas.
- Applications and documentation written for programs designed to build capacity in rural and remote communities should be trialed in selected communities, via focus groups or a similar consultation process, before programs are rolled out.
- All such programs need to be supported by field facilitators who understand the needs of targeted communities and who can provide appropriate support and assistance.
- Programs that promote regional economic development in rural and remote communities also need to include an element of education and/or training in them in order to empower the community and allow members

- to deal affectively with grant applications.
- Outcomes should incorporate community expectations as well as that of government funding bodies.

REFERENCES

American Society of Association Executives Foundation (2001). *People make it work: The social fabric of community on the Web*. Retrieved April 20, 2006, from <http://www.asaenet.org/foundation>

Aslin, H.J., & Brown, V.A. (2004). *Towards whole of community engagement*. Canberra: ACT Murray-Darling Basin Commission.

Beer, A., Maude, A., & Pritchard, B. (2003). *Developing Australia's regions: Theory and practice*. Sydney NSW: UNSW Press.

Carson, L., & Gelber, K. (2001). *Ideas for community consultation: A discussion on principles and procedures for making consultation work*. Sydney NSW: NSW Department of Urban Affairs and Planning.

Chapman, A. (2002). *Abraham Maslow's hierarchy of needs motivational model*. Retrieved May 11, 2006, from <http://www.businessballs.com/>

CTC Association Web site. Retrieved October 16, 2006, from <http://www.ctca.net.au>

CTC@NSW Web site. Retrieved July 20, 2004, from <http://ctc.nsw.gov.au>

Department of Communications, Information Technology & the Arts Web site. *Communications for Business Report*. Retrieved November 30, 2006, from http://www.dcita.gov.au/communications_for_business/funding_programs_and_support/clever_networks

Department of Local Government and Regional Development (2004). *Planning for the future*

report. Perth, WA: Government of Western Australia.

De Weaver, L., & Ellis, A. (2006). The CTC @ NSW Program: Achievements and ongoing challenges. *International Journal of Education and Development using ICT*, 2(2),15-26.

De Weaver, L., & Lloyd, D. (2005, August). *The language of community engagement in a regional and indigenous context*. Paper presented at International Conference on Engaging Communities. Brisbane: QLD. Government of the State of Queensland.

Fairclough, N. (2000). Multiliteracies and language: Orders of discourse and intertextuality. In Cope & Kalantis (Eds.), *Multiliteracies: Literacy learning and the design of social futures* (pp. 162-181). South Yarra, Vic: Macmillan Publishers Australia Pty Ltd.

Hearn, G., Kimber, M., Lennie, J., & Simpson, L. (2004). *ICTS and regional sustainability: A critique and a way forward*. Paper presented at CIRN Conference and Colloquium, Prato, Italy.

Local Access Global Reach: Five Years of Tasmanian Communities Online 1998- 2002. Retrieved May 31, 2005, from <http://www.education.tas.gov.au/tco>

Luke, A., & Gilbert, P. (1993). *Literacy in contexts: Australian perspectives and issues*. St. Leonards, NSW: Allan & Unwin.

NSW Department of Commerce & Office of Information Technology (June 2004), *CTC Final Report*, Sydney: NSW.

Pigg, K., & Crank, L.D. (2003). *Rural economic development: The impact of information and telecommunications technology*. Paper presented at 5th International Information Technology in Regional Areas Conference, Caloundra, Qld.

Plowman, I., Ashkanasy, N.M., Gardner, J., & Letts, M. (2003). Main Report, *Innovation in*

rural Queensland: Why some towns thrive while others languish. Brisbane, QLD: University of Queensland.

Department of Communications, Information Technology and the Arts (2004, February). *Regional Policy Research Forum Report*. Canberra: ACT.

The Role of ICT in Building Communities and Social Capital (2005, January). *A discussion paper*. Access Branch Department of Communications, Information Technology and the Arts.

Sankaran, S., Dick, B., Passfield, R., & Swepson, P. (2001). *Effective change management using action learning and action research*. Lismore, NSW: Southern Cross University Press.

Shepherd, A. (1998). *Sustainable rural development*. London: Macmillan Press Ltd.

Wollstenholme, R. (1995). *Understanding small rural communities and the consultation process*. Armidale, NSW: The Rural Development Centre, University of New England.

ADDITIONAL READINGS

While there appears to be a time lag regarding documentation and publications about other similar ICT programs, the following references should be of interest.

Fairclough, N. (1989). *Language and power*. London: Longman Group Ltd. Retrieved July 20, 2004, from <http://www.ctc.nsw.gov.au/about/>

MacLachlan, G., & Ian, R. (1994). *Framing and interpretation*. Melbourne: Melbourne University Press.

Ricento, T. (2000). *Journal of sociolinguistics*, 4(2), 196-213.

Romaine, S. (1994). *Language in society: An introduction to sociolinguistics*. New York: Oxford University Press.

Sorensen, T., & Epps, R. (Eds.). (1993). *Prospects and policies for rural Australia*. Melbourne: Longman Cheshire.

Stephens, T. (2003, November). Words fail us. *The Sydney Morning Herald*, 32.

Stilwell, F. (1993). *Reshaping Australia urban problems and policies*. Leichhardt: Pluto Press.

Trudgill, P. (1995). *Sociolinguistics: An introduction to language and society*. London: Penguin Group.

Watson, D. (2003). *Death sentence: The decay of public language*. Sydney: Random House Australia.

This work was previously published in Developing Successful ICT Strategies: Competitive Advantages in a Global Knowledge-Driven Society, edited by H. Rahman, pp. 298-312, copyright 2008 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 2.16

Developing a Global Perspective for Knowledge Management

Martin A. Schell
New York University, USA

ABSTRACT

Localization of a document or other product requires tacit knowledge of the target language and culture. Although it is promoted by many activists, localization is becoming increasingly inadequate as a strategy for disseminating knowledge on the World Wide Web (WWW). The 21st century has already seen dramatic rises in the numbers of Internet users in nearly every country, making it unlikely if not impossible for any translation effort to accommodate all of the 347 languages that claim at least 1 million speakers. The best way to maximize the accessibility of Web content is to make it more explicit, not more tacit. This means developing a global perspective and writing English text clearly so that nonnative speakers can easily understand it. Global English is characterized by simpler sentence structure, less jargon, and no slang, thereby making it a viable global language for countless Web users whose native language is not considered important enough to merit a localization effort.

INTRODUCTION

A key issue in economic and regional development (ERD) is the applicability of one region's successful program of development to another region. Although general solutions to universal problems (literacy, environmental awareness, AIDS prevention, sanitation, roads, etc.) can be designed by nongovernmental organizations (NGOs) or other global entities, their actual implementation needs to be adapted to local culture and conditions, ideally with grassroots stakeholder participation.

In addition to the traditional top-down approach of applying general principles to local situations, there is increasing recognition of the importance of a bottom-up approach in which one region's developmental success is seen as a potential model for other regions. The generalization of a locally successful program into an exemplar that can then be adapted to other localities poses a major problem in communication, or rather two

problems: The local knowledge must be articulated, and then it must be disseminated.

The implementation of information and communication technologies (ICT) has made huge strides in the first five years of the 21st century, and the number of people who have access to the Internet is now over 1 billion. In order to optimize ICT as a means for knowledge dissemination, it is necessary to have something to disseminate—specifically, knowledge that has been articulated. Therefore, the development of ICT needs to be accompanied by the development of human infrastructure, especially the ability to express oneself clearly to audiences who do not share one’s cultural background.

This chapter explains how English can be written more clearly so that it functions better as a global language, not only between native and nonnative speakers but more importantly between nonnative speakers from diverse linguistic backgrounds. The explanation extends into a discussion of how to streamline Web content. Thus, the chapter addresses a point of intersection between the two issues of articulation and dissemination, which are essential to the sharing of any region’s success so that it can benefit more of the world’s people.

BACKGROUND CONCEPTS

It is often said that human beings learn in three general ways: by hearing or reading words, by seeing images, and by doing. Although students, teachers, and other people who engage in a lot of verbal communication tend to consider the first of these three methods to be the most important, learning by doing has primacy in the sense of developing earliest in an infant. As noted by Nonaka and Takeuchi (1995), “A child learns to eat, walk, and talk through trial and error” (p. 10).

Learning by doing involves empathy and intuition, as well as trial and error. When a child learns to tie shoelaces, for example, these pro-

cesses enable him or her to acquire a skill that is rarely if ever learned through words, images, or a combination of both. Such *tacit knowledge* can be contrasted with *explicit knowledge* (Nonaka & Takeuchi, 1995, p. 8), *focal knowledge* (Sveiby, 1997), *codified knowledge* (Stiglitz, 1999, p. 11), or *formal knowledge* (Jarboe, 2001, p. 2). All four expressions of this fundamental dichotomy in human knowing are derived from the theories of Polanyi (1962, 1966).

Jarboe (2001) observes that learning by doing is facilitated by the “web of relationships and connections” that constitutes social capital (p. 3). This type of learning often involves imitating other people—not only family, friends, and coworkers, but also strangers within one’s community (who may, for example, unintentionally teach a person how to get on an escalator without hesitating). Learning by doing can also happen without guidance, which is how most video games and computer simulations are played.

Tacit knowledge can be operationally defined as knowledge that is demonstrated but not explained; it tends to be absorbed rather than grasped. It is acquired through learning by images and words, as well as learning by doing. For example, while growing up, people learn how to tell which colors will match acceptably when selecting a blouse and skirt (or jacket and pants) combination. Another example: Most gold shops in southeast Asia do not sell any items that are less than 18 karat (75% pure); the lack of a market for such items is not because customers in this region crave greater value or purity than Europeans or Americans do, but because they have tacit knowledge that higher karat gold looks better on darker skin.

In *Aspects of the Theory of Syntax*, Chomsky (1969) describes how native speakers tacitly understand their own language in ways that they often cannot explain:

Obviously, every speaker of a language has mastered and internalized a generative grammar that

expresses his knowledge of his language. This is not to say that he is aware of the rules of the grammar or even that he can become aware of them, or that his statements about his intuitive knowledge of the language are necessarily accurate. Any interesting generative grammar will be dealing, for the most part, with mental processes that are far beyond the level of actual or even potential consciousness; furthermore, it is quite apparent that a speaker's reports and viewpoints about his behavior and his competence may be in error. Thus a generative grammar attempts to specify what the speaker actually knows, not what he may report about his knowledge. (p. 8)

For example, people who are fluent in English know that *Clifford is a big red dog* is correct but *Clifford is a red big dog* is incorrect. If a student of English as a foreign language (EFL) asks a native speaker why the second sentence is wrong, the latter will realize how difficult it is to turn syntax into an explicit form of knowledge. He or she may even devise an erroneous rule such as "The color adjective always comes last," which fits *long black hair* but not *blue suede shoes*.

Complementarity and Conversion

In comparing his ideas to those of Polanyi, Sveiby (1997) notes that we can recall the meaning of a message after reading it, but we rarely remember its exact words. Sveiby explains:

The focal and tacit dimensions are complementary. The tacit knowledge functions as a background knowledge which assists in accomplishing a task which is in focus. That which is tacit varies from one situation to another. For instance, when reading a text, words and linguistic rules function as tacit subsidiary knowledge while the attention of the reader is focused on the meaning of the text. (Tacit and Focal Knowledge section, para. 2)

With a moment's effort, anyone who is literate can shift between subsidiary awareness and focal awareness while reading. This happens when an unfamiliar word catches one's attention, prompting a pause to search a dictionary; alternatively, one can simply stare at an individual word, letter, or numeral. The process of learning to read involves familiarizing oneself with the shapes of characters and then recognizing combinations of them as words until one achieves the ability to scan a sentence without focusing on them. Becoming literate basically means converting explicit knowledge into tacit knowledge, a process that Nonaka and Takeuchi (1995) call *internalization* in their socialization, externalization, combination, and internalization (SECI) model (pp. 62-70), which is summarized in Table 1.

Tacit knowledge has been defined in diverse ways in knowledge management (KM) literature, leading to ambiguous KM terminology and confusion (Bouthillier & Shearer, 2002; Sveiby, 2001). Researchers seem to agree that a major goal of KM programs is to convert tacit knowledge into explicit knowledge in order to share it throughout an organization. Nonaka and Takeuchi (1995) call this type of conversion *externalization* and see it as the key to knowledge creation. Tacit knowledge can often be made explicit by articulation: drawing a map to guide a guest to one's home, or telling an audience how to sell successfully.

There is a tendency in KM to conflate *unarticulated* with *hidden*, as Jarboe (2001) does when he exhorts economic development organizations to use information technology (IT) and "knowledge creation tools" that can "capture ... knowledge hidden within the organization" (p. 2). However, uncovering a seed of knowledge which can be disseminated does not prove that such knowledge was tacit. Suppose a project leader discovers that a team in another department recently developed some software which can expedite the leader's project. The project leader will rejoice in finding a hidden resource (hidden from his or her viewpoint, that is) but the team who coded

Table 1. Four modes of knowledge conversion (After Nonaka & Takeuchi, 1995, pp. 70-72)

| Mode | Conversion | Trigger (Input) | Process | Contents (Output) |
|-----------------|----------------------|--|---|--|
| Socialization | Tacit to Tacit | Building a Field of Interaction (Self-Organizing Team) | Share Experiences by Empathy and Intuition | Sympathized Knowledge (exchange of technical skills and mental models) |
| Externalization | Tacit to Explicit | Dialogue or Collective Reflection (Brainstorming) | Articulate by Metaphor and Analogy | Conceptual Knowledge (creation of new knowledge) |
| Combination | Explicit to Explicit | Linking New Ideas with Existing Ones (Networking) | Systematize by Analyzing and Organizing | Systemic Knowledge (crystallization of ideas into new system, service, or prototype) |
| Internalization | Explicit to Tacit | Learning by Doing | Embody by Applying Documents and Procedures | Operational Knowledge (implementation of policy or mass production as routine) |

the software already articulated those ideas into explicit knowledge. Such a “discovery” is a good example of networking, but not knowledge creation; Nonaka and Takeuchi (1995) would label it *combination*.

Tacit knowledge can be disseminated very widely by *socialization* (Nonaka & Takeuchi, 1995) without ever being articulated into explicit form. For example, charcoal is nearly always used as a base for growing orchids in southeast Asia. Perhaps this technique was discovered intuitively or accidentally by someone in Thailand, which has long been famous for its orchids. Countless amateur horticulturists adopted the technique by imitation (“It works!”) without ever receiving an explanation about why charcoal is better than soil. An explicit reason could be codified or formalized by a botanist, but it is not necessary for the propagation of the idea.

Data, Information, Knowledge, and Wisdom

As NCR Corporation’s overseas market expanded in the 1970s, their headquarters began receiving complaints from customer support representa-

tives about confusing terminology that resulted in mistaken translations of end-user manuals. NCR had the foresight to accumulate the complaints and assign a senior technical writer, Charles “Ted” Brusaw, to look for patterns and provide guidelines.

Brusaw (1978) traced the translation errors back to misunderstandings caused by word choice in the original English text. He and his team identified a large number of common English words that have multiple meanings which are tacitly understood by native speakers but can easily confuse nonnative speakers. The team compiled the *NCR Fundamental English Dictionary*, consisting of 1,175 clearly defined root words printed in boldface plus hundreds of problematic words interspersed alphabetically in regular font (each followed by a suggested substitute in parentheses).

Although NCR’s database about language problems predated the concept of KM, one could say that their knowledge repository belonged to the *IT track* in the KM model formulated by Sveiby (2001). The information technology track is characterized by seeing knowledge as quantifiable objects (e.g., a list of specific words that have been mistranslated), in contrast to the

people track which views knowledge as processes (e.g., general awareness of how ambiguity results in mistranslation).

Sveiby (2001) emphasizes the differences between the two tracks in order to highlight the need for investment in intangible assets, especially human infrastructure, but the two orientations are complementary. In the NCR case, the back-and-forth flow was like this: Accumulation of specific mistranslation incidents led to an awareness of general patterns, which led to the production of a list in a tangible book, which was distributed to employees as an informal training tool to increase their awareness.

Quantification facilitates digitalization, which has become the preferred method for recording, storing, and transmitting huge amounts of data without loss or distortion. Information and communication technologies have been developed and implemented to handle the technical aspects of information management (IM). While ICT strives to preserve the integrity of data and IM organizes it into information, KM operates at a higher level of abstraction. KM creates, combines, and communicates expertise (tacit knowledge) and ideas (explicit knowledge).

An underlying assumption in the collection and transmission of data is that it is worth retaining and disseminating. The maxim *garbage in, garbage out* (GIGO) applies here: “If invalid data is entered into a system, the resulting output will also be invalid. Although originally applied to computer software, the axiom holds true for all systems, including, for example, decision-making systems” (Jupitermedia, 2001). Therefore, when making economic and regional development decisions, it is essential to have confidence that one’s data is reliable.

Although completeness is an important characteristic of data integrity, it can be a drawback at the level of information. In describing how the Internet can be used for ERD, Jarboe (2001) mentions online databases that link small businesses to “a myriad of sites” which provide information

about finance, accounting, marketing, and so forth (p. 13). However, a Web site that contains dozens or hundreds of links can be time-consuming and even bewildering to navigate. It can also become a source of frustration if many of the links lead to sites that do nothing more than list links. As Jarboe himself notes, “There is an enormous need to be able to quickly distinguish between what information is relevant and what is irrelevant” (p. 2).

When the level rises from information to knowledge, the concept of GIGO becomes even more complex because subjective aspects must be taken into account. Instead of garbled data resulting from signal noise, or extraneous information manifesting as circular Web links, distortion becomes a matter of inaccurate reporting due to selective perception. For example, a TV camera can only record the scene that it is focused on. If a crew is filming a riot, the camera cannot show whether people who live a couple of blocks away remain undisturbed, unless the person behind the lens decides to seek a broader perspective.

At the level of wisdom, we recognize that our mental models may prevent us from determining what is useful and what is not. Nonaka and Takeuchi (1995) affirm the subjective nature of innovation, insisting “The key to knowledge creation lies in the mobilization and conversion of tacit knowledge” (p. 56). Development of a new idea, method, or invention means we are creating something that does not yet exist—the creative process has an intuitive element that leads us beyond what we already know. Therefore, no aspect of tacit knowledge should be rejected in advance as irrelevant, because no one can say for certain what the articulation of that aspect might bring (or help come into being). This state of receptivity is acknowledged in KM’s *people track* with phrases like “build environments conducive to sharing of knowledge” and “create innovation enhancing environments” (Sveiby, 2001).

INHERENT WEAKNESSES OF THE IT TRACK

The quest for quantifiable “knowledge objects” characterizes the IT track of KM, which focuses on capturing and distributing discrete items that are considered to be essential components of expertise. The act of counting objects assumes that they are identical members of a set (e.g., *one tree, two trees, not a mahogany tree, a teak tree*); consequently, the quantification of knowledge has an inevitable tendency to overlook diversity. As T. S. Eliot (1952) lamented, “Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information?” (p. 96).

Imagine, for example, a man walking into a building. An observer from the U.S. Federal Bureau of Investigation (FBI) photographs him and records the location, date, and time, thereby producing data. By noting that a meeting of the Communist Party is being held in the same building, the FBI observer creates information with a certain context. The FBI then builds a dossier for the man, which includes the knowledge that he is probably a Communist. With the wisdom of hindsight, it is easy to see how this “knowledge” is fraught with unproven assumptions that facilitated the transformation of a single observation into a supposed pattern of behavior.

New software and hardware have enabled a vast acceleration of the tendency to see people as statistics rather than as lives, an abstraction process that has been used by administrators of large populations for millennia. The proverb “You can’t see the forest for the trees” can apply to economic development in a literal way: Logging a rainforest is often justified in terms of providing jobs. Data about annual income is presented, analyzed, and evaluated, thereby producing economic information about the people who dwell in the forest, which in turn leads to the knowledge that they are benefiting from the removal of its trees.

However, as the proverb warns, focusing on details can prevent a person from seeing the whole picture. Awareness of the indigenous knowledge (IK) possessed by the forest people would lead the development specialist to look at tradeoffs. How many people have been gaining sustenance from the rainforest, for how many generations? How many people will be earning money from logging, and how many years will those jobs last? How will logging impact renewable resources (foods, medicines, and other materials) that indigenous people currently can obtain without using money?

The limited context of the original analysis would then be expanded to recognize long-term sustainable processes of obtaining food based on indigenous techniques of agroforestry, such as those outlined by Grenier (1998, p. 3). This broader perspective would lead to the collection of data that counts cashless providers (tacit income) as well as paid workers (explicit income). The new economic information would describe livelihoods, a concept that is more inclusive than jobs. Thus, the initial claim by government officials that they “know” that logging’s benefits outweigh its drawbacks would need to be revisited, and perhaps exposed as erroneous.

Of course, the IT track provides many benefits, too. Initiatives on the Web include the Computer Systems Policy Project (CSPP), the Virtual Souk (<http://www.southbazar.com>), and the ICT Stories Project that was started by infoDev and the International Institute for Communication and Development (IICD). CSPP (1998) offers a 23 question online assessment to help communities gauge their readiness for electronic commerce. The Virtual Souk (Hazan, 2002), developed in Egypt with NGO assistance, is itself an e-commerce project that connects local artisans and shopkeepers in North Africa with global markets. The Virtual Souk’s story is one of the regional successes that are recounted at the ICT Stories Web site in order to facilitate their global dissemination (IICD, 2003).

Nevertheless, the rapid growth of the IT track (Sveiby, 2001) calls for criticism of its assumptions about KM before they become too ingrained. The remainder of this chapter challenges some IT-track ideas about producing and distributing documents, particularly on the World Wide Web. Respective sections address how assumptions about language, infrastructure, and culture impact the dissemination of knowledge. The author offers suggestions for expanding one's awareness to a global perspective, which hopefully will lead the reader to attain a greater degree of wisdom about how to manage ERD knowledge so that it becomes available to everyone on our planet.

The Limits of Localization

Most Web sites that aim for multinational audiences *localize* their content by translating it into languages spoken by major groups of Internet users: Spanish, Chinese, Russian, and so forth. The Switzerland-based Localization Industry Standards Association (LISA, 2005) defines *localization* as "taking a product and making it linguistically and culturally appropriate to the target locale (country/region and language) where it will be used and sold."

In August 2003, the software developer Mas i Hernández (2003) tallied the presence of several dozen languages on the Web to determine the relative standing of his native Catalan. By inputting keywords specific to each language, he found that English was the dominant language of the text on 1,280 million pages, followed by German (182 million), French (100 million), and then a cluster of four languages in the 65-70 million range: Japanese, Spanish, Chinese, and Korean. As the president of a Web translation agency, Hopkins (2002) agrees with the principle of multilingualism. However, he recognizes that localization is not needed on each page because most Web content is global information that can be translated directly without adapting it to the

audience's culture (What is a Multilingual Website? section, para. 3).

Localizing every page of a Web site is not only "too much" but also "too little." By itself, localization can never succeed in reaching a worldwide audience because its purpose is to serve specific groups of users. Adding up a handful of regional groups—or even a few dozen local groups—does not equal a global audience. There are presently 6,912 living languages, including 347 that have over 1 million speakers each (Gordon, 2005d). It is not feasible to localize content into all of them. How often do you see sites that offer the option of viewing pages in *Bangla* (Bengali), Gujarati, Marathi, Panjabi, Telugu, or Vietnamese, each of which has over 40 million native speakers?

A common explanation for excluding these languages from Web site localization efforts is that they are spoken in areas that "do not have enough users to make localization worthwhile" (Nielsen, 1999, p. 315). However, the number of Internet users nearly tripled worldwide during the first five years of this millennium: from 361 million at the start of 2001 to 1,018 million at the end of 2005. Doubling or tripling occurred on every continent and in nearly all countries that began the 21st century with only a small fraction of the population having Internet access (Internet World Stats, 2005c).

The rapid increases in Internet penetration worldwide suggest that localization is a short-term strategy for global dissemination, because its coverage of the world's online population will become less complete as time goes on. The number of Internet users who speak "minor" languages is rising, making a comprehensive localization effort more costly and unwieldy. During 2005, Internet penetration reached 13.9% in Turkey, 12.8% in Thailand, and 11.3% in the Ukraine (Internet World Stats, 2005c), each of which has a national language that is spoken by over 40 million people.

In developing countries, many people who lack a computer at home access the Internet via cyber

cafes. This sharing of hardware is analogous to older forms of pass around readership, such as joining a library or renting a video instead of buying it. Statistics about total Internet users in such countries are often based on multiplying the number of Internet service provider (ISP) accounts by a sharing factor.¹ Because this factor is only an estimate of the actual situation, one should view user statistics (as well as most other statistics related to the Internet) with some skepticism.

Nevertheless, the shortage of Web pages in many languages is obvious to people who are native speakers of those languages. If a Web site does not consider their language important enough to merit localization, these users are likely to access the English version of the site.² At cyber cafes in Indonesia, for example, a few people will gather around a single user whose English is fluent enough to comprehend Web pages in that language. He or she will provide impromptu translation for the others while they surf as a group.

And there is evidence that people who speak English as a second language sometimes choose the English version even though the Web site offers pages in their native language. A survey conducted by Research & Research found that only 8% of Hispanic American Internet users prefer Spanish-language Web sites but 41% prefer English-language sites. The remaining 51% said they are bilingual and read Web content in either English or Spanish. In other words, 92% of Hispanic American Internet users feel comfortable with English-language Web sites, despite the fact that 63% of this market segment were born outside the United States (Romney, 2000).

A Census 2000 brief (Shin, 2003) lists the top 20 languages other than English spoken in the U.S. in 1990 and 2000. The category “all other languages” accounted for about 10% of “total non-English” in both years, rising to 1.7% of the total U.S. population in 2000 (p. 4, Table 1). In other words, a localization effort that includes the top 20 languages would exclude about 4.5 million speakers of “all other languages” (1.6 million of

whom speak English less than “very well”).

The incompleteness of localization is even more dramatic in the global arena: Translating a document into each of the 83 languages that has more than 10 million speakers would fail to serve 20.5% of the world’s population (Gordon, 2005d). In terms of the world’s Internet users, 20.4% would be neglected by a localization effort devoted to the top 10 languages spoken by the online population (Internet World Stats, 2005a). Clearly, using a global language is an essential part of worldwide outreach.

Using English Globally

LISA (2005) defines *internationalization* as “generalizing a product so that it can handle multiple languages and cultural conventions without the need for redesign” and calls this process the “forerunner of localization” (question 3) because internationalization is often implemented by editing a document before translation. Another way to express the complementarity of the two processes is to say that internationalization aims to make text as explicit as possible for a global audience, while localization aims to evoke a local audience’s empathy by appealing to tacit aspects of their culture.

Among the major languages of the world, English is the closest to being a global language. In *The Future of English?* Graddol (2000) lists 12 “major international domains of English” including international organizations and conferences, scientific and technical publications, global advertising and mass culture, aviation and maritime communications (“airspeak” and “seaspeak”), international tourism, universities, and the Internet (p. 8, Table 2). More than 60 countries publish at least some of their books in English (p. 9, Figure 2). And the vast majority of German scientists in eight fields reported that they use English as their working language, ranging from 72% of the scholars in sociology and in medical science to 98% of the physicists (p. 9, Table 3).

It certainly seems that producing a document in English is the best way to reach a global audience. However, the English spoken by Americans, Canadians, British, Australians, New Zealanders, Indians, Nigerians, Singaporeans, Jamaicans, and others is not itself a global language. Each nation speaks and writes its own variety, full of local idioms and slang: American English, Queen's English, and so forth.

In order to serve a worldwide audience (as in *World Wide Web*), it is necessary to use *Global English*—English which is written in such a way that it can easily be understood by nonnative speakers, as well as by native speakers in diverse parts of the planet. Global English lacks slang; it also has simpler sentence structure, less jargon, and fewer idioms than the English that is typically spoken and written in the “inner circle” (Kachru, 2005, pp. 13-14) of countries that were settled by the British.

It is well known in the field of international development that a communications gap is likely to arise between bureaucracies (or stakeholder groups) and the public “when the decision-making process is either surrounded by secrecy or obscured in technical language” (Reinicke & Deng, 2000, as quoted in Waddell & Allee, 2004, p. 4). In this light, LISA's (2005) promotion of “techspeak” such as the abbreviations *G11n*, *I18n*, *L10n*, and *T9n* for the terms *globalization*, *internationalization*, *localization*, and *translation*, respectively, seems misguided. It is not obvious that each abbreviation's embedded numeral indicates the number of omitted letters; therefore, everyone needs a brief initiation when encountering this alphanumeric jargon for the first time. A more serious problem is that the abbreviations tend to confuse the reader's eye because the numeral *1* is similar to uppercase *I* or lowercase *l* in many fonts.

The NCR dictionary produced by Charles Brusaw (1978) was one company's early attempt to encourage its writers to globalize their English in order to make “technical documents easier to

read and use by NCR employees and customers around the world.” One category of words found to be problematic for translators was “jargon that was understood only by the initiated few” (p. 1). Idioms were discouraged and slang was strongly discouraged.

Eliminating the use of slang in written documents and online content is more than a matter of improving readability for a global audience. A report by Stanford University's Persuasive Technology Lab (Fogg et al., 2002) listed “writing tone” among the top 10 factors that users mentioned when describing the trustworthiness of a Web site. “People generally said that sensationalism or slang hurt a site's credibility, while a straightforward, friendly writing style boosted credibility” (p. 43).

It is also important to avoid the use of idioms and slang when participating in an online discussion. This may seem counterintuitive because chatting is a way to open up and express oneself with few restrictions. Indeed, instant messaging can be so fast and fluid that it seems like speech instead of writing. However, it lacks the nonverbal clues of face-to-face chatting (or even phone conversations), and so it is prone to misinterpretation, especially when participants are from diverse cultural backgrounds.

The moderator of an online discussion group should remind members that clarity is important. Pointing out incomplete sentences and gently discouraging the use of the latest slang may slow the action, but such emphasis on explicit language will make a multicultural discussion more inclusive. Although casual Internet English is great for communicating with friends, relying on tacit linguistic habits is too parochial for a chat room, Web site, or blog that aims to attract a worldwide audience.

How to Write Global English

Besides its lack of slang and scarcity of idioms, Global English is characterized by the avoidance

of jargon and buzzwords. All four of these types of diction hinder inclusiveness by making it harder for uninitiated people to read a document. Consider the following sentence that ends a paragraph promoting an online clothing store:

Which is just the right feature for users who want what works.

This type of colloquial English is easy for a native speaker to understand. However, the incomplete sentence can confuse nonnative speakers, many of whom would expect the sentence to end in a question mark.

Changing the initial *which* to *this* might decrease the sentence's trendiness in the American or British market, but it would greatly increase the number of people who could understand the sentence in the global market. In addition, the word *just* and the idiom *what works* should be modified, resulting in:

This is exactly the right feature for users who want efficient online shopping.

The "coolness" of Web content often depends on using the latest buzzwords and slang. However, many nonnative speakers became fluent in English while studying or working in the U.S., UK, or Canada 20 or more years ago. After they returned to their native countries, they retained their fluency but their tacit knowledge of English slang eventually became outdated. For example, they might not know that an expression like *It sucks* is now inoffensive enough to appear in mainstream media and dictionaries.

Colloquial usage is not the only tacit aspect of language that can undermine successful global communication. Many of the words that anglophones consider ordinary have multiple meanings (and even different parts of speech) that can create ambiguity in a reader's mind, particularly if he or she is less than fully fluent in English.

Ambiguity makes a translator's work harder, slower, and less accurate (N. Hoft, personal communication, September 6, 2005; G. Fletcher, personal communication, September 9, 2005). Writing the original text in Global English means making every paragraph, sentence, and word as explicit as possible. This process includes internationalizing the document so that it is "as culturally and technically 'neutral' as possible," which will save time and money when the document is translated from English into one or more other languages (LISA, 2005, question 3).

Here are two examples of ambiguity that most native speakers of English would read without hesitation. However, a nonnative speaker might become confused by them. And even a good translator might render one of these words into a phrase that is ambiguous or incorrect in the target language.

The word *once* can be confusing as a conjunction, because some readers might misinterpret it as an adverb meaning "one time." For example:

Once the prompt appears, enter the course title.

Some people might think the prompt appears only once, regardless of the number of course titles. It would be better to write:

After the prompt appears, enter the course title.

A similar type of confusion can occur if *since* is used as a conjunction, because it can be misinterpreted as an adverb or preposition meaning "after":

Keep a log, since the use of this device can produce momentary fluctuations in the supply of power to other electrical equipment in the room.

Someone might think that the log does not need to be started until a fluctuation occurs. To remove the ambiguity, use *because* as the conjunction:

Keep a log, because the use of this device can produce momentary fluctuations in the supply of power to other electrical equipment in the room.

After finishing a document's final draft, the writer or editor should reread its entire text, seeking points of ambiguity. Any words or phrases that could hinder comprehension or translation should be replaced. However, the writer or editor cannot anticipate everything that might seem unclear to the document's readers or translators.

A people-track approach to removing ambiguity is to build redundancy into one's writing. This does not mean reiterating each sentence with a subsequent one that starts with *In other words* or a similar phrase. It is not necessary to be that blunt. Simply write in a way that provides some overlap between sentences, so they support each other and create a clear context for all of the paragraph's ideas. For example:

We recommend the purchase of this factory because it is a good medium-term investment. If our company buys the manufacturing facility this year, we will be able to upgrade it by the middle of next year. After we modernize the equipment, we will have additional production capacity to help us meet the increase in demand for our products that is expected two years from now.

Note the repetition of concepts in this example: *purchase ... buy, factory ... facility, upgrade ... modernize*. In addition, the time frames are in chronological order and support the use of *medium-term*.

Although some redundancy can be useful, most writing can be improved by making it more concise. A lot of writers repeat themselves unnecessarily and use extraneous phrases. Corpo-

rate and economic development reports tend to use double negatives and hedges that cloud their meaning. Here is an example of verbosity:

The other day, during our annual meeting, when most of us were thinking about the company's future, we heard, for the first time, some forecasts which, you will agree, were not discouraging.

The meaning could be made a lot clearer by splitting this run-on sentence into two shorter ones, such as:

Most of us were thinking about the company's future during our annual meeting. We heard new forecasts that were encouraging.

In "Standards for Online Content Authors," McAlpine (2005) emphasizes conciseness and clarity. She recommends that writers aim to limit sentences to a maximum of 21 words and paragraphs to 65 words (Style section, bullets 4 and 5). Indeed, it is generally less tiring to read sentences that have fewer words, as well as paragraphs that have fewer sentences. When a writer simplifies a document's syntax in order to achieve these targets, the content usually becomes clearer, too.

The principle that smaller "bundles" of information facilitate reader comprehension also operates at the level of document design. In *Designing Web Usability*, Nielsen (1999) advises keeping Web pages short so that they are "optimized for online readers who frequently scan text." If a topic contains a lot of information, the primary page should be narrowly focused and "secondary information relegated to supporting pages" (p. 15).

Streamlining a text in all of the ways mentioned in this section will not restrict one's writing style much, but it will greatly expand the document's potential audience by making the content easier to understand. Many people who are not completely fluent in English can read the language

more easily than they speak it. They can also reread a written document or Web page at their own pace with a dictionary, but such review is very awkward while engaging in a conversation or listening to a lecture.

LOGISTICAL CONSIDERATIONS

After knowledge has been articulated in Global English, the next consideration is: How can it be shared to the widest possible extent? If one chooses to use the World Wide Web to maximize the dissemination of economic and regional development knowledge, it is necessary to think about the logistics of Internet access before uploading the Web content.

Although digital subscriber line (DSL), cable, wireless, satellite, and other fast connections have become well established in industrialized economies, a significant fraction³ of users rely on older ways to access the Internet. Many Web site visitors are likely to use an integrated services digital network (ISDN), or even 56 Kbps modems. Connection rates and speeds can be low, particularly during business hours in their countries when heavy Internet traffic overloads local ISPs. Therefore, it would be a mistake to design a Web site that only works smoothly when it is accessed via a broadband connection.

In addition, it is important to consider that Internet time is often charged by the minute, as is telephone time. People who visit a Web site might be paying their ISP and telecom company a dollar or more per hour for online access. Local utility costs can severely impact the success of a site that aims to disseminate knowledge globally.

Therefore, streamlining the online content is a key to reaching and retaining a worldwide audience. It is wise to reduce the loading time of every page on a Web site in order to make access smoother and cheaper. The site's Webmaster can provide feedback about page-view failures and also advise how to make pages easy to re-access

if a visitor's connection unexpectedly fails.

In the "Response Times" section of his second chapter, Nielsen (1999) describes three thresholds of attention span:

1. A delay equal to 0.1 second is the limit for most users to feel that the system is reacting "instantly."
2. A delay of 1 second is the limit for feeling that one's flow of thought is uninterrupted (for example, after clicking on a link to read another page of text).
3. A delay of 10 seconds is the maximum for keeping a user's attention on the display screen while a page is loading.

Allowing for a half-second of latency in the system's responsiveness, Nielsen (1999) cautions that the 10-second limit for maintaining a person's attention on a Web page is reached with only 34 kilobytes (KB) for modem connections and 150 KB for ISDN connections (p. 48). Any page over these limits is likely to seem slow when loading on the screen, thereby becoming an unintended test of the user's patience.

Connection speed does not matter much for text-rich Web pages, which rarely exceed 10 KB. However, the Web designer needs to be careful about delays in loading time due to the inclusion of photos, music, or animation on a page. A digital photo in .jpg format is likely to exceed 34 KB, and a .wav file of instrumental or vocal music is typically 5-10 KB per second of playing time.

When planning a Web page, check the size of every multimedia file that will be part of it. Take all moving images off the page by providing a link to their .mov file ("Click here to see the video") instead of embedding the file in the page itself. Reduce the use of sound and carefully consider the visual quality of each photo in relation to its file size. A page that totals 500 KB is likely to take more than half a minute to appear on a user's screen if it is accessed via an ISDN connection, and longer if via a modem.

One should make the text as independent of the images as possible, even when it refers directly to a photo. Here is an example of dependent text that forces the reader to wait until the image loads:

Look at the photo on the left.

By adding a few words to describe the photo, one can make the text independent of it and free the reader to scan past it if he or she cannot see it immediately. For example:

Look at the photo of a traditional village in Africa (left).

It is also a good idea to ask the designer or Webmaster to insert the ALT attribute in the HyperText Markup Language (HTML) code for each page that includes an image. This attribute enables the display of descriptive text in the box that outlines a photo while its image is loading on the user's screen.

Tables and graphs should be planned carefully to accommodate their translation into other languages. German, for example, typically expands the length of the equivalent English text by about 30% (Nielsen, 1999, p. 318). Therefore, localization can cause problems in a table's appearance if the Web designer neglects to make the column widths flexible enough.

TRANSCENDING CULTURAL PREFERENCES

Articulation and accessibility are not enough; knowledge must also be acceptable to local stakeholders so they become motivated to adopt and adapt it. Allee (2000) emphasizes the importance of community participation in Web-based knowledge dissemination projects. "People usually don't follow a process or formula or steps. They want to tweak it or put their own spin on it. People, however, will support what they help create"

(Experts are Everywhere section, para. 2).

Relating this aspect of KM to ERD in general, Stiglitz (1999) agrees that local "doers of development" need to adapt knowledge and "make it their own" when adopting it. He then notes that this type of active learning promotes self-reliance and supports group identity. "It is not just a matter of being 'open' or 'closed' to outside knowledge; it is a matter of being open to outside knowledge in a way that reaffirms one's autonomy" (p. 9).

Web pages and other documents that accompany ERD efforts should be conducive to autonomy, or at least not undermine it. Recall that LISA's (2005) definition of internationalizing a document includes the goal of making it "culturally neutral" (question 3). Removing cultural biases before producing a globalized document streamlines the subsequent localization process (if any) and reduces the possibility that the content will alienate some readers. The following examples reveal a few ways that we can broaden our minds to accommodate other worldviews.

In 1986, I edited a speech by a Japanese businessman who asked, "Why does the term *classical* always refer to Europe? If we want to refer to the traditional arts and culture of other regions, we must insert an extra adjective: classical *Japanese* music, classical *Indian* dance, classical *Chinese* calligraphy." Although two decades have passed, the unqualified term *classical music* still refers to a period in European history, and *Classics* is the name of a field of study that focuses on ancient Greece and Rome.

One cannot anticipate every point of sensitivity, but a little research can go a long way toward reducing the intercultural friction that might accompany a document's publication. For example, it would be unwise to refer to Hinayana Buddhism when discussing the role of religion in economic and regional development in southeast Asia because *Hinayana* is a pejorative term coined by self-declared Mahayana Buddhists in order to contrast themselves with Theravada Buddhists (Lie, 2005).

People say, “History is written by the victors,” but there are exceptions to this cliché; Genghis Khan never lost a battle but his reputation is not good. If a country wins a war of independence, its people date their sovereignty from the year of declaration, not the year of the subsequent peace treaty; for the United States, it is 1776 rather than 1783. However, most Western history books ignore the August 17, 1945 declaration of independence by Indonesia and refer to The Hague conference late in 1949 instead.

The national languages of Indonesia (*Bahasa Indonesia*) and Malaysia (*Bahasa Melayu*) are often combined into *Malay* in lists of the world’s largest languages (Graddol, 2000, p. 8, Table 1; also, p. 27, Table 7). When tallying speakers who have Internet access, the online marketing company Global Reach (2004) states, “Malay is the same language that is spoken in Indonesia” but indicates that most of this market segment lives in Indonesia (footnote 26). A reader in Jakarta might therefore wonder why this “single” language is not called Indonesian instead of Malay. The confusion is due to the conflation of modern Malay with the older language of the same name, which gave birth to it and its sister Indonesian (Gordon, 2005b)—a situation analogous to combining Romanian and French into *Romance language speakers* and then saying “Romance is the same language that is spoken in France.”

Other cultural assumptions are unrelated to artistic, religious, political, or linguistic favoritism; they lead to embarrassment or confusion without arousing national pride. In his chapter about designing Web pages to serve a global audience, Nielsen (1999) shows a banner ad for Apple Computer that asked users to turn on a virtual light switch by clicking it. However, the switch was in the down position, which is the “on” position in many countries. Nielsen says the variation of this type of tacit knowledge is rarely mentioned in guidebooks that tell how to internationalize software or Web sites, but it can be discovered by testing the image on a sample

of users overseas before uploading to the World Wide Web (p. 315).

The Rise of Mandarin

Is another language likely to replace English as the global language? When the British Council published the first edition of Graddol’s *The Future of English?* in 1997, the mass media began sounding an alarm that English was being surpassed by “Chinese” (Lovgren, 2004). Graddol (2000) divided English speakers into three categories: those who speak it as a first language (native speakers, or L1), those who speak it fluently as a second (or third, etc.) language (L2), and those who are learning English as a foreign language (EFL) but are not yet fluent in it (p. 10).

Graddol (2000) estimated that there are 375 million L1, 375 million L2, and 750 million EFL speakers of English (p. 10, Figure 4). Although this rounded L1 figure is well above his estimates for Hindi (316 million) and Spanish (304 million), it is very far below the 1,113 million for “Chinese” (p. 8, Table 1). The popular press echoed these estimates without asking why the separation of L1 and L2 speakers was being applied to English but not to “Chinese.”

Most linguists do not recognize a monolithic language called “Chinese” that is spoken as a first language throughout the People’s Republic of China (PRC). “Chinese” consists of several large languages that have a common system of writing but are mutually unintelligible when spoken (C. Hurd, personal communication, December 5, 2005). In linguistic classification, it is considered a subfamily within the Sino-Tibetan family (Columbia, 2001; Gordon, 2005a). However, due to “social, cultural, or political factors,” (Gordon, 2005c, The Problem of Language Identification section, para. 1), politicians tend to displace linguists as the authorities who determine whether two or more languages are equivalent (thereby promoting national unity) or distinct (thereby promoting ethnic identity).

Mandarin is the official language of the PRC and the standard language of instruction in its public schools. In these respects, it is analogous to other national languages that were created to unify diverse populations (e.g., Filipino in the Philippines and Indonesian in Indonesia). In its *Ethnologue* encyclopedia of world languages, SIL International (formerly the Summer Institute of Linguistics) states that 70% of the people in China speak Mandarin as their native language (Gordon, 2005a), which would yield an L1 of 910 million among the present population of 1,300 million.

However, in May 2005, the PRC's Xinhua news agency reported a survey by the National Language Commission which found that only 53% of the population can speak Mandarin, and many of them "are not frequent Mandarin users, preferring their local dialect" ("Half of all Chinese," 2005). This yields a combined L1+L2 of 689 million. If one adds in all of the L1+L2 Mandarin speakers among the 23 million Taiwanese and 34 million (Liren, 2002) to 55 million (Seagrave, 1996, p. 14) overseas Chinese, Mandarin's total probably comes within the margin of error for Graddol's (2000) combined L1+L2 estimate of 750 million English speakers.

In *Asian Englishes: Beyond the Canon*, Kachru (2005) suggests a much higher L1+L2 total for English, based on estimates that one third of his native India uses English, as do 200 million people in the PRC, yielding 533 million L2 speakers in those two countries combined. However, these figures assume that people who have had only three years of English instruction in school are "users of the language" (pp. 206-207). When I lived in Tokyo, I frequently encountered Japanese who had studied English for six or more years and were reluctant to speak it; however, they had the potential to become L2 speakers. After conversing with many Japanese of varying levels of English fluency during 1984-1987, I observed that those who were L2 generally had lived at least six months in an L1 country such as the U.S. or UK.

Regardless of the numbers, there are two solid reasons why Mandarin will not become popular as a global language: It is hard to speak and hard to write. Tones in speech and ideograms in writing make it virtually inaccessible as a second language to the majority of the world's people. Adults whose native language is a tonal one such as Thai, Lao, or Vietnamese sometimes learn Mandarin by overhearing conversations or watching movies, but speakers of non-tonal languages have a lot more difficulty doing so and need twice as much time in an immersion setting such as Automatic Language Growth (J.M. Brown, personal communication, 1990). Learning enough ideograms to read a newspaper requires a long-term diligent effort.

One benchmark of a global language is whether it is used as a lingua franca between two nonnative speakers from separate countries, neither of whom knows the other's L1. For example, a Japanese who is working on a development project in Mozambique would be likely to use English to communicate with a Swede working on a project in Laos. This example is basically an extension of Kachru's (2005) definition of "a 'standard' English-knowing bilingual" in south Asia (p. 215), applying it as a touchstone for anglophones throughout the world. That is, a Global English speaker is someone who is intelligible not only to native speakers of English but also to nonnative speakers from diverse backgrounds.

Although Mandarin is used as an international lingua franca, its scope remains regional; people outside Taiwan, Singapore, and other Chinese-majority areas study the language primarily to communicate with citizens of the PRC. Its recent rise in popularity as a language for international commerce has been at the expense of Cantonese (Yue), not at the expense of English. One impulse for the shift was the reabsorption of Hong Kong in 1997. In addition, Mandarin language schools began to operate openly in Indonesia after the dictator Suharto resigned in 1998.

The Future of Global English

Graddol's (2000) report contains much more than a tally of speakers at various levels of fluency. He suggests that English will remain globally dominant but it will be influenced by nonnative speakers, leading to "new hybrid language varieties" (p. 36). A harbinger of this hybridization is Singapore, which has four official languages: English, Mandarin, Malay, and Tamil. English is the default language when two Singaporeans of different ethnicity make each other's acquaintance, earning it an L2 (p. 11, Table 5). This L2 "Singlish" is flavored with words and structures from three non-Indo-European language families, making it a notable variety despite its narrow geographical range.

In addition, Graddol (2000) foresees "migration toward L1 use of English" by middle-class professionals and university students who use it "as a primary means of social communication" in L2 countries (p. 58). Such migration has been going on for more than half a century in India, where the large anglophone sector supports the creation of literature in their own variety of English, dating back to the 1938 publication of Raja Rao's pioneering novel *Kanthapura* (Kachru, 2005, p. 137).

It is widely recognized that the globalization of American movies, music, and fast food make English trendy among millions, even billions, of people who are not fluent in it. This "wave" of popular culture is augmented by a socioeconomic "wave" in developing countries, some of whose governments now require English to be taught as a foreign language in primary schools. It remains to be seen whether the critical mass of L1+L2 speakers attained by Singapore and India will be replicated by dozens of other countries, each of them thereby developing its own variety of English.

To test the ability of anglophones to understand each other's varieties, Smith (1992) recorded conversations between five pairings of fluent speakers

from the U.S., UK, China, India, Japan, Taiwan, the Philippines, Indonesia, and Papua New Guinea. He played the audiotapes to three groups of anglophones who were studying in Hawaii in 1986: 10 Japanese, 10 Americans, and 9 people of various nationalities (mostly Asian L2). Smith found that the L1 British and American speakers were not always the most easily understood (p. 88). Graddol (2000) cites this finding to support his speculation that an "Asian standard English" (p. 56) may someday codify the similarities that already exist among the varieties of English spoken in east Asia.

A related finding of Smith's (1992) pilot study has a more immediate implication. Smith saw the skill of the listeners in the group of mixed nationalities as "evidence that familiarity with several different English varieties makes it easier to interpret cross-cultural communication in English" (p. 83). Both findings support this chapter's call for action: When used as a global language, English should be spoken in a way that is recognizable to anglophones all over the world; and Global English needs to be neutral enough to accommodate the phonologies and lexicons of all varieties of English, not only those in the traditional L1 countries that were settled by the British.

Kachru (2005) describes the interaction of diverse forms of English in terms of *pluricentricity*, the concept that "world Englishes have a plurality of centres" (p. 18). These centers provide norms and models for English language acquisition, regional codification, and literature. He places Singapore, India, Sri Lanka, and the Philippines in the *norm-providing group*, distinct from China, Taiwan, Japan, South Korea, and Thailand in the *norm-dependent group* (p. 19).

If the reader will permit a coinage, I propose the term *colingual* (analogous to *coworker*), which refers to people who *speak a language with each other*. People who converse in a common language are colinguals in that language. Although two native speakers of a language are colinguals in their

L1, they might not be colinguals in a shared L2. For example, two Japanese could both be colinguals in English with their American acquaintance but not with each other, because Japanese people tend to speak English only when communicating with non-Japanese. However, Singaporeans are likely to be colinguals in English with each other, even if they have the same L1.

This neologism is helpful for understanding Kachru's (2005) separation of anglophone countries into norm-providing and norm-dependent (p. 19). His division correlates with the answer to a question that tests the internal colingual level among an L2 country's English speakers: Do compatriots communicate with each other in English when no foreigners are present? In the norm-dependent group, the answer is "rarely;" however, in the norm-providing group, the answer is "often enough to create a critical mass of colinguals that generates its own norms."

Although Kachru (2005) makes an excellent case for a regional variety called South Asian English that is spoken in seven countries, he says nothing about the extent to which norm-providing Singapore has radiated its lexical influence to Malaysia and Indonesia (e.g., the coinage *handphone* to refer to a mobile telephone), nor whether the Philippines has provided syntactical models to Vietnam or Thailand. So, it is unclear why the Singaporean and Philippine varieties of English should be called centers rather than national varieties. Regional codification of the kind seen in South Asian English has yet to be evidenced in southeast Asia (Crystal, 2003, p. 57).

Given that the number of national and regional hybrid Englishes is likely to increase, what is the future of mutual intelligibility? A Japanese acquaintance told me about an experience she had while teaching her native language to Indonesians in North Sumatra. One day, the students invited her to go hiking, pronouncing the word in Japanese fashion (*haikingu*) as part of a Japanese

sentence. Etsuko was confused when they said everyone would gather in the evening, because she understood *haikingu* to be a day trip on level ground or in low hills. Instead, the students trekked up a small mountain, arriving at the peak in time for sunrise. In Indonesian, the borrowed word *hiking* refers to an activity that Japanese think of as mountain climbing.

This anecdote illustrates how the expansion of English as a global language may undermine itself. To preserve mutual intelligibility, we should recognize common ground, not repress diversity. Therefore, Global English will become more essential in the future, as a way for speakers of divergent forms of English to communicate with each other. In this light, the implementation of ICT requires the development of human infrastructure as well as physical infrastructure. We must learn to express ourselves clearly to audiences who do not share our cultural background and the concomitant tacit aspects of our speech and writing. In addition to making English more explicit on the Internet, we should promote the use of Global English in education and business.

Graddol (2000) uses a pyramid diagram (p. 12, Figure 6) to explain how the expansion of an Indian citizen's viewpoint from home to village to state to nation is accompanied by shifts in language. At the base of the pyramid are local languages used within families and learned by infants as L1. A step higher are languages of wider geographical scope, which are used in media broadcasts and primary schools. Another step higher are state languages (e.g., Malayalam in Kerala), which are used in government offices and secondary schools. At the top are Hindi and Indian English, which are used nationally and in universities. I propose that Global English is a step beyond the top of this pyramid, serving as a lingua franca for international communication and online education (e-learning).

CONCLUSION

Localization is very important in marketing and other fields that rely on tacit knowledge of a target language and culture. However, it is incomplete as a global strategy because it can never accommodate everyone. The limits of localization are becoming more apparent in the 21st century, with over 1 billion people now having access to the Internet and numbers increasing dramatically in virtually every country. Localizing a Web site into all 347 languages that each claim at least 1 million speakers is not a feasible approach to the global dissemination of knowledge.

To make the Web truly a worldwide medium, it is necessary to write English text in an explicit way that can be easily understood by nonnative speakers: simpler syntax, less jargon, fewer idioms, no slang. Writing a Web page or other document in Global English is the best way to ensure that people from all linguistic backgrounds have a reasonable chance of comprehending it. Global English will become more important in the near future, both online and in hardcopy; it may prove to be essential for maintaining English as a lingua franca if the growth of anglophones leads to a proliferation of new varieties of the language in diverse cultures throughout our world.

REFERENCES

- Allee, V. (2000, Fall). *e-Learning is not knowledge management*. Retrieved November 20, 2005, from LiNE Zine, <http://www.linezine.com/2.1/features/vaenkm.htm>
- Bouthillier, F., & Shearer, K. (2002). Understanding knowledge management and information management: The need for an empirical perspective. *Information Research*, 8(1), paper no. 141. Retrieved September 9, 2005, from <http://InformationR.net/ir/8-1/paper141.html>
- Brusaw, C. (1978). *NCR fundamental English dictionary*. Dayton, OH: NCR Corporation.
- Chomsky, N. (1969). *Aspects of the theory of syntax*. Cambridge, MA: MIT Press.
- Columbia University. (2001). Chinese language. In *The Columbia electronic encyclopedia* (6th ed.). New York: Columbia University Press. Retrieved December 6, 2005, from <http://www.bartleby.com/65/ch/Chinese.html>
- Computer Systems Policy Project. (1998). *The CSPP readiness guide*. Retrieved November 28, 2005, from <http://www.cspp.org/projects/readiness/23ques.htm>
- Crystal, D. (2003). *English as a global language* (2nd ed.). Cambridge, UK: Cambridge University Press.
- Eliot, T. S. (1952). Choruses from "The Rock." In *Complete poems and plays: 1909-1950*. New York: Harcourt, Brace & World, Inc.
- Federal Communications Commission. (2005, June 10). *Frequently asked questions (FAQs) about FCC form 477 (local telephone competition and broadband reporting)*. Retrieved October 2, 2005, from http://www.fcc.gov/broadband/broadband_data_faq.html
- Fogg, B. J., Soohoo, C., Danielson, D., Marable, L., Stanford, J., & Tauber, E. R. (2002, November 11). *How do people evaluate a Web site's credibility?* Stanford, CA: Persuasive Technology Lab, Stanford University.
- Global Reach. (2004, September 30). *Global Internet statistics: Sources & references*. Retrieved May 24, 2005, from <http://www.global-reach.biz/globstats/refs.php3>
- Gordon, R. G., Jr. (Ed.). (2005a). Chinese, Mandarin: A language of China. In *Ethnologue* (15th ed.). Retrieved December 6, 2005, from http://www.ethnologue.com/show_language.asp?code=cmn

- Gordon, R. G., Jr. (Ed.). (2005b). Indonesian: A language of Indonesia (Java and Bali). In *Ethnologue* (15th ed.). Retrieved December 6, 2005, from http://www.ethnologue.org/show_language.asp?code=ind
- Gordon, R. G., Jr. (Ed.). (2005c). Introduction to the printed volume. In *Ethnologue* (15th ed.). Retrieved December 6, 2005, from http://www.ethnologue.com/ethno_docs/introduction.asp
- Gordon, R. G., Jr. (Ed.). (2005d). Statistical summaries: Summary by language size. In *Ethnologue* (15th ed.). Retrieved May 23, 2005, from http://www.ethnologue.com/ethno_docs/distribution.asp?by=size
- Graddol, D. (2000). *The future of English?* (2nd ed.). London: The British Council.
- Grenier, L. (1998). *Working with indigenous knowledge: A guide for researchers*. Ottawa, Canada: International Development Research Centre.
- Half of all Chinese people can't speak Mandarin: Report. (2005, May 23). *Taipei Times*. Retrieved May 24, 2005, from <http://www.taipetimes.com>
- Hazan, M. (2002, March 25). *Virtual souk: E-commerce for unprivileged artisans*. Retrieved November 26, 2005, from <http://www.icconnect-online.org/Stories/Story.import5014>
- Hopkins, R., Jr. (2002). *Multilingual Websites: Benefits you can count on, headaches you can avoid*. Retrieved December 12, 2005, from http://www.weblations.com/eng/articles/art_2.htm
- International Institute for Communication and Development. (2003). *Welcome to ICT-stories*. Retrieved November 29, 2005, from <http://www.iicd.org/stories/lbd>
- International Telecommunication Union. (2003). *Technical notes*. Retrieved May 24, 2005, from http://www.itu.int/ITU-D/ict/statistics/WTI_2003.pdf
- International Telecommunication Union. (2005, April 26). *Economies by broadband penetration, 2004*. Retrieved May 24, 2005, from http://www.itu.int/ITU-D/ict/statistics/at_glance/top20_broad_2004.html
- Internet World Stats. (2005a, December 31). *Internet users by language*. Retrieved January 22, 2006, from <http://www.Internetworldstats.com/stats7.htm>
- Internet World Stats. (2005b). *Internet World Stats surfing and site guide*. Retrieved December 11, 2005, from <http://www.Internetworldstats.com/surfing.htm>
- Internet World Stats. (2005c, December 31). *World Internet users and population stats*. Retrieved January 22, 2006, from <http://www.Internetworldstats.com/stats.htm>
- Ipsos. (2005, March 2). *The majority of global Internet users using a high-speed connection*. Retrieved May 26, 2005, from <http://www.ipsos-na.com/news/pressrelease.cfm?id=2583>
- Jarboe, K. P. (2001, April). *Knowledge management as an economic development strategy*. Washington, DC: Economic Development Administration, U.S. Department of Commerce.
- Jupitermedia Corporation. (2001, December 3). What is garbage in, garbage out? In *Webopedia computer dictionary*. Retrieved October 7, 2005, from http://www.webopedia.com/TERM/g/garbage_in_garbage_out.html
- Kachru, B. (2005). *Asian Englishes: Beyond the canon*. Hong Kong, China: Hong Kong University Press.
- Lie, K. A. (2005). *The myth of Hinayana*. Retrieved November 3, 2005, from <http://www.lienet.no/hinayan1.htm>

- Liren, Z. (2002, September 12). *Distribution of the overseas Chinese population*. Retrieved January 15, 2006, from http://www.library.ohiou.edu/subjects/shao/databases_popdis.htm
- Localization Industry Standards Association, The. (2005). *Frequently asked questions about LISA and the localization industry*. Retrieved September 28, 2005, from <http://www.lisa.org/info/faqs.html>
- Lovgren, S. (2004, February 26). *English in decline as a first language, study says*. Retrieved May 23, 2005, from http://news.nationalgeographic.com/news/2004/02/0226_040226_language.html
- Mas i Hernández, J. (2003, September 2). *La salut del català a Internet*. Retrieved May 25, 2005, from <http://www.softcatala.org/articles/article26.htm>
- McAlpine, R. (2005). *Standards for online content authors*. Retrieved September 5, 2005, from http://www.webpagecontent.com/arc_archive/177/5/
- Nielsen, J. (1999). *Designing Web usability: The practice of simplicity*. Indianapolis, IN: New Riders.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford University Press.
- Polanyi, M. (1962). *Personal knowledge: Towards a post-critical philosophy*. Chicago: University of Chicago Press.
- Polanyi, M. (1966). *Tacit dimension*. Garden City, NY: Doubleday & Co.
- Romney, L. (2000, January 6). The cutting edge: Survey looks at online habits of U.S. Latinos. *Los Angeles Times*. Retrieved May 29, 2005, from <http://www.latimes.com>
- Seagrave, S. (1996). *Lords of the rim: The invisible empire of the overseas Chinese*. London: Transworld Publishers.
- Shin, H. (2003). *Language use and English-speaking ability: 2000* (Rep. No. C2KBR-29). Washington, DC: U.S. Census Bureau.
- Smith, L. (1992). Spread of English and issues of intelligibility. In B. Kachru (Ed.), *The other tongue: English across cultures* (2nd ed., pp. 75-90). Urbana: University of Illinois Press.
- Stiglitz, J. (1999, December). *Scan globally, reinvent locally: Knowledge infrastructure and the localization of knowledge*. Keynote Address at the First Global Development Network Conference, Bonn, Germany. Retrieved November 28, 2005, from <http://www.iucn.org/themes/ceesp/Publications/CMWG/Stiegliz-local-knowledge.PDF>
- Sveiby, K. (1997). *Tacit knowledge*. Retrieved October 1, 2005, from <http://www.sveiby.com/articles/Polanyi.html>
- Sveiby, K. (2001, April). *What is knowledge management?* Retrieved October 1, 2005, from <http://www.sveiby.com/articles/KnowledgeManagement.html>
- Waddell, S., & Allee, V. (2004, January 20). *Global action networks and the evolution of global public policy systems*. Paper presented at the International Conference on Systems Thinking in Management conducted at the University of Pennsylvania, Philadelphia. Retrieved November 20, 2005, from <http://www.gan-net.net/pdfs/ICSTM.pdf>
- Web Site Optimization. (2005, February 19). *January 2005 bandwidth report*. Retrieved December 11, 2005, from <http://www.Website-optimization.com/bw/0501/>

ENDNOTES

¹ The International Telecommunication Union (ITU, 2003) explains how the total number of Internet users is estimated: “Countries that do not have surveys generally base their estimates on derivations from reported Internet Service Provider subscriber counts, calculated by multiplying the number of subscribers by a multiplier” (p. 4).

ITU’s World Telecommunication Indicators database shows that these were some of the multipliers used in 2004: Myanmar 2; Argentina, Bahrain, Bangladesh 3; Nepal 4; El Salvador, Syria 5; Costa Rica 8; Latvia 9; Honduras 10; and Uganda 25 (E. Magpantay, personal communication, December 13, 2005). Other countries had more complex estimation methods, with the sharing factor sometimes varying even within a single city (E. de Argaez, personal communication, December 11, 2005).

The multiplier attempts to compensate for undercounting that results from several members of a household sharing a single Internet account. Internet World Stats (IWS, 2005b) reports various standards for tallying children, including “The ITU subscribes to the definition of an Internet user as someone aged 2 years old and above, who went online in the past 30 days” (Internet Usage section, para. 2).

However, the multiplier exacerbates overcounting that is related to an individual having more than one account (e.g., at work or school, as well as at home). Even so, the growing popularity of cyber cafes, which have extremely large ratios of users to accounts, probably outweighs the distortion that is due to multiplication of overcounts.

² Compare the estimated 750 million people who speak English as their first or second language (L1+L2) in Graddol’s (2000) report (p. 10, Figure 4) with the estimated

1,125 million who access Web pages in English more often than pages in other languages (Internet World Stats, 2005a). Internet World Stats assigns only one language to each person, based on the following method: “The keywords they search for determine the language they use to surf” (E. de Argaez, personal communication, January 22, 2006).

³ For most of the 21st century, South Korea has had the world’s highest proportion of Internet users who subscribe to broadband. According to ITU figures for the country, 11.9 million of 31.6 million Internet users subscribed, resulting in a penetration of less than 38% at the end of 2004 (W. Yasandikusuma, personal communication, May 27, 2005).

However, “broadband penetration” figures are calculated in different ways, showing perhaps the greatest variance of all Internet statistics. The term *broadband* is sometimes applied to speeds less than the ITU minimum of 256 kilobits per second in both directions (V. Gray, personal communication, May 26, 2005). For example, the Federal Communications Commission (FCC, 2005) of the United States defines *broadband* as a connection that “enables the end user to receive information from and/or send information to the Internet at information transfer rates exceeding 200 kilobits per second (kbps) in at least one direction” (question 5).

In addition, the term *penetration* is defined in several ways. Some surveys divide a country’s total number of broadband subscribers by the total number of inhabitants. Although the United States had the most broadband subscribers as of December 2004, the ITU (2005) ranked it only 16th globally on the basis of 11.4% penetration of its general population, compared to 24.9% for South Korea.

Other surveys divide the total number of households or users who have broadband capability installed (but might not actually subscribe) by the total number of “active Internet users.” For example, over 69.4 million American households had the capability as of December 2004, yielding a penetra-

tion of 54.7% for home users according to Web Site Optimization (WSO, 2005). The inflated WSO figure is exaggerated even more in the “Face of the Web 2004” study by Ipsos-Insight, which claims that 68% of the entire world “accessed” the Internet via broadband in October 2004 (Ipsos, 2005).

APPENDIX: SUGGESTED URLS

- http://www.12manage.com/methods_nonaka_seci.html (Tom De Geytere's summary of Nonaka and Takeuchi's SECI model, including a diagram of the knowledge spiral)
- <http://www.algworld.com/history.htm> (Automatic Language Growth and the work of J. Marvin Brown at AUA Language Center in Bangkok)
- http://www.anglistik.tu-bs.de/global-english/GE_Was_ist_GE.html (A list of links to online articles that use the term Global English)
- <http://www.globalenglish.info/globallyspeaking/index.htm> (Tips on intercultural communication in the Internet age)
- <http://www.globelanguage.com> (Translation company co-owned by George Fletcher)
- <http://www.ik-pages.net/about-ik.html> (List of indigenous knowledge characteristics)
- http://www.oecd.org/document/60/0,2340,en_2649_34225_2496764_1_1_1_1,00.html (Organization for Economic Co-operation and Development's broadband statistics for 2001-2004, based on ITU data)
- <http://www.pulpchat.com/faq/faq215.php> (List of chat room slang)
- <http://www.research-research.com> (Research & Research)
- <http://www.sveiby.com/articles/TacitTest.htm> (Karl-Erik Sveiby's hands-on exercise, "Test Your Tacit Knowledge")
- <http://www.useit.com> (Jakob Nielsen's Web site about usability)
- <http://www.world-ready.com/academic.htm> (A list of links offered by Nancy Hoft, a consultant in "world-readiness")

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 122-147, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.17

Deconstructing the South African Government's ICT for Development Discourse

Sagren Moodley

Human Sciences Research Council, South Africa

INTRODUCTION

The post-apartheid South African government has placed ICTs at the centre of the national agenda for social and economic development (Mbeki, 1996, 2002b; Presidential National Commission on the Information Society and Development (PNC on ISAD), 2003a). The question of whether the application of technologies to improve information and communication access can increase the capabilities of disadvantaged and poor people is central to whether the new ICTs (particularly the Internet) will support or undermine real development. Technology appears in the South African government's ICT for development discourse as a politically neutral force with the power to develop, and without which people are classified as *information-poor*. As Wajcman (2002) cogently argues, "governments everywhere legitimate much of their policy in terms of a technological imperative" (p. 348). One effect of this discourse

is to render poor people passive and dependent, as objects to be developed, rather than as active agents of development. Failure to address these assumptions may lead social scientists to become complacent in distracting attention away from the very *real* global economic, social, and cultural inequalities, to *virtual* inequalities, which merely hide an unwillingness to address the core failings of the development paradigm.

The paper attempts to meet the challenge put forth by Robert Wade (2002):

The current campaign to promote the uptake of information and communication technologies (ICTs) in developing countries and to get aid donors to redirect their aid budgets needs devil's advocates to challenge what John Stuart Mill once called 'the deep slumber of a decided opinion.' (p. 443)

BACKGROUND

The real test of the success of ICTs in development efforts is whether they ultimately contribute to reducing poverty and inequality, thereby improving the lives and livelihoods of the poor. Two important questions emerge from the debate: (1) Who will have access to ICTs and the networks formed? and (2) Who will have control not only of the technology and its application, but of data gathered and processed, and of information exchanged via different modes?

The paper makes the following assumptions: (1) technology is *socially shaped*; and (2) the direction and nature of technological development does not necessarily follow some inevitable trajectory, but rather is a component of a complex, multi-dimensional system of social, cultural, political, and economic change. Further, the paper is premised on the belief that: (1) technology, in and of itself, is neither positive nor negative (Kranzberg, 1985), what Heidegger (1977) refers to as “the ambiguous essence of technology” (p. 33); and (2) the deployment of ICTs is the consequence of human choices which are themselves constrained and shaped by social context. Simply put, ICTs are context-dependent (i.e., they are contingent on uses and applications in particular contexts).

Developing at the end of the 19th century in an era of rapid capitalist industrial expansion and the rise of powerfully intrusive states, Touraine (1988) maintains that the social sciences have been overly preoccupied with positivistic explanation and unduly shaped by an emphasis on order and control. This has left little room for human agency and on the individual actor in social science theories. To regain relevance and validity in the social sciences, Touraine (1988) urges social scientists to become *participant-observers*.

The author has been a participant-observer in numerous government ICT forums (e.g., the Government Information Technology Officers' Council (GITOC), the knowledge and information management (KIM) sub-committee, the Universal

Services Agency (U.S.), the Presidential National Commission on the Information Society and Development (PNC on ISAD), the Department of Communication's electronic commerce discussion process and various discussion colloquia on telecommunications, ICT convergence policy, etc). Collectively, these experiences have been a rich source of data gathering for the paper. By operating as a reflexive critic and a participant-observer, the researcher is well positioned to question the highly problematic set of assumptions underpinning the South African government's ICT for development discourse.

TECHNOLOGICAL DETERMINISM

The benefits of ICTs for the poor are seen as intuitively, self-evident, and universally valid by the South African government. It is clear that government has invested a great deal of faith in the power of ICTs to fast-track development (Matsese-Casaburri, 2002a, 2003; Zuma, 2002). The optimistic view of government focuses heavily on technology potential rather than on adapting appropriate information systems to meet the real needs of poor communities in different environments. Further, this rose-tinted view of technology fails to adequately deal with the constraints for accessing and applying ICTs by the poor. What is urgently needed is a more integrated framework for understanding both information and ICTs in relation to poverty alleviation and development.

The optimistic view of the South African government needs to be tempered in the light of evidence showing that learning is a critical feature of technological change (Bell & Pavitt, 1993; Giuliani & Bell, 2005; Lall, 1992). Further, the importance of ICTs for addressing the real information needs of the poor has tended to be overstated and there is a danger of the policy debate becoming too strongly focused around the capabilities of emerging technologies.

It would appear as if government is underplaying the constraints that make it difficult for the poor to access, assess, and apply information through ICTs. These include lack of human capabilities (i.e., literacy, English language skills, and technical computer competence); urban/rural inequities; gender inequalities; affordability; and lack of relevant information content. Further, it takes time for people to comprehend the potential benefits of ICT-mediated information, or to be willing to trust information that does not derive from personal networks.

The information needs of poor households, communities, and small-scale enterprises should be understood in advance of proposing ICT-based solutions. Significant “financial opportunity costs” for poverty alleviation strategies are likely to arise, since large amounts of limited resources are being diverted to poorly conceived ICT-related investments that might not have a direct impact on the needs of the poor. There is also the risk that introducing digital information systems may supplant existing systems that may be more appropriate and more cost effective in terms of access and coverage. Moreover, over-emphasis on technological solutions can have the effect of drawing attention away from the underlying causes of poverty such as inadequate health and educational facilities.

As part of an integrated development strategy, ICTs can contribute to socio-economic development, but investments in ICTs alone are not sufficient for development to occur. ICT applications are not sufficient to address problems of rural access without adherence to principles of integrated rural development. Unless there is minimal infrastructure development in transport, education, health and social and cultural facilities, it is unlikely that investments from ICTs alone will enable rural areas to cross the threshold from poverty to growth.

Government has over-enthusiastically embraced the application of ICTs to address the pressing needs of the poor (Fraser-Molekete, 2002;

Naidoo, 1998a-c). The major problem is that there is a widespread misunderstanding about how substantial benefits can be derived from ICTs for the poor. Persistent poverty, at both an individual and societal level, has deep and systemic roots. Chronic poverty, limited growth, and inequality are primarily the result of uneven access to material and financial resources.

The material deprivations of the poor are compounded by their lack of access to education, information, and knowledge; their lack of voice in the institutions and societal processes that shape their lives; and their inability to communicate effectively their needs, hopes, and expectations to those who have control over them. These deprivations are mirrored at the societal level by institutions and markets that function poorly, that are often unresponsive to the needs of the disadvantaged and disenfranchised, and that are all too frequently captured or are excessively influenced by economic, social, or cultural elites.

Government's discourse on ICTs for development is couched in the upbeat “we will all benefit from this” language (Mbeki, 1996, p. 1). There are times when it would seem as if government regards ICTs as the technical solution for poverty and underdevelopment (Mbeki, 2002a-b). The technological utopianism of government maintains that the digital world of the new ICTs holds the potential for breakthroughs in resolving the social problems of poverty and inequality in South Africa. The isolation of the poor can be ended and radical new approaches to poverty and social inequality can develop directly through the cyber-world (Ministry of Communications, 2001). The digital space holds potentials for conferring enormous economic benefits on society as a whole and its low-income segment in particular. It is for these reasons that government sees exclusion from the digital world as disastrous for those excluded.

There is a distinctive view in government that technology determines the nature of society (Matsepe-Casaburri, 2002b, 2003). ICTs have become

idolised as a force that can “fix” the economy, raise the general standard of living and human well-being in the country, and deliver on poverty alleviation (Zuma, 2002). For government, the transfer of technology to poor communities is seen as unproblematic (Universal Service Agency (U.S.), 2002). It is not realised that such a transfer would depend not merely on technical elements, but on social and cultural factors as well. Technology is seen as neutral, not as an instrument for the creation of cultural and social orders. The understanding of technology, as part of a wider socio-economic system, is particularly important when the technology is adapted within environments very different from those for which it was originally intended (Schumacher, 1973). When technology is transferred from one society to another, it reflects the social values, institutional forms, and culture of the transferring country.

Since the outcomes of ICTs are open-ended, we have no reason to expect the emerging socio-technical system built around ICTs to remedy social inequalities in our society or to relieve the plight of the poor, any more than other major socio-technical changes have had such effects in the recent past. The three previous “communication revolutions,” for example, have had significant impacts on society but failed to deliver the optimistic predictions first hoped for. The railway was believed to spark the *dictatorship of the proletariat*, the telegraph to engender world peace and the television to revolutionise education. It is highly unlikely then that ICT alone will end global poverty. In the long-term widespread adaptations to the new technological system will likely take place, just as broad social adaptations have been made to other socio-technological shifts (e.g., railways, automobiles, and electricity). But these adaptations are unlikely to remedy the fundamental, structurally based inequality between the poor and the well-to-do. Structural inequalities can be solved only by attacking them within the larger historical, cultural, and socio-economic matrix that generated them.

It would appear that the South African government is driven by a deterministic perspective on social development: technological innovations have a direct impact on social processes (PNC on ISAD, 2003a-b). This can be detected at all levels of discussion, both descriptive and predictive. There is no space for reflection on the myriad of complex ways in which technology and society are dialectically linked. The fact that technologies almost always have unintended and unplanned consequences is ignored. As much in its development as in its application and use, technology is intrinsically shaped by its economic, political and social environment (Williams & Edge, 1996).

There is a widespread approach in government that seems blinded by the “newness” and novelty of digital ICTs, and which, by emphasising the “revolutionary” character of the Internet and related technologies, tends to become (either deliberately or by negligence) ahistoric. To conceptualise technology and technological change outside of any social, economic, political, or cultural context can have several consequences. The first is that the approach becomes one of technological determinism, in which the technology is seen to act as an autonomous agent that has a direct effect on other social systems. Following MacKenzie (1984) and Winner (1993), Edge (1995) defines technological determinism as:

a belief... which holds that technical change is a prime cause of social change, and that technical innovations are themselves “uncaused”—in the sense that they arise only from the working out of an intrinsic, disembodied, impersonal ‘logic’, and not from any “social” influence. (p. 4, emphasis in original)

Such accounts ignore the social shaping of technology and the fact that technologies and social life are interconnected (Groper, 1996; Schmidt, 2001). These approaches disregard the political, social, and cultural processes that necessarily accompany the development of any technological innovation,

not least in the form of values, judgements and interests in operation that help structure Internet access and use (MacKenzie & Wajcman, 1999). Technological development comes to be seen as autonomous and self-generating. Technologies, however, are always situated within circuits of human action which provide their context and shape their direction.

THE “SOCIAL SHAPING OF TECHNOLOGY” APPROACH

Edge (1995) critiques traditional approaches to the social analysis of technical change, emphasising the extent to which such approaches “imply a *technological determinism*, use a simplified *linear model* of the innovation process, tend to treat the technology as a ‘black box,’ and are preoccupied with the ‘social impacts’ of a largely predetermined technical ‘trajectory’” (p. 14, emphasis in original). At a lecture entitled *The Question Concerning Technology*, delivered in 1955 in Germany, Martin Heidegger (1977) made the following prescient remark:

[W]e are delivered to [technology] in the worst possible way when we regard it as something neutral; for this conception of it, to which today we particularly like to do homage, makes us utterly blind to the essence of technology. (p. 4)

That said, we should not replace technological determinism with social determinism. The view we subscribe to is that the “social” and the “technological” cannot be separated. New technology is as much a social product as the shape of society is a technological product. There is a constant interplay between “technology” and “society” (Loader, 1998; Lyon, 1988, p. viii).

The technical attributes of the new ICTs increasingly dominate explanations of contemporary change and development. There is a discernible tendency to understand or conceptualise these

technologies in terms of technical properties and to construct the relation to the sociological world as one of applications and impacts. The challenge for social scientists is not so much to deny the weight of technology, but rather to develop analytic categories that allow us to capture the complex interweaving of technology and society.

It would appear that the “social shaping of technology” approach is beginning to take root in the social sciences (Klein & Kleinman, 2002; Kling, 2000; Pinch & Bijker, 1987; Rip, 1995; Sassen, 2002; Werle, 1998; Woolgar, 1991).

Following Heeks (2002), a reconceptualised “social shaping of technology” approach to ICTs is one which is:

- Centred on information rather than technology
- Integral to its environment
- Integrated with development objectives
- Indigenised

Such an approach potentially has the power to:

- Restore the agency of those rendered passive in the ICT for development arena
- Reorient technology to socially embedded, local uses
- Break down the binary of developed/underdeveloped, recognising poor people’s knowledge and experience, and so opening up the possibility that “we” can learn from and with “them”

It cannot be assumed that the ICT-based information system will be beneficial or harmful without understanding the local social dynamics and how the technology will be used. This is especially the case since communities are complex and dynamic. ICT will be best used where it is embedded in existing social relations, and where it serves to extend the capacity of people to perform tasks they would wish to do, *even in the*

absence of ICT. Moreover, from the literature on technology transfer (Archibugi & Michie, 1997; Archibugi & Pietrobelli, 2003), the role of local adaptive assimilation and learning is seen as key to successful implementation of technology in new settings. Learning, however, will not come about simply by local control of the technology. A level of technical competence and an understanding of the technology's potential are also required before local learning can take-off.

CONCLUSION

The post-apartheid South African government has embraced the ideology that ICT represents modernisation; and it is seen as a key technology for alleviating poverty. The theoretical heritage of this perspective is linked to the modernisation school, which assumes that social change is unidirectional, progressive, and moves society from industrial (or pre-industrial in the case of least developed countries) to post-industrial with modern ICT as the engine. In much of government technicist rhetoric we find an implicit belief in an unproblematic causal progression from ICT innovations to social change (Fraser-Moleketi, 2002). Technological complexities, complex social processes, and independent human agency are not seriously considered.

It seems that the South African government is attracted to the neutral, instrumental view of technology, which is why it builds an increasingly central role for it in its vision of an "information society." Government has taken the technological configuration of the new ICTs as a "given" or prefigured system that needs to become more widely diffused to citizens. Hence, government rhetoric forecloses an assessment of the need for greater variety in the deployment of ICT configurations. The challenge, however, is to reorient this technology to socially embedded and locally-led development that affirms and makes use of the

information, knowledge, and experience that poor people have.

There is clear evidence of technological determinism, which is steeped in a modernisation discourse arranged around political rhetoric and informed by a discursive power which rests on the universalisation of a particular, interpreted, theorised, and valorised regional (i.e., Western) experience. The imposition of policy legitimacy in terms of linking formalised systems of ideas with a recognised interpretation of a dominant Western experience formed within relations of power is set down in a hegemonic tradition (*pace* Gramsci, 1971) and widely accepted as proven and universally applicable.

By and large what emerges from a reading of government's ICT policy documents is a very optimistic view of the benefits to be harnessed from ICTs for poverty alleviation in South Africa.¹ This is surprising, given the recency of ICT developments and the paucity of solid empirical investigation of trends and impacts to date. Very little attention is paid to the costs, risks, and constraints that ICT diffusion is likely to entail. The fact that the poor face multiple barriers both to ICT utilisation and to benefiting from that utilisation, since they have little to spend on communication; live in areas where the Internet is costly and complex to provide; have low rates of education and speak languages that are not very well represented on the World Wide Web, tends to be played down in policy debates. At best, this selective reading of ICTs for development oversimplifies a complex reality; at worst it is likely to result in wasted resources, poorly thought-out projects, and unrealistic expectations.

ICT for development programmes have a better chance of success if the poor are seen as autonomous agents of action and if they define a social process of change in terms of the growing role of independent autonomous action on the part of dominated groups. Such an exercise will, of necessity, entail a *self-analysis* that requires the active participation of social actors engaged in a

collective struggle concerning political and social issues. It is imperative that we move away from the “heroic scenarios” and “intoxicating visions” (Bellamy & Taylor, 1998, p. 170) characterising much of government’s discourse on ICTs for development, and attempt to re-conceptualise the complex and multi-layered relationship between ICT, poverty, and development.

Contrary to the South African government, the key to integrating ICTs in the fight against poverty, then, is not to begin with ICTs, nor to posit them as an essential need. Rather it is to determine the impediments to poverty alleviation and to reducing inequality in society and, thereafter, to ascertain the information, communication and knowledge components of these impediments. In the light of this, the task is to: (1) assess, on the basis of global experience, how ICTs, broadly deployed and properly adapted, could help address these impediments; and (2) to develop and implement a strategy for encouraging and supporting the deployment of ICTs, in support of, and subordinate to, a national poverty-reduction strategy.

Government needs to move away from analytical perspectives that are techno-centric and determinist, that focus on historical discontinuity (i.e., the “information revolution”), and that make unwarranted claims about the future impact of ICTs on the lives of the poor. Much more useful is the “social shaping of technology” approach, which puts the dynamic interaction between social forces and technological innovation into the forefront. This approach calls for proactive policy-making, since it stresses the imperative that *the technological solutions must be shaped to match the vision of a preferred future*. ICTs will not by themselves change existing institutional settings. The use of ICTs within the conventional social and institutional framework not only hampers these technologies full potential, but may also cause many frustrating social problems.

REFERENCES

- Archibugi, D., & Michie, J. (1997). *Technology, globalisation, and economic performance*. Cambridge, UK: Cambridge University Press.
- Archibugi, D., & Pietrobelli, C. (2003). The globalisation of technology and its implications for developing countries: Windows of opportunity or further burden? *Technological Forecasting & Social Change*, 70(9), 861-883.
- Bell, M., & Pavitt, K. (1993). Technological accumulation and industrial growth: Contrasts between developed and developing countries. *Industrial and Corporate Change*, 2(2), 157-210.
- Bellamy, C., & Taylor, J. A. (1998). *Governing in the information age*. Buckingham, UK: Open University Press.
- Centre for Public Service Innovation (CPSI), Department of Public Service and Administration (DPSA) & the State Information Technology Agency (SITA). (2003). “Services to citizens”—*The access to services strategy for the e-government gateway*. Pretoria: CPSI, DPSA & SITA.
- Edge, D. (1995). The social shaping on technology. In N. Heap, R. Thomas, G. Einon, R. Mason, & H. Mackay (Eds.), *Information technology and society: A reader*. London: Cromwell Press.
- Fraser-Moleketi, G. (2002, October 28). *Address by the Minister of Public Service and Administration at the E-Africa Regional Conference*, Gauteng. Retrieved May 5, 2003, from <http://www.polity.org.za>
- Gramsci, A. (1971). *Selections from prison notebooks*. New York: International Publications.
- Groper, R. (1996). Electronic mail and the reinvigoration of American democracy. *Social Science Computer Review*, 14(2), 157-168.
- Giuliani, E., & Bell, M. (2005). The micro-determinants of meso-level learning and innovation:

- Evidence from a Chilean wine cluster. *Research Policy*, 34(1), 47-68.
- Heeks, R. (2002). I-development not e-development. *Journal of International Development*, 14, 1-11.
- Heidegger, M. (1977). *The question concerning technology and other essays*. New York: Harper & Row.
- Klein, H. K., & Kleinman, D. L. (2002). The social construction of technology: Structural considerations. *Science, Technology & Human Values*, 27(1), 28-52.
- Kling, R. (2000). Learning about information technologies and social change: the contribution of social informatics. *The Information Society*, 16, 217-232.
- Kranzberg, M. (1985). The information age: Evolution or revolution. In B. R. Guile (Ed.), *Information, technologies, and social transformation*. Washington, DC: National Academy of Engineering.
- Lall, S. (1992). Technological capabilities and industrialisation. *World Development*, 20, 165-186.
- Loader, B. (1998). *Cyberspace divide: Equality, agency, and policy in the information society*. London: Routledge.
- Lyon, D. (1988). *The information society: Issues and illusions*. Cambridge: Polity.
- Mackenzie, D. (1984). Marx and the machine. *Technology and Culture*, 25, 473-502.
- Mackenzie, D., & Wajcman, J. (1999). *The social shaping of technology*. Philadelphia, PA: Open University Press.
- Matsepe-Casaburri, I. (2002a). *Speech by the Minister of Communications on the Electronic Communication and Transactions Bill, NCOP*, 25th June. Retrieved February 27, 2003, from <http://www.doc.gov.za>
- Matsepe-Casaburri, I. (2002b, June 7). *Speech by the Minister of Communications on the second tabling of the Electronic Communication and Transactions Bill*, National Assembly. Retrieved February 27, 2003, from <http://www.doc.gov.za>
- Matsepe-Casaburri, I. (2003, March 10-11). *Address by the Minister of Communications at the SADC Communications Investment Forum's Session on SADC Economic Growth Through Regional Integration*, Maputo. Retrieved May 5, 2003, from <http://www.polity.org.za>
- Mbeki, T. (1996, May 13). *Opening address by the Executive Deputy President to the Information Society and Development (ISAD) Conference*, Gallagher Estate, Midrand. Retrieved May 5, 2003, from <http://www.pnc.gov.za>
- Mbeki, T. (2002a, September 30). *Address by the President of South Africa at the SAP SA's Sapila Conference banquet*, Sun City. Retrieved May 5, 2003, from <http://www.polity.org.za>
- Mbeki, T. (2002b, February 8). *State of the Nation address to the joint sitting of the Houses of Parliament*, Cape Town. Retrieved May 5, 2003, from <http://www.polity.org.za>
- Ministry of Communications (2001, October 21). *Advisory Council on Information Society and Development*. Retrieved on May 5, 2003, from <http://www.polity.org.za>
- Naidoo, J. (1998a, May 23). *Speech by the Minister for Posts, Telecommunications and Broadcasting at the launch of the Digital Enhanced Cordless Telecommunications (DECT) Network*. Retrieved February 27, 2003, from <http://www.doc.gov.za>
- Naidoo, J. (1998b, October 8). *Speech by the Minister for Posts, Telecommunications and Broadcasting at the OECD Conference on Electronic Commerce*. Retrieved February 27, 2003, from <http://www.doc.gov.za>

Naidoo, J. (1998c, November 13). *Speech by the Minister for Posts, Telecommunications and Broadcasting at the launch of the Centre of Excellence in Rural Communications*. Retrieved February 27, 2003, from <http://www.doc.gov.za>

Pinch, T., & Bijker, W. (1987). The social construction of facts and artefacts: Or how the sociology of science and the sociology of technology might benefit each other. In W. Bijker, T. Hughes, & T. Pinch (Eds.), *The social construction of technological systems: New directions in the sociology and history of technology*. Cambridge, MA: MIT Press.

Presidential National Commission on Information Society and Development (PNC on ISAD). (2003a). *Accelerating development with ICTs*. Pretoria: PNC on ISAD.

Presidential National Commission on Information Society and Development (PNC on ISAD). (2003b). *PNC on ISAD Home Page*. Retrieved March 10, 2003 from <http://www.pnc.gov.za>

Rip, A. (1995). Introduction of new technology: Making use of recent insights from sociology and economics of technology. *Technology Analysis & Strategic Management*, 7(4), 417-431.

Sassen, S. (2002). Towards a sociology of information technology. *Current Sociology*, 50(3), 365-388.

Schmidt, J. (2001). Editor's introduction: Community networking: Mapping the electronic commons. *Journal of Communications*, 11(2), 1.

Schumacher, E. F. (1973). *Small is beautiful: Economics as if people mattered*. New York: Harper & Row.

Touraine, A. (1988). *Return of the actor: Social theory in postindustrial society*. Minnesota: University of Minnesota Press.

Universal Service Agency (USA). (2002). *Annual Report 2001/2*. Pretoria: USA.

Wade, R. (2002). Bridging the digital divide: New route to development or new form of dependency? *Global Governance*, 8, 443-466.

Wajcman, J. (2002). Addressing technological change: The challenge to social theory. *Current Sociology*, 50(3), 347-363.

Werle, R. (1998). An institutional approach to technology. *Science Studies*, 11(1), 3-18.

Williams, R., & Edge, D. (1996). The social shaping of technology. In W. H. Dutton (Ed.), *Information and communication technologies: Visions and realities*. Oxford, UK: Oxford University Press.

Winner, L. (1993). Upon opening the black box and finding it empty: Social constructivism and the philosophy of technology. *Science, Technology & Human Values*, 18(3), 362-378.

Woolgar, S. (1991). The turn to technology in social studies of science. *Science, Technology & Human Values*, 16(1), 20-50.

Zuma, J. (2002, May 17). *Address at the World Telecommunications Day celebrations*. KwaZulu-Natal. Retrieved May 5, 2003, from <http://www.polity.org.za>

KEY TERMS

Dictatorship of the Proletariat: In Marxist theory the dictatorship of the proletariat refers to the ideal of proletarian supremacy following the overthrow of capitalism and preceding the classless state.

Discourses: The public or outward expression of (usually) unstated or implied ideological positions. Discourses connote values and these values are often assumed to reflect general endorsement. It is characteristic of discourses that they occur as self-evident truths or facts and therefore act to occlude oppositional or resistant discourses.

Information and Communication Technologies (ICTs): Reflects the technological convergence between digital computing, telecommunications, and broadcasting. Whereas computers were largely focused on the processing of information, ICTs undertake *both* processing and communication of information.

Information Revolution: Underscores a notion of historical discontinuity. The emphasis on historical discontinuity runs the danger of underestimating the continuities involved in the process, as much in the technological innovations as such as in their adaptation in the economic, social, and political contexts. Further, the term “information revolution” tends to imply that the technological discontinuity goes hand in hand with a revolutionary discontinuity in social and political relations. The empirical evidence does not live up to the proclaimed epochal dimensions of change. This then raises the question of what should change, thus opening up a wide field for ideological preferences of all sorts.

Information Society: Though as a heuristic device, the term information society has some value in exploring features of the contemporary world, it is far too inexact to be acceptable as a definitive term. In fact, the further one moves from grand national ICT plans and from futuristic forecasts of conditions prevailing within the information society, and the nearer one gets to actual social analysis in which technology is not perceived as a quasi-autonomous force acting upon society, the more questionable the concept of an information society appears.

Social Shaping of Technology: Technical change is no longer seen as autonomous or external to society, but as influenced and shaped by its societal context. Technology is inflected by the values, cultures, power systems, and institutional orders within which it is embedded. Thus, the social

shaping of technology approach serves as a needed corrective to technological determinism.

Technological Convergence: ICTs are based on a long list of technological innovations and evolutions that took place earlier. Effectively, ICTs are characterised by a complex process of technological convergence between microelectronics, telecommunications, computing, and broadcasting. Thus, there is no single historical moment that can be named as its starting point

Technological Determinism: The notion that technological development is autonomous of society; it shapes society, but is not reciprocally influenced. In more extreme varieties of technological determinism, the technology is seen as the most significant determinant of the nature of a society. The reality, of course, is that technologies do not, in practice, follow some predetermined course of development. Also, although technologies clearly have impacts, the nature of these is not built into the technology itself, but varies from one culture to another, depending on a broad range of social, political, and economic factors.

ENDNOTE

- ¹ Government sees an array of positive developments emerging from the information society, with increased productivity and better quality employment, decentralised and increased access to political decision-making and potential for e-government and e-commerce to improve the lives of the poor (Centre for Public Service Innovation [CPSI], Department of Public Service and Administration [DPSA] & The State Information Technology Agency [SITA], 2003).

Chapter 2.18

E Bario Project¹: In Search of a Methodology to Provide Access to Information Communication Technologies for Rural Communities in Malaysia

Poline Bala

Universiti Malaysia Sarawak, Malaysia

Roger W. Harris

City University of Hong Kong, Hong Kong

Peter Songan

Universiti Malaysia Sarawak, Malaysia

ABSTRACT

This chapter highlights an initiative by a group of researchers² from Universiti Malaysia Sarawak (UNIMAS) to connect villagers in the remote and isolated village of Bario to Information Communication Technologies (ICTs), which include computers, telephones, the Internet, and VSATs. This project has eased the information flow in and out of Bario, affecting the well-being of the people by providing a means to keep in touch with friends and relatives in urban areas. The response of the Bario community has been positive, but the objective of the e Bario project is more ambitious than to just provide access to the Internet, com-

puters and other related technologies. The main objective is to identify opportunities for remote and rural communities in Sarawak to develop socially, culturally and economically from the deployment of the technologies. The results of the initiative are expected to demonstrate the many ways in which ICTs can be used to improve the lives of marginalized groups, specifically, here, the rural and remote communities in Malaysia. However, to ensure that the objectives will ultimately be met, the team has had to search for an appropriate methodology that will ensure the full benefits of the initiative to the community. This chapter describes and discusses the approaches adopted, emphasizing the benefits of

a close association between the researchers and the community as well as the adoption of suitable participatory methods for engaging with the needs and opportunities that were discovered.

BACKGROUND

The imbalance of access to Information Communication Technologies (ICTs) is claimed to be linked to other forms of poverty and inequality. Drastic efforts are necessary to provide rural communities with access to computer mediated information and communication services or facilities³. This is particularly significant, as ICTs are widely accepted as new social and economic forces in the world economy today. In fact, some scholars (for example, Barr, 1998) suggest that a close correlation exists between telecommunication and economic development, whereby efficient telecommunication facilities foster economic development. As such, telecommunication access for remote and rural communities is now generally accepted as an appropriate goal to foster economic development in developing countries (Barr, 1998). And, especially for rural areas, advanced telecommunication access is expected to not only provide opportunities and means for rural communities to have access to the same services as urban areas in the field of business, but holds a promise to promote their social, economic and cultural conditions (Enberg, 1998).

Furthermore, it is thought that the remoteness and isolation of rural areas should be compensated by efficient telecommunication services. In this context, the rural populations need information and communication facilities as much as, if not even more than, densely populated urban communities. In fact, it is argued to be crucial for the betterment of life in rural areas where getting connected can mean so much. The ICTs can provide opportunities to obtain a wider range of information that can be useful to make better and more informed decisions (Paisley & Richardson,

1998). Besides providing access to sources for health and other categories of information, these technologies are an important means to keep in touch with distant friends and relatives. Fortunately, today, provision of this access is eased by advances in networking technologies that can enable rural communities to have the same benefits of connectivity as urban people.

However, the greater challenge for any initiatives to provide access to ICTs for rural communities is to ensure that “these services are efficiently and effectively deployed in these areas” (Barr, 1998). This is a great challenge, judging from past experiences with earlier technologies where their application in certain areas generated not merely disappointment, but even negative consequences. In a sense, technologies just by themselves do not guarantee benefits for the local people. As such, the challenge is to ensure not only the success of the technology itself (meaning that the technology runs and functions well), but also that the people benefit from its application. And, how do we ensure that there are benefits to the people? This is a question that the team continues to grapple with as we labor through the e Bario project.

THE CONTEXT

The e Bario project was described as “one of the most notable of Malaysia’s Internet development initiatives” by the International Telecommunications Union (ITU, 1998). The project was initiated at the same time that the Malaysian Government aggressively adopted ICTs for national development in its quest for a future knowledge-rich society⁴. In fact, ICTs form an important component of national development policies and the aspiration to be a fully developed nation by the year 2020 (Mahathir, 1991). This is significant for developing countries like Malaysia since the world is seen to be moving into an information age where wealth creation and accumulation are increasingly dependent on high technology for

the exchange of data, information and knowledge (Omar Abdul Rahman, 1993).

Like many other developing countries, Malaysia has large areas with undeveloped infrastructure and a widely scattered population. These can be enormous challenges for using ICTs for development, and especially for Sarawak, Malaysia's largest state. About 60% of Sarawak's total population of 2.027 million people live in rural areas. Many have no access to good roads and have access to only meagre; or worse still, have no access to telecommunication services⁵. The absence, in most rural areas, of an infrastructure includes the lack of both telephone lines and of a non-24 hours continuous supply of electricity. These deficits pose challenges for any ICT initiative in rural areas and remote communities of Sarawak.

Conscious of these challenges, the group of researchers took an ambitious step to begin with Bario, due to it being so highly isolated and remote⁶. Bario therefore exemplified the disconnected portion of the digital divide, and presented a challenging environment in which to test the idea of rural Internet connectivity in Malaysia. The team had to deal with many technical constraints including establishing an effective means of telecommunication with no telephone lines available, finding an appropriate and continuous source of electricity and determining a network configuration that is supported by other forms of power supply and via satellite.

But more challenging is to ensure that the rural communities will benefit. The team was made aware that this requires a shift in outlook from looking at technology to looking at people. The focus has to be on the people and on the process rather than on the technologies themselves (Anderson, 1998; FAO, 1998). The focus must place equal importance on understanding the context of the social, economic and political systems of the community in which the technology will be deployed, and the technology (Garcia & Gorenflo, 1998). This stems from the belief that a clear understanding of local communication patterns

and processes can ensure appropriate applications of technologies and content to the local situation. This is crucial since the success of the ICT's application largely depends on its integration with the local communication networks (Anderson, 1998).

Bearing this in mind, the team adopted the Participatory Action Research (PAR) model⁷ as the research methodology, in that it was deemed necessary that:

- The researchers should learn about life in Bario from the community;
- The community should learn about ICTs from the researchers;
- Community members should perform major portions of the research;
- The researchers should be able to identify with the community;
- As a team, the community-researchers should be capable of critically reflecting upon iterative cycles of action in order to achieve mutually beneficial outcomes from the project;
- Useful information systems will be embedded in the needs of the community;
- Specific actions are required by both the researchers and the community in order to articulate those needs;
- Methodologies for designing and implementing useful information systems will emerge from participatory action-oriented research activities; and,
- Data would be obtained using a combination of surveys, direct interviews, workshops and discussion groups.

Within the PAR framework, the researchers have engaged community members directly in the process; for instance, to conduct surveys, perform interviews and focus group meetings, and have held community gatherings for decision-making and to direct the conduct of the research. A system of close consultation between the project team and the rural users has been developed so that

their needs are realistically assessed. A survey was conducted of 140 (out of 242 households in Barrio) household heads to get indicators of the levels of literacy and education, and of the state of the telecommunication infrastructure.

Learning from others, like Richardson (1998) and Anderson (1998), the team adopted the idea of analyzing the needs of the people in rural communities. Firstly, a questionnaire was circulated that listed types of information that had been found to be of interest in other rural communities (Hudson, 2001). The questionnaires were completed by enumerators in interviews with heads of households. The enumerators were drawn from the Barrio community. Respondents were asked to indicate their level of interest for each type of information, the extent to which they currently received such information and the level of interest in receiving more of each type of information. Additionally, information was obtained regarding their existing communication patterns.⁸ This effort has helped to identify opportunities, for example information provision and training opportunities (skills and knowledge) that exist within the community, and this was used to inform the selection of content and hence the technology to deliver the content. Information gaps and skill gaps were revealed by integrating information delivery opportunities with an understanding of existing communication patterns and channels of information flow, and by knowing the profile of potential users of the technology and their awareness perceptions, attitudes, and usage of technology.

The Barrio community today consists of 78% Kelabit, with the others being Penan, Kenyah, Bidayuh, and Malays (11.5%), Chinese (1.6%) and some Indonesian immigrants (8%). Within the past 30 years, many Kelabit have moved away to pursue further education and obtain better job opportunities. Today, there are only about a thousand out of approximately 5,000 Kelabit who remain in the Highlands. Until recently this has been the elderly and the very young.

As a result of their diaspora, there has been a

need to bridge distances between the Kelabit in the Highlands and those living outside. This was helped initially with the construction of airstrips, and especially by the new concrete airstrip which was completed in 1996. This eased the movement of people in and out of the Highlands. Until recently, for many people in the Highlands, the airport is their closest link to the outside world (Bala, 2002). As people move in and out of the Highlands, the travelling Highlands residents, as well as outside visitors, become important sources of information.

Results from the survey suggest that the community is highly interested in IT, about which approximately 90% of respondents said they would like to receive a lot of information, although the majority (99%) of the respondents had not heard of the Internet. The significance of this emerges from the context that even though many have heard about (81%) and seen (74%) a computer, about 91% have never used one. A few have used a computer, but mainly for word processing (7%), and less than 1.5% have surfed the WWW. The data revealed that almost nobody receives any information about agricultural practices whereas around 90% of respondents would like to receive a lot of information about them, and 68% of respondents currently receive no information about information technology but about 98% would like to receive a lot. Delivering more information about information technology would appear then as potentially more popular than delivering more information about agricultural practices (Harris et al., 2000). Information about information technology appears to be the largest information gap, in terms of the amount of information and the number of people with interest, that was identified from the survey.

DISCUSSION

From this, the researchers concluded that the Barrio community has shown a progressive

readiness and enthusiasm for technology-induced improvements in their communication resources. From one perspective, it can be argued that the Internet represents a logical extension of a trend towards technology that the Bario community has experienced in the development of its communications capability. This is further strengthened by the community's willingness to take risks and embrace new learning experiences. This is evident from Pemanca Ngimet Ayu's (the Paramount Chief of the Community) comment when addressing the council of elders on the intent of the project. He said,

“Kira-kira 30 laak nuk puun malem, edtah enu beruh mediting ngen tauh iah ineh enu Kristen – tauh maya’ Tuhan Alla. Lun Merar tauh dih pelaba doopian la’ maya enu beruh sineh kadikuh idih mare ulun doo ngen tauh. Perapu ngen ineh medting meto’ sekulah dih. Sineh peh pelaba the useb tauh la ngalap sekulah dih kadikun tauh kekali, sekuleh ineh teh kereb ngiuk anak tauh dih lem ulun dedih. Kadi’ neh tauh perihda’at mated anak tauh dih me sekulah. Edto kinih mula’ anak tauh nuk doo ileh dih. Mula ideh uwan kerja dita. Kinih nih neh edtah teknologi beruh medting. Doo tauh terima idih, ni’er kepah tauh kareb pakai idih, paad tauh na’am ketedtan let ngen lun mula’ dih.”

(About 30 years ago Christianity, a new faith came to us which is Christianity — we are following the Lord. Our parents were very excited to embrace the new faith because it gave us good life. With the new faith, the school also came to us. We were also very excited to embrace the school because we foresaw that the school could help our children. Therefore we sacrificed to send our children to school. Today many of our children are doing in school. In fact, many nowadays are in high positions. Again, today a new technology has arrived in our midst. Let’s embrace it and see how we can use it in order not to be left by the rest of the societies.” Their capacity to take risks

is prevalent in their history as a people, such as when today’s Kelabit forefathers embraced formal education and Christianity about 30 years ago in view of the potential benefits they had to offer) (Harris, R.W. et al., 2001).

Today, the Kelabit see the opportunities provided by the ICTs as a new tool to empower them with information that can allow them to compete in the world, or at least be electronically connected with each other and the rest of the world⁹. This is obvious from a statement made by one of the respondents. He said, “...we cannot not try this technology. We need to be part of the change that is taking place, otherwise we will be lagging behind technologically, and continue to find it difficult to communicate with the rest of the world.”

Emerging from the focus group discussions, interviews and survey, the community and the research team were able to develop a joint research and development agenda that represents a prioritised set of information provision objectives that each supports a community development endeavour. We have adopted the following definition of community development developed by the United Nations: “Community development is the process by which the efforts of the people themselves are united with those of governmental authorities to improve the economic, social, and cultural conditions of communities and to enable them to contribute fully to national progress. This complex process is made up of two essential elements: the participation by the people themselves in efforts to improve their level of living, with as much reliance as possible on their own initiative; and the provision of technical and other services in ways that encourage initiative, self-help and cooperation” (Silverman, Anglin, & Sangha, 2001).

One event had a significant contribution to the development of the agenda. It took the form of a two-day symposium to which members of the Bario community were invited, along with influential members of the Kelabit diaspora living

elsewhere in Sarawak. Several members of the Kelabit people who had moved from the Highlands to the towns for education and employment retain strong links to their families in and around Bario and carry some degree of influence in decision making relating to local development. As many are highly educated and occupy senior management, professional and administrative positions in Sarawak society, they are well placed to advise the local community and the project team with regard to making effective use of ICTs in Bario. The two day symposium took the following format:

- Presentations on similar projects elsewhere;
- Outline of the research findings to date with regard to information channels and desires in Bario;
- Discussion on information opportunities so far identified;
- Consensus drawn on potential information areas;
- Break-out groups for each information area to expand with more detail, assign responsibilities and propose activities;
- Plenary presentations from each group for community consensus building and allocation of priorities for development activities and associated information provision.

The research and development agenda is shown in the Appendix, and it relates to information delivery that supports education, culture, commerce, agriculture, health, community, technology and human resource development. Each of these proposals was arrived at in a participatory style, in joint consultation with the researchers facilitating the community to develop these agendas themselves. This indicates a number of opportunities and potential applications of ICTs for the Bario community. As an example of actioning one of the identified areas, the team is now implementing a scheme for e-commerce in support of community-based tourism in Bario. The intention is to raise local incomes by using

the telecenter and the Internet for the promotion and sale of tourism in the Kelabit Highlands to overseas markets. Community-based tourism involves local communities in the management and provision of tourism products and ensures they derive reasonable financial returns whilst preserving the natural physical and cultural assets that they value. Operating tourism as a form of e-commerce disintermediates the tourism value chain and directs a higher proportion of incomes to product and service providers at the point of delivery.

Before the opportunities for development in the research agenda can become viable, there are issues specific¹⁰ to Bario that need to be solved. These issues were identified through the survey and interviews conducted and they include:

1. Literacy Level

About 87.9% of the respondents are able to write, although in Kelabit. All the respondents speak Kelabit, while 91.4% speak Malay, but only 75.7% can write in Malay. About 37.1% can speak English, although only 35% can write in English. Other languages spoken and written are Iban, Penan, Murut and Bidayuh. The language of the Internet is largely English, with as many as 65% of the Malaysian sites being written in English. This presents a challenge to the attempt to build local capacity through the implementation of ICTs.

2. Computer Literacy

Education-wise, most (30.7%) of the respondents have completed upper secondary education, 20.7% completed lower secondary school, 19% received primary school education, 0.7% received tertiary education, while the remaining (28.6%) never went to school. From these figures, it can be seen that while a majority of the people completed a basic level of education, it is an insufficient preparation for conducting an electronic business. However, as many computer experts are self-trained, a higher level of educa-

tion is not necessarily needed to become literate in computer use.

3. Management Capability

In fact, there are not enough people in Bario who have the necessary skills needed to keep up the basic maintenance of a computer system. This is mainly because anyone with a sufficient degree of education has moved away from Bario for higher paying jobs outside. This exodus of skilled personnel has left Bario without the necessary man or womanpower to engage in the application of the technologies. In order for ICTs to be successful, an extensive training in management will be needed.

Despite these challenges, especially the low level of literacy and computer awareness, the team found that the progressive readiness and enthusiasm of the Bario community for technology-induced improvements in their communication resources were favorable indicators for a systematic introduction to ICTs. Members of the community are capable not only of learning new knowledge, skills, ideas and roles, but also have the capacity to integrate new knowledge with their existing knowledge and build something permanent and of value upon this base. The team's experience suggests that technology cannot function successfully without the community's aspirations and readiness to improve its own well-being. When a community has aspirations, whether economic or cultural, most likely members will be willing to learn new skills, ideas and roles. The Bario community has done just this with embracing formal education, and is confident it will do the same with ICTs. The willingness of the Bario community to participate in the project, fundamentally, is one reason why Bario was chosen for the initiative.

In fact, it has been the close working organisation of the multi-discipline project team and the harmonious relationships it has had with the Bario community that facilitated progress

towards the project's goals. And this was made possible by the participatory approach that was adopted, which helped to facilitate flexibility and adaptability among both the community and the implementation team, contributing, it is argued, to the prospects of sustainability. In addition, the Participatory Rural Appraisal (PRA) techniques were found to offer helpful insights in identifying the potential role of information in community development (Chambers, 1997). It encouraged the team to anticipate what it found: that development solutions and their applicability to their local context would be highly specific, localised, contextual, complex, diverse, dynamic and unpredictable.

Bearing this in mind, the team embraced new methods of working, and flexible approaches that could help in the application of ICTs to improve rural life in Sarawak. Some of these are non-ICT related activities, but can provide guidance that is more useful than was initially expected. Some of these approaches include:

- Acknowledging anthropological and ethnographical contributions to Informatics;
- Designing information systems that are appropriate to community-bounded, as opposed to business-bounded, contexts;
- Adopting social analysis that is appropriate for loosely organised communities, as opposed to tightly organised hierarchical organisations;
- Cultivating sensitivity to the cultural contexts and variations of technology deployments;
- Aggressive focus on those social impacts of technology that can generate community empowerment.

This differs greatly from common approaches to the implementation of information systems within organisations, known as systems design and analysis, which often failed to render effective guidance for the identification of the community's information needs. Additionally, the

team concluded that pre-and post-implementation measures based on quantification of benefits, which is a common form of ICT impact assessment, would fail to capture the full effects of the technology in the setting under study. All these require institutional adaptability, co-ordination of multiple agencies, aggressive focussing on targets, balancing of multiple viewpoints and skilful management of relationships.

CONCLUSIONS

This experience indicates that application of ICT-based development efforts at community levels demands new skills and approaches from a variety of professions, some of which challenge traditional practices in several disciplines. As project implementers and promoters, the team encountered a huge range of skills, disciplines and professions during its regular operations. Besides having to adopt multiple roles in advancing the aims of the project (for instance, handling transportation of equipment, power supply, and language, accommodation of people and equipment, and familiarisation of beneficiaries), members had to be capable of associating and dealing with illiterate farmers, local administrators, technicians, small businessmen, officials, local and national community representatives, senior government officers and government ministers. Since the information solutions span education, health, commerce, agriculture and culture as well as communications, there is no single agency that carries responsibility or authority for community development by means of ICTs. Instead, a range of agencies needs to be mobilised and co-ordinated for full benefits to flow to the community.

Considering how the e Bario project is progressing, it is obvious that successful implementations of rural ICTs within contexts similar to Bario remain challenging and highly experimental. Nothing like it had been known to exist in Malaysia; therefore the participants had few

yardsticks against which to measure or compare their activities. Replicated implementations by government or other agencies will undoubtedly encounter a similar set of challenges that will have to be overcome in order to achieve desirable results.

The experiences gained by the team seem to offer methodological guidance for future professional practice. In the first place, community empowerment by means of information is unlikely to emerge as a result of merely implementing technology. Participatory forms of analysis in which community aspirations and development activities are moulded and tracked in a cyclic manner are more likely to achieve desirable results than are technology implementations that are predicated on fixed expectations and inflexible assumptions of what outcomes should look like. Secondly, this finding has implications for post-intervention evaluation. If assessments are based on predicted outcomes, and much of the outcome is not predicted, then the assessments will be clouded and the value of real benefits underestimated. These lessons will be usefully carried forward into wider scale implementations by no longer needing the intensive research attention given to the e Bario project. Simple to use and replicable methodologies thereby contribute to accelerated technology diffusion, allowing larger numbers of people to enjoy the benefits of access to ICTs.

ENDNOTES

- ¹ The e Bario project is coordinated by Universiti Malaysia Sarawak (UNIMAS) and is financially supported by the Demonstrator Application Grant Scheme (DAGS) and Canada's International Development Research Centre (IDRC).
- ² The team is highly inter-disciplinary, and includes researchers with backgrounds in Information Systems, Anthropology, Cognitive Science, Community Development,

Education, Electrical Engineering and the like. Members include Prof. Khairuddin Ab Hamid, Associate Prof. Dr. Peter Songan, Dr. Alvin Yeo Wee, Mr. Al Khalid Othman, Dr. Ngu Bing Hiong, Soubakeavathi Rethinasamy, Jayapragas Gnaniah, Noor Shah Mohd Salleh, Dr. Roger Harris, Elaine Khoo Guat Lien, Ms. Poline Bala and Jacqueline Bulan (Research Assistant).

³ This discrepancy, often known as “digital gap” or “information gap”, can exist between the rich and the poor, between developed and developing nations, and also between urban and rural populations. According to Hudson (1998), the latter is far more significant since about 80% of the population in the poorest countries live in rural areas. Moreover, most telecommunication infrastructures in developing countries are found in the larger cities and are almost non-existent in rural and remote areas.

⁴ During the period of the project, the government has been promoting the advantages of the “K-economy” in which dependence on physical resources will give way to the exploitation of knowledge resources in the future development of the economy. Dr. Mahathir Mohammad says, “In our pursuits towards developing the K-economy, knowledge has to replace labour and capital as the key factors of production in our economy. The challenge for Malaysia is to develop this knowledge amongst our citizens so that our success will be due to the contributions of Malaysian talents and knowledge workers” (NST, April 4, 2001).

⁵ It is estimated that the distribution of telephones throughout the state is in the ratio of seven phones for 100 people. The number is expected to increase to 15 phones for the same number of people in 2005 and 25 phones for the year 2020 (Sarawak Tribune, April 22, 1999).

⁶ Bario is located in the Kelabit Highlands, close to the border between Kalimantan and Malaysia in the Miri Division of Sarawak prior to World War II, little was known of the Kelabit and their surroundings. The Kelabit’s only means of communication to the closest town was by foot, climbing mountains, following the mountain ridges, and crossing and re-crossing rivers and valleys on a journey that took several weeks. Nowadays, flying to Bario, the main Kelabit center, is the only practical way to get there. There is no road, and a land expedition requires a river journey plus an additional weeklong trek across forested mountains (Bala 2002).

⁷ According to Robert Chambers (1997), PAR is an encompassing method that combines action, reflection, participation and research. Here, PAR has been employed for the purpose of actively involving the people themselves in generating knowledge about their condition and how it can be changed. The impact of the research process then is assessed based on what action people take in response to knowledge that has been accumulated and disseminated during the course of the research process, and the extent to which change takes place, and in what direction the change occurs among the research subjects (Mikkleson, 1995).

⁸ This approach is highly recommended by the World Bank (1998) as a systematic approach to the application of IT to rural communities. In order to support IT adoption that will contribute to rural development, it is essential to begin with the needs of the rural community. As a first step, a feasibility study is required in order to: identify the needs and priorities of rural communities in such areas as agriculture, education, commerce, natural resource management, health, etc.; determine the types of information needed to help meet those needs, including information gathered from the rural population and

transmitted to policy-makers and project designers, and information shared among rural communities; determine the gaps between the information currently available and what is needed; and determine how the use of ICTs can close those gaps and build valuable synergies by mobilizing information across sectors.

⁹ This is obvious from a statement made by one of the respondents. He said, "...we cannot not try this technology. We need to be part of the change that is taking place, otherwise we will be lagging behind technologically, and continue to find it difficult to communicate with the rest of the world" (Harris, Bala, Songan, & Khoo, 2001).

¹⁰ And also are highly different from those faced by highly developed areas in Malaysia, for instance the Klang Valley, where the main issues are security, contractual and financial issues, lack of IT skilled personnel, privacy, deception problems, issues of globalization, ownership, lack of computers, and issues of censorship.

REFERENCES

Anderson, L., Crowder, L.V., Dion, D., & Truelove, W. (1998). Applying the lessons of participatory communication and training to rural telecentres. In *The First Mile of Connectivity*. Rome: Food and Agriculture Organisation of the United Nations. Retrieved April 28, 2000 from: <http://www.fao.org/WAICENT/FAOINFO/SUSTDEV/Cddirect/Cdre0029.html>.

Bala, P. (2002). Changing borders and identities in the Kelabit Highlands: Anthropological reflections on growing up in a Kelabit village near the international border. *Dayak Studies Contemporary Series*, No. 1, The Institute of East Asian Studies, Universiti Malaysia Sarawak.

Barr, D. F. (1998). Integrated rural development

through telecommunications. In *The First Mile of Connectivity*. Rome: Food and Agriculture Organisation of the United Nations. Retrieved April 28, 2000 from: <http://www.fao.org/WAICENT/FAOINFO/SUSTDEV/Cddirect/Cdre0029.html>.

Chambers, R. (1997). *Whose reality counts?* London: Intermediate Technology Publications.

Connecting Malaysia's rural communities to the Information Age: The E-Bario project (n.d.). Retrieved October 22, 2002 from: http://www.itu.int/osg/spu/wsis-themes/ict_stories/e-bario-casestudy.html.

Ernberg, J. (1998). Empowering communities in the information society: An international perspective. In *The First Mile of Connectivity*. Rome: Food and Agriculture Organisation of the United Nations. Retrieved on April 28, 2000 from: <http://www.fao.org/WAICENT/FAOINFO/SUSTDEV/Cddirect/Cdre0028.html>.

Garcia, D.L & Gorenflo, N.R. (1998). Rural networking cooperatives: Lessons for international development and aid strategies. In *The First Mile of Connectivity*. Rome: Food and Agriculture Organisation of the United Nations. Retrieved on April 28, 2000 from: <http://www.fao.org/WAICENT/FAOINFO/SUSTDEV/Cddirect/Cdre0033.html>.

Harris, R.W. (1999). Rural information technology for Sarawak's development. *Sarawak Development Journal*, 2(1), 72-84.

Harris, R.W., Bala, P., Songan, P., & Khoo, G.L. (2001). Challenges and opportunities in introducing information and communication technologies to the Kelabit community of North Central Borneo. *New Media and Society*, 3(3), 271-296.

Hudson, H.E. (1998). Global information infrastructure: The rural challenge. In *The First Mile of Connectivity*. Rome: Food and Agriculture Organisation of the United Nations. Retrieved on April 28, 2000 from: <http://www.fao.org/>

WAICENT/FAOINFO/SUSTDEV/Cddirect/Cdre0032.html.

International Telecommunications Union (ITU). (1998). *World Telecommunications Development Report, Universal Access*. Retrieved from: http://www.itu.int/ti/publications/WTDR_98/index.htm.

Mahathir, M. (1999). *The Way Forward*. YAB Dato' Seri Dr. Mahathir Mohamad. Working Paper presented at the Malaysian Business Council, February 1991. Retrieved from: <http://www.smpke.jpm.my/pm3.htm>.

Mikkleson, B. (1995). *Methods for development work and research: A guide for practitioners*. New Delhi: Sage Publications.

Paisley, D. & Richardson, D. (1998). Why the first mile and not the last? In *The First Mile of Connec-*

tivity. Rome: Food and Agriculture Organisation of the United Nations. Retrieved on April 28, 2000 from: <http://www.fao.org/WAICENT/FAOINFO/SUSTDEV/Cddirect/Cdre0026.html>.

Rahman, O. A. (1993). Industrial targets of Vision 2020: The science and technology perspective. In Abdul hamid, A. S. (Ed.), *Malaysia's Vision 2020: Understanding the Concept, Implications and Challenges*. Petaling Jaya: Pelanduk Publications.

Talla, Y. (1979). *The Kelabit of the Kelabit Highlands, Sarawak*. Pulau Pinang: University Sains Malaysia.

World Bank. (1998). *World Bank Development Report, Knowledge for Development*, The World Bank, Washington DC, USA.

APPENDIX

| Potential Areas for Social and Human Development through ICTs in Bario | | | | |
|--|--|---|---|--|
| Broad Topic Area | Narrow Topic Area | Project Area | Envisioned Scenario | |
| Education | IT – Based Teaching and Learning | Evaluation of IT-based teaching materials | A significant proportion of the school curriculum is taught using computers. The teachers develop some of their own software for teaching mainstream subjects, as well as adopting pre-written software. All teachers are familiar with the software tools used for creating teaching software that can be used by pupils in the classroom or individually. | |
| | Effectiveness of the IT Literacy Programme | Measuring the pace of growth of IT literacy among school staff and pupils | IT literacy is embedded into the school curriculum. All pupils are familiar and skilled with computers. They regularly use computers for projects and classroom work and for self study. | |
| | Attitudes and Intentions, Pupils and Staff | Tracking the attitudes towards technology and the intentions to use it. | Computers are the first choice for getting things done, both for teaching and learning and for school administration. Using the computer is no big deal. Everyone understands that computers are the natural choice for achieving their informational and knowledge-based goals. | |
| | Distance learning | Distance learning in school Distance learning out of school Networked language skills learning and building | School pupils regularly enrol on courses from distant institutions, in a range of co-curriculum subjects. They are awarded certificates of competence from those institutions. Non- pupils regularly enrol on courses from distant institutions, in a range of co-curriculum subjects. They are awarded certificates of competence from those institutions. Pupils at the school engage with software-based learning that originates in distant institutions for the purpose of building language skills. | |
| Culture | Genealogy | Recording genealogical data in the computer | A comprehensive Kelabit genealogy is recorded on a computer that is connected to the internet and which can be accessed and updated from any computer that is similarly connected. Family trees are documented and photographs of individuals are included. Family life-histories are recorded, including dates and locations of major events. | |
| | Oral Traditions | Recording and classifying oral traditions | Oral histories are recorded and/or transcribed and maintained in a database on a computer that is accessible via the internet. Traditions are recorded along with what is known of their origin. | |
| | Indigenous Knowledge | Assembling, classifying, recording and disseminating indigenous knowledge | Indigenous Kelabit knowledge that relates to local history, natural history, the environment, economics and culture is maintained in a database on a computer that is connected to the Internet. | |
| | Spiritual Fortification | Assembling, disseminating and contributing to sources of religious support and intra-denominational communications. | The church community, through its own Web site, regularly communicates with equivalent communities world-wide and augments its local activities as a result. | |
| | Telecentre design | Adoption of local cultural symbolism in the design of the telecentre and the imagery used. | The custom-built telecentre manifests the local cultural engagement between itself, technology and the outside world. | |
| | | | | |
| | | | | |

APPENDIX CONTINUED

| | | | |
|-------------|---------------------------------|---|---|
| Commerce | Tourism | Developing tourism potential through internet outreach and local tourism resource enhancement – highland trekking | Tourists from the world over are able to book trekking and cultural encounter vacations directly with operators in Bario. Bario becomes a world-class location for such activities, on a par with Nepal. |
| | Trade | Developing opportunities for trade in local handicrafts Developing opportunities for trade in Bario rice | Local craftsmen obtain a good living from e-commerce for their products. Local farmers obtain a good living from e-commerce in Bario rice. The amount of land given over to rice production increases and unit production is increased as a result of improved methods. Bario rice becomes a trademark product with a premium value, and quality standards are maintained. |
| Agriculture | Agricultural Practices | Digital trade in digital images – the Bario image bank | Photographs of local culture, geography and agriculture are regularly traded over the Internet, with revenues going to individuals whose images appear in the pictures. |
| | | Assembling, classifying and sharing relevant information relating to rice production Assembling, classifying and sharing relevant information relating to pest control | Rice production greatly increases through access to government extension programmes as well as farmer-to-farmer networks and exchanges. Pest control information is readily available and sharable as soon as pests become a threat. |
| Health | Upper respiratory illness | Assembling and disseminating relevant information relating to the avoidance and relief of upper respiratory illness | Upper respiratory illness ceases to be the main health complaint in Bario. |
| | Telemedicine Health care | Opportunities for telemedicine IT Based training in health care | Medical information, including heart beat audio recordings, is regularly exchanged across the internet between medical staff in Bario and doctors in Miri, Kuching and beyond. Community members regularly attend health care programmes presented across the Internet. |

APPENDIX CONTINUED

| | | | |
|----------------------------|---|---|---|
| | Attitudes and Intentions | Attitudes and Intentions towards IT | The community is able to express its own needs for information, to develop its own information sources and to obtain access to the information resources it needs in support of the development programmes that it has decided upon for itself. IT becomes the principal vehicle for achieving community development. |
| Community | Community Empowerment and Well-Being | Development and testing of an appropriate index | The community is able to measure its own advancement and to assign the degree to which that advancement has been achieved as a result of improved access to information and to ICTs. |
| | Gender Relations | Assessing the influence of IT on gender relations | Women perceive themselves as enjoying improved status and income and are able to attribute a defined proportion of that to their involvement with information and with ICTs. |
| | Social Communications | Assessing the value and need for improved facilities for social communities | Communications between distant family members become daily commonplace events. Anyone can send or receive an e-mail to anyone they know who has an e-mail account anywhere in the world. |
| | Telecentre Sustainability | Developing a business model for community ownership. | The community telecentre becomes a self-sustaining entity, free of institutional support, a going business concern. |
| | Wireless Networking | Wireless networking over a LAN | All computers within a given radius from the community telecentre are potentially able to connect to the local network and to obtain access to the internet. |
| Technology | Local area cell phones | Applying cellular telephony in a remote local area. | Individuals are able to use local cellular phones to communicate within the Barrio district, and possibly to connect to the wider national public telephone service. |
| | Satellite internet access | Evaluation of satellite internet access | The limitations and potential of access to the internet via satellite are well known by the researchers and by the community. |
| Human Resource Development | Training in IT and Information Literacy | Effectiveness of methods for achieving IT Literacy | The community develops methods for achieving IT literacy that are appropriate for their own use of IT. It becomes a demonstrably IT literate community. |

This work was previously published in Using Community Informatics to Transform Regions, edited by S. Marshall, W. Taylor & X. Yu, pp. 115-131, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.19

ICTs and the Communicative Conditions for Democracy: A Local Experiment with Web-Mediated Civic Publicness

Seija Ridell

University of Turku, Finland

ABSTRACT

In this chapter, the contribution of new information and communication technologies to enhancing democracy at the local level is articulated as a practical and empirical question that pertains to the locally established patterns and practices of public communication. It is suggested that in order to realize the democratic potential inherent in ICTs, the compartmentalized, hierarchical and one-way practices of both administrative-political machinery and the mainstream media must be exposed and challenged through concrete action. The article draws upon a participatory action research project in which alternative, dialogical and citizen-oriented forms of web-mediated public communication were created and maintained in close collaboration with grass-roots civic actors and groups. In the experimental project, specific efforts were made to enable and encourage online encounters between those local stakeholders that

rarely meet in the discursive public spaces of mainstream media.

PUBLIC COMMUNICATION, ICTS AND DEMOCRACY

It can be argued, following the American pragmatist philosopher John Dewey (1927), that society exists in communication. In other words, organized social and communal life is not possible without communication. At the same time, the ways in which communication is structured materially and functions socioculturally reveal what kind of society we are talking about. There thus is, as formulated by Lewis Friedland (1996) a “fundamental relationship between communication and democracy” (p. 187).

Starting from this view, a prerequisite for a democratic society is the existence of communicative “spaces,” which enable people not only to get

relevant information about the social world but also to participate openly and on equal terms in the public definition, discussion, consultation, and debate on commonly shared but often controversial and problematic issues. Ideally, these public spaces of communication also allow for and foster interaction between “normally” separate social actors. Currently, the prime (re)producer of the public sphere, the media, and especially the professional institution of journalism, perform poorly in enabling and arranging dialogical relationships in their spaces of publicness.

The new information and communication technologies (ICTs), and above all, the Internet have been endowed with high hopes and deep fears as regards the democratic reinvigoration of the public sphere (see, e.g., Tsagarousianou, 1999; Tsagarousianou et al., 1998). Optimists see the Net as remedy to the elitist and monological ills of mass-mediated public communication. The pessimists, in contrast, fear the Net will annihilate any possibilities of open and equal public sphere. What is problematic in the utopias and dystopias of the digitally mediated public sphere is that they are often not only abstract and normative but also at least implicitly deterministic, explaining sociocultural issues with positive or negative technological causality.

Rather than speculating with ICTs’ impact on the future development of the public sphere, it is more useful to approach the new technologies’ contribution as an empirical question. We should examine, for example, whether ICTs allow citizens to behave and engage publicly in ways that the traditional media do not enable (Coleman, 2001, p. 118); or assess how ICT applications are utilized in electronic democracy projects to promote two-way communication between citizens, public officials, and politicians (Tsagarousianou, 1999, p. 202).

From a pragmatic starting point, one cannot separate ICTs’ public potential from the issue of material democracy. It is hard to imagine how digitally mediated communication could function

democratically unless everybody, regardless of his or her material wealth, social status, and cultural competencies, has access to new communication and information technologies as well as opportunities to obtain adequate computer literacy and navigating skills (cf., Wilhelm, 2000). The challenge of material equality is made even more pressing by the fact that computers are becoming basic tools of daily life. This intensifies the disconnection from the rest of society for those without access to new technologies.

Moreover, the dominant economic trend, boosted by strong industrial players, is toward increasingly interpersonal and privatized uses of new communication technologies as providers of symbolic consumer products at the same time as the Net is increasingly being used as a commercial marketplace (Dahlgren, 2001, pp. 74-75). The economically formatted spaces of the Net only remotely contain the aspect of public communication, even less of democratic public communication. As Wilhelm (2000) asked, “can any of us any longer point to a noncommercial space where the interests of the public are articulated and vocalized in a sustained and deliberative manner?” (p. 4). Similarly, Coleman (2001) pointed out that “it is hard to think of a single site specifically dedicated to public discourse” (p. 120).

In terms of social agency, the Net’s increasingly commercially shaped topography prioritizes the role of individually selecting customers and prevents people from recognizing themselves as actors with a public identity. Thus, apart from equal entry to new technologies at the infrastructural level and the level of technical skills, people also need to be challenged in their privatized customer role as well as be offered stimulation and reasons for using ICTs for public ends.

Given economic and other structural conditions, it is clear that the democratic potential of network technologies does not actualize by itself but requires active involvement in communicative processes. This then, not only poses challenges to the media as the institutionalized (re)producer of

the public sphere. Academic research also needs to problematize its working assumptions about public life, its own role in relation to other social practices, as well as the seemingly noncommittal outsider position of academic subjects implied in the professional identity. As London (1999) pointed out, it is not enough that people within the academy speak across disciplinary boundaries; they should speak across social roles. The need for self-reflexivity is not lessened by a cultural climate hostile to critical assessment of the self-evidence of market conditions (cf., Tsagarousianou, 1999, p. 200; Wilhelm, 2000, p. 114).

In this chapter, the question of ICTs' democratic potential in the processes of public communication is analyzed from a critical media studies perspective and in the context of municipal democracy. Drawing upon a local experiment, this chapter assesses whether ICTs can be employed to introduce other than top-down ways of public debate and participation, contributing, in this way, to new forms of Web-based publicness (Tsagarousianou, 1999, pp. 20-2-203).

The local experiment was conducted in 1998-2000 at the University of Tampere, as part of the Journalism Research Centre's research project *Locality in the Global Net*.¹ The project assumed a participatory action research approach, challenging the dominant idea that scholars' role is to merely provide expertise or extract information from the people they study (London, 1999). Rather, the project wanted to align itself with civic interest and experiment with ICTs in creating a locally based communicative space that would enable people to position themselves as participating publics in relation to the social world.

This chapter starts from a more general context by assessing how the ongoing economic trends condition the media's performance and, related to this, what is the current role of ICTs in the production of journalism. Attention is then

focused on the local level by looking at the practices of public communication and the utilization of ICTs in the context of municipal democracy. Here, our example is the second largest town in Finland, Tampere, which has set itself a "bold and dedicated" objective to become not only the leading Finnish municipality in the use of ICTs but "a global leader in the research, development and application of issues related to the Information Society."²

Then, the discussion in this chapter moves on to describing and assessing the local experiment in Web-mediated civic publicness. During the experiment, an online gathering place — a civic Web forum — was created and sustained in close cooperation with local grassroots citizen groups. By assisting already active groups in furthering Web-mediated public discussion on locally important and often controversial issues, the project aimed to problematize the locally established patterns of public communication.

The focus of the experiment was twofold. Attention was paid not only to ICTs' potential in citizen-government interactions but also to the central role the media play in orchestrating and portraying local public life, which is usually ignored in electronic democracy projects. On the civic Web forum, specific efforts were made to encourage public interaction between those local stakeholders that rarely meet in the mass-mediated spaces of publicness.

The experiment clearly showed that a prerequisite for ICTs' use for more open and dialogical practices of publicness is the tackling of the communicative hierarchies and power structures of local governance, on the one hand, and the challenging of the conventionalized strategies with which journalism frames locally important issues and mediates the relations between local stakeholders, on the other.

PUBLIC LIFE IN CRISIS

Erosion of the Mass-Mediated Public Sphere

In (post)modern societies, it is the institution of mass media, and within it, most notably, the professional practice of journalism, that has specialized in producing and sustaining the public sphere. It is more pervasively — and at the same time seemingly unproblematically — the mass-mediated (journalistic) representations that define and present for “all of us” what is real and relevant in the social world (cf., Hall, 1985). Or, to put the point more generally, societies are increasingly held together by cultural, mostly mass-mediated, representations. In (re)producing these constitutive symbolic links, especially news journalism has established a more or less self-evident status as the transparent discourse of the real (see Ridell, 1998).

Within media studies, the way news journalism performs its cultural task has faced mounting criticism over the past few decades. Critical media scholars have problematized the privileged and unquestioned status of news as the primary definer of social reality. Contrary to professional proclamations and common sense assumptions concerning the mission of the genre, they claim that through its conventionalized working practices, elitist choices of topics and accessing of protagonists as well as strategies of presentation news not only provides flawed information about the social world but also suppresses public discussion concerning it. One of the most important reasons for the latter is seen to be that news denies ordinary people serious entry into the public sphere and instead positions them into a mute, passive, and helpless onlooker role.

Another major drawback of the news genre, especially on television, is its constant, nearly 24 hour rolling out of disconnected bits and pieces of information. In the news, events and happen-

ings pop up haphazardly, unrelated to previous events and social developments and without being linked to their contextual background. This flood of chaotic details makes, as Justin Lewis (1991, p. 143, p. 204) puts it, the specificities of history, of causes and consequences, disappear completely, engendering in this way a deeply historical view of the world. Or, as John Dewey (1927, p. 180) noted decades ago, the triviality of news can be ascribed to the way it reports events as isolated from any connections.

What is noteworthy in this context is that the properties of ICTs and the Net, such as the basically unlimited space and interactivity, have not been taken advantage of in renewing the journalistic working practices and strategies of representation. News journalism, as it currently actualizes on the Net, is largely based on the forms and contents familiar from the older media, circulating material already published in other media outlets and, as a result, perpetuates the genre’s fragmented view of social reality and its one-way relations to the audience. This, of course, can be explained by the fact that, contrary to the idealistic self-image of the profession, the production of journalism in the digitally mediated environment is also conditioned by the largely privately owned media industry. Its commercial logic directs Web-journalism toward a “broadcast model, aimed at aggregating and attracting viewership to key online sites in order to please advertisers” (Wilhelm, 2000, p. 144). According to the critics, the commercial media logic with its concomitant forms of representing social reality is most pervasive in the United States, but it is increasingly becoming a general tendency worldwide (see, e.g., Moog & Sluyter-Beltrao, 2001, p. 48).

The intensifying concentration of ownership and the acceleration of competition within the media industry have already actualized in the way news journalism increasingly uses melodramatic, personalized, and scandalous elements. They are calculated to ensure the effective selling of news products to the largest possible audience in a mar-

ket situation, where the “general” audience is split into segmented subgroups. In terms of representing public life, the economically rational logic of production amplifies the voices of those already prominent in the journalistic public sphere. At the same time, however, political actors who wish to attain public visibility are forced to adapt their actions and strategies to the logic of the media, and especially that of television as the dominant institution of the mass-mediated public sphere (Dahlgren, 2001, p. 84).

As regards the future of the public sphere, the media industry’s current developments are about to render obsolete the idea of collective civic arenas for information and discussion on socially relevant issues and substitute it with the idea of a shopping mall. The commercially formatted environments also on the Net implicate a model of social agency within the confines of which the primary interest is directed to fulfilling privatized needs according to differentiated tastes and habits.³ In this actor role, participating in collective conversation is framed by consumerist interest. The spaces currently constructed by digitally mediated news journalism conform to this commercial logic. Rather than constructing virtual sites for democratic public interaction, Web-mediated journalism offers tailored news commodities for private consumption via different distributional platforms.

To summarize somewhat bluntly the critical views, news journalism, the prime guarantor and buttress of public life in democratic societies, has long been in a state in which it, instead of promoting democracy, actually prevents democracy from functioning. Moreover, as Moog and Sluyter-Beltrao (2001) noted, current “media practices threaten to undermine not only public faith in the political process, but the status of the news media as well” (p. 48).

Focus on the Local: Government, Media, and Public Communication

Regarding the media’s role in contributing to the viability of public life in a municipal context, the situation looks, at least at first glance, more nuanced. At the local level, journalism is even making attempts to reform its established patterns of gaining and conveying information and, in this way, improving its public performance. In Finland, some newspapers have also, in cooperation with academic journalism research, followed the American public journalism movement’s example and tried out more reader-oriented ways of producing and designing news stories, such as arranging local citizen juries (see Kunelius, 1999a, 1999b; Heikkilä, 2000). These experiments have been successful, but it remains to be seen whether they will result in more profound changes in professional identity and daily working practices. As regards local journalism on the Web, the interactive potential inherent in the network technology has not as yet been exploited from the starting point of public journalism.

There are two major problems in the way journalism currently mediates local public life. First, problematic are the conventionalized strategies of presentation that journalism uses in portraying locally important, often controversial, issues and actors connected to them. Instead of arranging discussion and debate around these issues, journalism typically gives concerned parties access to its representational space separately. Thus, in one story of a local newspaper, there is, say, a city manager or a town planner, telling about this or that land use plan that has been initiated or is in the process of being carried through in a specific part of the town. In a subsequent story, voice may then be given to residents who are seen, more often than not, to resist the plans. Furthermore, the plans are often presented by the media as already being finally prepared within the municipal planning

and decision-making machinery. This also holds for cases that, in terms of actual decision making, are still at quite a preliminary stage. In this way, the media contribute to an impression that major changes in daily environment are planned and executed with apparent disregard for people who are directly affected by the changes.

Second, in the cases where the media make active residents and city representatives “meet” in their discursive spaces, the encounters are typically framed by antagonism. Pitting these two groups against one another is part of a larger presentational strategy, on the basis of which journalism makes the interests of these parties appear as inherently and irreversibly confrontational.

The strategies of separation and antagonism exclude the possibility of shared or negotiated interests, not to mention collaboration between residents and local government. By routinely employing these strategies of presentation, journalism mediates local public life in a way that breeds and exacerbates hostilities between stakeholders.

Problematically enough, at least in Finland, municipalities have traditionally relied on local media in their communicative relations with the residents. Not only have the media been the major public platform for official announcements, they have also been used as the main channel for introducing more significant plans to the citizenry. Thus, rather than, for instance, mailing a release or a newsletter to households, local governments delegated the task of public information delivery to the media. The media-dependent communication strategy is considered the cheapest way to reach the majority of residents at the same time as the professional mediation of journalism is believed to lend credibility to the city’s plans.⁴ Here, ICTs already changed the situation somewhat and will probably change it more, as municipalities can utilize the Net as a platform for directly informing residents, for example, about future projects and plans.⁵ However, given the uneven access to ICTs, the local media’s role as a public intermedi-

ary between residents and local government will, in all likelihood, remain central in the future as well.⁶

An additional feature of the locally established practices of public communication in Finland is that people in local government, both elected and employed, tend to avoid communicating with residents in public arenas. In our example town, Tampere, city officials and politicians have traditionally attended other than government-initiated public meetings rarely, even when specifically invited to participate, ignoring in this way the explicit plea and demand, presented by residents in many different occasions, that city representatives should engage in public interaction with the citizenry. Especially problematic is that the city representatives’ views of citizen participation in municipal decision making are presented through the local media instead of being communicated more directly to the people. The refusal of open contact with the residents on public forums, accompanied with reliance on the media as the intermediary agency, deepen the possible suspicions harbored by the latter about the alienation of the professional political and administrative class from people’s everyday priorities and problems.

In many Finnish municipalities, the established patterns of public interaction between local government and active resident groups are now deadlocked in a situation where the interests of a vocal minority, both on the side of residents and on the side of local government, clash time and again. Our example town Tampere is, due to, among other things, the protracted cooperation between social democrats and the political right in leading the city,⁷ as well as the problematic role of local media, an especially illustrative case of the “pathologies” of public communication.

As to the active residents in Tampere, the institutionalized antagonism is actualized in the way residents feel that their needs and expectations concerning, among other things, sustainable environment, are not met in town planning, and

that their views are deliberately ignored in the decision-making processes. The civic distrust is deepened by media coverage that keeps residents and the representatives of government apart, at the same time as it portrays the latter as a partner with powerful economic actors. Moreover, the tendency of the media to generalize the points of view of big corporate players as the only alternative available in given situations, strengthens citizens' perceptions that local government advances, despite claims to the contrary, specific and exclusive interests instead of representing more general interests that would encompass the residents' viewpoints.

Correspondingly, suspicions arise and pre-judgements are reinforced in the direction of city representatives, too, who let the residents' views and opinions be mediated to them through the journalistic filtering. This positions especially active residents into a role where they solely and stubbornly oppose any changes in their environment. The mass-mediated controversy is expressed, for example, in the way leading city officials repeatedly label active residents in the local newspaper as "the vocal minority," giving to understand that the "silent majority" either does not care about or is happy with the current practices of local governance.

The civic discontent and mistrust with the local government, also more generally, in the Finnish municipalities, echo findings of studies that explore what ordinary Americans think about the political system in the United States. Hacker (1996, p. 216), for one, summarized these findings by pointing out that, against conventional wisdom, people are not indifferent to politics but rather feel that ordinary citizens are excluded from government and have no role whatsoever in defining public issues and policy choices. According to Hacker (1996), people perceive political decision making to be a process run by the professional political class, lobbyists representing economic and industrial powers, and journalists. The deep-rooted sense of civic powerlessness in the United

States and elsewhere is also reflected in low voter turnouts in political elections. A similar development has been witnessed in Finland, where the turnout in municipal elections has been in decline for more than a decade, reaching a historical low of 55.9% in the most recent elections (year 2000). In our example town Tampere, the turnout was even lower, 53.6%.

In the United States, it is precisely the erosion of representative politics and professional journalism — something that with good reason can be conceived of as a widespread crisis of the central institutions of modern public life — that has given rise to the public journalism movement. Its advocates within academia and the institution of journalism aim to "rescue" the quality of public communication and public life by carrying out joint projects where the points of view of ordinary people are given priority on journalism's agenda.⁸

LOCAL DEMOCRACY AND ICTS: LESSONS FROM TAMPERE

Proclamations and Promises

As statistics tell, Finland ranks among one of the world's leading nations in terms of the diffusion of new ICTs. Sales of mobile phones, for instance, have shown strong growth in recent years. The number of home PCs and network connections has also steadily increased. One of the densest Internet penetrations in the world bolsters feelings of national pride among many Finnish proponents of an information society. In Finland, 64% of inhabitants (in the age group 15-79) have, according to a survey conducted in 2001, used the Net during the last three months, and 31% of them said that they visit the Web at least five times a week. In Tampere at the end of year 2001, 68% of inhabitants owned a computer, and almost two thirds of inhabitants had a Net connection from their homes, workplaces, or schools.⁹ In actual

practice, however, home network access in Finnish municipalities is concentrated in the more affluent households¹⁰ (cf., Wilhelm, 2000, pp. 54-55, pp. 62-65 for the situation in the United States).

Notwithstanding the still uneven diffusion of ICTs and Net connectivity, the interactive properties of computer network technologies have given rise to hopeful expectations with respect to the functioning of public life and democracy at the local level. The most optimistic prognoses suggest that the new technology will, by making possible direct provision of information and two-way communication between ordinary citizens and the representatives of government, contribute to solving the problems of local governance (cf. Bryan et al., 1998, pp. 1-3). In the background looms the straightforward assumption that wider access to technology and data will somehow automatically enhance participation.

Currently, almost all 432 (in year 2001) Finnish municipalities created a virtual existence for themselves and operated a Web site. Even though many invested a considerable amount of effort in offering government-related information and services online, the more interactive properties of ICTs have thus far been utilized modestly by the municipalities (Ruusula, 2001; Ridell, 2002). This, in fact, also seems to be the case elsewhere (see, e.g., Tsagarousianou, 1998; Hague & Loader, 1999; Richman, 2004).

The city of Tampere started developing its Web pages in 1994, and at the moment, considers itself as one of the leading, if not the leading, municipality in Finland in the use of ICTs and the provision of online governmental services. In 2001, the city launched, in collaboration with local businesses, the University of Tampere, and the Tampere University of Technology, an ambitious eTampere program that aims to make Tampere “a key city within the global Information Society” by the year 2006.¹¹ The program consists of seven modules, one of which is named Infocity and involves developing Tampere into a model of an information society in terms of online

public services, citizens’ access to the Internet, and network skills.¹²

As for online content, the city of Tampere’s Web site offers government-related information quite comprehensively, including contact information of different departments and elected officials; most recent meeting agendas and minutes; maps; planning reviews; statistics; press releases; information on social, health, school, day care, cultural, and traffic services; and so on. The amount of services available electronically is ever increasing. Moreover, it is possible to search from the meeting documents¹³ and other data on the city’s server as well as give feedback by submitting an online form, by sending e-mail to city officials, or by giving an opinion on the city’s virtual discussion section. There are also regular questionnaires and opinion polls online for finding out what residents think about issues that relate to the city’s field of activities.

During the past couple of years, the city of Tampere has started to take advantage of the Net’s interactive properties by complementing its Web site with more innovative two-way applications. To name one, an “interactive survey application” is the town planning game that wishes to offer residents an entertaining way to give their opinion on where additional buildings should be located in specific neighborhoods (for more details, see Seppälä, 2000).

In the development of the city’s online services, the role of the local university, on the one hand, has been stimulating as, for instance, a virtual “Citizen Kiosk” (where residents can ask city officials focused questions and get answers within a few days) was introduced after discussions between the *Locality in the Global Net* project and the city’s Information Office. During the project, the idea of the city council’s votes map was also introduced by the Project (see Ridell, 2001). The Information Office put the idea into practice in 2002.¹⁴

On the other hand, the gradually enhancing interactivity of the city’s Web site cannot be

separated from the attempts by public administration (also in Tampere) to react to the bottom-up demands from active resident groups. In the long run, these pressures may result in real “e-participation services,” where ICT applications are designed by starting from the communicative and participatory needs of citizenry.

Practical Lessons

Both the “bold and dedicated” information society rhetoric and the promises concerning its actualization make the city of Tampere appear as an exemplary model for employing ICTs for the purposes of local democracy. As regards to assisting citizens’ equal access to the Net, the city has also taken many concrete actions in recent years. For instance, the number of free-access terminals in public locales has increased, and the city organizes courses in basic Net skills (here, for instance, the Internet bus called *Nettynysse*¹⁵ has been important) and sponsors third-sector actors who offer computer courses. In terms of enabling and encouraging materially active local citizenship, however, not much has been done so far. The public terminals are meant only for surfing and otherwise “consuming” the Net, and places where residents could learn how to produce their own materials on the Net and also take part in the production are lacking.

The picture changes even more, if we relate the official proclamations to the locally established practices of public communication and ask whether the city of Tampere used ICTs for enlarging the political process by fostering alternative ways to communicate and participate. In this connection, it is especially important to examine whether residents are allowed new ways of behaving and engaging publicly.

In Tampere, a major part of the city’s online services consists of giving wider access to governmental information, even though, as mentioned, ICTs are used in different ways to collect residents’ opinions about the city’s field of activities.

The value of governmental information for the local citizenry cannot, of course, be ignored, especially when we talk about public documents that are parts and products of actual planning and decision-making processes. In these cases, the usefulness of online data relates to the way they expose and make intelligible these processes. Currently, the city of Tampere’s Web site presents the official documents quite statically, screening from view the more dynamic aspects of government. For example, board meeting records merely report the decisions made and refer only briefly, if at all, to discussions and debate on issues taking place during the meetings. The possibilities of hyperlinking are not utilized.¹⁶ Moreover, the layout of Web records resembles that of paper minutes in their user-unfriendliness, with thick rows and narrow margins. This practice of public documentation keeps up the perception of municipal decision making as a monolithic professional institution in the functioning of which the involvement of local residents is not welcome.

The closed appearance of local government is created at the city Web site’s main interface. Its structure follows the departmental headings, reflecting the information-seeking behavior of the municipal service provider rather than organizing the information offered according to the needs of end users.

Furthermore, some features of the new technology, such as the Net’s visuality, are currently employed in a way that actually amplifies the one-directionality of information provision. This is the case, for instance, when persuasive maps are used to present the professionally selected and manufactured scenarios of specific planning areas. Here, we are talking less about employing ICTs for offering the residents a possibility to canvass alternative plans than about convincing them through the one-way dissemination of information.

Apart from the distribution of information, the city of Tampere uses ICTs for mapping, among other things, people’s use of the Internet

and their opinions of the priorities of the city budget. One problem with the city's Web polls is that the questions have been structured, as is typical of surveys, in a way that predetermines the parameters of opinions. Thus, a survey on the city budget follows the established organization of the city's fields of activities, leaving the citizens with no possibility of commenting on, criticizing, or making proposals on the hierarchy of preferences already implicated in the selection and formulation of the questions.¹⁷ In terms of widening the democratic process, however, it is the process of coming to topics of importance that is essential and should be opened to the citizenry. The pre-closing of the agenda also holds for the more two-way applications, such as the town planning game, where the options offered and the end results the player can obtain are fixed in advance (according to the city's official land use policies and plans).

The discussion section also makes rather poor use of the interactive characteristics of ICTs. The submission of opinions and questions is premoderated, and the city uses software that supports the expression of separate opinions instead of that which encourages formation of threads of topical conversation. Moreover, few of the elected and employed officials figure voluntarily in the "discussion." City representatives, especially officeholders, seem to prefer personal phone or e-mail contacts with the residents instead of coming out with public comments and answers. This communicative strategy directs people to adopt the position of a client or a customer in relation to local government, instead of encouraging them to assume a publicly participating citizen role. As such, the increasingly customer-oriented ethos among public officials intertwines interestingly with the more traditional, paternalistic conception of democracy. What is noteworthy is that both notions refuse the needs of alert and questioning citizens interested in participating in local public life and motivated to be treated as parties in the processes of local government.

As a whole, our example town Tampere has thus far developed its Web site in a way that prioritizes the administration's professional and organizational needs. The properties of network technology have been accommodated to the prevailing one-way, top-down structures of public communication rather than being used for involving citizens in a meaningful way or opening new forms of public interaction between residents and local government.

Most tangibly, the effects of existing communication practices are actualized in the narrow position constructed for local citizenry in the city of Tampere's Web site. Residents can retrieve the offered governmental information, use the services available, give feedback, and register their opinions on specific, previously supplied topics within a framework determined beforehand by the city as professional machinery. They are not, however, encouraged to initiate public discussion with city representatives, to problematize the officially established agenda of government, to make value judgements of the way the city is governed, or to submit proposals on how the town should be run. In other words, as official netizens, the residents of Tampere are provided with ample, and sometimes even entertaining, opportunities to react, but negligible opportunities to act. Thus, in terms of public agency, the introduction of ICTs by the city has, instead of renewing or enlarging the democratic process, amplified its established mode of operation.

PROMOTING LOCAL DEMOCRACY THROUGH A RESEARCH PROJECT

Challenging Local Journalism: The Premises of Manse Forum

In the *Locality in the Global Net* project,¹⁸ the existing practices of public communication in Tampere were conceived of as a prime condition for the democratic employment of ICTs. The proj-

ect proceeded from the conviction that unless the communicative pathologies are explicitly tackled, no technological application can possibly be of use in enhancing the viability of local democracy.

The starting point of the project was to problematize through practical action the antagonistic frame that governs public relationships between active residents, city officials, and politicians in Tampere and is effectively sustained and often also intensified by the local media. The Internet's interactive properties were seen to offer new possibilities for opening and facilitating direct connections between local stakeholders and, through this process, for challenging local journalism to improve its mediating performance.

In the background of the project, there was the more general promise of the Internet's potential as a locally grounded space for open and citizen-oriented forms of public communication. A more theoretical framework was offered by the notion of Web-mediated civic publicness that can be seen to actualize in specific citizen-oriented genres. The notion of civic publicness is based on the view that citizens should be able to assume an active and creative role as participants in and as (co)producers of the public sphere, allowed to take part in the definition of the domain and agenda of public discussion. The civic Web genres that would enable this kind of public behavior, however, are something that do not exist as yet but must be initiated, created, and stabilized as parts of locally rooted activities and struggles.

In order to experiment with the Net's relevance as a local public sphere, the project established a virtual space — Manse Forum — that served as an arena for encouraging dialogical relationships among city representatives, politicians, residents, and economic actors as well as an arena for trying out citizen-oriented forms and contents. Moreover, in accordance with the participatory action research approach (cf., Whyte, 1991), the project's researcher entered into close cooperation with some local grassroots citizen groups, regularly attending the groups' meetings and offering her

time and the project's resources to group members for producing materials on Manse Forum and for getting mainstream media coverage for the issues the groups considered important.

By collaborating in this way with grassroots groups, the Locality project assumed a more radically citizen-oriented stand than is typical in so-called public journalism experiments. In the latter, the partners are usually journalistic enterprises or specific editorial offices, the primary aim being to solve journalism's problems together with the professional actors. Thus, whereas the advocates of public journalism want to raise citizens' concerns in the foreground of the agenda of public communication without compromising journalism's role as the privileged intermediary of public life, on Manse Forum, the purpose was to circumvent the self-evident primacy of journalism as the producer of the public sphere, and instead attempt to more directly realize — with the help of ICTs — citizen-oriented forms and practices of public communication.

With respect to mainstream journalism, there are at least two levels at which the notion of civic publicness challenges its conventionalized practices, also problematizing the political commitments implicated in professional proclamations.

First, the collaboration with grassroots actors and groups raises to the public agenda issues and points of view that are often excluded from the journalistic public sphere or are framed there as troublemaking from the viewpoint of the rational functioning of society. By providing an outlet for those alternative opinions that tend to be marginalized by journalism, citizen-oriented publicness wishes to widen the circle of actors and groups having the right to a public voice.

Moreover, for journalism, while rhetorically endorsing civic interest, a practical alignment with grassroots actors is a despicable transgression of the highly valued norms of impartiality and neutrality — it signals taking an opinionated stand, which is strictly forbidden to the specialized producers of the public sphere. The professional

proclamations, however, ignore the fact that journalism is, in actual practice, far from nonpartisan. With its elitist source relations and patterns of accessing, it promotes actively and effectively the viewpoints of those with economic, political, or other forms of power. Thus, in reporting assumedly objectively what takes place in the social world, journalists implicate that, in terms of power structures and relations, everything is as it should be. In other words, in journalism, the limits of public communication — and at the same time the parameters of acceptable thinking and action — are drawn in a way that affirms the *status quo*. The alignment with the powerful is so deeply embedded in the working practices of journalism and so internalized by journalists that it appears to them as unbiased and natural.

Second, in terms of civic publicness, it is not enough to enable the multivoicedness of the public sphere at the representational level. What is essential is to arrange dialogical relationships among all relevant parties on issues that concern many people or are perceived as important by them. This, then, requires deliberately crossing over the power-related boundaries of established social roles — something that journalism cautiously avoids doing — for discussion between differently positioned stakeholders does not come about by itself.

In contrast to journalism's affirmative logic of mediation, the notion of civic publicness stresses the importance of such discursive forums that allow not only interaction and consultation among participants but, ideally, also enable an open and public treatment of controversy. Understood in this way, public dialogue exceeds the associative uses of conversation and may serve as a vehicle for facing together and exploring and solving collaboratively complex issues in which values and interests of actors differ and conflict.

Manse Forum in Action

The guiding principle in realizing Manse Forum was the assumption that dialogical and deliberative public discussion does not arise and progress automatically, but it requires active involvement in communicative relations.¹⁹ Therefore, systematic efforts were made to engage in dialogue all those actors seen to have a relevant connection to given issues. Here, the researcher and her assistant, together with some active citizens, encouraged concerned parties to take part in discussions. For instance, responsible city officials were asked to comment on the points put forward on Manse Forum or to provide answers to questions presented there. Economic actors were also urged to take part in discussions and answer questions that concerned them.

Another basic line of operation was to focus on topics that were considered by active residents and grassroots civic groups as important issues in the Tampere region. A major part of these issues concerned shared physical spaces that residents perceived as a common good instead of being primarily a target for private profit making, exploited under the guise of proprietary secrets.

In practical terms, the production of Manse Forum was linked to the activities of three grassroots groups in Tampere. These groups manifest, in the Finnish context, a new locally based citizen activism that in recent years has arisen in different parts of the world, especially (though not solely) in bigger cities (see, for instance, Richard, 1999). Typical of this urban activism is that it gathers together people who feel dissatisfied over the party-based representational politics and who wish to tackle more directly plans that are seen to deteriorate the quality of near environs or risk the standards of municipal services. Also characteristically, the wish to cooperate in order to defend against the perceived threats, exceeds

the ideological differences the participants may otherwise have among themselves.

One of three grassroots citizen groups was the local town forum, *Tampere-foorumi*, which has been active since 1996, defining as its main goal to initiate and arrange diverse and constructive public discussion on locally relevant issues between political power holders, economic actors, and city residents. Rather than being an interest group, *Tampere-foorumi* represents in itself a form of civic publicness, its activities ranging from the arrangement of live public meetings to publishing a leaflet. The researcher, and later also her assistant, regularly attended the meetings of *Tampere-foorumi*'s planning group and participated actively in its work. In comparison to two other groups, the collaboration functioned at a different level, and, related to this, the Manse Forum Web site presents itself as *Tampere-foorumi*'s virtual counterpart. Even the Web site's graphical symbols refer to town forum activities, and there is also contact information of people active in the planning group, the forum's mission statement, and the records of public meetings arranged by *Tampere-foorumi*.²⁰

The second group consisted of active residents who took part in the process of outlining a draft for the city of Tampere's sustainable development policy program under the banner Local Agenda 21. The initiator of the process was the city's environmental department, within which some progressive officials invited groups of concerned residents to brainstorm, during Fall 1998 and Spring 1999, ideas for the sustainable development policy text. The researcher attended the meetings of the *Local Agenda 21 planning culture group* that focused on producing ideas for opening the processes of town planning in Tampere and improving communication between city representatives and residents.

The third group was a grassroots movement *Mältinranta-liike* that has been active since 1997, aiming to problematize, on globally and locally based environmental grounds, the city of Tam-

pere's plan to build a motor bridge in the middle of town. The movement demanded, among other things, that a municipal referendum be arranged on the issue, and it collected almost 10000 names to back up its initiative. The researcher attended *Mältinranta* movement's meetings and gave the group members technical assistance in using the Net, in participating in the discussions, and in producing other materials on Manse Forum. She also helped the group in its efforts to get its viewpoints acknowledged in mainstream media.

In the discursive space of Manse Forum, several issue-based sections were created to address questions considered important by the collaborating groups. Thus, a section was established for the disputed bridge case and another for following the planning of the area that was the focus of interest of the Agenda 21 group. There are also sections that frame their topics more generally or in terms of everyday activities, such as "Dwelling," "Traffic," "Democracy in Tampere," and "Sustainable consumption." Members of *Tampere-foorumi*'s planning group acted as coordinators and facilitators in most of the sections.

Each topical section has a front page with a short, regularly updated presentation of the issue at hand, also containing related background material and hyperlinks to pertinent information on outside pages, such as to meeting agendas and minutes on the city of Tampere's Web site. A central part of each section is an actively facilitated discussion arena.

Regular discussion-oriented contents²¹ on Manse Forum are also public queries to city representatives and, less regularly, to significant economic actors. The *Mältinranta* movement has made several queries to city council members and members of the technical board on the bridge issue. *Tampere-foorumi*'s planning group, for its part, carries through follow-up queries to different stakeholders after its public meetings. What is noteworthy in these queries is that they are closely linked to offline activities, utilizing the Web in a complementary way to advance the

public treatment of given issues, especially by drawing into collective conversation those parties that choose not to take part in face-to-face gatherings or are not “disturbed” by the producers of the mass-mediated public sphere. Moreover, in contrast to the online surveys and polls by the city of Tampere, on Manse Forum, it is the citizens who formulate the questions and pose them to the representatives of local government.

Linked to the activities of Agenda 21 group, a monitoring system for citizens’ initiatives was created on Manse Forum. The group submitted an official proposal concerning direct citizen participation in a significant planning project, followed actively the treatment of the proposal by the planning and decision-making machinery, and documented its phases throughout the process. The year-long monitoring produced public records that enable those interested to follow the process and get a many-sided and dynamic view of a locally important case. In the long run, this kind of online monitoring can be seen to form permanent traces of collective civic memory.

Additional citizen-oriented forms on Manse Forum, to mention here just two, are an open bulletin board and a public participant’s guidebook. The bulletin board is meant for posting announcements of events and issues by local citizen groups and associations, and the city’s notices are picked there by the facilitators when directly relating or otherwise pertinent to issues under discussion on Manse Forum.

The guide for public participants, for its part, offers easily accessible information about local residents’ legal rights, such as the early and continuous citizen comment and participation, stipulated as a necessary part of significant land use projects in the national building act. The guide also gives down-to-earth advice concerning, among other things, the possibilities of defending one’s rights and fighting one’s case (both as a citizen and a consumer) or taking action against

plans that threaten to destroy one’s environment or deteriorate its quality. People are also invited to give examples and tell their own experiences as well as participate in developing the guide by offering critique and making proposals for improvements. The interactivity of the guide could be increased by complementing it with an online service where people can submit questions to legal experts.

All contributions on Manse Forum are meant to be dialogical, wishing to make visible the interactional aspects of all public communication. Thus, not only discussions and queries but also, for example, the online monitoring, intends to alert city representatives to realize that residents are interested in local issues and are motivated to be engaged more directly in their planning. At the same time, the point is to demonstrate that enhanced interactivity of public communication increases the diversity and relevance of information. For instance, by following Manse Forum and attending discussions there, the citizenry and city representatives can be directly informed about each others’ views on specific issues. In the long run, the dialogical forms of Web-mediated civic publicness accumulate into a wealth of case-related civic information that provides a more nuanced and contextualized picture of local reality than is possible by relying only on traditional media coverage of issues.

Moreover, by giving active residents and resident groups a prominent role in producing Manse Forum, the Locality project wanted to challenge journalists and public administrators to rethink their own roles as currently defined within the power-related structures of public communication.

Struggling for Civic Web Genres

From a wider sociocultural perspective, the forms created and maintained on Manse Forum, together

with local grassroots groups, can be viewed as embryos of Web-mediated civic genres: as alternative cultural models that enable, formalize, and stabilize citizen-oriented communicative action. The importance of civic genres lies in the fact that through them, people can recognize themselves and act as participants of public discussion and public life instead of being positioned — as by administrative and most media genres — into the role of spectators, whose activity is restricted to expressing individual preferences and reacting to or choosing from given alternatives.

A key question in reforming local democracy with the help of ICTs concerns the design of such Web-mediated genres that allow and encourage people to assume a publicly participating citizen role. This, of course, is more easily said than done. Namely, genres are cultural artefacts that codify the processes of public interaction in a way that fits into the established patterns of social activity and communicative relations in communities. In other words, initiating alternative genres is a potentially subversive action, as it means, to slightly rephrase Agre's (1998, p. 98) point, intervening in the communicative relationships and problematizing the values and power relations they reflect.

A major cultural obstacle that stays in the way of realizing alternative Web genres and of contributing, in this way, to virtual civic publicness, is the taken-for-granted attitude of mainstream media. The self-evident pervasiveness of media in people's everyday life makes it difficult to challenge with civic forms of public discourse and action the "audiencing" genres that the current trends of media industry ever more efficiently produce and distribute.

During the Locality project, a major stumbling block was that the network technology appeared more or less alien to many grassroots actors, who, as such, were highly motivated to engage in public interaction and willing to raise public discussion on local issues. In the background, there was primarily the fact that most of the activ-

ists, especially in the Mältinranta movement and Agenda 21 group, neither had, for economic or other reasons, ready access to the Net nor skills to use it. During the subproject, the researcher also witnessed these active citizens' serious doubts about their possibilities and abilities to learn the required technical skills as well as their skepticism — partly due to unequal access to computers and telecommunications capabilities — of the new technology's civic potential.

Another major obstacle in the course of the project was the apparent reluctance of city representatives and especially of officeholders to interact openly with active residents and grassroots activists on Manse Forum. It is noteworthy that many of those officials who gave reasons to facilitators for their refusal to participate in discussion or to answer questions directed at them, pleaded to lack of time because of other, more pressing tasks. The workload of city servants is real, tracing back to insufficient human resources, and it may even risk the Internet's potential as an interactive medium in public administration.²² However, the stressing of importance of other duties compared with using one's work time for "associating with residents on the Net,"²³ also reveals that the Internet is not as yet considered an appropriate channel for communication between citizenry and local government.

The unaccommodating attitude of city representatives discouraged Manse Forum's facilitators, undermining their motivation and, as a whole, frustrating their attempts to organize and coordinate diverse and dialogical public discussion. As such, the shunning of officeholders from open interaction with the citizenry is a familiar phenomenon from other electronic democracy projects. Schuler (1996, p. 124), for instance, referred to early experiences from Santa Monica, where government officials, according to him, were unwilling to participate in public discussion and debate on an equal footing with residents (see also Schmidtke, 1998; Tambini, 1998).

WEB-MEDIATED CIVIC PUBLICNESS AND THE FUTURE OF LOCAL DEMOCRACY

To summarize, the observations made during the Locality project are, first, in line with those views that stress the importance of equal entry to the computer network technology, including physical- and skill-based access for all residents, as a basic requirement for a democratic information society. Without providing the material means to enter and participate in the public forum, the democratic hopes attached to new technology in the theoretical cyberutopias and in the official information society rhetoric will come to nothing.

Enlarging public connectivity by setting up free-access terminals at libraries, social service agencies, employment offices, senior and youth centers, and other public locales is a good start. This, however, needs to be complemented with the establishment of new physical locations with computer and telecommunications facilities, where training and technical assistance are provided. Wired civic centers of this kind would make it possible for people to engage in local public life as its active stakeholders — by not only enabling their participation in discussion offline and online but also by encouraging them to take part in initiating public activities and in producing paper and Web publications.

Realizing the material requirements would mean making a public policy choice that defines municipal online services as a community asset and sees residents as its co-owners. Moreover, it would mean developing these services as public cybercasting or as an integral part of the public library system (cf., Grundner, cited in Schuler, 1996, pp. 281-282).

Second, in order to tap ICTs' democratic potential and to actualize genres of Web-mediated civic publicness, it is at least as necessary to problematize and alter the locally settled communicative conditions by tackling their pathologies. Providing citizens with universal access and network skills

remains empty staging, unless these are linked to actual possibilities to communicate meaningfully with the representatives of local government. Moreover, neither the amount of governmental information and services available online nor the technical sophistication of applications will enhance the viability of municipal democracy, if local government does not respect residents' informational needs, communicate with citizenry in public, and open its processes to more direct citizen participation. In other words, innovations in local democratic practice are a prerequisite for the designation of truly interactive online services and the introduction of Web-based participation tools.

In many respects, ICTs' democratic potential in the local context boils down to power, the essential question being who is allowed in municipalities to take part in the processes of defining and implementing democracy. One can argue that a system of government is entitled to call itself democratic only after its policy choices are negotiable and open to public scrutiny. Thus, to be truly democratic, local government should encourage open public discussion and debate on the nature and premises of its agenda.

Traditionally, in Finnish municipalities, citizenry has not been allowed an active and creative role in delineating and deciding the public agenda and policy choices. Our example town, Tampere, is an illustrative case, as there the strategic lines of operation have been strictly in the hands of leading city officials and the leaders of the two biggest party groups.²⁴ In Tampere, the relations between active residents and city representatives have also been exceptionally poor. Rather than perceiving grassroots actors as knowledgeable experts of their environment and as potential partners in town planning processes, public administrators tended to treat them as rivals or even enemies who need to be shown time and again where the actual power resides.

Even though recent reforms in legislation are forcing Finnish municipalities to open their

processes of land use and urban planning,²⁵ and there are even signs of a gradual opening of strategic planning processes, it will take time and a long series of environmental and other struggles before local government is viewed, not to mention practiced, as a joint project, where public officials, politicians, residents, and other stakeholders together envision possible futures and try to innovate solutions to problematic issues. An additional factor in the development is the professionalized, increasingly customer-oriented ethos that is currently pervading public administration and perceiving citizens as consumers of democracy instead of as democracy's coproducers.

Obviously, given the rigidity of local public communication practices, the ICTs will change nothing. However, when connected to the intensifying bottom-up pressures from the grassroots level and the experiments in public journalism and civic publicness, the interactive properties of ICTs will definitely have a transformative effect on the asymmetrical distribution of power that currently structures public communication in municipalities. Namely, as Hacker (1996) pointed out:

...interactive communication creates a symmetry of communication between leaders and citizens. This shifts the balance of power and is a threat to leaders who wish to remain elitist in their administration. Interactive approaches to political communication expand the public sphere and decrease the elite sphere of power and influence. (p. 224)

In assessing the communicative conditions of democratic information society at the local level, one should not bypass the local media. To start with, their role is superior when talking about the cultural image of ICTs and the possibility to locate their deployment and use more generally in the public interest agenda. If the media keep framing the meaning of new technology predominantly in market-defined terms, this will suppress in

people's eyes the Internet's potential as a public and democratic resource, effectively marginalizing its civic uses. Thus, one challenge for the media is to give room, in their representations of the development of the Net, also for the significance of civic interest instead of strengthening the iron hold of consumerism.

A major challenge, especially for mainstream journalism, offline and online, concerns its capabilities to organize public communication in a way that makes possible dialogical and deliberative public discussion. As was argued in this article, the routinely employed journalistic strategies of separation and antagonism keep local stakeholders apart, effectively preventing any real interaction across the established social roles and boundaries of power relations.

The conventionalized strategies of journalistic representation have profound social consequences, as they construct for people a role as helpless onlookers without possibilities to have any real impact, even on the local reality. Thus, the challenge posed for journalism in terms of public agency is whether the profession is able to develop such strategies that do not represent local government as a priori closed from the citizenry but rather emphasize its dynamic nature, making visible those points in the long-lasting processes of planning and decision making that contain officially constructed and self-defined places for citizen involvement. In this way, journalism would enable people to recognize and assume a publicly participating citizen role, rather than suggest a fatalistic attitude to its audience.

As regards developing the space of local journalism toward a dialogical sphere of publicness, an essential requirement relates to exposing the imbalances of material and structural positions of different stakeholders. Rather than implicitly endorsing *status quo*, journalism should extend public dialogue to involve power relations and collision of interests. In practical terms, this would demand engaging not only political but

also economic power holders as participants in public interaction and, in this way, making visible the latter's integration in the local social web as publicly accountable actors. This, for its part, would make it possible to problematize the dominance of economic values and reevaluate the self-evident priority of corporate interests and profit-making, currently so prominent in the mass-mediated public sphere.

ENDNOTES

¹ Retrieved December 30, 2002 from the World Wide Web: <http://mansetori.uta.fi/info-e.htm>.

² Retrieved December 30, 2002 from the World Wide Web: <http://www.etampere.fi/office/en/>.

³ A parallel development is the erosion of physical public space by the colonization of commercialization and the increasingly privatized needs of transportation (see, for instance, Kressel, 1998).

⁴ Personal communication and e-mail communication with the Head of Information, the City of Tampere, Spring, 1999.

⁵ In Tampere, for instance, the Net was recently approved as an official platform for the city's announcements and notices.

⁶ Though, it should be remembered that not everybody can afford or even wants to subscribe to a newspaper. For instance, in Tampere, with a history as a workers' town and with a monopoly newspaper with a right-wing history, the ideological reasons for not subscribing to the local newspaper should not be underestimated.

⁷ See Laine and Peltonen's (2000) description of the "companion in arms axis" that was formed between social democrats and the right-wing party after World War II, having since been a structural element of local governance in Tampere.

⁸ See, for instance, Charity (1995), Merritt (1995), and Rosen (1991, 1994, 1996).

⁹ Suomen Gallup Web Oy, NetTrack, July 2002. See <http://www.gallupweb.com/www.tampere.fi/viy/tiedote/uusin/tutkimus.pdf> [30.12.2002].

¹⁰ It should be noted that the amount of homes being connected to the Net does not mean that the problems of access would be resolved. A two-tiered system seems to be speedily developing on the teleoperator and the Internet operator market, meaning that with more money, you get faster and more effective connections. As Bryan et al. (1998, p. 15) pointed out, "even the Internet has a fast lane and a slow lane," thus reproducing, like the old media, social exclusion.

¹¹ Retrieved December 30, 2002 from the World Wide Web: <http://www.etampere.fi/office/en/>.

¹² Retrieved December 30, 2002 from the World Wide Web: <http://www.etampere.fi/infocity/programme/>.

¹³ The usefulness of electronic records, however, is lessened by the fact that agendas and minutes are available online only for two years. It is possible to get hold of the older documents by going to city hall and asking to see them or by getting a chargeable copy.

¹⁴ See <http://inter2.tampere.fi/aanestys/> [30.12.2002].

¹⁵ See <http://www.tampere.fi/kirjasto/nettitynysse/english.htm>. [30.12.2002].

¹⁶ The hyperlinking of agendas and minutes with, for instance, dynamic geographical information would offer an interesting direction in terms of developing ICT applications that serve citizens' information needs and increase the public transparency of local government. For more on the participatory potential of geographical information systems (GIS), see, for instance, Craig (2002), Craig et al. (1998), and Sarjakoski (1998).

¹⁷ From a democracy perspective, an initial problem with polling, as formulated by Neil Postman (1993, pp. 132-136), is that people do not exactly “have” opinions but are, rather, involved in “opinioning.” Thus, in aggregating presumably finished and measurable opinions into public opinion, polling hides from view the complex and culturally mediated processes of thinking that go to the heart of democratic society.

¹⁸ *The Locality in the Global Net* project was conducted from 1998 to 2000 by the Journalism Research and Development Centre, University of Tampere. The project created an umbrella Web site named Manse Square, with three independent but interrelated sub-sites. All Manse Square Web sites are still active, providing a virtual space for local neighborhoods (Manse Communities), a place for civic discussion and public debate for all inhabitants of the city of Tampere (Manse Forum), and a platform for the production of local news and stories for the university’s journalism students (Manse Media). See the final report of the project at <http://mansetori.uta.fi/report/default.htm> [30.12.2002]. For more information about Manse Forum, see Ridell (2001).

¹⁹ Moreover, as studies on Usenet’s political newsgroups and other virtual forums show, public interaction on the Web seems to follow a dynamics that is more or less inimical to thoughtful and sustained public discussion and debate. Rather than listening to other participants’ viewpoints, reflecting on the merits of their arguments, and reevaluating their own positions in relation to new information, discussants voice their own preferences and use other messages to amplify their views. Wilhelm’s (1999, 2000) conclusion of the Web as an arena for public discussion is quite somber. According to him (2000, p. 98), the way virtual forums are

currently designed and used may expand the self-expression and monologue, while doing little to solve social and political problems (see also Dutton, 1996; Hill & Hughes, 1998; Docter & Dutton, 1999).

²⁰ See <http://manseforumi.uta.fi/Mission-E.htm> [30.12.2002].

²¹ The grassroots activists produced other, more self-expressive contents on Manse Forum, such as poems and photo exhibitions.

²² Let it be noted that even people in Tampereforumi’s planning group, despite their commitment to arranging public interaction, were often too busy to participate other than sporadically.

²³ Research interview with a municipal official, the city of Tampere, Spring, 2000.

²⁴ This is reflected, for instance, in the rhetoric and argumentation employed in official strategy and policy documents of the city of Tampere. As Eriksson and Lehtimäki (1998, p. 296) noted of the Tampere City Strategy text, it “convincingly reproduces the top hierarchical position of the strategy maker(s),” constituting other actors primarily as “followers or subordinates who need to adopt the vision and to join the City Management in realising it.”

²⁵ There are several laws that have been reformed significantly during the 1990s in Finland, such as Municipal Act, Planning and Construction Act and Constitution, to mention the most important. In all reforms, the role of more direct citizen participation as a complementary element of the representational government has been stressed.

REFERENCES

Agre, P. E. (1998). Designing genres for new media: Social, economic and political contexts.

- In S. G. Jones (Ed.), *Cybersociety 2.0: Revisiting Computer-Mediated Communication and Community*, (pp. 69-99). Thousand Oaks, CA: Sage.
- Bryan, C., Tsagarousianou, R., & Tambini, D. (1998). Electronic democracy and the civic networking movement in context. In R. Tsagarousianou, D. Tambini & C. Bryan (Eds.), *Cyberdemocracy: Technology, Cities and Civic Networks* (pp. 1-17). London: Routledge.
- Charity, A. (1995). *Doing public journalism*. New York: The Guilford Press.
- Coleman, S. (2001). The transformation of citizenship? In B. Axford & R. Huggins (Eds.), *New Media and Politics* (pp. 109-126). London: Sage.
- Craig, W. (Ed.), (2002). *Community empowerment, public participation and geographic information science*. London: Taylor & Francis.
- Craig, W., Harris, T., & Weiner, D. (1998). *Empowerment, marginalization and public participation GIS*. Report of Varenius Workshop, (October 15—17), Santa Barbara, CA. Retrieved November 28, 2002 from the World Wide Web: http://www.ncgia.ucsb.edu/Publications/Varenius_Reports/PPGIS98.pdf.
- Dahlgren, P. (2001). The transformation of democracy? In B. Axford & R. Huggins (Eds.), *New Media and Politics* (pp. 64-88). London: Sage.
- Dewey, J. (1927). *The public and its problems*. Denver, CO: Alan Swallow.
- Docter, S., & Dutton, W. H. (1998). The first amendment online. Santa Monica's public electronic network. In R. Tsagarousianou, D. Tambini & C. Bryan (Eds.), *Cyberdemocracy: Technology, Cities and Civic Networks* (pp. 125-147). London: Routledge.
- Dutton, W. H. (1996). Network rules of order: regulating speech in public electronic fora. *Media, Culture & Society*, 18(2), 269-290.
- Eriksson, P., & Lehtimäki, H. (1998). Strategic management of the local information society — a constructionist perspective on the production and evaluation of strategy documents. *Hallinnon tutkimus/Administrative Studies (Finnish journal for administrative studies)*, 17(4), 290-301.
- Friedland, L. A. (1996). Electronic democracy and the new citizenship. *Media, Culture & Society*, 18(2), 185-212.
- Hacker, K. L. (1996). Missing links in the evolution of electronic democratization. *Media, Culture & Society*, 18(2), 213-232.
- Hague, B. N., & Loader, B. D. (1999). Digital democracy: An introduction. In: R. Tsagarousianou, D. Tambini & C. Bryan (Eds.), *Cyberdemocracy: Technology, Cities and Civic Networks* (pp. 3-22). London: Routledge.
- Hall, S. (1985). Ideology and communication theory. In B. Dervin, L. Grossberg, B. O'Keefe & E. Wartella (Eds.), *Rethinking Communication, 1, Paradigm Issues* (pp. 40-52). Newbury Park: Sage.
- Heikkilä, H. (2000). How to make thin journalism strong? Experiences of a public journalism project in Finland. *Nordicom Review*, 21(2), 83-100.
- Hill, K. A., & Hughes, J. E. (1998). *Cyberpolitics: citizen activism in the age of the Internet*. Lanham, MD: Rowman & Littlefield Publishers Inc.
- Kressel, S. (1998). *Privatizing the public realm*. Retrieved December 30, 2002 from the World Wide Web at: <http://www.progress.org/priv03.htm>.
- Kunelius, R. (1999a). *Why conversation is the body (and not the soul) of democracy*. Paper presented at the Citizenship and/in journalism seminar. University of Tampere, Department of Journalism and Mass Communication, (April 23—24).
- Kunelius, R. (1999b). *Problems, experiments, imagination: Research towards rethinking jour-*

nalism. Paper presented in the Nordic Conference for Mass Communication Studies. Kungälv, Sweden, (August 14-17).

Laine, M., & Peltonen, L. (2000). Sodasta politiikkaan: Tampereen aseveliakseli ja paikallisen hallintatavan sukupolviulottuvuus (From war to politics: the companion in arms axis and the generational dimension of local governance). *Sosiologia*, 37(4), 306-320.

Lewis, J. (1991). *The ideological octopus*. New York: Routledge.

London, S. (1999). *The Academy and public life: healing the rift*. A report from the seminar on the Professions and Public Life, Higher Education Exchange, Spring, 1999. Retrieved December 30, 2002 from the World Wide Web: <http://www.scottlondon.com/reports/hex.html>.

Merritt, D. (1995). *Public journalism and public life*. Hillsdale, NJ: Lawrence Erlbaum.

Moog, S., & Sluyter-Beltrao, J. (2001). The transformation of political communication? In B. Axford & R. Huggins (Eds.), *New Media and Politics* (pp. 30-63). London: Sage.

Postman, N. (1993). *Technopoly. The surrender of culture to technology*. New York: Vintage Books.

Richard, E. (1999). Tools of governance. In B. N. Hague & B. D. Loader (Eds.), *Digital Democracy: Discourse and Decision Making in the Information Age* (pp. 73-86). London: Routledge.

Richman, R. (2004). *Metropolitan governance and telecommunications policy: changing perceptions of place and local governance in the information society*. Chapter 9 in this book.

Ridell, S. (1998). *Tolkullistamisen politiikkaa: televisiouutisten vastaanotto kriittisestä generäkökulmasta*. (Politics of sense-making: television news reception from a critical genre perspective). Ph.D. dissertation, University of

Tampere, Department of Journalism and Mass Communication.

Ridell, S. (2001). Manse Forum: a local experiment with Web-mediated civic publicness. In A. Heinonen, et al. (Eds.), *Locality in the Global Net. The Internet as a Space of Citizen Communication and Local Publicness*. The final report of the project Locality in the Global Net. Retrieved December 30, 2002 from the World Wide Web: <http://mansetori.uta.fi/report/ridell.pdf>.

Ridell, S. (2002). The web as a space for local agency. *Communications*, 27(2), 147-169.

Rosen, J. (1991). Making journalism more public. *Communication*, 12(3), 267-284.

Rosen, J. (1994). Making things more public. On the political responsibility of the media intellectual. *Critical Studies in Mass Communication*, 11(4), 362-388.

Rosen, J. (1996). *Getting connections right: public journalism and the troubles of the press*. New York: 20th Century Foundation.

Ruusula, M. (2001). *Palveleeko verkko kuntalaista? Suomen kuntien verkkosivustojen laadullinen vertailu*. Helsinki: Sisäministeriö. Julkisen verkkoasioinnin kehittämishankkeen (JUNA) julkaisuja. [Does the net serve the local resident? A qualitative comparison of the Finnish municipalities' web pages]. Retrieved December 30, 2002 from the World Wide Web: <http://194.89.205.3/suom/juna/julkaisut/Palveleeko.pdf>.

Sarjakoski, T. (1998). Networked GIS for public participation — emphasis on utilizing image data. *Computer, Environment and Urban Systems*, 22(4), 381-392.

Schmidtke, O. (1998). Berlin in the Net: prospects for cyberdemocracy from above and from below. In R. Tsagarousianou, D. Tambini & C. Bryan (Eds.), *Cyberdemocracy: Technology, Cities and Civic Networks* (pp. 60-83). London: Routledge.

Schuler, D. (1996). *New community networks: wired for change*. New York: ACM Press.

Seppälä, J. (2000). *Verkkomedia osallistumisen välineenä — Case Tampereen kaupunkisuunnittelupeli* (Web media as a vehicle for participation in Tampere — the case of town planning game). Master's thesis, University of Tampere, Department of Journalism and Mass Communication.

Tambini, D. (1998). Civic networking and universal rights to connectivity: Bologna. In R. Tsagarousianou, D. Tambini & C. Bryan (Eds.), *Cyberdemocracy: Technology, Cities and Civic Networks* (pp. 84-109). London: Routledge.

Tsagarousianou, R. (1998). Electronic democracy and the public sphere: Opportunities and challenges. In R. Tsagarousianou, D. Tambini & C. Bryan (Eds.), *Cyberdemocracy: Technology, Cities and Civic Networks* (pp. 167-178). London: Routledge.

Tsagarousianou, R. (1999). Electronic democracy: rhetoric and reality. *Communications*, 24(2), 189-208.

Tsagarousianou, R., Tambini, D., & Bryan, C. (Eds.). (1998). *Cyberdemocracy: technology, cities and civic networks*. London: Routledge.

Whyte, W. F. (Ed.). (1991). *Participatory action research*. Newbury Park: Sage.

Wilhelm, A. G. (1999). Virtual sounding boards: How deliberative is online political discussion? In B. N. Hague & B. D. Loader (Eds.), *Digital Democracy: Discourse and Decision Making in the Information Age* (pp. 154-178). London: Routledge.

Wilhelm, A. G. (2000). *Democracy in the digital age*. New York: Routledge.

This work was previously published in eTransformation in Governance: New Directions in Government and Politics, edited by M. Malkia, A.-V. Anttiroiko & R. Savolainen, pp. 85-109, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.20

The Creation of a Commercial Software Development Company in a Developing Country for Outsourcing Purposes

Sam Lubbe

University of KwaZulu-Natal, South Africa

ABSTRACT

SDC has financial services knowledge with cross-industry technical skill capabilities. Their emphasis is on advanced development techniques and tools. The model they used is proving to be successful for all parties and the growth process had provided them with invaluable experience and expertise in the HR transformation. The lesson they have is that they need to ensure that they have a strong presence in the market.

INTRODUCTION

Some case studies are qualitative while some are not. Custom also has it that not everything is a case,

but firstly having established the criteria for case studies, it was therefore decided to subsequently follow the case study method. This was also done because the authors felt that the creation of a software development company (SDC) justified a case study. This was further motivated because there has been a growing interest in the use of qualitative techniques in the administrative sciences and the case study could do justification to research.

This case study will therefore report on the creation of a software development company (SDC) in South Africa using a detailed description of interrelationships between perceptions of what is happening in developing countries and what is happening in developed countries. The case describes the scenario and contributions stemming from the methodological point of view. The case

study also illustrates points such as the value of following a structured method of establishing a methodology for starting such an SDC. The need is discussed for context specific measures of the characteristics for an SDC and the reporting of process measures while establishing an evaluation of the SDC that is being created. Also the need to explore the necessary relationships between the clients and the systems that are created and the perceptions of the clients are discussed. This is because the unidirectional assessment of the SDC can impact on the users and user characteristics and on computer software implementation. Despite the normative nature of the SDC the most important conclusion is the desirability for a variety of approaches to studying SDCs. No one approach to SDC research can provide the richness that information systems research needs for further advancement of the skills in a developing country.

INFORMATION SYSTEMS IN SOUTH AFRICA IN CONTEXT

South Africa is a medium sized country, 471,000 square miles at the southern tip of the African continent with a population of some 43 million people. Relative to the rest of Africa, South Africa is substantially industrialised. The Republic of South Africa is a wealthy country from an industrial and agricultural point of view and computers have been actively in use in South African business and industry since the early 1960s when both IBM and ICL opened offices in Johannesburg. Today South Africa employs computers in every aspect of industry, business, and government, as well as having a relatively high percentage of home computers among the middle class. All the major vendors are present and there is considerable interest in hi-tech.

The business and industrial sectors in South Africa are as sophisticated as anywhere in the world in the use of information systems. South

Africa leads the world in deep level mining and supports this activity extensively with computer systems. The country also has a substantial financial services sector that has won international recognition for its excellence in information technology. For example, the First National Bank (FNB) of South Africa was named one of the world's top 100 computer users by *ComputerWorld Magazine* in May 1995 and in July 1996; the same bank also won the prestigious Smithsonian Institute prize for the innovative application of biometrics in their information technology.

Background

Information systems play an important role in the survival of a country and its organisations. Coupled with the lower costs, increased processing capabilities of hardware, and cost conscientiousness of many CIOs and CEOs, it becomes a vital source of deriving efficient and cost effective solutions for organisational problems. A good manager using a well-organised information system enhances any organisation's ability to compete favourably and it minimizes the assumptions and presumptions in decision making that could lead to bad performance and eventually the downfall of the organisation.

In many organisations, information technology (IT) (especially software) also shapes the process of product development. Organisations that are able to adapt new software technology into their development process have often seen increased productivity and improvement overall in product quality. This is why so much emphasis is being placed in South Africa on the correct procedure for software development. This has provided the motivation for many organisations to strive to become a software development company (SDC).

The cost of software development systems, like information systems, stems directly from the cost of resources required to provide and support the functions of systems. The decision to outsource development to SDCs can be a serious strategic

change. Therefore, before managers can support software engineering, these SDCs must have a realistic understanding of the viability and of the costs and benefits of the tools. Cost benefit analysis usually can mean continuous reaching of goals (Lubbe, 1997). Benefits must usually exceed costs to justify the expense and this is another reason why organisations will look at SDCs as an alternative to developing software in-house.

The economics of software engineering has often focused on software cost estimation. Essentially this is a consideration of the costs related to single development projects. First world sophistication, which is in demand, requires worldwide growth of the use of information technology. However, a worldwide shortage of information technology skills exists. The high level of South African skills (business and technical) consequently causes an alarming rate of loss of top skills and thus a shortage of quality human resources in the IT sector.

Motivation for Starting a Commercial Software Development Operation

The external business pressure causes conversions and downsizing of industry sectors. This in turn causes a trend towards more efficient, focused business SDCs. The increasing competition in the global market place and new entrance is another motivation for starting a new commercial software development operation. The demand for faster and more cost-effective software systems delivery causes better local content as well as flawless production services, which can also be another motivating factor.

Some of the internal IT pressures such as skill shortages, the need for incentives to retain IT staff, perceived lack of professionalism, better productivity, delivery speed, quality, and clear career paths could be a very good motivating factor for starting an SDC.

Further motivation for starting an SDC in developing countries could be to stop the outflow of South African talent by creating job opportunities for new graduates. The worldwide dispersion of these talents could be prevented, ensuring a nucleus of software developers.

For all software developers, recruitment opportunities would be created, thus enabling a contracting option and keeping their talent for the newly proposed SDCs. The SDC should ensure retraining of these people—ensuring interest, loyalty, and the driving force to succeed in the company. Creating the previously mentioned nucleus of software experts makes it easier for customers to rely on excellent solutions and maintenance of the completed products. The solution could be a result of a mixture of the right professionals leading to applicable end products.

Creating a Commercial Software Development Company

Background to Starting a New SDC

The vision of the SDC company is to become the leading SA systems integrator for speed of delivery, quality, and value, using the most advanced tools and techniques, and to be the most appealing IT employer in SA.

One should keep in mind that to start a large-scale software development company, some projects, such as high-volume commercial transactions processing systems, require advanced analysis, design, and development techniques. This will also entail doing an evaluation of the SDC's software development process in respect of the capability maturity model (CMM). Currently a minimum of CMM Level 3 has been targeted. This will ensure that a standard system development process is integrated throughout all development activities of the SDC. As a result, of this a degree of certainty in the quality of the software products will be guaranteed. Furthermore, this will also allow

The Creation of a Commercial Software Development Company

the SDC to benchmark its development process against international standards.

The present SDC company has signed and completed more than 1700 maintenance requests in their first year of operation. On the other hand, they have finished 99 projects in the first year and the following figures were provided in respect of the attainment of their goals:

- Of 78 projects with planned end dates:
 - 18% were delivered ahead of time.
 - 44% were delivered on time.
 - 27% were delivered within one month of the planned dates giving them a completed figure of 89%.

An issue of concern is that they did not speak about the 11% that were needed to complete a 100% record. Of the 60 projects with initial costs estimates:

- 52% were delivered under estimate.
- 28% were delivered on estimate.
- Only 20% were delivered slightly over.

The 20% delivered slightly over, needs to be defined but they declined the offer to clarify this.

The company was created in the late 1990s by combing an established existing organisation and some key staff from the present organisation in the ratio of 3:2. The organisation presently has nearly 200 staff members and is based in one of the harbour cities of South Africa. Their future aim is to expand into international markets. They have some academic connections with one SA university since 1990 and had recruited some of the IS graduates from this university. They regard this as a long and mutual friendship.

The managing structure of the company starts as a normal hierarchical organisation with a managing director at the top and directors for various departments. The operations director controls the following sectors: strategy and architecture,

software factory, business intelligence, systems maintenance, support and renewal, project office, and network infrastructure (see Figure 1).

The company identified the software manufacturing industry in South Africa as a situation of concern. They identified the current outputs of the IT industry as of a low standard and regard this as a future challenge for the success of the SDC. Their strategy is basically to prevent high staff turnover and to keep abreast of dramatic changes in the software manufacturing business.

Services and Operations of the SDC Company

The company's services include items such as strategy and architecture, software factory, business intelligence, systems maintenance, and support renewal.

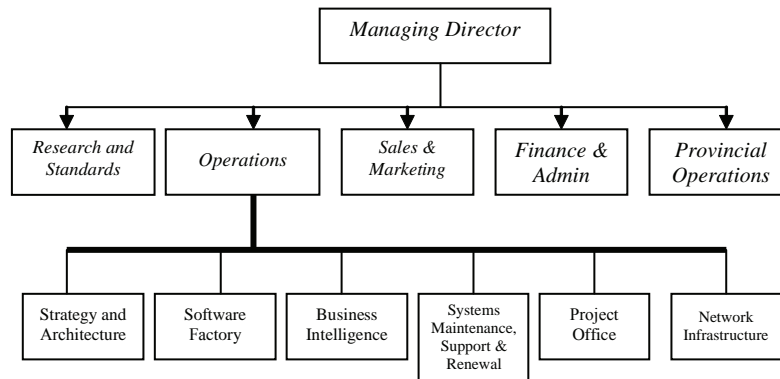
On the strategic architecture side of the SDC, IT enabled business transformation consulting for this newly established organisation consists of project definition, planning, and management. Analysis is an important aspect of any SDC and for this specific SDC that had been set up.

The design of processes, applications, and technology are important factors for managers of SDC and the organisation. Business migration and development coordination is an aspect that should be kept in mind by the managers when they want to develop a new system or application and development of technology.

All of this ensures business change and proper development coordination. The SDC can evaluate packages on behalf of any organisation and look at gap analysis in order to ensure that all variations are within all acceptable norms.

Project management is an important facet of systems development. The SDC would, however, struggle to do some systems integration if they are not an integral part of the company. The SDCs staff however, needs some training in order to ensure a successful implementation.

Figure 1. Organogram for SDC



On the other hand, business systems development is the main thrust for the company that had been selected as part of the case study component. They specialise in enterprise systems groups and the distributed systems for any organisation. Their approach is an engineered, model-driven approach with tight project definition, management, and control. They feel that this approach would enable them to satisfy requirements from organisations that approach them. They implement changes and new systems with a minimum disruption to any organisation.

The problem they face is that as an organization, they have only six years component-based developing experience. However, overall the combined experience of the staff might be several years. They specialise in applications such as GEN (Sterling), Microsoft, DB2, SQL server, and Oracle.

The business intelligence section of SDC entails the formulation of a data warehouse strategy for the organisation by designing, developing, and helping to implement the data warehouse. They regard their duties as including the following: data analysis and DB design, data sanitisation and transformation, data warehouse development, and metabase management. The important aspect of this part of their duty includes data distribution, data mining, information reporting, and decision

support. Here they use software such as SA.S, BO, DB2, and the SQL server.

The systems maintenance, support, and renewal sectors include some of the following duties:

- Service level agreement
- Production maintenance, running, and control
- Help service desk
- Request logging and work tracking
- Change control and management
- Production management, support, and standby
- Optimisation of platform
- Legacy renewal via internet enablement and component wrapping
- They use software such as COBOL, IDB2, IDMS, ADS/Online, MS, and Delphi.
- The strong point of the SDC is whole personal finance solutions. The system entails personal insurance (life and risk), employee benefits, and medical aid thus ensuring a well-developed financial package that ensures that the human resources section of any organisation is well run. In this regard, they use an EB2000/Dataaway.
- Their customer base expansion strategy includes the EB centre (retirement funds,

The Creation of a Commercial Software Development Company

life insurance, properties, healthcare, and investments) while they work across industry into telecommunications, transport, utilities and manufacturing.

- Their approach to systems development

They use a twin track type of development. This entails the following:

- The first step is the usual application requirements gathering, analysis, and design. During requirements gathering and analysis, the underlying philosophy is centred around in-depth identification of business needs. It is recognised that these phases of development are as crucial in terms of final product quality, as is the choice of development technology and actual construction. Therefore, the deployment of good analysts with sufficient experience in the client's business area is given a priority.
- Thereafter, development is split in two different tracks along a component based development timeline.
- The first track entails component design and operation specification and the specific development of components. They release the component and the two tracks meet each other.
- During the first track's process they also release the component interface release to the second track developers.
- The second track entails the application interface prototyping, building the application and application integration testing. There is communication between these two tracks all of the time in order to ensure that the timeline is honoured.
- The last combined step is the application release builds whereby the application is installed and tested in the organisation.

The important step for SDC is the tactical delivery approach that the organisation follows. They follow the European approach whereby code and older software is re-used. If this approach is not applicable, they would investigate. If it is not better to buy, they build the application. If this is not applicable, then build for re-use would be their suggestion to their clients. Their target market is existing systems in the open market but their conceptual approach might differ. They keep a stock of component objects they can re-use. During the development process, they adopt an approach such that the end product is the application that can be generalized and used for other companies as well.

Taxonomy of Components

Their taxonomy could be divided into two sections. The first section is the technical section and deals with the following aspects:

- The security aspect has eight entities in the component and more than 30 public operations. The ADPV is a purchased component as well as the audit part of it. They do registration of all the parts they develop and install.
- The main taxonomy of components can be found in the business side of the organisation. They have 40 FIC applications and 19 public operations.
- The important aspect of their business is the client environment (69 entities and 11 public operations), investment applications (12 entities and 2 public operations), contribution applications (14 entities and 3 public operations), annuity costing basis (11 entities and public operations), EB event (1 entity and 3 public operations), client agreement role (68 entities and 14 public operations), fees (12 entities and 2 operations), Notation (5 entities, 2 public operations), annuity calculations (2 entities), global operations

(no entities or public operations), agreement applications (40 entities, 11 public operations), portfolio applications (34 component entities and 5 public operations), and some investment switching applications which they have finished but nothing is sold yet.

- Components in the developing pipeline entails issues such as EB late pay limits, EM membership fixed property, EB bonus rates, EB commutation limits, and global tax rates and limits.
- The results of the joint venture are that they had a successful HR transformation ensuring that they do not lose too many of their employees (8% vs. 25% previously). Their productivity is 100% better and therefore they can deliver systems faster. There is an international demand for their products.

Broad Requirements for Sustaining SDC Development

In order to succeed, an aggressive government plan is needed. Industry and regional initiative need to be coordinated and correlated. The important aspect is free movement of information and skills. This means the elimination of inflow barriers for high-tech skills. To reach this goal, the government needs to do aggressive international marketing. Furthermore, the government needs to offer incentives for sustaining the growth of SDCs. Some ideas could be tax holidays for new start-ups, facilitation of international links, and knowledge exchange programmes, and so forth.

Sustaining the Generation of SDCs

Companies need to copy examples of the growth of a national software capability that will ensure survival. This would require a prototype roadmap for the growth of a software centre. A lesson can be learned from the government of India: The Indian government has drawn up some software companies contracts with multi-nationals to send

Indian programmers to work in the USA or Europe at the client's site or under direct suspension of clients' technical managers.

Indian companies set up development centres in India where development and maintenance was done under Indian managers. Typical projects were systems maintenance, software test development, and execution as well as software components. Furthermore, some value adding is required while companies are building their research and development capabilities. This would require:

- Highly developed project management capabilities
- Quality by decision
- Extensive employee training
- The highly evolved practise of process engineering and relationship management

The South African software industry and the SDCs need extensive domain knowledge in banking, insurance, and financial services. They also need to create new technical capabilities and products to sell overseas.

For all of this, SDCs in developing countries need a highly educated work force, low cost of labour, highly developed information and telecommunication infrastructure and business modules consisting of:

- Pilot project
- Larger scale development
- Dedicated development centres
- Own development units

The success factors of countries such as India and Ireland need to be copied. South Africa and other developing countries would like to educate a young, highly educated workforce with strong technical and business skills. These workers need to be highly effective and efficient.

SDCs need full government support for the industry, with both financial and nonfinancial industries for both indigenous and overseas com-

The Creation of a Commercial Software Development Company

panies. This would make these countries an ideal gateway to the international markets.

To summarise some patterns:

- A well-educated work force is mandatory.
- Do not start building independent products.
- Take advantage of regional markets.

CONCLUSION

They have strong financial services knowledge with strong cross-industry technical skill capability and an emphasis on advanced development

techniques and tools. The model they are using is proving to be successful for all parties and the growth process had provided them with invaluable experience and expertise in the HR transformation. They think they are well positioned for significant growth.

REFERENCE

Lubbe, S. (1997). *The assessment of the effectiveness of IT investments in South African organisations*. PhD dissertation. University of the Witwatersrand, Johannesburg, SA.

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 126-136, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.21

The Information Society in Ukraine

Serge S. Azarov
Lucky Net Ltd., Ukraine

INFORMATION SOCIETY DEVELOPMENT IN UKRAINE

In order to assess the prospects for the development of the information society in Ukraine, there is a need to consider the possible directions or approaches that such development might take. In *The Diversity within Unity*, Etzioni (2001) states:

Two approaches are to be avoided: promoting assimilation and unbounded multiculturalism. Assimilation—which entails requiring minorities to abandon all of their distinct institutions, cultures, values, habits, and connections to other societies in order to fully mesh into the prevailing culture—is sociologically difficult to achieve and unnecessary for dealing with the issues at hand, as we shall see. It is morally unjustified because of our respect for some normative differences, such as to which gods we pray. Unbounded multiculturalism—which entails giving up the concept of shared values, loyalties, and identity in order to privilege ethnic and religious differences, presuming that nations can be replaced by a large number of diverse minorities—is also unnecessary. It is

likely to evoke undemocratic backlashes, ranging from support for extremist, right-wing parties and populist leaders to anti-minority policies.

Taking into consideration Etzioni's recommendation, there is a need to search for an intermediate approach. However, this raises at least two questions. First is when to precisely commence a movement towards a synthetic approach to the construction of the information society, taking globalization into consideration but preserving the local identity. The second question is who—a leader, a certain group, a class, elite, or a society, in general,—should become a “key executor” of such a grand plan? In other words, the first question calls for an answer regarding the time of the “moment of truth” when ephemeral social illusions give way to specific financial and economic plans and programs.

Toraine (1997) stressed that the “moment of truth” being sought should be understood as the last step-wise stage between the industrial and post-industrial eras. This is a result of the gap appearing between the international economy and a nation-state leading to the destruction of such a

model of a society that unites instrumental rationality and cultural identity. Researching the new social movements at the end of the 20th century, he developed a so called “action sociology” which he used to state that it is “new and diverse social movements, not political or state institutions” that are the true driving force of progress.

The foregoing sets the boundaries for the answers to the questions posed above. This article now analyzes the social and economic conditions in the development of the Ukrainian civil society in order to expose any “gap between the international economy and the nation-state” as well as the existence of “new social movements.”

In such an analysis it is not useful to be overly enthusiastic since it was the Marxist classicists who were the first to write about “the new social movements” and state that “when an idea grips the masses, it becomes a material Force” (Marx, 1848). Of course, what they meant under the notion “the masses” was a new social force; an oppressed class of worker formed during the first stage of capitalism in the process of re-appropriation of added value (peasantry is the capitalism’s heritage from feudalism). That is why, bearing in mind Marx, we must ask:

- In what way are “the new social forces” being formed in the post-industrial society?
- Amongst which social strata existing in today’s society should we look for the “blessed springs of the information society”?

These questions are the key to exposing the productive and cultural identity of both a person and social environments. On the one hand, these form the new information society. However, on the other hand, they are themselves being formed from the “old” social groups including “workers and peasants,” a notorious “middle class,” a ruling elite and even the bearers of the incomprehensible “national idea.”

IDENTITIES AND THE INTERNET

In examining these questions, it is useful to examine the writings of Castells (1997) in *The Power of Identity* which provides a basis to not only to answer these questions but also to begin discussing a notion of “identity.” Castells dedicates his book precisely to the effects of the emerging phenomena of the information society on the new social movements, state policy and the *personal reactions* of the people in the world to globalization and “sprinter” technological development. Castells’ principle propositions are as follows (Castells, 1997):

- The most important feature of the information society is not its dominance of knowledge but in the change in direction of the use of knowledge which displaces previous forms of both personal and property dependency typical of industrial capitalism;
- Globalization gives rise to a tendency to increase identity which can help an individual withstand the external world since the new social structures being formed are networked communities;
- With the beginning of the information era, relations between “society” and the person not only harmonize but become more intense;
- Social and biological traits of human beings, which lock them in the narrow forms of “old communities,” are juxtaposed with the global traits that incorporate them into the new world structures;
- The essence of the networked human identity lies in the fact that for the individual, the process of self-identification becomes self-sufficient. Identifying the value orientations of activities of such self identification based on a specific cultural identity, excludes the necessity to address other social structures;

- There are three types of network identity and each of them can play a key role as a driving force of social progress; they are as follows:
 - legitimizing identity, which is typical of industrial society and corresponds to a system of values of a traditional civil society and nation-state;
 - resistance identity, which is typical of a period of transition when a new value system, recognizing the significance of local communities, is formed; and
 - project identity, that is the based upon a personality that is shaped in the information society;
- A role of the new social movements based on the resistance identity and the project identity protests against the existing social structures;
- Whilst the protest identity is destructive, it is a key source of energy to progress from the industrial to information structures; and
- Technology *does not determine* either historical evolution or social changes but is a potential resource for the development of society and provides for different models of social change.

Thus, according to Castells, the new social forces in the post-industrial society are formed during the processes of searching for both personal and group resistance identities in order to form a new project identity in the end. Of course, this approach cannot be expressed by means of unified social and political, or economic rules of behavior or recommendations, since the globalization process is not regionally homogenous. For instance, certain regions, such as the Pacific region, appear to be actively involved in the global economy while other regions including certain African and Asian countries, are prejudiced against or hostile to concepts of globalization.

Whilst acknowledging the role of the Internet in formation of the information society, Castells

nevertheless stresses that network communication is not a universal means of communication and is not likely to become one in the near future. He considers that:

new electronic net media do not depart from traditional cultures: they absorb them. Social and cultural differentiation leads to the segmentation of multimedia users. It also increases social stratification among the people. The multimedia public will be populated by two separate populations: the interacting and the interacted and it is critical for all kinds of social effects that there should be the development of an open and horizontal network of communication instead of exclusive and closed on-demand media services. The significance of the multimedia increases tremendously in a system in which reality itself (that is, peoples material/symbolic existence) is entirely captured, fully immersed in a virtual image setting, in the world of make believe, in which appearances are not just on the screen through which experience is communicated, but they become the experience. (Castells 1997, pp. 372-375)

Castells contrasts the old forms of national, religious, class and ideological identity with the new networked identity. It is well accepted that national identity in the nation-states historically determined the legal relations between the state and its subjects. Identity based on formal citizenship plays the same role in the multinational states. However, separatist movements based on the notion of national identity exist even in such developed countries as Canada or Spain.

Today, a religious identity is a base for many Muslim countries. But even in such countries there are contradictions derived from different interpretations of religious principles or Confessions of faith. The same can be said about class and ideological identity which, it can be argued, was never fully employed in any country.

In the early part of the 21st century all other forms of identity, including the impacts of such key factors as culture, traditions, history and language, play a role of symbolic interpretations of the national identity in many countries, since they only play a system-forming role in the period of military encounters.

One other dichotomy in the domain of labor division in industrial society is a division between urban and rural cultures. A specific feature of urban culture and identity is *event intensity in the complexity and the tolerance in the decision-making process*. This is not a “gift of heavens.” It is nothing else but a manifestation of the instinct of self-preservation in places with high-density of population without which personal and group collisions would hamper development. In 1900 one in ten people in the world lived in a city, in 1994 every second person lived in a city, while in 2004 the number of city-dwellers exceeded 87% in developed countries. At the beginning of the 21st century, megapolices appeared, and their management is becoming a key problem for the 21st century. On the other hand, devotion to traditions and conservatism, which are also derivatives of a specifically rural way of life and agricultural production, called “idiocy of rural life” by Marx (1948), are typical of rural culture.

At the first stage of development, the information society inherited all features of urban culture of the industrial society and reflected them on the Internet. To a great extent, the Internet was a manifestation of urban culture and active Internet users in the cities were the first representatives of the networked identity. A networked identity, an Internet function, “given to us in sensations,” provides both an individual and virtual communities with a possibility to “resist the external world” (not symbolically but actively). It can also “incorporate” in the emerging new world structures without the blessing of either the state or other subjects of a dominating national or religious identity.

In other words, in the situation when network communications are open for free access, it is easier for individuals, who do not have any particularly strong national, religious or ideological reflections, to find themselves a comfortable “refuge” on the Internet in various old social groups. Moreover, in the information society *a networked person practically does not need direct contact with the old power or social structures.*

In the process of self-organization, based on personal or group experience in the sphere of the formation of networked identity, a departure from a legitimizing identity which is peculiar to the industrial society and nation-state resistance identity, takes place. But all these “departure” phenomena *should not be regarded as destruction of identity as such but as the destruction of the old forms of identity and the formation of new forms of identity.* It upon this base that social movements and forces, aimed at the formation and development of the information society, will be formed.

Finally, it is useful to consider the views of the Russian scientist Inozemtsev’s paper “Senselessness of Questioning”:

posing a question like which forces, personal and individualistic or communal and state-oriented, can determine progressive development of Russia is fallacious. Today any state is objectively incapable of controlling key resources of public development which are now information and knowledge... Russian state is an intellectual and moral bankrupt that is attempting at presenting its surface polish for an evidence of solvency and conceals its scandalous failure to offer any appealing development strategy to the nation by the slogans of struggle for stability. In no country in the world community-type consolidation promoted liberation of capacities and potential of each individual... In the Russian situation, absolutization of a community development principle is inevitably leading to the state bureaucracy. (Inozemtsev, 2004)

PROBLEMS AND PROSPECTS FOR UKRAINE

In spite of the fact that many wanted to avoid the loss of identity in the process of globalization, its preservation, according to Castells, is in any situation doomed to failure since legitimizing identity sooner or later transforms into resistance identity. However, in Ukraine we still have not made it clear which aspect of identity we are talking about, whether it is national, religious, class and ideological, urban, or rural. We are a multinational state and that is why it is complicated to discuss a national identity. On the other hand, religious, class and ideological identities are hardly topical in the development of an information society.

In spite of the fact that in 2004, 67% of the population lived in the cities, Ukraine still had a typical representation of a rural identity. The matter at hand cannot be adequately represented by statistical figures alone but requires examination through the *chronological dynamics of the migration of generations*. In 1991, Ukraine had only entered into the third stage of the five-stage Gibbs model of urbanization (Gibbs, 1963), and in this stage the increase in the urban population is provided not by birth rate, but by migration from a countryside.

In 2004 the majority of elite representatives still originated from the rural areas, either first or second generation. In such a situation it becomes difficult for these representatives to learn to think in the moral, ethical and intellectual terms required of urban culture and to tolerate their opponents in order to perceive the information society as a development factor. Due to this rural-communal bias towards conservatism and a communitarian model of the civil society, there is a tendency to simply copy and disseminate negative features of the socialist command-administrative system. This is generally elitist. But there is also the concept of a ruling elite to be considered. Power can be considered to be an obtrusion of the will of certain subjects upon others using

physical or symbolic violence. Fortunately, there are reasons to believe that the sad times where physical violence to impose power have sunk into oblivion in many situations. However, what is left in its place is a symbolic violence in the form of threats, regulation of behavior, both personal and business, playing out the traditional identities of Orthodoxy or Roman Catholicism and obscure propaganda of values of some sort of integration, for example Euro Atlantic integration. That is why it is difficult to look for the new social forces amongst our ruling elite and is probably, a waste of effort. Such new social forces are more likely to appear within civil society. It is the resistance identity, which will play a regulatory role during the period of transition from an industrial to an information society. This will appear in the sphere of goals, alternatives, and activities, which are most likely to be the system-forming factors of the civil society.

In this context, the resistance identity either of society as a whole or as a fragment of it, will take the shape of civil identity. This implies a certain level of identification by an individual with the information society, a readiness to exert influence upon the formation processes and to bear responsibility. In short, this implies “good old ethical norms.”

It is nevertheless necessary to approach the spontaneous manifestations and “germs” of the civil society with particular care, barring excessive “freedom” euphoria. Since many of the initial approaches still bear the features of “democratic centralism” and totalitarianism whilst their leaders, under a civil society slogan, often still act with personal, selfish or power-seeking motives behind their efforts.

Same caution should also be taken when approaching the state sector. The concept of an authoritarian state, of course, will not disappear easily. However, if it is to survive, the state will increasingly need to rapidly adapt and transform in the direction of the civil society. Given the entrenched nature of the state systems, it is unlikely

that this will occur synchronously but most likely lag a generation behind. Such a situation can be clearly seen in divergence between the implementation of external policy of the sovereign state in building international partnerships and internal policy in which there is a decentralization of power to regions. Such decentralization involves the delegation of certain functions from central bodies to the regions and NGOs in order to form network distribution of authorities.

Any phenomenon, be it globalization, identity, or information society, is in reality a process. Developed as a speculative theory, the notion of the information society naturally reflected all specific features of the age of industrialism just as Marx' communist theory reflected the features of the capitalism of the middle of the 19th century. Therefore it is clear that the information society in the middle of the 21st century will remind us of Bell's (Bell, 1973) or Toffler's models (Toffler, 1987) in the same way the USSR reminded us of the Manifesto of the Communist Party. The "Manifesto of the Communist Party," of course promised, that "the proletarians have nothing to lose but their chains. They have a world to win." However, a "proletarian identity" did not rescue toilers from slavery, and the communist bureaucracy became the true winner.

Nevertheless, there are a number of key issues in information society theory, just as in the theory of communism there was "no private ownership of productive tools" and "the dictatorship of the proletariat." In the notion of an information society, the equivalent unshakable principles are "open society" and "freedom of communication and personality." If these principles are maintained, then no social or economic phenomena will be able to dissolve any form of identity which will emerge from the legitimization of a civil identity. It is the national identity of the country that will undergo few alterations. Since historical practice has demonstrated the stability of this form of iden-

tity (only tribal identity is more ancient than this one) and it will accompany our life for centuries to come. However, it is the nations themselves that will undergo changes in similar fashion to the way a national identity of "Roman" gave way to "Italian."

REFERENCES

- Bell, D. (1973). *Coming of post-industrial society: A venture in social forecasting*, 339-368.
- Castells, M. (1997). *The power of identity, the information age: Economy, society and culture, Vol. II*. Cambridge, MA; Oxford, UK: Blackwell.
- Etzioni, A. (2001). *The diversity within unity*. Retrieved from http://www.gwu.edu/~ccps/DWU_Platform.pdf
- Gibbs, J. P. (1963) *The evolution of population concentration. dconomic geography*, 39.
- Inozemtsev, V. (2004). *Senselessness of questioning*. Retrieved from http://www.postindustrial.net/content1/show_content.php?table=free&lang=russian&id=72
- Marx, K. (ND). Capital Volume III. *The process of capitalist production as a whole*. Retrieved from <http://www.marxists.org/archive/marx/works/1894-c3/index.htm>
- Marx, K. & Engels, F. (ND). *Manifesto of the Communist Party*. Retrieved from <http://www.anu.edu.au/polsci/marx/classics/manifesto.html>
- Toffler, A. (1987). *The third wave* (12th ed.) Retrieved from <http://www.toffler.com/thethird-wave/default.shtml>
- Touraine A. (1997) Pourrons-nous vivre ensemble? Egaux et defferents. *Philosophical Problems* (pp. 188-191). Russian Academy of Science.

KEY TERMS

Globalization: This term was first applied to the world economy, which under conditions of global information and communication network can basically operate as a unified system in the real-time mode.

Identity: According to Inozemtsev (2004) and authors of the WSIS 2003 Declaration *identity* is *originality*. Overall, identity can be understood as a system of factors that make it possible for a human being or a community to relate to another. Selecting certain factors as dominant in this system, the researches arrive at certain types

of identity—personal, group, national, class, cultural, professional and so on, as far as “fan-group” identity.

Information Society: The 2003 WSIS “*Declaration of Principles - Building the Information Society*” states that the information society is the society where anyone can produce information and knowledge, have an access to them, use and share them in order to provide individuals, communities and nations with a possibility to fully actualize their potential, securing their sustainable development and improving the quality of life, on the basis of the goals and principles of the UN Charter and fully abiding by the Universal Declaration of Human Rights.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor; X. Yu, pp. 451-455, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 2.22

Telecommunication Problems in Rural Areas of Armenia

Gevorg Melkonyan

Internet Users' Society of Shirak, Armenia

BACKGROUND

The Synergy Project “Priorities in the Development of Telecommunications Sector in the South Caucasus” (2003) has the task of modernising the telecommunications system:

- Creation of conditions for free information space;
- Establishing the market of information and knowledge as a factor of production;
- Ensuring informational security of individuals, society, state, and establishing an effective system of free and equitable receiving, dissemination and use of information as a key condition for democratic development;
- Increasing the level of education of the population, the scientific-technical and cultural development of the society by expanding the opportunity of information exchange on an international, regional and national level and, consequently, increasing professionalism and creativity;
- Forming new structures in the public administration, economy, business, culture and social spheres based on massive use of information technologies, computer technologies and telecommunication; and
- Effective use of information resources in the activities of government bodies.

In the rural areas of Armenia during the Soviet authority, the telephone communication system was based on analog stations and a linear network. After many years of operation, the analog telephone stations are worn out, and the linear network is damaged and in the most part is completely destroyed. In spite of the fact that in recent years the infrastructure of telephone communication of the country was considerably improved, one can still see non-uniformity of development of infrastructure between various regions, urban and rural infrastructures of telephone communication, and also between city and other regions of the country and in particular remote villages.

A four-year project of ArmenTel, the telecommunication company with the monopoly in

Armenia, aimed to provide 800 villages with a digital telecommunication technology until 1997, but this promise remains unaccomplished. As a consequence, the majority of villages in the country are now suffering information isolation. Add to this, the terrible condition of rural roads, which have not been reconditioned for 10-15 years, and the image of the majority of villages of Armenia in this aspect will be clear. The only communication facility with the external world is television.

Under these conditions, some public and charitable organizations have undertaken their own research on telecommunication problems and on satisfaction of villages' information need. For example, in 2000, as part of the 3PN (2004) within the framework of the "Narod" network project (NNP, 2004) at school #1 of Akhuryan village, we tried to organize an Internet centre which could also be used by small groups of school children from the neighbouring villages, but owing to absence of telephone communication, this idea was not realized. In the same year, with the support of the Bureau of Educational and Cultural Affairs of the U.S. Department of State, the Armenian School Connectivity Programs (<http://www.ac2k.am/>) (AC2K, 2004) began as part of the Program "Project Harmony" (<http://www.projectharmony.am/>) and many villages, including Akhuryan, obtained access to such services as e-mail, distance learning and e-commerce. The program creates centres connected to the Internet at schools in rural regions using a basic radio-modem connection, which in the absence of linear telephone communication is the only option for rural areas.

RIGHT DIRECTION OF DEVELOPMENT POLICIES

It is necessary to note, that the creation of a telecommunication network in rural regions by the creation the Internet centres at schools is the

right strategy for closing the digital divide as the experience in many countries shows. Despite different socio-economic conditions, in all countries there are similar problems and difficulties:

- Low and insolvent demand of telecommunication services due to small density of the population;
- Significant distances of the villages from the regional centres and truncated relief (sometimes by natural barriers—mountains, gorges, bogs);
- Absence of necessary technical and financial assets; and
- Absence of the highly-skilled specialists.

Irrespective of the development level of the country, the problems of providing telecommunication services in rural areas are similar, and similar solutions are possible—differing in their application, means and fundraising strategies for the necessary resources.

The decision to use the village high school as the telecommunication center was because it is a uniting factor in a village community and is the institution for the preparation of the young generation most receptive to new information technologies. In the present socio-economic environment, the village school is disadvantaged in comparison with urban schools, for example, highly-qualified teachers and specialists do not find rural life attractive. Therefore, a regional computer network for rural educational institutions will be particularly useful for the school-children, the teachers and for the whole rural community. Access to the Internet is a valuable educational information resource for the village school children and teachers, which helps them to prepare for competitive examinations, and is an irreplaceable communication facility that enables dialogue about common projects with colleagues world-wide.

The transformation of villages to be convenient and attractive places to live, is strategically impor-

tant for the sustained development of the country, and so one should expect effective participation and support by the appropriate state structures and, most of all, by the national government. In particular, the government of Armenia has already decided to sanction local and regional networks of the data transfer in a range of frequencies from 2.4 up to 2.5 GHz in all territory of the country. Henceforth, use of radio-modems and wireless network access in this range of frequencies will provide rural Internet centers with the high-quality Internet services. As the base scheme of regional network development, it is expedient to use the network of TV towers—previously having coordinated this with the TVR Committee. Such a concept for the development of telecommunications in rural region was offered in October 2000, at the international seminar “Conversion potential of Armenia” organized by the International Scientific and Technical Centre in Yerevan (<http://www.sci.am/istc2000/>).

After the successful development of new communication facility application processes, information and telecommunication technologies can become not only one of the factors ensuring competitiveness of the economy, but also a basis of active regional cooperation between communities and the formation of a uniform economic space in the region.

ACHIEVEMENTS, THE PROBLEMS AND FUTURE TRENDS

Many rural schools in Armenia are supplied with modern computers donated by different charity organizations and private persons. For schools that do not benefit from such initiatives, the organization “Project Harmony” offers an alternative solution: to equip a bus with computers. However, given the condition of our rural roads, we must note that with this equipment (at a cost of US\$80,000-\$100,000) will not solve the problems. The author believes that it would be more effec-

tive to locate computer and telecommunication equipment where it can be in constant use. And for schools deprived of Internet access, training can be offered by means of multimedia programs on CD-ROMs simulating a real Internet network - offering selection from the most popular sites on a disk and using it as one of computers of a server for the local network. This technique was successfully used at the childhood-youth centre “Meghvik” (<http://users.freenet.am/~meghvik/>) in Gyumri, Armenia.

An acute problem for Internet centres in rural communities (community telecentres) is shortage of expertise. Because of its absence, the directors of schools, being aware of computer breakage and the failure of the programs, often lock away the computers, and then later the computers are obsolete and no longer suitable for work with the new versions of the programs. Carried out by Open Society Institute (<http://www.isoc.am/>), IREX (<http://www.irex.am/>), ACCELS (<http://www.accel.s.am/>), “World learning” (<http://www.worldlearning.am/>) and “Project Harmony” preliminary courses have eased this problem a little, but further courses are necessary.

Recently, the Open Society Institute of Armenia (<http://www.osi.am/>) has developed a community telecenters creation program in rural regions of Armenia, which should help considerably with the problem of information provision in rural communities, thereby reducing the digital divide between the urban and rural population. For this purpose, the Open Society Institute has given a grant to the Armenian association of users CDS/ISIS (<http://www.distancelearning.am/>), which has chosen NGO “Internet Society” of Armenia (<http://www.isoc.am/>) as the partner. The grant was stipulated to prepare the personnel for work at the telecentre - managers, network administrators, operators, and also specialists in training and creation of the programs for training. In addition, a Web-portal for a telecentres network was to be created which all telecentres of the country would use. In the early phase of

the grant, there have been approximately 40 telecentres organized in schools. Forty students have completed training on WebCT™, and also use of the Internet for searching for educational resources.

The Internet training was conducted on the basis of a site <http://www.teachers.ash.org.au/shansen/wow/>. Equipment for the preparation and duplication of a video course was acquired. A Web-portal (<http://www.telecentres.am>) was prepared on which courses on the preparation of the managers, network administrators, links to the telecentres of the world, and also a list of the telecentres of Armenia, in particular, are published. The level of training and availability of the highly qualified specialists in the sphere of telecommunication defines the quality of telecommunication services delivered to the community.

Another important problem for rural telecommunications in Armenia is the unreasonably high price of the main channels of communication, that is caused by an exclusive condition of the telecommunication market in Armenia. But encouraging changes are planned: After lingering discussions and negotiation of authorities with the management of ArmenTel company, the monopolist in sphere of telecommunications of Armenia, the government decided to cancel from July 2004, the exclusive license of ArmenTel company on the international channels of communication. This means the liberalization of the telecommunications market with new operators in the telecommunications market, the gradual improvement of quality of communication channels offered, and a decrease of the price of telecommunications is expected. All these changes create the preconditions for successful development of regional telecommunications and general application of new information technologies, including in the remote rural communities.

CONCLUSION

For effective functioning of community telecentres, it is necessary to analyze the social, economic, educational, cultural and technical factors in the life of rural community, to find and to develop further expedient ways of development, providing interactive harmony of all the participants and sustained development of the community (RTTF, 2004).

Effective interaction in solving the problems of telecommunication sector can influence the development of the telecommunications infrastructure, including in rural areas. Here it is necessary to pay special attention to liberalization of the telecommunications market and further improvement of the legislation in this important part of the economy (NRRI, 2004).

The main problems include: the improvement and closing of tariff regulation and price calculation, improvement of effectiveness of operator activity, regulating of mutual payments, reforming of the sector management, improvement of the statistical base, assistance in the further development and perfection of the market relations in the telecommunication sector.

REFERENCES

- 3PN. (2004). *The three pomegranate network*. Retrieved September 2004, from <http://www.3noor.org>
- AC2K. (2004). *Armenian school connectivity programs*. Retrieved September 2004, from <http://www.ac2k.am/>
- Kozinska-Baldyga, A. (2001). *Interklasa program* (in Polish). Federation of Educational Initiatives, Warszawa. Retrieved from <http://www.fio.interklasa.pl/>
- Misaros, G., Salageanu, D., & Youmans, A. (2001). *TeleCenter program presentation*. Timisoara. Retrieved from <http://www.rural-center.org>

NNP. (2004). *The Narod network project*. Retrieved September 2004, from <http://www.narod.org/education/edu.html>

NRRI. (2004). *Advanced telecommunications in rural areas*. National Regulatory Research Institute. Retrieved September 2004, from <http://www.nrri.ohio-state.edu/programs/telcom/advtelcom.html>

Priorities in the Development of Telecommunications Sector in the South Caucasus (2003). Synergy project. Grant of Eurasia Foundation C02-4017. Final Report.

RTTF. (2004). *Rural telecommunication taskforce*. Retrieved September 2004, from <http://www.rttf.org/>

KEY TERMS

Communication Technologies: The branch of technology concerned with the representation, transfer, interpretation, and processing of data among persons, places and machines.

Distance Learning (Teletraining): Training that in which usually live instruction is conveyed in real time via telecommunications infrastructure, that may be accomplished on a point-to-point basis or on a point-to-multipoint basis, and may assume many forms, such as a teleseminar, a teleconference or an electronic classroom, usually including both audio and video.

E-Commerce (Electronic Commerce): Business transactions conducted by electronic means other than conventional telephone service, e.g., facsimile or electronic mail (e-mail).

E-Mail (Electronic Mail): An electronic means for communication in which usually text is transmitted, operations include sending, storing,

processing and receiving information, users are allowed to communicate under specified conditions and messages are held in storage until called for by the addressee.

Information: In intelligence usage, unprocessed data of every description which may be used in the production of intelligence.

Linear Network: The specific physical, i.e., real, arrangement of the elements of the network.

Mobile Adviser: The highly-skilled expert, voluntary or on a contractual basis, maintains the regional network of the telecentres and helps the personnel by providing advice and necessary programs.

Network: An interconnection of three or more communicating entities.

Rural Area: Residence of a not urban type.

Synergy Project: A team-developed project.

Telecommunication: Any transmission, emission, or reception of signs, signals, writings, images, sounds, or information of any nature by wire, radio, visual, or other electromagnetic systems.

Telecommunications Infrastructure: The aggregate of equipment, such as radios, telephones, teletypewriters, facsimile equipment, data equipment (computers, modems and other equipment), cables and switches, used for providing telecommunications services.

Telecommunications System: A collection of individual telecommunications networks, transmission systems, relay stations, tributary stations, and data terminal equipment usually capable of interconnection and interoperation to form an integrated whole. The components of a communications system serve a common purpose, are technically compatible, use common procedures, respond to controls and operate in unison.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, X. Yu, pp. 683-686, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 2.23

ICT as an Example of Industrial Policy in EU

Morten Falch

Technical University of Denmark, Denmark

Anders Henten

Technical University of Denmark, Denmark

INTRODUCTION

A substantial part of the economic growth that has taken place within the past 2 decades is related to information and communication technology (ICT). First, the ICT sector itself has achieved very high growth rates. Second, productivity gains in other sectors have been achieved, to a large extent, through implementation of ICT-related innovations. It is, therefore, no surprise that ICT plays an important role in virtually all industrial policy programs. Policies stimulating e-government are one of the ingredients in such programs.

In 2000, the leaders of the European Union (EU) adopted the Lisbon strategy to make the EU the most dynamic and competitive knowledge-based economy in the world (CEC, 2000). ICT was seen as a key component in achieving these goals¹, and a special program—eEurope—has been designed to realize the Lisbon goals in the ICT area. This program is, however, also a con-

tinuation of a wide range of ICT initiatives taken by the EU Commission since 1984.

BACKGROUND

In the eEurope program, the Commission mentions three types of benefits stemming from ICT:

1. The ICT sector itself accounted for 6% of employment in the EU in 2000
2. ICT improves productivity in other sectors
3. ICT boosts citizenship and quality of life (CEC, 2004a).

Although the third point may, in part, be outside the scope of industrial policy, as it does not directly address the economic sphere, the three points reflect very well the dual aspect of the EU

ICT policy, which has been inherent from the early beginning:

- **International Competitiveness:** Telecom is considered to be a high-tech sector of strategic importance with regard to the generation of employment and economic growth. In addition, telecom is a sector in which the EU has a relatively strong position compared to the United States (U.S.) and Japan.
- **The Information Society:** Telecom networks constitute an essential infrastructure for the information society. Cheap and ubiquitous access to advanced telecom services is, therefore, important for the generation of employment and economic growth in any industry.

The first point is typical for sector-specific industrial policy. The objective is to strengthen an industrial sector deemed to be of particular importance to maintain or even improve the EU position in the international division of labor. The major reason is a high growth potential with regard to employment and contribution to GDP.

The second point is somewhat more related to horizontal industrial policy aiming at improving the business environment in general. Here, ICT is seen as a part of the overall infrastructure used by all industries. It should be noted that this distinction is not completely clear-cut. The argument for industrial policies directed towards a specific sector will often be that a particular sector possesses important spillovers to other industries. For instance, one of the arguments used as justification for the support to the agricultural sector is that agricultural production generates employment in food-processing industries.

The telecom sector itself has often used its importance for the entire economy as an argument for support. This argument has also been widely used by other sectors if they had an interest in affecting political decisions. However, with

regard to telecom, there has also been a strong pressure from users—in particular, business users—depending on access to more advanced communication services.

A strong ICT sector may support the development of an information society, and an advanced information society will benefit the ICT sector as it stimulates demand and innovation of ICT products and services. Still, the two objectives are addressing two different groups—users and producers of ICT—and these groups often have contradicting interests.

THE EU RESEARCH PROGRAMS

The first initiative taken by the Commission was the introduction of a number of European-wide research programs. The ESPRIT program supporting IT research was commissioned in 1984 and the first phase of the RACE program, supporting telecom research, was commissioned the year after. Both programs offered support for so-called pre-competitive research. In this way, any accusations of industry subsidies could be avoided, and it was easier for competing companies to exchange information. The core of the RACE program was to develop technologies for developing a broadband in Europe (a distant goal at that time), and the focus was mainly on providing the basic infrastructure, although very few applications justifying the need for huge investments in optical networks were available. An important objective of the program was also to create an international forum for discussions and cooperation between European telecom companies to establish a common vision for the future European telecom networks and, thereby, facilitate integration of a market fragmented along national borders.

The RACE program was extended and followed by a series of other telematic research programs. However, there has been a gradual shift in focus from development of basic technolo-

gies towards development of applications. This reflects a trend towards more application-oriented research as well as a shift towards more focus on the demand side. Also, the kind of participants in the research programs has changed. From the beginning, telecom operators were very active in the programs, but following a reorientation of the telecom operators towards more commercial—and more limited—research and development activities, they have restricted their participation. On the other hand, a large number of small- and middle-size consultancy firms and information technology (IT) companies have engaged in the programs.

STANDARDIZATION

A related activity was the establishment of a European standardization body, ETSI. The creation of this body moved a part of international standardization from ITU into the European framework. In addition, it enabled a more direct involvement from industry partners in the standardization process. Many of the EU-funded research projects participate directly in ETSI so that the research made through cooperation between European industry actors can result in common European standards.

The establishment of a European-based standardization body is not only a way to contribute to the development of a common internal market within the EU. It also contributes to strengthening the role of the EU-based industries in the formation of global standards, and thereby it contributes to an improved international competitiveness of the European telecom industry.

SECTOR REFORM

Another line of EU policy has been related to the market reform of the telecom sector. This reform was initiated by the Green Paper issued in 1987

(CEC, 1987) and followed by a series of directives that have been revised a couple of times. The latest major revision was made through the issuing of the new telecom framework directives in 2002. The vision behind the market reform is to change the telecom sector from being a public utility provided by publicly owned—or at least publicly controlled—monopolies into a “normal” industry sector, where private companies compete for market shares and without any sector-specific regulation.

Although the sector reform should be seen in the context of an ongoing reform of public sector activities in general, the primary objective is to initiate a more dynamic development of the telecom sector itself through a complete restructuring and to remove barriers set by former public involvement. It should, however, be noted that the objective of “normalization” of the sector was not clearly defined from the beginning. The first step, which was suggested in the Green Paper, was the liberalization of terminal equipment, creating a common market in this area. The Green Paper of 1987 also suggested a liberalization of other telecom services than telephony, while telephony, which at that time was by far the most important service, as well as the physical network, should be reserved for the incumbent monopoly operators.

A further point is that not all member countries agreed on the proposed liberalization. In particular, France, together with countries from Southern Europe, were very reluctant to liberalize the telecom market, and many countries were concerned about how their own incumbent telecom operator could survive in a liberalized market. A good example of this is Denmark, where the market was divided between four regional operators in limited geographical areas. The Danish government wanted to create a strong Danish actor on the telecom market and merged all operators into one (Tele Danmark). In addition, a substantial part of the revenue raised through the subsequent privatization was given

to Tele Danmark, enabling the company to invest in telecom companies abroad.

A more recent line of policy actions is related to the stimulation of demand and development of content. These types of initiatives dominate the eEurope program initiated for realizing the goals set by the Lisbon agenda with regard to ICT. The objectives of the program do not include anything about the ICT sector itself, but focuses on making ICT available to everybody and stimulating entrepreneurship.

eEUROPE

The eEurope program was initiated in 2000 as a Commission initiative for the special European Council of Lisbon (ECE, 2000). The program has later been followed by the eEurope 2005 program (CEC, 2002a), and the successor of this program—i2010—has just been announced (CEC, 2005).

The eEurope plan 2000-2002 had three overall objectives: Cheaper, faster and more secure Internet, investment in people and skills and greater use of the Internet. In the eEurope 2005 plan, these aims were replaced with: Modern online public services, dynamic e-business environment, widespread availability of broadband access and secure information infrastructure (CEC, 2003). Both plans include actions stimulating network as well as content development.

This dual perspective is most clearly formulated in the 2005 plan, where the mutual dependence between network development and content development is recognized and public action is recommended to correct this market failure: “Funding more advanced multimedia services depends on the availability of broadband for these services to run on, while funding broadband infrastructure depends on the availability of new services to use it. Action is, therefore, needed to stimulate services and infrastructure to create

the dynamic where one side develops from the growth of the other” (CEC, 2003, p. 2).

This is the typical market failure argument used for implementing industrial policy: To achieve the most favorable development, it is necessary to help the market to take the right decisions.

Both plans include a large number of action points, but none or very few of these points include initiatives that would be termed as industrial policy in the supply-oriented, traditional sense. However, they include the development of a wide range of e-government applications, such as e-learning and e-health, and the provision of broadband access to public institutions. Development of such applications enables both cost saving and service improvements in the public sector. But maybe even more important is the impact on other sectors. Development of e-government services stimulate development of similar service in the private sector and lead to further growth in the demand for infrastructure facilities, such as broadband. eEurope also includes a large number of initiatives involving the private sector. These initiatives include support to research and development in telecom networks as well as applications like e-business. The objective of many of these initiatives is to develop pilots, which can inspire other parts of the private sector. Finally, the plans include a continuation of the telecom reform process and measures for improvement of legislation to facilitate e-business.

Although the 2005 plan states the importance of the supply side, the only really new initiative, in addition to a continuation of the telecom reform process, is a suggestion to finance network development in less favored regions; for example, by the use of structural funds. This initiative is maybe the one most in line with the old-type industrial policy subsidies.

In addition to initiatives at the EU level, most member countries have defined their own national broadband strategies as a part of eEurope. National programs within the ICT area are far from a new phenomenon. In the early 1990s, it became fashion

for each country to develop its own plan for how it could become global champions in ICT (Henten, Falch, & Skouby, 1995).

The national programs fit very well with the EU programs, as they basically use the same type of remedies: Support for research and development and pilot projects, e-government initiatives, and demand stimulation through demand from public sector institutions. Very few countries have discussed direct subsidies for network development. Sweden has had programs for public funding of broadband networks, and in Denmark, broadband access receives substantial taxation subsidies, as companies are allowed to offer broadband connections to their employees as a tax-free fringe benefit.

FUTURE TRENDS

The eEurope and iEurope programs tend to emphasize more on content development and stimulation of demand than previous ICT programs. The same trend can be observed in other countries; for example, in the Japanese U-Japan program. One reason for this is that the major parts of telecom reform now have been implemented and the supply of network infrastructure no more is seen as a major bottleneck for development of the information society. Therefore, more attention is given to development of content. In this context, e-government plays a major role, as development of public content can stimulate development of content in the private sector as well as the demand for ICT network facilities, such as broadband.

CONCLUSION

During the process of creation of the EU internal market, it has been important to remove all barriers for international trade between member states. This includes national subsidies as well as other measures favoring domestic industries. On the

other hand, it has been important to ensure development of the European industry in competition with the U.S. and Japan. This has led to a strategy with policy goals that are not very different from those set by traditional national industrial policy; but at the European level, many of the traditional remedies are replaced by a new set of initiatives with focus on stimulation of ICT-based innovations and applications. In this context, e-government plays a crucial role, as development of public e-services stimulates the overall use and demand for ICT. The impact of such policies on the entire economy is difficult to assess. But there has been a clear, positive impact on the penetration of ICT technologies in the countries being most active in this policy area. In particular, policies securing more competition on national ICT markets led to a much faster introduction and higher penetration of new ICT services, such as broadband access and mobile communication.

REFERENCES

- Bora, B., Lloyd, P., & Pangestu, M. (2001). *Industrial policy and the WTO*. Geneva: UNCTAD.
- Brander, J., & Spencer, B. (1983). The international R&D rivalry and industrial strategy. *Review of Economic Studies*, *L-4*(163), 707-722.
- Carlsson, B., & Jacobsson, S. (2004, June 23-24). Dynamics of innovation systems—Policy-making in a complex and non-deterministic world. *Proceedings of the International Workshop on Functions of Innovation Systems*, University of Utrecht, The Netherlands.
- CEC. (1990). Industrial policy in an open and competitive environment: Guidelines for a community *Approach*. COM(90), 556, Brussels.
- CEC. (2000, March 23-24). *eEurope—An information society for all*. Communication on a commission initiative for the special European Council of Lisbon, Brussels.

ICT as an Example of Industrial Policy in EU

CEC. (2002a). *eEurope 2005: An information society for all*. COM(2002) 263 final, Brussels.

CEC. (2002b). *Industrial policy in an enlarged Europe*. COM(2002) 714 final, Brussels.

CEC. (2003). *Some key issues in Europe's competitiveness—Towards an integrated approach*. COM(2003) 704 final, Brussels.

CEC. (2004a). *eEurope 2005 action plan: Update, structural overview of action plan targets and revision*. COM(2004) 380 final, Brussels.

CEC. (2004b). *Fostering structural change: An industrial policy for an enlarged Europe*. COM(2004) 274 final, Brussels.

CEC. (2005). *i2010—A European information society for growth and employment*. COM(2005) 229 final, Brussels.

Cowling, K. (Ed.). (1999). *Industrial policy in Europe*. London: Routledge.

DiLorenzo, T. (1990, June). The genesis of industrial policy. *The Freeman*, 40(6).

Ehlers, S. (2003). *IT policy in Japan—from hard to soft*. ITPS. Stockholm, Sweden.

Falch, M., Saugstrup, D., & Schneider, M. (2004, September 4-7). How to achieve the goal of broadband for all. *Proceedings of the ITS Conference*, Berlin.

Foreman-Peck, J., & Federico, G. (Eds.). (1999). *European industrial policy*. Oxford: Oxford University Press.

Gillet, S. E., Lehr, W. H., & Osorio, C. (2004). Local government broadband initiatives. *Telecommunications Policy*, 28(7/8).

Hart, J. (2001, November 9-10). Can industrial policy be good policy? *Proceedings of the Conference on The Political Economy of Policy Reform*, Tulane University, New Orleans, LA.

Henten, A., Falch, M., & Skouby, K. E. (1995).

European planning for an information society. CTI working paper no. 4, Technical University of Denmark, Lyngby, Denmark.

McKenzie, R. (2002). *Industrial policy*. *The Concise Encyclopedia of Economics*. Retrieved from www.econlib.org/library/Enc/Industrial-Policy.html

Navarro, L. (2003). *Industrial policy in the economics literature: Recent theoretical developments and implications for EU policy*. Enterprise papers no. 12, Enterprise Directorate-General, European Commission, Brussels.

PricewaterhouseCoopers. (2004). *Rethinking the European ICT agenda*. Ministry of Economic Affairs. Hague, The Netherlands.

KEY TERMS

eEurope: The eEurope program was initiated in 2000 as a part of the Lisbon Process to ensure that the EU will fully benefit from opportunities of the information society. The objectives are to make communication services including broadband widely available, to stimulate content development and improve e-literacy—all in a way that strengthens social cohesion.

ETSI: ETSI is a European standardization body established following an initiative set by the European Commission. ETSI prepares common standards for telecommunication systems for fixed and mobile networks and services, TV broadcasting as well as for information technologies. Both European and non-European companies can be members. Today it has 688 members from 55 countries.

EU Research and Development Programs in ICT: European research activities are structured around consecutive 4-year programs, or so-called Framework Programs. The Sixth Framework Program (FP6) sets priorities—including the information society technologies (IST) priority—for

the period 2002-2006. While the first cycles mainly focused on the basic technology, later programs include a wide range of applications as well. The current program includes a project line on ICT research for innovative government.

Industrial Policy: State policies conducted with the aim of strengthening the industrial base of a country or region. General macroeconomic stabilization policies are not considered part of industrial policies; however, industrial policies can encompass a broad range of supply-and-demand-oriented policy initiatives.

International Telecommunication Union (ITU): An international organization within the United Nations system where governments and the private sector coordinate global telecom networks and services.

Lisbon Process: At a summit in Lisbon in March 2000, European leaders set the goal of

the EU becoming “the most dynamic and competitive knowledge-based economy in the world” by 2010. The target was a 3% average annual economic growth and the creation of 20 million jobs by 2010.

Telecom Sector Reform: A reform that has transformed the telecom sector from national monopolies controlled by governments to a sector with competition and private ownership. The telecom market was in principle liberalized in 1996 within the U.S. and in 1998 within the EU, although public ownership of telecom operators still persists in some European countries.

ENDNOTE

- ¹ See EU Web site for more information on Lisbon agenda: http://europa.eu.int/growthandjobs/index_en.htm

This work was previously published in Encyclopedia of Digital Government, edited by A. Anttiroiko and M. Malkia, pp. 947-951, copyright 2007 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 2.24

Information Literacy for Telecenter Users in Low-Income Regional Mexican Communities

Antonio Santos

Universidad de las Americas-Puebla, Mexico

INTRODUCTION

The purpose of this article is to propose a methodology to increase information literacy among people who attend telecenters in low-income communities in Mexico. The Mexican government created telecenters, or community technology centers, as part of a national project under which adults lacking basic education who are isolated and living under economically and technologically marginal standards are granted access to educational materials and work training in the form of printed, audiovisual, and electronic media (CONEVyT, 2001). Our research group evaluated the Mexican telecenter program as part of a nationwide qualitative diagnostic study, which represented the initial stage of a three-year research project conducted by the Information and Communication Technologies for Education and Community Development research group at the

Universidad de las Americas-Puebla in Mexico for the National Institute for Adult Education. The results of this study combine with the concepts of information literacy and socioconstructivist pedagogy to form the basis for the present proposal.

This article is organized in three parts. The first is centered around a discussion of current literature treating technology for social development, including the aforementioned diagnostic study on telecenters, or *plazas comunitarias*, as they are called in this Mexican project. The purpose of the second part, which is to explore a different perspective on the subject at hand, is developed during a discussion of information literacy and social constructivism. The third part fleshes out ideas broached in sections one and two and proposes a methodology for technology community centers, as the *plazas comunitarias*, under which information literacy and personal development are promoted.

BACKGROUND

In this section, the traditional view that access to technology leads to social development is analyzed and criticized. This view may be considered limiting as it might hinder potential benefits from reaching users of technology; to illustrate this point, results of the diagnostic study on the *plazas comunitarias* project in Mexico will be presented and discussed.

Technology for Social Development

In most developing countries, providing access to information and communication technology (ICT) to low-income populations—that is, bridging the digital divide—is a high priority since it is widely believed that ICT can be a tool “for social action and positive social change” (APC, 2003, p. 12) as well as a facilitator of “more productive and rewarding lives” (McNair, 2000, p. 9). However, in developing countries, the ICT revolution remains an unfulfilled promise to low-income populations due to obvious access inequalities and the conviction of developing societies that access to technology implicitly leads to social development (Moghaddam & Lebedeva, 2004; Curtain, 2004). It makes perfect sense then that most efforts made by these governments are dedicated to supplying the technology with the expectation that this is enough to decrease the digital divide.

According to Hewitt (2001), these expectations are simply too high, and it is an overstatement that just giving people access to the Internet broadens their employment opportunities and improves their chances at achieving sustainable economic growth. In the same vein, León (1999) accepts the importance of access to information and communication technology, but agrees with Hewitt that this alone does not constitute entrée into a new stage of social development. During an OECD roundtable discussion of ICT and the digital divide, participants commented that the gap is not digital, but rather educational, and they

stressed the need to empower people with educational, cognitive, and behavioral skills instead of just supplying them with equipment (OECD Secretariat, 2000). Steyaert (2000) adds to this list the need to develop information skills in order to become fully information literate. And finally, in a 1996 UNESCO report, Delors worries about the high hopes for social change that are imposed on technology. He declares that the so-called information and communication revolution is not purely technological and that it is important to situate it in a greater social and economic context, a comment that touches on one of the chief criticisms directed at the supply of technology in an effort to diminish the digital divide.

A Diagnostic Study on Plazas Comunitarias

A prime example of a project under which a one-dimensional, causal relationship is asserted between technology and social development is the *plazas comunitarias* project in Mexico. To clearly understand how this linear view prevents users from exploiting the full potential of ICT, the results of the diagnostic study conducted by our research group are explained here (for the full research report see Salinas, Porras, Santos, & Ramos, 2002).

Problem Statement

The *plazas comunitarias* are being opened nationwide to allow low-income populations the opportunity to: 1) attend literacy and non-formal basic education programs; 2) receive continuing education; and 3) become technology literate.

However, due to lofty aspirations on the part of the government at the project's outset, the *plazas* were opened at a hectic pace. Thus, the Institute did not have time to develop a basic model that would aid them in integrating the objectives they hoped to achieve. Understanding the need for such a model, the Institute contacted

our research group to aid in the development of an educational model.

Research Design

The main objective of the qualitative study was to diagnose how the *plazas* were functioning during their first year in operation. It was an exploratory qualitative study done in a sample of 17 *plazas* in six Mexican states over a six-month period. Researchers employed observation and in-depth interview as data collection methods as well as a number of informational sources. To encourage inclusion and expand the sample's variability, the *plazas* were selected using purposive sampling. Questions asked during the study included: How do students learn? How are ICT being used? How are all its physical areas being used? How are the *plazas'* services being promoted? How are the *plazas'* personnel performing their job tasks? And how are the *plazas* relating to their local communities? All observations were recorded in research journals. Finally, the constant comparative method of inductive data analysis was used to identify patterns that might help us understand how the *plazas* were functioning.

Results

1. Although the *plazas comunitarias* project was something new for the Mexican population, it was not entirely an educational innovation as the project lacked a systemic perspective and failed to consider many of the complexities of the social system related to the *plazas*.
2. The *plazas* were operated as traditional schools, not as center of adult education. The opening of the *plazas'* buildings caused employees and adult students to feel that they were in a formal learning environment, and technological materials were used in the same way as in traditional schools. That is, ICT served only as a vehicle of information and not as a mind-tool (Jonassen, 1996).
3. Telecenter users frequently engaged in cognitive processes of the lower orders. In fact, most observed teaching, learning, and utilization of technology practices were focused on the memorization of content for answering multiple-choice exams. Therefore, these adults were not developing higher order skills that would improve their everyday lives, such as learning to learn, problem-solving capabilities, and collaborative learning methods.
4. The role of ICT in the *plazas* was basically to teach its users the essential functions of the equipment and how to manipulate it in order to extract information. Thus, there was no clear understanding of the potential of ICT to improve quality of life or teach life-long learning skills. For the *plazas*, using technology meant only the rote learning of software applications, so ICT was not really perceived as part of the whole knowledge construction process.
5. The *plazas comunitarias* are not decreasing the social inequalities and exclusion of the poor because the people that need these services most are not stepping forward to become telecenter users. They do not recognize any link between the services offered at telecenters and their own personal needs. On the contrary, individuals with more education and belonging to a higher socioeconomic class go to the *plazas* without outside encouragement since the benefits of ICT are more obvious and credible to them. Thus, traditional economic and social inequalities and exclusions are simply replicated at the *plazas* rather than decreased (Steyaert, 2002).

A DIFFERENT PERSPECTIVE

The literature previously cited in this article suggests the employment of an alternative perspective on the use of ICT for social development. To this end, the notion of information literacy and the epistemological and pedagogical concepts of social constructivism are discussed in this section.

Information Literacy

Access to technology is not enough to effect a real difference in the quality of life of socioeconomically disadvantaged populations. Physical access to technology is not as critical as developing information skills, that is, becoming information literate (Steyaert, 2000, 2002). Possessing such skills is a central factor in dealing with social inequalities and exclusion since too little attention is currently paid to developing individual knowledge-acquisition skills, which aid in the satisfaction of individual needs and interests.

The American Library Association (1989) defines information literacy as “the ability to know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.” This definition is dynamic because it states specific skills and actions that would allow a person to solve a problem and, at the same time, become information literate. It is important to note that this person’s goal is to solve a significant, personal problem and not to become information literate. In this regard, Dewey (1938) addresses the importance of acquiring skills as “means of attaining ends which make direct vital appeal” (p. 6).

Social Constructivism

In contrast to traditional objectivism, which assumes that knowledge is “out there” and that it can be transferred to the person, social constructivism takes the view that knowledge is a process more than it is an object, a process through which

individuals develop higher cognitive abilities and construct knowledge through social interaction (Driscoll, 2000). In this social constructivist vision, “knowing is not a static disposition of actors, but rather an on-going social accomplishment” (Orlikowsky, cited in Rowland, 2004). Moreover, the social constructivist posture contends that knowledge is closely related to action and with the context and situation within which it is constructed and used (Brown, Collins, & Duguid, 1989). According to this epistemological perspective, social constructivist pedagogy strives to build learning environments focused on problem solving, where the sharing of knowledge is encouraged through collaborative learning to allow for free meaning development and negotiation. Within one of these learning environments, ICT must be dynamically integrated into the social processes so that people can actively and collaboratively use ICT as a mind-tool (Jonassen, 1996), instead of learning passively from ICT equipment as sheer carriers of information.

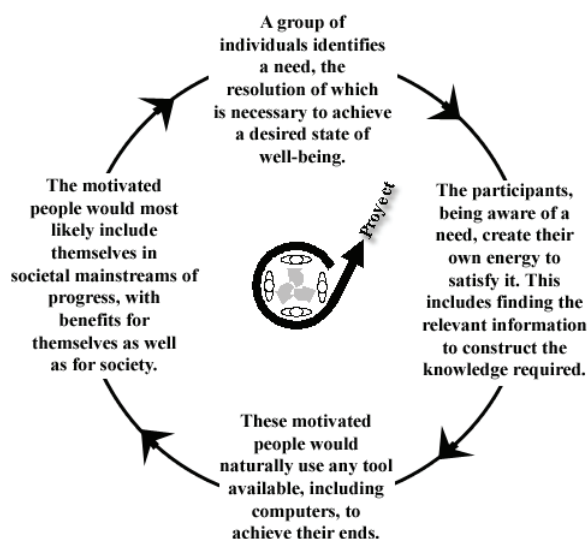
METHODOLOGY TO FACILITATE INFORMATION LITERACY

Drawing from ideas presented in the last section, our research group designed a methodology for the *plazas comunitarias* to promote social development by integrating the use of ICT. This methodology is based on information literacy and social constructivist pedagogy.

The Methodology’s Goal

As Figure 1 demonstrates, the methodology’s goal is to engage the *plazas’* users in a “virtuous cycle” (that is, the opposite of a “vicious cycle”), within which they experience a dynamic process that leads them to a higher state of well-being. The energy that drives a virtuous cycle comes from within the participants themselves; it is generated when a decision is made to act collaboratively and

Figure 1. "Virtuous cycle" of ICT integration



become motivated to satisfy a significant need. To organize these collaborative actions, users develop a group project—that will eventually satisfy the previously identified need—by performing a series of activities.

The premise is by getting involved in a significant activity, the person develops the necessary intrinsic motivation to seek out relevant information and make critical decisions to solve his or her problems. These motivated people would naturally use any tool available, including computers, to achieve their personal ends. In this way, ICT becomes a problem-solving mind-tool instead of being an end in itself. The hypothesis here is that motivated people would most likely include (rather than exclude) themselves in societal mainstreams of progress, producing benefits for themselves as well as for the community.

Project Development

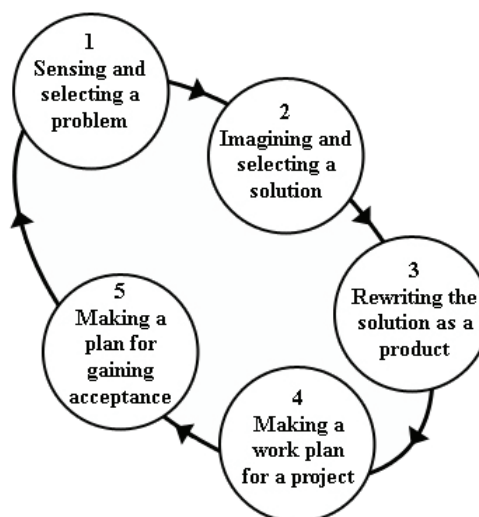
The heart of a virtuous cycle is the set of activities in which users participate in the development of a group project. This process starts at any *plaza comunitaria* when one of its educational advisers invites a group of users to initiate a group project.

The process may be carried out with one person alone, but two or more are preferred as the methodology attempts to exploit the proven benefits of collaborative learning. Then, the adviser and the group complete five different activities, as shown in Figure 2. Selecting a problem (defined as anything that interferes with the satisfaction of a need) as a team and then developing a project to solve it is the first step. The adviser then asks the participants to share their life circumstances with the group and identify problems to which a solution might improve the quality of their lives.

Once each person has expressed their life circumstances to the group and has identified at least one problem, the adviser begins a process of discussion, consensus, and action with the group with the goal of selecting the problem to be solved. The decision is based on which problem is more closely related to their community, taking into consideration their local values and culture, and how much knowledge they already possess with respect to each problem.

Next, the group repeats the process of discussion, consensus, and action, but now with the purpose of imagining possible solutions and selecting one for the chosen problem. The selec-

Figure 2. Activities to develop a group project



tion is made based on such criteria as pertinence, available resources, cost, and time. Then, in order to avoid lengthy discussions and to focus their efforts, the adviser asks the users to imagine a product that they could develop to embody that solution. This product becomes the ultimate goal of the project.

To systemize the group's actions, adviser and users construct a work plan to develop the identified product. This is done by listing all the possible activities and sub-tasks that must be accomplished to reach the project's culmination. Once they are listed, the adviser writes them down in a table format using the following columns: "Task Description"; "What information do we need?"; "What do we need to learn?"; "Which media might we use?"; "Who will do it?"; and "How much time is required?" Finally, as part of the work plan, the group discusses a strategy and makes a list of activities that it might do to achieve community acceptance of its solution-product.

Once the work plan is established, activity begins and users—whose goal it is to complete the project and not to learn certain technology—start to naturally integrate ICT as a mind-tool and develop the information literacy skills needed to accomplish their goals.

CONCLUSION

This article has presented a different way of using IT for social development, one where the individual, his community, and his local culture become the center of all activities. The methodology proposed here has now been tested in the field, and its results will be presented in a future publication. However, there is still much work to be done in this area; we need to develop more research and development projects with a systemic perspective if we want to understand the use of ICT in complex social contexts. In such cases, a phenomenological view seems to be much more powerful for understanding how

a socioeconomically excluded person could improve his quality of life by having access to, for example, the Internet. The qualitative paradigm and the related methodology introduced in this essay appear to be the right choice in experiencing and comprehending the myriad relationships that are cultivated inside a telecenter. Once inside, we might, together with the local players, inductively construct the knowledge necessary to propose broader solutions to the issue of facilitating social development and equality through the implementation of technology.

REFERENCES

- American Library Association. (2000). *Information literacy competency standards for higher education*. Retrieved March 15, 2004, from <http://www.ala.org/ala/acrl/acrlstandards/standards.pdf>
- Asociación para el Progreso de las Comunicaciones (APC). (2003). *Involucrando a la sociedad civil en políticas de TIC* [Involving civil society in ICT policies]. Johannesburg, South Africa: STE Publishers.
- Brown, J., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Consejo Nacional de Educación para la Vida y el Trabajo (CONEVyT). (2001). *Programa de mediano plazo 2001-2006* [Medium-range program 2001-2006]. Mexico City.
- Curtain, R. (2004). *Information and communications technologies and development: Help or hindrance?* Retrieved June 23, 2004, from <http://www.developmentgateway.com.au/ict/assesstool/>
- Delors, J. (1996). *La educación encierra un tesoro*. [Learning: The treasure within]. Paris: UNESCO Editions.

Dewey, J. (1938). *Experience and education*. New York: Macmillan.

Driscoll, M.P. (2000). *Psychology of learning for instruction*. Needham Heights, MA: Allyn & Bacon.

Hewitt de Alcántara, C. (2001). *The development divide in a digital age: An issues paper*. Retrieved April 3, 2002, from <http://www.unrisd.org/engindex/publ/cat/publdnt.htm>

Jonassen, D.H. (1996). *Computers in the classroom: Mindtools for critical thinking*. Englewood Cliffs, NJ: Prentice Hall.

León, O. (1999). Nuevas tecnologías en tiempo de paradojas [New technologies for paradoxical times] [Electronic version]. *Chasqui Revista Latinoamericana de Comunicación*, 68. Retrieved April 15, 2002, from <http://www.comunica.org/chasqui/index.htm>

McNair, S. (2000). The emerging policy agenda. In *Schooling for tomorrow: Learning to bridge the digital divide* (pp. 9-19). Paris: OECD Publications.

Moghaddam, F., & Lebedeva, N. (2004). Carriers, dual perceptions, and the information communication revolution. *Educational Technology Research and Development*, 52(1), 83-87.

OECD Secretariat. (2000). Emerging trends and issues: The nature of the digital divide in learning. In *Schooling for tomorrow: Learning to bridge the digital divide* (pp. 101-112). Paris: OECD Publications.

Rowland, G. (2004). Shall we dance? A design epistemology for organizational learning and performance. *Educational Technology Research and Development*, 52(1), 33-48.

Salinas, B., Porrás, L., Ramos, J., & Santos A. (2002). *Caracterización socioeducativa de las plazas comunitarias INEA-CONEVyT* [Socio-educational characterization of the *plazas comunitarias*

INEA-CONEVyT] (Tech. Rep. No. 1). Puebla, Mexico: Universidad de las Americas-Puebla, Centro de Estudios sobre Calidad de Vida.

Steyaert, J. (2000). *Digital skills, literacy in the information society*. Retrieved April 14, 2004, from <http://www.steyaert.org/Jan/>

Steyaert, J. (2002). Inequality and the digital divide: Myths and realities. In S. Hick, & J. McNutt (Eds.), *Advocacy, activism and the Internet* (pp. 199-211). Chicago: Lyceum Press.

KEY TERMS

Cultural Function of a Telecenter: Set of processes that a telecenter as an open social system carries out to strengthen grass-root values and identity. ICT should facilitate multiculturalism instead of pursuing the standardization of society.

Distributive Function of a Telecenter: Set of processes that a telecenter as an open social system carries out to foster the egalitarian distribution of its benefits and ICT growth and integration into the community's social dynamics.

ICT as a Cognitive Partner: Traditionally, ICT is used as a vehicle of information, but when used as a cognitive partner, it collaborates in the thinking processes of humans by performing actions such as changing a graph instantaneously or supporting a person to build his ideas when designing a concept map.

Information Literacy: The ability to collaboratively know when there is a personal or communal need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand. (This definition is based on that given by the American Library Association (1989), however, here a social construction of knowledge dimension was added.)

Pedagogic Function of a Telecenter: Set of processes that a telecenter as an open social system carries out to foster social construction of knowledge and the development of cognitive and collaborative skills in ICT users; using ICT as a cognitive partner to empower people instead of as a vehicle of information.

Socio-Organizational Function of a Telecenter: Set of processes that a telecenter as an open social system carries out to strengthen and

support the natural social groups and organizations that exist in its local community.

Telecenter: An open social system where people interact among themselves, with technology and with their context, exchanging information, materials, ideas, feelings, and so forth. The purpose of a telecenter is to maintain this flow by: (1) carrying out cultural, pedagogic, distributive, and socio-organizational functions; and (2) providing access to the necessary technology.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, X. Yu, pp. 445-450, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 2.25

Gender and ICT Policies and Programmes in an Indian State

Malathi Subramanian

University of Delhi, India

Anupama Saxena

Guru Ghasidas University Bilaspur, India

INTRODUCTION

The development and use of information and communication technologies have stimulated huge changes in the life of people globally, leading to a process of transition from the industrial to the information society. The ultimate aim of the information society should be the empowerment and development of all its citizens through equal access to and use of information (Goulding & Spacey, 2002).

BACKGROUND

Unfortunately, despite the potential ability of information to empower disadvantaged groups and the massive investments in information and communication technologies, the information society has remained largely silent on gender issues (Jansen, 1989). There is evidence of a gender imbalance in the use of ICT that threatens to restrict women from being equal partners and beneficiaries of the emerging information society, thus creating a gender-based digital divide.

Decades of experiences have shown that without explicit attention to gender in policy, gender issues are not considered for implementation (Hafkin, 2002). Policy making in technological fields often ignores the needs, requirements, and aspirations of women unless gender analysis is included (Marcelle, 2002). If gender issues are not articulated in ICT policy, it is unlikely that girls and women will reap the benefits of the information age (Hafkin). Closing one's eyes to this fact can entrench inequality and even enlarge the gender gap, making ICT a "gender-negative" technology (United Nation's Development Programme [UNDP], 2003).

Thus, the issue of mainstreaming gender into ICT policies and programmes in the context of India becomes important, as here the ICT policy and programmes have been viewed by national and state governments largely within neoliberal macroeconomic frameworks of gross domestic product (GDP), employment, and competitiveness (Gurumurthy, 2003) rather than as issues of development or empowerment as well. Moreover, as in most of the developing countries, ICT education in India is largely confined to cities as the institutions

that offer ICT education are urban based. While there may be a marginally increased enrollment of women in technical institutes in the last two decades, this has not resulted in more women in ICT-related careers or at decision-making levels. Women are vastly underrepresented in government, business, and social and political institutions even in the urban context. Men still hold most of the management and control positions in ICT-related employment and policy-making bodies. In the ICT-related employment sector, males account for 70 to 75% of the workforce. It has been held that even in the urban context, in the period following education, mobility or a lack of it is a crucial factor that affects the access to ICT and networking capacities of women, which is reflected in the extent of the presence of women in this sector (Pichappan, 2001). Women in India are considered to be the most socially excluded group, and a lack of access to information is being identified as one of the most important reasons for their exclusion (Hooper, 2003). This lack of access to information has added to their alienation from mainstream development activities and empowerment, resulting in increased social exclusion and economic and political marginalization, especially of rural, tribal, and other socially disadvantaged women of India.

A Brief Profile of the Indian State of Chattisgarh

Chattisgarh is a newly formed state of India that came into existence in the year 2000. It is a state richly endowed with natural resources but also marked with severe poverty, backwardness, illiteracy, and ignorance: 79% of the state population lives in rural areas, 32.55% of the population is of scheduled tribes (STs), and 12.22% is of scheduled castes (SCs). During 1999 to 2000, the state was third in share of the rural poor in India, with 11.35% of the total poor. Its low position in social and economic infrastructure and development is well documented (Dev, 2004; Kannan, 2004). The

state has been ranked second to last in the list of all Indian states for telecommunications density (report of the Ministry of Communications and Information Technology, <http://www.trai.gov.in/dld1.html>).

Women in Chattisgarh

Women in Chattisgarh are visible in every walk of life, be it in agriculture, in the collection and processing of the state's rich forest wealth, or in construction and wage work in urban areas. Contrary to the situation in many parts of India, Chattisgarh enjoys a comparatively favorable position in terms of women's population as reflected in the sex ratio, which is 990 females to 1,000 males (census of India, 2001, <http://www.censusindia.net/>). However, in terms of infant mortality rates, its record is 97 girl deaths out of 1,000 infants, which is the highest in India (Rustogi, 2003). Furthermore, during 2000 to 2001, the school dropout rate (Class I-VIII, i.e., grade one to grade eight in schools in India) in Chattisgarh was 47.15%. This rate was higher among the SC (49.95%) and ST (63.68%) categories. Also, the female dropout rates were much higher than those of males (social infrastructure document, <http://chhattisgarh.nic.in/opportunities/Social%20Infrastructure.pdf>).

ICT Policies and Programmes

Nevertheless, with the formation of a separate state for its people, the state is aspiring for the prosperity and growth of its people (state vision document, <http://chhattisgarh.nic.in/vision/new/Chp%205%20-%20Unlocking%20Natural%20Wealth.PDF>). Expressing its commitment toward the development of its woman population, the state has envisaged a very ambitious and comprehensive women's policy (<http://chhattisgarh.nic.in/wcd/womenpolicy.PDF>). Realizing the importance of ICT, Chattisgarh also has a very comprehensive and ambitious IT policy (<http://chhattisgarh.nic>.

in/policy/IT%20Policy.pdf). After its emergence in November 2000, the state government launched a number of ICT-related schemes and programmes for the benefit and development of its people, which are listed as follows:

1. **Bhuiyan:** All land records are computerized under this scheme. By paying only rupees, anyone can get a copy of the land records. Implemented in all Tehasil (Block) headquarters of the state, it is also planned to be extended to the villages at a future date.
2. **E-Sangwari:** This scheme is implemented with the objective of providing seven services to common citizens and was launched in the Bilaspur district only: (a) death certificates, (b) birth certificates, (c) caste certificates, (d) Form 16, pertaining to income tax, (e) khasaras (land records), (f) income certificates, and (g) domicile certificates.
3. **E-Kosh:** This scheme started in December 2004 to computerize all treasury transactions of the district headquarters.
4. **E-Panchayatas (Local Self-Government Units):** This programme was launched on January 26, 2005. It is executed through janpad panchayatas (local self-government units). Each janpad panchayata is given two computers that will be linked by satellite. The total cost of the project is over 9 million rupees, excluding the cost of software and satellite linking. It is sought to be an informative programme aimed at informing the rural people about the development and welfare schemes, and making available forms online. It is expected to be interactive in the future.
5. **Videoconferencing:** This programme was launched in January 2001. The heads of various government departments answer the questions asked by the common people through videoconferencing. It is being operated daily, and according to the officer in charge, 8 to 10 questions are asked daily.
6. **Feedback:** Most of the departments of the government are on the Web with the facility of a feedback system. Any citizen of the state can register any complaints or suggestions related to any of the schemes or programmes of the state government through the Internet. The complaint or suggestion is directly sent to the concerned department or official online. The status of the application or complaint can also be ascertained online.
7. **Wireless Loop-Line (WLL) Telephone:** Bharat Sanchar Nigam (the central agency providing telephone and Internet services all over India) has provided at least one phone to each village under this scheme with a 50% subsidy of the total bill. At some villages, Internet facility is also being started through this.

The ICT-related schemes listed attempt to make administration more citizen friendly in that earlier, obtaining these services involved visits to the offices concerned, often requiring a lot of time and effort. Making these schemes available on the Internet has also made it possible to obtain feedback from the public at the users' end, which was not easy earlier. The use of the Internet in administration in that sense is aimed at collapsing the distance between the officials and the public. In the Indian context, since before the ICT-based administrative schemes were introduced, it has been primarily men rather than women who often come into contact and interaction with officials (also mostly male) in administration. This is an activity in the public domain, which is traditionally male dominated, and is also considered largely the responsibility of the man in male-headed Indian families. The use of the Internet in administration could put the schemes within the reach of women without them having to move from their locales. However, this has not happened as assumed with the ICT-related policies and programmes, which aim at bringing administration within the reach of every citizen.

ICT Programmes and Women in Chattisgarh

Field surveys show that while it is generally assumed by policy makers (mainly male) that ICT policies and programmes will benefit men and women equally, the ground reality is that there is a vast difference in the availability, use, and access of ICT facilities for men and women. Hence, it is necessary to examine the gender perspective in the ICT policies and programmes. The ICT policies, programmes, and schemes in Chattisgarh seem to bypass the question of women's capacity building and empowerment. The impact of these policies at the user end for women is one of exclusion due to various reasons that need to be addressed urgently to avoid the digital gender divide superimposed on the already existing gender disadvantages for women arising from sociocultural factors (Nadamoto, 2003). Without a gender perspective, the low participation of women in accessing and using the ICT-based facilities may not be noticed. This is the case in the Chattisgarh region where even in urban areas, as compared to men, a very low number of women use the Internet-based facilities and services such as videoconferencing with public bodies; accessing Internet-based services like e-sangwari for obtaining records regarding births, deaths, or land; or using local government-information kiosks for obtaining information under the e-panchayata scheme. In fact, very few women have telephones registered in their own names. Similarly, in the educational sphere, there is low enrollment, retention, and visibility of women in ICT-related courses of study. Thus, in the Indian context, where women are already less visible in the public spheres due to sociocultural factors and men already dominate, ICT schemes are more available and accessible to men. This is also because ICTs have masculine connotations due to the traditionally larger presence of men in technological disciplines. Such is the picture in urban areas in Chattisgarh where more women

are literate, are aware, and face comparatively less sociocultural constraints. Even if these programmes and facilities based on ICT are made available in the rural areas, women would still find it difficult to benefit from them due to the already existing limitations of a male-dominated society, especially those in areas dominated by the scheduled castes and tribes, who have been recognized as disadvantaged and who suffer from severe poverty, illiteracy, and backwardness, added to by the domination of patriarchal values, traditions, and attitudes.

While the state government of Chattisgarh is using the Internet in publicizing its various policies and programmes, advertising tenders and contracts, and making available the application forms of various schemes, in the absence of any capacity-building measures for women using ICT, at the operational level it is difficult for women to benefit from these schemes as they are unable to access the schemes due to various reasons located in the sociocultural milieu in which women are already disadvantaged. Traditionally, the households in India, whether in the urban or the rural sector, are male dominated, with the sphere of functions and activity related to the household clearly demarcated for women, which restricts their mobility in the public domain. This is reflected in women's choices of courses of study, the fact that very few are opting for and remaining in IT-related courses, and women's low presence in decision-making structures, even in urban areas where most of the ICT-related educational and training centres are found, where ICT-based programmes and schemes are being implemented, and where more women are educated and aware. In the rural areas, particularly in the backward areas and where socially disadvantaged sectors already exist, the digital divide accentuates the existing disparities both for men and women. For women who are situated in a rural backward area, it is doubly accentuated in that the well-intended ICT programmes and schemes do not reach them due

to the urban bias in these programmes, and also because of the already existing gender disparity in the sociocultural milieu.

As ICT is becoming a popular and powerful tool for opinion formation through the dissemination of information, women's voices remain unheard while the men continue to dominate the common public discourse and opinion. The increased use of ICT in business is also benefiting mostly men as that sphere is also male dominated in India. In this sense, it could be said that the ICT-based services could further accentuate the dominance of men even though it may be intended to benefit all citizens. The ICT-based services, instead of being a means of empowerment and development of women, may in fact help in perpetuating the existing male-dominated gender patterns and biases in the society unless the issue of capacity building and empowerment of women is addressed.

FUTURE TRENDS

It is obvious from the foregoing analysis that without including the gender perspective into ICT policies and programmes, the potential benefits of ICTs may bypass girls and women, leading to a gender-based digital divide accentuating the preexisting gender imbalance. Access to and use of the new technologies may be directly linked to the social and economic development of women. In the Indian context, for instance, after the death of their husbands, without death certificates, many women face difficulties in getting the family pensions or rights over the properties of their husbands. Likewise, because of the lack of access to land records, it becomes difficult for women to sell or buy land without the help of a male. Similarly, as the videoconferencing facility is available only in the district headquarters, it is almost impossible for rural women to visit the site without the male members of their families. Thus, if women do not have access to and control over

these technologies, it may result in their further marginalization from the economic, social, and political mainstream. Indian rural women comprise a social group that is already disadvantaged in the predigital society, and there is a threat that when it comes to the prospect of participating in and benefiting from the emerging information society, they will again find themselves doubly disadvantaged.

CONCLUSION

Technology has actually been historically and culturally construed as masculine. There has been a tendency toward the division of disciplines into masculine and feminine. For instance, arts, literature, languages, social sciences, and teachers' education are viewed as feminine. On the other hand, professional disciplines such as engineering, agriculture, medicine, commerce, and law have been traditionally perceived as masculine. More women are enrolled in the so-called feminine disciplines. As a result, women are conspicuously absent from the decision-making structure of ICT policy and programmes, resulting in the absence of the gender perspective in ICT policies and programmes.

Women's organizations, the office bearers of women's wings of different political parties, and other gender-focused organizations do not consider ICTs as a development concern or as an advocacy or political issue.

There is sometimes the problem of conceptual clarity regarding the modalities of gender mainstreaming among policy makers, those who implement them, development workers, and even among the academia. This lack of clarity or awareness, either conceptually or in operationalization, of gender mainstreaming and the resultant uncertainty have often led to nothing being done substantially apart from the mere use of some new words without much change in intentions or consequences for women

There is often a common tendency in India among policy makers and among those who implement them to treat some areas as gender neutral, and this is the case with the ICT policies and programmes in Chattisgarh.

The patriarchal character of society and the well-entrenched patriarchal attitudes creep into the formulation and implementation of the ICT policies and programmes.

Unless a gender perspective is mainstreamed into policies and programmes, ICT is likely to remain a male-centric technology benefiting mostly men and depriving women, especially those who live in rural areas and those who are already socially disadvantaged as in Chattisgarh. There is an urgent need to ensure adequate measures in this direction to ascertain equal benefit and use of ICT for women.

REFERENCES

Academic Sources

Dev, M. S. (2004, May). Post reform regional variations. *Seminar*, 537, 26.

Gender and ICT discussion forum. (2005). Retrieved from <http://www.oneworld.net>

Goulding, A., & Spacey, R. (2002). Women and the information society: Barriers and participation. In *Proceedings of the 68th IFLA Council and General Conference*. Retrieved from <http://www.ifla.org/IV/ifla68/papers/013-096e.pdf>

Gurumurthy, A. (2003). ICT policy and gender issues: Lessons from the past and homework for now. *Gender Caucus of World Summit on Information Society*. Retrieved from <http://www.genderwsis.org/245.0.html>

Hafkin, N. (2002). *Gender issues in ICT policy in developing countries: An overview*. Retrieved from <http://www.un.org/womenwatch/daw/egm/ict2002/reports/Paper-NHafkin.PDF>

Hooper, E. (2003). *Review of social exclusion in selected countries in DFID Asia region*. Retrieved from http://www.magarstudiescenter.org/selected_readings-dremma.htm

Jansen, S. (1989). Gender and the information society: A socially structured silence. *Journal of Communication*, 39(3), 196-211.

Kannan, K. P. (2004). Shining socio spatial disparities. *Seminar*, 537, 31.

Marcelle, G. (2002). *Gender equality & ICT policy*. Presentation at World Bank Digital Divide, Washington, DC. Retrieved from <http://www.worldbank.org/gender/digitaldivide/worldbank-presentation>

Nadamoto, S. (2003). *Gender and ICTs: A comparative analysis of three cases in India*. Retrieved from <http://ict.open.ac.uk/gender/papers/nadamoto.ppt>

Pichappan, P. (2001). *Towards optimising mobility in ICT sector to create international paradox and gender balance*. Retrieved from http://www.dirf.org/Unesco_Malaysia

Rustogi, P. (2003). *Gender biases and discrimination against women*. New Delhi, India: SWDS & UNIFEM.

United Nations Development Programme (UNDP). (2003). Gender mainstreaming: Past, present and future. In *Transforming the mainstream: Gender in UNDP* (Chapter 1, p. 25-28). Retrieved from <http://www.undp.org/gender/docs/publication-transforming-th-mainstream.pdf>

United Nations Economic and Social Council. (2007). Retrieved from <http://www.un.org/esa/coordination/ecosoc/document.htm>

Policy Documents

- **Census of India:** <http://www.censusindia.net/>

- **IT Policy of Chattisgarh State of India:** <http://chhattisgarh.nic.in/policy/IT%20Policy.pdf>
- **Report of the Ministry of Communications and Information Technology, Government of India:** <http://www.trai.gov.in/dld1.html>
- **Social Infrastructure Document, Chattisgarh Government:** <http://chhattisgarh.nic.in/opportunities/Social%20Infrastructure.pdf>
- **State Vision Document of Chattisgarh State:** <http://chhattisgarh.nic.in/vision/new/Chp%205%20-%20Unlocking%20Natural%20Wealth.pdf>
- **Women's Policy of Chattisgarh State:** <http://chhattisgarh.nic.in/wcd/womenpolicy.pdf>

KEY TERMS

Digital Divide: The digital divide is defined as the disparity between individuals with and those without access to a computer and the Internet. The divide is applicable to all population sectors encompassing both adults and children, but the focus of much attention has been on segments of the population seen as underserved: people in low-income, rural, and multicultural areas, and women.

Gender: Gender refers to socially constructed rather than biologically determined roles of men and women, as well as the relationship between men and women in a given society at a specific time and place. These roles and relationships are not fixed but can and do change in the light of evolving needs and opportunities.

Gender Mainstreaming: Gender mainstreaming was defined by the United Nations Economic and Social Council in 1997 as a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring, and evaluation of the policies and programmes in all political, economic, and social spheres so that women and men benefit equally, and inequality is not perpetuated.

Gender Neutral: Gender neutral means a policy or programme that purports to, or is assumed to, impact men and women in the same manner. (It could also mean a lack of gender awareness or even "gender blindness," i.e., not conscious about the ground reality about the position of women in a particular society.)

ICT Policy: An ICT policy is an integrated set of decisions, guidelines, laws, regulations, and other mechanisms geared to directing and shaping the production, acquisition, and use of ICTs. Because the ICT sector is heterogeneous, extending beyond traditional classifications of industrial or services sectors, and because the production and diffusion of ICTs are of equal importance, policies in the ICT sector intersect with a number of other areas of policy making: technology, media, industrial, and telecommunications policy, and so forth.

Primitive Tribes: The most backward groups of Indian tribes.

Scheduled Castes (SC): The socially disadvantaged section of the Indian society on the basis of the caste system, identified for affirmative action by the Indian constitution.

Scheduled Tribes (ST): The indigenous people of India, the forest dwellers commonly known as tribes, identified for affirmative action by the Indian constitution.

Chapter 2.26

Crossing the Digital Divide in a Women's Community ICT Centre

Clem Herman

The Open University, U K

INTRODUCTION

This article examines the role of community-based training initiatives in enabling women to cross the so-called digital divide and become confident users of ICTs. Drawing on a case study of the Women's Electronic Village Hall (WEVH) in Manchester, United Kingdom, one of the first such initiatives in Europe offering both skills training and Internet access to women, the article will illustrate the impact that community-based initiatives can have in challenging and changing prevailing gendered attitudes toward technology. Gendered constructions of technology in dominant discourse suggest that women must also cross an internal digital divide, involving a change in attitude and self-identification, before they can see themselves as technically competent. Learning about technology is intimately linked to learning about gender, and the performance of skills and tasks that are culturally identified as masculine can be an empowering step for women, successfully challenging preconceived gendered relationships with technology.

The WEVH occupied a unique position, acting as a model for other women's ICT initiatives and influencing the development and proliferation of other community-based ICT access projects. There were two main motivating forces behind its setting up in 1992. The first was a shared vision of the potential for ICTs to be used as a tool to combat social exclusion. The second was a feminist commitment to redressing the inequalities and underrepresentation of women in computing. Both these perspectives formed an important backdrop to the growth and development of the organisation and have continued to inform its strategic plans.

BACKGROUND

The Digital Divide

The context in which the WEVH was set up in the early 1990s was the first wave of initiatives concerned with tackling the so-called digital divide. During the decade that followed, there

was a proliferation of initiatives driven by both British government and European policy aimed at ensuring that the emerging information society was inclusive of all citizens including specific measures for the participation of women.

While the personal ownership of PCs (personal computers) and home-based access to the Internet has increased at a rapid pace in Britain since the early 1990s, it is still the case that significant sections of the population do not have access to computers or the Internet. Moreover, those who are digitally disadvantaged often do not have the skills to take advantage of the potential that ICTs have to offer¹ (Office of National Statistics, <http://www.statistics.gov.uk>). Community-based ICT facilities to tackle the so-called digital divide were seen as one of the key strategic tools in community development and urban regeneration that was reflected in policies at the local, national, and European level.²

During the first wave of measures to tackle the digital divide in Europe in the early 1990s, women were considered one of the primary target groups for ICT training and access. The emerging Internet at that time was predominantly used by “techie” men, designed and implemented without the perceived need for inclusive strategies, and immersed in a strongly male-identified culture. At the time of its creation, the WEVH was therefore responding to a clear need to tackle gender inequality, an issue that was considered self-evident to all concerned. Over a decade later, following the transformation of user interface design and the creation of the World Wide Web, Internet access reached the majority of the British population, and there is now only a small difference in usage between men and women (Citizens Online, 2005).³ While this is certainly an improvement, this simple analysis of Internet usage ignores the realities of women's continued underrepresentation in the IT industry, from their lack of influence on content and applications development to widespread inequalities in women's employment opportunities in IT. Yet it seems that the increase

in women's access to the Internet and basic ICT skills has seen a reduction in public commitment to resources for women-specific ICT initiatives, which had historically been justified by the statistics of Internet usage.

While quite rightly addressing important social-exclusion issues, the notion of the digital divide as it has been used in British policy debates is somewhat limited, assuming a one-way process in which access to a computer and the Internet enables individuals to cross over and join the digitally empowered. However, there are significant numbers of ex-Internet users or refusers, that is, those who have stopped using the Internet either by choice or because they no longer have access: “It is clear ... that overall growth patterns of Internet usage conceal significant changes in usage by different sub-populations, including some evidence of drop off by particular groups” (Woolgar, 2000, p. 5).

Community ICT Access

The creation of the WEVH was part of a growing movement of community ICT initiatives that were developed at the local level both in Britain and elsewhere in the early 1990s. All of the initiatives had the common aim of providing “supported access in a location other than work or home” and “access to ICT in a social context” (Liff, Watts, & Stewart, 2000, p. 2-3). They have been known by a range of names including e-gateways, telecottages, telecentres, electronic village halls (EVHs), ICT learning centres, cybercafes, telework centres, community teleservice centres, and so on.

The idea of the electronic village hall was based directly on a model pioneered by Lars Qvortrup in Denmark, and was influenced by a growing counterculture in the USA of online community networks and bulletin boards such as The Well (Rheingold, 1995). The creation of urban electronic village halls was part of a vision for the city of Manchester that combined community grassroots involvement with a local-

authority public-information service known as the Manchester Host, an e-mail and bulletin-board system that local people could connect with and use to communicate with each other that would have shared community space as well as online databases supplying information. A cornerstone of the vision was that local people who did not have access to computers in their homes would be able to use these services at community access points: There were already some examples of these kinds of community centres operating successfully in rural Scandinavia. The concept of an electronic village hall in Manchester was a deliberate attempt to adapt the concept of a rural telecottage into an inner city context (Leach & Coppitch, 2005). The name implied that the centres would function as cozy, friendly local meeting places where technology could be made accessible and simple to use. In 1990, there was no World Wide Web, just text-based, command-line interfaces, so it was imperative that there were people to enthuse and support new users who might find the technology intimidating. The centres would be staffed by enthusiastic “telemateurs” who would raise awareness and act as missionaries within the communities. This was very important: The projects were not responding to expressed needs, but were proactive in trying to create those needs and a critical mass of users on the Manchester Host. As well as the WEVH, two other electronic village halls were set up in geographical neighbourhoods, providing services to spatial rather than virtual communities. The EVHs were charged with wide-ranging social and economic aims, including a regeneration agenda supporting and encouraging the development of local communities and businesses through the use of ICTs.

Women and ICT: Finding a Space

While this political context in the city of Manchester was one strand in the WEVH story that

informed its strategic and financial development, it was the feminist agenda of empowering women through the use of technology that formed the core of the organisation's vision. In looking at how the experience of the WEVH connects with theories about gender and technology, it is possible to trace a changing awareness and perspective within the organisation during its historical development, which reflected changes in external environments and political climates within what might loosely be called the women's movement in Manchester.

The original proposal for the WEVH was to house the project in a women's community centre, a building that had been home to the famous Pankhurst family. (Emmeline Pankhurst and her daughters were leaders of the British suffragette movement in the early years of the 20th century, and their house became an important focus for the women's movement in Manchester in the 1980s.) However, differing perceptions and attitudes toward technology resulted in the project being located elsewhere. Existing workers at the centre who had been immersed in the political struggles of the 1980s adopted what could be described as an ecofeminist position: They saw technology as something to resist rather than embrace and were afraid the project would take over the work of the centre. There was a level of technophobia that sprang from a tradition of radical feminism in which technology was to be resisted as part of the patriarchal, military, industrial complex, a biologically determinist viewpoint advocated by writers such as Susan Griffin and Adrienne Rich (Grint & Gill, 1995). The 1980s women's movement had been characterised by peace and antinuclear protests, the emergence of green and environmental causes, anticapitalism, and a celebration of women's creative diversity. The new information and communication technologies were seen to be associated with masculine values and were perceived as a threat to hard-won women's space.

Equality of Opportunity

In fact, from its inception, the WEVH can be seen to have subscribed to a liberal feminist agenda in relation to technology (Henwood, 1993) in that the aim was to get more women into technology by increasing the supply of skilled women. Women were identified as lagging behind in their involvement with new technologies, and the new centre would help them catch up by offering special programmes of training. This approach came through the conviction that providing opportunities for skills development would bring about change and was consistent with the dominant equality-of-opportunity discourse current at that time. This was an approach prevalent in women's training centres throughout Britain, which provided access to training in nontraditional skills. This agenda was also overtly highlighted in the criteria of funding agencies. Many of the training and research projects were funded by the European Union and were based on the underlying justification that there were skills shortages in a particular industry (in this case IT) and women were underrepresented in these occupational sectors. The solution was to increase the number of women in these sectors by encouraging them to develop skills and enter work in ICT. Training was carried out within a culture of nurturing and supporting women, which drew on traditional feminist pedagogical methodologies—peer support group, personal growth and consciousness raising, a celebration of the hidden achievements of women in history, and so on (Ellen & Herman, 2005).

While individual women certainly achieved personal success, not surprisingly, very little change was brought about to the gender balance in the IT industry as a whole. Although women consistently found employment directly after their training (<http://www.wevh.org.uk>), only a handful of women went into areas of IT that were highly gender segregated such as computer networking. Those women who went on to study computing or IT in higher education mainly went into so-called

“soft” or hybrid degrees, not into the traditionally male-dominated subjects such as computer science. This is hardly surprising given the scale of the problem: The equal opportunities or liberal feminist agenda, the “women-into” approach, has not generally been successful in achieving the large-scale restructuring of gendered occupational segregation in technology (Ellen & Herman, 2005). In fact, any attempts to rectify the unequal gender balance in segregated occupations without tackling underlying cultural norms seem destined to remain marginal in their impact.

Cultural change is necessary at both the macro and micro level. Parallel to the discourse of equal opportunities and the liberal feminist analysis of gender and technology, the WEVH can be seen as having the more subversive strategy of challenging the perception of “technology as masculine culture” (Wacjman, 1991, p. 137). Understanding technology as culture (both as the work environment in which technology is used as well as the artefacts and hardware themselves) has enabled the organisation to challenge attitudes that women had about themselves and their own expectations. Women experienced participation with technology as an appropriate activity rather than a transgressive act to be resisted. An environment in which trainers and technical staff were all women and learning was experienced in an all-female group provided a stark contrast to the cultural norm of technology as masculine. The women-only training environment was crucial to success: It allowed skills to be acquired in a gender-neutral way without having to refer to dominant cultural assumptions of gender-appropriate knowledge.

Empowerment and Cultural Change

Even within a small-scale environment such as the WEVH, it has been possible to challenge deeply held cultural attitudes. One of the key strategies was to ensure that women had hands-on experience of touching technology, which has often

been a taboo activity for women. Throughout all training provision, an emphasis was placed on giving women the empowering experience of handling pieces of technological equipment and to see this as fun and enjoyable. In introductory courses, women had to assemble their own PCs by plugging in the correct leads; in the networking course, women were installing motherboards and fitting new cards, crawling under tables to connect wires. All trainees were taught to carry out routine maintenance and troubleshooting procedures.

These experiences are empowering not only because they develop useful skills, but also precisely because they are transgressive and not what women would have expected of themselves. These women were not performing gender in the way in which they had been used to, and by doing so, they were subverting received notions of gender-appropriate behaviour or performance (Butler, 1999). This empowerment was something that women could transfer to other areas of their lives, and many expressed how they had become more confident and increased their own self-esteem. One woman says, "the training I received at the WEVH has had an incalculable effect on my life...I learnt about the logic behind computer systems which set both my capabilities and my imagination free" (Dyson, 1999, p. 78). By challenging internal stereotypes about the type of knowledge and skills considered appropriate for themselves as women, they could then apply this knowledge to other situations.

A final perspective through which this process of bringing women into a self-confident engagement with technology can be viewed is that of Haraway's (1991, p. 149) notion of the cyborg. As women acknowledge and develop their own relationships with technology through the acquisition of skills, they gain an understanding of and positively embrace the role that technology does and will play in their lives. They recognise that they "are all hybrids of machine and organism...are all cyborgs," and see technology as part of their own

future rather than something external to them: "[The WEVH provides] the right atmosphere for any woman, of any background, to attain her best. It made us feel positive about the future, new technology and picture ourselves in it" (Dyson, 1999, p. 75). Opening up opportunities for women to positively use and shape technology has been the ultimate goal for the WEVH; as much as skills and knowledge, it is attitudes that must be changed for this process to succeed.

FUTURE TRENDS

It is clear from this case study that community-based women's training centres such as the WEVH can play a vital role in supporting women to become skilled and confident users of ICT and cross over the digital divide. During the rapid expansion of Internet usage since the late 1990s, the WEVH and similar centres have been important in ensuring gender equality in access to ICTs and pioneering new approaches to empower women in their use of technology. Yet, while Internet usage has now reached the majority of the British population and is relatively equal in terms of gender, there is still a need to support those who are digitally disadvantaged. The lack of Internet access and ICT skills is closely correlated with other indicators of economic disadvantage such as educational achievement, ethnicity, age, and employment status. Thus, for the foreseeable future, there will continue to be a role for women's centres to provide support and empowerment for a significant minority of women who would otherwise not have the skills or confidence to use ICTs. And while the prevailing culture of the IT industry as a whole continues to be male dominated with significantly fewer women employed in this sector, it is important that women's ICT initiatives continue to offer spaces that are free from mainstream gendered constructions of technology, and a basis from which to campaign for change.

CONCLUSION

The original aims and objectives of community ICT initiatives have been clearly tied to an agenda of local democracy and participation. In the case of the WEVH, the fear was that ordinary women would be excluded from participating in the new information society and therefore it was imperative to provide public access points for those without access to equipment at home or at work. But it was always clear that democratisation included not only the means of participation (i.e., hardware and connectivity), but also the skills and attitudes needed to effectively make use of these. For women in particular, there were internal messages and cultural barriers that also had to be overcome. This vision has remained but has had to adapt to a wide range of changes. Technological developments and the wider ownership of PCs have altered the role from one of advocacy and awareness to that of fulfilling expressed needs.

The WEVH has been a unique example of a vision that has survived and grown despite the changing agendas of funding agencies and politicians, a vision of a centre where women can become confident users of technology. Above all, it has played a unique role as a place of personal change and transition for women, an inspiration for other community ICT initiatives, and has created a culture of women using and shaping technology.

REFERENCES

- Butler, J. (1999). *Gender trouble: Feminism and the subversion of identity*. London: Routledge.
- Citizens Online. (2005). *Adults who have used the Internet in the last 3 months by gender*. Retrieved September 9, 2005, from <http://www.citizensonline.org.uk/statistics>
- Dyson, C. (1999). *The impact of women-centred IT training*. Unpublished master's thesis, University of Manchester, Manchester, UK.
- Ellen, D., & Herman, C. (2005). Women's training revisited: Developing new learning pathways for women IT technicians using a holistic approach. In J. Archibald, J. Emms, F. Grundy, J. Payne, & E. Turner (Eds.), *The gender politics of ICT* (pp. 251-264). Middlessex, UK: Middlesex University Press.
- Grint, K., & Gill, R. (Eds.). (1995). *The gender technology relation: Contemporary theory and research*. London: Taylor and Francis.
- Haraway, D. (1991). A manifesto for cyborgs: Science technology and socialist feminism in the 1980s. In D. Haraway (Ed.), *Simians, cyborgs and women: The reinvention of nature* (pp. 149-181). London: Free Association Books
- Henwood, F. (1993). Establishing gender perspectives on information technology: Problems, issues and opportunities. In E. Green, J. Owen, & D. Pain (Eds.), *Gendered design? Information technology and office systems* (pp. 31-49). London: Taylor & Francis.
- Leach, B., & Coppitch, G. (2005). *Transforming communities through local information networks: The case study of Manchester*. MCIN. Retrieved September 9, 2005, from <http://www.mcin.net/uploads/mcin%20paper%20mar%202005%20.doc>
- Liff, S., Watts, P., & Stewart, F. (2000). *Inclusion in the information society: The distinctive role of e-gateways*. Retrieved February 21, 2006, from <http://users.wbs.warwick.ac.uk/ikon/research/egate.pdf>
- Rheingold, H. (1995). *The virtual community*. London: Minerva.
- Wacjman, J. (1991). *Feminism confronts technology*. Cambridge, UK: Polity Press.

Woolgar, S. (2000). *Virtual society profile*. Profile 2000. Retrieved February 21, 2006, from <http://virtualsociety.sbs.ox.ac.uk/>

KEY TERMS

Cyborg: Originally used to describe human-machine hybrids and commonly found in science fiction, the term was adopted by Haraway (1991) to advocate women's involvement with rather than rejection of technology.

Digital Divide: The division between those who have access to ICTs (particularly the Internet) and those who do not, implying that those without access are disadvantaged. It is used to describe both local and global inequalities.

Electronic Village Hall: A centre providing computers and Internet access for local people or people from a particular community or group. It is also known as a cybercafe, community technology centre, telecentre, or telecottage.

Empowerment: Development of the capacity (either of an individual or a group) to act independently and be able to make and influence decisions and choices affecting one's own life.

ICTs (Information and Communication Technologies): The convergence of computerised information systems with communications technologies, generally used to mean all forms of electronic communication including computers, mobile phones, and other devices.

Information Society: A society in which information and knowledge are central to economic and social life, in contrast to industrial or agricultural societies. The term was widely used by British and European policy makers in the 1990s.

Liberal Feminism: Feminist theory focusing on equal rights and emphasising the removal of barriers to ensure equality of opportunity for all regardless of gender.

ENDNOTES

- ¹ In February 2005, 35% of adults in the United Kingdom had never used the Internet. Of these, 42% had no Internet connection, and 37% felt they lacked the knowledge or confidence to use it. (Office of National Statistics, <http://www.statistics.gov.uk>)
- ² For example, the UK Online initiative in 2000
- ³ The Office of National Statistics (<http://www.statistics.gov.uk>) estimated that 64% of men and 56% of women had used the Internet in the 3 months up to September 2005.

This work was previously published in Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 154-159, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 2.27

Developing Regional Tourism Using Information Communications Technology

Dean Carson

Southern Cross University, Australia

INTRODUCTION

Tourism and hospitality industries are heavily reliant on the effective exchange of information between suppliers, intermediaries, regulatory and marketing agencies, and consumers (Sheldon, 1999). Many technologies may be employed to facilitate this exchange, with the selection of the most appropriate technologies in any given circumstance depending on issues such as the proximity of agents; the extent to which information is dynamic; and the application of information as part of business or decision-making processes.

In regional tourism [i.e., that which occurs outside major capital cities, domestic source markets, or international tourism gateways (Kelly, 2003)], suppliers, intermediaries, facilitators, and consumers are likely to be highly dispersed (Carson, Sharma, & Waller, 2003). Information is likely to be dynamic, as tourists respond to seasonal changes in product offerings. A lack of critical mass of products and consumers in regional areas (Carson, Richards, & Rose, 2004) heightens the importance of effective information exchange, as businesses have fewer opportunities to draw on

local markets to make up for any market instability that may result from poor communication.

Information and communications technologies (ICT) and, specifically, online technologies, offer potential for improving communication effectiveness, which may be defined to include accuracy, reliability, timeliness, and accessibility of information exchange (Carson & Sharma, 2002). While these technologies may be employed by businesses operating in regional destinations, it is important to recognize that regional destinations tend to operate as tourism systems (Leiper, 1995), with close connections between organisations in the private, public, and community sectors required to take advantage of the economic, social, and environmental benefits of tourism while minimizing the negative consequences. As an ICT issue, then, the question is not simply how can tourism businesses best employ the technologies for their individual sustainability, but how can regional tourism systems as a whole effectively employ ICT (Carson & Richards, 2004)?

Despite the substantial potential, and the growing role played by ICT (particularly online technologies) in the regional tourism destination

development, Alford (2004) provided strong evidence that many systems have failed to meet expectations. Project costs, particularly in the implementation phase, have been poorly assessed, and there has been a high rate of project failure. Alford suggests that technology-driven approaches to decision making have a poor record of success and proposes the use of critical theory to increase the understanding of ICT issues. This approach recognizes that technology inevitably interacts with “the real world” and that real-world constraints are more important to the outcome of technology projects than their technical merits.

This article is concerned with proposing a framework that may assist regional tourism destinations to incorporate some real-world thinking in making decisions about what types of ICT to implement and support. It also describes some of the broad international trends in ICT and tourism that may influence the adoption of technology. The article is based on a five-year research program in Australia that has included case studies of technology adoption by a variety of organisations that participate in regional tourism systems in Australia (see, for example, Carson, Taylor, & Richards, 2003; Carson, Sharma, & Waller, 2003; Sharma & Carson, 2002), and a review of the international literature addressing tourism and ICT adoption generally. The article argues from the standpoint that regional tourism systems and their component organisations need to make careful decisions about what technologies to implement, and how these may best be employed. Furthermore, substantial barriers to technology adoption persist in many regional areas, and these will need to be addressed to allow tourism to reach its potential as an economic driver, particularly in developing countries and depressed rural economies (Kelly, 2002).

A FRAMEWORK FOR REGIONAL TOURISM TO EMPLOY ICT

Throughout the late 1980s, researchers such as Buhalis (1998, 1997), Sheldon (1999), and Werthner and Klein (1999) suggested that ICT and, in particular, online technologies, would become more widely depended upon by tourism businesses, consumers, and intermediaries to manage relationships between these agents. ICT may therefore facilitate relationships between business and consumer, business and business, and business and government. There are additional relationships between government and government and consumer and consumer (for example, chat rooms) that have been facilitated by ICT but are not considered in this paper. Likewise, consumer and government relationships have been enhanced through initiatives such as Australia’s Electronic Travel Authority System, which allows for online processing of visa applications for many international visitors (Sustainable Tourism Cooperative Research Centre, 1999).

Carson and Sharma (2001, p. 121) proposed an online architecture as a guide for tourism businesses in assessing their ICT needs, and then matching tools and applications to those needs. The online architecture suggests that organisations (primarily, but not exclusively, private firms) need to consider their information exchange needs in relation to communication, research, promotion, product distribution, and management functions. The online architecture emphasizes that technology can only be effective if its use enhances the ability to perform business functions. The best technology is not necessarily that which is newest to market or that which contains the greatest number of features. The best technology is that which most closely matches the business needs of the purchasing agent. The online architecture provides a framework for assessing that match.

Figure 1. Influences on the online architecture

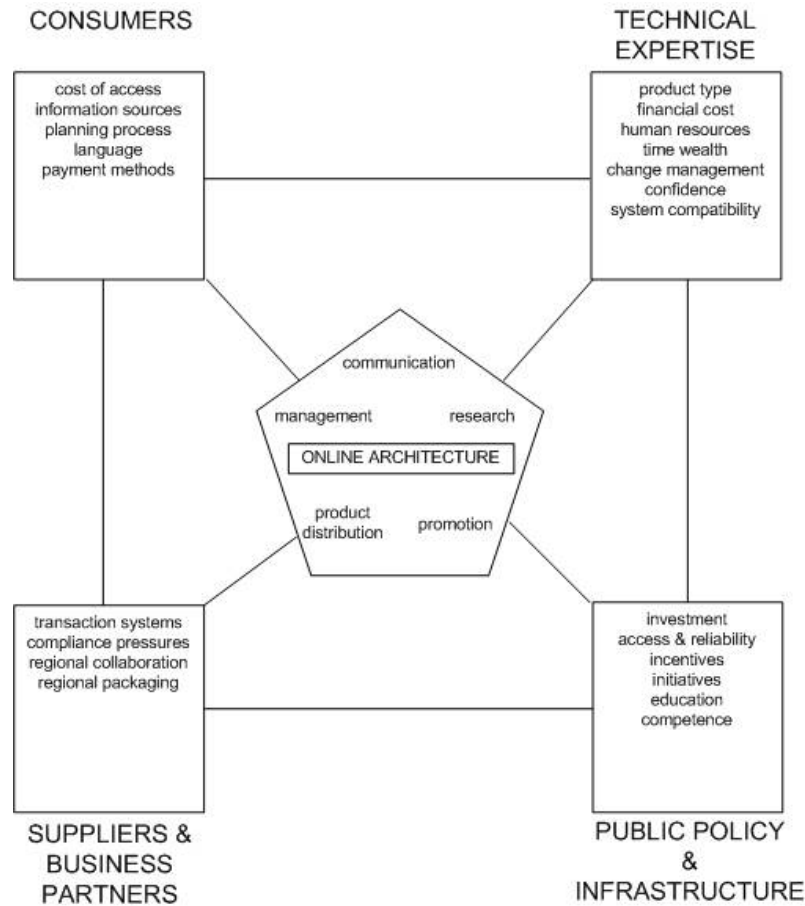


Figure 1 is a refinement of the online architecture proposed by Carson and Sharma (2001). It encompasses the five components of technology application described by Carson and Sharma, and also includes a set of influences on the specific technology mix for an enterprise or, in the context of this article, a destination. Four influences are identified as being consumers, technical expertise, public policy and infrastructure, and suppliers and business partners. Within each influence are conditions that act upon the capacity for regions to choose an online architecture. Conditions may include financial, human, and time costs (technical expertise), public investment and access to infra-

structure, the nature of regional collaboration, as well as the preferences of consumers.

It may not be that each of the four influences described in Figure 1 have equal weight in implementation of a regional online architecture. Some of the conditions (for example, access to adequate infrastructure) may be prerequisite, while others (such as the compatibility of online systems of business operation with offline systems) may exert degrees of influence. While the framework in Figure 1 may assist regions in scoping their general online architecture requirements, decisions about specific technologies, applications, and management approaches are driven by the cues listed as follows:

Communication

- What networks require maintenance through communication?
- Who are the targets?
- How often and when do I communicate with them?
- What is the format of the communication?
- What technologies do my targets have, and what technologies do they plan to use?

Research

- What information do I need?
- When do I need it?
- What costs do I incur currently in getting that information?
- Is the information available online?
- What are the costs of getting this information online?

Promotion

- Who is the intended audience?
- What is the message?
- What action do you expect the audience to take having received the message?
- Can they take this action online?
- How do you measure the impact of the message?

Product Distribution

- What am I selling?
- Who am I selling it to?
- When is it normally paid for?
- What are the costs of accessing e-commerce models (in-house, outsourcing, etc.)?
- What inventory management systems do I have?

Management

- What management functions do I need to perform (banking, recruitment, staff training, compliance, etc.)?
- How often do I perform them?
- Are there resources online?
- What is the cost of accessing them compared to the current cost?

The research by Sharma and Carson (2002) showed that businesses that undertook a formal or informal program of ICT planning that considered each aspect of the online architecture were more likely to persist with technology implementation, and to self-assess their ICT strategies as highly effective for their businesses. Those who used a more technology-driven process of planning (based on “what was possible” rather than on “what was required”) tended to perceive more barriers to implementation, and to suffer greater rates of withdrawal from their ICT tools and applications. Of course, all elements of the online architecture are essentially concerned with communication, and in a regional setting, may contribute to the maintenance of networks and relationships both within a region and between a region and other elements of the tourism system.

The Australian research described by Sharma and Carson (2002), and a review of key international literature in the field, has identified a range of ICT tools and applications that have been developed specifically for tourism or that have found particular application in regional tourism destinations. Table 1 identifies some of these initiatives to provide a sample of the ways in which ICT has been employed to facilitate regional tourism development. Initiatives marked with an asterisk are described in brief below the table.

Developing Regional Tourism Using Information Communications Technology

Table 1. Potential ICT responses to an online architecture for regional tourism (Sharma & Carson, 2004; Carson & Richards, 2004; Knoblock, 2004; Christou et al., 2004; La Micela, Roberti, & Jacucci, 2002; Maidche & Staab, 2002; Flouri & Buhalis, 2004)

| Business Function | Business and Consumer | Business and Business | Business and Government |
|----------------------|--|---|---|
| Communication • | <ul style="list-style-type: none"> E-mail distribution lists Automated telephone systems | <ul style="list-style-type: none"> AFTA WebMAIL* (Australia) | <ul style="list-style-type: none"> Online travel advisory systems |
| Research • | <ul style="list-style-type: none"> Software agents Semantic Web applications | <ul style="list-style-type: none"> Decipher* (Australia) and similar international ventures | <ul style="list-style-type: none"> Business Entry Point* (Australia) |
| Promotion | <ul style="list-style-type: none"> 'Brochure ware' destination marketing Web sites at enterprise, local, regional, state/province, and national levels Visitor Centre touch screen kiosks In-flight and in-room interactive media | <ul style="list-style-type: none"> B2b Web sites | <ul style="list-style-type: none"> Australian Tourism Data Warehouse* (Australia) |
| Product Distribution | <ul style="list-style-type: none"> Online travel auctions 'Last minute' online booking services E-ticketing Smartcards Wireless technologies | <ul style="list-style-type: none"> Transfer of traditional global distribution systems to online platforms | <ul style="list-style-type: none"> PICO* (Italy) |
| Management | <ul style="list-style-type: none"> Customer Relationship Management (CRM) software Event management software Accommodation management systems (e.g., Fidelio) | <ul style="list-style-type: none"> Digital training assistants Inventory management systems | <ul style="list-style-type: none"> Electronic tax systems Online license applications |

- **AFTA WebMAIL:** WebMAIL is an online information management system for travel agents in Australia (AFTA is the Australian Federation of Travel Agents). WebMAIL collects and collates product offerings and announcements from participating industry

suppliers across Australia, and provides a single point of access to these for registered travel agents. The system has been instrumental in assisting travel agents in managing the high volume of daily information (special deals, new packages, etc.) they have

received by fax and individual e-mail in the past (Sharma & Carson, 2004).

- **Decipher:** Decipher is an Internet-based “one-stop shop” for tourism research and business intelligence aimed at the Australian tourism industry. It stores publications, tables, maps, and other information packets in a central location and provides access to these through a series of knowledge products (such as business planning and marketing tools) and search functions (Carson & Richards, 2004). Decipher has similar aims to technologies under development or currently implemented in Austria (Woeber, 2003), Canada (Waksberg, Stevens, & Vales, 2000), Spain (Navaro & Rubio, 2000), and in the state of Illinois in the United States (Gretzel & Fesenmaier, 2002).
- **Business Entry Point:** The Business Entry Point is an online information service for small firms in Australia. It provides assistance with licensing and accreditation requirements, and assists in business planning and compliance.
- **Australian Tourism Data Warehouse:** The Australian Tourism Data Warehouse is one example of a national-level tourism product database used for online promotion purposes. The Data Warehouse brings together state and regional product databases using a common data structure and ontology.
- **GDS:** Global distribution systems are used by airlines, travel agencies, and other intermediaries to manage product inventory and to sell tourism products and packages. In the past, these have been dedicated line electronic services, but virtually all of the major GDSs (Amadeus, SABRE, Galileo, etc.) have migrated to online systems.
- **PICO:** PICO is the *Project of Innovation by means of Cooperation* that has used ICT applications in destinations in northern Italy to create a series of forums and information-exchange vehicles to assist local tourism

organisations to work together as a single virtual tourism organisation (La Micela, Roberti, & Jacucci, 2002).

CONCLUSION: DEVELOPING REGIONAL TOURISM DESTINATIONS USING ICT

It is clear from Table 1 that there is a wide range of ICT applications that have either been specifically designed for tourism or that have substantial use among tourism organisations. Many of these have clear advantages for enterprises and intermediaries involved in regional tourism, as they help address issues of isolation, geographic dispersal, lack of critical mass of enterprises and consumers, and management of dynamic information. Carson, Richards, and Rose (2004) have argued that for regional tourism destinations to gain a competitive advantage, they need to work collaboratively. One feature of that collaboration may be the sharing of ICT resources and infrastructure to achieve common purposes, such as accessing markets, maintaining relationships with suppliers and tour packagers, managing customer relations, or accessing business intelligence and research.

A review by Sheldon (1999) indicated that the larger enterprises, particularly airlines and accommodation chains, have been at the forefront of ICT adoption in tourism. The increasing reliance on applications such as GDS by these sectors has then flowed down to other sectors, most notably, travel agents and other intermediaries. Regional destinations tend to have fewer large enterprises and have therefore lacked the technology demonstrators and lead users that may facilitate adoption. In some countries, including Australia, government programs have attempted to address this issue by offering incentives and education for regional tourism enterprises and organisations to encourage technology uptake (Sharma & Carson, 2002). In some cases, these programs have clear ideas of how regional tour-

ism enterprises should use technology, and these ideas are often formed from experience in metropolitan areas or the claims of ICT manufacturers and distributors. Experience suggests (Carson, Sharma, & Waller, 2003) that regional enterprises often find their own ways of using ICT that may be different from those envisaged. For example, there has been a relatively low rate of uptake of Web-based commerce by Australian regional tourism enterprises if that commerce is assessed in terms of the number of enterprises with their own, e-commerce enabled Web sites. Instead, smaller regional enterprises have engaged collaboratively with private-sector e-commerce portals such as *wotif.com.au* and *lastminute.com*. Engaging in this way has reduced the individual costs of adoption and helps to manage the ongoing issues of poor ICT infrastructure in many regional destinations around the world.

ICT has proven to be an effective tool in assisting regional tourism destination development. The employment of a decision-making framework such as the online architecture described in this paper may contribute to ongoing innovation in ICT use. Significantly, while there may be a focus on individual enterprises selecting and implementing ICT, the collaborative aspect of regional destinations must also be considered. Many ICT applications offer collaborative solutions to the communication, research, promotion, product distribution, and management needs of regional tourism enterprises and destination managers. Effective implementation of online architecture, however, requires attention to the needs and resources of consumers, enterprises, policy makers, infrastructure providers, and business partners. Alford (2004) recommended a communicative and collaborative approach to planning implementation projects for ICT in tourism, and the online architecture offers some cues for managing that communication.

REFERENCES

- Alford, P. (2004). Critical theory—an alternative solution to IT planning implementation problems in tourism. *ENTER Conference*. Cairo, January [CD-ROM].
- Buhalis, D. (1997). Information technology as a strategic tool for economic, social, cultural and environmental benefits enhancement of tourism at destination regions. *Progress in Tourism and Hospitality Research*, 3(1), 71-93.
- Buhalis, D. (1998). Strategic use of information technologies in the tourism industry. *Tourism Management*, 19(5), 409-421.
- Carson, D., & Richards, F. (2004). Delivering technological innovation in tourism: Considerations in the implementation of Decipher. *ENTER Conference*. Cairo, January [CD-ROM].
- Carson, D., & Sharma, P. (2001). Trends in the use of Internet technologies. *World Hospitality and Tourism Trends*, 2(3), 116-128.
- Carson, D., & Sharma, P. (2002). A model of Australian tourism information: Implications for information systems. In K.W. Woeber, A.J. Frew & Hilz, M. (Eds.), *Proceedings of the Ninth International Conference of Information Technology and Travel and Tourism* (pp. 49-58). Austria: Springer-Verlag Wein.
- Carson, D., Richards, F., & Rose, S. (2004). A framework for assessing the innovation potential of Australia's regional tourism systems. *CAUTHE Conference*. Brisbane, February [CD-ROM].
- Carson, D., Sharma, P., & Waller, I. (2003). Regional tourism and the Internet: E-business structures for regional tourism organisations. In S. Marshall, W. Taylor, & X. Yu (Eds.), *Using community informatics to transform regions* (pp. 271-286). Hershey, PA: Idea Group Publishing.

- Carson, D., Taylor, A., & Richards, F.E. (2003). Delivering business intelligence for regional tourism in Australia: Analysis of the Decipher technological innovation. In S. Marshall, & W. Taylor (Eds.), *Proceedings of the Fifth International IT in Regional Areas (ITiRA)* (pp. 357-367). Sunshine Coast, December 15-17, 2003.
- Christou, E., Avdimiotis, S., Kassianidis, P., and Sigala, M. (2004). Examining the factors influencing the adoption of Web-based ticketing: Etix and its adopters. *ENTER Conference*. Cairo, January [CD-ROM].
- Flouri, E., & Buhalis, D. (2004). Wireless technologies for tourism destinations. *ENTER Conference*. Cairo, January [CD-ROM].
- Gretzel, U., & Fesenmaier, D. R. (2002). Implementing knowledge-based interfirm networks in heterogeneous B2B environments: A case study of the Illinois Tourism Network. In K.W. Woeber, A.J. Frew & Hilz, M. (Eds.), *Proceedings of the Ninth International Conference of Information Technology and Travel and Tourism* (pp. 39-48). Austria: Springer-Verlag Wein.
- Kelly, I. (2002). *Australian Regional Tourism Handbook: Industry Solutions 2002*. Gold Coast: Cooperative Research Centre for Sustainable Tourism.
- Kelly, I. (2003). *Australian Regional Tourism Handbook: Industry Solutions 2003*. Gold Coast: Cooperative Research Centre for Sustainable Tourism.
- Knoblock, C. A. (2004). Building software agents for planning, monitoring, and optimizing travel. *ENTER Conference*. Cairo, January [CD-ROM].
- La Micela, A., Roberti, P., & Jacucci, G. (2002). From individual tourism organisations to a single virtual tourism organisation for destination management. In K.W. Woeber, A.J. Frew & Hilz, M. (Eds.), *Proceedings of the Ninth International Conference of Information Technology and Travel and Tourism* (pp. 87-96). Austria: Springer-Verlag Wein.
- Leiper, N. (1995). *Tourism management*. Melbourne: TAFE Publications.
- Maidche, A., & Staab, S. (2002). Applying semantic Web technologies for tourism information systems. In K.W. Woeber, A.J. Frew & Hilz, M. (Eds.), *Proceedings of the Ninth International Conference of Information Technology and Travel and Tourism* (pp. 311-319). Austria: Springer-Verlag Wein.
- Navaro, J. R., & Rubio, J. Q. (2000). DATATUR: Tourism statistics information system—The experience of Spain. In D. R. Fesenmaier, S. Klein, & D. Buhalis (Eds.), *Information and communication technologies in tourism 2000* (pp. 126-146). New York: Springer.
- Sharma, P., & Carson, D. (2002). Promoting SMTE migration to the online economy: Case studies from Australia. In K.W. Woeber, A.J. Frew & Hilz, M. (Eds.), *Proceedings of the Ninth International Conference of Information Technology and Travel and Tourism* (pp. 136-144). Austria: Springer-Verlag Wein.
- Sharma, P., & Carson, D. (2004). Adaptive responses by Australian travel agents to disintermediation: The WebMAIL information network. *ENTER Conference*. Cairo, January [CD-ROM].
- Sheldon, P. J. (1999). *Tourism information technology*. New York: CABI.
- Sustainable Tourism Cooperative Research Centre. (1999). *Meeting the challenge*. Canberra: Department of Industry, Science and Resources.
- Waksberg, R., Stevens, B., & Vales, G. (2000). The Canadian tourism exchange—Content, collaboration and commerce. In D. Fesenmaier, S. Klein, & D. Buhalis (Eds.), *Information and*

communication technologies in tourism 2000 (pp. 245-264). New York: Springer.

Werthner, H., & Klein, S. (1999). *Information technology and tourism—A challenging relationship*. Vienna: Springer-Verlag.

Woeber, K. W. (2003). Information supply in tourism management by marketing decision support systems. *Tourism Management*, 24(3), 241-255.

KEY TERMS

Accommodation Management Systems: Integrated software (desktop, network, or Web-based) to assist a variety of functions for accommodation establishments. This may include reservations, room maintenance, banquet booking, finance, and customer relationship management.

Destination Marketing Organisation (DMO): Public-sector organisations charged with the promotion of a destination. They may operate at local, regional, or national level, and often include membership from private-sector organisations.

Destination Marketing Web Site: Web site featuring information about individual products and generic information about a local, regional, or national destination. These sites may be purely for promotion or may include e-commerce facilities for booking and purchasing product. They may be managed by DMOs or by private firms or industry associations not affiliated with a DMO.

Event Management Software: Integrated software (desktop, network, or Web-based) to assist a variety of functions for event managers.

This may include venue booking, delegate registrations, speaker requirements, transport, and accommodation management.

Global Distribution Systems: Global distribution systems are used by airlines, travel agencies, and other intermediaries to manage product inventory and to sell tourism products and packages. In the past, these have been dedicated line electronic services, but virtually all of the major GDS (Amadeus, SABRE, Galileo, etc.) have migrated to online systems.

Intermediaries: In the tourism and travel sectors, intermediaries are those organisations that package or on-sell product. These include travel agents, tour packagers, inbound tour operators, and destination marketing organisations. The Internet has led to the emergence of electronic intermediaries that offer their services entirely online.

Online Architecture: An organisations' online architecture demonstrates the range of functions they perform, or intend to perform, using online or other information technologies. Functions may pertain to communication, research, promotion, product distribution, or enterprise management.

Regional Tourism Systems: The combination of organisations and institutions with an interest in the management of tourism in a given destination. Regions may be defined by administrative boundaries or by communities of interest.

Smartcard: Card system that allows visitors to prepurchase products or product "credits" and to use the card at venues and attractions (such as hotels, theme parks, tours, etc.) in lieu of direct payment.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 176-181, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 2.28

A Framework for Ontology-Based Tourism Application Generator

Roopa Jakkilinki

Victoria University, Australia

Nalin Sharda

Victoria University, Australia

ABSTRACT

This chapter provides an overview of tourism ontology and how it can be used for developing e-tourism applications. The Semantic Web is the next generation Web; it uses background knowledge captured as an ontology and stored in machine-processable and interpretable form. Ontologies form the core of the Semantic Web and can be used to develop intelligent applications. However, generating applications based on ontology still remains a challenging task. This chapter presents a framework that provides a systematic process for developing intelligent e-tourism applications by using a tourism ontology.

INTRODUCTION

Tourism is one of the most successful and dynamic industries in the world, and it is constantly evolving because of technological advancements. Information technology is being used to enhance tourism services such as travel bookings, itinerary planning, destination marketing, and informa-

tion sharing. These services use dynamic Web applications.

The current tourism applications rely on static information sources such as Web sites to create tourism products and services. These applications lack intelligence; for example, an itinerary planner in the current scenario will allow the tourist to make bookings, but it cannot suggest an itinerary based on the travellers preferences. A Semantic Web application using an ontology, generic profiling, and semi-structured query tools can overcome the technical limitations of the current systems, and help build intelligent e-tourism tools, or applications.

This chapter discusses the purpose of developing a tourism ontology and proposes a model to develop intelligent tourism applications based on the same. The second section presents the background knowledge, followed by a proposed model for developing e-tourism applications, the following section demonstrates the working of an itinerary planner, and we finish with the conclusions.

The main objective of this chapter is to present a framework for developing ontology based

e-tourism applications. The specific foci of the chapter are:

- To provide an understanding of the Semantic Web and ontologies
- To introduce various existing travel ontologies and applications based on the same
- To describe a process model for developing e-tourism applications
- To present a case study using an intelligent itinerary planner

BACKGROUND

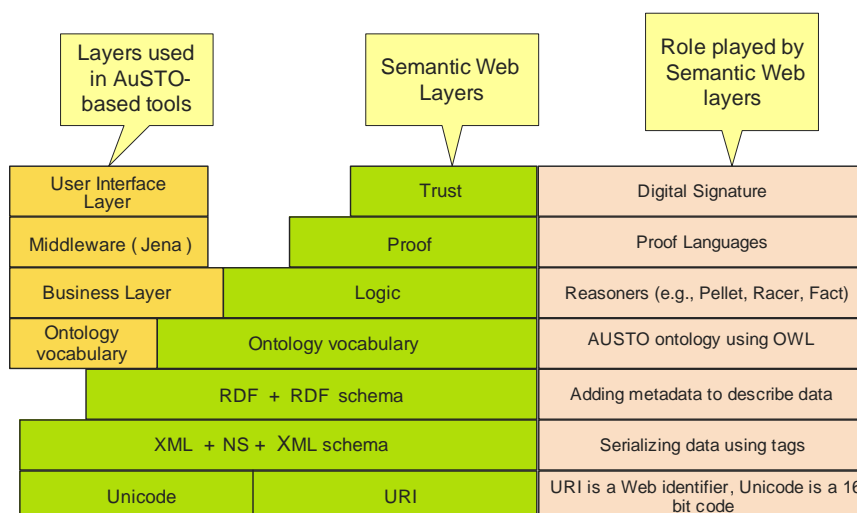
Semantic Web

The Semantic Web was thought up by Tim Berners-Lee as a mesh of information linked up in such a way so as to be easily processable by machines. It is not intended to be read by people, as it describes relationships between data that software will interpret (Palmer, 2001). Figure 1 represents the Semantic Web stack which has a layered architecture, it is based on a hierarchy of languages, each language both exploiting the features, and extending the

capabilities of the layers below (Butler, 2003). A brief introduction to the Semantic Web layers is presented in the following:

- **Uniform resource identifier (URI):** The Web naming and addressing convention, like the strings starting with “http” or “ftp”; they are short strings used to identify resources on the Web. Anyone can create new URIs. Example: `http://melba.vu.edu.au/roopa.txt`.
- **Unicode:** A replacement for the older ASCII code and can cope with multiple languages. It is a 16-bit code that can be used to represent the characters in most of the world’s scripts.
- **Extensible Markup Language (XML):** A standard format for serializing data using tags; XML file can contain data like a database, it is derived from Standard Generalized Markup Language (SGML) and is somewhat similar to Hypertext Markup Language (HTML). XML schema is a schema language used for describing XML data as well-defined schemas or data models. XML namespaces (NS) is an extension to XML for managing a collection of names identified by URIs.

Figure 1. The Semantic Web stack, and its layers covered in this chapter



- **Resource description framework (RDF):** This allows users to add metadata to describe the core data; RDF Schema is a language for describing RDF vocabularies (Bray, n.d.); in other words, RDF schema provides a way of organizing a large set of RDF vocabulary.
- **Ontology vocabulary:** A data model that represents the terminology used in a domain; it also is used to reason about the objects in that domain and the relations between them. Web Ontology Language (OWL) and Darpa Agent Markup Language + Ontology Interchange Language (DAML+OIL) are some of the languages used to describe ontologies.
- **Logic:** The Logic layer allows carrying out reasoning on a set of data, based on pre-defined rules, in order to draw conclusions. Inference engines or reasoners (Inference Engine, n.d.), such as, Racer, Fact, and Pellet work at this layer.
- **Proof and trust:** The proof and trust layers are still nascent. In most applications construction of proof is done by using some rules, the other party can use these rules to see whether or not a statement is true. Trust layer allows the creation of digital signatures for authentication and encryption.

What are Ontologies?

An ontology is a data model that represents a domain; it can be used to reason about the objects in that domain and the relations between them. Ontologies represent knowledge about the world or some part of it, they consist of: classes, collection of objects; attributes, properties an object can have and share; relations, represent the way the objects are related; and individuals, which are instances of the class (Chandrasekaran, Josephson, & Benjamins, 1999).

An ontology can be a domain ontology and theory ontology (Swartout, Patil, Knight, & Russ, 1997). A domain ontology models a specific

domain; it represents the particular meanings of terms as they apply to that domain, for example, tourism. A theory ontology provides a set of concepts for representing some aspect of the world, such as time and space.

Need for Tourism Ontology

Ontologies are especially useful where multiple entities such as researchers and organisations are active in the same domain, but each entity uses their own data model for that domain. For example, in the tourism domain, different entities such as travel agents, hotel chains, national, and regional tourism organisations have their own way of representing their services to the consumer (accommodation, events, attractions, services, etc.) using different data models. Furthermore, these data models maybe represented using different software technologies. This leads to interoperability problems, that is, software developed for one system cannot access data on another.

If tourism entities need to communicate with one another, a common data representation is needed. This common representation needs to represent both the concepts in the domain, and the relationships between these concepts. In addition, it should be possible for each tourism entity to map its data models to that used in a common ontology.

Having an ontology is very useful in this situation; as it models the domain in a structured manner, all entities will be able to use the ontology to communicate with all other entities, by mapping their source data model to the common ontology and then using the existing mappings between the ontology and the other destination data models (Clissmann & Höpken, n.d.).

Another benefit of ontologies is that they make it possible to carry out reasoning on the domain, they also act as back ends for intelligent applications, that is, they provide the ability to derive domain knowledge for developing intelligent applications. These applications, with the help

of a reasoner, can infer facts from the domain ontology. Creating an ontology for tourism will allow knowledge sharing between different tourism organizations, and also will allow for the creation of intelligent e-tourism tools such as search engines and tour planners.

Travel Ontologies

A variety of tourism ontologies have been developed to date. In this section we give an overview of a number of tourism related ontologies. The Harmonise ontology is not only a minimum standard ontology, but also a means of reconciling various ontologies.

OTA Specification. The Open Travel Alliance specifications have been designed to serve two purposes, namely to act as a common language for travel related services, and to provide a mechanism for information exchange between travel industry members (The Open Travel Alliance, n.d.). It is possible to view the OTA specifications as a comprehensive ontology, defining concepts such as AirSchedule, GolfCourseReservation, HotelContentDescription, HotelPreferences, and so on. The OTA specification has already been utilised in a travel related project called Agentcities (Gordon, Kowalski, Paprzycki, Pelech, Szymczak, & Wasowicz, 2005).

MONDECA. MONDECA's tourism ontology defines tourism concepts based on the World Tourism Organization (WTO) thesaurus (MONDECA, n.d.). These include among others, terms for tourism object profiling, tourism and cultural objects, tourism packages, and tourism multimedia content. MONDECA has created a proprietary system called the Intelligent Topic Manager (ITM) that is used to manage its travel ontology.

TAGA Ontology. The Travel Agent Game in Agentcities (TAGA) is an agent framework for simulating the global travel market on the Web. Its purpose is to demonstrate the capabilities of Agentcities (Agentcities, n.d.) and Semantic Web

technologies. TAGA works on the Foundation for Intelligent Physical Agents (FIPA) compliant platforms within the Agentcities environment (The Foundation for Intelligent physical agents, n.d.). In addition to the FIPA content language ontology, TAGA defines two domain ontologies to be used in simulations. The first ontology covers basic travel concepts such as itineraries, customers, travel services, and service reservations. The second ontology is devoted to auctions and defines different type of auctions, roles the participants play in them, and the protocols used. TAGA ontologies are limited in their usability, and are rather unrealistic due to the nature of the TAGA simulations.

Harmonize Ontology. Harmonize is an attempt at ontology-mediated integration of tourism systems following different standards (E-Tourism, n.d.). Its goal is to allow organizations to exchange information without changing their data models. The Harmonize project also involves sub-domains that are partially related to the world of travel: geographical and geo-spatial concepts, means of transportation, political, temporal, and gastronomy, and so forth. These sub-domain concepts can be used within the travel system.

Numerous ontologies have been developed for the domain of tourism. Defining and agreeing on the right ontology is a difficult task. One could argue that the choice of the right ontology is purely subjective, because the meaning of various terms differs across domains, users, and situations. Each of these ontologies have been developed with a specific task in mind and specialises in a particular aspect of the tourism domain; for example, a tourism ontology that specialises in tourism events can be used to develop an event planner. Most of the ontologies have been developed with a tool in mind, and their scope is limited to that tool. We have developed an abstract ontology called the Australian sustainable tourism ontology (AuSTO) which covers all the general concepts used in tourism, both from the customer perspective and from the enterprise perspective;

subsequently several intelligent tools such a tour planner, search engines and travel recommender systems are planned for development based on the AuSTO ontology.

Applications Based on Travel Ontologies

A number of intelligent applications such as search engines, tour planners, and location-based tour guides have been developed using ontologies. These applications help the traveller as well as tour operator to plan trips and find information about destinations. In this section we describe two such applications and their usage.

On Tour. On Tour can be considered as an intelligent search engine. The main objective of the On Tour system is to connect isolated pieces of information, that is, to assist the user in finding information from a variety of sources, and to allow individualized use of the same (Daniel, 2005). As a search engine, On Tour allows for the querying of distributed data as well as considering the semantics of discovered concepts and instances. It allows the user to specify preferences like maximum budget and minimum comfort, and define further constraints such as personal schedule. This system helps the user to plan a vacation from the beginning to the end. In later phases of development On Tour will act as a recommender system by giving advice on best restaurants, venue for musicals, and so on. It also will provide support for mobile devices. On Tour approach is to extract pieces of information from structured Web pages and conduct constraint based reasoning for the integration of multiple information sources.

Talea. Talea is a platform aimed at supporting the development of Web-based tourism applications (Levi, Vagliengo, & Goy, 2005). This software was designed and developed within the Diadi 2000 (Dissemination of Innovation

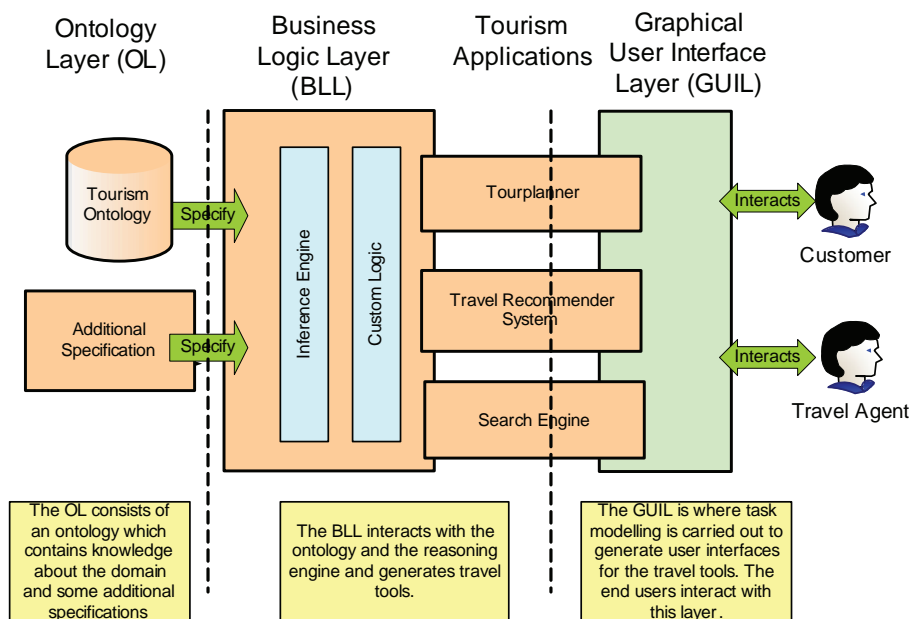
in Industrial Decline areas) project. The Diadi 2000 project aims at applying ICT technologies to small and medium enterprises (SMEs) to increase the value of their businesses. Talea provides for multi device access, where customers and suppliers can use PDAs or smart phones to buy and offer tourism services. This software acts as a matchmaker by matching service provision with request; tourism suppliers can advertise their services such as room availability, car rentals, and so on, and customers can perform a search for a particular service.

Dynamic Packaging System. An important type of e-tourism application that has evolved in recent years is a dynamic packaging system (Cardoso, 2005). It is used by airlines, hotels, tour operators, and travel agencies to create customised packages for individual consumers. Dynamic packaging can be defined as the combining of different travel components, bundled and priced in real-time, in response to the request from a consumer or a booking agent. They have created an e-tourism ontology that allows interoperability through the use of shared vocabulary and meanings for terms. Semantic mediators are used to support a virtual view that integrates semantically annotated e-tourism information sources. Final dynamic package processes are created using conditional planning ranking and selection. Once the dynamic package processes are evaluated they are presented to the tourist and the tourist can select the package that he finds most appealing or suitable according to his preferences.

TOURISM APPLICATION GENERATOR ARCHITECTURE

Figure 2 presents the underlying model for generating ontology based e-tourism applications; called the e-tourism application generator architecture (e-TAGA). The e-TAGA model consists of

Figure 2. A tourism application generator architecture (e-TAGA)



three layers: the ontology layer (OL), the business logic layer (BLL) and the graphical user interface layer (GUI). The OL provides persistence for the tourism ontology; the business logic layer includes two common components and parts of the tourism applications themselves. The two common components in the BL are the inference engine (IE) and the custom logic (CL). The GUI layer includes the graphical user interface (GUI) components of individual tourism applications and some common GUI elements.

Ontology Layer (OL)

The ontology layer consists of the ontology which embodies knowledge about the domain and some additional specifications. This layer is the core of all Semantic Web systems. We will use the AuSTO ontology to exemplify the operation of the various layers.

Tools for Ontology Development

In any ontology development project one needs to begin by selecting an ontology development tool. In the AuSTO project three different tools were compared in order to decide which one of these would be most suitable for our tourism ontology development. The three tools considered were Protégé 2000, Ontolingua, and OntoEdit free. This comparison was based on ontological aspects and usability aspects. Our study indicated that Protégé 2000 is far superior in usability and ontology aspects as compared to Ontolingua and OntoEdit free (Jakkilinki, Sharda, & Georgievski, 2005), hence Protégé2000 was selected. Protégé2000 (Protégé, n.d.) comprises an open architecture that allows programmers to insert arbitrary components into the tool. This feature can be exploited during the development of Semantic Web applications based on the ontology. An additional benefit of Protégé 2000 toolkit is

developers can package the implementation of the application as a Protégé plug-in and test how the system behaves in response to any changes in the ontology.

Methodology Followed to Develop AuSTO Ontology

Ontology development methodology includes tools, techniques and process followed in order to develop the ontology. The methodology followed to develop the AuSTO ontology is as follows (Jakkilinki et al., 2005).

1. **Identify the purpose behind ontology development:** The pertinent questions are listed here, along with their answer for AuSTO development.
 - Why is the ontology being built? In the case of AuSTO, the ontology is being built to describe the tourism domain.
 - What is its intended use? AuSTO ontology will be used as a knowledge base to develop intelligent tools such as an itinerary planner.
 - Who are the users? AuSTO will be used by operators in tourism domain, such as the tourist operators, tourism vendors.
2. **Ontology capture mechanism** consists of three different stages:
 - **Determining the scope of the ontology:** This involves identifying all the key concepts and relationships in the domain.
 - **Selecting a method to develop the ontology:** The method we followed to develop AuSTO is the top-down approach.
 - **Defining the concepts in the ontology:** This involves taking closely related terms and grouping them as classes.
3. **Coding the ontology:** Coding refers to representing the ontology in some formal

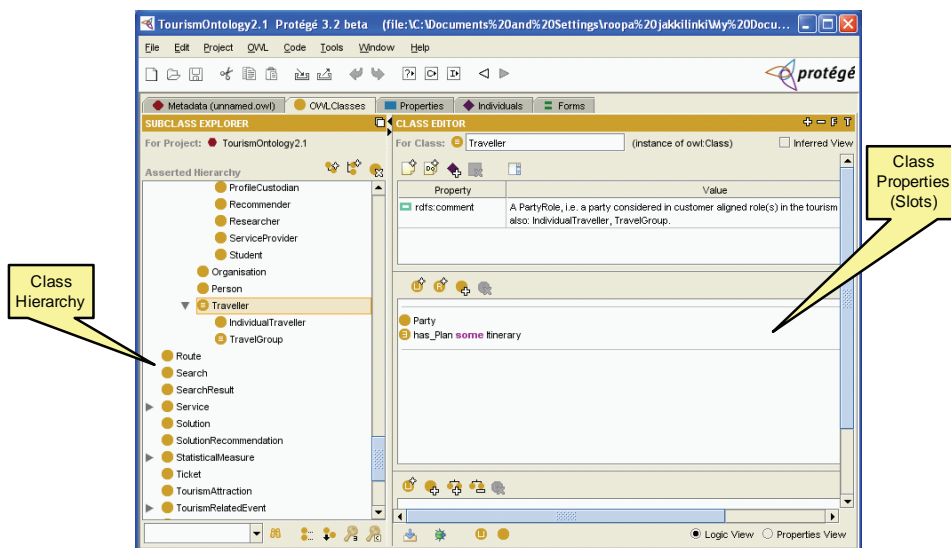
language. A suitable ontology editor has to be selected, in the case of AuSTO the ontology editor used is Protégé. Once the ontology editor is selected the classes have to be entered as concepts and their attributes are entered as slots.

4. **Refinement:** This consists of two phases, namely intra-coding refinement and extra-coding refinement. Intra-coding refinement refers to the refinement done during the coding phase, whereas extra-coding refinement refers to the changes made to overcome the errors uncovered during the testing and maintenance stages.
5. **Testing:** The testing process uncovers any defects in functional logic and implementation. Testing should be carried out during all stages of development.
6. **Maintenance:** This can be corrective, adaptive or perfective. Corrective maintenance involves correcting the ontology to overcome the errors discovered by users while querying the ontology. Adaptive maintenance involves modifying the ontology to fulfil new requirements. Perfective maintenance involves improving the ontology by further refining it, in order to enhance its functionality (Pressman, 1997).

Brief Description of Classes in AuSTO

Creating an ontology involves delineating concepts into a class hierarchy. Three important approaches to develop class hierarchies are top-down, bottom-up and a combination approach (Uschold & Gruninger, 1996). In the top-down approach the development process starts with the definition of the most general concepts in the domain, followed by specialised concepts. In the bottom-up approach the development process starts with the definition of the most specific classes, which form the leaves of the class hierarchy tree, with subsequent grouping of these classes into more general concepts. The combined approach

Figure 3. A screen shot of the AuSTO ontology



uses a combination of top-down and bottom-up processes. The approach followed for AuSTO is the bottom-up approach. This approach is usually driven by the need for having a workable vocabulary quickly and then enhancing it as the project progresses. AuSTO is written in OWL (Web Ontology Language), Figure 3 is a screen shot of AuSTO ontology in Protégé. The AuSTO ontology consists of a class hierarchy shown on the left, each class has properties and one can create individuals, or instances of a class, using the instance tab in the Protégé interface.

AuSTO being tourism ontology it contains classes from the tourism domain. Following list gives some of the important classes in AuSTO:

- **Involved party** can be traveller, vendor, operator, and so forth.
- **Requirement** refers to travel requirements
- **Offering** includes travel products and services.
- **Solution** refers to systems outputs such as itineraries.
- **Resource** can be reserved or rented items.
- **Specification** allows for both offering specifications and requirement specifications

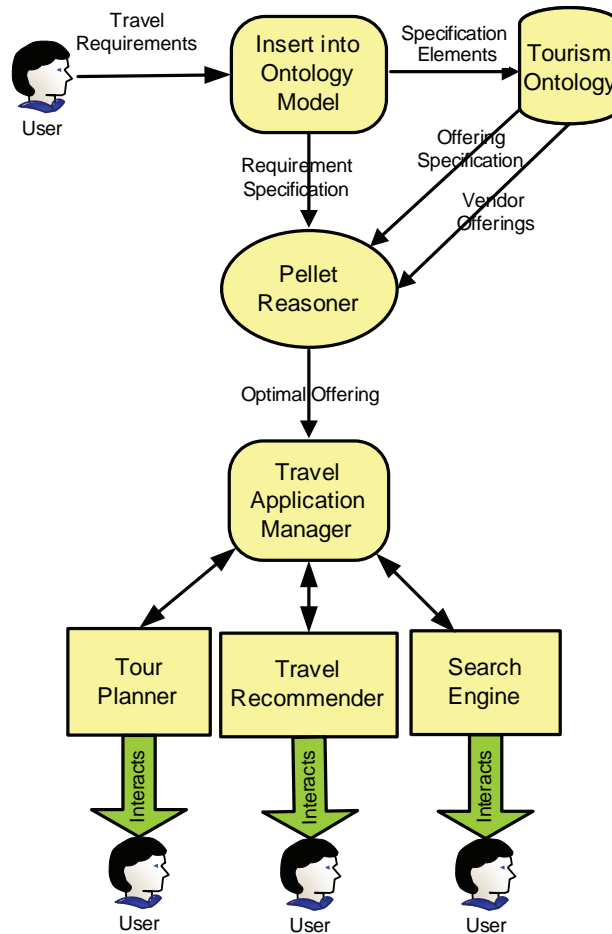
- **Preference** includes traveller’s preferences such as date, time, location, or price range.

Each of these classes can represent a plethora of tourism information. For example, requirement represents diverse travel requirements such as accommodation, entertainment, transport, and offering represents the wide range of travel products and services that vendors make available to the traveller, often as part of a packaged solution.

Business Layer

The business logic layer (BLL) uses an inference engine and custom logic, and is responsible for generating outcomes; that is, it returns results based on user interactions. Figure 4 describes the BLL for the applications based on AuSTO. A user specifies his travel requirements in the ontology and the tourism vendor advertises his offerings which are tourism services in the ontology. The offerings and requirements are loaded into the ontology model of the Jena subsystem. Pellet reasoner matches the travel requirements to the vendor offerings and sends it to the travel application manger. Travel tools such as tour

Figure 4. Architecture for the business layer



planners can query the travel application manager and produce the travel solution, which in this case is an itinerary.

What are Reasoners?

The reasoner is a software that applies logic to the knowledge embodied in the ontology for arriving at some conclusions (*Inference Engine*, n.d.). We generally recognize two types of inferencing, namely forward chaining, and backward chaining. In forward chaining one proceeds from a given situation towards a desired goal by adding new assertions along the way; whereas, in backward

chaining one starts with the desired goal and then attempts to find the method for arriving at the goal. A number of reasoners are available, such as Racer, FaCT, Pellet, and F-OWL. Pellet is the reasoner used in the AuSTO project, it is an open-source Java-based OWL DL reasoner developed by the Maryland Information and Network Dynamics Lab Semantic Web Agents Project (Mindswap, n.d.).

Role Played by Jena

Jena is a Java framework for building Semantic Web applications, it is open source and has been

developed by HP (Hewlett Packard) Labs. Jena acts as a middleware which connects the ontology, reasoner and the user interface. In Jena all operations are done by manipulating the Jena model. Therefore, to manipulate an ontology it needs to be loaded into the Jena model first. Jena has four subsystems: query engine, database interface, reasoning engine, and ontology management. Jena's architecture allows external reasoners to be plugged into the Jena models.

User Interface Layer

One of the most difficult aspects of building an application is designing the user interface. User Interface design is the design of the graphical elements on the computer screen with which a user interacts to conduct application tasks. The user interface is as important as the functionality of the application, and plays an important role in the success of any product. User interfaces accomplish two fundamental tasks: communicating information from the computer to the user and communicating information from the user to the computer.

The benefits of a good user interface design include: lower training costs, less user stress, consistency in application usage, increased ability to recover from errors, better user control, less clicks to find information, ability to store more information per screen, easier to use the software, selection amongst many choices using limited space, see all selections at all times, better understanding of the software, save screen space, and higher data entry speed (Miller, n.d.).

Task analysis and modelling techniques are increasingly being used in designing user interfaces, they form an important part of user interface design process and help design more intuitive interfaces.

What are Task Analysis and Task Modelling?

Task analysis involves the study of a system functionality as a collection of tasks. Generally the systems function is divided into a set of top-level tasks, and each one of these is further divided into sub-tasks, and so forth to develop a task-tree. This process can be used to guide the design of new systems beginning with user requirement capture. One of the most important applications of task analysis is designing user interfaces, in which menus are based on the task trees. The top level menus can be labelled after the top level tasks and the sub menus after the next level tasks (Dix, Finlay, Abowd, & Beale, 1998).

After an informal task analysis where the main tasks and their attributes have been identified, task modelling is used to understand the relationships among the various tasks in order to better address the design of interactive applications.

As task modelling is used to model the behaviour of a system from user's perspective, it captures the system requirements and actions defined as a set of tasks, and models the behaviour of the system as a scenario of tasks. This allows the designers to improve the human computer interaction aspects when designing a system's operation (Georgievski & Sharda, 2003). Although task models have long been considered in human-computer interaction, only recently have user interface developers and designers realized their importance to obtain more effective and consistent solutions (Giulio, Paterno, & Santaro, 2002). Task models play an important role because they represent the logical activities that should support users in reaching their goals, and knowing the tasks necessary to attain a goal is fundamental to any good design (Paterno, 2002).

There are two types of task models: user task model and system task model. A user task model

states the problems to be solved by the system, and thus consists of overlapping user scenarios (Georgievski & Sharda, 2003). Actors involved in a user task model are generally human; however, it may include external systems and the environment. A system task model forms the basis for specifying a solution in the form of system requirements. Actors involved in a system task model are generally subsystems, interfaces, and, at times humans.

Tools for Task Modelling

One of the main problems in task modelling is that it is a time-consuming and sometimes tedious process. To overcome this problem interest has been increasing in tools that support task analysis and modelling. However, current tools are outcomes of research projects, and are used mainly by groups that have developed them.

The concur task tree environment (CTTE) is a Java Applet based tool developed by Human Computer Interaction Group – ISTI (Pisa). CTTE provides the ability to build task models from a visual perspective where the user can define and structure the tasks in a logical fashion using the graphical editor provided in the tool. CTTE enables the user to focus on the activities of their model and thus allowing the user to identify the requirements of the model and organize them into a logical hierarchy of task and subtasks (Georgievski & Sharda, 2003).

The main features of the CTTE tool are (Giulio et al., 2002):

- **Focuses on activities:** Allows designers to concentrate on the activities that a user has to perform, rather than programming details.
- **Hierarchical structure:** Provides a wide range of granularity allowing large and small task tree structures to be developed and reused.

- **Graphical syntax:** Facilitates easy interpretation of the logical task structure using graphical representation.
- **Concurrent notation:** Provides rich set of possible temporal relationships that can be used to specify the relationship between the tasks.
- **Distinct task representations:** Uses distinct icons to represent user task, application task, interaction task, and abstract task

CTTE provides the ability to build two types of task models: single user task models and cooperative task models. Single user task models are used to represent systems that a single user controls. A cooperative task model is similar to a single user task model; however it includes tasks executed by two or more users.

Other useful features of CTTE tool are model comparison, reachability analysis, and interactive task model simulator (Giulio et al., 2002).

Itinerary Planner Case Study

In this section we describe the task model created to represent the user interface for the itinerary planner. This task model guide the development of the user interface by focusing on the various functions the user interface needs to perform.

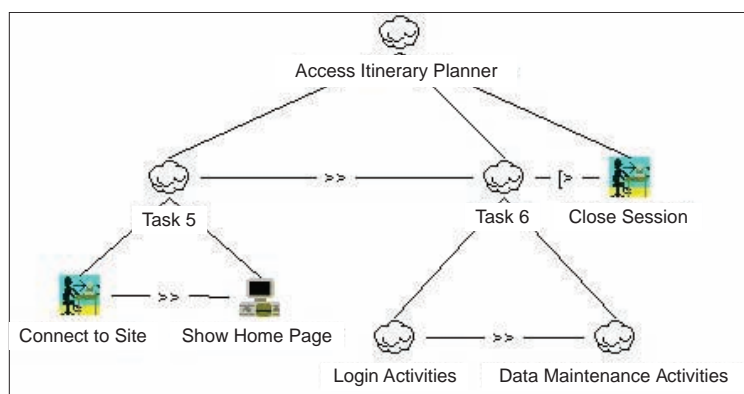
CTTE allows the following types of tasks to build the entire task model:

- **Abstract tasks** define a set of subtasks to be performed at a conceptual level
- **User tasks** denoted the operation/tasks executed by the user
- **Interaction tasks** represent tasks that carry out communication between entities within the task model.
- **Application tasks** are of tasks executed by the system or application entities in the process model

Table 1. Temporal operators used in CTTE

| Syntax | Notation | Description |
|------------------------|------------------------------------|---|
| $T1 \square T2$ | Choice | A choice between two or more tasks |
| $T1 \gg T2$ | Enabling | T1 enables T2 when T1 is terminated |
| $T1[\square] \gg T2$ | Enabling with Information Exchange | T1 provides some information to T2 besides enabling it |
| $T1 \triangleright T2$ | Suspend/Resume | T2 can interrupt T1, and when T2 is terminated T1 can be reactivated from the state reached before the interruption |
| T^* | Iteration | Tasks performed repetitively |

Figure 5. Itinerary planner abstract model



CTTE uses transition notations to describe the temporal relationships between tasks and the execution sequence for the task model. The temporal operators used in CTTE are described in Table 1.

We have implemented the task model for itinerary planner as a single user task model that represents the overall function of the user interface from a user perspective. We represent these tasks as tree diagrams in Figures 5 to 11. In the task tree diagram we define the execution sequence for each task using the temporal operators described in Table 1.

Figure 5: This shows the itinerary planner abstract task model. It illustrates the tasks the user can perform on connecting to the itinerary planner Web site. Task 5 consists of connecting to the Web site and viewing the home page. Task

6 involves logging into the Web site and then carrying out the data maintenance activities. Figures 8 to 13 expand on these activities.

Figure 6: This shows the task model that expands the Login Activity task. Login Activities describe the tasks to be performed for the user to login, it allows for an existing user, as well as new user.

Figure 7: Data Maintenance Activities task tree, which provides a choice between four abstract tasks: Preference Maintenance, Requirement Maintenance, Itinerary Maintenance, and Offering Maintenance.

Figure 8: Preference Maintenance Activities task tree, which consists of the tasks involved in maintaining the preferences of the traveler. Here preferences refer to what of the traveler likes, with regard to various facilities such as accommodation, transport, and so forth.

Figure 6. Login activities

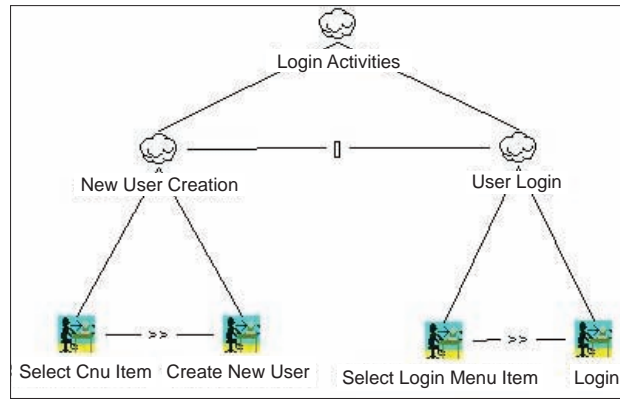


Figure 7. Data maintenance activities

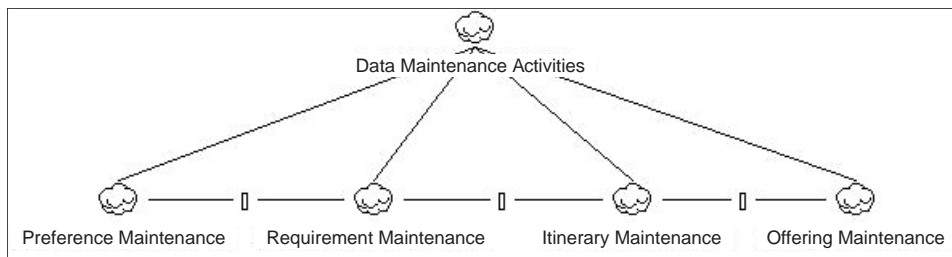


Figure 8. Preference maintenance activities

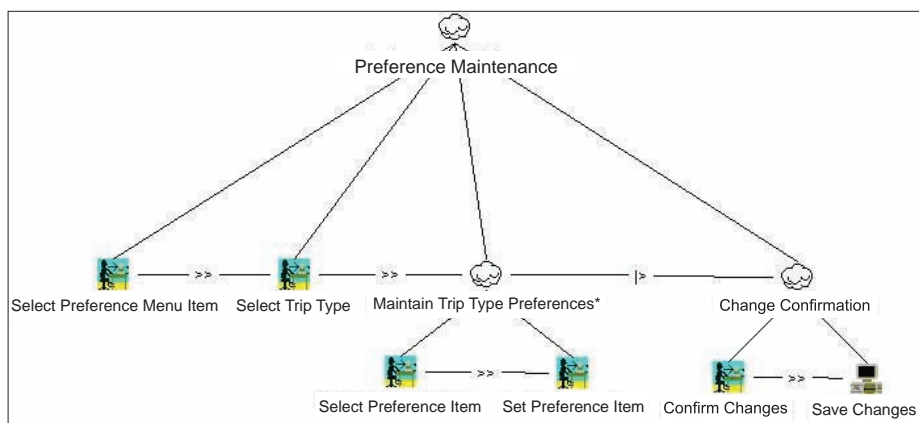


Figure 9. Requirement maintenance activities

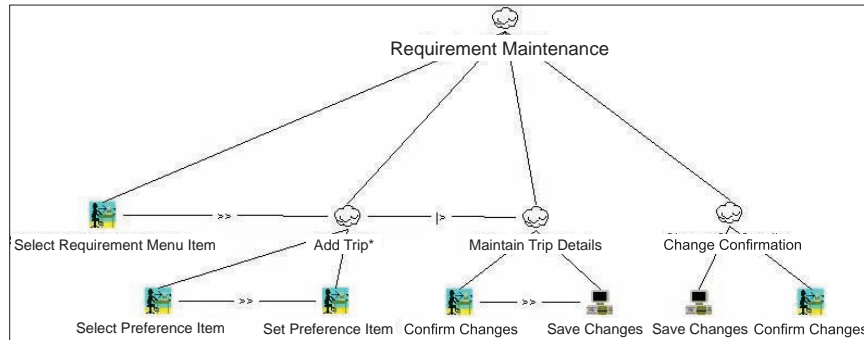


Figure 10. Itinerary maintenance activities

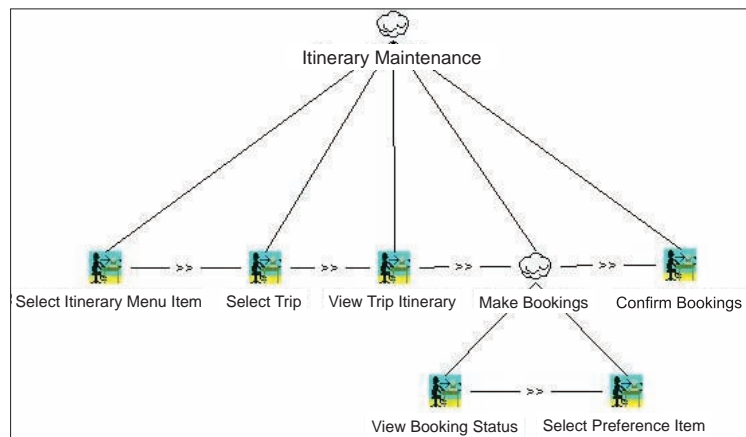


Figure 11. Offering maintenance activities

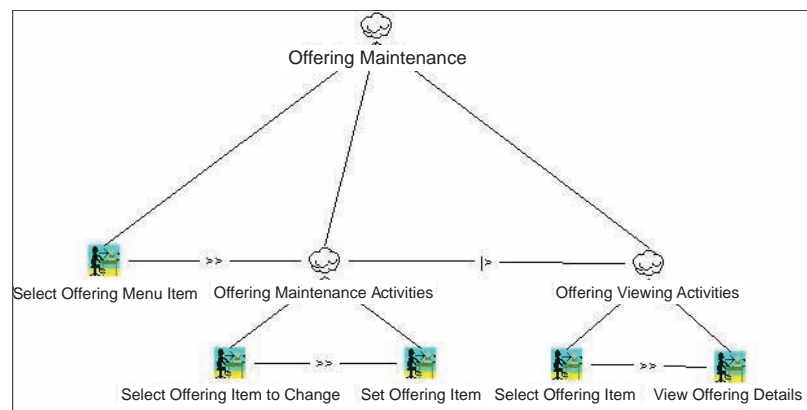


Figure 9: Requirement Maintenance Activities task tree, which describes the tasks involved in maintaining the traveler requirements. Requirements refer to the travelers demands for the tour, for example the traveler may want 5-star accommodation and a business class flight.

Figure 10: Itinerary Maintenance Activities task tree, which describes the tasks involved in creating an itinerary for the traveler. An itinerary is generated by matching the traveler's requirements with the offerings available.

Figure 11: Offering Maintenance Activities task tree, which describes the tasks involved in maintaining the offerings being provided by various travel vendors. Tourism vendors can advertise their services such as room availability, tickets availability through this option.

Working of an Itinerary Planner

In this section we describe the operation of a travel itinerary planner; this itinerary planner has been developed based on the application generator framework. It consists of AuSTO ontology, a user interface created using ASP.net, and a business logic layer, which acts as a connector between the ontology and the user interface. The AuSTO ontology is populated by a tourism domain expert, the application allows tourism operators to advertise their offerings in the offerings page, and the offerings are stored in the ontology. The end user or the tourist can specify his requirements in the requirements page, these requirements are stored in the ontology, and the tourist also can specify his preferences which also are be stored in the ontology. The itinerary planner matches the requirements with the offerings, and produces an itinerary; the end user can either reject the itinerary offerings or accept these and confirm bookings in the itinerary page. The user interface for the itinerary planner has been developed based on the task model described in the previous section. This application is explained in some more detail with the help of screen shots in the following.

Figure 12: This shows the new user screen, which allows the creation of a new user. It is necessary to have an account in order to use the application.

Figure 13: This shows the user login screen where an existing user can login into the application. Once the user logs in, he has access to facilities such as storing preferences or specifying requirements.

Figure 14: This shows the requirements screen where a tourist can enter his requirements for a trip. Once the requirements are entered the tourist clicks the Add Trip button and a new leg can be added.

Figure 15: This shows the itinerary screen, the tourists' requirements are matched with the vendor offerings and an itinerary is produced. The tourist can accept offerings in the itinerary with the help of the checkboxes, and make booking by clicking on the Make Bookings button and then confirm bookings.

Figure 16: This shows the preferences screen, which allows the user to store his preferences for accommodation, transport facilities and other such services. Different preferences for different kind of trips can be stored, such as family trip and business trip.

Figure 17: This shows the offerings maintenance screen, tourism vendors such as hotels or transport providers can advertise their offerings on this page. For example, hotels can advertise their room availability, and transport providers can advertise their vehicle availability.

CONCLUSION

There is a need for standardisation of definitions and concepts in the field of tourism; the solution is to develop travel ontologies. Number of travel ontologies have been developed in recent times, each with an application in mind; we have developed an Australian sustainable tourism ontology (AuSTO), specifically for the Australian

A Framework for Ontology-Based Tourism Application Generator

Figure 12. New user screen

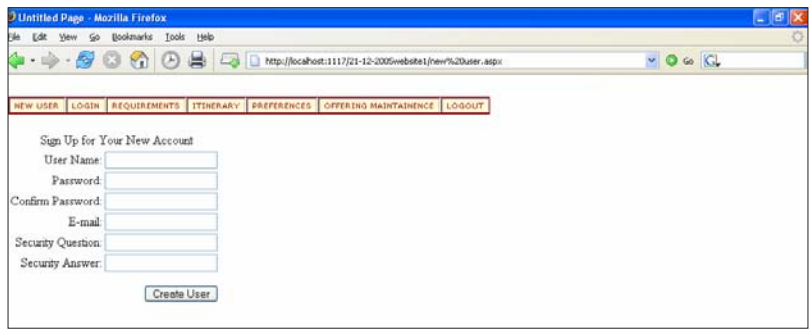


Figure 13. Login screen

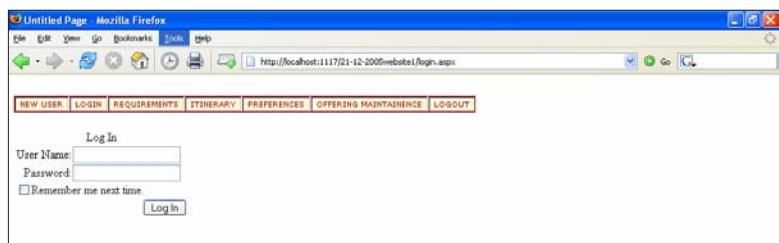


Figure 14. Requirements screen

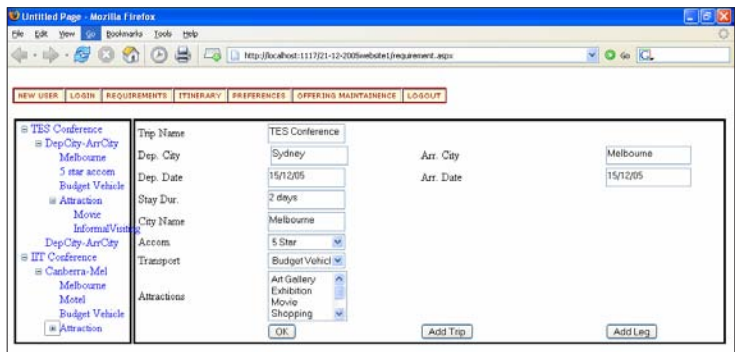


Figure 15. Itinerary screen

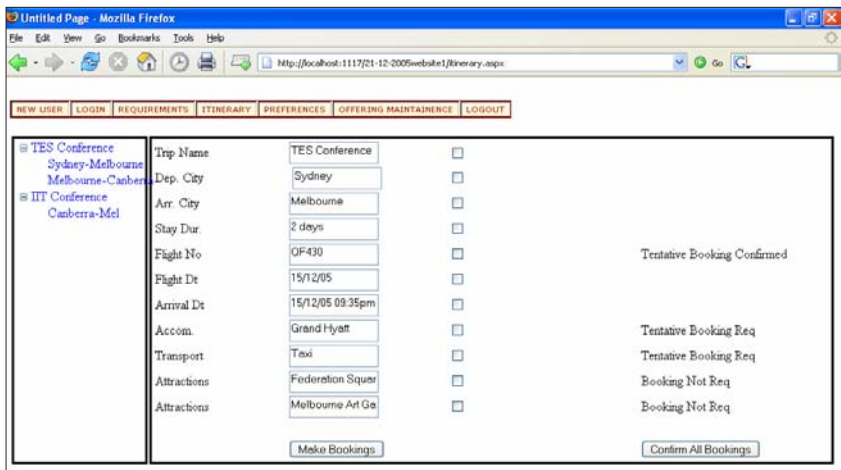
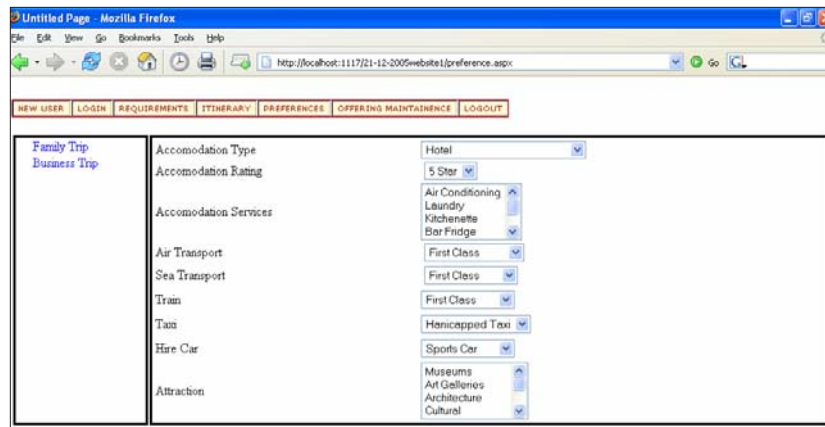


Figure 16. Preferences screen



tourism sector. This AuSTO ontology reuses the knowledge from some of the existing ontologies. Ontologies enable the development of Semantic Web applications, but ontology driven application development is still a nascent field. We are developing an intelligent travel application generator based on the AuSTO ontology. The application generator framework enables the production of different intelligent travel tools such as Itinerary planners, and recommender systems. We are building an itinerary planner by using this framework, and this intelligent itinerary planner can match the user requirements specified in the ontology with vendor offerings specified in the ontology and produce an itinerary as a solution. This chapter presented an overview of the Semantic Web, introduced different tourism ontologies and some applications based on tourism ontologies, and describes in detail a framework for developing e-tourism applications based on ontologies.

ACKNOWLEDGMENT

We would like to thank Sustainable Tourism Cooperative Research Center (STCRC), Australia, for the funding this research. We also would like

to thank Henk Meijerink and Paul Mohinyan for their help in this research.

REFERENCES

- Agentcities. (n.d.). Retrieved August 15, 2005, from <http://www.agentcities.org>
- Bray, T. (n.d.). *What is RDF*. Retrieved May 31, 2006, from <http://www.xml.com/pub/a/2001/01/24/rdf.html?page=2>
- Butler, M. H. (2003). *Is the Semantic Web hype?* Retrieved May 31, 2006, from <http://www.hpl.hp.com/personal/marbut/isTheSemanticWeb-Hype.pdf>
- Cardoso, J. (2005). *E-tourism: Creating dynamic packages using Semantic Web processes*. Paper presented at the W3C Workshop on Frameworks for Semantics in Web Services.
- Chandrasekaran, B., Josephson, J. R., & Benjamins, V. R. (1999). What are ontologies, and why do we need them? *IEEE*, 14(1), 20-26.
- Clissmann, C., & Höpken, W. (n.d.). *Harmonise ontology user manual*. Retrieved from www.harmon-ten.info/harmoten_docs/D2_2_Ontology_User_Manual_V3.2.0.3.doc

- Daniel, B. (2005). *On tour, the Semantic Web and its benefits to the tourism industry*. Retrieved May 25, 2006, from <http://etourism.deri.at/ont/docu2004/OnTour%20%20Semantic%20Web%20and%20its%20benefits%20to%20the%20tourism%20industry.pdf>
- Dix, A., Finlay, J., Abowd, G., & Beale, G. R. (1998). *Human-computer interaction*. Prentice Hall.
- E-tourism. (n.d.). Retrieved August 16, 2005, from <http://deri.at/research/projects/e-tourism>
- Foundation for Intelligent Physical Agents, The. (n.d.). Retrieved August 15, 2005, from <http://www.fipa.org>
- Georgievski, M., & Sharda, N. (2003). *Task modelling for a holistic quality of service model—TRAQS*. Paper presented at the IEEE India Council Annual Convention and Exhibition, India.
- Giulio, M., Paterno, F., & Santaro, C. (2002). CTTE: Support for developing and analyzing task models for interactive system design. *IEEE Transaction on Software Engineering*, 28(9), 1-17.
- Gordon, M., Kowalski, A., Paprzycki, M., Pelech, T., Szymczak, M., & Wasowicz, T. (2005). Ontologies in a travel support system. *Internet 2005*, 285-300.
- Inference engine. (n.d.). Retrieved May 15, 2006, from <http://www.emclab.umr.edu/consortium/Whatis/node17.html>
- Jakkilinki, R., Sharda, N., & Georgievski, M. (2005). *Developing an ontology for multimedia design and planning pyramid*. Paper presented at the International Symposium on Information and Communications Technologies, Petaling Jaya Malaysia.
- Levi, G., Vagliengo, A., & Goy, A. (2005). *Talea: An ontology-based framework for e-business applications development*. Paper presented at the 2nd Italian Semantic Web Workshop on Semantic Web Applications and Perspectives, Trento, Italy.
- Miller, R. H. (n.d.). *Web interface design: Learning from our past*. Retrieved May 25, 2006, from <http://www.cs.rutgers.edu/~shklar/www4/rmiller/rhmpapr.html#background>
- Mindswap. (n.d.). Retrieved May 15, 2006, from <http://www.mindswap.org/2003/pellet/index.shtm>
- Mondeca. (n.d.). Retrieved August 15, 2005, from <http://www.mondeca.com>
- Open Travel Alliance, The. (n.d.). Retrieved August 15, 2005, from <http://www.opentravel.org>
- Palmer, S. B. (2001). *The Semantic Web: An introduction*. Retrieved May 25, 2006, from <http://infomesh.net/2001/swintro/>
- Paterno, F. (2002). *Task modelling: Where we are, where we are headed*. Paper presented at the First International Workshop on Task Models and Diagrams for User Interface Design, Tamodia, Bucharest, Romania.
- Pressman, R. S. (1997). *Software engineering, a practitioner's approach* (4th ed.). McGraw-Hill.
- Protégé. (n.d.). Retrieved May 25, 2006, from <http://protege.stanford.edu/>
- Swartout, B., Patil, R., Knight, K., & Russ, T. (1997). *Towards distributed use of large scale ontologies*. Paper presented at the Symposium on Ontological Engineering of AAAI, Stanford, CA.
- Uschold, M., & Gruninger, M. (1996). Ontologies: Principles, methods and applications. *Knowledge Engineering Review*, 11(2).

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper, pp. 26-49, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.29

Developing Visual Tourism Recommender Systems

Mohan Ponnada

Victoria University, Australia

Roopa Jakkilinki

Victoria University, Australia

Nalin Sharda

Victoria University, Australia

ABSTRACT

Tourism recommender systems (TRS) have become popular in recent years; however, most lack visual means of presenting the recommendations. This paper presents ways of developing visual travel recommender systems (V-TRS). The two popular travel recommender systems being used today are the TripMatcher™ and Me-Print™. Tour recommendation using image-based planning using SCORM (TRIPS) is a system that aims to make the presentation more visual. It uses SCORM and CORDRA standards. Sharable content object reference model (SCORM) is a standard that collates content from various Web sites, and content object repository discovery and registration/resolution architecture (CORDRA) aims to locate and reference SCORM repositories throughout the Internet. The information collected

is stored in the form of an XML file. This XML file can be visualised by either converting it into a Flash movie or into a synchronized multimedia integration language (SMIL) presentation. A case study demonstrating the operation of current travel recommender systems also is presented. Further research in this area should aim to improve user interaction and provide more control functions within a V-TRS to make tour-planning simple, fun and more interactive.

INTRODUCTION

Recommender systems have become popular with the advent of e-commerce. The development of this technology is being strengthened as more people start using the Internet for making purchases. Recommender systems are used by

Amazon.com (Linden, Smith, & York, 2003) to recommend books, and movies are recommended on MovieLens (Miller, Albert, Lam, Konstan, & Riedl, 2003). In recent years there has been much work done to improve recommender systems. With increasing Internet adoption, business transactions on the Internet are likely to grow substantially; this encourages vendors to add recommendation capabilities to their Web sites (Peddy & Armentrout, 2003). Tourism is one of the most successful and dynamic industries in the world, and is constantly evolving with continuous technological advancements that include Internet based systems. One such advancement is visual travel recommender systems (V-TRS).

Travel recommender systems (TRSs) are increasingly being adopted to support the tourism industry, some examples of this include Triplehop's TripMatcher™ (Delgado, 2001; Starkov, 2001), and VacationCoach's expert advice platform Me-Print™ (VacationCoach, 2002). A TRS allows tourists to access an informed recommendation for travel planning via an artificial intelligence-based engine. However, current TRSs do not provide tourists with the facility to visualise their complete holiday itinerary, integrating location, transportation, accommodation, attractions, and entertainment. The tourist has to browse through individual Web pages to build a mental picture of the planned tour. In this chapter we introduce the concept of a visual TRS, which can overcome this limitation.

The main objectives of this chapter are:

- To understand recommender systems
- To provide an insight into current application of recommender systems in the tourism industry
- To gain an understanding of services provided by TRS systems, their benefits and limitations
- To present the framework of a visual travel recommender system

- To present a case study demonstrating the operation of current travel recommender systems
- To discuss the future trends in travel recommender systems

BACKGROUND INFORMATION

Recommender Systems

“Recommender Systems are an attempt to mathematically model and technically reproduce the process of recommendations in the real world” (Berka & Plößnig, 2004). Recommender systems are being used by e-commerce Web sites to make suggestions to their customers (Schafer, Konstan, & Riedl, 1999). These recommendations can be made on various factors such as demographics, past buying behaviour of the customers, and prediction of the future buying behaviour.

Recommender systems enhance sales in three different ways (Schafer et al., 1999):

- **Browsers to buyers:** A good Web site can turn visitors of the site into buyers by helping them find the products they wish to purchase.
- **Cross-selling:** Well linked Web pages can improve cross-selling by suggesting additional products for the customer to purchase.
- **Loyalty:** Recommender Systems can improve loyalty by creating a relationship of trust between the Web site and the customer.

Classification of Recommender Systems

The process of recommendation varies depending on the application and the system in question. However, the general concepts underpinning rec-

ommender systems are the same. Recommender systems can be classified into four recommendation paradigms (Stabb et al., 2002), namely:

- **Content-based recommender systems**
- **Collaborative-filtering recommendation systems**
- **Knowledge-based recommendation systems**
- **Hybrid recommender systems**

Content-Based Recommender Systems. In content-based recommender systems, the users express their needs, desires and constraints. The recommender system makes a recommendation by matching the user profile with the product information, using information retrieval techniques. The system understands the user's desires and preferences based on the characteristics and ratings provided, and by looking at past user preferences.

However, this system has a number of limitations (Balabanovi, 1997; Shardanand, 1995):

- Firstly, the "new user problem" comes into play since the user has to rate a sufficient number of items before a content-based recommender system understands the user's preferences.
- Secondly, the number of features associated with an item influences this type of system. To extract sufficient features, the content must be in a text form, or features should be assigned to items manually. Such feature extraction is difficult for graphics, audio and video streams.
- A third disadvantage is that a content-based recommender system recommends items that match against the user profile, this provides little opportunity to the users to experience the item being recommended (Shardanand, 1995).

Collaborative-Filtering Recommender Systems. Collaborative-filtering recommender systems are the most widely used recommender system, where user feedback, reviews and rating given by other users are relied upon to recommend an item (Hill, Stead, Rosenstein, & Furnas, 1995). For example, suppose if a user is looking for a book on the Java language in an online book store, the system recommends books which have high ratings based on the feedback from readers who have read various Java books. These systems work well if there is a large volume of ratings for each item.

Reliance on these types of systems is problematic for the recommendation of new items or where the number of reviews is low. Also, it does not account for divergence in preferences between new and previous users. Pazzani (1999) suggests one way of overcoming this limitation via the use of a hybrid recommender system, that combine collaborative, content-based, and demographic filtering approaches.

Knowledge-Based Recommendation Systems. Knowledge-based recommender systems combine the knowledge about the user and the products and services on offer to make a recommendation. If a user visits an online book store, the system recommends other books in related topics. The system knows what the user is looking for, and based on this the system recommends additional products (Burke, 2000). These systems do not need extensive knowledge about an item to make a decision, but like the content-based recommender systems, they require knowledge about the user and his/her buying patterns, which can be acquired by a series of queries.

Hybrid Recommender Systems. Hybrid recommender systems combine two or more recommendation methodologies. These systems were developed in order to overcome the limitations of each of the individual systems. Most often, collaborative-filtering is combined with some other

methodology. Decisions are made by combining two or more techniques, including artificial neural networks (Pazzani & Billsus, 1997), information retrieval techniques (Hull, 1998), and Bayesian classifiers (Mooney, Bennett, & Roy, 1998).

In the modern Internet world, recommender systems have the ability to act as key tools that influence the success of a business. “Recommender systems are changing from novelties used by a few e-Commerce sites, to serious business tools that are re-shaping the world of e-Commerce” (Schafer et al., 1999), these systems are supporting many Web sites that help customers find the right product.

Current Travel Recommendation Systems

Since the mid 1990s, tourism Web sites have flourished, allowing users to plan and view their holiday locations online. As tourists began using online tourism information, TRSs were developed to recommend holiday locations and activities. The two most popular recommender systems for tourism and travel presently in use are TripMatcher™ (Delgado, 2001; Starkov, 2001) used by Ski-Europe, and Me-Print™ (VacationCoach, 2002) used by Travelocity.

TripleHop’s Trip Matcher™. Traditionally, when a person wanted to go on a holiday, they visited a travel agent and had a counselling session. After having analysed the requirements and specifications of the customer, the travel agent made recommendations as to what would be an ideal place for them to visit. TripleHop’s Trip Matcher™ tries to mimic the counselling scenario by allowing the users to search for advice on available destinations. The technical process behind the system is designed so that when the user specifies his/her requirements and constraints, the system matches the specified preferences with the services and items on the catalogue, or the database. This system is being used by Ski-Europe.com.

Ricci (2000) explains, “TripleHop’s matching engine uses a more sophisticated approach to reduce user input. It guesses importance of attributes that the user does not explicitly mention. It then combines statistics on past user queries with a prediction computed as a weighted average of importance assigned by similar users.”

The system then advises users about potential destinations they may book, based on their interest and browsing pattern. The software learns about user preferences by remembering navigation patterns each time he/she browses through the Web site, enabling it to provide useful recommendations. From an algorithm perspective, it uses contextual filtering and attribute-based collaborative filtering.

VacationCoach Me-Print™. Me-Print™ relies on three important components to give personalised travel advice, namely, intelligent profiling, expert knowledge base, and robust advice engineering. Me-Print™ uses profiling of users to categorize them. It exploits user profile such as their unique lifestyle and leisure preferences in relative terms. For example, if a user likes golf, the algorithm considers user’s preference for golf in comparison to other sports such as tennis, or swimming. These multiple preferences are used to provide advice based on priorities and interests.

Services Offered by Current TRS

A travel recommender system allows users to choose their holiday while sitting in front of a computer. A simple user interface provided by the recommender system offers an interactive and simple means of communicating with the system. These systems aim at making the interaction time brief, by reducing the time needed for visiting various Web sites to gather information. At times the system has to deal with issues relating to under, or, over specification of user requirements. The system suggests appropriate repair actions such as “constraint relaxation” if the user has over-specified the requirements, and “tightening,” if

details have been under specified. The framework for this system is based on case-based reasoning (Ricci, 2002).

The system has the ability to formulate queries and offer various examples to users if they are not experienced enough to come up with a proper query. Ricci (2002) states that an effective TRS should not only support active preference construction, but also should allow users to explore the different options available.

Benefits of Integrating TRS in Today's Business

A TRS system can be very helpful in tourism business, as it displays a list of products retrieved by a query to the system, and allows the user to make an informed selection. After the choice has been made, the initial query is saved along with the selected destination, this enables the system to identify and suggest a better set of products in the future. An information feedback technique such as Rocchio's method (the relevance feedback technique) is used to add new terms and constraints into the original query based on the selections made (Ricci, 2002). Research shows that an accurate recommendation, even if not taken up by the customer, can increase the user's trust in the system, which is necessary for future recommendation acceptance.

Some TRSs interact with the users in multiple stages and pose a sequence of questions, each question raised as a result of previous interaction. If these systems are designed to manage the human-machine interaction effectively they help to grow the business, as the users are not expected to be familiar with the system to begin with. This draws in more potential buyers who need help in making decisions.

Limitations of Current Travel Recommender System

Recommendations from a TRS aim to help the tourist in making informed decisions about their

travel plans. However, current TRSs deal only with the first stage of planning a trip, that is, destination selection. Present TRSs are unable to generate a complete travel itinerary which includes information such as accommodation and tourist attractions. Furthermore, a tourist is unable to visualise the planned holiday by using the current TRS technology. New information presentation models are required to increase user's confidence in the selected destination, such as providing the user a view of his/her trip, and allowing comparison between different options on a given trip.

Visual Travel Recommender Systems (V-TRS)

Visual travel recommender system (V-TRS) is a TRS that uses visual information, along with audio, to enhance the presentation of the recommendations made to the user. Two models aiming to develop the V-TRS are presented in the following.

Tourism Recommendation Using Image-Based Planning (TRIP)

Most of the TRSs available today don't provide a complete itinerary, but rather focus solely on the destination selection. This forces travellers to spend a lot of time browsing the Internet, looking for different attractions at their chosen destination. In addition to the suggestions provided by the recommender system, there can be a number of factors that effect the tourist's decision. Generally, tourists seek a second opinion from their acquaintances (relatives and friends). Often, many changes, and some backtracking is required before a travel itinerary is finalised. All of these factors make travel planning a complex undertaking.

As more people rely on the Internet to book their travel plans, it is important for travel Web sites to not only provide textual information, but also visual information. This will further help

travellers in their decision-making process. A recommender system with more visual presentation and reasoning enables tourists to get a feel of the destination. The tourism recommendation using image-based planning (TRIP) proposed by Kimber, Georgievski, and Sharda (2006) aims to achieve this.

TRIP Overview. Before booking a holiday package, the traveller would want to have an idea of what he/she is going to experience on the trip. “How am I going to organize my trip?” and “How can I get the maximum value for my time and money?” are the major questions that occur at that point in time. Most of the time, it is difficult to find the right details about the trip, and one has to go through the time-consuming process of visiting Web sites, gathering chunks of information and then sorting the details. The TRIP system aims to overcome this drawback by presenting the details visually. The presentation can be customised based on the user’s requirements. This will enable the user to have a clear idea as to what he/she is going to experience on the trip. The presentation provided by the visual travel recommender system will include details about the user’s selection such as hotels, the services offered by the hotels, the places that he/she is going to visit, and other major activities.

Tour planning is influenced by experiences, thus, the recommender system should provide the tourist with visual clues to assist them in decision making. Planning a complete tour involves various components and decisions, which can be categorised into travel, accommodation, interesting places to visit and hospitality considerations. Some hindrances to decision making can be the time required to gather and analyse information about the destination, balancing schedules with other activities, and ensuring that the travel experience is satisfying.

Keen and Rawlings (2004) have proposed a system which facilitates the decision making process by using a visual language. Their prototype demonstrates tourism products available in

Northern Tasmania, Australia. Users are provided information on a wide range of tourism products in the form of images and videos. As the user explores the information, the system keeps track of their browsing pattern, and a logic-based statistical profile is constructed. The profile building is a continuous process—the more the user uses the system, the better the profile becomes. This profile influences the system’s interaction with the user in the future and any information of interest to the user is stored in an electronic scrapbook (e-scrapbook).

The e-scrapbook is a personalised area in which the user can place information about items of interest. Typical information could be travel schedule, accommodation booking, and recreational activities. The user can place different products in the e-scrapbook, for example, cost of accommodation at various hotels. The user can easily delete items from the e-scrapbook, and also save items in it for future use. This gives flexibility to the user, and helps in gathering information over a period of time.

The system also allows past users to post their e-scrapbooks on a Web site, thereby allowing new searchers to import partial or entire e-scrapbooks from experienced users. This facility gives new users a demonstration of how to plan a trip, and gives valuable feedback. Once the user is happy with all the information in the e-scrapbook they can purchase the products. This method of travel recommendation using image-based planning helps user to narrow their choices until they are satisfied, and, at the same time, provide a graphical overview.

Tour Recommendation Using Image-Based Planning with SCORM (TRIPS)

In the present Internet environment, tourists have to visit a number of Web sites in an attempt to visualise their tour. The proposed tour recommendation using image-based planning with

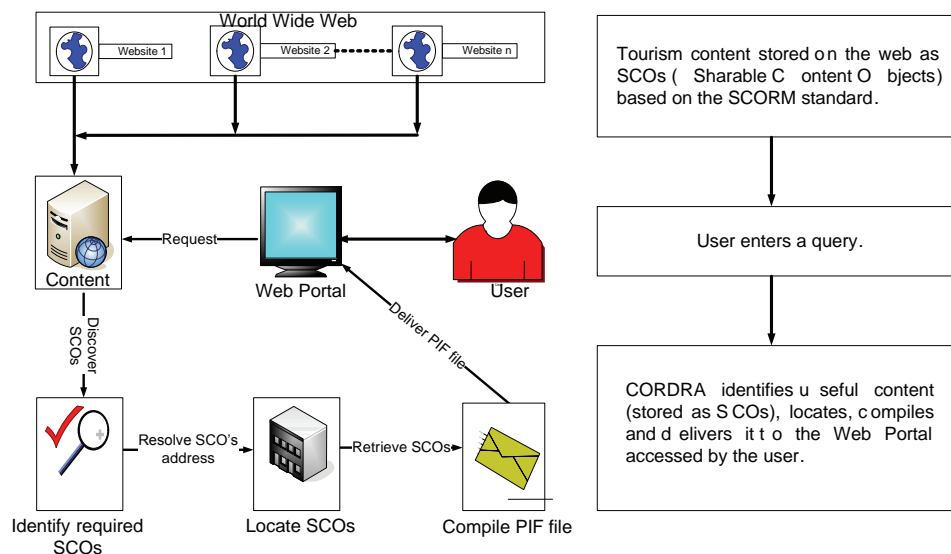
SCORM (TRIPS) system, will allow tourists to visualise their entire vacation by collating content from various Web sites. TRIPS uses the sharable content object reference model (SCORM) to store tourism information on various Web servers. If tourism Web sites post their information based on the SCORM standard, the proposed system could assemble relevant multimedia content from different sites and present it to the user to create a virtual experience. The SCORM standard has originally been developed as a reference model for Web-based e-learning technology. It is possible for us to adapt this standard for creating a visual experience generator for tourists.

The SCORM standard was proposed by The Department of Defence (DoD) and Advanced Distributed Learning (ADL) laboratories in 1997 to standardise the format of e-learning contents on the Web. The SCORM model aims to improve performance and reduce costs of e-learning systems. It was created by collating various e-learning specifications used by the Institute of Electrical and Electronics Engineers (IEEE). The main objectives of SCORM standards are to define

reusable learning objects and to develop content and assessment models. SCORM, as an e-learning standard, enables portability of learning contents, thereby allowing content to be used across different courses. In addition to SCORM, an extension is being developed to enable content registration and resolution of all relevant information throughout the Internet, this is called the content object repository discovery and registration/resolution architecture (CORDRA).

CORDRA. The CORDRA model also is an undertaking of the Department of Defense (DoD) and Advanced Distributed Learning (ADL), and aims to extend the current SCORM standard. This model is being developed so that one can locate and reference SCORM repositories throughout the Internet. Figure 1 presents a conceptual model of how CORDRA will achieve this. CORDRA searches the World Wide Web, much the same way current search engines do. Once the required resources are discovered, their location is resolved; making the resources accessible to SCORM based systems as the sharable content objects (SCOs). Even though SCORM and CORDRA standards

Figure 1. Finding and delivering content as SCOs



have been developed for e-learning systems, these can be used to create visual TRSs. If the tourism Web sites store information using SCORM, then based on a user query, the CORDRA system can collate all related information from the Web. However, the collated information needs to be combined into presentations that the user can view in a controlled manner.

Visual Tour Planning Using TRIPS. The TRIPS system uses sharable content objects (SCOs); these are Web information objects such as pictures, videos, and descriptions of places. Once a traveller's destination is finalised, further options need to be explored. For example, if a traveller is travelling to Melbourne (Australia) in January, options could include watching the Australian Open (tennis), visiting beaches, cruising over the Yarra River, or visiting historic sites. Depending on the number of days available, the tourist can visit all the places mentioned, or visit a selection of places based on priorities. The TRIPS

system contains information about the tourist's destination and their interests, and gathers SCOs related to the tourist's interests. Once the tourist finalises his/her selection, TRIPS can create an activity tree of the itinerary, and deliver the useful content (SCOs) as a package interchange file (PIF). The PIF contains an XML file (imsmanifest.xml) with all control files and resources referenced in the contents pages. The PIF, therefore contains information about the activities available to the tourist, structured in a hierarchy.

Conversion to Flash Movie. Next, the TRIPS system needs to provide options for delivering content in a user-defined sequence. This enables the user to control the sequence of on-screen displays. The Melbourne tourist may want to consider visiting the Australian Open on the first day and then take a half-day wine tour of the Yarra valley, and relax on a beach in the afternoon, followed by a dinner cruise on the Yarra River. SCOs with information relating to these activi-

Figure 2. Conversion of PIF file to Flash movie file using ActiveSWF software

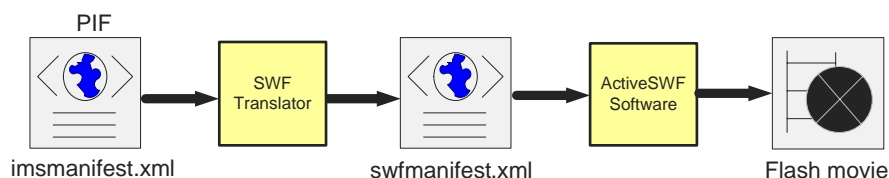
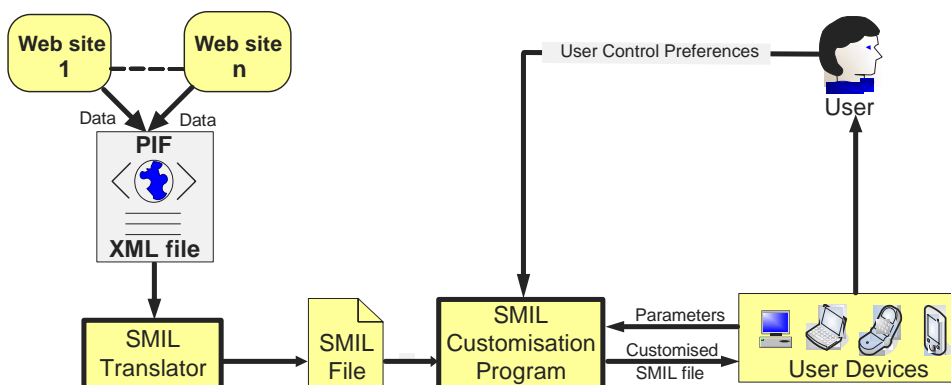


Figure 3. Conversion of PIF file to SMIL file using a translator



ties will be collated in the PIF file. The aim is to present to the tourist a short presentation of the travel itinerary being considered. One way to do this is to convert the imsmanifest.xml file to a format compatible with ActiveSWF (Activeswf, 2005) tool which can convert an XML file to a Flash movie. The duration of the movie can be selected by the user bearing in mind the number of options to be viewed. Figure 2 shows the conversion of imsmanifest.xml file to swfmanifest.xml (ActiveSWF readable xml file), and then to a Flash movie.

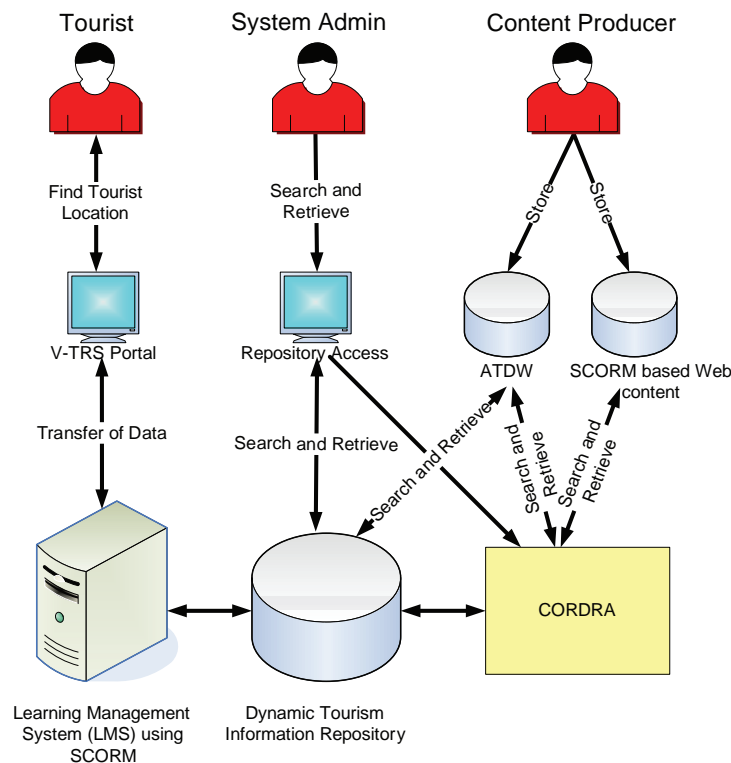
Conversion to SMIL Movie. The conversion of PIF file into a presentation also can be achieved by using the SMIL standard, as shown in Figure 3. The synchronized multimedia integration language (SMIL) is a W3C recommendation that makes use of XML for creating descriptive multimedia presentations. It defines different mark-ups such as timing mark-up, layout mark-up, anima-

tions, and visual transitions. The translated SMIL file can be sent to any user device, such as a Web browser on a computer, or on a portable device. The program checks for parameters such as screen resolution, bandwidth, and customises the SMIL presentation to match the system parameters. This process can optimise the presentation suitable for display on the specific user device.

As shown in Figure 3, SCOs from various Web sites are collected and stored into the PIF file, this file is sent to a translator which translates the file into a SMIL file, and the SMIL file is then sent to a customisation program which checks the parameters on the user device. The SMIL file is modified according to these parameters and then sent to the user device for viewing.

TRIPS Architecture. Based on the characteristics of SCORM, a new model has been developed for creating the TRIPS system. This new model allows tourism information to be converted into

Figure 4. Tour recommendation using image-based planning with SCORM (TRIPS) model



reusable content packages. These packages will be searchable and accessible through the local SCORM repositories, as well as through the CORDRA enhancement. The advantage of this is that all information stored using the SCORM standard will be more interoperable, accessible, reusable, maintainable and adaptable. The overall architecture of the TRIPS system is shown in Figure 4.

The process of converting `imsmanifest.xml` to a presentation file (`swfmanifest.xml` or `.smil`) takes place on the server-side. On the client-side, a graphical user-interface is used to browse potential destinations and their components.

The TRIPS architecture can be broken down into five main components: visual-TRS Web portal, learning management system (LMS) using SCORM, dynamic tourism information repository, repository access, and CORDRA. This system has three types of users: tourist, system administrator, and content producers.

V-TRS Web Portal. The tourist interacts with the system via the V-TRS portal. This portal works with a SCORM-based learning management system (LMS).

Learning Management System (LMS). As SCORM is a standard designed for e-Learning, the system designed to use it are called learning management system (LMS). The TRIPS system can use any of the standard LMSs available, and adapt it to work as a V-TRS.

Dynamic Tourism Information Repository. Dynamic tourism information repository is a central storage system. This repository can be set up as a single server or a network of shared resources. The primary function of this repository is to store all the sharable content objects (SCOs) that will be used for tour visualisation.

Repository Access. Repository access is a console or a portal used by the system administrator to access the information within the repository. Unlike the tourist, who gains admittance through the LMS, the system administrator accesses the

SCOs in their raw format and can even modify these, if required.

Role of CORDRA. CORDRA, though currently under development, already shows great promise when considering the possibility of incorporating it into the TRIPS model. CORDRA will pave the way for a far superior search facility due to its access to the World Wide Web, which is an ever expanding resource of tourism information. Currently, the Australian Tourism Data Warehouse (ATDW) stores tourism product and destination information that relates to Australian tourism (ATDW, 2005). In order to implement the functionality promised by CORDRA, the ATDW's expanding database could be included. The data from various databases, when combined with information on the Web, creates a huge data source that can be accessed by TRIPS. This provides TRIPS the opportunity to become a universally accessible V-TRS.

FUTURE TRENDS

How Visual TRS Can Enhance the Current TRS

Even though the current travel recommender systems make quality recommendations to the user, these recommendations are not presented in a way that lets the user visualise the entire trip. Future recommender systems will make use of audio-visual media to provide an in-depth view of the user's trip, where, the human-computer interaction is made more interesting by using audio and video in innovative ways. Dynamic text will be displayed along with the images to provide a description of each destination. Narration of this text in different languages also will be possible. TRIPS can be used in a distributed environment using CORDRA. If all tourism related Web sites are SCORM and CORDRA compliant, then information from any Web site can be retrieved

and used to recommend a complete holiday plan, including travel, accommodation, and other activities. Tourists will then have an easy and effective way of planning their personal or business travel. This also will improve the credibility of the World Wide Web as an effective vehicle for travel planning.

Case Study

Current recommender systems are not very interactive in terms of presenting the details of the tour. Even though the recommendations that they make are of a good quality, their presentation is more textual and rather unappealing. The system output does not give a feel of what the user is going to experience on the trip. In other words, the current recommender systems give a simplistic description of the different available destinations and offers.

For the purpose of this case study, we have developed a Web site that emulates how current TRSs work and make suggestions based upon user's choices and other criterion. We discuss

this system and present screen shots of its user interface.

Figure 5 shows the input screen for the recommender system. First, one must answer some questions, such as the region, budget, desired length of vacation, type of vacation and other such preferences.

The user input is analysed and the system makes recommendations with brief details of different packages which match the user's preferences. In this case, if the user wants to know what is included in each package, he/she needs to visit different Web links. Figure 6 shows a screen capture of how recommendations are often displayed.

To some extent, recommendations made by such systems are useful; however, they fail to hold the user's attention. Our aim is to present these recommendations in a more appealing and attractive manner. We want to make the process of making recommendations more fun and interactive, by changing the way information is presented to the user. Rather than displaying the recommendations in the form of text, we are in-

Figure 5. Input screen of the travel recommender system

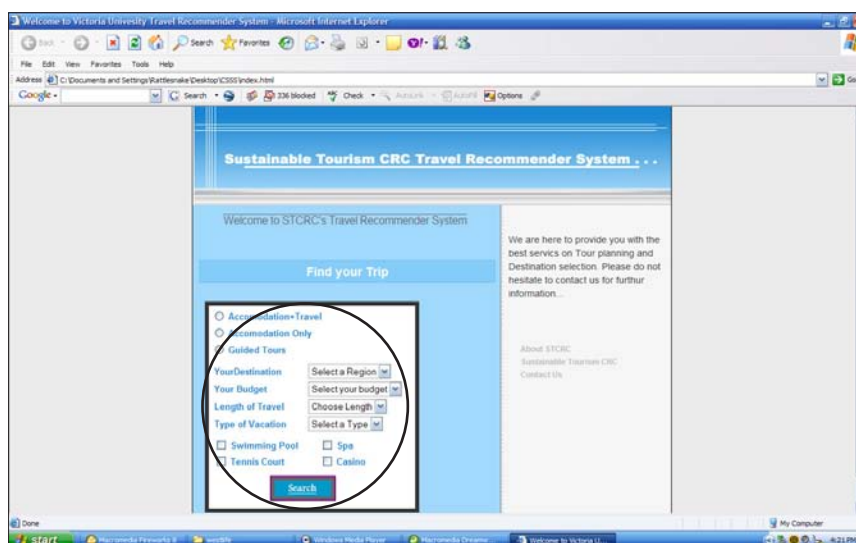
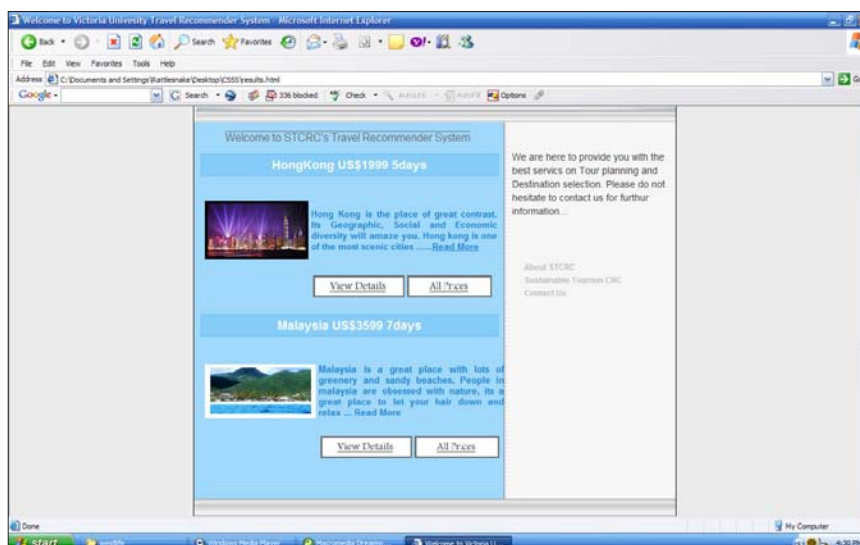


Figure 6. Screen showing the recommendations made by the system



roducing audio, video and text narration, thereby taking the concept of travel recommender systems to the next level.

CONCLUSION

The technology of recommender systems is improving constantly as more people use the Internet for making purchases. Vendors all over the world are encouraged to add recommender capabilities to their Web sites to attract more online business. This chapter discussed how the limitations of current travel recommender systems (TRS) can be eliminated by using visual travel recommender systems (V-TRS). Recommender systems are classified as content-based, collaborative, knowledge-based and hybrid. The most widely used travel recommender systems today are the TripMatcher™ and MePrint™. Current TRSs only deal with the first stage of tour planning, that is, destination selection, and are unable to provide a visual presentation of the entire tour. The proposed V-TRS aims to save time, while making the systems more interactive, and providing a visual

presentation to give the tourist a feel of the entire trip. In this chapter we have proposed a sharable content object reference model (SCORM) based architecture to visualise the tour, and suggested ways to use the content object repository discovery and registration/resolution architecture (CORDRA) enhancement.

Two different ways can be used to generate a video presentation from the data in XML format:

- Convert the XML file into a Flash movie
- Convert it into a synchronized multimedia integration language (SMIL) file

Further research in this area should investigate the user interface and control functions of the V-TRSs to make the task of tour planning, fun, easy, and more interactive.

REFERENCES

Activeswf. (2005). *Software ActiveSWF Prof 1.9.3*. Retrieved December, 2005 from <http://www.activeswf.com>

- ATDW. (2005). *Australian Tourism Data Warehouse*. Retrieved December, 2005 from <http://www.atdw.com.au>
- Balabanovi, M., & Shoham, Y. (1997). Fab: Content-based, collaborative recommendation. *ACM Communication*, 40(3), 66-72.
- Berka, T., & Plößnig, M. (2004). Designing recommender systems for tourism. In *Enter 2004*, Kairo.
- Burke, R. (2000). Knowledge-based recommender systems. *Encyclopedia of Library and Information Systems*, 69(32).
- Delgado, J. (2001). *Who's who in recommender systems*. Paper presented at the ACM SIGIR Workshop on Recommender Systems, New Orleans.
- Hill, W., Stead, L., Rosenstein, M., & Furnas, G. (1995). *Recommending and evaluating choices in a virtual community of use*. Paper presented at the CHI-95 Conference, Denver, CO.
- Hull, A. D. (1998). *The TREC-7 filtering track: description and analysis*. Paper presented at the Proceedings of TREC-7, 7th Retrieval Conference, Gaithersburg, US.
- Kimber, J., Georgievski, M., & Sharda, N. (2006, January 18-20). *Developing a visualisation tool for tour planning*. Paper presented at the IFITT Global Travel & Tourism Technology and eBusiness Conference, Lausanne, Switzerland.
- Mooney, R., Bennett, P., & Roy, L. (1998). *Book recommending using text categorization with extracted information*. Paper presented at the AAAI Workshop on Recommender Systems, Madison.
- Pazzani, J. M. (1999). A framework for collaborative, content-based and demographic filtering. *Artificial Intelligence Review*, 13, 393-408.
- Pazzani, J. M., & Billsus, D. (1997). Learning and revising user profiles: The identification of interesting Web sites. *Machine learning*, 27(3), 313-331.
- Ricci, F. (2002). Travel recommender systems. *IEEE Intelligent Systems*, 55-57.
- Schafer, J. B., Konstan, J. A., & Riedl, J. (1999). *Recommender systems in electronic commerce*. Paper presented at the ACM Conference on Electronic Commerce.
- Shardanand, U., & Maes, P. (1995). *Social information filtering: Algorithms for automating "word of mouth"*. Paper presented at the Proceedings of ACM conference on Human Factors in Computing Systems.
- Stabb, S., Werther, H., Ricci, F., Zipf, A., Gretzel, U., Fesenmaier, D. R., et al. (2002). Intelligent systems for tourism. *Intelligent Systems, IEEE [see also IEEE Intelligent Systems and Their Applications]*, 17(6), 53-66.
- Starkov, M. (2001). *How to turn lookers into bookers—Recommendation engines in travel and hospitality*, Retrieved May 10, 2006, from http://www.hotel-online.com/News/PR2001_3rd/Aug01_EnginesinTravel.html
- VacationCoach. (2002). *Using knowledge personalization to sell complex products*. Retrieved January 20, 2006, from <http://crm.ittoolbox.com/pub/LK032002.pdf>

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper, pp. 162-179, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.30

Design and Implementation Approaches for Location-Based, Tourism-Related Services

George Kakalettris

University of Athens, Greece

Dimitris Varoutas

University of Athens, Greece

Dimitris Katsianis

University of Athens, Greece

Thomas Sphicopoulos

University of Athens, Greece

ABSTRACT

The globally observed recession of mobile services market has pushed mobile network operators into looking for opportunities to provide value added services on top of their high cost infrastructures. Recent advances in mobile positioning technologies enable services that make use of the mobile user location information, offering intuitive, attractive applications to the potential customer. Mobile tourism services are among the primary options to be considered by service providers for this new market. This chapter presents the key concepts, capabilities, and considerations of

infrastructures and applications targeted to the mobile tourist, covering data and content delivery, positioning, systems' interactions, platforms, protocols, security, and privacy as well as business modelling aspects.

INTRODUCTION

During the last decade of the 20th century, wireless data networks have invaded everyday life and have gradually started taking over areas traditionally considered as being only suited to wired applications. Due to their versatility, wire-

less telecommunications systems have become a widespread standard, leading to hardware price drops and radical quality increases. Today there exist a bunch of technologies that allow the delivery of information to mobile or wireless devices and their users, all presenting different characteristics in performance/ quality, autonomy and cost. These technological advances accompanied by the reach of the saturation level (Ellinger, Barras, & Jackel, 2002; Gruber, 2005; Gruber & Verboven, 2001) in the mobile telephony market pushed hardware vendors and network and service providers into looking for new business opportunities. The needs of tourism-related information provision and services were amongst the first to be considered for new applications in the field of communication devices.

In traditional fixed systems, the location of a terminal and its user was a part of its identity and remained constant for a long period during its lifetime. In this new mobility era, this observation no longer holds: the physical position of the user might be highly variable, introducing a whole new range of issues and opportunities to be taken into account. The use of intelligent systems that exploit the positional information of the client, accompanied by the ability to provide feedback over a wireless medium, can lead to the provision of innovative highly intuitive services that were not available in the near past (Grajski & Kirk, 2003; Kakaletris, Varoutas, Katsianis, Sphicopoulos, & Kouvas, 2004; Rao & Minakakis, 2003; Staab & Werthner, 2002; Yilin, 2000).

But, although mobile telephony networks offer maximum mobility, they are not the only means for providing location-based services (LBS) for tourism. Local fixed wireless networks in their various forms are another of the modern and popular technologies facilitating relevant services. In addition to telecommunication systems and from a technological perspective, there are a wide range of other systems such as global positioning system (GPS) (Dana, 1994; ETSI, 2006; GARMIN, n.d.), or ID tags (Bohn & Mattern, 2004;

Tarumi, Morishita, & Kambayashi, 2000) which might have a significant role in the development and deployment of e-tourism applications based on location information.

This chapter presents the technological concepts associated with the provision of location-aware tourism-related services under a service-oriented approach capable of supporting open value chains and to lead financially viable open and powerful communication systems. The rest of the chapter is organised as follows: The “Background” section presents the technological and business background of location-based services; the “Technology Overview” section gets into details of the technological aspects and issues raised in the domains of positioning and data/content delivery, which are fundamental elements of the examined class of services; the section on “Mobile Tourism Services” captures the specific needs and opportunities in the specific application area and presents issues and considerations with respect to integrating the various parts into an open system capable of delivering such services. In the “Conclusion,” technology and market conclusions and trends are presented. Finally, due to the large number of acronyms and the frequency of their appearance, a table of acronyms is provided at the end of the chapter in order to ease reading through it (see Appendix).

BACKGROUND

The application of the above-mentioned technologies and concepts in tourism gave birth to the ubiquitous tourism¹ concept (OTC, 2003), which refers to the existence and access of tourism related services at any place, any time. Although tourism-related services are mostly related to content provision, more applications can be identified. In its entirety, content provision for e-tourism covers a large number of thematic areas: culture, urgencies, transportation, events, and so on. Thus, content might be both temporally and spatially

labelled (LoVEUS, 2002; M-Guide, 2002). In addition, information seeking and avalanche-like content provision might guide the user to areas quite outside her/his initial focus areas.

The information technology (IT), the Internet and the mobile telecommunications revolutions of the last decades of the 20th century made it possible for enterprises to enable massive access to their applications and data. Users are able to access applications and information through a variety of integrated “channels” including the Internet, mobile telephony, and voice interfaces and thus bring forward the concept of multi-channel architectures. Consequently, multi-channel content delivery and media-independent publishing have emerged in order to address the demand for personalised content that can adapt to the end-user device capabilities. Devices, such as PDAs, cellular phones, smartphones, and television set-top boxes, introduced the need for additional channels for publishing content. The approach of maintaining independent content sets per channel proved to be highly inefficient in terms of maintenance, until the wide adoption of eXtensible Markup Language (XML) and related technologies, such as eXtensible Stylesheet Language / XSL Transformation (XSL/XSLT), offered a standard solution to this challenge.

Technology is not the sole reason behind the emergence of the ubiquitous tourism concept. The existing 2/2.5G² mobile market has reached saturation as analysts have predicted, but its effects have only been acknowledged lately, due to the high expectations of the emerging 3G³ markets. The costs of licensing (Andersson, Hulten, & Valiente, 2005; Katsianis, Welling, Ylonen, Varoutas, Sphicopoulos, Elnegaard, et al., 2001; Yan 2004) and deployment of 3G networks led mobile network operators⁴ (MNOs) into a global recession era and a global pessimism for their adoption which actually reflects user attitudes towards the new standard. In order to confront that, business opportunities based on existing mobile and wireless networks have been further

investigated (Katsianis et al., 2001; Varoutas, Katsianis, Sphicopoulos, Loizillon, Kalhagen, & Stordahl, et al., 2003). The provision of value added services over 2.5/3G networks not only allows providers and users to make the most out of the existing infrastructures, but also encourages usage and drives expectations for the next generation of mobile networks (Varoutas, Katsianis, Sphicopoulos, Stordahl, & Welling, 2006). To provide such services, the integration of various components and base-services is required, which breaks the current status of most MNOs that have traditionally been formed as almost monolithic self-contained service(s) providers.

This need for integration of various market stakeholders in complex business models aiming for the provision of high quality services has been indicated not only by mobile market analysts but also by information systems architects. The service-oriented approach (Brown, Johnston, & Kelly 2003; Colan, 2004), a whole new IT perspective which is rushing into the industry, underlies the concepts and offers the guidelines that render possible such complex collaboration schemes. In the LBS domain, mobile positioning protocol and mobile location protocol (Ericsson; OMA, 2002) already exercise concepts in-line with current service-oriented architectures (SOA) common practices. Nevertheless, the design of services, such as location-based ones, will always have to face domain specific challenges concerning technical, economical or even ethical and social factors of the service application (Daoud & Mohan 2002).

Nowadays it is possible and desirable to build open systems that can support the delivery of tourism-related location-dependent content to an end-user on top of the technological and business background already described, allowing:

- Seamless interoperability of systems and content provided by several market stakeholders towards providing a large range of high-quality location-based content delivery

services, through standards and loosely coupled elements

- Exploitation of state-of-the-art and future technology in positioning, mobile devices, and network infrastructures
- Compliance with requirements and standards for personalisation and quality of service (QoS)
- Low-cost implementation and upgrade road-map from 2/2.5G to 3G and other current and future mobile and wireless networks
- Guarantees of privacy

As already mentioned, provision of tourism-related content can be shown that covers a large portion of the information that is usually delivered through location-based services. A number of studies already exist that focus on various aspects of technologies, architectures and business models of this area (Devine & Holmquist, 2001; EMILY, 2002; M-Guide, 2002). This chapter presents the design aspects of such services in a generic way, capturing the needs of many location-dependent services since it assumes a highly heterogeneous network infrastructure leveraged by the Internet protocol (IP) layer. In this way, dealing with the details of mobile or other wireless network infrastructures is avoided yet interoperability and integration issues are been identified and investigated.

TECHNOLOGY OVERVIEW

In the following sections the technologies involved in the provision of mobile tourism services are introduced. Connectivity, which essentially allows delivering data to a device, and positioning, which is the ability to locate a device and consequently its user in space, are the fundamental enabling technologies for the provision of location-based services. Assuming these, tourism related information could be delivered to devices capable of presenting it (e.g., mobile phones), with a multitude

of options (quality, depth, size, etc.), derived from exactly the same content that would drive traditional applications (Web sites, printed elements, etc.). The driving force behind these is modern software platforms and system architectures that facilitate the creation of the various nodes of a complex structure of collaborating service elements.

Wireless and Mobile Data Services

Since the last decade of the 20th century and the beginning of the 21st, the mobile user has come to enjoy the provision of many technologies and services that were hard to even imagine several years before (Lin & Chlamtac, 2001). Besides voice, some of the most common ones are:

- **Information services** (News, Directories, Weather, Athletics, Financial, etc.)
- **Entertainment** (Chat & Flirt Services, Guess who, Alerts, Horoscope, ringtones, etc.)
- **Communication tools** (SMS, MMS, e-mail, instant messaging, etc.)

Apart from these common services, a series of other, more complex ones are being offered to the user like navigation, local news, SMS vote, microbilling, and so forth. Enabling these services is achieved through various means the most important of which being the Web, SMS, and MMS. These higher-level information exchange media are based on lower level communication channels offered by an infrastructure provider. The most important ones are briefly described below:

- **Global system for mobile telecommunications (GSM)** refers to 2nd generation mobile telephony networks (Mouly & Pautet, 1995), which although digital, was designed with voice communications in mind, thus giving data rates of 9.6kbis/s, which is rather slow for multimedia applications. Additionally

data transfer is not packet switched thus not optimised for computer type communications requiring circuits to be allocated even if no data are exchanged. Since its initial appearance, several enhancements were proposed as side-by-side technologies that enable higher performance data transfers (Korhonen, Aalto, Gurtov, & Lamanen, 2001).

- **General packet radio services (GPRS)** is a wireless communication protocol based on the same modulation as GSM, designed to be provided as a complementary medium to facilitate data transfers over GSM networks. It is packet-based and delivers data rates of approximately 40kbps⁵ (Korhonen et al., 2001; Pahlavan & Krishnamurthy, 2002; Patil, 2003; Tisal 2001). It supports continuous connection to the Internet for mobile equipment users. Since GPRS radio resources are utilised only when devices have data to exchange, its end-user cost is lower in both terms of money and power consumption. Packet switching allows more users to be simultaneously connected to the Internet, yet performance drops on high load and no strict guarantees can be given.
- **Enhanced data rates for global evolution (EDGE)** facilitates high-speed mobile data transfer over which can reach a peak rate of 384kbps and is aimed to mobile network operators that might not be able to obtain UMTS (further information is provided below) spectrum but would not like to be left out the modern high speed data services (Halonen, Romero, & Melero, 2003; Rysavi 2005). Even higher speeds may be available in good radio conditions. EDGE provides the same benefits of GPRS (e.g., packet switching, always connected) however by using a different modulation schematic achieves much higher speeds.
- **High speed circuit switched data (HSCSD)** overcomes the limitation of GSM circuit switched data, which supports the allocation of one user per channel per time slot and allows multiple channels to be virtually merged thus offering higher data rates (Halonen et al., 2003; Korhonen et al., 2001). However the allocation of multiple channels raises the connection cost of the end-user, rendering the service rather inappropriate when compared to other modern techniques.
- **Universal mobile telecommunications system (UMTS)** utilises WCDMA (wide-band CDMA) over a 5MHz bandwidth thus allows speeds the increase of mobile network speed in order to allow high-speed transfers. UMTS is one of the five types of 3G radio interfaces specified in the ITU⁶'s IMT-2000 recommendation. It allows various classes of service, ranging from more than 100kbps for a fast moving user up to a 2Mbps for a fixed client "lab" speed (3GPP, 2002; Lin & Chlamtac, 2001; UMTS, n.d.).
- **High-speed downlink packet access (HSDPA)** is deployed as an upgrade to UMTS networks and captures the observation that most end-user high-bandwidth demanding applications require one-way high-speed communications, downstream (i.e., towards the end-user). On-demand video, TV and data downloading are some applications that expose such a transfer pattern thus can benefit quite significantly from the speed offered by HSDPA which is up to 3.5 times faster compared to the maximum rate of 14Mbps of today's 3G UMTS (Holma & Toskala, 2004; Kaaranen, 2005; Rysavy, 2005).
- **Wireless fidelity (WiFi)** is a term that in general refers to the 802.11 family of wireless network protocols (Muller, 2003; Smith, 2003). A variety of protocols (e.g., 802.11b, 802.11g) that operate in 2.4GHz and 5GHz bands, being the most popular ones, belong to this family, offering nominal speeds of up to

108Mbps (802.11.Super-g). WiFi networks are fixed, local-area, wireless networks thus do not offer the mobility capabilities provided by mobile networks. Additionally, although they can operate without an infrastructure (e.g., on a computer-to-computer way), yet another (usually fixed) connection to the Internet is required in order to obtain worldwide access.

- **Bluetooth (IEEE 802.15)** is a short-range, relatively low performance communications protocol. It is designed so that it allows low power consumption and it is very simple to implement so that it can be easily adopted by “dummy” devices such as headphones, computer mice, keyboards, and so forth. (Bluetooth.org, 2001; Miller & Bisdikian, 2002; Morrow, 2002; Muller, 2001; Xiao & Pan, 2005).

Location-Based Services

Location-based services are an entire class of mobile services that utilise positional (mostly geospatial) information of the mobile user in order to provide intuitive, easy access to content and tools. The term covers a quite large group of services since it can range from global scale services to highly spatially constrained ones (within a room or a building, such as a museum or a conference center).

One of the main aspects of location-based services is positioning, that is, the estimation of the user position, a topic to be covered in detailed sub-subsequent sections. Depending on the service class, the mobile equipment and the infrastructure, different approaches and accuracy levels can be applied (Dao, Rizos, & Wang, 2002; Northstream, 2001). In this chapter, the focus is on global scale services, but the elements and concepts presented are not restricted to this particular class of services (Kakaletris et al., 2004). Most location-based services can be categorised into four main business applications:

- **Tracking services (with two sub categories):** emergency services and fleet management services. In the case of emergency services (such as the E-911), the network has the ability to locate persons who are in danger or missing (with special interests for kids) and give them the necessary protection (Reed, Krizman, Woerner, & Rappaport, 1998). Emergency services are first priority for USA (FCC, 2001) and US companies focus on these class services. Road assistance and tracking of stolen equipment (cars, boats, etc.) are other similar services (Fritsch & Scherner, 2005). Fleet management services cover scenarios such as radio-taxi coordination, transportations, delivery, and so on, and in the general case, require high accuracy (Feng, Zhu, Mukai, & Watanabe, 2005; Iwasaki, Kawaguchi, & Inagaki, 2005).
- **Information services:** In this category of services content relative to the location of the user is provided to him/her. However in global scale services the focus is not on the accuracy of user’s position acquisition but rather on the content and the way it is presented (Taylor & Ryan, 1995). Local news, cultural information, events highlighting, or even advertising are some of the applications of this category. Such services may be provided near sightseeing or within museums (Zimmermann, Lorenz, & Specht, 2003). In high granularity services (e.g., within museums) positioning has to be accurate and in many cases highly sophisticated since it might even need 3-dimensional location of the user and directional clues (Pateli, Giaglis, & Spinellis, 2005).
- **Fun and entertainment:** Player position-aware games are a new opportunity for service providers and the first flavors are already out. Despite the criticism, chat and flirt is another very popular type of service. In this area, location-aware systems will have

Table 1. Typical wireless and mobile data networks

| Technology | Typical Performance ⁷ | End-user relative cost | Scope | Compatibility |
|------------|----------------------------------|------------------------|---------------|------------------------|
| GSM | 9.6Kbps | High | Global | Very high |
| GPRS | 40Kbps | Medium | Global | High |
| HSCSD | 64Kbps | Very High | Global | Low |
| EDGE | 115Kbps | Medium | Global | Low |
| UMTS | 220Kbps | Medium | Global | Medium (in deployment) |
| HSDPA | 750kbps | Medium | Global | Low |
| WiFi | 11Mbps ⁸ | Low | Local/indoors | High |
| Bluetooth | 500Kbps | Low | Indoors | High |

the opportunity to refine partner matches within a certain distance (Gratsias, Frentzos, Delis, & Theodoridis, 2005; Karagiozidis, Markoulidakis, Velentzas, & Kauranne, 2003; Lee, Prabhu, & Park, 2002).

- **Billing:** Billing also can adopt location-aware schemes. Creating attractive options such as allowing users to exercise cheaper communications when in certain hot spots (such as home, etc.) is a possible scenario of location-based billing (Gratsias et al., 2005; Koutsopoulou, Panagiotakis, & Alonistioti, 2005).

Positioning

Location-based tourist information requires positioning of the mobile user with a variable accuracy (Kakaletris et al., 2004; Yilin, 2000). Yet this does not imply that automated acquisition of positional information is always required or desired in order to consume such a service, as when checking available information by forehand, not being physically present in some area. It is obvious that locating the user requires that one is equipped with a module that has some kind of connection to a fixed infrastructure. However the elements of this composition might vary:

- **Equipment** can be a PDA, a 2G or 3G mobile phone, a personal computer, an ID tag, an IR Scanner, a GPS receiver, and so on.
- **Connection to the infrastructure** can be unidirectional or bidirectional utilizing systems such as WiFi, GSM, GPRS, UMTS, satellite antenna/receiver, IR receiver/transmitter, and so on.
- **Infrastructure** can be mobile or fixed network such as a satellite system, a mobile telephony/data network (GSM, GPRS, UMTS, etc.), a set of WiFi or Bluetooth access points, installed RF tags, fixed IR scanners, and so on.

Positioning can be categorised under two main classes:

- **Active:** The client is the only one responsible for the computational load of the position estimation.
- **Passive:** The client (user/mobile equipment) is being located without adding any logic to positioning by itself. Infrastructure obtains simple to extract information from client and calculates the position.

Hybrid methods also are very popular, allowing for high accuracy and availability systems. Exploitation of the positional information also can vary quite significantly:

- In **self-contained systems**, such as GPS enabled PDAs, the content might be already present on the mobile equipment and a local piece of software acts on them, thus no further connection to the outside world is required. The range of location-based services to be supported in this case is limited, navigation being the most popular one.
- In **always-connected systems** a medium for exchanging information with the infrastructure and usually the world (the Internet) is required. This can be done in order to acquire the position, or exchange information that will allow position estimation, or access the core service/content.

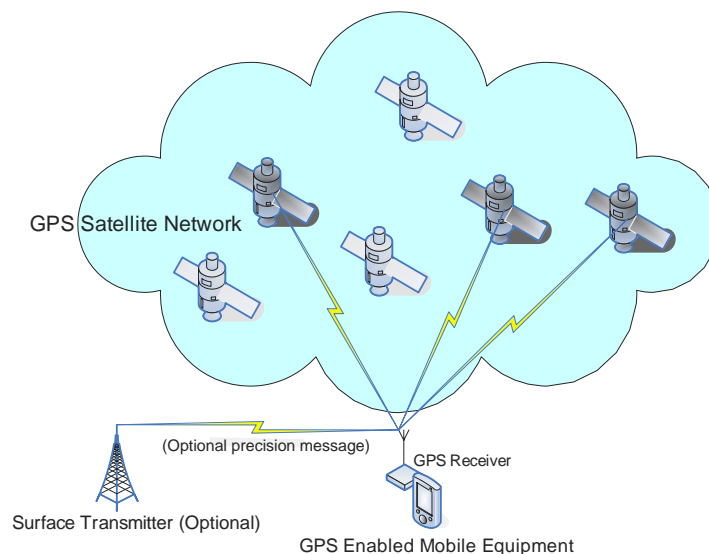
The rest of this section presents the details of some of the most important positioning methods, their requirements, and their characteristics. There are a number of ways for obtaining user's position

and the following sections describe some of the current applied automated methods:

The GPS

GPS positioning (ETSI, 2006; GARMIN, n.d.) is based on a network of 24 earth orbiting satellites. It was originally designed and implemented to cover the needs of the US military forces, however since the 1980's it has been used for wide spectrum of applications ranging from civil engineering to recreational systems. Communication is one-way; consequently clients only receive signals, thus guaranteeing privacy. A GPS client/device receives signals from several satellites with at least three satellites needed for 2-dimensional coordinate estimation (latitude, longitude) while four are required for three-dimensional positioning (latitude, longitude, and altitude). Signals are time-tagged, enabling the client to calculate distance from each satellite using the send/receive time difference. Accurate position estimation requires combining the aforementioned distances for multiple satellites. Bookkeeping of coordinates is a way to calculate the speed and direction of

Figure 1. GPS operation



moving GPS devices, a facility provided by almost all modern receivers. In such systems end-user devices are quite small and due to low power consumption tend to be highly autonomous.

Civilian GPS satellite signal is low power (i.e., less than 50 watts in 1575.42 MHz). It penetrates glass and plastic, but cannot go through metal, ground or concrete, effectively preventing indoors GPS usage. Dense urban use also can be problematic in some cases. Additionally, the GPS signal is vulnerable to signal travel time errors that lead to false distance estimation. Reflection of signal on solid objects as well as other orbital/stratospheric phenomena can result to wrong time estimations. Utilizing more satellites is a way to deal with such problems.

One of the strongest points of GPS however is accuracy, which can range from 1 to 15 meters for civilian systems. This fact, accompanied by the simplicity of the relevant devices and the availability of the service which can be utilised at no cost (apart from equipment) makes it capable of driving major successful commercial applications, such as navigation for tourists. As already mentioned, GPS is controlled by the U.S. Department of Defence, nevertheless it is expected that the European Galileo system will be competing with it by 2008 (Di Fazio, Mocci, Rossini, D'Angelo,

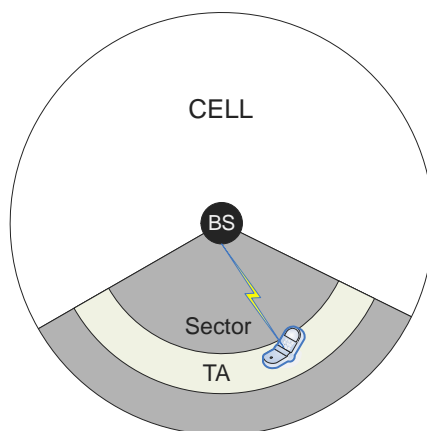
Lorelli, & Jarosh, 2004; El-Rabbany, 2002; Prasad & Ruggieri, 2005). GPS has to be accompanied by a supplementary network in order to drive interactive on line systems where satellite coverage is unavailable. Pseudo-GPS systems emulate the existence of satellites for indoors use without requiring any additional equipment, yet they are not widely adopted solutions (Schmid, Neubauer, Ehm, Weigel, Lemke, Heinrichs, 2005).

GSM-Positioning

GSM positioning (ETSI, 2006; Mao & Douligieris, 2000; Spirito, 2001; Zhao, 2002) is a facility potentially provided by GSM mobile network operators. Its operation is based on the fact that there is always some type of raw information on the location of a certain GSM mobile device in order for the network to be able to deliver information to the user. Since it can be originated from the network, it is raising serious privacy and security concerns, which can be overlooked for emergency purposes but not without risk of misuse.

GSM positioning is always available in some form, as long as network coverage is provided. However depending on the network infrastructure and method utilised its accuracy might vary quite significantly ranging from 100m to more

Figure 2. Cell ID/Cell ID + TA



than 500m (even several kilometers) (Caffery & Stuber, 1998b; Drane, Macnaughtan, & Scott, 1998). Although due to this low level of accuracy GSM positioning is of little use for high accuracy demanding application, it is accompanied by a bidirectional communication channel (voice or data) thus enabling interactive applications. Its network-side activation, whenever applicable, makes it ideal for some special emergency and tracking cases.

- **CellID** is a location technology that utilises the well-known location of fixed network elements, that is, the base station transceivers (BTS), to identify the mobile equipment location (Figure 2). It can be easily combined with timing advance (TA) in GSM networks and round trip time⁹ (RTT) information in WCDMA networks in order to improve accuracy. TA is a technique that utilises the timing advance information applied by the GSM network to determine the approximate distance a MS is from a base station.
- **Enhanced-observed time difference (E-OTD)** is a more complex method for calculating device position (Caffery & Stuber 1998a, 1998b). It requires location measurement units (LMUs), a type of device used to provide precise timing information for asynchronous networks. Although this method can increase accuracy, it also increases

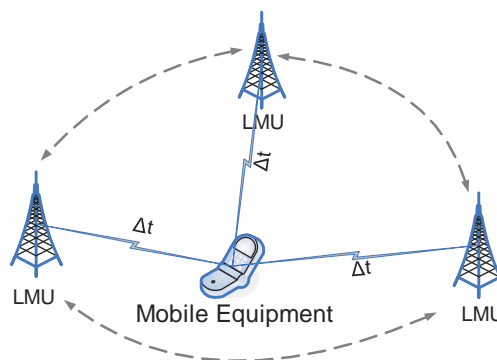
infrastructure cost and it still suffers from issues with network density in rural areas. E-OTD and time of arrival (TOA) methods are very similar to GPS positioning already described. The location of mobile devices is calculated using the signaling time from two or more stations (see Figure 3).

Typically GSM-positioning would not always be enabled, since this requires significant resources from the operator's side. In the typical usage scenario, the user has to ask for locating him/her, either through an SMS or through a request over the standard Internet protocol (IP). Due to its privacy risk, GSM positioning is usually surrounded by rules of activation and bureaucratic procedures/agreements, which can be even harder to overcome in cross-MNO cases unless a standard user-driven mechanism is utilised. Unfortunately despite the existence of specifications, in mid 2001 decade there is still no standard for GSM positioning that is widely adopted by operators. A final restriction on its use is its cost, which can vary quite vastly depending on the level of consumption of the service.

WLAN

Wireless local area network (WLAN) positioning (Wang, Jia, Lee, & Li, 2003) is a local type of positioning usable within range of WLAN

Figure 3. E-OTD operation



hot spots, which is mostly restricted indoors or in quite constrained areas (e.g., building blocks, etc.).¹⁰ It is the primary candidate technology for big buildings like airports, museums, market places and other sites where radio interference is not an issue and it should generally be accurate enough to guide a visitor through the coverage area. Positioning is very similar to GPS and GSM positioning, thus it uses the time difference between the signals from some known positions. This information can be corrected and improved with site calibration, a method which also can be utilised in some GSM positioning cases but not without significant difficulties. In the WLAN positioning case, information about the physical structure of the target area (walls, obstacles, etc.) is of crucial information in order to obtain reliable results.

According to systems' vendors, WLAN positioning can be quite accurate (one meter indoors according to Ekahau, 2006) yet site calibration is definitely required for such accuracy. Its cost is

quite reasonable since infrastructure and equipment are quite cheap and it is well suited for interactive on-line applications since data network coverage is implied.

Other Methods

Despite its peculiarity considered in the context of the e-services described above, observation accompanied by a traditional map (i.e., paper-printed) also could be a useful method of information dissemination for tourists even in the electronic age. This does not suffer from service unavailability, privacy, mobility, and autonomy issues, and its price is usually low. Using an electronic map instead of a printed one would add in detail and in some cases reduce in size while posing some restrictions on autonomy, however if not accompanied by a positioning system it would still require observation and manual operation in order to consolidate other information.

Positioning through mapping addresses to geographical coordinates is very similar to using maps

Table 2. LBS summary of performance, implementation, and cost trends (Sources: EMILY, 2002; Hightower & Borriello, 2001; Moureu, 2000; SnapTrack, 2001)

| Metric | CELL-ID + TA | E-OTD | GPS | A-GPS | Hybrids |
|-------------------------------|--------------|------------------------|------------------|--------------------|----------------------|
| Accuracy | 100m 10km | 100m 500m | 10m undefined | 10m 100m | 1m 100m |
| Kick-off time | Low | Low | High | Very high | Very high |
| Dimensions | 2 | 2 | 3 | 2/3 | 2/3 (+direction) |
| Mobile Equipment Requirements | None | Low | High | High | High |
| Applicability | Good | Poor | High | Medium | Good |
| Infrastructure Cost | None | High | None | None-to-high | High |
| Best area applicability | Dense urban | Urban / Dense urban | Suburban | Suburban, urban | Outdoors, Indoors |
| Coverage | High | High | Partial | High | High |
| Overall Quality | Poor | Medium | High | High | Excellent |
| Compatibility | Medium | Poor | Full | Medium | Poor |

Figure 4. Indicative LBS technologies quality per area (accuracy, availability, calculation time)¹²

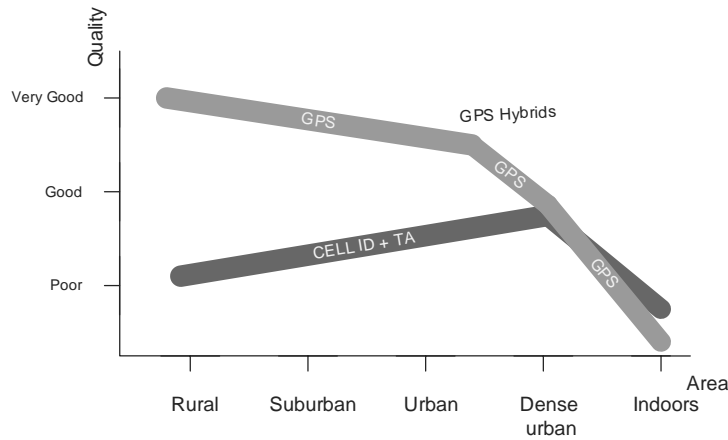
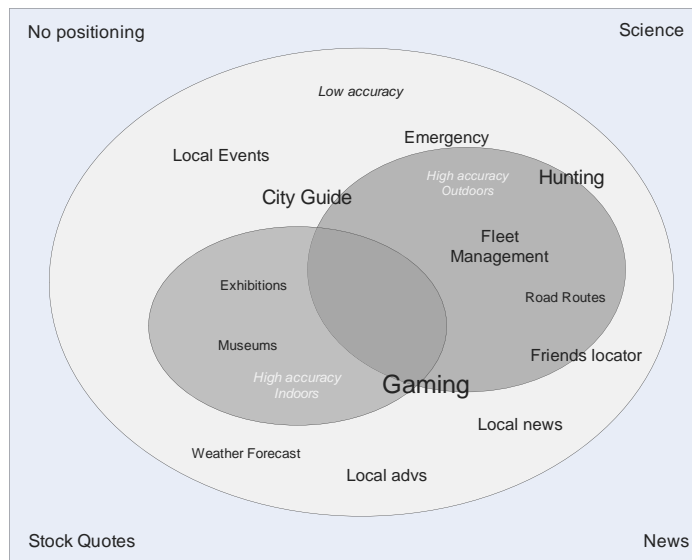


Figure 5. LBS technologies services and accuracy¹³



since it requires observation and manual utilisation of information. However the location is obtained through lookups in appropriate databases, such as geographical information systems¹¹ (GIS). It is quite usable in urban areas and roadsides of rural areas and it can be both electronic and traditional (maps with indices).

There are several other methods, like local sensor networks, ID tags based on infrared or radio frequencies (IR or RF), gyroscopes, and statisti-

cal models (Hightower & Borriello 2001; Nellen, Bronnimann, Held, & Sennhauser, 2004; Spratt 2003). Out of these one could expect low-cost gyroscopes to be the most attractive mechanisms for mobile travelers in the future (whenever it becomes possible to build lightweight, low-cost gyroscopes) since they could drive the most fascinating classes of applications. For example taking into account the direction of sight of the user could even further enhance the simplicity of

interaction with a service, especially in complex (with respect to location and quantity of content) environments such as museums or exhibitions. Further issues and opportunities can be found in the section on “Mobile Tourism Services.”

Summary

Each method presented has advantages and shortcomings. It seems that GPS is currently the primary means of reliable positioning when global positioning comes into play, however hybrid positioning (i.e., by blending of different location technologies) utilizing GSM and WLAN methods could be optimal. In the rest of this chapter “hybrid” will refer to combining GPS with other location techniques.

There are several whitepapers, guidelines, studies, and surveys showing the details of each positioning approach (Caffery & Stuber, 1998b; Hightower & Borriello, 2001), however a higher level evaluation of the ones applicable to tourism as it appeals to mobile network operators will be introduced below. Other types of systems like personnel/patient tracking in hospitals (Dao et al., 2002; Douglas, 2004), information delivery in museums (Sparacino, 2002) or emergency related ones (FCC, 2001; GSM, 2002) generally require more sophisticated means for delivering their services.

When designing an open infrastructure then, positioning should not have any strong relation to the implementation of services for the mobile traveler. Realisations of different services should leave methods of getting positioning information open, allowing the end-user to choose among them: GPS, GSM and map outdoors, WLAN and GSM inside. Services should be prepared to receive coordinates as bunches of numbers in the three-dimensional + direction space accompanied by definition of coordinate-standard and accuracy.

Such an approach would leave all possibilities open for the user. Also this method would keep

service providers’ monetary costs down, because service provider can leave all costs of positioning to be decided by the traveler.

When building services for the mobile traveler, designers should ideally therefore forget the actual positioning method and provide a service in a way that it would be able to cope with any degree of accuracy or availability of positioning information. Obtaining the position would then be a task to be carried out by external parties such as equipment manufacturers or infrastructure providers, both of them working on low details of the software that manages the “networking” hardware.

Positioning Standards

An attempt to standardise positioning has been carried out during the past few years. Solutions and best practices have been proposed by vendors, associations and individual researchers (Adams, Ashwell, & Baxter, 2003; GSM, 2002; Rao & Minakakis, 2003). As a consequence the terms mobile positioning center (MPC) and gateway mobile location center (GMLC) systems emerged in order to label the entities of the infrastructure that were used in order to extract positioning information and estimate end-user locations. The mobile location protocol (MLP) is an application protocol developed by the location interoperability forum (LIF) that specifies the messages to be exchanged over standard Internet technologies in order to obtain coordinates from a positioning center. It is focusing on network based positioning and has its origin in proprietary commercial protocols. OpenLS (OpenGIS location services [OGS]) defines the interfaces to an open location-based services platform, such as the GeoMobility server. Utilizing XML for location services (XSL) defines the data exchanged in the interactions with the geographic information system (GIS) for various classes of services that capture facilities such as routing (navigation), position extraction, lookup (directory), map drawing (presentation), and so on.

Popular, yet proprietary protocols such mobile positioning protocol (MPP) (Ericsson) also can be an option since many existing systems support these.

Content Technologies

One of the major aspects of mobile tourism services is the delivery of content to the end-user. This in the general case involves identifying the content to be displayed, (optionally) moving it to the device¹⁴ and presenting it. In the following paragraphs focus is given on the case that content is passed to the device upon request, that is, does not reside pre-installed on the device.

Delivering content of location-based services to the end-user is not as simple as it seems at first sight. There is a multitude of devices that content can be delivered to and a number of media through which it can be transferred, all of them presenting different capabilities and shortcomings. Typical examples are SMS, MMS, and WAP:

- **SMS** market penetration is significantly higher than the penetration of WAP. The majority of the location-based systems implemented by MNOs, use the SMS for exchanging data. However presentation and interaction facilities are severely limited over this transport medium; furthermore SMS can be extremely expensive per byte of data exchanged
- **MMS** significantly increases the quality of presentation and reduces the price per byte of exchanged data. Yet its penetration is significantly lower than SMS, it suffers the same interaction restrictions and finally its cost can be significant over SMS for simple text information exchange
- **WAP** adds to presentation and interactivity quite significantly. However its penetration is quite limited and it is not expected to be widely adopted unless significant convergence to Web technologies is achieved

Research on service types show that the SMS/MMS solution might be more appropriate, while WAP/Web is the only way for others (Bennett, 2001; Heijden & Taylor 2000). Taking into account that current end-user mobile terminals have limited displays and end-users are not accustomed to consuming interactive services through the mobile phone interface, SMS/MMS may be a commercially viable solution for a wide range of location-based services. Special sub-sections of tourism related services such as directory lookups can be ideally served through simple SMS exchanges.

Positioning also is influenced by device capabilities. The majority of mobile phones are not equipped with GPS devices, which could have a significant impact on their autonomy, size, and weight since the cost of a GPS receiver is insignificant compared to the cost of the rest of the device. Even PDAs or laptops do not usually come out of the box accompanied by GPS receivers, making it a requirement to purchase one separately. The primary option is a Bluetooth GPS device that can be easily connected to portable computing devices such as latest mobile phones, PDAs, or laptops; however despite the small size of these devices this scenario requires that the user carry one extra component.

Mobile Terminals That Support LBS

The development and full deployment of high quality location-based services for tourists assumes the existence of terminals with extended capabilities in battery capacity, processing power, main memory, application capabilities, size, and weight. Such devices may be categorised according to an incremental rating of the applications they can support. Today, four categories of terminals can be found in market:

- **Standard GSM mobile terminals**
- **GPRS/UMTS phones:** There are two categories of GPRS/UMTS phones. The WAP

based and the HTML based ones. The former category offers facilities for consuming WAP information sources (WAP sites) while the latter one exchanges information in Web standard formats such as HTML, JPEG, etc. They require a Web server, which will host the mapping applications and will be responsible for routing requests to external systems.

- **PDAs/Smartphones:** Smartphones are latest generation mobile phones equipped with enhanced displays, more powerful processors and capabilities of carrying out tasks that were formerly responsibility of computer systems. PDAs are devices in some extent similar to the smartphones, stressing on presentation and application capabilities rather than communications. Latest generation devices are usually equipped with an HTML browser able to interface with standard Web sites. PDAs offer built in or expandability options for GPS, GSM, WiFi, and so on.
- **Laptops with communication facilities:** These offer all the advanced options of computers in terms of computational and storage capacity, yet they have limited mobility features.

Multi-Channel Content Delivery

Multi-channel content delivery is a very important aspect of the content provision system. Infrastructure and content should be suitably constructed so that they allow delivery of information through various media and means, be it SMS message exchanges, GPRS, or fixed networks connections, computers/PDAs/phones, and so on. Nowadays there is a whole suite of technologies and a large number of systems that enable multi-channel content delivery, under the *author once—publish many* approach, where the same source content is used for several targets ranging from printed media to mobile devices.

Nowadays the most widely applied solutions for this approach are based on a set of standards and tools build around XML, a simple text language developed by the World Wide Web Consortium (W3C) that has its roots on SGML. XML can be used with a wide range of applications, such as authoring tools, content display engines, translation tools, and database applications (Anderson 2000; Bosak 1998; Bosak & Bray 1999). However, its major use in the context of mobile tourism services is for structuring the tourism related content in a form that it becomes meaningful for a series of software elements and operations. More precisely, the various parts of a document are labeled in a special manner (tagged) so that can be extracted by various applications to fulfill their own needs (Anderson, 2000). A relevant technology is the well-known HTML which uses a somewhat similar tagging mechanism yet it neither enforces structure nor allows for application specific labeling that would facilitate a customised use of the document. HTML uses a fixed set of tags and describes only formatting instructions for the Web. On the other hand XML is completely extensible since it does not have predefined tags, unless it explicitly conforms to a schema. Various schemas exist in order to capture industrial and domain specific needs and as long as two systems comprehend the same schema they can use XML documents to exchange information. News Industry Text Format (NITF) and News Markup Language (NewsML) are two examples of markup languages that could be of some use to tourism related services, since they enable the sharing of syndicated news articles from alternative news providers.

In addition to XML, the combination of XSL/XSLT is one of the fundamental parts of the described content delivery chain. A stylesheet is a declaration that describes how to display a document and XSL is a language for expressing stylesheets for XML documents. By keeping content and its presentation information separate in the XML document and the XSL stylesheet

respectively, display of the same original document on different media and preferences sets is achieved by simply modifying the stylesheet.¹⁵ However modifying presentation might not be enough in several cases; transformation of the source document might be required and this is where XSLT comes into play. Although XSLT transformation was originally intended to perform complex styling operations, like the generation of tables of contents and indexes, currently it is often used as a complete general-purpose XML transformation language. In that manner it is the standard means for transforming the source XML document (e.g., tourism content) into presentable forms such as HTML or WML¹⁶ pages, or other XML schemas or even into other more complex formats.

Apart the content structure, a number of features are exploitable in the context of establishing advanced, reliable multi-channel content delivery services, such as mobile tourism related ones:

- **Security**, in order to authenticate users and authorise access to sections of the system and potentially charge usage, required in order to safeguard mobile user's privacy and content/service providers resources
- **Session management**, in order to drive stateful applications driven by a series of user actions, a feature required for almost every type of modern interactive Web application
- **Automated device/channel detection**, in order to enable adaptation to device capabilities, with minimal user intervention that drive better application experience
- **Client and/or server form processing and validation** that allows meaningful interaction with the system while minimizing message exchanges
- **Content rendering**, that adapts to the device capabilities and user preferences (personalisation), required for delivering content to a multitude of heterogeneous devices

- **Support for off-line operation of devices**, able to drive different application and connectivity scenarios, especially useful in several forms of application in the mobile tourism area¹⁷

Unfortunately, it can be shown that with today's applied technologies, depending on the device/channel, almost all requested features have to be achieved by a different set of technologies and interactions each time. Approaching this problem through the Model-View-Controller design pattern (Gamma, 1995) offers a potential design solution to the challenge, by breaking an application into modules so the logic can be dealt separately from the interface. This allows developers to maintain a single code base for all channels and face each device/channel as a different view for a given transaction. The Model-View-Controller pattern can have as many views as desired and isolates the request handler (aka the Controller) and enterprise system (the Model) from any knowledge of the view. Achieving the desired features (e.g., security, session management, form validation, and content rendering across all devices and channels) is case/device/channel specific.

In the proposed multi-channel approach considering the Web as the primary channel allows an all-in-one solution for already established Web content provision services. The value of a multi-channel content delivery enabling platform is that it provides to the hosting enterprise a single interaction model for all external systems or users and leverages security, session management, and content rendering.

Commercial, freeware and open source software markets offer a wide range of tools that relate to the multi-channel content delivery process. One can easily locate a series of software tools that transform rich content into tailored formats mainly for adopting Web content to mobile devices or vice versa, or systems that offer some degree of support for multi-channel content delivery.

These systems mostly belong to one of the following categories:

- **Content management systems (CMS)**
- **Authoring and publishing tools**
- **Wireless application gateways (WAG)**

Platforms such as enterprise portals and e-commerce suites also might be offering some degree of support for multi-channel content delivery, however they are considered of rather little use in the case of rich mobile tourism services by themselves, since they are capturing this aspect under the perspective of their specific application domain. Such facilities also can be offered by application servers, however at a much lower level. Currently there is no product that provides a full solution that can take raw content and transform it automatically to multiple formats for any requesting device taking into account all the aspects of multi-channel content delivery referenced in the previous section.

Content Types

There are various types of content that can be delivered and displayed by end-user devices. Text is the easiest to handle, however it is relatively

less attractive compared to the others due to its nature, which only uses vision through the channel reading. On the opposite side, rich multimedia content such as Flash¹⁸ (Against the Clock [Firm], 2002; Kozak, 2002) is highly attractive, however its current support by mobile devices is not global, yet it is expected to increase in the near future, as convergence of technologies dictates. Direct execution of “binary” code on the devices through industry standards also can be referenced, however support is relatively limited and minimal or no cross device compatibility is provided.

The Semantic Web

The Semantic Web (W3C, 2001) comes into the scene in order to cover, among others, many of the issues met in the multi-channel content delivery area. It is led by W3C and provides a whole framework so that data obtain a well defined meaning and can be reused under different cases potentially leading to quite different end-user experiences and content compositions. The key-enabling concept is the resource description framework that is heavily dependent on XML contracts. The Semantic Web can be considered as the next step of the current World Wide Web (Berners-Lee & Hendler, 2001; Berners-Lee et al., 2001).

Table 3. LBS content types (Source: M-Guide, 2002)

| Content class | Compatibility | Features | Size | Power | Sample technologies |
|-----------------------------------|---------------|-----------|----------|-----------|------------------------------|
| Text | Very high | Poor | Very Low | Very low | HTML, Plain text |
| Audio | High | Medium | Low | Medium | MP3, MIDI |
| Image | High | Medium | Low | Medium | JPEG, WBMP, GIF |
| Video | Medium | High | High | Very high | MPEG, 3GP ¹⁹ etc |
| Integrated interactive multimedia | Poor | Very high | Medium | Very high | Macromedia Flash |
| Executable entities | Very poor | Very high | Medium | Very high | Applets / ActiveX Components |

Software in Control

All of the above mentioned technologies are provided through software elements which might be either proprietary, bound to a specific device and/or case or generic enough to fit several scenarios or even totally irrelevant services. Commercial or open source platforms do exist that can support almost all of the stages of mobile tourist content delivery, with little or even no need for integration development.²⁰ Nevertheless, provisioning of custom services will most probably demand explicit development of custom software elements.

In scenarios that several market players are involved for the provision of a rich service, such as the case of mobile tourism ones, the traditional component oriented architecture, which modularises software in order to be reused among various cases, needs to be enriched by concepts that allow independence among the various stakeholders.

The concept of service-oriented architecture (SOA) captures architectural style that aims to achieve loose coupling among interacting software entities (Erl, 2004, 2005; Newcomer & Lomow, 2005). In this context a service is a unit of logic and data provided by the service provider that is assigned to provide the appropriate results for its consumer. In this framework the provider and consumer are both software agents that act behalf of their owners. As a concept SOA is quite abstract and can be utilised both for B2B and B2C interactions. Typically lots of protocols and operations fall under its meaning, however in mid-2001, more concrete forms of service oriented paradigms are being applied, accompanied by relevant protocols and enabling platforms.

The model of publisher/subscribers, assisted by a directory service over a transport consisting mostly of XML and Internet based protocols is the current roadmap for applying the SOA:

- **Service publishers** (might) announce their characteristics in a directory service (e.g., UDDI, 2004).

- **Service consumers** can either look in the directory service and locate the service that meets their requirements and obtain a reference to the access point of the service or they directly obtain this through other media.
- **Consequently consumers** use the access point reference to directly communicate with the server.
- **SOAP over XML over HTTP** (i.e., TCP/IP) are the most common protocols for consumer/provider interaction, yet message details are service dependent.

Recent extensions of the initial concept of Web services for the SOA approach add state management, thus allowing a standardised way to access resources hosted by suppliers (Czajkowski, Foster, Ferguson, Frey, Graham, & Snelling, 2004; Foster, Frey, Graham, Tuecke, Czajkowski, & Ferguson, 2004; Huber & Huber 2002; Snell, Tidwell, & Kulchenko, 2002). Typically consumers have no internal knowledge of the operation of the service provider and a particular service in question. The provider might revise implementation, as well as other characteristics of a service without explicitly notifying clients.²¹

One level below the overall software architecture is the software technology, which in the case of location-based services has two facets: infrastructure and client. Developing on the infrastructure side is facilitated by numerous technologies and platforms and is of little interest from the mobility perspective. All Web service enabling technologies, assisted by technologies to deliver reach content are quite applicable for the purposes of tourism location-based services. Dozens of open-source free or fully commercial platforms exist in the today's software market, making it available for anyone to adapt its infrastructure to their own needs and capabilities. However, due to its relatively recent appearance, development on the device has somewhat limited options. For the time being, the most common

platforms for mobile device development are the two described below and come from commercial software vendors, however they are both freely available to the development communities:

- **The micro edition of the Java 2 platform** is the port of Java to portable devices that have minimal capabilities of processing and storage. It is a runtime environment that provides on one hand a subset of the facilities offered by the typical desktop Java engines, yet it provides microdevice-specific capabilities access, potentially assisted by vendor specific libraries. J2ME is very common in latest 2G and 3G mobile phones as well as non PocketPC PDAs (SUN).
- **The Microsoft .NET compact framework** is a subset of the Microsoft .NET framework, the Microsoft technology for desktop and Web application on the Windows platform. Although meant to be platform independent through standardisation (ECMA²²), currently .NET compact framework is only available for PocketPC and other flavours of the Windows platform. Due to its requirements it is not suitable for current low-end devices, yet its performance is very promising in addressed devices (Microsoft).

MOBILE TOURISM SERVICES

“Tourism-related” content refers to any content that might be of interest to the visitor of a location (Beatty 2002; Kakalettris et al 2004; Karagiozidis et al 2003; Kim, Kim, Gautam, & Lee, 2005). This content, be it static (e.g., maps, routes), of low refresh rate (e.g., scheduled or periodic events), highly dynamic (e.g., traffic), cultural (e.g., museums, exhibitions, local historical info), informative (e.g., weather, local news) or commercial (e.g. restaurants, commercial fun parks, etc.), has an increased degree of interest to the “consumer”, especially when he/she is in

particular locations. The term “location” is a varying-“size” descriptor which might range from the actual spot where one is standing in a room, to just a rough approximation of a country. In this context of course, the term “tourist” is very loosely related to the typical “tourist” and mostly fits the definition of “mobile equipment user”. It is obvious that a very large number of services related to content delivery fit this definition, such as map delivery, archaeological information delivery, events announcements, emergency, or health services, transportation information acquisition, even in-doors museum exhibition presentations. These are all forms of this type of location-based tourism-related content delivery service.

When designing an infrastructure able to support such services, requirements that have to be met come from various sources:

- **Technical issues** that have to be exploited and addressed in order for it to be applicable
- **Regulatory and social/ethical restrictions** that have to be met in order for the supplied services to be publishable
- **End-user expectations and requirements** that have to be considered in order to achieve successful commercialisation, and so on.

The requirements presented here arise from a careful study of the 2/2.5G and 3G mobile network technical specifications, location-based services related whitepapers and applied paradigms (Laitinen, 2001; Ludden, 2000; Northstream, 2001; Searle, 2001), modern IT system architecture concepts (Varoutas, Katsianis, Sphicopoulos, Cerboni, Kalhagen, Stordahl, et al., 2002; Varoutas et al., 2006), regulations & standards (FCC, 2001; GSM, 2002; IST-REPOSIT, 2001; LIF-IOT, 2002), and finally, market and end-user surveys (Beatty, 2002; Dao et al., 2002; Katsianis et al., 2001; LoVEUS, 2002; M-Guide, 2002). This comprehensive study led to the identification of the following key points that require careful con-

sideration when implementing a location-aware service that aims to provide tourist information content:

- **QoS in quantifiable technical terms** (response time, throughput, availability, scalability, coverage, accuracy, etc.)
- **QoS in non-quantifiable terms** (quality of content e.g coverage, depth, media, multi-linguality/multiculturality, etc.)
- **Integration capabilities** (relevant services support and integration capabilities)
- **Security** (authentication, authorisation, privacy, etc.)
- **Service related procedures** (e.g., activation /de-activation, billing, pricing, personalisation, stakeholders interoperability, etc.)
- **Service specific features** (e.g., notification, positioning triggering)
- **Content related issues** (e.g., ontology)
- **Present and emerging technology capabilities** (positioning, presentation, mobile networks, etc.)

Having carefully examined alternatives and the potential impact of decisions on the above-mentioned key points, several interesting conclusions can be identified as referenced below. Although technology enthusiasts would think otherwise, end-users are not generally amazed by high accuracy positioning mechanisms or very high data rate demanding services. The already referenced user surveys show that they rather prefer low cost intuitive services that will satisfy their expectations, within reasonable quality limits. In the same context, widely used equipment lacks high interactivity capabilities (i.e., means of passing information to the service and presenting content to end-users). Although emerging devices are expected to vastly improve this particular aspect, average users are not enticed by such capabilities.

High accuracy in positioning is not always a real concern either. For example delivering some

sort of transportation information or providing a local directory service, requires only a rough approximation of the position. On the other hand, presenting information in an actual exhibit, which the visitor is looking at, requires not only precise position as to where one is located but also information about the direction of sight, and even that detail of information may not be adequate. At this point, the conclusion is that “less accuracy” does not render LBS useless but rather restricts the range of services that can be provided. Therefore, although almost identical content might be available for presentation to each end-user visiting a museum or an open archaeological site, equipment differentiation (e.g., display capabilities, channel usage, positioning mechanism, and capabilities), can drive a completely different degree of content exploitation.

Another issue is that some requirements, for example accurate positioning and enhanced content, come with some extra “cost” to the end user. Cost is not only in financial terms, which are mostly obvious, positioning accuracy (e.g., through a GPS module) and advanced display capabilities for example, might have a severe impact on device autonomy and size. Enhanced content (video, virtual reality representations, etc.) will require more bandwidth and even more powerful equipment (having indirect impact on autonomy and size).

When to locate a user is yet another confusing issue. User-requested positioning requires an extra step to be taken by the end user, who actually has to request to be located or explicitly state his/her location at the moment. Alternatively, the user can be continuously located (tracked) by the system. Continuously positioning the mobile user is not usually required, even in the case when the undoubted demand it implies in terms of infrastructure and equipment resources is not a problem. A typical example is a highly mobile user who is accessing some location-based directory of content, related to a specific position he/she has been some time earlier. While the

user may be attracted to these particular sites of interest, mobility might cause the delivery of quite different content in subsequent requests for information, which could come to be quite irritating. Thus the user should have the possibility to allow either continuous or on-request triggered positioning. A good practice would be to totally avoid automatic positioning instead of temporarily ignoring new position information, however certain applications could require two positional indicators (“live” position and “querying” position). The issue of delay also needs to be taken into consideration when locating the user. In on-demand positioning schemes, the system

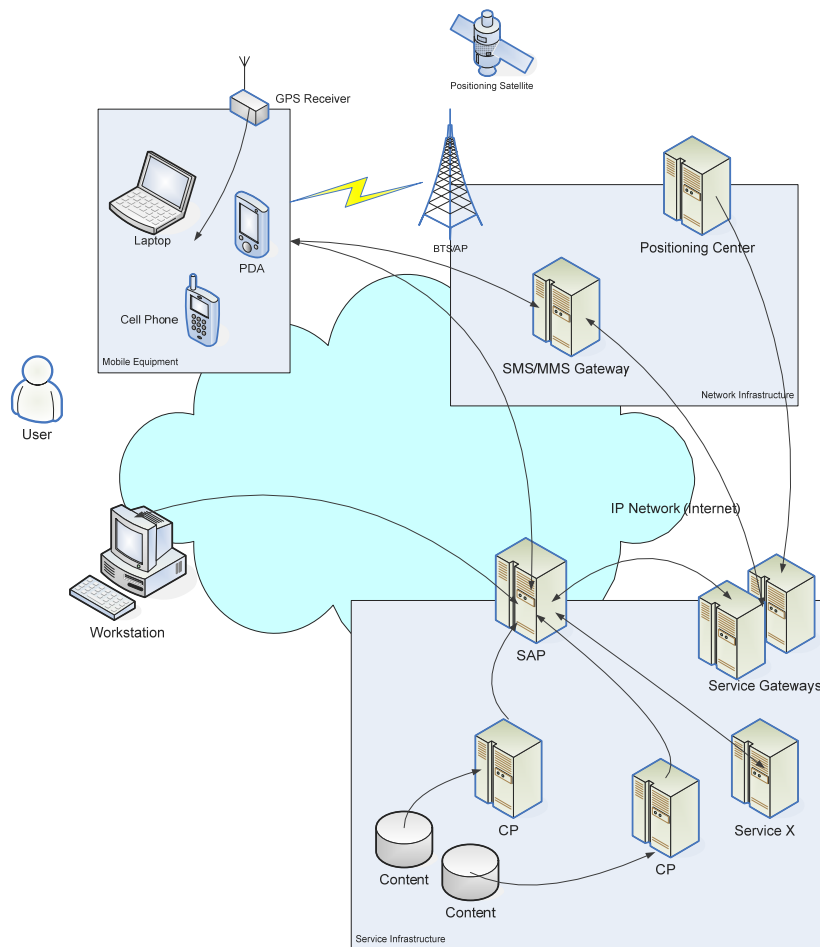
might introduce quite significant delays due to high load or computational issues which might render some applications rather unattractive.

Finally, a very important observation that guides the proposed approach is network convergence; xxML/HTTP/TCP/IP “stacks” tend to provide a uniform roadmap for offering a very large range of services to each-and-every consumer oriented device type.

System Concepts

In the rest of this chapter various concepts of an open architecture, capable of providing rich mobile

Figure 6. Example of layout of LBS system (Based on Kakalettris et al., 2004)



tourism services, are pointed out. Although an architectural approach is introduced, the intention is not to propose a single solution that could be identified as the best in one way or the other for the tourist; the purpose of the analysis to follow is rather to position the enabling technologies and identify the issues, shortcomings and strong points of various approaches. Depending on the particular application one has to provide, different roadmaps can be followed. An hypothetical structure of an LBS provision system targeting tourism content delivery is shown in Figure 6. In this scenario, the elements are separated in three conceptually different clusters:

- **End-user devices**, be it mobile or fixed ones. For simplicity, it will be considered that mobile ones have some sort of positioning capabilities either on their own (e.g., GPS) or network assisted/provided.
- **Network infrastructure**, which is either a mobile network or a fixed wireless local area network, or a combination of both. In case of mobile equipment that lack positioning capabilities, it is necessary that the network provide the ability to locate the user through connection information, spatial information and potentially the user's previous behavioural data. The network might provide various means of submitting information to the user, such as MMS/SMS (GSM, 2003).
- **Service infrastructure**, which relates to the systems that delivers information and facilities to the user utilizing as one of its implied inputs, the positional information of the user.

The mobile/wireless network details such as access points, MSCs, VLRs, HLRs and so forth are almost totally hidden and only interactions of higher-level components are being referenced. Additionally SOA constructs which obey to specific patterns are omitted (Brown et al., 2003; Colan, 2004; UDDI, 2004). The following sections high-

light important structural and operational aspects of such a system.

Service Interactions

In the presented architecture, the main element is the "service" (i.e., to tourists). Under the modern understanding of realizing a service-oriented architecture, services are implemented under the WebServices paradigm, utilizing in almost 100 percent of the cases the SOAP/XML - HTTP - TCP/IP route. Thus messages are exchanged in a very standardised manner which can be found to be fully supported by vendors' major server systems (content management systems, relational database management systems, runtime environments, etc.), and mobile/client systems as stated by the leading technologies of the area (provided by Microsoft, SUN, IBM, etc.). Under this architecture, the system elements such as services are loosely coupled and can be even dynamically composed upon interaction/request by using SOA enabling systems such as the UDDI registry.²³ Composition can be entirely left to the servicing side, thus the service access point (SAP) and its delegates, however exploring mobile equipment capabilities allows that this task also can be performed at the client side through the same standard mechanisms.

Service Access Point

In the proposed scheme the concept of a service access point (SAP) is introduced, which is responsible for accepting customer (i.e., tourist) requests for a bunch of services. This is not required to be part of an MNO infrastructure, but in the case that the full Webservice approach is followed this element is a Web service hosting server, accessed by the client devices through typical WS addressing constructs. In case typical World Wide Web (WWW) interactions are performed through a browser then this server would be a normal Web/application server. A unifying approach

can be that both servers exist (even in the same system) in the provider's infrastructure and the Web server redirects incoming calls to the same SAP that the Webservice consuming capable clients access. This point can be responsible for a series of actions, which among others include:

- Authenticating end-user even beyond typical username/password challenges by utilising sophisticated network provided authentication mechanisms
- Orchestrating service interactions in an application specific scenario when an end-user delivered service requires invocation of a series of services
- Providing facilities for dynamic service composition allowing the end-users, devices or services to seek and locate suitable content and service provided that match their needs with regards to quality, cost, availability, and so on; delegating lookups to registries such as UDDI is performed at this level
- Providing a repository for open-schema persistent end-user profiles that can be selectively partially offered to subsequent request handlers. Alternatively a distributed profile schema could be used however this would raise interoperability issues and would increase the risk of compromising user privacy. Updating profiles could be triggered by users and other services to the extent allowed by their role in the system
- Providing a "service-side triggered" positioning acquisition point, in case end-user equipment is incapable of autonomously handling positioning which is the main the case when SMS/MMS channels are utilised. In this case requesting services would address this element in order to obtain user position upon and special security concerns have to be handled
- Providing a mechanism for content lookup in registered content providers acting as a content broker, so that content that meets

specific minimal structural requirements can be delivered to end users without additional processing nodes

- Maintaining session state on top of stateless protocols
- Acting as a front-end for non-IP network connected channels, such as SMS/MMS ones, to coordinate requests and replies between channel gateways and content/sub-service providers
- Providing presentation transformation layer to adapt content to client device/channel needs

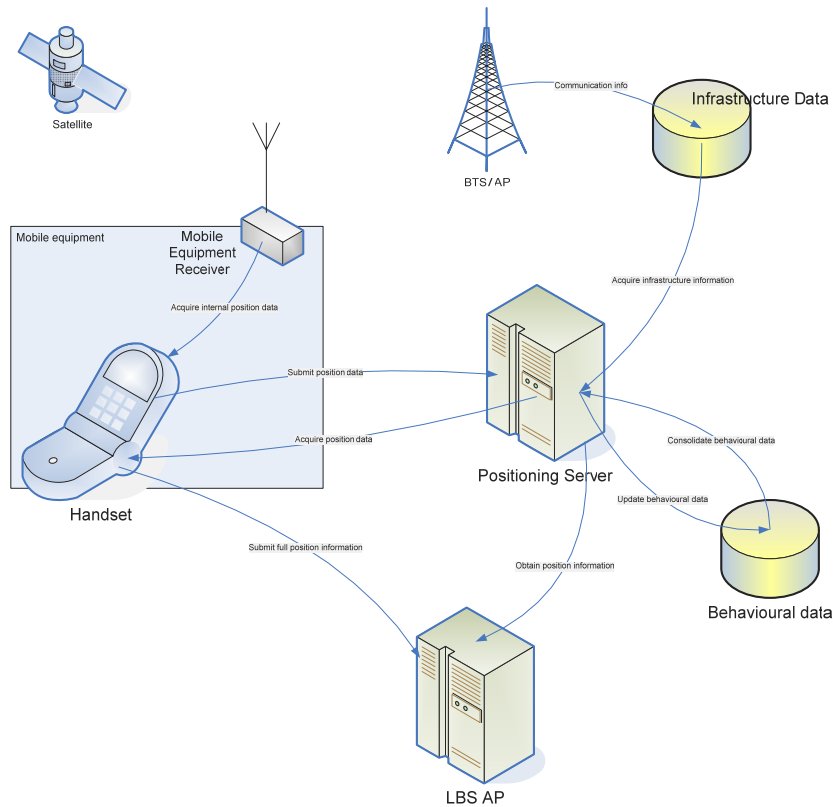
Optimisation features as a caching of aggregated content are application specific ones that can be considered as part of the SAP. Advanced value added services on top of positioning such as movement prediction also can be considered however they should preferably be implemented as a typical Web service to be accessed on demand.

Homogenisation of Positioning

Examining the details of user positioning, be it network driven, client driven, or even manual, shows a significant heterogeneity not only in the area of the actual position estimation, but also in the process of obtaining this information which is a rather quite important aspect of the system design. Even the relatively simple case of manual positioning might have various implementations: manually supplying the coordinates of the location or indirectly acquiring them out of location information (e.g., road intersections, etc.). The following graph shows various potential interactions among equipment, software, and data that could be utilised to drive user positioning.

It is desirable to hide as much as possible of this heterogeneity from the ASP point of view. A potential solution would be as to separate positioning into three distinct layers as follows:

Figure 7. Positioning interactions (Based on Kakaletis et al., 2004)



- One layer is concerned with the actual calculation of the position. This layer is quite different in each and every implementation, not only due to the various alternatives of positioning mechanisms but also due to differentiation to details of the actual algorithms and infrastructures. Very little can be done in order to unify this layer other than defining the appropriate interfaces
 - The second layer is the SAP positioning layer, which has to provide the actual end-user position to the application layer. This layer is separated in a server-side and a client-side part (components to extract device data where applicable) and its purpose is to determine the actual position supplier and
 - extract information data, or provide a means for manually identifying position
 - The top-level layer is the application layer, which has to determine whether new positioning is required, reuse of previous information is adequate or actual position is known (e.g., within query), forward a request to SAP layer and ultimately return location information back to the end-user (within response)
- The aforementioned layers might make use of components (e.g., coordinates translators) or services (e.g., GIS). A subset of the previous interactions, through eliminating the direct message exchange of the positioning server and SAP

could potentially minimize the risk of building privacy holes in the system.

Push & Pull Services

There are two ways one can consider delivery of content to the end user. In both cases, it is assumed that the user has posed a request for content and they are not entirely network driven, since this would raise several regulatory issues. In each case the user interaction pattern is somewhat different:

- A **pull** service is the one that delivers request to the user upon his/her explicit request within a reasonable interaction time;
- A **push** service is one that submits information to the user when special criteria are met and there seems to be no explicit binding of a request to a response in the form of interaction. These criteria could be location, time or more advanced ones like matched lookups for information and so on.

Over the typical HTTP/TCP/IP stack found in advanced mobile equipment one can consume such services by various mechanisms. The simplest approach would be by periodically polling through a proprietary client for any kind of pushed information to be presented to the user. Triggering polling by identifying significant positional change also could be considered for appropriate devices. This solution introduces network usage even when no information is to be delivered to the user, and is actually a mixture of pushing and concepts services. Traditional mobile devices could be contacted through typical gateways (SMS/MMS) whenever network-monitoring procedures decide that interesting information is available. Push services on location criteria can however become a potential scalability and performance threat for an LBS infrastructure, because of the computational and bandwidth demands required for scanning vast collections

of data on each and every end-user move.

User Authentication and Identification

A very important part of the service is user identification, authentication, and authorisation (Gajparia, Mitchell, & Yeun, 2005; Soppera & Burbridge, 2005). The SAP is proposed for taking over the responsibility of authorizing end-users. Authentication is actually optional since it is considered that just identifying the user can be quite enough in several application scenarios, such as free-of-charge information delivery. Simple identification might be utilised for some personalisation facilities. A basic scenario for authentication would be based on a username/password challenge scheme, which will be verified against a user directory. Client certificates are a more advanced option. Using secure channels for performing authentication is required to avoid common security penetration cases, yet not all devices might be capable of all common types of secure information exchange. SAP is responsible for maintaining the user directory where users (via their credentials) are mapped to unique identifiers and authorisation information.

Authentication is of crucial importance when positioning takes place under a network provided positioning mechanism. Acquiring end-user's location relying on simple username/password challenge opens a wide opportunity for service misuse. Taking advantage of the "spying effect,"²⁴ an unauthorised user can attach a typical mobile device related to a specific user account on a person to be "watched," and request positioning information through a secondary device (e.g., fixed PC or other mobile equipment [ME]) on behalf of the above-mentioned account. If no network session data are being used, location information will potentially be delivered to the "spy". This might be a well-accepted feature of some implementations but the typical perspective of privacy forces counter measures for avoidance of such

situations. In the SMS/MMS channels case this information is being incorporated in the state of the gateway/SAP session that is being established to fulfil a client request. On the TCP/IP typical channel the situation is a bit more complicated. Since the client is requesting position over an HTTP request, the MNO typically receives the request for locating the user by the SAP. Thus some user identifier must be presented (other than the username). Fortunately, the SAP already has the TCP/IP session information (source address/port) that is being used in order for the user to be serviced. Typically end-user mobile equipment is behind a NAT gateway and this address is not a real one, thus the port number must also be used in order for the related MNO to locate the correct user. The SAP can select the correct MNO either by the internal directory service (the source address of the request directly or indirectly identifies the MNO) or by the end-user information record being used. The MNO can therefore identify the actual user through NAT layer information and GPRS IP address assignment records.

Nevertheless a highly secure approach could be restricting positioning information exchange internally to the MNO infrastructure, by having positioning servers to replying only to requests raised internally by MNO subscribers, and more specifically only by the mobile device being located. In this scenario, the client device acts as an autonomously positioned piece of equipment, at least as this can be understood from the SAP point of view.

Content Structure

Limiting delivered content to “tourism” related categories might not be a significant restriction for the location-related content to be provided, but certainly poses some requirements on the structure this content must meet. There exist rich schemas for describing “tourism” content (TourML 2003), which attempt to fully capture

the corresponding ontology. However from our point of view forcing “over” structuring of content is usually a source of problems for the content producers and providers. It is a strategic decision that content providers expose content compliant with a minimal set of requirements. These requirements could include position information (in various forms, e.g., rectangles, series of points, etc.), language identifiers, labels, multiple classifications in a two level hierarchy (though not a hard constraint) and a content rating scheme. Content classifiers are open to extension by CPs and are being aggregated by the SAP. The first level is mainly proposed to be a means to define end-user content selection preferences, but a more sophisticated scheme can make use of a free hierarchy. Content rating is being required in order for free of charge, simple or rich content to be differentiated by the SAP, in order for it to be delivered to various clients, although the actual content manipulation is to be performed by the content provider (CP). Internally CPs might realise a more complex structure, but the SAP is concerned only about the above-mentioned tags. Usage of extra tags can be handled by additional user preferences, for which an extensible mechanism should be provided.

Presentation

A final, but quite important issue is that eventually data must be presented to the end-user. Presentation can be realised by a wide series of equipment, which might range from high quality multimedia laptops to simple SMS capable mobile phones. As already mentioned the XML/XSL/XSLT set of standards and related tools provide a powerful mechanism for implementing an *author-once-publish-many* times scheme, capable of covering a wide range of end user preferences and equipment. At this point, it can be identified that these are two level transformations in order to achieve maximum content reusability:

- The first level is internal CP transformation and renders original data into a form that will comply with the SAP required minimal structure;
- The second level of transformations is the one that will transform the content in a way that it will fully exploit the capabilities of the end user device and user preferences. Such rendering can result into simple text fragments to be posted over SMS, MMS fragments, WML, HTML, DHTML pages, and even advanced SMIL²⁵ presentations.

Presentation transformation should not be considered as a Web-only requirement; even if data are accessed through proprietary Web service clients such transformations would be of use.

Application Gateways

The assumed infrastructure of these models of service delivery is heavily based on the assumption of a homogeneous underlying network—on HTTP/TCP/IP layers. It is obvious that this is not a realistic assumption especially when mobile networks come to play. In order to hide the diversity of the underlying infrastructures, gateways are required that allow for the translation of non-SAP native requests to be fulfilled. These gateways receive client requests and deliver them to the SAP in a form they can be understood. At this point it is obvious that in order for uniform interaction to be achievable by all CPs, translation of requests is being handled by a specific reception point of the gateway that analyses the content of the incoming message and forms the appropriate request to the SAP. When requests are being replied, the data are being appropriately packaged and delivered to the actual network operator infrastructure components that will push it back to the requesting equipment through the appropriate “channel.” Typically channels that require gateways are the SMS, EMS, MMS ones, while the functionality of

such gateways also is significant for implementation of alerting services.

Pricing/Billing

Authorizing users is not only required for enabling access to the services and content authentication but also for charging and billing. When requests and responses are being exchanged among the various parties, the SAP user identification is being utilised in order for the CP or application service provider (ASP) to authorise and charge the appropriate subscriber. Alternatively ASPs or CPs perform no user identification and deliver data on behalf of the SAP, which is the actually charged partner. This would cover the CP/ASP/SAP part of the service usage. On the other hand the network operator will charge network usage, potentially posing a premium on top of the traffic which is being delivered to specific ASP/CPs/SAPs, and so on. Another scenario is that ASPs/CPs might vary the charges depending on user location or user preferences (such as content quality, type, or location-based advertising allowance), thus allowing for quite complex pricing/billing schemes.

CONCLUSION

Making use of standards and protocols (e.g., LIF, XML, and HTTP), avoiding proprietary solutions and limiting interoperability requirements to a minimum renders architecture capable of integrating various stakeholders with limited cost and implications. The technologies being proposed allow interoperability and redirection among various sub-service providers and the integration of services in order to provide a homogenous application to the end-user.

Although the proposed solution for tourists has been tested²⁶ on a single network operator elsewhere, support for location-based services is not restricted to a single network provider, even when

positioning is performed by the mobile network operator. Despite its “tourism content delivery” orientation, the infrastructure in this testbed can be made capable of providing more complex services with minimum impact on service providers, by making use of state-of-the-art client equipment features, such as Java, DHTML, and so on. In this regard, utilizing a directory service under a standard protocol, within the SAP, is mostly adequate for creating a totally uniform platform for indoors and outdoors LBS and quite heterogeneous positioning methods and capabilities (e.g., RFID, wireless access point identification, etc.). Since the motivation behind location-based services is its potential beneficiary commercial exploitation, a preliminary technoeconomic evaluation based on hypothetical deployment and commercialisation scenarios has been attempted by the authors and can be found in M-Guide (2002). The study presents basic financial indicators that showed the viability of the proposed solution as well as a full description of the evaluation scenarios and results. The details of the methodology used in technoeconomic evaluation can be found in IST-TONIC (2000).

There are various aspects of the presented approach where potential improvements will lead to further benefits for the end-user and the content/network providers. These largely involve standards identification and adoption, as well as refinements of current implementations. An essential improvement would be to fully fit the design discussed here to the open service-oriented architecture initiative, thus providing dynamic service discovery. Introducing the attributes and rules that will enable the creation of a universal directory service to support each and every relevant information and service lookup is a step that should be made.

Although business-to-customer (B2C) information interchange is sufficiently faced under our perspective, business-to-business (B2B) is partially dealt with. B2B data exchange is limited to areas where information is essential for servicing

a particular user request, for example, positioning, authentication, and so on. However B2B collaboration can be further exploited in subjects such as content modifications due to relocation, caching, restructuring service organisation, and so on. Further work on this area would potentially enhance scalability of “push services,” another area that has not been fully exploited.

Work also needs to be done on roaming-user scenarios in order for the infrastructure to fully comply with market requirements, since handling and network positioning of roaming users is currently performed inefficiently. Moreover, a more detailed technoeconomic study is needed, based on specific deployment scenarios, taking into consideration up-to-date technological and financial data in order for a more precise profit/loss prediction of relevant service deployment to be made possible.

ACKNOWLEDGMENTS

A part of this work has been performed with the support of the E-Content M-Guide Project, which was partially funded by the European Union. The authors would like to acknowledge the support and contributions of their colleagues from M-Guide project, namely Exodus SA, Vodafone-Panafon SA, University of Athens, Municipality of Athens, Adaptia and Iternet. The authors would also like to thank the two anonymous reviewers for the fruitful comments.

REFERENCES

- Adams, P. M., Ashwell, G. W. B., & Baxter, R. (2003). Location-based services: An overview of the standards. *BT Technology Journal*, 21(1), 34-43.
- Against the Clock (Firm). (2002). *Macromedia flash 5: Animating for the Web*. Upper Saddle River, NJ: Prentice Hall.

- Anderson, R. (2000). *Professional XML*. Birmingham, UK; Chicago: Wrox Press.
- Andersson, P., Hulten, S., & Valiente, P. (2005). Beauty contest licensing lessons from the 3G process in Sweden. *Telecommunications Policy*, 29(8), 577-593.
- Beatty, C. (2002). Location-based services: Navigation for the masses, at last! *Journal of Navigation*, 55(2), 241-248.
- Bennett, C. (2001). *Practical WAP: Developing applications for the wireless Web*. Cambridge, UK; New York: Cambridge University Press.
- Berners-Lee, T., & Hendler, J. (2001). Publishing on the semantic Web: The coming Internet revolution will profoundly affect scientific information. *Nature*, 410(6832), 1023-1024.
- Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The Semantic Web: A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities. *Scientific American*, 284(5), 3.
- Bluetooth.org. (2001). *The bluetooth membership site*. Retrieved from <http://www.bluetooth.org/>
- Bohn, J., & Mattern, F. (2004). Super-distributed RFID tag infrastructures. *Ambient Intelligence, Proceedings*, 3295, 1-12.
- Bosak, J. (1998). Media-independent publishing: Four myths about XML. *Computer*, 31(10), 120-122.
- Bosak, J., & Bray, T. (1999). XML and the second-generation. *Scientific American*, 280(5), 89-93.
- Brown, A., Johnston, S., & Kelly, K. (2003). *Using service-oriented architecture and component-based development to build Web service applications*: IBM Corporation.
- Caffery, J., & Stuber, G. L. (1998a). Subscriber location in CDMA cellular networks. *IEEE Transactions on Vehicular Technology*, 47(2), 406-416.
- Caffery, J. J., & Stuber, G. L. (1998b). Overview of radiolocation in CDMA cellular systems. *IEEE Communications Magazine*, 36(4), 38-45.
- Colan, M. (2004). *Service-oriented architecture expands the vision of Web services*: IBM Corporation.
- Czajkowski, K., Foster, I., Ferguson, D. F., Frey, J., Graham, S., Snelling, D., et al. (2004). *The ws-resource framework*. Retrieved from <http://www.globus.org/wsrf/specs/ws-wsrf.pdf>
- Dana, P. H. (1994). *GPS overview*. Department of Geography, University of Texas at Austin.
- Dao, D., Rizos, C., & Wang, J. (2002). Location-based services: Technical and business issues. *GPS Solutions*, 6(3), 169.
- Daoud, F., & Mohan, S. (2002). Strategies for provisioning and operating VHE services in multi-access networks. *IEEE Communications Magazine*, 40(1), 78.
- Devine, A., & Holmquist, S. (2001). *Mobile internet content providers and their business models*. The Royal Institute of Technology, Sweden.
- Di Fazio, A., Mocci, G., Rossini, E., D'Angelo, G., Lorelli, A., & Jarosh, A. (2004). Gauss satellite solution for location-based services. *International Journal of Satellite Communications and Networking*, 22(1), 55-85.
- Douglas, E. (2004). Indoor positioning system can track equipment and people. *Anesthesiology News*.
- Drane, C., Macnaughtan, M., & Scott, C. (1998). Positioning GSM telephones. *IEEE Communications Magazine*, 36(4), 46+.
- Ekahau. (2006). Ekahau Positioning Engine 3.1—Ekahau Site Calibration. Retrieved from <http://www.ekahau.com/>
- El-Rabbany, A. (2002). *Introduction to GPS: The global positioning system*. Boston: Artech House.

- Ellinger, F., Barras, D., & Jackel, H. (2002). Mobile phone market study. *TRLabs/IEEE Wireless 2002*. Retrieved from http://www.ife.ee.ethz.ch/~ellinger/Homepage/mp_rev.pdf
- EMILY. (2002). *Business models: EMILY (IST-2000-26040) Project*.
- Ericsson. *Mobile positioning system / mobile positioning protocol*. Ericsson.
- Erl, T. (2004). *Service-oriented architecture: A field guide to integrating XML and Web services*. Upper Saddle River, NJ: Prentice Hall Professional Technical Reference.
- Erl, T. (2005). *Service-oriented architecture: Concepts, technology, and design*. Upper Saddle River, NJ: Prentice Hall Professional Technical Reference.
- ETSI. (2006). *ETSI telecom standards*. Retrieved from <http://www.etsi.org/>
- Extensible markup language (XML). (n.d.). Retrieved from <http://www.w3.org/XML/>
- FCC. (2001). *FCC wireless 911 requirements*. FCC.
- Feng, J., Zhu, Y. L., Mukai, N., & Watanabe, T. (2005). Search on transportation network for location-based service. *Innovations in Applied Artificial Intelligence*, 3533, 657-666.
- Foster, I., Frey, J., Graham, S., Tuecke, S., Czajkowski, K., & Ferguson, D. F. (2004). *Modeling stateful resources with Web services*. Retrieved from <http://devresource.hp.com/drc/specifications/wsrif/ModelingState-1-1.pdf>
- Fritsch, L., & Scherner, T. (2005). A multilaterally secure, privacy-friendly location-based service for disaster management and civil protection. *Networking ICN 2005*, 2(3421), 1130-1137.
- Gajparia, A. S., Mitchell, C. J., & Yeun, C. Y. (2005). Supporting user privacy in location based services. *IEICE Transactions on Communications*, E88B(7), 2837-2847.
- Gamma, E. (1995). *Design patterns: Elements of reusable object-oriented software*. Reading, MA: Addison-Wesley.
- GARMIN. (n.d.). *GPS guide for beginners*. Retrieved from <http://www.garmin.com/about-GPS/manual.html>
- Grajski, K. A., & Kirk, E. (2003). Towards a mobile multimedia age—location-based services: A case study. *Wireless Personal Communications*, 26(2-3), 105-116.
- Gratsias, K., Frentzos, E., Delis, V., & Theodoridis, Y. (2005). Towards a taxonomy of location based services. *Web and Wireless Geographical Information Systems, Proceedings*, 3833, 19-30.
- Gruber, H. (2005). *The economics of mobile telecommunications*. New York: Cambridge University Press.
- Gruber, H., & Verboven, F. (2001). The diffusion of mobile telecommunications services in the european union. *European Economic Review*, 45(3), 588.
- GSM. (2002). *Location based services*. Retrieved from <http://www.gsmworld.com/documents/lbs/se23.pdf>
- GSM. (2003). *MMS interworking guidelines*. Retrieved from <http://www.gsmworld.com/documents/ireg/ir52310.pdf>
- Halonon, T., Romero, J., & Melero, J. (2003). *GSM, GPRS, and EDGE performance: Evolution towards 3G/UMTS* (2nd ed.). Chichester, West Sussex, UK; Hoboken, NJ: J. Wiley.
- Heijden, M. v. d., & Taylor, M. (2000). *Understanding wap: Wireless applications, devices, and services*. Boston: Artech House.
- Hightower, J., & Borriello, G. (2001). Location systems for ubiquitous computing. *Computer*, 34(8), 57+.

- Holma, H., & Toskala, A. (2004). *Wcdma for UMTS: Radio access for third generation mobile communications* (3rd ed.). Hoboken, NJ: J. Wiley & Sons.
- Huber, A. J., & Huber, J. F. (2002). *UMTS and mobile computing*. Boston: Artech House.
- IST-REPOSIT. (2001). Real time dynamic bandwidth optimisation in satellite networks. *IST*. EU.
- IST-TONIC. (2000). Technoeconomics of IP optimised networks and services. *IST*. EU.
- Iwasaki, Y., Kawaguchi, N., & Inagaki, Y. (2005). Azim: Direction-based service system for both indoors and outdoors. *IEICE Transactions on Communications, E88B*(3), 1034-1044.
- Kaarainen, H. (2005). *UMTS networks: Architecture, mobility, and services* (2nd ed.). Chichester, West Sussex, UK; Hoboken, NJ: J. Wiley & Sons.
- Kakaletris, G., Varoutas, D., Katsianis, D., Sphicopoulos, T., & Kouvas, G. (2004). Designing and implementing an open infrastructure for location-based, tourism-related content delivery. *Wireless Personal Communications, 30*(2-4), 153-165.
- Karagiozidis, M., Markoulidakis, Y., Velentzas, S., & Kauranne, T. (2003). Commercial use of mobile, personalised location-based services. *Journal of the Communications Network, 2*, 15-20.
- Katsianis, D., Welling, I., Ylonen, M., Varoutas, D., Sphicopoulos, T., Elnegaard, N. K., et al. (2001). The financial perspective of the mobile networks in europe. *IEEE Personal Communications [see also IEEE Wireless Communications]*, 8(6), 58-64.
- Kim, J. W., Kim, C.S., Gautam, A., & Lee, Y. (2005). Location-based tour guide system using mobile gis and Web crawling. *Web and Wireless Geographical Information Systems, 3428*, 51-63.
- Korhonen, J., Aalto, O., Gurtov, A., & Lamanen, H. (2001). *Measured performance of GSM, HSCSD and GPRS*. Paper presented at the IEEE International Conference on Communications (ICC'01).
- Koutsopoulou, M., Panagiotakis, S., Alonistioti, A., & Kaloxylas, A. (2005). Customised billing for location-based services. *Distributed Applications and Interoperable Systems, 3543*, 27-37.
- Kozak, B. (2002). *Macromedia flash MX freehand 10: Advanced training from the source*. Berkeley, CA: Macromedia Press.
- Laitinen, H. (2001). *Cellular location techniques*. Paper presented at the MLW.
- Lee, Y., Prabhu, N., & Park, E. K. (2002). Middleware for location based information services in mobile environment. *Developing and Infrastructure for Mobile and Wireless Systems, 2538*, 173-182.
- LIF-IOT. (2002). *Location services (LCS) interoperability test (IOT) specification in GSM*. Location Interoperability Forum (LIF), Interoperability Testing Group.
- Lin, J. Y.-B., & Chlamtac, I. (2001). *Wireless and mobile network architectures*. New York: Wiley.
- LoVEUS. (2002). *User requirements of the LoVEUS system* (LoVEUS IST-2000-30155).
- Ludden, B. (2000). *Location technology*. Vodafone.
- M-Guide. (2002). *User needs—market analysis* (Deliverable D2.1).
- Mao, Z., & Douligeris, C. (2000). A location-based mobility tracking scheme for pcs networks. *Computer Communications, 23*(18), 1729-1739.
- Microsoft. (n.d.). *Microsoft .Net compact framework 2.0*, Retrieved from <http://msdn.microsoft.com/mobility/netcf/>

- Miller, B. A., & Bisdikian, C. (2002). *Bluetooth revealed* (2nd ed.). Upper Saddle River, NJ: Prentice Hall PTR.
- Morrow, R. (2002). *Bluetooth operation and use*. New York: McGraw-Hill.
- Mouly, M., & Pautet, M. B. (1995). Current evolution of the GSM systems. *IEEE Personal Communications*, 2(5), 9-19.
- Moureu L. (2000), Impact of location-based services on the mobility market. *Alcatel Telecommunications Review 2nd Quarter 2000*.
- Muller, N. J. (2001). *Bluetooth demystified*. New York: McGraw-Hill.
- Muller, N. J. (2003). *WiFi for the enterprise*. New York: McGraw-Hill.
- Nellen, P. M., Bronnimann, R., Held, M., & Sennhauser, U. (2004). Long-term monitoring of polarization-mode dispersion of aerial optical cables with respect to line availability. *Journal of Lightwave Technology*, 22(8), 1848-1855.
- Newcomer, E., & Lomow, G. (2005). *Understanding soa with Web services*. Upper Saddle River, NJ: Addison-Wesley.
- Northstream. (2001). *Location based services: Considerations and challenges*. Retrieved from <http://www.northstream.se>
- OGS. (n.d.). *Opengis location services, open geospatial consortium*. Retrieved from <http://www.opengeospatial.org/functional/?page=ols>
- OMA. (2002). *Mobile location protocol, location working group*: Open Mobile Alliance.
- OTC. (n.d.). *Open tourism consortium*. Retrieved from <http://www.opentourism.org/>
- Pahlavan, K., & Krishnamurthy, P. (2002). *Principles of wireless networks: A unified approach*. Upper Saddle River, NJ: Prentice Hall PTR.
- Pateli, A. G., Giaglis, G. M., & Spinellis, D. D. (2005). Trial evaluation of wireless info-communication and indoor location-based services in exhibition shows. *Advances in Informatics, Proceedings*, 3746, 199-210.
- Patil, B. (2003). *IP in wireless networks*. Upper Saddle River, NJ: Prentice Hall Professional Technical Reference.
- Prasad, R., & Ruggieri, M. (2005). *Applied satellite navigation using GPS, Galileo, and augmentation systems*. Boston: Artech House.
- Rao, B., & Minakakis, L. (2003). Evolution of mobile location-based services. *Communications of the Acm*, 46(12), 61-65.
- Reed, J. H., Krizman, K. J., Woerner, B. D., & Rappaport, T. S. (1998). An overview of the challenges and progress in meeting the e-911 requirement for location service. *IEEE Communications Magazine*, 36(4), 30-37.
- Rysavy, P. (2005). *Data capabilities: GPRS to HSDPA and beyond*. Retrieved from http://www.3gamericas.org/pdfs/rysavy_data_sept2005.pdf
- Schmid, A., Neubauer, A., Ehm, H., Weigel, R., Lemke, N., Heinrichs, G., et al. (2005). Combined Galileo/GPS architecture for enhanced sensitivity reception. *Aeu-International Journal of Electronics and Communications*, 59(5), 297-306.
- Searle, M. (2001). *Location base services*. Paper presented at the InSig.
- Smith, R. J. (2003). *WiFi home networking*. New York: McGraw-Hill.
- SnapTrack. (2001). *Location technologies for GSM, GPRS and WCDMA networks*. White paper.
- Snell, J., Tidwell, D., & Kulchenko, P. (2002). *Programming Web services with soap* (1st ed.). Sebastopol, CA: O'Reilly & Associates.

- Soppera, A., & Burbridge, T. (2005). Wireless identification: Privacy and security. *Bt Technology Journal*, 23(4), 54-64.
- Sparacino, F. (2002). *The museum wearable: Real-time sensor-driven understanding of visitors' interests for personalized visually-augmented museum experiences*. Paper presented at the Museums and the Web.
- Spirito, M. A. (2001). On the accuracy of cellular mobile station location estimation. *IEEE Transactions on Vehicular Technology*, 50(3), 674-685.
- Spratt, M. (2003). An overview of positioning by diffusion. *Wireless Networks*, 9(6), 565-574.
- Staab, S., & Werthner, H. (2002). Intelligent systems for tourism. *IEEE Intelligent Systems*, 17(6), 53-55.
- SUN. (n.d.). *Java 2 platform, micro edition (j2me)*. Retrieved from <http://java.sun.com/j2me/>
- Tarumi, H., Morishita, K., & Kambayashi, Y. (2000). Public applications of spacetag and their impacts. *Digital Cities, 1765*, 350-363.
- Taylor, J. H., & Ryan, J. (1995). Museums and galleries on the internet. *Internet Research-Electronic Networking Applications and Policy*, 5(1), 80+.
- 3GPP. (2002). *3rd Generation Partnership Project—3GPP*. Retrieved from <http://www.3gpp.org/>
- Tisal, J. (2001). *The GSM network: GPRS evolution: One step towards UMTS* (2nd ed.). Chichester; New York: J. Wiley.
- TourML. (2003). *TourML*. Retrieved from <http://www.tourml.org/>
- UDDI. (2004). *Enabling service-oriented architecture*, Retrieved from <http://www.uddi.org/>
- UMTS. (n.d.). *The UMTS forum*. Retrieved from <http://www.umts-forum.org/>
- Varoutas, D., Katsianis, D., Sphicopoulos, T., Cerboni, A., Kalhagen, K. O., Stordahl, K., et al. (2002, June 16-19). *3G MVNOs financial perspectives*. Paper presented at the IST Mobile and Wireless Telecommunications Summit, Thessaloniki, Greece.
- Varoutas, D., Katsianis, D., Sphicopoulos, T., Loizillon, F., Kalhagen, K. O., Stordahl, K., et al. (2003). Business opportunities through UMTS—WLAN networks. *Annales Des Telecommunications-Annals of Telecommunications*, 58(3-4), 553-575.
- Varoutas, D., Katsianis, D., Sphicopoulos, T., Stordahl, K., & Welling, I. (2006). On the economics of 3G mobile virtual network operators (MVNOs). *Wireless Personal Communications*, 36(2), 129-142.
- W3C. (2001). *The Semantic Web*. Retrieved from <http://www.w3.org/2001/sw/>
- Wang, Y., Jia, X., Lee, H. K., & Li, G. Y. (2003). *An indoors wireless positioning system based on wireless local area network infrastructure*. Paper presented at the SatNav 2003, the 6th International Symposium on Satellite Navigation Technology Including Mobile Positioning & Location Services, Australia.
- Xiao, Y., & Pan, Y. (2005). *Wireless lans and bluetooth*. New York: Nova Science Publishers.
- Yan, X. (2004). 3G licensing in Hong Kong: The debate. *Telecommunications Policy*, 28(2), 213-226.
- Yilin, Z. (2000). Mobile phone location determination and its impact on intelligent transportation systems. *IEEE Transactions on Intelligent Transportation Systems*, 1(1), 55.
- Zhao, Y. L. (2002). Standardization of mobile phone positioning for 3G systems. *IEEE Communications Magazine*, 40(7), 108-116.
- Zimmermann, A., Lorenz, A., & Specht, M. (2003). User modeling in adaptive audio-augmented museum environments. *User Modeling 2003, Proceedings*, 2702, 403-407.

ENDNOTES

- ¹ Being redefined for the electronic era.
- ² 2nd generation (2G) of mobile telephony is widely known as GSM, while the term 2.5G is used for the 2G networks with data and Internet access capabilities mainly based on GPRS.
- ³ The 3rd generation of mobile telephony is mainly known as UMTS.
- ⁴ Also labelled as “operator” when no ambiguity is introduced.
- ⁵ Speed might vary upon device capabilities, reception quality, network load, and so forth.
- ⁶ International Telecommunication Union whose standardisation sector is ITU-T, known as CCITT up to 1993 (CCITT originates back to 1865).
- ⁷ Performance highly varies upon network load, infrastructure specifications, reception and mobile equipment capabilities.
- ⁸ Nominal speed varies from 11 (802.11b) to 108Mbps (Super-G).
- ⁹ The time required for a signal (or minimal data element) to be send by the source, transmitted back by the target and received back at the source.
- ¹⁰ Outdoors WLAN access is becoming more and more popular since year 2005.
- ¹¹ Basic geographical information systems are data repositories that offer storage and retrieval facilities suited to the type of information in focus (geospatial) accompanied by appropriate management and visualisation tools.
- ¹² Source: Derived from Searle (2001)
- ¹³ Source: Derived from Searle (2001)
- ¹⁴ There are cases that content might be pre-installed on a device.
- ¹⁵ The XSL Formatting Objects (XSL-FO) vocabulary is designed in order to facilitate content display on a wide variety of media such as screen, paper, or even voice.
- ¹⁶ Mark-up language technologically similar with HTML for use with WAP and 2G/2.5G Web-enabled mobile phones.
- ¹⁷ In advance downloading of the content to the mobile device and consequently displaying it to the tourist by utilizing combined user-interaction and equipment (such as a GPS device) provided information.
- ¹⁸ Flash technology (introduced by MacroMedia Inc. in 1996) is mainly used for creating interactive multimedia presentations on the Web.
- ¹⁹ 3GP is a format defined by 3GPP as a simplified version of MPEG-4 Part 14 for multimedia objects exchange and playback on 3G mobile phones.
- ²⁰ Development effort required to achieve systems’ inter-working when no sufficient configuration/customisation capabilities exist in the involved software entities.
- ²¹ Special concerns apply to this assumption.
- ²² An initially European standardisation organisation, currently named as ECMA International.
- ²³ The UDDI registry is essentially a “yellow pages” like service for locating Web services capable of serving a particular request.
- ²⁴ The term has been proposed by Antti Damski, Adaptia Ltd. in M-GUIDE Project (M-Guide, 2002)
- ²⁵ A markup language of similar technology to HTML that allows display and playback of interactive multimedia content adding special features for synchronisation/presentation, partially supported by some of the well-known Web browsers.
- ²⁶ The solution has been developed and tested as part of the M-Guide Project, which has been partially funded project by EU under the eContent initiative, during 2002-2004.

APPENDIX: ACRONYMS

| Acronym | Description |
|---------|--|
| 2 G | 2 nd generation mobile telephony (e.g., GSM) |
| 2.5 G | 2 nd generation mobile telephony (e.g., GSM + GPRS) |
| 3GPP | 3G Partnership Project |
| A-GPS | assisted GPS |
| AOA | angle of arrival |
| ASP | application service provider |
| B2B | business to business |
| B2C | business to client |
| BS | base station |
| BTS | base transceiver station |
| CCITT | International Telegraph and Telephone Consultative Committee |
| CDMA | code division multiple access |
| CMS | content management system |
| COO | cell of origin |
| CSS | cascading stylesheet |
| DHTML | Dynamic HTML |
| ECMA | European Computer Manufacturers Association |
| EDGE | enhanced data GSM environment |
| E-OTD | enhanced observed time difference |
| GIS | geographical information system |
| GMLC | gateway mobile location center |
| GPRS | general packer radio service |
| GPS | global positioning system |
| GSM | global system for mobile communication |
| HSCSD | high speed circuit switched data |
| HSDPA | high-speed downlink packet access |
| HTML | Hypertext Markup Language |
| HTTP | hypertext transfer protocol |
| ICT | information and telecommunication technology |
| IEEE | Institute of Electrical and Electronics Engineers |
| IP | Internet protocol |
| IR | infrared |
| IS | information systems |
| IT | information technology |

continued on following page

APPENDIX: ACRONYMS CONTINUED

| | |
|--------|---|
| ITU | International Telecommunication Union |
| JPEG | Joint Photographic Experts Group' |
| LAN | local area network |
| LBS | location-based services |
| LIF | location interoperability forum |
| LMU | location measurement unit |
| ME | mobile equipment |
| MLP | mobile location protocol |
| MMS | multimedia messaging service |
| MNO | mobile network operator |
| MPC | mobile positioning center |
| MPEG | Motion Picture Expert Group |
| MPP | mobile positioning protocol |
| MSID | mobile subscriber ID |
| NAT | network address translation |
| OMA | Open Mobile Alliance |
| OpenLS | OpenGIS location services |
| PDA | personal data assistant |
| QoS | quality of service |
| RDF | resource description framework |
| RF | radio frequency |
| RTT | round trip time |
| SAP | service access point |
| SMS | short message system |
| SOA | service oriented architecture |
| SOAP | simple object access protocol |
| TA | timing advance |
| TCP | transport control protocol |
| TDMA | time division multiple access |
| TOA | time of arrival |
| UDDI | universal description, discovery, and integration |
| UMTS | universal mobile telecommunications system |
| URI | uniform resource identifiers |
| URL | uniform resource locator |
| W3C | World Wide Web Consortium |
| WAG | wireless application gateway |
| WAN | wide area network |
| WAP | wireless access protocol |

continued on following page

APPENDIX: ACRONYMS CONTINUED

| | |
|--------|---|
| WCDMA | wideband CDMA |
| WiFi | wireless fidelity, any type of 802.11xx network |
| WLAN | wireless LAN |
| WML | Wireless Markup Language |
| WSRF | Web services resource framework |
| XLS | XML for location services |
| XML | eXtensible Markup Language |
| XSL | eXtensible Stylesheet Language |
| XSL-FO | XSL formatting objects |
| XSLT | XSL transformation |

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper, pp. 114-161, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.31

Collaborative Commerce and the Hotel Industry

Michelle Rowe

Edith Cowan University, Australia

Alfred Ogle

Edith Cowan University, Australia

ABSTRACT

This chapter proposes a framework to consider the application of collaborative commerce (c-commerce) in the hotel industry. C-commerce and some general characteristics of the hotel industry are examined, followed by a discussion on the likelihood of c-commerce adoption by hotels. A case study of two five-star hotels located in Perth, Western Australia is considered in light of the framework. Corporate structure, information technology (IT) and its importance to organisation strategy, the role and attitudes of the general manager of each hotel to IT as well as the social identity of the hotel to c-commerce emerge as issues critical to c-commerce. This area of study is in its infancy and further research is required to more fully consider the issues.

INTRODUCTION

Hoteliers are notoriously secretive and have been reluctant to share information and ideas with others, especially their rivals, due to a “fear of information leakage” (Chung, Oh, Kim, & Han, 2004, p. 429). This paranoia manifests itself in the dearth of literature on strategic alliances in the lodging sector (Dev & Klein, 1993). But what if hoteliers saw themselves in a different light—sharing information and ideas—from a perspective of co-opetition (competitive co-operation) or collaboration? This chapter poses this question and probes the likelihood of hotels seeing themselves in this light. This issue will be considered in the context of collaborative commerce which will firstly be defined and explained.

Collaborative commerce (c-commerce) is the use of Internet-based technology that promotes

collaboration in business. The emergence of c-commerce reflects a shift of focus to relationships between firms, not just transactions (Sheth, 1996). Network behaviour, which underpins inter-organisational relationships, is of interest to tourism and hospitality operators. The premise behind the formation of networks is the realisation that a single organisation is incapable or unwilling to cope with environmental conditions (Cravens, Shipp, & Cravens, 1993) and does not possess the skills and expertise needed to compete in that environment.

This chapter overviews the concept of c-commerce and investigates the relevance of this concept to the hotel industry generally by way of a case study of two five-star rated hotels located in Perth, Australia. Although collaborative strategies of international hotel chains have been explored (Fyall & Spyriadis, 2003), the authors seek to investigate the phenomenon with respect to a framework that considers c-commerce and its antecedents. To understand factors necessary for and to explain adoption of c-commerce, the domains of MIS, management and an industry perspective are all relevant—hence a multidisciplinary approach is taken.

The influence of the manager and ownership structure of the hotel are thought to be important factors in the adoption of c-commerce. Using case studies of Perth hotels, the chapter also raises the questions of what motivates general managers (GMs) to enter into relationships with competitors, the nature and extent of these relationships and the role of information technology (IT) within the organisation and in such relationships. These issues have not been widely researched, however, and are considered here.

WHAT IS C-COMMERCE?

C-commerce is the use of technology, especially Internet-based technology, that promotes collaboration amongst businesses. It consists of all of an

organisation's IT bases, knowledge management and business interactions with its customers, suppliers and partners in the business communities in which it interacts (Gartner Group, 1999; McCarthy, 1999). C-commerce can occur horizontally involving co-opetition, being a sharing of resources and information amongst competitors, or vertically along a supply chain.

C-commerce is the coming together of firms, including competitors, to exploit opportunities that arise. As global competition intensifies many organisations are forming partnerships as an expeditious way to keep up or to access unique or "pioneering" resources (Ring & Van de Ven, 1992, 1994). As stated, collaboration around IT is a response to an increasingly complex and dynamic market (Cravens et al., 1993). Increasingly it is argued that firms, especially small and medium enterprises (SMEs) must enter into such partnerships to survive in globalised marketplaces. Most tourism enterprises worldwide fall into the SME category and are known as small and medium tourism enterprises (SMTEs) (Buhalis, 1996).

What are the Benefits of C-Commerce?

C-commerce is concerned with obtaining sustainable competitive advantage from the maximisation of value adding benefits obtained by working collaboratively with others via IT. The adoption of IT has been identified as a possible source of strategic competitive advantage (Yetton, Johnston & Craig, 1994) as well as a potential generator of innovation resulting in further competitive advantage (Ryssel, Ritter & Germunden, 2004).

C-commerce enables firms to "grow" their assets and access markets (Bitici, Martinez, Albores, & Parung, 2004; Ring & Van de Ven, 1992). Internal efficiencies can be generated by the sharing of information via IT within inter-organisational relationships (IOR) (Ryssel et al., 2004). It can be argued that collaborative enterprises or networks "create new and unique value propositions by

complementing, integrating and leveraging each other's capabilities and competencies" (Dyer & Singh, 1998, p. 676). IT/ICT are critical drivers of integration and cooperation since they enable businesses to integrate activities and functions otherwise not possible (Joo, 2002).

Collaboration generates "relational rents" or "supernormal profits jointly generated in an exchange relationship" (Dyer & Singh, 1998, p. 662) that cannot be achieved individually. These authors contend that the competitive advantage of these partnerships requires the presence of four factors: relation-specific assets, knowledge-sharing routines, complementary resource endowments, and effective governance. For these relational rents or benefits to arise these elements are required. Often the question is if they are in place. Firms need to adopt a different approach to strategic planning and management to allow the creation of networks and associated infrastructure based on shared resources with other organisations (Chi & Holsapple, 2005). This requires strategic thinking, trust and a realization of the importance of co-opting rather than competition which typically exists amongst individual firms. Again these issues need to be considered generally and specially in relation to the hotel industry.

The Hotel Industry

When considering the adoption of c-commerce, the industry context needs to be borne in mind. The ownership and corporate structure as well as management of the hotel, including the expertise, perceptions and influence of the GM and the role of IT in the property or chain are important factors influencing c-commerce adoption.

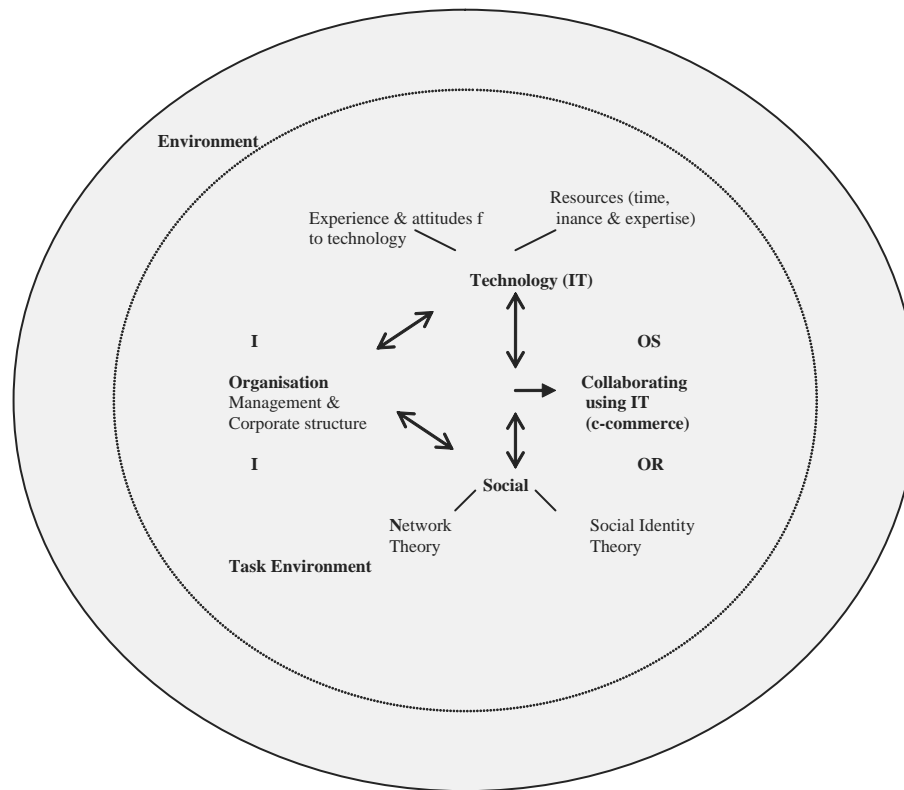
Inter-organisational systems (IOS), of which c-commerce is one type (see Chi & Holsapple (2005) for a more complete discussion), have been facilitated by electronic commerce. The tourist industry was one of the first industries to adopt information and communication technologies (ICT) (Garzotto, Paolini, Speroni, Proll, Retsch-

itzegger, & Schwinger, 2004).

In the past, electronic data interchange (EDI) and electronic funds transfer (EFT) have been the technologies to enter into IOS. The standards required for EDI and its high set up costs have tended to act as a barrier for SMTEs to enter into IOS. This potentially is overcome by the Internet. It is possible for hotels to take advantage of the Web via collaboration around the net as a way to deal with excess capacity and increase occupancy rates quickly. This is the case within many chains as the role of online intermediaries has expanded dramatically, especially since 9/11 (Starkov, 2002). Individual hotels are better able to compete in an increasingly dynamic marketplace via the exploitation of the advantages of the Web (Grover, Teng & Fiedler, 2002) as evident in the widespread participation in "distressed Web sites" such as needitnow.com, Travelocity.com; wotif.com and participation in innovative distribution services such as auctions and disintermediation (Connolly, 2000).

Chains of hotels generally have in place integration of the property management system (PMS) with the corporate central reservation system (CRS) and global distribution system (GDS) systems although in the past SMTEs appeared to have been under-represented in most mainstream CRS and GDS (Go, 1992). CRS integration allows for individual properties to benefit from the extensive reach of the chains marketing network and to allow for cross selling amongst properties within the chain. A view held in the late 90s was that via seamless distributions channels, untapped opportunities could be availed to firms (Stern & Weitz, 1997). That view is validated with Internet-enabled GDS integration that allows chain properties to extend their reach beyond that of their chain marketing network whilst simplifying and streamlining the booking process, thereby enhancing customer service (Connolly, 2000) and creating competitive advantage. In some instances independent or non-chain properties subscribe to a non-affiliate reservation network which enables

Figure 1. Holistic view of the factors necessary for c-commerce adoption



independent operators to obtain many of the benefits enjoyed by chain-affiliated operators (Kasavana & Brooks, 2001). This interoperability of systems is an example of c-commerce, especially the CRS which has been the most commonly used wide area network (WAN) application in hotels (Brooks, 1999). However, GDS provide hotel bookings only for major hotel chains (Dogac, Kabak., Laleci, Sinir, Yildiz, Kirbas, & Gurcan, 2004)—excluding small independent operators. Web service technology would overcome the advantage afforded to top tier players, however this is beyond the scope of this chapter.

What about sharing of information between rivals in a location? Is this likely? Given that many hotels are part of a chain, interoperable systems are in place which facilitates the flow of information within the organisation. This may

mean individual hotels do not need to collaborate with hotels in situ. Where strong information flows occur within the organisation (effectively c-commerce between hotels making up the chain) the need for and hence adoption of c-commerce between competitors in one location is negligible and may not be necessary.

Factors Considered Critical to C-Commerce Adoption

A review of the literature concerning c-commerce, IT, and inter-organisational theories as well as from the hotel industry perspective has been undertaken. In summary, c-commerce requires firms to develop a strategy, both short and long term; adopt appropriate business models; develop and sustain appropriate collaborative cultures engendering trust; invest in

IT to facilitate information and knowledge sharing; and set in place appropriate organisational structures to enable collaboration (Kalakota & Robinson, 1999).

A framework depicting critical factors underlying c-commerce adoption is set out in Figure 1. The nature of management and management's attitudes to IT and risk taking as well as the corporate structure of the hotel are important factors shaping attitudes towards c-commerce. To understand networking or the c-commerce relationship, consideration needs to be given to two broad groups of theories: network or inter-organisational relationships theory and social identity theory.

DISCUSSION OF PROPOSED FRAMEWORK

Organisation

Decisions to adopt IT are made by management. This can either reflect corporate policy, as is the case for chains, or, where management is autonomous such as is the case for independents, organisational decisions. Attitudes to and experiences of management tend to influence subsequent decisions and predispositions (particularly from the perspective of traditional decision making techniques—see Fulop, Linstead, Lilley, & Clarke, 2004) and this is the case with respect to IT.

Issues concerning ownership, management structure and degree of centralisation of decision making, including IT, come into play here and influence attitudes to IT and collaboration. These are important to the hotel industry as discussed.

Technology (IT)

Firms make IT decisions either to generate cost savings or to enable a value added strategy to be pursued. Cost savings tend to be the strategy adopted where IT is peripheral to the business and

where management's experience of IT is limited. The concern is for efficiency and systems to be in place to help achieve this. A value added strategy is appropriate (Levy, Powell, & Yetton, 2001) due to strategic necessity or where management is seeking growth and understands the connection between IS and added value.

C-commerce requires a strategic decision to invest in and collaborate around IT with others. Without a strategic view of IT c-commerce cannot arise and certainly would not be considered. Where a strategic view of IT is adopted the benefits flowing from investments in IT (including c-commerce) are likely to add value and generate potential competitive advantage as discussed earlier in this chapter. Responsiveness to the market and latest technologies available which customers may demand could be a driver for IT adoption. In such case IT is seen to provide a "strategic opportunity" to improve business performance and potentially generate competitive advantage rather than merely be an operational tool to increase efficiency.

Resources

Resource based theory of the firm (Caldeira & Ward, 2003; Feeny & Willcocks, 1998) suggests that firms are characterised by a set of competencies or skills and capabilities that are important to enable it to achieve a sustainable competitive advantage. IT is part of that resources set. Important to c-commerce is the availability of resources dedicated to its implementation and also to adaptation of systems with "partners." These resources include time to plan and focus on future directions, rather than operational issues, financial resources to invest in software and hardware, and expertise of management, IT advisors or an IT "champion." SMEs have limited resources and generally do not possess the technical know how or resources to, for example, maintain effective Web sites (Gonzales, 2004). A coming together or collaboration is a means to overcome such limitations as access

to scarce resources, including skills, information and knowledge is facilitated (Macpherson, Jones, Zhang, & Wilson, 2003).

Social Network Theory

Network theory refers to cooperative IORs that include strategic alliances, partnerships, coalitions, joint ventures, franchises, network organizations and c-commerce. A variety of motivations underpins the formation of cooperative relationships such as access to new technology, markets, development of economies of scale and complementarity of skills as well as risk sharing (Powell, 1987; Ring & Van de Ven, 1992).

The literature indicates that IT is not the driver underlying c-commerce, rather relationships precede any collaboration around IT (O'Keefe, 2001). This indicates social bonds should be created first before c-commerce is possible. The development of informal connections via networking is critical to subsequent c-commerce. Some assert that once a relationship exists the use of IT within that relationship encourages a commitment to the relationship, thereby enhancing the relationship (Grover et al., 2002).

Without the cultivation of relationships, firms are not able to capture the full value of technology (O'Keefe, 2001). Such a coming together will only occur if the shared benefits are acknowledged and are deemed to be worthwhile. Perceptions of these benefits and a willingness to engage in c-commerce are influenced by attitudes to and experience of IT as well as the availability of resources able to be dedicated to c-commerce.

Whilst technology is central to c-commerce, it is the willingness to share information rather than the technology per se that potentially can constrain the relationship (Mason, Castleman & Parker, 2004; O'Keefe, 2001). Attitudes to knowledge and the willingness to share information with others are critical. Knowledge is seen as a source of competitive advantage. The sharing of this knowledge though potentially undermines

this advantage since the knowledge gained by cooperation may be used for competition (Levy et al., 2001). This can only be overcome through the generation of trust, commitment to the relationship and an agreement to not act opportunistically, enforced by endogenous systems agreed and adhered to.

Participants in networks are likely to be entrepreneurial in nature—identifying opportunities, mobilising resources, and looking beyond resource limitations. This requires a boundary spanning approach—a willingness to interact with others “outside the organisation so as to obtain valuable information from the task and general environment” (Jones & George, 2003, p.173). Entrepreneurs are more likely to boundary span and network as they recognise the benefits in sharing ideas and information with participants either in similar or different industries. It is a contention of the authors that participants in networks and c-commerce are more likely to be entrepreneurial firms that are growing (Chell & Baines, 2000).

Table 1 summarises factors that are considered to be important to the adoption of c-commerce from a network theory/IOR perspective. Some factors pertain to the individual organisation whilst others relate to the dynamics and interaction between the potential partners and often develop over time as negotiations unfold.

Trust is identified as a critical factor to collaboration—without it there can be only limited mutual obligation between cooperating partners. Trust is a prerequisite for knowledge sharing and is fundamental to the question “to collaborate or not to collaborate.” Whilst trust is difficult to achieve, it is possibly the most crucial aspect for success (O'Keefe, 2001) and is a precursor to commitment (Morgan & Hunt, 1994).

The concept of inter-firm adaptation has been considered in extensive research into IORs (Brennan, Turnbull, & Wilson, 2003). Adaptation (Hallen, Johnson, & Sayed-Mohammed, 1991) is a central feature of a working business

Table 1. Summary of main factors necessary for collaborative IORs/c-commerce

| Factors pertaining to individual organisation | Factors pertaining to interaction of potential partners |
|--|--|
| <ul style="list-style-type: none"> • Commitment and trust • Adaptation • Level of investment in IT within the firm and level of Enterprise Application Integration • Network competence • Willingness to share information/enter into relationship (trust) • Willingness to behave in fair/equitable manner (trust) • Motivation behind co-opting • Personality/values/beliefs of proprietor • Organisation culture/collaborative culture • Reliance on trust/endogenous systems • Goals/vision, for example, growth • Growth of the SME | <ul style="list-style-type: none"> • Commitment and trust • Adaptation • Congruency • Track record with partner (trust) • Motivation behind co-opting • Reliance on trust/endogenous systems • Goals/vision, for example, growth • Interaction/dynamics and negotiations between parties |

relationship. It requires combined investment by both parties to the relationship, especially to shared IT systems in the case of c-commerce. This creates durable economic bonds between the partners. The willingness to adapt behaviour or to be flexible, for example, via adaptation to overcome difficulties experienced in an IOR, is important in generating trust.

Whilst trust and commitment and other characteristics depicting relationship quality are necessary for c-commerce, the lack of participation in collaborative ventures may reflect a weaker identification with social groups outside the organisation. This is what social identity theory argues.

Social Identity Theory

Social identity theory (Tajfel & Turner, 1979) identified the importance of the social self which contrasts with the individual self. Cooperation

(Kramer, 1993) with other decision makers, and so willingness and propensity to enter into c-commerce, is a function of the strength of one’s personal identity viz that of a collective identity. When personal identities are salient, the focus is on personal goals and outcomes. For cooperation with others to occur then, the salience of one’s collective identity needs to transcend one’s personal identity. Motives of decision makers are more complex than ego (Axelrod, 1984; Kramer, 1993), with self-interest being one variable explaining cooperation. This has implications for c-commerce adoption in that the benefits of collaboration and the importance of a collective view preceding such cooperation need to be considered.

This is supported by other authors (Terry, 2003) who assert that individuals seek to improve their social identity and are motivated to belong to high status groups. This has implications for establishing c-commerce.

Consideration Regarding the Hotel Industry

A number of these issues are now considered in relation to the hotel industry. The hotel industry is characterised by corporations or chains and independent operators. The benefits from c-commerce are considered to be greater for independents since they tend not to have the critical mass associated with top tier players (i.e., chains) and because they do not have in place strong collaborative arrangements, which exist internally within chains.

Interoperable systems already exist in chains, but do not exist amongst independents. Independents appear to resort to subscription to affiliate reservation networks that allow non-chain properties to participate as overflow facilities (Kasavana & Brooks, 2001) rather than network amongst themselves. This reliance on existing intermediaries potentially may be a barrier to c-commerce adoption. However it presents itself as a way for “independents to maintain their individuality and distinctive methodology, while still benefiting from the economies of scale that an affiliation with a larger group of like-minded properties can offer” (Travel Impact Newswire, 2004).

Where a hotel is owner managed and therefore has greater autonomy to determine policy, the GM is more likely think strategically and boundary span and so consider collaboration and initiate relationships fundamental to c-commerce. C-commerce though requires interoperable systems and the development of relationships, so may evolve over time, reflecting a typology of IOS developed elsewhere (Chi & Holsapple, 2005). Softwares that are available to facilitate such sharing of information as well as the Internet and the semantic Web are means by which this difficulty can be overcome. These issues fall outside of the scope of this chapter.

In relation to issues of size and resources, while medium sized hotels may *prima facie* employ more than 200 employees (the upper limit of medium enterprise in Australia) (Australian

Bureau of Statistics, 2002) according to full time staff equivalent figures (FTSE) many fall into the category of a medium size employer. However, the context of the hotel in relation to an international corporation needs to be considered. Secondly, whilst many hotels use IT in a comprehensive and integrated manner in their operations and indeed within the chain (if this is relevant), much of its application is operational rather than strategic in nature.

CASE STUDY

Many of the issues discussed can be illustrated by the experience of two five star hotels located in Perth, the capital city of Western Australia.

Hotel A is a franchisee of a world renowned chain of hotels, the reputation of the chain and the brand generating its competitive advantage. There is a reliance on corporate policy and IT decision making. Built in 1973, this purpose built CBD hotel has 390 rooms and overlooks the scenic Swan River. Its target market is corporate clientele. Around 70% of its guests are domestic corporates and 10% are international corporates. The international name and its acclaimed loyalty program make this hotel more attractive to international corporates compared to regional chain or independents.

The GM is an industry veteran with 35 years industry experience, with 20 of those years employed in this hotel chain. Commencing as a bartender, he progressed into food and beverage management and then engaged in hotel general management.

Thirty-six percent of room bookings are made via chain-related reservation channels with corporate systems critical to the operation of this hotel. Decisions regarding IT are centralised and little autonomy is given to the GM in this regard. The GM saw IT as being ancillary to strategy and perceived it as being a tool to increase efficiency of the business. This reflects the centralised ap-

proach taken by the hotel towards IT and the longstanding position this GM has had within this chain. Whilst the future application of IT such as self check-in and check-out is recognised, since people and personalised service are at the heart of the business, such technologies are not likely to become reality. Certainly any decision in this area would be made at the Head Office level.

The nature of the corporate structure means that intra-chain networking is critical with a substantial reliance on integration with sister hotels in terms of room reservations. Interoperable systems exist in-house and thus between hotels, with systems determined by the corporation rather than by individual hotels.

This hotel relies on formal networks via Australian Hotels Association (AHA) rather than initiating relationships with external organisations. There is a willingness to participate in the industry practice of sharing information such as occupancy and roomrate figures. The hotel is a stable and mature business, placed third in the Perth market in terms of revenue per available room (REVPAR). Seventy percent of its policies are brand driven and therefore while the GM has the prerogative to cater to the distinct conditions of the individual property, autonomy is restricted.

Hotel B belongs to small regional chain. This particular chain was unique in that each property within the chain is owner managed and independently operated in terms of policies and procedures (P&P). Housed in what was originally the Australian Taxation Office built in 1968, the building was converted into a hotel in 1996 and has 306 rooms affording Swan River views. Located in the CBD, its target market is corporate guests with currently 60-70% of its clientele being domestic corporates. The GM has been in the hospitality industry for 20 years, first as a dishwasher in his family restaurant in Perth, then shifting to food production. Focusing on production, he worked up to Chef de Cuisine, then became interested in the service aspects of the industry taking on a position of Food and Beverage Manager, Ex-

ecutive Assistant Manager and then GM of this hotel in 2002.

The GM had a greater degree of autonomy with respect to IT investments and decision making and indeed strategic direction for the hotel. IT adoption was seen as potentially generating strategic opportunity for the business (Engsbo, Saarinen, Salmi, & Scupola, 2001) and a means to set the hotel apart from the competition. The hotel is the market leader in the Perth market in terms of REVPAR and is growing and innovative. In part this reflects the nature of the GM—younger, more entrepreneurial and who looks to IT as a means by which strategic advantage can be achieved. He is unrestricted by a chain corporate culture and so is less restricted in his decision making. Personal relationships between counterparts are important to this GM, indicating that the synergy between peers within the chain was strong.

The GM tended to take the initiative with regard to networking amongst competitors, was open to changes occurring with respect to IT and is more entrepreneurial and boundary spanning in its interactions with those outside of the organisation to obtain valuable information from the task and general environments (Jones & George, 2003). This was recognised as being a way to increase the quantity and richness of information available to the hotel to aid decision making in a dynamic and competitive environment. This openness to IT innovation adoption is typically not a trait of hoteliers hailing from food production due to the limited opportunities for such adoption in the kitchen area. This GM admits that he is somewhat of an anomaly in this regard.

Attitudes toward technology is a factor that differentiates the approaches of the two hotels and this reflects individual traits such as age, length of tenure, level of entrepreneurship, and background. In addition to these individual factors, corporate culture and decision making practices and degree of centralisation of decision making come into play.

DISCUSSION

Firms engaged in c-commerce do so because they recognize the strategic benefits, however c-commerce demands significant investment in IOS. A commitment to the relationship requiring investment in IT from a long term perspective then is critical. Efficiency no longer is the sole motivation for IT adoption (Levy et al., 2001). This is an important point—one hotel saw IT purely as a tool to increase efficiency and so took a passive role, relying on corporate IT strategy. The other had a more strategic approach generally in their business and towards IT.

In part this reflects the nature of the ownership of the hotel, that is, owner managed as well as the attitudes of the GM to IT and change generally. Whilst the independent hotel recognized the value adding potential of IT, it is not likely that this will extend to c-commerce. This firm had a strong individual identity and whilst acknowledging the benefit in strategic alliances to win business and sharing information such as occupancy rates and possibly REVPAR with competitors, as is generally the case in this industry, evidence of further collaboration is not apparent.

This chapter proposes that organisations must possess certain characteristics for effective c-commerce adoption—these are embodied in the framework set out in Figure 1 and Table 1. The lack of these characteristics and low level of awareness of the benefits of c-commerce would act as an inhibitor to c-commerce adoption. For the hotel industry c-commerce of sorts exists amongst chains anyway and so since relationships are focused inwards within the chain generating a high corporate identity, the drive for relations outside that corporation is less.

From the case study it is evident there is a lack of a social identity amongst players in the industry in situ, other than membership of the AHA provides. Whilst hotels have a track record of adopting IT as discussed it tends not to be strategic. Certainly there is no real evidence

of integration of IT within corporate strategy, reflecting a view of IT as a tool to increase efficiency of operations. The strategic benefits and competitive advantage IT could generate for the business need to be understood for c-commerce to be entered into.

Research is required to determine whether the factors embodied in the framework proposed here are critical antecedents to c-commerce adoption. The relationship between these and or other factors identified by subsequent research needs to be investigated more fully with respect to the hotel industry, both in Australia and overseas.

From the case study the influence of the GM, and management structure and decision making practices of the hotel are significant influencers to potential c-commerce adoption. Hotels that are part of a chain already have interoperable systems that facilitate information and knowledge sharing amongst the chain—this seems to be more important to individual hotels compared with potential collaboration with rivals in a location. This reflects the salience of individual identity viz social identity.

The autonomy of GM is a significant issue. GMs of hotels in a chain are more concerned with operational issues with strategy and policy determined at corporate level, including IT investment decisions such as PMS system and other softwares that are used. Since the GM in the owner managed hotel had a greater degree of autonomy, he is able to determine IT investment decisions which requires a more strategic view.

Investigation of the impact the external and task environments have upon c-commerce adoption in the hotel industry is important especially comparing contexts. Given that the majority of research regarding collaborative IORs and c-commerce has taken place in Europe the impact of the cultural and institutional settings needs to be acknowledged. The influence of parent companies upon individual hotel decision making also needs to be explored.

CONCLUSION

In conclusion, c-commerce is an emerging phenomenon in many countries and industries. Little evidence exists as to its adoption generally, or amongst the hotel industry in particular. This chapter seeks to identify the factors critical to c-commerce adoption. The framework proposed in this chapter requires “testing” in hotels taking into account different national as well as other industry contexts so that validation or refinement can occur.

The notion that ownership structure and management significantly influence the business, its direction and so adoption of IT has significant relevance to the use of IT in the businesses studied here. Where the GM had little interest and involvement in IT the likelihood of innovative uses of IT was less.

Where a strategic view of the use of IT is taken by management collaboration around IT is deemed to be more likely. However this is complicated by issues of ownership structure and centralisation of IT and policy. The case study discussed here would indicate c-commerce is likely to be adopted by the independent sector of the industry where managers have greater autonomy to enter into such partnerships. Chains already collaborate around IT and so share information online and via CRS. Because of this and reliance on centralised IT decision making, individual hotels are less likely to enter into such relationships in situ.

Overall, there seems to be a strong relationship between the attitudes of GM to IT and their strategic vision and the role of IT and likelihood to adopt c-commerce. Where c-commerce exists in-house (that is in large chains) there is no need to consider entering into such collaborative arrangements with competitors. The rate of adoption, should it occur, will be slow until benefits are perceived. The influence of the corporate structure and the role of the GM are factors that significantly influence the likelihood of c-commerce adoption in the hotel industry. Such adop-

tion is not likely at least at this point in time due to the factors outlined here.

REFERENCES

- Australian Bureau of Statistics. (2002). *Small business in Australia* (cat. 1321). Canberra: Australian Bureau of Statistics.
- Axelrod, R. (1984). *The evolution of cooperation*. New York: Basic Books.
- Bititci, U., Martinez, V., Albores, P., & Parung, J. (2004) Creating and managing value in collaborative networks. *International Journal of Physical Distribution and Logistics Management*, 34(3), 251-268.
- Brennan, D., Turnbull, P., & Wilson, D. (2003). Dyadic adaptation in business-to-business markets. *European Journal of Marketing*, 37(11/12), 1636-1665.
- Brooks, R. M. (1999). *From the hotel property's perspective: The network computing alternative: Hotel online*.
- Buhalis, D. (1996). Enhancing the competitiveness of small and medium-sized tourism enterprises. *International Journal of Electronic Commerce, Electronic Markets*, 6(1), 1-6.
- Caldeira, M. M., & Ward, J. M. (2003). Using resource-based theory to interpret the successful adoption and use of information systems and technology in manufacturing small and medium-sized enterprises. *European Journal of Information Systems*, 12, 127-141.
- Chell, E., & Baines, S. (2000). Networking, entrepreneurship and microbusiness behaviour. *Journal of Small Business Management*, 12(3), 195-215.
- Chi, L., & Holsapple, C. W. (2005). Understanding computer-mediated interorganisational col-

- laboration: A model and framework. *Journal of Knowledge Management*, 9(1), 53-75.
- Chung, K. Y., Oh, S. Y., Kim, S. S., & Han, S. Y. (2004). Three representative market segmentation methodologies for hotel guest room customers. *Tourism Management*, 25(4), 429-441.
- Connolly, D. J. (2000). Trends 2000: Shaping the Future. In *Proceedings of the 5th Outdoor Recreation & Tourism Trends Symposium*, Lansing, MI (pp. 73-83).
- Cravens, D. W., Shipp, S. H., & Cravens, K. S. (1993, March). Analysis of co-operative inter-organisational relationships, strategic alliance formation and strategic alliance effectiveness. *Journal of Strategic Marketing*, 55-70.
- Dev, C., & Klein, S. (1993, February). Strategic alliances in the hotel industry. *Cornell Hotel and Restaurant Administration Quarterly*, 42-51.
- Dogac, A., Kabak, Y., Laleci, G., Sinir, S., Yildiz, A., Kirbas, S., & Gurcan, Y. (2004). Semantically enriched Web services for the travel industry. *SIGMOD Record*, 33(3).
- Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganisational competitive advantage. *The Academy of Management Review*, 23(4), 660-680.
- Engsbo, M., Saarinen, T., Salmi, H., & Scupola, A. (2001). A framework of adoption of e-commerce in networks of SMEs. In *Proceedings of IRIS 2001*, Ulvik, Norway.
- Feeny, D. & Willcocks, L. (1998). Core IS capabilities for exploiting information technology. *Sloan Management Review*, 39(3), 354-367.
- Fulop, L., Linstead, S., Lilley, S., & Clarke, R.J. (2004). Decision making in organisations. In S. Linstead, L. Fulop, & S. Lilley (Eds.) *Management and organization: A critical text* (pp. 462-494). New York: Palgrave.
- Fyall, A., & Spyriadis, A. (2003). *Collaborating for growth: The international hotel industry*. Paper presented to Riding the Wave of Tourism and Hospitality Research, Council of Australian University Tourism and Hospitality Education Conference (CAUTHE), Coffs Harbour, Southern Cross University.
- GartnerGroup. (1999) Gartner Group identifies e-commerce supply chain movement: An emerging trend in collaborative Web communities. *GartnerInteractive*. Retrieved from <http://gartner5.gartnerWeb.com/public/static/aboutgg/presrel/>
- Garzotto, F., Paolini, P., Speroni, M., Proll, B., Retschitzegger, W & Schwinger, W. (2004, August 30-September 3). Ubiquitous access to cultural tourism portals. In *Proceedings of Database and Expert Systems Applications, the 15th International Workshop (DEXA'04)*, Zaragoza, Spain.
- Go, F. (1992). The role of computerised reservations systems in the hospitality industry. *Tourism Management*, 13(1), 22-26.
- Gonzales, M. V. (2004). Application of information technologies in the commercialisation and management of tourist products and destinations, in intermediate regions: Reticular integrated strategies. In *WISICT '04: Proceedings of the Winter International Symposium on Information and Communication Technologies*, Cancun, Mexico.
- Grover, V., Teng, J. T. C., & Fiedler, K. D. (2002). Investigating the role of IT in building buyer-supplier relationships. *Journal of the Association of Information Systems*, 3, 217-245.
- Hallen, L., Johanson, J., & Seyed-Mohamed, N. (1991). Interfirm adaptation in business relationships. *Journal of Marketing*, 55(2), 29-37.
- Holsapple, C. W. & Singh, M. (2000). Toward a unified view of electronic commerce, electronic business, and collaborative commerce: A knowl-

edge management approach. *Knowledge and Process Management*, 7(3), 151-164.

Jones, G. R. & George, J. M. (2003). *Contemporary management* (3rd ed.). Boston: McGraw Hill.

Joo, J. (2002, Summer). A business model and its development strategies for electronic tourism markets. *Information Systems Management*, 58-69.

Kalakota, R. & Robinson, M. (1999). *Frontiers of electronic commerce*. Reading, Massachusetts: Addison-Wesley.

Kasavana, M. L. & Brooks, R. M. (2001). *Managing front office operations*. MI: Educational Institute of the American Hotel & Lodging Association.

Kramer, R. M. (1993). Cooperation and organisational identification. In J. K. Murnighan (Ed.), *Social psychology in organisations: Advances in theory and research* (pp. 244-268). London: Prentice Hall.

Levy, M., Powell, P., & Yetton, P. (2001) SMEs: Aligning IS and the strategic context. *Journal of Information Technology*, 16(3), 133-44.

McCarthy, J. (1999) Gartner foretells of collaborative commerce. *Breaking News:IDG.net*. Retrieved from <http://www.idg.net/idgns/1999/08/16/GartnerForetellsOfCollaborativeCommerce.shtml>.

Macpherson, A., Jones, O., Zhang, M., & Wilson, A. (2003). Reconceptualising learning spaces: Developing capabilities in high-tech small firms. *Journal of Workplace Learning*, 15(6), 259-270.

Mason, C., Castleman, T., & Parker, C. (2004, May). Knowledge management for SME-based regional clusters. In *Proceedings of COLLECTeR*, University of South Australia, Adelaide.

Morgan, R., & Hunt, S. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58(3), 20-38.

O'Keefe, M. (2001) Building intellectual capital in the supply chain : The role of e-commerce. *Supply Chain Management: An International Journal*, 6(4), 148-151.

Powell, W. (1987). Hybrid organisational arrangements. *California Management Review*, 30, 67-87.

Ring, P. & Van de Ven, A. (1992). Structuring cooperative relationships between organisations. *Strategic Management Journal*, 13, 483-498.

Ring, P. & Van de Ven A. (1994) Developmental processes of cooperative inter-organisational relationships. *Academy of Management Review*, 19(1), 90-118.

Ryssel, R., Ritter, T., & Germunden, H. G. (2004). The impact of information technology deployment on trust, commitment, and value creation in business relationships. *Journal of Business & Industrial Marketing*, 19(3), 197-207.

Sheth, J. (1996). Organisational buying behaviour; past performance and future expectations. *Journal of Business and Industrial Marketing*, 11(3/4), 7-24.

Starkov, M. (2002). *The Internet: Hotelier's best ally or worst enemy? What went wrong with direct Web distribution in hospitality?* Retrieved March 23, 2005 from http://www.hotel-online.com/NEWS/PR2002_4th/Oct02_InternetAlly.html

Stern, L. W., & Weitz, B. A. (1997). The revolution of distribution: Challenges and opportunities. *Long Range Planning*, 30(6), 823-829.

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W. G. Austin & A. S. Worchel (Eds.), *The social psychology of intergroup relations* (pp. 33-47). Monterey, CA: Brooks/Cole.

Terry, D. J. (2003). Social identity and diversity in organisations. *Asia Pacific Journal of Human Resources*, 41(1), 25-35.

Collaborative Commerce and the Hotel Industry

Tetteh, E. O. & Burn, J. M. (2001). Global strategies for SME-business: Applying the SMALL framework. *Logistics Information Management*, 14(1/2), 171-80.

Travel Impact Newswire. (2004, December 1). Edition 81.

Yetton, P., Johnston, K., & Craig, J. (1994, Summer) Computer aided architects: A case study of IT and strategic change. *Sloan Management Review*.

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper, pp. 242-259, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.32

Peering into the Black Box: A Holistic Framework for Innovating at the Intersection of ICT & Health

Ben Bellows

University of California at Berkeley, USA

Aman Bhandari

University of California at Berkeley, USA

Mahad Ibrahim

University of California at Berkeley, USA

Jaspal S. Sandhu

University of California at Berkeley, USA

ABSTRACT

This chapter begins with an overview of public health in developing regions. From this population-level perspective, we discuss the information challenges in each of the four domains of public health: research, education, health-care delivery, and disease surveillance. We introduce health-related use classes—categories of specific use cases—to provide a structured presentation of health and information communication technologies in developing regions. In this regard, we define and discuss the following six use classes: (a) surveillance and information gathering, (b)

research, (c) provider to provider, (d) provider to patient, (e) education, and (f) logistics. Defining ICT broadly, we argue that the design or selection of technology requires consideration of the cost, ease of use, infrastructure, culture of ICT use, penetration of different ICTs, and population health profile. All of these factors vary among resource-scarce settings, and each factor can greatly impact the appropriate choice in any given setting. We discuss the following three types of assessment, each of which plays a crucial role in project evaluation: systems issues, usability, and health outcomes. Designing ICT for health applications in developing countries requires a deep

understanding of various contextual factors, such as health and ICT infrastructure, disease burden, and sociocultural issues. With this in mind, and with some understanding of future trends in health and ICT utilization, we provide forward-looking recommendations for practitioners, researchers, funders, and policy makers.

INTRODUCTION

Human and societal development without health is not sustainable. The World Health Organization (WHO) defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1948, Preamble). Public health can be categorized into four domains: research, education, health-care delivery, and disease surveillance. In this chapter, when we refer to public health, we refer to the bundle of health-related activities that fall under those four domains, which have an impact on the individual (e.g., delivery of medical treatment or health education) and the larger population (e.g., health-care infrastructure capacity or tracking HIV infections).

Unhealthy people have difficulty being productive members of their communities, and unhealthy nations cannot be productive partners in the global community (Deaton, 2003; Hancock, 1993). For many developing economies, disease burdens debilitate entire populations and have a significant impact on a range of factors such as economic growth and development (Baldacci, Clements, Cui, & Gupta, 2005; “Health and Wealth,” 2002; Sachs et al, 2002). Poor infrastructure, lack of health systems, lack of access to medical care and medical goods, and financing are major barriers to improving population-wide health and national development. According to the WHO (2004), in 2002 the combined public and private per capita health-care spending in developing countries averaged \$70 per year compared to \$3,055 in high income countries. The global disease burden

comes from a variety of causes such as malaria, HIV, diarrhea, tobacco-induced chronic diseases, poor sanitation, and lack of clean water. The scope and scale of challenges facing such regions is great and requires innovative solutions. This is the context in which information and communication technologies must operate, and in this chapter, our aim is to discuss the promises and challenges of using such technologies to tackle global health problems in low-income regions.

ICT for development has received considerable interest outside of public health for a variety of applications that are discussed elsewhere in this book, such as in education and governmental affairs. While the application of ICT into health care has been on the periphery of ICT innovation, the intersection of ICT and health may be one of the greatest means to positively enhance development. Information access, exchange, and brokering are central to the delivery of health care on both an individual level via clinical providers and a macrolevel via policy makers. Access to information has a significant impact not only on the delivery of health care, but also on increasing equity in health, and thus ICT intervention offers promise in improving health care (e.g., in education, delivery, and clinical outcomes). This promise, however, is tempered by the complex interface of the design, development, and maintenance of ICT, and the nature of public health in developing regions. The application of ICT to improve health similarly depends on access to relevant, reliable knowledge in forms that are appropriate, readily assimilated, and easily applied, whether by a biomedical researcher, a nurse, a doctor, a midwifery student, or a mother.

A range of applications involving ICT for health have been undertaken in recent years. Activities range from the Ptolemy project that links full-text clinical journal access from the University of Toronto with a network of several dozen East African surgeons, to a satellite-based radio feed across Asia with health-education local programming run by Equal Access, a nonprofit organiza-

tion focused on low-cost technology (Beveridge, Howard, Burton, & Holder, 2003; Camaran Pipes, Program Coordinator [personal communication, August 30, 2005]). Various ICTs such as the Internet, radio, and mobile phones can be utilized to build research, training, and implementation capacity. The broad diversity of applications and end users (from surgeons to illiterate patients) in this context presents great opportunity as well as significant challenges and ethical considerations (e.g., access, cost, connectivity, and culturally appropriate content delivery).

The existence of distinct technology use classes or groupings of use cases (e.g., provider to provider, provider to patient, and surveillance) distinguishes ICT for health from other domains. Each use class implies a different set of implementation costs and benefits. Furthermore, much attention has been directed toward the latest Internet-enabled technologies, but public health practitioners have at their disposal a much broader set of ICTs. Public health must focus on the context and goals of health and the capabilities of particular ICTs rather than on being technology driven. Finally, the

infrastructure needed for public health intervention is quite complex, varying significantly over both disease categories and physical context. This complexity creates multiple barriers to technology access from social, economic, and political factors rather than technological ones.

In this chapter, we seek to move beyond the limited focus in much of the literature on ICT and health informatics to provide an integrative and expanded framework and analysis of the role of ICTs in public health. Specifically, we will describe each of the distinct use classes, emphasizing their impact on the design, deployment, and maintenance of ICT. We lay out a comprehensive map between ICT and public health. Moreover, we seek to make explicit the multiple barriers to technology access present in the public health infrastructure. Our specific goals are as follows:

1. Indicate the appropriate roles that ICT can play in improving multiple public health domains, specifically delivery, education, research, and surveillance

Table 1. Barriers to effective ICT utilization in health

| Individual | Organization | Population/Society |
|---|---|--|
| Experience | Lack of administrative data | Per capita spending on health |
| Language | Lack of personnel capable of undertaking research | Policies that disincentive research |
| Economic instability | Human resources | Regulatory framework |
| Rural location | Incentives | (possibility of getting sued in U.S.) |
| Distance from points of service | Funding | Policy framework (UK, Canada) |
| Lack of trained personnel to provide service | Infrastructure | Lack of national funding to document population health |
| Cultural strictures against receiving service | No educational or training institutions | Organizational infrastructure |
| Economic inability to access service | Networks | Physical infrastructure |
| Lack of trainers to educate individuals | Decision making (information over load) | Underinvestment in education |
| | Capital resource constraints | Policy environment |
| | Labor constraints | Technology availability |
| | Information quality constraints | Resource availability |
| | Human resources necessary for maintenance of equipment, network | Language |
| | Cultural concepts regarding gender and ethnicity | Education |
| | Ethical constraints to implementation | Culture |
| | | Politics |
| | | Gender |
| | | Socio-demographic differences |
| | | Ethical constraints to implementation |

2. Describe the multiple use classes for ICT, highlighting these with concrete examples
3. Provide recommendations for practitioners, discussing promising applications of technology and meaningful assessment of initiatives
4. Discuss future trends

INFORMATION CHALLENGES IN PUBLIC HEALTH

Much of the discussion of ICT within the sphere of public health in low-income countries has been limited to remote diagnostics and vertical health information systems that report to the central government disease and death events, patient load, and other tasks that fall under medical services and disease surveillance. The discussion of ICT in public health could expand to include health education strategies, effective research tools, and interactive surveillance and response data systems. For many developing countries, the health sector is significantly tied to donor agencies' priorities, which often place a premium on public-sector implementation, individual project reporting, and short-term crisis response.

From a consumer or patient perspective, however, the single largest challenge to public health is access. Low utilization of health services is a function of both underfunded demand and poor supply of high-quality services. ICT can play a significant role in addressing both supply- and demand-side constraints; however, a greater understanding of the barriers to the effective use of ICT in public health applications is needed. Table 1 identifies challenges to public health activities at various levels of social organization. ICT can help overcome those barriers.

Surveillance

Health data are necessary for informed decision making and the allocation of scarce health re-

sources. Disease trends change rapidly, and surveillance systems need to capture those trends to accurately forecast emerging threats to the public's health. The challenges to the implementation of ICT solutions to data collection on population health are exacerbated by centrifugal mandates that devolve power from the central authorities to regional health agencies, and in some cases, to nongovernmental actors. These regional data collection agencies often lack the training, experience, and resources to adequately collect data, much less mount a response to rapidly emerging situations. New surveillance systems should be modular, decentralized, and connect an array of information suppliers on a competitive basis.

Research

Health research essentially is the experimental and observational functions of testing health products, services, and policies. The supply and demand of ICT in health research is inhibited by the same infrastructural challenges facing other public health domains. The ICT challenges to conducting research are exacerbated by ethical quandaries, such as balancing the great need for innovative solutions to pressing public health problems against the protection of communities and individuals in the research.

Fostering the production of health research in developing countries represents a critical challenge of the global public health community. ICT offers a cost-efficient platform for disseminating health research originating from the developing world; however, the cost of dissemination is far from the only barrier. Only 10% of global health research funding is targeted toward 90% of the global disease burden (10/90 gap), which translates into a 1/99 gap for health information (Godlee, Pakenham-Walsh, Ncayiyana, Cohen, & Packer, 2004). It is clear that a significant part of the problem is a result of infrastructure challenges that inhibit both the creation of health research and also the submission of relevant health research into

appropriate forums. A few of these infrastructure challenges can be alleviated by the implementation of certain ICT. For example, wired and wireless Internet systems can bridge problems with inadequate and costly postal systems. However, according to one study, the publication barriers faced by developing-country researchers extend beyond purely poor infrastructure. As Horton (2000) noted, developing-country researchers faced broader challenges to both initiating research and disseminating their results, such as the following:

- Lack of a culture of research, thus little reward
- Absence of a peer group to stimulate debate and review work
- Bias in favor of developed countries from journal editors and reviewers
- Lack of interest from editors concerning diseases that are prevalent in developing countries, but not in the developed countries
- Bias toward high-tech, lab-oriented research

Education

There is the need to improve the quality of health-care information in terms of its reliability, relevance, and usability. One barrier to health education is the lack of information demand. Limited demand is a function of any of the following factors: a poor reading culture, low motivation associated with poor working conditions and poor prospects for career development, lack of awareness of evidence-based health care, long-term professional isolation, and long-term lack of access to information leading to the view that whatever is available is adequate (Godlee et al., 2004).

The lack of demand is related in part to the poor quality of much of the information supply (scientific and technical journal papers, reports,

theses, conference papers, and bibliographic, factual, and full-text information, for instance). Poor supply worsens educational performance, lowers demand, and creates a negative feedback loop (Easterly, 2002; Edejer, 2000). Godlee et al. (2004) see improved electronic access to essential information for health professionals, such as drug formularies and evidence-based handbooks, as critical to improve health services. Information supply challenges include access to the technological tools for information retrieval, such as high-bandwidth Internet connections. The lack of infrastructure at the societal or economic level is a significant handicap. For instance, global communication networks continue to expand, but remain too costly for many low-income communities. Another supply barrier is the lack of clearly evolved educational standards and norms, including the encouragement of research into better ways of teaching that would enhance the ease of use and value of the content often streamed in from high-income countries (Arunachalam, 2003).

Medical Services

Medical treatment is costly in terms of human resources and money. Providing medical services to improve population health requires a highly trained professional corps and a highly productive infrastructure. The reality in most developing countries is an urban core of highly trained medical professionals that treat a wealthy minority in private practices. Underfunded public clinics close at midday so that staff can open shop to private patients in the afternoon. The financially lucrative, yet non-essential treatments and services sold in many private practices appeal to the paying patients but are not the services that would be prioritized if the national health funds were distributed among the entire population (Walsh & Warren, 1980).

The most useful and urgently needed services in any low-income population often are simple and repetitive. They are such because the enormous

costs in treating large numbers require that the service be effective and efficiently provided. Childhood vaccines are classic examples of the type of medical service that is both effective and efficient for large low-income populations (Walsh & Warren). It is a form of triage as those same low-income individuals would benefit just as well from the personalized attention provided to rich patients if they were ever presented the opportunity.

ICT USES AND APPLICATIONS

There is a long history of ICT applications in industrialized countries; telemedicine (or telehealth) dates back to the late 1960s in the United States. Research and implementation from industrialized regions may prove useful to new initiatives in developing countries. At the same time, the unique constraints within developing countries and evolving technologies allow for new uses and applications. The Institute of Medicine defines telemedicine as “the use of electronic information and communications technologies to provide and support health care when distance separates the participants” (*Telemedicine: A Guide to Assessing Telecommunications in Health Care*, 1996).

Telemedicine initiatives in industrialized countries, such as Norway and the United States, have often sought to serve groups separated by distance from medical resources, but distance separating participants is not an essential quality of the applications we will discuss in this chapter. The following retrospective on the failures of telemedicine in its infancy is highly relevant to our current discussion (Bashshur, 1980, pp. 13-14):

Many telemedicine projects begun in the early seventies were discontinued because they were not self-sustaining. Some were hastily conceived, almost assuring their eventual demise.

In some instances this is not surprising since they were implemented without a clear definition of mission, an identification of the specific niche they would occupy in the existing health care system, or the unique contribution they would make to it. Moreover, the serious questions dealing with the economic viability of this mode of practice...were not addressed....[T]hese projects were designed as self-limiting experiments without intention of continuation beyond the experimental stage.

As we review current initiatives and look to the future, it is important to develop a framework for discussing the applications. Perhaps more than other ICT application areas, such as education and governance, health applications involve a variety of users of various backgrounds and technical proficiency. Professional software systems designers often employ use cases, stories describing the detailed use of a system, to determine the functional requirements of that system. The use case has evolved from a concept introduced by Jacobson, Christerson, Jonsson, and Overgaard (1992) in *Object-Oriented Software Engineering* to a fundamental tool in software design.

In this work, we define use classes as groupings of use cases with similar traits. Applications with common human and organizational elements, for example, linking providers to patients, belong together in a use class. It is important to cluster applications into such use classes because, although the use classes themselves are agnostic with respect to the specific technology, the applications within a particular class may utilize some of the same technologies or approaches as one another. This is because of commonalities in the ability of users, physical constraints, and technical requirements.

For ICT applications in health, we define six primary use classes; though these are by no means

exhaustive, they do cover the majority of current and upcoming applications. These use classes are (a) surveillance and information gathering, (b) research, (c) provider to provider, (d) provider to patient, (e) education, and (f) logistics.

A MULTITUDE OF USE CLASSES

Surveillance and Information Gathering

The practice of public health cannot exist under a state of ignorance; however, in many developing societies, this is the predominant condition because of the lack of reliable disease surveillance and other critical health data. The systematic gathering and analysis of clinical, environmental, and behavioral information represents a key user class. This type of information gathering allows public health to move from being reactive to responsive, with an end result of saving and improving lives. The Centers for Disease Control and Prevention (CDC) (2005) define public health surveillance as “the ongoing systematic collection, analysis, and interpretation of health data for the purposes of improving health and safety. Key to public health surveillance is the dissemination and use of data to improve health.”

The key components in the labor- and information-intensive practice of public health information gathering are the following:

1. The systematic and comprehensive collection of information on communicable and noncommunicable diseases, environmental factors, and behavioral and other health-risk factors
2. The integration and analysis of disparate data sources to identify public health events and problems
3. The dissemination of the results to the public health community so that a response can be developed

Perhaps the most well-known type of information gathering is the surveillance of communicable diseases. These types of diseases are of great importance because of the potential for rapid global spread without proper intervention (e.g., severe acute respiratory syndrome [SARS] or avian influenza subtype H5N1). In 2005, the Uige Province of Angola experienced the largest and deadliest outbreak of the Marburg hemorrhagic fever ever. There is no cure or effective treatment for the Marburg virus, but there are techniques for limiting the exposure and spread of the virus. In Angola, these measures were implemented months after the initial outbreak because of poor performance in the technical and social aspects of the national surveillance infrastructure (Ndayimirije & Kindhauser, 2005). A major gap was the lack of a functioning surveillance system that might have generated action reports concerning the existence of abnormal clinical cases. In the end, Dr. Maria Bonino, leveraging her experience, reported potential hemorrhagic fever cases to the government and international agencies with the assistance of the district health administrator Dr. Matondo Alexandre (LaFraniere & Grady, 2005). Months after the first cases, the existence of Marburg was confirmed, allowing for a full-scale response by the collective expertise of the Global Outbreak Alert and Response Network (GOARN) operated by the WHO. This case illustrates serious gaps in the collection of surveillance data. The public health information infrastructure relies on data collected from a variety of sources (Lumpkin & Richards, 2002).

1. Medical data is derived from clinical encounters and includes patient history, physical findings, and clinical tests.
2. Environmental data is derived from ongoing monitoring programs of the environment, for example, tests for the level of air pollutants in a given community, or the capturing of insects, birds, and animals to test for particular diseases.

Peering into the Black Box

3. Survey data is designed to fill in the gaps of the other primary methods of gathering data. Surveys can be conducted via direct clinical intervention, the phone, or other mechanisms. Examples include the demographic and health surveys, or national HIV serosurveys.

Health data collection can be a Herculean task in industrialized regions, but in developing regions, severe resource constraints often turn the best plans of systematic data collection into a patchwork of incomplete data sets and missing information. However, a surveillance infrastructure does exist for certain types of diseases due to significant international attention and intervention. In Angola, the GOARN network, in their response to the Marburg outbreak, used

the existing basic infrastructure for poliomyelitis eradication to aid their efforts (Ndayimirije & Kindhauser, 2005). In Uganda, one innovative method of using ICT to bridge these obstacles is the use of handheld computers and wireless connectivity technologies to allow consistent transmission of health data between rural health workers and the national authorities. Uganda has a poor wired communication infrastructure, but the mobile-phone network offers comprehensive coverage throughout the country; thus, by using technologies from Wideray Corporation (<http://www.wideray.com>), health workers are able to transmit information locally via 802.11b wireless connections to a server (Wideray jack server). Those data are then passed onward to data repositories located in the Ministry of Health in Kampala via GPRS (general packet radio service)

Table 2. Essential sources of health-related information (AbouZahr & Boerma, 2005)

1. A census.
 2. Continuous monitoring of births and deaths with certification of cause of death. Where universal coverage and medical death certification is not feasible, consideration should be given to sample vital registration systems (i.e., registration of vital events in randomly selected samples of the population) coupled with verbal autopsy.
 3. A surveillance and response system focused on epidemic and vaccine-preventable diseases (e.g., cholera, HIV, and polio) as well as emerging diseases (e.g., SARS).
 4. A programme of household surveys designed to measure use of healthcare services and important household or individual behaviors, covering both demographic and health surveys and other surveys that can be used to generate health-related information, such as surveys of living standards.
 5. A system of service generated data derived from facilities and patient-provider interactions covering aspects such as care offered, quality of care and treatments administered.
 6. Mapping of public health facilities and services at national and district levels.
 7. Behavioral surveillance focusing especially on risk factors such as smoking, unsafe sex and malnutrition.
 8. National health accounts.
 9. Financial and management information.
 10. Modeling, estimates and projections.
 11. Health research, including clinical, health systems and operations research.
-

on the GSM (Global System for Mobile Communications) network (Taggart, 2003).

Voxiva presents another approach to bridging the immense infrastructure challenges for data reporting in developing countries. An organization that frames itself as a service provider, Voxiva allows for its partners to collect real-time data from disparate locations using whatever technological means are available (Casas, LaJoie, & Prahalad, 2003; Voxiva, 2005). Furthermore, they enable effective communication using this same strategy, focusing on the use of available technology. Paul Meyer, founder of Voxiva, originally noted that the telephone was a much more widespread, accessible, and thus practical tool than the Internet; based on this, Voxiva began a disease surveillance initiative, Alerta, in Peru in 2002. This enabled better reporting in terms of yield, frequency, and data quality without investment in infrastructure or technology at the edges of the network. Today, Voxiva's solutions continue to allow heterogeneous forms of interaction for data reporting, including the Web, telephone, fax, e-mail, and SMS (short messaging service). Since they operate as a service, their partners (or clients) are not responsible for technical issues or maintenance: simply interfacing with the system as users. Today, Voxiva has international health surveillance initiatives in Peru (Nacer for maternal and child health); Tamil Nadu, India (post-tsunami Health Watch); Andhra Pradesh, India (Acute Encephalitis Syndrome Surveillance Information Management System [AESSIMS] for Japanese encephalitis); and Rwanda (Treatment Research and AIDS Centre [TRACnet] for HIV/AIDS).

Surveillance and information gathering are ultimately concerned with generating knowledge about the state of health in a given area. As has been discussed, the collection of data is critical to this endeavor, but equally important is the proper analysis of collected information to ascertain actionable knowledge. A large part of the analysis equation involves the presence of personnel skilled in epidemiological techniques and data analysis,

but ICTs do have a role in assisting analysis. In particular, geographic information systems (GISs) have been increasingly used to map data to improve analysis and decision making in developing regions. One example is the HealthMapper application, a geographic database, information-management, and mapping application, developed by the WHO to support the surveillance needs of national Guinea worm-eradication programs. As the software was designed for public health needs, it can be applied to numerous disease surveillance applications incorporating surveillance-specific data as well as data relating to population settlements, social and health services, and the natural environment (WHO, 2005). Developed by researchers at the Centers for Disease Control and Prevention, EpiInfo represents a similar effort to create freely available software for surveillance data management and analysis (2005).

Research

Information gaps in health research in developing countries exist in both the consumption and production of research. However, the global public health community often focuses only on the consumption of health research information as the key information gap facing developing countries. Thus, providing access to critical health research through free or reduced-price access to journals is the principal intervention. This point of view neglects that information gaps are often a result of multiple problems, and health research is no different. Journals are often the least valuable information sources for health professionals (Godlee et al., 2004). The focus on access clouds the issue of information needs, and there is often a considerable gap between information and useful knowledge. Being able to select the information that is necessary and appropriate given the particular local context is the critical issue. Access to appropriate knowledge is complicated by two factors: (a) most health information sources are produced and hosted in developed nations, and

(b) there exists scant research on the ecology of information for health workers in developing nations: “Notwithstanding an often rudimentary computing environment, users in developing countries should be empowered to produce digital library collections themselves, not just consume information produced elsewhere...In the developing world, digital libraries represent a killer app for computing technology” (Witten, Loots, Trujillo, & Bainbridge, 2001, p.84).

Applications are needed for analyzing surveillance data, evaluating health interventions and related projects, and conducting analysis of clinical trial data. One thought has been to focus on creating parallel knowledge networks so that developing-country researchers can exchange information amongst themselves, but in many countries of Africa for instance, these initiatives face severe infrastructure bottlenecks. It is often easier and cheaper in many African countries to communicate with Europe using the telecommunications system than it is to connect to their neighbors. As is evident, ICTs have the potential to assist in improving some of the barriers related to the production and consumption of health research, but many challenges are beyond the realm of the technology.

Provider to Provider

The need for health care is universal; however, the quality, availability, needs, and health service delivery mechanisms differ greatly across the world. Health-care providers are the human interface and play a central role in large regional and local health-care systems. Differences in service quality among health-care providers are one of the key distinctions between developing and developed nations. Health-care providers as referred to in this chapter are service professionals or semiprofessionals responsible for delivering some form of preventive and curative care. Health-care providers tend to be differentiated both by specialties and severity of care (e.g., primary,

secondary, and tertiary), as well as the economic model of their affiliate institution: public, for profit, and nonprofit.

Guided by standard health policy and high-income-country precedent, many low-income countries have focused on the development of a distributed public-sector health-care infrastructure based on primary care. However, a substantial portion of health-care services in developing societies are delivered by private providers on a fee-for-service basis (Hanson & Berman, 1998; Prata, Montagu, & Jefferys, 2005). “Private” providers are defined as those who fall outside the direct control of government, and can include both for-profit and nonprofit providers (Hanson & Berman). Many of these private providers tend to be small and independent, for example, individual doctors and drug shops. This informal private sector serves a significant portion of many low-income populations, and could potentially improve the quality of their services through the adoption of low-cost ICT strategies. As AbouZahr and Boerma (2005) note, “ICTs have a significant role to play at the level of individuals and communities, for effective clinical management and for assessing the extent to which services are meeting the needs and demand of patients and communities” (p. 529).

Health-care service providers have two broadly defined information needs. The first area is the collection, processing, reporting, and use of pertinent health information. The second information need is to consult, coordinate, and diagnose across disparate locations, specialties, and levels of care. It is assumed that poor provider service is simply due to a lack of information, but the reality is more complex. Several factors impact the demand and supply of health information, and ultimately the efficacy of provider services:

- **Many actors, many needs, and unequal power:** At inception, the Health Information System (HIS) of Mozambique was heavily centralized, and information policy em-

phasized reporting from the primary levels to the central authority (Braa et al., 2001). Later, Mozambique adopted the WHO-recommended primary health-care strategy, which focuses on the district and local delivery of health care, thus there is greater use of information at these levels rather than through upward reporting. However, local use of information is hampered by two factors: (a) an underfunded local infrastructure and (b) the dependence of Mozambique on foreign donors for a substantial portion of their resources, creating yet a different set of information needs.

- **The lack of capacity to utilize information effectively:** Health workers have little or no training to interpret health data in a useful manner. In the Cuamba district of Mozambique, the health center had cumulative data on each point in the DPT (diphtheria, pertussis, tetanus) immunization campaign; however, those data, if interpreted properly, would have shown a dropout rate of 55% by the last required immunization and only 10% coverage for the target population of 2,500 children (Braa et al., 2001).
- **Infrastructure problems:** Technical infrastructure is handicapped by irregular electricity access, the lack of skilled technical personnel, and the inability to fully implement comprehensive communications infrastructure.
- **Absence of strong provider networks:** Developing societies are characterized by a single public health-care entity and an array of small, independent private providers that account for most health-care contacts. These informal and unregulated health-care markets present both data collection and health policy enforcement difficulties.
- **Lack of a strong health information infrastructure:** The health information infrastructure (HII) refers to the organizations, technologies, and policies responsible for the use of information relevant to health-care services. Due to the lack of financial and technical resources in many developing countries, the HII infrastructure is inadequate or nonexistent.
- **Gaps in data due to intermittent and noncomprehensive data collection:** This is largely a result of failed governance. Developing-country governments are unable to enforce surveillance reporting from the health sector (public and private).
- **Pertinent information and data spread among diverse group of stakeholders:** Essential health information is not derived from one source, but is the responsibility of many domestic and international actors.
- **Lack of agreement on an essential data set:** An essential data set is the most important data elements chosen from all primary health programs routinely reported by health service providers. The essential data set is guided by two principles: (a) The number of data elements should be limited to 100 or 150, and should enable the calculation of 80 to 120 indicators, and (b) the essential data set should integrate the needs of various programs. When building the data set, one must ask two important questions: (a) Why do we want to collect this information? (b) How will we use it? (Shaw, 2005)

Similarly, we also find challenges in the supply of health information:

The need to collect, process, report, and use information is a crucial part of any health-care information system. The continuing improvement in the quality, cost, and capabilities in modern ICT has allowed an entirely new type of information exchange: remote consultation, coordination, and diagnosis. While this type of ICT application is in its infancy, certain applications have showed the promise of ICTs to extend the reach of health

services. While urbanization is accelerating across the developing world, significant populations remain in rural or underserved areas. Though many issues are beyond the reach of technology, many challenges in remote consultation, coordination, and diagnosis are a direct result of deficiencies in the technical infrastructure.

A remote hospital in Yugoslavia received a donated ultrasound unit from Dartmouth-Hitchcock Medical Center (USA) for use in the examination and diagnosis of patients (Dartmouth Medical School, 2005). While there was a definite need for the ultrasound machine, the hospital did not possess the capacity to read the images. A doctor and medical student from Dartmouth Medical School attempted to remove this barrier by designing a system for remote image reading. In their pilot study, 50 images were compressed, transmitted, uncompressed, and reviewed by two attending radiologists, as well as one radiology resident and medical student. In 64% of the cases, the reviewer could not tell the difference between the two types of images. Image compression was critical to the feasibility of the transmission of large images over a slow link; however, increased data compression affects different aspects of image quality, which can be highly problematic for clinical applications, such as radiology. The study found that 67% of the images were suitable for diagnostic purposes, and of the remaining images deemed unsuitable, the machine, rather than the image compression, may have caused the problem.

Another similar example demonstrates the use of annotated images (via a Web-based referral system called EyesTalk) in order to refer difficult ophthalmologic cases to centers of excellence within the Aravind Eye Care System (AECS; Bhandari, Ibrahim, & Sandhu, 2004). For example, a complex case of childhood glaucoma was referred to one of the system hospitals with a pediatric glaucoma specialist; this referral included the referring clinician's comments as well as two digital images of the child's condition. The receiving ophthalmologist reviewed the

information, spoke with the referring doctor over the telephone for further information, and made his recommendations.

In the industrialized world, health-care systems are dominated by strong public and private entities (e.g., National Health Service, United Kingdom). These strong entities are capable of implementing information policies and management both internally and externally; however, as has been shown, many developing societies are entirely different. Small, independent providers in developing countries have an inability to communicate for reasons that go well beyond ICT, but ICT in collaboration with programmatic and policy-level change can have an impact on more effective service delivery, particularly in resource sharing and the sharing of information to improve clinical management and response.

Provider to Patient

Connecting providers directly to patients was a major objective of many of the telehealth initiatives in the United States and other industrialized countries over the past 40 years. In all cases, the aim was largely the same: to connect health-care providers to patients who would otherwise be inaccessible due to distance or transportation. This communication could be used for a variety of services, including the provision of health information, diagnosis, and treatment follow-up. In fact, telephones were first used for diagnosis almost as soon as they were invented, with a pediatrician diagnosing a child with croup over the phone in 1897 (Fosaelli, 1983). Successful diagnosis is more appropriate to some medical disciplines than others; to date, primarily in industrialized countries, these disciplines include dermatology and mental health (radiology also, but that falls under the provider-to-provider use class).

Newer communication technologies include asynchronous modalities (where there is a delay in communication), e-mail, for example. This introduces dynamics into the proposed applica-

Figure 1. An N-Logue kiosk operator demonstrates the remote eye care diagnosis system in Tamil Nadu, India (Copyright A. Bhandari, M. Ibrahim, J.S. Sandhu 2004)



tions that have not been witnessed previously. Synchronous communication technologies, for example, telephones and audio-video links, are largely intuitive for new users, are more comfortable for patients because of direct interaction with providers, and have been used extensively in a variety of medical disciplines. Asynchronous methods have not been used extensively, and bring both advantages and disadvantages.

E-mail as an example makes better use of resources, including bandwidth and the provider's time, making it more cost effective and potentially allowing for consultation with a wider range of providers; with little need for scheduling, and given the lower time investment, consultation with specialists around the world is a possibility (e.g., Graham et al., 2003), but the sustainability and scalability of such a model is still in question. Furthermore, the utility of information that may be conveyed using a combination of text and images is subject to the abilities and/or training of the user or mediator, such as a kiosk operator. Evaluating the health outcomes based on these different modalities in a developing setting would be very useful for planning effective ICT initiatives in the future (see Whited, 2001, for an evaluation of outcomes in a developed setting). Patient satisfaction is another issue that may vary

with differing modes of interaction. Finally, and perhaps most importantly, e-mail incurs a delay in response. Where transportation is costly, as it is for many rural people in the developing world, a delay between medical service events often prevents the patient from following up; in the case of e-mail being used for diagnosis of an ophthalmic condition at a kiosk in a larger village in India, the patient may not be able to return to the kiosk for lack of time and/or funds.

The Aravind Eye Care System, among other ICT initiatives, has experimented with remote diagnosis (see Figure 1). AECS is one of the largest providers of eye care in the world, located in Tamil Nadu, India, and focused on the eradication of preventable blindness in underserved populations. In 2003, AECS partnered with n-Logue, a private company created by Professor Ashok Jhunjhunwala of the Indian Institute of Technology, Madras, to establish rural information kiosks throughout India. The partnership was aimed at providing another mechanism for screening patients and directing them to the hospital for care. Many of Tamil Nadu's residents live in rural settings where transportation to urban centers for treatment represents a significant burden. Much like the eye camps that AECS runs, this initiative was aimed at bringing the diagnosis to the people.

Figure 2. Women in Kunduz, Afghanistan being trained to use Equal Access Satellite Receiver (Copyright Equal Access 2005, reprinted with permission)



Under the supervision of one of the doctors at their Madurai hospital, AECS designated several counselors to deal with requests for consultation made from the n-Logue kiosks.

At present, the system has not met with widespread use due to several factors. The n-Logue wireless technology was good at providing connectivity across distances cost effectively, but bandwidth was severely limited. Each kiosk owner was provided with a bundle of technologies, including a digital camera, but its resolution often proved insufficient for proper diagnosis of anything beyond the most mature cataracts. Furthermore, patients preferred synchronous communication mechanisms such as videoconferencing sessions with the counselors to detailing their problem to the kiosk owner who relays the information via e-mail along with a picture. The bandwidth restrictions of the n-Logue system made it difficult to hold satisfactory videoconferencing sessions, though attempts were made to deal with poor performance. Another problem was the kiosk owners themselves because they served as the key point of contact with the rural communities. If they did not buy into the potential of such services, or were unwilling to provide the assistance necessary to facilitate such contacts, the system was effectively useless. This was the case with many kiosk owners; but in cases where

a motivated kiosk owner existed, positive results were seen by AECS (Bhandari et al., 2004). There exists potential for this system to be used additionally for follow-up care and the dissemination of information (including education), but this potential is yet unrealized aside from some experiments.

Connecting providers to patients, via any modality, must be accompanied by proper support and follow up; training mediators, such as kiosk operators, to assist with diagnosis or screening is critical to the success of such operations. Furthermore, practitioners should realize that this is of more value to some medical specialties than others, and that digital imaging can play a very important role in the feasibility of operations for some of these disciplines.

Education

As we have already indicated, education is one of the major areas of public health. As a use class, education presents more usability challenges than the other classes because of the diversity of end users. Health education can be subdivided into two subclasses: (a) continuing education for medical staff and semiskilled training for paraprofessionals, and (b) direct population education. Each of these subclasses represents a distinct but

diverse set of users with different needs, values, and abilities.

- **Health worker education:** Chandrasekhar and Ghosh (2001, p. 851) indicate the need for “education and lifelong learning that will enable doctors in developing countries to be informed about and trained in the use of advances in knowledge.” Pakenham-Walsh, Priestley, and Smith (1997, p. 90) further develop the need to educate a broader set of health workers: “Providing access to reliable health information for health workers in developing countries is potentially the single most cost effective and achievable strategy for sustainable improvement in health care.” The challenges are in providing that reliable access, but also in allowing for ownership of information, in other words, for health workers and others to actively participate in, and contribute to, the educational process rather than passively assimilate information created in a different context. In either case, ICT has not been adequately used to date to accomplish the task of continual training for medical professionals and paraprofessionals. The end users of such systems have a wide variety of abilities and informational needs, from skilled surgeons to midwives.
- **Population education:** As we have already noted, the goal of health education is to change peoples’ behavior in order to benefit community health. Unfortunately, such health promotion has always been a very difficult proposition, given any medium. Recent trends toward using culturally appropriate entertainment have proved more successful than traditional means of education, such as the presentation of facts (e.g., Brown, 2004; Farr, Witte, Jarato, & Menard, 2005, for HIV/AIDS). ICTs are well-designed for entertainment and are often used for this

purpose across the developing world, so leveraging this in order to develop meaningful health education initiatives is promising.

Equal Access’ educational initiatives use satellite radio to enable community women (see figure 2) to create audio content and broadcast it to a wide geographic area (Bellows & Sandhu, personal communication, 2005). Their system is being used to develop locally created programs that enable health education in Nepal, Afghanistan, and India. Satellite radio as a medium allows them to create their own content at a much lower cost than traditional broadcast radio, and to reach a much broader audience. The drawbacks are the cost of program creation and the equipment cost. In other settings, educational kiosks have been used in urban health clinics in Mexico City to educate women about prenatal care (Langer & Catino, 2003). In direct education of populations at large, the users are highly varied. In many cases, they may not be literate, or they may speak many dialects and languages over a small geographic area, but this is very country dependent. For example, Cuba and Mongolia both have literacy rates of more than 97%, while Nepal’s rate is 45% and Niger’s is less than 20% (CIA, 2005). This makes the development of appropriate educational material difficult. While some technologists approach this problem by developing content (or devices) that communicate in all manners to all people, another approach is to view the community’s collective assets (in terms of both literacy and linguistic ability) as an element of the system (Sandhu, Hey, Newman, & Agogino, 2005). Rather than creating ICT that can communicate with every person, ICT that can communicate with every community can have greater population impact, if designed carefully.

Logistics

Logistical systems form the backbone of the major areas of public health. Logistic systems supply

not only products, but also health professionals who provide key services. As a use class, logistics has two general subclasses of end users divided into (a) disaster-relief systems for emergency and temporary medical services, and (b) permanent population health services that enhance health systems. Both of these subclasses represent a distinct but diverse set of users with different needs, values, and abilities.

- **Disaster relief logistics:** In the December 2004 Indian Ocean tsunami, there was a need for both short-term disaster relief and long-term systems enhancement. The logistics of relief include collecting immediate surveillance data, funneling resources to set up medical services, creating systems to inform the affected populations about treatment and prevention of contagion, and evaluating the process to continue squeezing more efficiency from future missions. Various organizations specialize in developing the necessary systems and skills for logistics relief programs. The Fritz Institute, for example, focuses on developing and deploying humanitarian logistics software, and addressing the problem of aid delivery, supply-chain management and coordination, and operations research. Such logistical organization of services and goods is critical to both public health relief efforts and health systems in general. As *The Economist* noted:

what is special about this tsunami is the geographical extent of the devastation and the number of countries affected. Earthquakes produce terrible consequences, but normally of a highly localised sort...the damage stretches across thousands of miles and involves millions of people. That produces a huge logistical challenge for international organisations and

aid agencies: how to get relief supplies and, later, reconstruction assistance to so many places at more or less the same time. Much more of the money and planning will have to be devoted to planes, helicopters, trucks and supply lines than in “normal” disasters and relief efforts.

(“Asia’s Devastation: Reflections on a Rare but Terrible Calamity,” 2004, p.9)

The tsunami operation highlighted the complexities of getting relief across borders in the shortest possible time and with maximum efficiency. Humanitarian organizations not only had to cope with damaged infrastructure, they were also dealing with 12 different governments and 12 different sets of customs regulations. Delays in getting aid to those who needed it cost lives (Bannon, 2005). Coordinated efforts via ICT applications such as humanitarian logistics software applications are starting to gain attention. Recent crises demonstrate that ICTs can improve the delivery of health and disaster-management services to poor and remote locations (Chandrasekhar & Ghosh, 2001). However, the opposite is also true, and ICTs should be supported by contingency plans when ICT-dependent operations fail. In the 2005 U.S. Hurricane Katrina relief effort, mobile medical services could not be seconded quickly to disaster areas in part because the communications infrastructure had been decimated resulting in an inability to coordinate human efforts to drive the placement of such extra resources. The service providers and volunteers, however, expected the systems to be ready, and the absence of any effective response system led to immediate criticisms of federal and state inaction (Marchione, 2005).

- **Long-term population health services:** There are a variety of logistical ICT applications that can enhance health systems. The discussion of each would require detail

beyond the scope of this chapter; however, several general examples should be mentioned. Systems to assure consistent medical goods and information supply are critical for every aspect of public health. For example, “stock-outs,” when inventory levels reach zero in the face of continuing demand, are a constant problem for public clinics in many developing countries, and having a basic communications link in place can help alleviate this problem. In another example, effective surveillance and subsequent logistical coordination requires a data supply chain to deliver information to decision makers and resource-allocation centers. Furthermore, health services are only operational if clinical data are accessible by health-care workers. Some other examples of supporting health-care delivery and systems include the implementation of mini medical records via smart-card applications that capture clinical data. Some efforts are being made to have personal health data carried on a card to clinics of the patient’s choice. All of these applications should be designed with two major goals in mind: the enhancement of decision-making capacity and the organization of services for patient care.

A VARIETY OF TECHNOLOGIES

In July 2005, *The Economist* asserted that the mobile phone, not the personal computer, was the key to alleviating the digital divide (“Business: Calling an End to Poverty,” 2005). Even C. K. Prahalad claimed in that same issue, “Emerging markets will be wireless-centric, not PC-centric,” but wireless technologies alone will not offer a means for tackling all problems. Though the article cites a World Bank report indicating that 77% of the world’s population lives within range of a mobile network, this is in fact an optimistic estimate;

60% is more accurate (*Financing Information and Communication Infrastructure Needs in the Developing World: Public and Private Roles*, 2005). Additionally, many of the people in this 60% do not have access to the networks because of the prohibitive handset cost. Furthermore, building mobile networks that will reach the remainder of the population will be difficult as this represents the poorest, most rural populations, and as the quality of access will necessarily be worse. Sharing devices where appropriate will certainly help alleviate some of these problems, but the reality is that heterogeneous methods integrating multiple technologies with more traditional forms of communication will be necessary to achieve the apparent goal of improving lives as Voxiva is now doing with health surveillance in Peru and India. It is important to recognize that a variety of ICTs exist, each with its own set of strengths and weaknesses. Furthermore, the requirements of each use class within the health sector vary greatly, so no single ICT will prove decisive.

A particular ICT activity can similarly be enabled by multiple technologies, depending on the setting; for example, television can be relayed via traditional terrestrial broadcast, via the Internet on a personal computer, or via satellite using a dish. In this television example—in addition to different platforms and broadcast mechanisms—there can also be different applications, such as entertainment, news, or education. Although the end result may be similar, the cost, ease of use, infrastructure, and penetration might be extremely different. These factors can greatly impact the appropriate choice in a given setting.

Assessment

Health ICT involves the intersection of technology, health, and local context and thus requires a multifaceted approach to answering the question of how best to judge these technologies. In other words, an assessment of the technology alone is not likely to yield a sufficient analysis because

without improved health outcomes, the overall benefit will be negligible. These issues of technical and population health performance impact both design and assessment. As health ICT operates at the intersection of several fields, we must clarify what is meant by assessment. Assessment includes systems-level issues, health outcomes (or relevant proxies for health outcomes), usability, and technical evaluation; however, we will only discuss the first three of these as technical evaluation (e.g., reliability, performance, interoperability) is well established. Each of these factors plays a critical role in the successful deployment of a sustainable health ICT solution.

Systems Issues

How do we assess these various technologies? In order to judge any technology one must first ask questions concerning the initiative, project, or intervention. The following are systems-level issues, where systems are comprised of people, organizations, and technology:

1. What are the system goals?
2. What are the needs of the target users?
3. What are the capabilities of this target population?
4. What are the needs of the critical stakeholders (often not the users)?
5. Who has ownership of the technology? Is there sufficient local investment in the initiative to provide for sustainability?
6. What is the duration of the project and how will the system evolve?
7. How will maintenance and support be provided?
8. What are the assumed modes of interaction with the system, and are they feasible?
9. What is the source of financing, what are the real operation costs, and is it economically sustainable?

The answers to these questions should be used during the systems design phase, and should be answered prior to undertaking any initiative. At the same time, these questions can and should be revisited during the progress of such an initiative in order to assess its effectiveness as it is implemented.

Health Outcomes

Different assessment strategies are appropriate for different ICT initiatives in health, both by the nature of the application and the purpose of the project. A one-size-fits-all assessment strategy is not practical and may be somewhat harmful. Why conduct assessment? In some cases, assessment is no more than program evaluation and is used to improve the ongoing processes of an initiative. Beyond this, program evaluation may help others undertaking similar initiatives. In the most rigorous sense, as is often appropriate in a more experimental initiative, formal research methods can be used to elicit intervention effects in order to add to the greater body of knowledge and to plan a strategy for similar initiatives elsewhere.

Randomized control trials (RCTs) of products and even services are the most rigorous means of assessing the potential. The gold standard, double-blinded RCT, may be impractical or unethical in many settings (Smith & Pell, 2003). An intervention might be randomized against a placebo or compared to the current gold-standard product or service in what are called equivalency trials. For example, an equivalency trial might compare in-person cataract diagnosis (the gold standard) against remote diagnosis using e-mail with digital imagery. Randomized intervention trials require the measurement of effects at the scale of an individual, or perhaps a community; as such, this methodology does not lend itself easily to particular ICT applications (e.g., changing from paper to electronic medical records at a particular health center).

Evaluating medical interventions has traditionally considered efficacy and clinical outcomes. Increasingly, there is also concern with cost and effectiveness in the field. For public health evaluators, the ultimate goal is verification of health outcomes: alive or dead, sick or healthy. However, other indicators often suffice to answer questions of program functionality. For example, health education evaluations rely on measuring changes in knowledge, attitudes, or behaviors (in increasing order of difficulty), but do not have time to wait for health events to validate the intervention.

Ethical issues also arise, particularly in the design of RCTs. International standards require prior informed consent of study participants; furthermore, research cannot assign harm to study subjects (United Nations, 2005). Withholding a service that is known to be beneficial from a population when there are sufficient funds to provide the service to this population may be unethical. A more comprehensive discussion of RCT ethics is not appropriate here, but ethical issues should be at the forefront of any research design.

Committees for the protection of human subjects (CPHS), also known as institutional review boards (IRBs), were established in the hope that peer review would reduce the likelihood of abusive research. Community advisory boards (CABs) take research oversight one step further with active community participation in research design and implementation. Community-based participatory research (CBPR) is a loosely defined field in which the community forms an active partnership in, and in some cases leads, research efforts (Minkler, 1997). Rather than limit participation to the CAB, CBPR calls for community involvement from the first efforts at framing the research question to the dissemination and publication of findings. Critics argue that this gradient of increasing involvement from IRB to CBPR compromises the quality of objective inquiry; however, there are compelling counterarguments noting the greater ethical validity of study participants playing an active role

in research design and implementation. Though there are some similarities, CBPR is distinct from the participatory methods that have been used in other development-related work (e.g., Narayan & Srinivasan, 1994).

Usability

Usability refers to the ease with which people can utilize a product or service for a particular purpose. Though the term is often applied to artifacts, it can apply to any designed system, of which technology is often only a part.

Voxiva represents an excellent example of a system that has adequately addressed issues of usability. They circumvented many usability issues by focusing on existing technology: their system users were already familiar with the technology as it was readily accessible and required no further maintenance. However, in the case of other applications, such as electronic surveillance systems, it may be necessary to develop new technology. In such cases, it is imperative to follow systematic usability design and assessment strategies. Good usability alone will not make a project successful, but poor usability of health ICT does not only plague projects, it can actually harm individuals (e.g., see Koppel et al., 2005).

Various methods exist for assessing the usability of products or services, primarily from the fields of human-computer interaction and human factors engineering. A treatment of these methods is outside the scope of this chapter, so for a more comprehensive review of usability, including usability assessment, the reader is referred to Kuniavsky (2003), Nielsen (1994), and Norman (2002). Beyond this, Karsh (2004) provides a topically relevant, comprehensive overview of issues related to technology acceptance.

Design is inherently an iterative process, and integrating systems usability testing into this process leads to more robust, lean, and ultimately useful products and services. The key is to involve

users early and often in the design process, in particular eliciting and addressing their unique needs as system users.

OVERALL CONSIDERATIONS

In the short term, information technologies essentially “introduce new channels of communication and transactions in healthcare” (Demiris, 2004, p. 145). Effective delivery of health services requires a plethora of data. Measuring population outcomes, monitoring service delivery outputs, and managing health systems all require large, often complex, information flows. Technologies that manage information and communication increase the efficiency of information flows, and ultimately save lives and money. The ability to coordinate a health system and delivery of care is predicated on the ability to communicate and have access to information. In the long term, health ICT “refers to a fundamental redesign of healthcare delivery” (Scott, 2004, p.1). Health ICT applications and principles promise to rebuild health industries in profound ways. However, the challenges are significant because emerging economies impose resource constraints on ICT development that are not present in wealthier societies. In addition to resource constraints, there are a number of other very important challenges, including the match between design and cultural context, systems infrastructure, and disease characteristics.

It is necessary for design purposes to know the local context and variety of applications. In one example of the challenges to public health, researchers identified four critical factors in telehealth transfer to Ethiopia: national ICT policies, ICT infrastructure, telehealth implementation factors, and culture-specific beliefs and values and differences in technology cultures between the developers in rich countries and the users in poor countries (Tan et al., 2005). Heeks (2002) highlighted a “design-actuality gap,” which he defined as the match or mismatch between infor-

mation systems designs and local user reality. Two further illustrations make similar points. First, according to Jayasuriya (1999, p. 335):

Factors that led to the failure [of the Philippine computerized information system (IS)] included ambiguity in the organization and in responsibility for the project, lack of capacity to undertake large information systems development projects and inability to retain appropriate staff. However, when the historical and contextual issues were revealed and the interplay between the content, process and context of the change was analyzed it was revealed that the content of the IS was not responsive to the changes in the wider health system. The case study confirms the need to analyze and understand organizational, environmental and cultural issues in adopting models and procedures used elsewhere when managing information systems in developing countries.

Second, according to WHO (2001a):

New technologies hold great potential for improving health care, primarily by increasing the quality, relevance and delivery of information to health personnel. Unfortunately, this potential is far from being realized in many countries, partly because of the financial, technological and infrastructure challenges of the “digital divide,” but also because the real and greatly varying needs of the users are often overlooked.

ICT development, use, and implementation can face infrastructure-level barriers that not only include the lack of a highly skilled work-

force and appropriate financing, but also other factors that fall under the broad umbrella of ICT governance; some examples include issues such as the sustainability of ICT systems, training and management capacity, constant maintenance of software systems, establishing data standards, adequate and appropriate power supply, and privacy and security of particular types of sensitive health data (e.g., pregnancy or HIV test results). In the West, there are regulatory systems in place that guide rule enforcement, and policy initiatives that protect privacy such as the Health Insurance Portability and Accountability Act (HIPAA) regulations in the United States. Innovative solutions must be generated in order to have a high level of ICT governance that also encompasses ethical considerations. Furthermore, because of the lack of health-care infrastructure in many developing regions, product design must be appropriate to the particular context. For example, having robust hardware (e.g., for power-supply issues, having longer life batteries or alternative power options) or proper management is more critical.

In the developed world, various insurance and governmental schemes generally pay for most of health care; however, in the developing world, the individual can bear over two thirds of the cost (Lewinberg, 2003). The lack of third-party payers for medical infrastructure in these regions is a significant barrier. The annual total expenditure per person in the world's developing regions is less than \$75 on all health expenses (Quick, 2003; Trouiller, Olliaro, Torreele, Orbinski, Laing, & Ford, 2002). Since the consumer does not bear the actual cost of substantial portions of health care in developed nations, the demand for medical care and new technologies is very high (Cutler & McClellan, 2001). Clearly, this is not the case in developing nations. However, even if the cost of technology or particular types of care was significantly reduced, the lack of infrastructure would make it very difficult to distribute, administer or use, and properly sustain the use of various medical goods (Hongoro & McPake, 2004). Furthermore,

there are significant indirect costs, including waiting time, transportation costs, lost wages, poor-quality health services, and many others (Melese, Alemayehu, Friedlander, & Courtright, 2004; Russell, 2004). These indirect costs are substantial and are significant deterrents to utilizing health care. These factors will substantially impact any sort of ICT for health initiatives and should be taken into account.

Alternative health finance strategies are being piloted. The World Bank, German Development Bank (KfW), and others are considering a mechanism called output-based assistance (OBA). Instead of using input-based global budgets, which allocate funds for supplies, labor, and other goods and services to the provider, an OBA approach gives patients the means to choose their preferred health-care provider. Patients use vouchers for health services at qualified government and non-government facilities. Providers are reimbursed on a per-patient basis, the clinic's output, as long as quality criteria are met in delivering the service. OBA has been lauded as a strategy to put aid in the hands of those who need it most while freeing service providers to develop competitively priced high-quality health services (Campell, Janisch, Potts, & Bellows, 2005; Sandiford, Gorter, & Salvetto, 2002; Yamamoto, 2004). ICT reporting systems will improve the efficiency and reduce fraud of future iterations of this strategy.

The nature of a particular disease will dictate not only ICT design and health finance structures, but also a host of other factors such as intervention, sustainability, complexity, and costs. In general, the public health community categorizes diseases as either acute (HIV) or chronic (cardiovascular diseases); however, one must go beyond such categories and understand the true natural history of disease and its treatment. For example, an SMS-based (mobile phone) medication reminder may result in very different levels of compliance after several months for tuberculosis patients, who are generally asymptomatic, when compared with diabetics, who can become symptomatic very

Peering into the Black Box

quickly. Also, the course of diabetes is a chronic condition requiring a lifetime of treatment and vigilance.

Major barriers to information-technology access and development include disease characteristics, appropriate accompanying technology, sociocultural considerations, and poor health-care infrastructure. ICT for health projects should be mindful of the overall goals of public health in developing countries, which is to reduce population-wide morbidity and mortality. When building such projects, designers should consider the net impact of any particular ICT implementation on a disease or health issue, and whether extremely scarce resources are being used wisely. Initiatives should also attempt to build in cost-reducing, efficiency-increasing systems for health care, and avoid redeploing an entirely different way of delivering care.

TRENDS AND CONCLUSION

Future trends will be affected by the dynamic nature of both technology and the shifting disease burden. There are several likely stages of ICT utilization for health in developing countries that

will be dependent on the state of the infrastructure available.

In the short term, it is practical to assume that the state of the ICT infrastructure (lack of infrastructure in many cases) will be relatively stable; however, the utilization of the existing infrastructure will be somewhat variable. We anticipate an increase of currently available services: more health worker training, more telehealth applications, improved frequency of data gathering for surveillance, and more sites using information technology for effective management. Skilled medical staff, particularly in urban areas, will gain increasing access to health information, but this will still be tempered by the cost of accessing some of the most relevant content (e.g., health journal research).

In the long term, we expect ICT infrastructure to develop and overcome current bottlenecks. The diffusion of modern ICTs—mobile telephony is the most prominent example today—have allowed many populations to leapfrog older technologies (such as terrestrial telephony) because of the lower access costs. In a similar fashion, we expect mobile telephony, WLL (wireless local loop), WAN (wide area network, including Worldwide Interoperability for Microwave Access [WiMAX]), and other such technologies to enable wider access to

Table 3. Change in the rank order of disease burden for 8 leading causes worldwide, 1990-2020 (Lopez & Murray, 1998)

| Rank | Disease or Injury | |
|------|--|---------------------------------------|
| | 1990 | 2020 |
| 1 | Lower respiratory infections | Ischemic heart disease |
| 2 | Diarrheal diseases | Unipolar major depression |
| 3 | Conditions during the perinatal period | Road traffic accidents |
| 4 | Unipolar major depression | Cerebrovascular disease |
| 5 | Ischemic heart disease | Chronic obstructive pulmonary disease |
| 6 | Cerebrovascular disease | Lower respiratory infections |
| 7 | Tuberculosis | Tuberculosis |
| 8 | Measles | War |

information and communication channels. Thus, we expect a proliferation of the number and type of health services, but this will occur over a time scale that is largely paced by the natural diffusion of the technology.

While economic viability plays a central role in the sustainability of any health ICT initiative, technology itself plays another critical role. Computing and communication technologies—from software applications to mobile phones to networking equipment—are constantly evolving. The highly dynamic nature of technology and the obsolescence of the technology left in its wake are of paramount concern as new technology often requires further capital investment and personnel training. Using older technologies with local support is appropriate as long as the technology is meeting the necessary requirements, and maintenance does not depend on components that can no longer be acquired. Technological sustainability and obsolescence are key concerns because of the often critical nature of health services that may grow dependent on the technology.

We need to understand not only technological change, but also dynamic health issues. The global burden of disease (GBD) forecast for 2020 (see Table 3) provides a gross indication of the changing face of disease and injury. Notably, depression will climb to second on the list in the face of prevailing global stigma and discrimination against those who suffer from it (WHO, 2001b). Road traffic accidents will represent the third highest disease burden, and while health ICT initiatives may serve to improve response to such accidents, prevention will be equally as important. Though these forecasts were compiled by a group of world experts, they were developed with disparate data and many strong assumptions, and are subject to regional differences; however, the importance of this data to our discussion is not the actual changes in the GBD, but that there will be a change, and that ICT initiatives, or the use of ICT more generally, must adapt to these changes.

Health disparities within countries and regions will explode over the upcoming years. For the first time, many health technologies, including ICT, will be available in country, but only to those who can afford them (e.g., Apollo Hospitals in India). It is yet unclear whether having these technologies present in country will have any impact on population health at the national scale, but is nonetheless an important trend to watch.

In order to successfully develop and integrate ICTs for public health applications, it is crucial to approach the process holistically, addressing human factors with respect to organizations, cultural context, and end users. Comprehensive ICT strategies should integrate more “basic” technologies (terrestrial phones, conventional radio, and television) with new opportunities. Multipronged assessment is critical to addressing locally relevant issues as well as to providing information for others who may undertake similar initiatives. All of this ICT development and integration should consider the use classes as a starting point for applying these lessons to research, education, health-care delivery, and surveillance in public health.

REFERENCES

- AbouZahr, C., & Boerma, T. (2005). Health information systems: The foundations of public health. *Bull World Health Organ*, 83(8), 578-583.
- Arunachalam, S. (2003). Information for research in developing countries: Information technology: Friend or foe? *Bulletin of the American Society for Information Science and Technology*, 29(5), 16-21.
- Asia's devastation: Reflections on a rare but terrible calamity. (2004, December 29). *The Economist*, p. 9.
- Baldacci, E., Clements, B., Cui, Q., & Gupta, S. (2005). What does it take to help the poor? *Finance and Development*, 42(2), 20.

Peering into the Black Box

- Bannon, V. (2005, January 12). Red Cross: Disaster donors must focus on local volunteers. *Wall Street Journal*.
- Bashshur, R. (1980). *Technology serves the people: The story of a cooperative telemedicine project by NASA, the Indian Health Service and the Papago people*. Washington, DC: National Aeronautics and Space Administration.
- Beveridge, M., Howard, A., Burton, K., & Holder, W. (2003). The Ptolemy project: A scalable model for delivering health information in Africa. *BMJ*, 327(7418), 790-793.
- Bhandari, A., Ibrahim, M., & Sandhu, J. S. (2004). *Remote eye care delivery via rural information kiosks* (white paper). Berkeley, CA: University of California.
- Braa, J., Macome, E., Mavimbe, J. C., Nhampossa, J. L., Leopoldo da Costa, J., Jose, B., et al. (2001). A study of the actual and potential usage of information and communication technology at district and provincial levels in Mozambique with a focus on the health sector. *Electronic Journal on Information Systems in Developing Countries*, 5(2), 1-29.
- Brown, H. (2004). UN urges broadcasters to air AIDS programmes. *The Lancet*, 363(9405), 295.
- Business: Calling an end to poverty. Mobile phones and development. (2005). *The Economist*, 376, 53.
- Campell, M., Janisch, C., Potts, M., & Bellows, B. (2005). *The need and potential for output-based assistance in health and family planning*. Unpublished manuscript.
- Casas, C., LaJoie, W., & Prahalad, C. K. (2003). *Voxiva case study*. MI: University of Michigan Business School, Department of Strategy and Corporate Business.
- Centers for Disease Control and Prevention. (2005). *EpiInfo*. Retrieved March 21, 2005, from <http://www.cdc.gov/epiinfo/>
- Chandrasekhar, C. P., & Ghosh, J. (2001). Information and communication technologies and health in low income countries: The potential and the constraints. *Bull World Health Organ*, 79(9), 850-855.
- Central Intelligence Agency (CIA). (2005). *World fact book*. Retrieved on September 27, 2006 from <https://www.cia.gov/cia/publications/factbook/index.html>
- Cutler, D., & McClellan, M. (2001). Is technological change in medicine worth it? *Health Affairs*, 20(5), 11-29.
- Dartmouth Medical School (2005) *Ultrasound images transmitted over the phone allow radiologists to diagnose patients in poorer countries in real time*. Press Release. May 17, 2005.
- Deaton, A. (2003). Health, inequality and economic development. *Journal of Economic Literature*, 41(1), 113-158.
- Demiris, G. (2004). Preface. In G. Demiris (Ed.), *E-health: Current status and future trends* (Vol. 106, pp. 145). Washington, DC: IOS Press.
- Easterly, W. (2002). *The elusive quest for growth*. Cambridge, MA: MIT Paperback Press.
- Edejer, T. T.-T. (2000). Disseminating health information in developing countries: The role of the Internet. *BMJ*, 321(7264), 797-800.
- Equal access: Satellite radio programming in South Asia. (2005). (pp. personal communication). San Francisco.
- Farr, A., Witte, K., Jarato, K., & Menard, T. (2005). The effectiveness of media use in health education: Evaluation of an HIV/AIDS television campaign in Ethiopia. *Journal of Health Communication*, 10(3), 225-235.

- Financing information and communication infrastructure needs in the developing world: Public and private roles.* (2005). Washington, DC: World Bank, Global Information and Communication Technologies Department.
- Fosaelli, P. (1983). The telephone in pediatric medicine: A review. *Clinical Pediatrics*, 22(4), 293-296.
- Godlee, F., Pakenham-Walsh, N., Ncayiyana, D., Cohen, B., & Packer, A. (2004). Can we achieve health information for all by 2015? *Lancet*, 364(9430), 295-300.
- Graham, L., Zimmerman, M., Vassallo, D., Patterson, V., Swinfen, P., Swinfen, R., et al. (2003). Telemedicine: The way ahead for medicine in the developing world. *Tropical Doctor*, 33(1), 36-38.
- Hancock, T. (1993). *Health, human development and the community ecosystem: Three ecological models.* Oxford, United Kingdom: Oxford University Press.
- Hanson, K., & Berman, P. (1998). Private health care provision in developing countries: A preliminary analysis of levels and composition. *Health Policy and Planning*, 13(3), 195-211.
- Health and wealth. (2002). *Nature Medicine*, 8(2), 89.
- Heeks, R. (2002). Information systems and developing countries: Failure, success, and local improvisations. *The Information Society*, 18, 101-112.
- Hongoro, C., & McPake, B. (2004). How to bridge the gap in human resources for health. *Lancet*, 364(9443), 1451-1456.
- Horton, R. (2000). North and south: Bridging the information gap. *The Lancet*, 355(9222), 2231-2237.
- Jacobson, I., Christerson, M., Jonsson, P., & Overgaard, G. (1992). *Object-oriented software engineering: A use case driven approach.* Wokingham, UK: Addison-Wesley.
- Jayasuriya, R. (1999). Managing information systems for health services in a developing country: A case study using a contextualist framework. *International Journal of Information Management*, 19(5), 335-349.
- Karsh, B. T. (2004). Beyond usability: Designing effective technology implementation systems to promote patient safety. *Quality and Safety in Healthcare*, 13(5), 388-394.
- Koppel, R., Metlay, J. P., Cohen, A., Abaluck, B., Localio, A. R., Kimmel, S. E., et al. (2005). Role of computerized physician order entry systems in facilitating medication errors. *JAMA*, 293(10), 1197-1203.
- Kuniavsky, M. *Observing the user experience: a practitioner's guide to user research.* San Francisco, Calif.: Morgan Kaufmann, 2003.
- LaFraniere, S., & Grady, D. (2005, April 17). Stalking a deadly virus, battling a town's fears. *New York Times*, p. 1.
- Langer, T. A., & Catino, J. (2003). *Improving prenatal care in Mexico City: Impact of an interactive computer-based education and empowerment tool.* Paper presented at the XVII FIGO World Congress of Obstetrics and Gynecology, Santiago, Chile.
- Lewinberg, A. (2003). *Guide for policymakers and researchers: Understanding the challenge making essential medicines available to the world's poor.* Toronto, Canada: University of Toronto, Centre for Innovation Law and Policy.
- Lopez, A. D., & Murray, C. C. (1998). The global burden of disease, 1990-2020. *Nature Medicine*, 4(11), 1241-1243.
- Lumpkin, J. R., & Richards, M. S. (2002). Transforming the public health information infrastructure. *Health Affairs*, 21(6), 45.

Peering into the Black Box

- Marchione, M. (2005). *Doctors hamstrung in relief efforts*. Retrieved September 4, 2005, from http://news.yahoo.com/s/ap/20050904/ap_on_he_me/katrina_health_1
- Melese, M., Alemayehu, W., Friedlander, E., & Courtright, P. (2004). Indirect costs associated with accessing eye care services as a barrier to service use in Ethiopia. *Tropical Medicine and International Health*, 9(3), 426-431.
- Minkler, M. (Ed.). (1997). *Community organizing & community building for health*. New Brunswick, NJ: Rutgers State University Press.
- Narayan, D., & Srinivasan, L. (1994). *Participatory development toolkit: Materials to facilitate community empowerment*. Washington, DC: World Bank.
- Ndayimirije, N., & Kindhauser, M. K. (2005). Marburg hemorrhagic fever in Angola: Fighting fear and a lethal pathogen. *New England Journal of Medicine*, 352(21), 2155-2158.
- Nielsen, J. *Usability engineering*. San Francisco, Calif.: Morgan Kaufmann, 1994.
- Norman, D. A. (2002). *The Design of Everyday Things*. New York: Basic Books.
- Pakenham-Walsh, N., Priestley, C., & Smith, R. (1997). Meeting the information needs of health workers in developing countries. *BMJ*, 314(7074), 90-.
- Prata, N., Montagu, D., & Jefferys, E. (2005). Private sector, human resources and health franchising in Africa. *Bull World Health Organization*, 83, 274-279.
- Quick, J. D. (2003). Ensuring access to essential medicines in the developing countries: A framework for action. *Clinical Pharmacology Therapeutics*, 73(4), 279-283.
- Russell, S. (2004). The economic burden of illness for households in developing countries: A review of studies focusing on malaria, tuberculosis, and human immunodeficiency virus/acquired immunodeficiency syndrome. *American Journal of Tropical Medicine and Hygiene*, 71(Suppl. 2), 147-155.
- Sachs, J., Ahluwalia, I.J., Amoako, K.Y., Aninat, E., Cohen, D., Diabre, Z., et al. (2002). *Report of the Commission on Macroeconomics and Health: Investing in health for economic development*. Geneva, Switzerland: World Health Organization.
- Sandhu, J., Hey, J., Newman, C., & Agogino, A. (2005). *Informal health and legal rights education in rural, agricultural communities using mobile devices*. Paper presented at the IEEE Technology for Education in Developing Countries (TEDC) Workshop, Kaohsiung, Taiwan.
- Sandiford, P., Gorter, A., & Salvetto, M. (2002). Use of voucher schemes for output-based aid in the health sector in Nicaragua: Three case studies. *Public Policy for the Private Sector*, 4, 1-4.
- Scott, J. (2004). Message from James K Scott, director of the European Union Center at the University of Missouri. In G. Demiris (Ed.), *E-health: Current status and future trends* (Vol. 106, pp. 1-2). Washington, DC: IOS Press.
- Shaw, V. (2005). Health information system reform in South Africa: Developing an essential data set. *Bull World Health Organization*, 83(8), 632-639.
- Smith, G. C. S., & Pell, J. P. (2003). Parachute use to prevent death and major trauma related to gravitational challenge: Systematic review of randomised controlled trials. *BMJ*, 327(7429), 1459-1461.
- Taggart, K. (2003). Ugandan doctors pilot electronic communications. *Medical Post*, 39(37), 6.
- Telemedicine: A guide to assessing telecommunications in health care*. (1996). Washington, DC: U.S. Institute of Medicine, Committee on Evaluating Clinical Applications of Telemedicine.

Trouiller, P., Oliaro, P., Torreele, E., Orbinski, J., Laing, R., & Ford, N. (2002). Drug development for neglected diseases: A deficient market and a public-health policy failure. *Lancet*, 359(9324), 2188-2194.

United Nations (UN). (2005). *Declaration of Helsinki: Ethical principles for medical research involving human subjects*. World Medical Association.

Voxiva. (2005). Retrieved August 30, 2005, from <http://www.voxiva.net>

Walsh, J. A., & Warren, K. S. (1980). Selective primary health care: An interim strategy for disease control in developing countries. *Social Science & Medicine [Med Econ]*, 14(2), 145-163.

Whited, J. (2001). Tele dermatology: Current status and future directions. *American Journal of Clinical Dermatology*, 2(2), 59-64.

Witten, I. H., Loots, M., Trujillo, M. F., & Bainbridge, D. (2001). The promise of digital libraries in developing countries. *Communications of the ACM (Association for Computing Machinery)*, 44(5), 82-85.

World Health Organization (WHO). (1948). *World Health Organization constitution*. Geneva, Switzerland: Author.

World Health Organization (WHO). (2001a). *United Nations millennium action plan: Health InterNetwork*. Retrieved September 15, 2005, from <http://www.healthinternetwork.net/src/millennium.php>

World Health Organization (WHO). (2001b). *The world health report 2001. Mental health: New understanding, new hope*. Geneva, Switzerland: Author.

World Health Organization (WHO). (2004). *Health expenditure data*. Retrieved September 15, 2005, from <http://devdata.worldbank.org/external/dg-sector.asp?W=0&RMDK=110&SMDK=473886>

World Health Organization (WHO). (2005). *HealthMapper*. Retrieved September 15, 2005, from http://www.who.int/health_mapping/tools/healthmapper/en/

Yamamoto, C. (2004). *Output-based aid in health: Reaching the poor through public-private partnership*. Washington, DC: World Bank.

NOTE

The author list does not imply the usual meaning with regard to the level of contribution. This chapter was truly a team effort with equal contributions from all.

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, and M. Acevedo-Ruiz, pp. 235-265, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.33

Analysing a Rural Community's Reception of ICT in Ghana

Paula F. Saddler

Association of Certified Fraud Examiners, USA

INTRODUCTION

The Fiankoma Project was a development awareness (DA) initiative run by the Video Educational Trust aiming to link the small rural community of Fiankoma (Ghana) with people and institutions in Brighton UK through Information and Communication Technologies (ICT). People in both settings produced accounts of their lives using digital media that were turned into a Web site for cultural exchange and development education. A parallel research project *Understandings of education in an African village: The impact of information and communication technologies* studied the effects of the intervention on the Ghanaian community, seeking to gain the perspective of rural Africans on ICT and development and particularly education. Ethnographic and participatory methods enabled the research to achieve an unusual perspective on these issues (Thomas & Ahmed, 2004; Chambers, 2003).

The research drew on data collected by Fiankoma Project workers as well as the mostly Ghanaian researchers in the *Understandings* team. "Data chains" were used to make more explicit the moves

from field experience to textual outcomes. Visual material often formed the first link in the chain, prompting reflection on the issues of interest and a stimulus for dialogue in the shape of informal interviews. The chain was continued by discussions between insider and outsider researchers of the previous links, interpreting existing data, and generating narratives derived from researchers' experience and understandings of the context. This linked with other data to guide further lines of inquiry (see Pryor & Ampiah, 2004 for a full methodological discussion).

Fuller accounts focusing on educational issues in Ghana are published elsewhere (Pryor & Ampiah, 2003; Pryor, 2005, forthcoming). This article discusses ICT and development issues, reporting on attitudes before the intervention, describing the approach to using digital media and its effect on attitudes towards community development. This is analysed and placed within an emergent framework for considering how ICT use might impact beneficially on rural people in disadvantaged contexts.

BACKGROUND

Before intervention from the Fiankoma project, villagers had little experience of electronic media, but paradoxically these were having a profound effect. Inexperience was due to the remoteness of the village and its lack of electricity, in itself a point of contention. Some months previously the village elders had proclaimed a levy to bring electricity to village. Any sum of money is difficult to find in rural Africa, but the levy appeared to be well within people's capacity to pay. The researchers conducted a ranking exercise, which confirmed that most people in the village considered electricity to be the one thing that would most improve their lives and bring economic benefits. Nonetheless, many had refused to pay. Interview data suggested that reluctance to pay was due not to poverty, but because of the weak social fabric of the village. Fiankoma is not a community to which its occupants owe allegiance, but a settler community. People live there because from the 1930s onwards, they or their parents left their homes to carve out farms in the forest. Despite many years residence, people felt more connected to their places of origin. Their attitude towards the electricity fund was reflected in their reluctance to contribute to anything locally—including the schools that their children attended. Recent work suggests that this situation is common in Ghana and elsewhere in sub-Saharan Africa with rural-rural migration leading to less stable populations than has been thought the case (Litchfield & Waddington, 2003).

Villagers' most frequent encounter with electronic media was radio mainly used for music. FM reception was poor and AM output did not use the local language. This also confined TV viewing mainly to infrequent Akan language soap operas and soccer matches. In a village of some hundred households up to five TV sets were in use at any one time, run from car batteries that had to go by taxi to be recharged. Nonetheless,

everyone watched TV occasionally, although few had any power over what and when. A traveling video showing Nigerian action-packed blockbusters, high on violence especially towards women, played to quite large audiences. During the project the village elders banned these shows, which were seen as corrupting the young, an action validated by Leach, Fiscian, Kadzamira, Lemani, and Machankanja (2003) who report boys' claims elsewhere in Ghana that sexual molestation of girls took place "to practice things in films" (p. 37).

The village had no telephone, few people had used one, though they knew about them from television, and it was placed very low in the ranking exercise. Computers were unfamiliar, as they did not feature in televised dramas. Although the senior secondary school syllabus includes some "hands on" experience, the few students who attended reported that this had failed to materialize. Very few had heard of the Internet.

Attitudes and understandings are ultimately more important than hardware and infrastructure issues (Leonard & Dorsey, 1996). Villagers' reactions to the project's work yielded important insights about their image of ICT. It had been anticipated that understanding the purpose of the project and the notion of cultural exchange would be problematic, so much effort went into explanations. Nevertheless two misconceptions surfaced.

The first, that the project was to provide development aid, occurred throughout the fieldnotes and was dominant in interviews. Development and its outcomes are familiar concrete ideas, whereas cultural exchange is abstract and unfamiliar. Moreover the very idea of cultural exchange presupposes experiences of a cultural "other," which is difficult to grasp for people whose experience of other cultures is hazy. "Obruni" (strangers, white people) might be benevolent, but that they wished to learn from villagers was incomprehensible. Recognising a power differential between the two parties, where difference in wealth was a

key distinguishing feature, good intentions could only be assured by some material benefit accruing from the exchange (Nelson & Wright, 1995).

Second, screenings of work in progress provoked worry about how the images might be used. Some felt that the "Obruni wanted to make a mockery of the inhabitants of the village."² Another view of malign intent, the idea from animist religion that Obruni would carry away people's spirits, may seem remote from the realities of modern technology, but in some respects it is close to the truth. The tourist gaze does not flatter developing countries, and affords no control to the subjects (Linnekin & Poyer, 1990). Images are created and removed from sight with no "come back." The "spirits" can be edited and used without reference to those portrayed. This "régime of representation" stereotypes the subjects, "classifies them according to a norm and constructs the excluded as 'other'" (Hall, 1999, p. 259). In global news media Africa is largely absent but when covered is usually seen negatively (Hawk, 1992) and Africans' poverty is explained "with reference to their own cultural lack" (Stevenson, 1999, p.138). The media's construction of Africa functions to perpetuate feelings of Western superiority and provides legitimisation for existing relations of dominance (Borgartz, 2002). Until recently this issue only surfaced for Africans who migrated to the North. However, with the reach of media extended to remote villages, people are exposed to a romanticised picture of global culture, yet do not see their own realities reflected.

In summary, although people were passive consumers of electronic media on a very small scale, these were affecting their cultural attitudes. Television and video gave a window into a more sophisticated and attractive urban world, mostly the cities of West Africa (cf., Lewin, 2000; Hall, 1998). ICT development was at best irrelevant for most people. At worst it reinforced the divide between them and the urban elite.

Faced with these problems, the methods used by the Fiankoma Project are significant. A docu-

ment was produced, spelling out the approach in the form of 12 rules (see www.fiankoma.org). The Fiankoma Method recognises that technology is less important than knowing what to do with it and conceptualises this in terms of enabling people to publish their own information and represent their own lives. The Web site was designed with its audience in mind, a process facilitated by having actual partners. A wide range of media, especially low tech, such as drawings and scrapbooks, enabled more people to participate actively. As far as possible, editorial responsibility was given to groups of people to help them explore cultural commonalities and differences. They were encouraged to respond to each other's contributions and find equivalence, so simple reproducible activities were favored. Humor and media conventions worked well and provided a safe context in which to look at problematic issues. Using ICT in development awareness required allocating time for making materials, viewing work from the other community and reflective discussion. The Web site was seen as something to be used rather than just created and the strategy for use included opportunities such as guest books, public events, and competitions.

EFFECT OF THE INTERVENTION ON ATTITUDES TOWARDS COMMUNITY DEVELOPMENT

When the Fiankoma project Web site was running, researchers returned to the village to collect more data and a group of villagers was taken to the city and introduced to computers. The session ended with browsing the Internet, especially the Fiankoma Web site.

Reactions were very positive, especially when people saw their village and themselves on the computer screen. The experience was intended to provoke thought about how computer technology might impact on their lives in the longer term, but it was difficult to get them to think beyond the

immediate experience. Issues of connectivity and access gave the experience a degree of unreality. Some expressed skepticism about the effect of computers, for example, that computers, though very exciting and useful, would emphasise the difference between urban and rural people. Others were more optimistic: a boy who had seen the Web site reversed his decision to drop out of school. The exchange value of school was heightened, as computers were the province of senior secondary school graduates and the use value of schooling via literacy was accentuated, since getting the most from the Web site depended on reading. ICT provided a window onto a world of opportunity, which was linked to education.

The Internet session also alleviated worries about the effect of the project's images. Visibility was now viewed positively: "Before no one knew I existed, now the whole world can see me."

Several months later, the Fiankoma project workers returned to share more UK work. A film was screened and two further Internet café visits staged. At the screenings most interest accrued from participants seeing themselves, especially activities where they had been most active in planning and authoring. The UK sections they were most positive about were those with strong points of connection to their own.

The Internet sessions were particularly targeted at teachers and older pupils. Teachers now recognised great educational potential in the Internet and that more access might enable Ghanaians to catch up, though this was unlikely as lack of resources would always put African countries at a disadvantage (c.f., "leapfrogging" and "marginalisation" in Yates (2002, p.6)).

However, the most dramatic effect of the Fiankoma project happened a few months later. A letter was received saying that the village had resurrected plans to raise money for electricity. The main engine for this was to be community action. The richest man in the village had donated land for a community farm and the village was

organising communal labor. All profits were going towards electrification and the village was now seeking other ways of getting further contributions. The Fiankoma Project responded to this by offering to raise matching funds. Several harvests later sufficient money has been raised and at the time of writing electrification is expected imminently.

The extent to which the Fiankoma project caused this change in attitudes towards community development is obviously open to debate. However, available data suggest that villagers hold it responsible. Whereas previously lack of community spirit generated little "push" towards this development, interaction with ICTs seems to have exerted a strong enough "pull" to counter the lack of community spirit.

DISCUSSION

This was a case study of an unusual eventuality—a cultural exchange project. As such it is difficult to generalise and hard to reproduce these specific circumstances and interventions elsewhere. Moreover, it is difficult to compare its effect on village life with ICT for development projects elsewhere in sub-Saharan Africa. Project reports tend to focus on individual effects and community impact is either unreported or is speculative rather than evaluative in nature (Etta & Warnahui, 2003; Adeya, 2002). More important, this was not a development initiative but a cultural exchange project. Villagers had no expectation of computers coming to the village for a very long time, so they were not demanding electricity to browse the Internet. The key outcome was that the particular form of their interaction with ICT had helped to galvanise a village into taking collective action where there had been very little sense of community; and this testifies to the power of some of the practices used. Analysis of just what was so powerful about these practices

may be useful in pointing to ways in which ICT development projects, especially those in rural Africa might conceptualise their work.

Before intervention, the impact of ICT on people in the village was negative, at best neutral. Radio, television and video appeared to have interrupted some traditional forms of communication, such as story telling. Video was associated with violent and sexually dubious messages, offensive to many adults in the village. Television was a window into a world of material plenty invoking invidious comparisons between urban and rural life and diminishing villagers' sense of dignity. Few could exercise power in their consumption of media, being reliant on neighbors' goodwill and limited by language. Rural people like them were infrequently portrayed and then in a negative way. Access to ICT was limited, passive and unmediated. They were sufficiently involved to be drawn into the periphery of the global media world, but the means of access and the nature of the texts only emphasised their sense of inferiority and exclusion.

By contrast, media access via the Fiankoma project, although still limited, was active/interactive and mediated. These features contributed to the ICT having a much more positive impact. In theorising this, the research identified three aspects that seem to have contributed to the change in attitudes:

- Recognition
- Association
- Appropriation

Recognition works in two ways. First, people were able to see people represented whose lifestyle they recognised. The effect might not be so extreme for people from other villages, but nevertheless, the sympathetic portrayal of "people like us" is a far cry both from glamorised views of urban society and the negative portrayal of village life otherwise available. It was recognisable because rural people had been actively involved

in generating text, rather than just consuming it. Recognition also occurred in the sense that the villagers felt themselves recognised by outsiders and therefore distinguished by being portrayed.

By being on the Internet they experienced association by joining with a wider world. Although the Web site was not accessible in the village, the site was interactive and messages were passed on. Rich and poor can rub shoulders and talk to each other in cyber space and the Internet allowed people to communicate and associate as part of a prestigious global community.

Both recognition and association raised morale and enhanced dignity. Describing the village to a wider audience seems to have given people a sense of identity. A community that was not there before was called into being. This provided the "push," while the idea of the benefits of electrification furnished the "pull" to provoke this community into action.

Appropriation occurred through the active methodology of the Fiankoma project. People could develop skills and actively appropriate techniques only seen passively before, thus developing an enhanced understanding of how media worked. Producing materials via digital media is likely to demystify the process and make the producer a more critical consumer, enabling a meta-perspective and a deeper understanding. When people in the village were making the accounts of their lives, it was clear that they already possessed some media literacy as they used conventions such as those seen in Ghanaian soap opera, but those who took an active part in it had undoubtedly extended this literacy by the end of the project. Sayed (1998), in defining information literacy, identifies two aspects: first, narrow or specific notions, concentrating on mastery and understanding of IT; second, global definitions, emphasising access to, location and critical evaluation of information. Active methods such as those of the Fiankoma project put people in a good position to gain both aspects. Although most of what is available via digital technology fits more easily with fears about

exploitation and mockery, enhanced knowledge to read what was going on and to see behind the techniques can only be positive in combating any sense of inferiority.

CONCLUSION

Much ICT development work has focused on issues of access and hardware. Optimists suggest that increased provision will empower disadvantaged communities (leapfrog) whereas pessimists argue that they will only ever get further behind (marginalisation). The work reported here suggests that whilst addressing issues of connectivity, it is important to think clearly about issues of text and representation. At a practical level the Fiankoma method provides clear guidelines for community developers using ICT and digital media, emphasising active skills such as authoring and editing rather than just passive skills of being able to move around the World Wide Web. At a more theoretical level, the three concepts of recognition, association and appropriation represent an emergent framework not only for analysing electronic media artifacts, but also for appraising the potential impact of development work with ICT, particularly with people in low-income countries and other marginalised groups.

REFERENCES

- Adeya, C. N. (2002). ICTs and poverty: A literature review. Ottawa: International Development Research Centre. Retrieved July 17, 2004, from http://web.idrc.ca/en/ev-24718-201-1-DO_TOPIC.html
- Borgartz, L. (2002). Digital media and cultural exchange: Representation, self-representation and the Fiankoma Project. Unpublished Dissertation. Brighton: University of Sussex.
- Chambers, R. (2003). *Whose reality counts? Putting the first last* (2nd ed.). London: ITDG Publishing.
- Etta, F. E., & Wamahiu, S. P. (2003). *The experience with community telecentres*. Ottawa: CODESRIA/IDRC.
- Hall, M. (1998). Africa connected. *First Monday*, Peer Reviewed Journal on the Internet, 3. Retrieved August 15, 2002, from http://www.firstmonday.orh/issues/issue3_11/hall
- Hawk, B.G. (1992). Metaphors of African Coverage. In B.G. Hawk (Ed.), *Africa's media image* (pp. 3-15). Westport, VA: Praeger.
- Leach F., Fiscian, V., Kadzamira, R., Lemani, E., & Machanknaja, P. (2003). *An investigative study of the abuse of girls in African schools*. London: Department for International Development.
- Leonard, L., & Dorsey, S. (1996). *Country assessment and implementation strategy: Ghana Leland initiative: Africa Global information infrastructure gateway project*. Accra: USAID.
- Lewin, K. (2000). New technologies and knowledge acquisition and use in developing countries. *Compare*, 30, 313-321.
- Linnekin, J., & Poyer, L. (1990). *Cultural identity and ethnicity in the Pacific*. Honolulu: University of Hawaii Press.
- Litchfield, J., & Waddington, H. (2003). *Migration and poverty in Ghana: Evidence from the Ghana living standards survey*. Paper presented at International Workshop on Migration and Poverty in West Africa, Poverty Research Unit, University of Sussex, March 2003.
- Nelson, N., & Wright, S. (1995). *Participation and power*. In N. Nelson and S. Wright (Eds.), *Power and participatory development: Theory and practice*. London: Intermediate Technology Publications.

Pryor, J. (2005, forthcoming). Community participation in rural schooling: The cart before the horse, a case study from Ghana. *Compare*, 35.

Pryor, J., & Ghartey Ampiah, J. (2003). *Understandings of education in an African village: The impact of information and communication technologies*. London: Department for International Development.

Pryor, J., & Ghartey Ampiah, J. (2004). Listening to voices in the village: Collaborating through data chains. In B. B. Swadener & K. Mutua (Eds.), *Decolonizing research in cross-cultural contexts: Critical personal narratives*. Albany: State University of New York Press.

Sayed, Y. (1998). *The segregated information highway*. Cape Town: University of Cape Town Press.

Stevenson, N. (1999). *The transformation of the media: Globalisation, morality and ethics*. New York: Pearson.

Thomas, H., & Ahmed, J. (2004). *Cultural bodies: Ethnography and theory*. Malden, MA: Blackwell.

Yates, C. (2001). *A review of experience with information and communications technologies in education projects*. Cambridge: International Extension College.

KEY TERMS

Appropriation: The idea that active exploration whilst creating their own texts enables people to appropriate the knowledge that will help them read other texts.

Association: The degree to which participation in global communication confers on participants some of the prestige associated with more glamorous lifestyles.

Development Awareness Projects: Projects aimed at promoting awareness and understanding of international development issues usually with people in high-income countries.

Fiankoma Method: An approach to community working with ICTs emphasising active authorship.

Leapfrogging: The notion that access to ICTs will enable people to skip over stages of technological and economic development.

Marginalisation: The idea that availability of ICTs will serve further to marginalise poor people.

Recognition: The extent to which digital media should both enable marginalised people to recognise themselves and their lifestyle and to feel recognised by their experiences with them.

ENDNOTES

¹ The two projects were funded by separate sections of the UK Department for International Development (DFID).

² Direct quotes from interviews such as this are literal translations from Twi.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, X. Yu, pp. 7-15, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 2.34

Factors Motivating the Acceptance of New Information and Communication Technologies in UK Healthcare: A Test of Three Models

Janice A. Osborune
Brunel University, UK

Malcolm Clarke
Brunel University, UK

ABSTRACT

This paper discusses the use of three published models, the Technology acceptance model (TAM), Rogers diffusion of Innovation theory (IDT), and the Triandis theory of interpersonal behaviour (TIB), and attempts to bring them together in an integrated model to better predict the adoption of new information and communication technologies by a cohort of health professionals within UK primary care in an attempt to aid implementers in bringing technology in at an organizational level.

INTRODUCTION

Over the last 25 years, public healthcare delivery has been undergoing continuing changes. This has included the use of new information and communication technologies in a bid to improve services to patients, speed up waiting times, and addressing structural problems in the National Health Service (NHS). These changes have been largely driven by technical competence on the medical side but not matched sufficiently in technical organizational improvements. This article discusses the use of three published models, the Technology Acceptance Model (TAM), Rogers

Diffusion of Innovation theory (IDT), and the Triandis Theory of Interpersonal behaviour (TIB), and attempts to bring them together to assist in the political decision to bring technology in at the organization level too.

PUBLIC HEALTHCARE IN THE UK: AN OVERVIEW

Within the United Kingdom, there exists a plethora of organizations and bodies providing the majority of healthcare in the UK including general practitioners to accidents and emergency departments, and dentistry. These organizations all fall under the National Health Service (NHS), the publicly funded healthcare system of each part of the UK, which in theory is managed by the Department of Health. Services provided under this organization are characterised by free service to all citizens and is divided into two levels of care, primary and secondary.

In the United Kingdom, a patient must first see their own doctor (referred to as the GP) located in close proximity to the patient's home. GP's are the first point of contact for users in the UK. This level of service provided is known as primary care. At present, 90% of all health and social care contacts with the NHS are through primary healthcare (NHS, 2001). Primary healthcare is provided through a combination of general practitioners and community medical workers. Services such as district nursing and child health monitoring are provided by community medical workers. If specialist help is required by a patient, he or she will be referred to a hospital or a consultant by their GPs. This is referred to as secondary care, as self-referral is not allowed and the clinical condition presenting normally cannot be dealt with by a primary care specialist and so is dealt with at this level.

One major problem in the NHS is that of communication between hospital specialists and general practitioners particularly in inner city areas. The written communication between GPs and consultants have been highlighted as being of poor quality (Rowland, 1992) and often having poor educational value (AGHTA, 1996). This problem has led to problems occurring in the outpatient referral system in terms of delays for hospital appointments, leading to frustration by patients (DOH, 1991).

In addition to this, there have been problems with out of hours GP services (Hallam, 1994), which has led to recommendations being made for more access to the healthcare system through entry points such as NHS Direct (Rogers, Chapple, & Sergison, 1999).

The government, in an effort to modernize the National Health Service and to deal with the numerous structural problems, have emphasized in policy initiatives the vision for connecting health policies with the capabilities of new information and communication technologies, which are able to provide new kinds of service that are more responsive to public needs and speed up access to healthcare. *The Information Strategy for the Modern NHS* (1998-2005) was seen as both visionary and relevant to the needs of the NHS. In the *Information for health* policy document for example, removing distance from healthcare was seen as a goal of the innovative technology Telemedicine.

Opportunities in the field of telemedicine will be seized to remove distance from healthcare, to improve the quality of that care, and to help deliver new and integrated services. GP's will be able to send test readings or images electronically to hospital specialists many miles away and in the same way receive results and advice more quickly (National Health Service Executive, 1998)

One of the major programmes, which the government has initiated, is the National Programme for IT for which an overview is provided.

National Programme for IT (Formerly NPfit)

The National Programme for Information Technology (Npfit) came about in 2002 as a result of the UK government's decision to make an unprecedented investment in information technology as essential to its plans for the National Health Service. This programme has been seen as one of the most expensive information technology programmes in the world with costs estimated to run over £18 billion over ten years. (Brennan, 2005).

The programme aims to connect 30,000 general practitioners and 270 acute, community, and mental health trusts to a single, secure, national system to make information available when and where it is needed, including to patients themselves (Hutton, 2004).

In tracing its history, the Npfit programme came about as a result of suggestions made in the Wanless Treasury's report (Wanless, 2002). The report gave reasons as to why previous targets set by the NHS Executive, of all NHS trust having electronic medical reports implemented by 2005, had not been achieved. These reasons included budgets for information technology being used to relieve financial pressures elsewhere instead of locally and an inadequate setting of central information technology (IT) standards.

The Report recommended that the NHS double the proportion of its budget invested in information technology to 4%, to bring it closer into lines with the healthcare in the United States, which has a budget of 6%. They concluded that without a major advance in the effective use of information and communication technology, the health service would find it difficult to deliver the efficient high quality service, which the public will demand. The government's response to this

was to allocate £2.3bn for a new national programme for IT (Doh, 2002). The Primary aim of the programme is **for** electronic patient records to be implemented in all acute trusts by the end of 2007. In 2005, the government established an agency, *Connecting for health*, as the single national provider of IT, which would deliver the National programme ensuring the maintenance, development, and effective delivery of the IT products and services delivered by the former NHS information authority.

There are several products that the National Programme plans to deliver, which includes:

- **A National Care Record System (NCRS):** *Connecting for health* plans to produce holistic records for patients from birth to death gradually, holding a review of the person's health and all his or her health contacts within the National Health Service. This summary patient record called the "spine" will be accessible 24 hours a day, seven days a week by health professionals, whether they work in hospitals, primary care, or community services.
- **Electronic Booking:** This programme, *Choose and book*, will allow GPs and other primary care staff to make initial hospital or clinic outpatient appointments at a convenient time, date, and place for the patient. If the patient prefers, he or she can make their appointment later online or through a telephone booking service.
- **Electronic Transfer of Prescriptions:** This will allow for prescribers to create and transfer prescriptions directly to a patient's community pharmacist and the Prescription Pricing Authority (PPA). It's aim is to reduce reliance on article prescriptions and it is expected to reduce prescription errors and provide better information at the point of prescribing.
- **New National Networking Service (N3):** This will provide the NHS with world-

class networking services, including secure broadband connectivity, from every site where NHS services are delivered or managed

Based on the expenditure of this and similar programmes, we deduce that money is available so the choice is between spending the time to do it well, seeing that the government intends to have information technology playing a central part in healthcare within the very near future, or to do it badly on time. This then leads us to look at external models on which to identify factors, which play a part in technology adoption.

DEVELOPMENT OF RESEARCH MODEL

There have been several theoretical perspectives, which have been used to study the determinants of IT acceptance and adoption across a variety of disciplines including Communications (Rogers, 1995), Sociology (Wejnert, 2002), and Information systems research (Knol & Stroeken, 2001).

Intention-based models and behavioural decision theories have been used to explain usage of information systems (e.g., Agarwal & Prasad, 1997; Davis, 1989) and results further show that behavioural intentions are significantly and positively correlated with actual behaviour. According to these theories, user adoption and usage behaviours are determined by intention to use information technology, which in turn is influenced by beliefs and attitudes about information technology.

Although there are many theories, which can be used to explain intention we have selected three. The technology acceptance model, the theory of interpersonal behaviour, and Rogers innovation and diffusion model. These models will form the basis of our conceptual model.

Technology Acceptance Model (TAM)

The technology acceptance model (TAM, Davis, 1993) is described as the most dominant theoretical model in information technology acceptance (Misiulek, Zakaria, & Zhang) and is an adaptation of the Theory of Reasoned Action (TRA, Fishbein & Ajzen, 1980). The TAM's goal is to provide an explanation of the determinants of computer acceptance that is generally capable of explaining user behaviour across a broad range of end-user computing technologies and user populations (Davis, Bagozzi, & Warshaw, 1989).

The TAM identifies two beliefs perceived usefulness and perceived ease of use, as being of primary importance for computer acceptance behaviour. The model posts that a users adoption of an information system is determined by behavioural intention, which is determined by the user's belief about the system, similar to the TRA. The model differs from the TRA in that behavioural intention is viewed as being determined by the individual's attitude and perceived usefulness. The TAM does not however include the subjective norms of the TRA as it was not found to be significant (Davis, 1989).

The Triandis Theory of Interpersonal Behaviour

The Triandis model (Triandis, 1980, see Figure 1) explains individuals' behaviour in terms of what they have always done (habit), by what they think they should do (social norms) and by the consequences, they associate with a behaviour (perceived consequences). The model also contains aspects that are directly related to the individual, for example attitudes, genetic factors, intention, and behaviour and others that are related to the individual's environment, for example culture, facilitating conditions, and social situations.

Rogers Innovation and Diffusion Theory

The Innovation and Diffusion Theory proposes that an innovation is an idea or practice perceived as new by an individual, group, or organization (Rogers, 1995). Diffusion is described as the process by which an innovation spreads. The individuals’ decision to accept or reject an innovation occurs in the following stages, awareness of the innovation, which leads to an attitude being formed towards it based on the individuals perception of the innovation. The decision to adopt or reject is then made, implementation takes place, and the individual confirms his or her decision. The perceived characteristics of an innovation include its relative advantage, compatibility, complexity, trialability, and observability (Rogers, 1995).

Reasons Behind Integration

Previous models described here can contribute to our proposal of an integrated model in a variety of ways, which are:

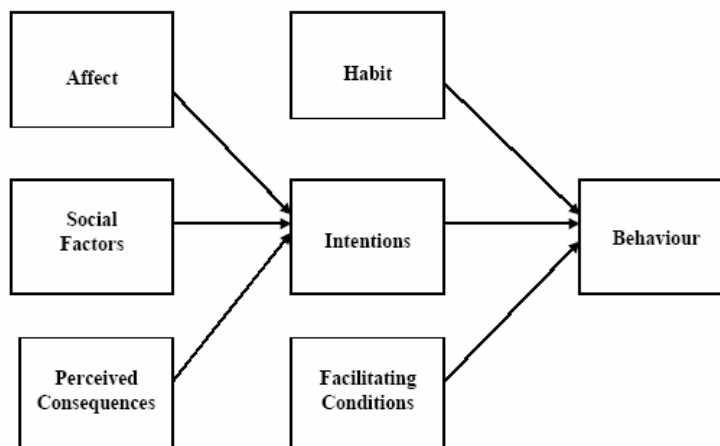
Incompleteness

Although strong empirical support for the TAM has been established through numerous studies

(Karahanna, Straub, & Chervany, 1999; Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003), the TAM has had several criticisms levelled at it, including not offering sufficient understanding to provide system designers with information needed for creating and promoting user acceptance of systems (Mathieson, Peacock, & Chin, 2001), and its assumption that its use is volitional, which means that in there are no barriers to prevent an individual from using a technology or a system if he or she chose to do so (Mathieson et al., 2001). There may be situations in which an individual wants to use an IT, but is prevented by lack of time, money, or expertise (Chau & Hu, 2001; Taylor & Todd, 1995). Given the fact that the information and communication technologies, including mobile health technologies (described as computing technology, comprising software, hardware, and communications specifically associated with mobility, Zaslavsky & Tari , 1988) are fairly new to health professionals, the possibility exists that they may choose not to use the technology because they may not have sufficient skills or the ability to use the technology, hence the model would not give a complete picture of factors affecting adoption.

Because of the uncertain theoretical status of the TAM, Davis (1989) dropped the subjective norm, which has resulted in studies using

Figure 1. Triandis Theory of Interpersonal Behaviour



the TAM seldom including variables related to the social environment. Technology adoption in healthcare is a current hot topic at the moment and we believe that social pressure plays an important role in explaining reasons behind their use.

Similarities Between the Models

Although these theories focus on different determinants to explain consumer behaviour in the adoption of technology, they have similarities:

1. The TAM and the Triandis model are both intention-based models, which assume that attitudes influence intention, which determines behaviour and the actual use of the technology.
2. Perceived ease of use in TAM is related to the complexity construct of the Innovation Diffusion theory in fact the complexity construct is the exact opposite of the Perceived ease of use construct.
3. Perceived consequences in the Triandis model construct is similar to the construct of perceived usefulness (PU) in the TAM and similar to relative advantage in the Innovation Diffusion theory.

We have divided the technology adoption process into three factor areas, those related to the social environment, those related to the technology, and those related to the individual. We find the Triandis model most relevant for factors related to the social environment; for the technology related section we find the attributes from the diffusion of innovation, which concentrates on both the technology and its compatibility and the TAM more suitable; and for those related to the individual, we find the IDT and the Triandis model more suitable. As these models do not give a complete overview on their own, we find it necessary to combine the three to evaluate adoption.

AN INTEGRATIVE MODEL

Given their complementary nature, a model that integrates the key research constructs from TAM, TIB, and EDT should explain more variance in IT usage intention than either model alone. Such an integrated model is depicted in Figure 3. In this section, we discuss how the assembled model attempts to do the duties assigned to it.

Social Factors

An individual's perception of social pressure to perform or not perform a behaviour affects intention, (Fishbein & Ajzen, 1975). Perception of social pressure refers to an individual's perception of whether individuals close to or important to them think that they should or should not perform a behaviour. Consequently, we view social factors as norms, values, and roles, which influence an individual's intention to adopt medical technology. These values in our context may be conveyed by interaction with patients and peers.

There are varying views on physicians being influenced socially. It has been suggested that general medical practitioners are influenced in their decision-making by medical specialists, who are seen as being innovative and creative. (Blumberg, 1999). Such opinion leaders can activate local networks to diffuse an innovation by facilitating transfer of information (Young, Hollands, Ward, & Holman, 2003).

Perceived Usefulness

Among the many possible influences on technology use, Davis (1989) suggests that two determinants are of particular importance: perceived usefulness and perceived ease of use. Perceived usefulness is the tendency of people to use or not use a technology to the extent they believe it will help them perform their job better.

Perceived Ease of Use

PEOU is the degree to which a person believes using a particular system would be free of effort, and if the performance benefits of usage are outweighed by the effort of using the technology (Davis, 1989). Hence, the more complex the innovation of an information technology, the lower the probability of its adoption will be (Rogers, 1995). Applying this to technology adoption in the NHS, technologies perceived to be user friendly will be more appealing to both patients and practitioners. Perceived ease of use refers to ease of using the technology, sending data electronically as in the case of mobile technology, obtaining the data necessary to proceed with consultations as in the case of General Practitioners.

Facilitating Conditions

Facilitating conditions are the objective factors that make a behaviour easy or difficult. In the Triandis model, facilitating conditions are important determinants of behaviour. Even if intentions to perform the behaviour are high, the habits are

well established and the physiological arousals are optimal, there may be no action/behaviour if the situation or objective factors do not warrant the behaviour (Triandis, 1980). A simplified explanation of this is that facilitating conditions are important in that individuals with the intention of accomplishing something may be unable to do because their environment prevents the activity from being performed.

Triandis hypothesizes that facilitating conditions directly affect the actual behaviour rather than intentions because he argues that one might have the intention to perform a certain act, but if the environment does not support this behaviour then the act will most likely not be executed. We define facilitating conditions as those factors in an individual’s environment that facilitate the act of adopting technology. Empirical investigations have shown that facilitating conditions could also have a significant positive impact on attitude (Chang & Cheung, 2001).

We expect facilitating conditions to have a positive influence on technology adoption.

Figure 2. Integrated model

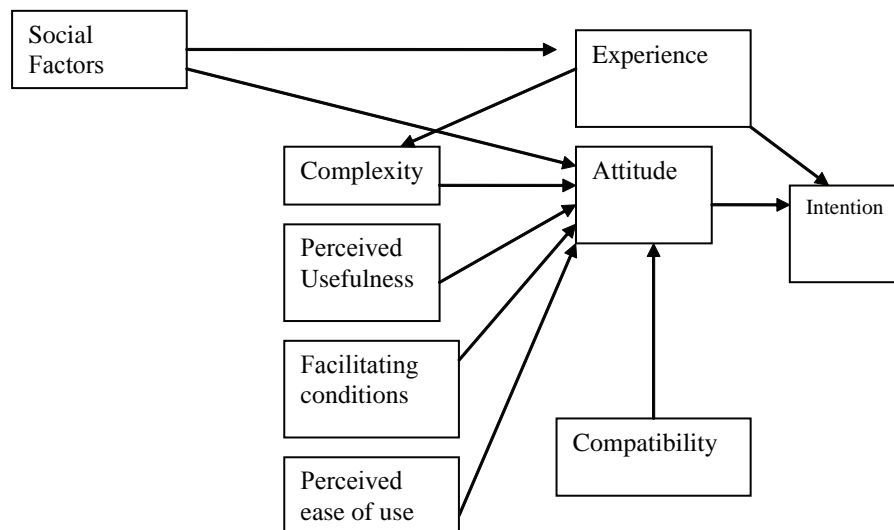


Figure 3. Comparison of the three models

| | TAM | TIB | IDT |
|------------------|-----------------------|-------------------------|--------------------------|
| Variables | Perceived ease of use | Social factors | Relative advantage |
| | Perceived usefulness | Facilitating conditions | Trialability/ Experience |
| | Attitude | Perceived consequences | Compatibility |
| | | Genetic Factors | Complexity |
| | | Cultural Factors | Observability |

Key:

TAM : Technology Acceptance Model

TIB : Triandis Theory of interpersonal behaviour

IDT : Innovation Diffusion Theory

Perceived Consequences

According to Triandis, each act or behaviour is perceived as having a potential outcome that can be either positive or negative. An individual’s choice of behaviour is based on the probability that an action will provoke a specific consequence.

Relative Advantage

Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. Physician perceptions of new technologies affect the adoption of innovation in clinical practice. For example, physician perceptions related to teledermatology suggest that this new technology needs to be quick, efficient, reliable, and easily used (Weinstock, Nguyen, & Risica, 2002). If new technologies are too time consuming or complicated, they may not be widely adopted and used. In a study on the perceptions of GPs towards teledermatology, the results reported a preference for reliable, efficient, and easy-to-use technology (Collins, Nicolson, Bowns, & Walters, 2000).

Trialability/Experience

Trialability is the degree to which an innovation may be experimented with a limited basis. The

more adopters experiment with a new technology and explore its ramifications, the greater the likelihood that the innovation will be used during early stages of adoption (Agarwal & Prasad, 1997; Natek & Lesjak, 2006).

Intention

Behavioural intention refers to “instructions that people give to themselves to behave in certain ways” (Triandis, 1980) or their motivation regarding the performance of a given behaviour. In our model, intention refers to health professionals’ motivation to adopt information technologies.

Attitude

According to Fishbein and Ajzen (1980), “attitude is a learned predisposition to respond in a consistently favorable or unfavorable manner with a given object.” Attitude is directly related to behavioural intention and adoption because people will only intend to perform behaviour for which they have positive feelings (Han, Harkke, Mustonen, Seppanen, & Kallio, 2005; Marino, 2004). We hypothesise that attitude is positively related to the users intention to use new ICTs in healthcare

Compatibility

This construct has not been included in most studies on technology adoption apart from those using the IDT (Cho,). Compatibility refers to the conformity of an innovation in our case new ICTs with the values and beliefs of users and with previously introduced ideas and needs (McCole, 2002). Therefore, the adoption of a new technology depends on its compatibility with existing practices. The importance of technology compatibility with the organization and its tasks has been shown to be a significant factor in successful technology implementations (Cooper & Zmud, 1990). We hypothesise that compatibility is positively related to the user's attitude towards new ICT's in healthcare.

DISCUSSION

The primary objective of this paper was to compare two of the more dominant technology acceptance and adoption models in IT research, namely the TAM and the IDT as well as a less popular model from the social science, the TIB, then extend these models to an integrated model of IT acceptance and adoption.

On their own these models do not fully evaluate the acceptance of technology by individual, however when integrated the weaknesses of the individual models are totally cancelled out by the strengths of the integrated model.

As described earlier, the TAM assumes that there are no barriers to preventing an individual from using a technology if he or she wished. The IDT and the TIB however feature variables, which can affect adoption by the individual, hence filling one of the gaps of the TAM. The Triandis models which attempts to cover all the major component of the individual and their environments with its 34 variables is somewhat difficult to test by virtue of its complexity hence only the variables relating to our study have selected. The

IDT focuses on the process of adoption as well as the, this is complementary with both perceived characteristics of the technology complimenting both the TIB and the TAM

Based on these factors, we believe the integrated model will have better explanatory power of user adoption of technology. However dear readers, as with any cake, the proof is in the eating and as such, we will shortly be conducting an exhaustive study on a cohort of health professionals within a Primary Care Trust given new medical technology as part of a government modernization initiative to see if the model lives up to expectation. We ask that you wait with bated breath!

REFERENCES

- Agarwal, R., & Prasad, J. (1997). The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. *Decision Sciences*, 28(3), 557-583.
- AGHTA. (1996). *Advisory group on health technology assessment. Assessing the effects of health technologies: Principles practice proposals*. London: Department of Health.
- Blumberg, R. S. (1999). The leadership of innovation. *Gastroenterology*, 116(4), 787.
- Brennan, S. (2005). *The NHS IT project*. Abingdon, UK: Radcliff Medical Press.
- Chang, M. K., & Cheung, W. (2001). Determinants of the intention to use Internet/WWW at work: A confirmatory study. *Information & Management*, 39(1), 1-14.
- Chau, P. Y. K., & Hu, P. J. H. (2001). Information technology acceptance by individual professionals: A model comparison approach. *Decision Sciences*, 32(4), 699-719.
- Cho, V. (2006). A study of the roles of trusts and risks in information-oriented online legal

- services using an integrated model. *Information and Management* 43(4) 502-520.
- Collins, K., Nicolson P., Bowns. I, Walters, S. (2000). *General Practitioners' Perception of Telemedicine in Dermatology: A Psychological Perspective* *Journal of Telemedicine and Telecare* 6(1), 50-53
- Cooper, R., & Zmud, R. (1990). Information technology implementation research: A technological diffusion approach. *Management Science*, 36(2), 123-139.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340.
- Davis, F. D. (1993). User acceptance of information technology: System characteristics, user perceptions, and behavioural impacts. *International Journal of Man-Machine Studies*, 38(3), 475-487.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- Doh. (2002). *Delivering 21st century IT support for the NHS. National strategic programme*. London: Department of Health.
- DOH. (1991). *Research for health: A research and development strategy for the NHS*. London: HMSO.
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behaviour: An introduction to theory and research*. Reading, MA: Addison Wesley.
- Fishbein, M., & Ajzen, I. (1980). Predicting and understanding consumer behaviour: Attitude behaviour correspondence. In I. Ajzen, & M. Fishbein (Eds.), *Understanding attitudes and predicting social behaviour* (pp. 149-172). Englewood Cliffs, NJ: Prentice Hall.
- Hallam, L. (1994). Primary medical care outside normal working hours: Review of published work. *British Medical Journal*, 308(6923), 249-253.
- Han, S., Harkke, V., Mustonen, P., Seppanen, M., & Kallio, M. (2005). Understanding physician acceptance of mobile technology: Insights from two telephone interviews in Finland. *International Journal of Electronic Healthcare*, 1(4), 380-395.
- Hutton, J. (2004). *National programme for IT. House of commons official report* London: Department of Health.
- Karahanna, E., Straub, D. W., & Chervany, N. L. (1999). Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs. *MIS Quarterly*, 23(2), 183-213.
- Knol, W. H., & Stroeken, J. H. M. (2001). The diffusion and adoption of information technology in saml - and mediums - ed enterprises through IT scenarios. *Technology Analysis, & Strategic Management*, 13(2), 227- 46.
- Marino, A. (2004). Innovation technology and application issues in Italian e-healthcare. *International Journal of Electronic Healthcare*, 1(2), 210-220.
- Mathieson, K., Peacock, E., & Chin, W. W. (2001). Extending the technology acceptance model: The influence of perceived user resources. *DATA BASE for Advances in Information Systems*, 32(3), 86-112.
- McCole, P. (2002). The role of trust for electronic commerce in services. *International Journal of Contemporary Hospitality Management*, 14(2), 81-87.
- Misiolek, N., Zakaria, N., & Zhang, P. (2002). *Trust in organizational acceptance of information technology: A conceptual model and preliminary evidence*. Paper presented at the annual meeting of the Decision Sciences Institute, San Diego, CA

(November 23-26)

Natek, S., & Lesjak, D. (2006). Trial work: The way to successful information system projects in healthcare. *International Journal of Electronic Healthcare*, 2(3), 223-230.

National Health Service Executive. (1998). *Information for health: An information strategy for the modern NHS 1998-2001*. London: National Health Service Executive.

NHS. (2001). *Building the information core—Implementing the NHS plan*. London: Department of Health, UK Government.

Rogers, A., Chapple, A., & Sergison, M. (1999). If a patient is too costly they tend to get rid of you: The impact of people's perceptions of rationing on the use of primary care. *Healthcare Analysis*, 7(3), 25-237.

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: The Free Press.

Rowland, M. (1992). Communications between GP's and specialists. In M. Roland, & A. Coulter (Eds.), *Hospital referrals* (pp. 108-22). Oxford: Oxford University Press.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research*, 6(2), 144-176.

Triandis, H. C. (1980). Values, attitudes, and interpersonal behaviour. In M. M. Page (Ed.), *Nebraska symposium on motivation 1979* (pp. 195-295). Lincoln: University of Nebraska Press.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186-205.

Venkatesh, V., Morris, M., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 26(4), 425-478.

Wanless, D. (2002). *Securing our future health: Taking a long-term view. Final report*. Retrieved September 27, 2005, from http://www.hm-treasury.gov.uk/Consultations_and_Legislation/wanless/consult_wanless_final.cfm

Weinstock, M., Nguyen, F., & Risica, P. (2002). Patient and referring provider satisfaction with teledermatology. *Journal of the American Academy of Dermatology*, 47(1), 68-72.

Wejnert, B. (2002). Integrating models of diffusion of innovations: A conceptual framework. *Annual Review Sociology*, 28(1), 297-326.

Young, J. M., Hollands, M. J., Ward, J., & Holman, C. D. J. (2003). Role for opinion leaders in promoting evidence-based surgery. *Archives of Surgery*, 138, 785-791.

Zaslavsky, A., & Tari, Z. (1988). Mobile computing: Overview and status. *The Australian Computer Journal*, 30(2), 42-52.

This work was previously published in International Journal of Healthcare Information Systems and Informatics, Vol. 1, Issue 4, edited by J. Tan, pp. 29-39, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.35

Information and Communication Technologies: Towards a Mediated Learning Context

Glenn Finger

Griffith University, Australia

Maret McGlasson

Griffith University, Australia

Paul Finger

Griffith University, Australia

ABSTRACT

Teaching and learning in the 21st century should be markedly different from earlier times through the design of new teaching and learning environments. Through the presentation of three models of technology-rich learning environments (teacher-directed, learner-centered and mediated), this chapter provides a case study of the design and delivery of a course called Learning with Information and Communication Technologies (ICTs) guided by a mediated learner approach, using

new approaches to using ICTs and assessment for learning as key course design drivers. That course aims to prepare future teachers who demonstrate strong theoretical and practical understanding of designing and creating effective ICT teaching and learning experiences, and are confident and proficient users of ICTs. We provide an analysis of the implementation of that course through the presentation of the learning stories and reflections of students. Specific discussion is provided about the conceptualization and implementation of an e-portfolio approach to promote deep learning.

INTRODUCTION

Through the presentation of three models of technology-rich learning environments, namely, teacher-directed, learner-centered and mediated (see Trinidad, 2004), this chapter provides a case study of the design and delivery of a course called *Learning with ICTs* guided by a mediated learner approach using new approaches to using ICTs and assessment for learning as key course design drivers. *Learning with ICTs* aims to prepare future teachers who demonstrate strong theoretical and practical understanding of designing and creating effective ICT teaching and learning experiences, and who are confident and proficient users of ICTs. In terms of diversity, the students who undertake this course enter the university with a very diverse range of ICT knowledge, skills and attitudes. This diversity is discussed together with the conceptualization and implementation of an e-portfolio approach to promote deep learning. Therefore, there is a dual challenge here—first, to use ICTs in the design and delivery of a university teacher education course that caters to a diverse range of student needs and strengths, and second, for that course to promote the development of ICT skills and knowledge for those students as future teachers to be able to design and deliver effective teaching and learning using ICTs with their students.

Teaching and learning in the 21st century should be markedly different from earlier times, as Russell and Finger (2005) have argued that teaching and learning is now occurring in an increasingly online world. Since the penetration of computers in educational institutions, in particular during the last two decades, there has been a dynamic increase in access by teachers and students to ICTs through the purchase of hardware and software, ongoing renewal and upgrading of hardware and software, and large ongoing investments in infrastructure that has dramatically improved connectivity. Traditionally, learning environments were restricted to face-to-face delivery or where

distance education was undertaken, delivery was largely characterized by the posting of printed resources, and communication was often slow and cumbersome. However, the move to adopt new and emerging technologies to transform the ways we teach and learn requires improved understanding of how we can best use those new and emerging technologies. For example, Fraser (2003) suggests that, while students spend approximately 20,000 hours in classrooms by the time of their graduation from a university, “educators often rely exclusively on assessing achievement and pay scant attention to the quality of the learning environment” (Fraser, 2003, p. vii). He argues that there is considerable optimism internationally that the integration of ICTs will enable the creation of learning environments, but warns that this optimism needs to be “accompanied by systematic research and evaluation” (Fraser, 2003, p. vii). This caution is echoed in *The Becta Review 2005 Evidence on the Progress of ICT in Education*:

A key challenge for institutions is to develop effective and innovative ways of using ICT to extend learning beyond the boundaries of their organization, and in doing so support practitioners in delivering more learner-focused educational experiences. (p. 5)

BACKGROUND

The use of new and emerging technologies, referred to throughout this chapter as ICTs, has gained many proponents in higher education as a means for opening possibilities for improved delivery of programs with benefits for educators and students. Chambers, for example, identified education as “the next killer application for the Internet” (Chambers, 2001). There is now a plethora of terms, such as Web-supported, Web-enhanced and Web-based modes of delivery, e-learning and flexible learning, to reflect higher education strategies that utilize ICTs, with many universities developing e-strategies.

According to Bigum and Rowan (2004), the enthusiasm of vice chancellors in universities reflects two drivers: "... a perception that flexible delivery is more effective and efficient in terms of getting teaching resources to students, and secondly, that one form of flexible delivery, online teaching, offers possibilities for generating revenue from overseas fee-paying students" (p. 213).

Bigum and Rowan also cautiously note that the status of the term *flexible learning* is reflected in sayings in some Australian universities as being "inversely proportional to the distance you are from the vice chancellor!" (Holzl, 1999, p. 1). There is an inherent danger that teaching and learning is viewed narrowly as a consumer package to be marketed and delivered to students who become seen as customers rather than learners. Bigum and Rowan (2004) caution that "how we frame this work matters" (p. 223), as we need to be aware in our quest for improved teaching and learning using ICTs that particular performances of flexibility "close down what is possible, rather than, as the rhetoric suggests, open up performances of teacher education" (p. 223).

Similarly, Roffe (2004) adds substantially to the conception of e-learning, as he argues that the "e" term should not be seen exclusively as equating to electronic learning, but rather needs to be understood in terms of the human purpose of learning. Roffe proposes that e-learning should be concerned with more human "e"s—engagement of the learner, enhancement of learning, ease of use, empowerment of the learner to control the learning schedule and execution of the learning program (Roffe, 2002). Then we argue that in designing courses for students in higher education programs, which capitalize on the use of ICTs, a design process needs to be driven by the conceptualisation of a model of an ICT-rich learning environment.

DEFINING DEEP LEARNING

Throughout this chapter, we will refer to the term deep learning in ways consistent with the definition provided by Education Queensland's

Productive Pedagogies (Education Queensland, 2002a, 2002b). Deep learning is conceptualized as relating to deep understanding and deep knowledge. For example, students develop deep understanding when they grasp the relatively complex relationships between the central concepts of a topic. Instead of being able to recite only fragmented pieces of information, they understand the topic in a relatively systematic, integrated or holistic way. As a result of their deep understanding, they can produce new knowledge by discovering relationships, solving problems, constructing explanations and drawing conclusions. On the other hand, students have only shallow understanding when they do not or cannot use knowledge to make clear distinctions, present arguments, solve problems or develop more complex understanding of other related phenomena (Education Queensland, 2002a).

Knowledge is *deep* when it concerns the central ideas of a topic or discipline judged to be crucial to it. Deep knowledge involves establishing relatively complex connections to those central concepts. Knowledge is *shallow, thin or superficial* when it is not connected with significant concepts or central ideas of a topic or discipline, and is dealt with only in an algorithmic or procedural fashion. Knowledge is also shallow when important, central ideas have been trivialized by the teacher or students, or when it is presented as non-problematic. This superficiality can be due, in part, to instructional strategies; for example, when a teacher covers large numbers of fragmented ideas and bits of information unconnected to other knowledge (Education Queensland, 2002b). When both deep knowledge and deep understanding are combined, deep learning takes place.

MODELS OF ICT-RICH LEARNING ENVIRONMENTS

Trinidad (2003) notes that in Hong Kong, as with many countries, many leaders and policy makers "correlate the use of technology with pedagogical

changes” (p. 101). However, in many Hong Kong classrooms, even with the introduction of new technologies, “... teachers remain teaching in a transmissive, exam-driven culture (teaching for the test) and the technology is used for lower-level activities, such as teachers presenting lectures via PowerPoint and students’ word processing assignments and searching the Internet” (Trinidad, 2003, p. 101).

Thus, there is the potential for educators to use ICTs to continue to teach with a subject-centered approach using traditional pedagogies. Trinidad theorizes three conceptions of technology-rich learning environments: (1) teacher-directed, (2) learner-centered, and (3) mediated. The following summaries of these models are drawn from Trinidad’s theorizing.

The Teacher-Directed Learning Environment: ICTs Integrated into Existing Approaches

In this model, teaching, learning and assessment reflect a transmissive approach whereby the educator is expert with a specific knowledge base and the student is seen as a passive receptor of the knowledge to be taught, acquired and assessed. The implication of the use of ICTs in this model is to support a teacher-directed approach. Elsewhere, Roblyer (2004) refers to this as a directed or objectivist approach that views knowledge as having a separate, real existence outside the human mind and learning happens when this knowledge is transmitted to people and they store it in their minds. Drill and practice software, and low-level

use of the Internet as a means to obtain information, reflects this approach. Figure 1 provides a visual representation of this model, with the positioning of ICTs as an adjunct resource for educators and students.

The Learner-Centered Teaching Environment: ICTs Transform Pedagogy, Curriculum and Assessment

The learner-centered teaching environment reflects a more constructivist approach, as described by Roblyer (2004), whereby humans construct knowledge by participating in certain experiences that foster creativity, self-analysis and metacognition, and promote problem solving and group collaboration. In this model, according to Trinidad (2004), the educator can be involved in restructuring the learning activities and the curriculum to transform curriculum, pedagogy and assessment. As displayed in Figure 2, adapted from the work of Newhouse, Trinidad and Clarkson (cited in Trinidad, 2003), this learning environment highlights the central importance of a learner-directed approach, and the role of ICTs enables transformation.

The Mediated Learning Environment

Albon and Trinidad (2001) theorize the Mediated Learning Approach (MLA), which “revolves around the learner and the technology, which *drives* the model” (p. 106). Here we see the “e” word’s more sophisticated definition: “There becomes a sense of empowerment and engagement

Figure 1. ICTs and the teacher-directed learning environment (Adapted from Albon & Trinidad, 2001)

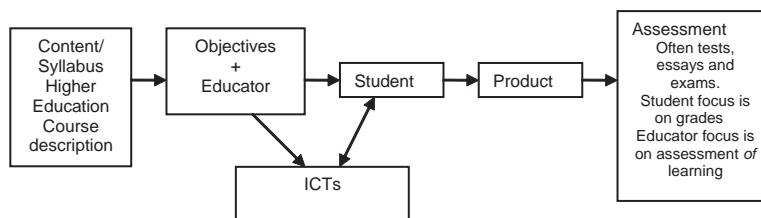
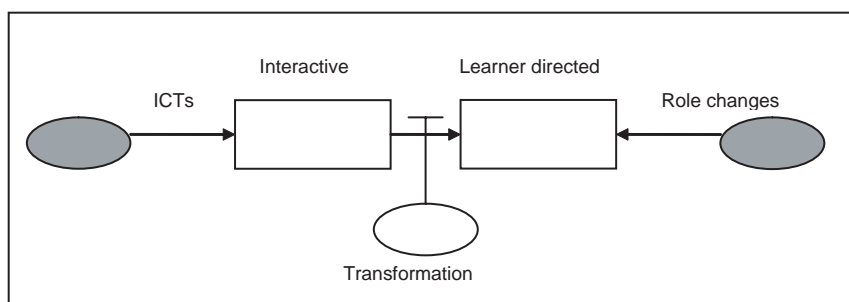


Figure 2. ICTs and the learner-centered learning environment (Adapted from Newhouse, Trinidad & Clarkson, cited in Trinidad, 2003, p. 22)



for the learner ... where they are no longer dependent on the specific and often limited knowledge of their educator, but work within the community of learners mediated by the educator” (Trinidad, 2004, p. 105). In this model, ICTs become the vehicle for communication, collaboration and the framework for mediated learning, which provides for interactions to assist the development of new and self-sustaining communities of learners to exist alongside established, traditional approaches. Subsequently, not only ICTs are utilized, but multiple information sources are used, ranging from traditional text materials in the form of books to the online resources of the Internet. In this model, ICTs are used as interactive technologies that enable learning communities “that transcends the four walls of classrooms but are not restricted by traditional class timeframes” (Trinidad, 2004, p. 106). It becomes essential, then, that educators design courses that provide learning experiences using forms of communication and facilities to access information at a time and place of the learner’s choosing, beyond and in addition to the traditional timetabled face-to-face lectures and tutorials.

In MLAs, the ICTs that drive the design of learning are complemented in the design approach by the assessment *for* learning, rather than assessment *of* learning. Assessment *for* learning, discussed in detail later in this chapter, also drives MLAs. Assessment is seen as more than knowing

the content, but becomes integrally interwoven into stories of learning whereby students collect and select authentic and diverse evidence, drawn from a larger archive representing what a person or organization has learned over time and on which the learner has reflected. Figure 3 builds substantially upon the model developed by Trinidad to theorize the importance of assessment *for* learning. The model overcomes the limitation of the earlier Trinidad model, which presented a self-contained model, whereas the model built in Figure 3 highlights the transformations occurring throughout the learning journeys of students within a course, and also articulates the connections between other formal and informal learning, as well as future learning. Too often, we see courses developed as stand-alone courses within higher education programs. Rather, we need to see ICTs and assessment *for* learning drive course design to assist students to synthesize learning among the courses they are studying within a specified study duration (e.g., within a semester) as well as throughout longer learning journeys (e.g., from learning over 3-4 years of a formal university program to life-long learning).

In addition, the model attempts to acknowledge the learning experiences students bring with them to the specified course. That is, students who enter the university program bring a diverse range of ICT knowledge, skills and attitudes. As displayed in Figure 3, this diversity was captured through the

use of the *ICT Continua* (Education Queensland, 2003), which commences with a *Minimum* phase, proceeds to a *Developmental* phase, and is ongoing through the *Innovator* and *Leader* phases. Most students entering the program were identified as being at a *Minimum* level of ICT knowledge and skills. Some students were best described as being terrified of using computers, while some had advanced ICT skills and knowledge. Consistent with the conceptualization shown in Figure 3, all students were encouraged to adopt the *Learning Journey* metaphor accompanied by an expectation that there would be transformational learning. Assistance and support was provided through peers, online sources and collaborating organizations.

In this chapter, this model is critically important for analyzing the case study presented, as both the ICTs and assessment *for* learning are key drivers in designing the MLA. In the following section, we discuss the use of ICTs and the assessment *for* learning approaches with specific reference to the portfolio process and the development of a learning community through discussion forums.

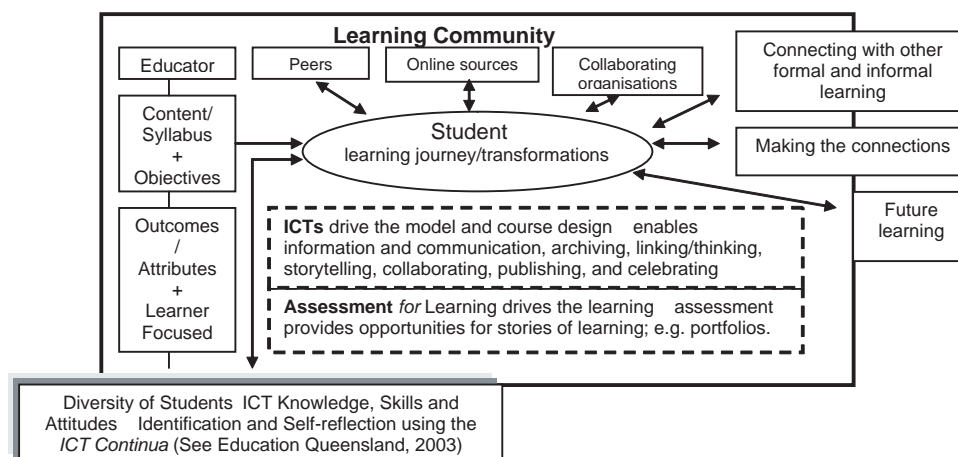
CASE STUDY: DESIGNING THE COURSE *LEARNING WITH ICTS*: TOWARDS A MEDIATED LEARNING ENVIRONMENT

This case study focuses on the design and delivery of the course *Learning with ICTs*. This course is a first-semester, first-year course situated within an eight-semester, 4-year teacher education preservice program at the Gold Coast campus of Griffith University in Queensland, Australia. This course is also delivered from two other Griffith University campuses (Mount Gravatt and Logan), and university policy requires cross-campus consistency in the formulation of the course outline. Semester 1, 2005, was the first time this new course was delivered, due to it being a course within a new bachelor of education (primary) program that commenced in 2005.

The Architecture: Course Design

The course conceptualization was guided by the need for the entire suite of four first-semester courses to have an integrated assessment item so

Figure 3. The MLA



Note: This model builds substantially on the model provided by Trinidad, 2004

students could make connections between the four courses rather than the courses being delivered as four discrete courses. Also guiding the conceptualization of all four courses was a central question: Who are we as learners? Subsequently, the expectation was that students entering their first semester of the teacher education program would undertake personal and group investigations around that central question through the theoretical perspectives, learning experiences, content and assessment of each course, as well as through making the connections among those courses.

The Assessment

For *Learning with ICTs*, three assessable tasks were required: problem set, Web site development and portfolio. Additional activities students were required to do included attending lectures and workshops. The course was Web enhanced through the provision of the Blackboard platform adopted by Griffith University. Students were provided with additional online learning resources in the form of summaries of lectures, Web links to useful Web sites, and a range of tools, such as the discussion forum. The discussion forums were established by the lecturer around key topics related to the central concepts of

the course, and students were expected to engage in these regularly. These were intended to provide students with opportunities to formulate and share ideas with other students in a non-threatening environment and scaffold students into developing more articulate analyses and linkages with theoretical perspectives as they progressed through the course. These enabled informed discussion about the topics posted, contribution of original ideas supported by reference to relevant literature and thoughtful responses to other people's contributions.

The Problem Set

The problem set was undertaken by students using ICTs to formulate their answers to a range of problematic scenarios. An example of a problematic scenario was:

Your school has been expending substantial funds from the school budget to acquire ICTs for some years. However, there are concerns that these ICTs are not being used effectively in classrooms. As an enthusiastic and informed user of ICTs, especially through your deep understandings of learning with ICTs developed throughout your preservice teacher education program, you have been asked to outline a rationale to inform the improved use of ICTs in

Figure 4. Traditional portfolio process: Emphasis is on collection of evidence (Adapted from Barrett, 2005b)

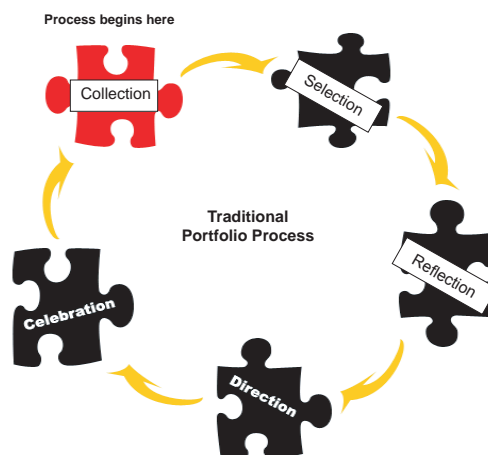
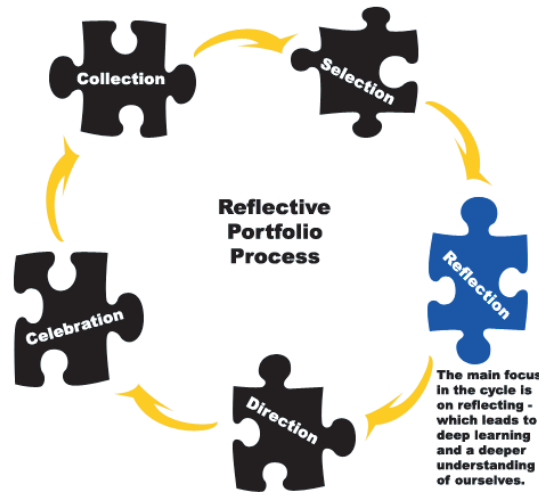


Figure 5. Reflective portfolio process: Emphasis is on reflection (Source: Adapted from Barrett, 2005)



your school to the school's ICT committee. Your rationale for ICT use needs to be supported by reference to learning theories and theorists, especially those associated with directed instruction and constructivism.

Students were scaffolded into the problem sets through their engagement with the textbook, lectures and discussions in workshops, and through the establishment of online discussion forums. The discussion forums were designed using the Blackboard platform, and students were allowed to make new threads and respond to other students' ideas.

The Web Site: Who are we as Learners?

The assessment task directly linked with the other courses and required students, working in pairs, to design a Web site using Macromedia Dreamweaver. Students were provided with the following design challenge:

As a teacher, you will be required to utilize a variety of tools to promote effective communication. This task exploits some of the communication capabilities of the World Wide Web. In the courses Introduc-

tion to Education, Studies in Sociocultural Understandings and Communicative Performance, you have been investigating the question "Who are we as learners?" by investigating your experiences as a learner and your reasons for selecting teaching as a career. You should also have come to realize the diversity that exists between yourselves and your potential students. Your task now is to assemble the discoveries you have made into a series of Web pages. The aim of this task is to use these pages to illustrate the aforementioned diversities and your understanding of your journey, as a learner, to date. Your Web site should also reflect some of the implications of this new knowledge for your professional life as a teacher.

Students created their Web sites around a suggested structure, which included the homepage titled *Who are we as Learners?*, and pages called *Personal Learning Journeys*, *Why Teach?*, *What makes a Good Teacher?* and *Our Professional Futures*. Artefacts in the form of assignments from the other courses, as well as additional information using a variety of media, were collected by students as "assets." The variety of media enabled students to develop interactive multimedia and digital video stories of learn-

ing. Students then selected and organized those assets for inclusion in the Web sites. As well as using *Macromedia Dreamweaver*, students used Macromedia Fireworks, Macromedia Flash, Windows Moviemaker, Microsoft PowerPoint, Adobe Photoshop, Adobe Acrobat and Microsoft Photo Editor to create their artefacts. The design of this assessment enabled the Web site to be a central vehicle for the development of students' personal stories of learning with the portfolio described in the following discussion.

The Portfolio

The Portfolio was conceived initially as a showcase piece to demonstrate basic and advanced ICTs skills through developing samples using a variety of software. However, guided by our move to conceptualize the course guided by MLA, students were encouraged to develop the portfolio more as a personal story of learning through the notion of an ICTs journey consistent with the *ICT Continua* (Education Queensland, 2003) used as a self-reflection tool, whereby teachers—in this case, future teachers—can move through *Minimum, Developmental, Innovator* and *Leader* phases. The ICTs Journey metaphor aligns with the MLA model (see Figure 3).

The portfolio task was established as a foundation for a portfolio students will continue to contribute to throughout the 4 years of their program. Therefore, the self-reflection links with prior ICT skills and knowledge and provides the platform for ongoing ICTs learning by linking with future learning. Students were required to demonstrate an extensive range of ICT skills and knowledge, including word processing, desktop publishing, presentation software, multimedia design, spreadsheets, databases, educational software, Internet use and Web site development. The ICT skills needed to be complemented by descriptions of how each ICT application could be used creatively in teaching and learning environments. The Web site development described earlier was

integrated into the portfolio, and discussion forum contributions were also required to be included. We continue to investigate how the portfolio enhances students' personal learning journeys and how the format supports this process. The following provides insights into the design of the portfolio in terms of moving towards e-portfolios within the context of assisting the development of an MLA using ICTs.

Defining E-Portfolios

There are many definitions for portfolios within education. The literature ranges from traditional portfolios showcasing assessment through to reflective digital portfolios or e-portfolios that support deep learning. Four major types of portfolios can be identified in the literature.

Traditional Portfolios

In 1991, Valencia (cited in Chatel, 2003) stated that a portfolio is a collection of student work that provides the means for “collecting evaluative information formatively as well as summatively” (p. 33), giving it the unique characteristic of always being a work in progress. It is a collection of physical artefacts that reflect a student's development and progress. Figure 4 demonstrates the traditional approach to developing a portfolio as presented by Barrett (2004a, 2004b, 2005), which commences with collection, selection, reflection, direction and celebration. In the traditional portfolio, emphasis is on the collection of artefacts, with the final product usually presented as a paper copy for assessment.

Reflective Portfolios

Barrett (2005b) advocates that a portfolio should be more than just a collection of data and recommends that the role of reflection in the portfolio is important for promoting deep learning. Barrett states:

... an educational portfolio contains work that a learner has collected, reflected, selected and presented to show growth and change over time, representing an individual or organization's human capital. A critical component of an educational portfolio is the learner's reflection on the individual pieces of work (often called "artefacts") as well as an overall reflection on the story that the portfolio tells. (p. 2)

Figure 5 shows that the emphasis is within the reflection phase of the process.

E-Portfolios

Barrett (2005a) notes that e-portfolios, also known as digital portfolios or electronic portfolios, are defined by the National Learning Infrastructure Initiative (NLII, 2003) as:

- A collection of authentic and diverse evidence
- Drawn from a larger archive representing what a person or organization has learned over time
- On which the person or organization has reflected

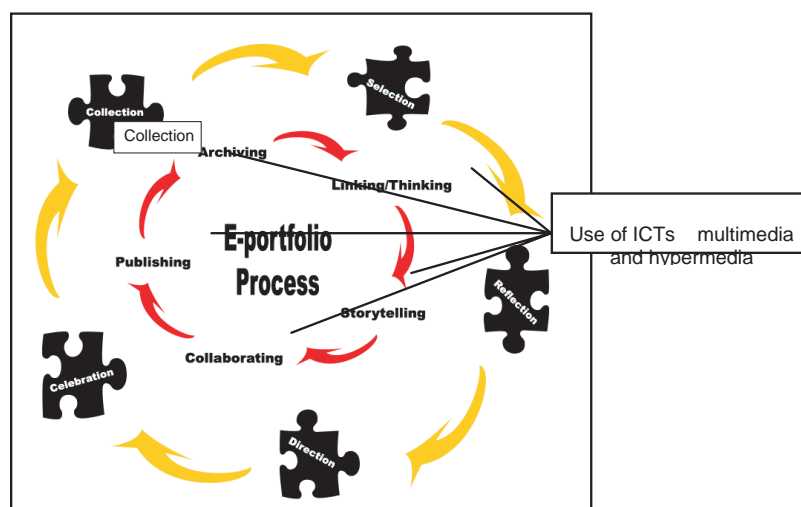
- Designed for presentation to one or more audiences for a particular rhetorical purpose

The traditional process, which involved collecting, selecting, reflecting, direction and celebration, is enhanced through the use of ICTs, according to Barrett (2004a) through the use of multimedia and hypermedia to enable archiving, linking and thinking, storytelling, collaborating and publishing. Figure 6 diagrammatically portrays the enhanced process of creating a portfolio with the added ICT enhancements. This extends the ability to communicate the stories of learning from the restrictions of a predominantly paper or print publication to multimedia, digital stories using video, audio, graphics and text in a Web-based portfolio. The use of hyperlinks through hypermedia can be a powerful means to demonstrate connections and links, rather than being limited to the restrictions of a linear story of learning similar to the teacher-directed learning environment model shown in Figure 1.

Higher Education Portfolios

In the context of higher education, the term portfolio denotes collections of evidence assembled

Figure 6. E-portfolio process: Enhancing the process through ICTs



by students, faculty members or entire institutions to enhance the effectiveness of teaching and learning, assess learning effectiveness and demonstrate competence to external stakeholders (DiBiase, 2002). Several types of academic portfolios have received attention in the literature; however, three have become prominent, according to Ketcheson (2001):

- **Student learning portfolios:** *Purposeful collections of examples of student work annotated (ideally) with students' reflective commentary. Examples may be drawn from assignments associated with a single course, or from curricular and co-curricular activities spanning a student's entire academic career.*
- **Teaching portfolios:** *Consist of course syllabi, assignments, student work and other artefacts, collected by practicing or aspiring teachers with the intent of fostering self reflection and peer review of teaching.*
- **Institutional portfolios:** *Contain examples of [an] institution's activities, programs, and initiatives, each expressing an element of reflection and self-assessment. Through its portfolio, an institution documents how it is achieving its stated mission by examples that speak to the interests of various audiences.* (p. 84)

For this case study, these contexts of designing the assessment *for* learning, defining e-portfolios as a process that is learner focused and using ICTs to enable the use of multimedia and hypermedia for students to collect, select, reflect, direct, publish and celebrate their stories of learning merge to inform the design of the course *Learning with ICTs* to create a mediated learning environment driven by the use of ICTs and assessment *for* learning. The key emphasis in the following analysis is to relate stories of personal learning in that course.

This is consistent with Barrett's theorizing that any portfolio should be a story of learning that promotes deep learning. Her thoughts are that the portfolio needs to incorporate a section within the reflection phase that focuses on storytelling. Moreover, Barrett refers to the work of Paulson and Paulson (1994), who outline the differences between the positivist and constructivist paradigms of portfolios:

- **Positivist portfolios:** *The purpose of the portfolio is to assess learning outcomes, and those outcomes are, generally, defined externally. Positivism assumes that meaning is constant across users, contexts and purposes ... The portfolio is a receptacle for examples of student work used to infer what and how much learning has occurred.*
- **Constructivist portfolios:** *The portfolio is a learning environment in which the learner constructs meaning. It assumes that meaning varies across individuals, over time and with purpose. The portfolio presents process, a record of the processes associated with learning itself; a summation of individual portfolios would be too complex for normative description.* (p. 36)

As the course design and delivery takes place within a university higher education context, there is a need to acknowledge both a positivist and constructivist approach. As an institution, we need to meet both certifications as well as promote personal growth and development of students. Therefore, when developing a portfolio, a hierarchical approach could be used. According to Barrett and Wilkerson (2004), the positivist approach is "the floor below which they cannot fall." The constructivist approach is where we hope our teacher candidates will go above the floor, showcasing the many ways that they are going beyond minimum requirements.

Reflections and Narratives: Personal Stories of Learning

As suggested by Holloway and Wheeler (1996), “Narratives and life histories are stories which individuals tell about their condition, work or life” (p. 59). While these are not new forms of data collection, as there is evidence of the use of these, for example, in the form of autobiographies and diaries, Holloway and Wheeler suggest that previously, “narratives were not analyzed systematically; but more recently, they have found a place in naturalistic enquiry for studying “the phenomena of development and transition in people’s lives” (Josselson & Lieblich, 1993, p. ix). This approach is adopted here to gain access “to the world of participants and share their experiences” (Holloway & Wheeler, 1996, p. 60). This aligns with the *Productive Pedagogies* (Education Queensland, 2002c) reference to the use of narrative in lessons encouraging the use of personal stories, biographies, historical accounts, and literary and cultural texts. In contrast, an expository teaching style places more emphasis on written, non-fiction prose, and scientific and expository expression by both teacher and students. It involves descriptions, reports, explanations, demonstrations and the use of documentaries (Education Queensland, 2002c).

Students’ personal stories of learning were gained from the artefacts collected and selected by them for inclusion in their Websites developed around the focus question *Who are we as learners?*, as well as for their portfolios. A student example of a Web site is provided to illustrate one student’s personal story of learning, and examples are drawn from that student’s e-portfolio to demonstrate the course in action. Students were also required to engage in online discussion forum topics posted regularly throughout the course. This chapter draws upon their responses in the final forum for the course and presents a synthesis of those responses to portray students talking about their learning.

Web Site: Who are we as Learners?

Generally, students were challenged early in the course with the task of having to design and present a Web site. However, after some scaffolding into the construction process, the Web sites were designed and constructed to provide a means for the collection, selection and presentation of student artefacts related to the focus question and the required questions framed for each of the Web pages. Students used a variety of media and created “assets” and “images” folders for archiving their artefacts. A course, *Sociocultural Understandings*, being undertaken simultaneously by students, required them to provide an autobiographical account of an experience in their lives and analyze this through a sociocultural lens. Students included this in their Web sites as a link from their *Personal Learning Journey* Web page. The following is an excerpt from a student example:

Throughout the development of oneself, each individual person is exposed to an individual set of incidents and circumstances, which occur in social institutions that impacts and defines that person’s beliefs and values in a process known as socialization (Holmes, Hughes, & Julian, 2003). A key moment in the development of my beliefs occurred in the event outlined in this account. This very event defined my belief of who I am as a learner: I discovered on reflection of this particular event that society suggests that there are those exposed to advantage in life and those exposed to disadvantage, but our social foundation suggests that the disadvantaged should be supported by the advantaged. (Student sample in Web site)

That Web site included a rich suite of images of the student throughout various stages of learning and growth, together with reflections of his personal learning journeys, key events in his life, including the highs and the lows, the struggles and the achievements, his reasons for wanting

to become a teacher, his thoughts on what makes a great teacher and his vision for his professional future.

E-Portfolio: A Student Sample

The portfolio process as described earlier in this chapter required students to portray their personal stories of learning in terms of ICT skills and knowledge through the creation of ICT samples to demonstrate basic and advanced skills and knowledge using a wide range of software. Figure 7 portrays the homepage of a student with navigation to the samples and stories of learning in his e-portfolio. This e-portfolio presented not only a means for the archiving, linking and publishing of evidence of learning unable to be demonstrated through a single essay or end-of-semester exam, but it provided the means for linking with other assessments undertaken in this course, such as the discussion forum contributions and Web site development, and enabled links with other assessments in other courses being undertaken by the student. As indicated earlier in relation to the Web site, the e-portfolio also enables a powerful means for using it as a platform for linking with future learning. Additional pages can be added,

additional artefacts can be archived and linked, and the currently stored evidence of learning will provide a rich resource for reflection as the student's learning journey continues.

Students Talking about their Learning

Throughout the course, students participated in an online forum discussion that had to be included in their portfolios. Consistent with the MLA model (see Figure 3), and after the course delivery, the assessment for learning experiences provided by the problem sets, the Web site—*Who are we as Learners?*—and the portfolio process, the culminating forum was framed by the course convenor as:

This is the final forum for this course. I am confident that students are making the connections required this semester and can make sense of the ways in which this course has been designed, and the ways in which the four semester-1 courses are attempting to make connections. ... I'd like to think that through your activities, you've made several other important connections—connected with the Teaching Team (lecturers and tutors), and con-

Figure 7. E-portfolio homepage (Acknowledgment: This Web page was constructed by a co-author of this chapter)



nected with other students ... these connections are critical to assist your sense of belonging and sense of learning community. Finally, the Web site—Who are we as learners?—encourages you to make links (should I say ‘hyperlinks’?) with the other courses you are undertaking. So ... the final forum for this course asks you to reflect upon your learning journey this semester in terms of the deep understanding and deep learning (the really important personal and professional growth experienced). You are invited to share some of your reflections about that deep learning. Comment, for example, on the challenges, the highlights and the connections. (Finger, 2005)

The following reflections have been synthesized from the student responses provided to that forum topic.

Discussion Forums: Effective for Communicating Ideas

The online facility provided by the discussion forums was perceived as being extremely effective by students. These perceptions tended to be supported by expressions by students that the forums provided a facility for assisting students to gain confidence in articulating ideas required by the problem set assessment task.

- “The discussion forums were a super idea to help with the problem set questions. I enjoyed reading other people’s input, and it also helped me think about other students’ different viewpoints.”
- “These discussion forums are great! There are a number of reasons why I feel this. The first is that it is a non-threatening environment where you can express your ideas . . . The second is that it also allows you to examine other people’s ideas at the same time, ideas that you may not have thought of or that could have been presented in the

lectures or tutorials. There have been weeks when you come into the forums late and see the quality stuff that others have already written and all you can do is just say ‘That’s right.’ It did also open up our thought patterns in preparation for the problem set, again giving us greater understanding and deeper thought before confronting the scenarios in the problem set.”

- “The discussion forums have provided me with opportunities to write, read and think about my own learning journeys. . . I also found that the forum topics complemented the text and lectures very well.”
- “I think that the forums gave us all an opportunity to express our opinions and they really helped me to interact with my peers.”
- “In addition, I liked the forums because they helped me to get my mind around the concepts I had read or learnt in the lectures. They also meant that I had time to respond to the questions asked in the forums and wasn’t put on the spot . . . they were a non-threatening way to communicate ideas.”

Reflections: Who am I as a Learner?

Students reflected that the focus question—*Who are we as learners?*—was effective in linking their learning in this course with the other three courses they undertook during the semester.

- “What a journey. I feel that this course has been very reflective and allowed me to explore who I am as a learner with the help of the other three courses.”
- “The overall theme of who are we as learners really makes you think about why we are here, why we made that choice to be part of the education field, and I’m grateful for having the chance to reflect upon it.”

Making the Connections

Students generally reported that the focus question—*Who are we as learners?*—facilitated the connections between the courses, and some students indicated that the Web site enabled the connections to be made.

- “To me, this course helped me link all the other courses I am doing because of the Web site having grouped all my ideas of who we are as learners.”
- “By looking at the connections between and within each course, I now see that all the courses—despite the different topic areas—are designed to make each of us look at who we are. This course has intrinsically given us a powerful medium for learning.”
- Students also mentioned the connections made between assessment items within the course *Learning with ICTs*, connections with the teaching team and connections with other students.
- “The forum topics, lectures and assessment items have all been directly linked.”
- “The ‘hyperlinks’ between the Web site and our other courses are starting to appear at long last. All of our subjects encouraged us to learn about our attitudes, beliefs and values and then challenge them in a new way. It has been an amazing journey, and I am proud of how much I have learnt.”

The Challenge of Designing a Web Site

Students enrolled in this course came with a wide range of ICT skills and knowledge. Very few had designed and constructed Web sites. The course required students to create a Web site as described earlier in this chapter using Macromedia Dreamweaver to enable the development of a Web-based means for collecting, selecting, reflecting and publishing artefacts related to the central question of *Who are we as learners?* Many responses from students

highlighted the challenge this created, which they overcame, and felt great personal satisfaction with their learning.

- “Week 1 ... What do you mean I’ll be designing a Web page? Are you out of your mind? Only ICT geniuses can do that stuff ... but here I am at the end, having accomplished something I never thought I could, would or should, and I’m really proud of my input and the final result.”
- “For me, this course has been an absolute treasure; I started off thinking, they are kidding right—design a Web site! After cursing and grumbling, we started; we made mistakes; we grumbled some more; we continued; we made more mistakes ... the final design is ready now. But you know, the road I have traveled to get to where I am with my Web design has been the most stimulating, educational experience I have had since starting my degree ... thanks for the challenge and the learning experience; this is precisely why I want to teach, to offer challenge, stimulation and excitement—which you clearly set out and attained with this student.”

Stories of Inspiration to Teach

Powerful stories were presented by many students related to becoming inspired to teach from the learning experiences provided in this course. Underlying these reflections were often messages of the importance of the human dimension in teaching the course and the relationships between the lecturer, tutors and the students.

- “I have learnt that anyone can dictate information to students and say ‘learn this,’ but good teachers inspire deeper learning. They encourage students to explore what they know, explore the unknown and explore what their peers know.”

- “Glenn [lecturer] and my tutor should be commended for their fabulous work and their inspiring stories ... I don’t know what everyone else thinks ... BUT I AM INSPIRED.”
- “What has been the deep learning for me this semester? It has been making the connections with the various course contents, with the tutors and lecturers, the students, and how I can use these experiences in my future role as a primary school teacher. But above all, it has been about connecting with me and the deep personal reasons for wanting to enter the profession.”
- “Glenn, you have been so approachable and friendly, and many of us have spoken of what a great example of what teachers should be you are; you are interested in more than the surface, thank you!”
- “I would like to thank Glenn and Maret [tutor] for their fantastic teaching efforts this semester; your passion for teaching reminds us all of why we chose to study this course and head in the direction we are going, thank you.”
- “Glenn, you mentioned how impressed you were with the tutorial attendance; I think you can take credit for that—your passion and enthusiasm overflowed the lecture theatre and infected all of us.”
- “I could not see how anyone, no matter how gifted, would be able to make computers and keyboards and hard drives exciting. But! All credit to Glenn, he pulled it off marvellously! Not only did he make these mundane electrical pieces seem interesting, but explained in his always polite humor how technology has, is and will affect us. One thing that I constantly noticed throughout the semester was Glenn’s passion for his course. This came through not only in his lectures, but even when greeting me in the hallway. It was great to meet someone who so obviously enjoyed and loved his career with children, and has made me much more aware of my desire to enter this profession, too. So thank you, Glenn.”

Some students suggested that the success was related to the narratives and sometimes the associated humor provided by the lecturer to illustrate theoretical perspectives. The following reflections are indicative that there is a powerful human dimension required to inspire students. The use of ICTs can assist in achieving this, but are insufficient by themselves to ensure success. Passion, enthusiasm, modeling commitment and the building of authentic relationships with students were seen by students as contributing to their commitment to teach.

- “My tutor, Carmel, should be commended on her kind approach to teaching. ... I feel inspired by her and Glenn ... here’s a pat on the back. Your stories have also inspired me ...”

FUTURE TRENDS AND SOLUTIONS: THE JOURNEY CONTINUES ...

Based upon the students’ stories, the e-portfolios provide the platform for the personal stories of learning to continue. The continuing collecting, selecting, reflecting, directing and publishing will continue as students proceed through their higher education program on their journeys as future teachers. The *ICT Continua* (Education Queensland, 2003) will continue to provide the self-reflective device for documenting and guiding that journey.

Continuing research and investigation is needed to theorize e-portfolios to promote deep learning by students in higher education. The case study provided here has provided a sense of a road map that has gone some distance along this journey. However, considerable development

is required to further explore the ways in which students can collect, select, reflect, direct, publish and celebrate their learning. For example, why might students see some attempts at e-portfolio as simply another requirement or assessment of learning.

Similarly, the promotion in this chapter of MLAs requires more theoretical models built to guide and be guided by course design and delivery. There seems to have been some critically important intangibles, almost impossible-to-measure qualities emanating throughout the story provided in this chapter—stories of higher education, humans, humor and stories of passion, challenge, commitment and inspiration. A key challenge is our need to develop improved understandings of the interface between teaching, learning and ICTs. How can ICTs assist in transforming learning in higher education, as Roffe (2002) puts it, so that it engages learners, enhances learning, provides ease of use, empowers the learner to control the learning schedule and assists in the execution of the learning program?

CONCLUSION

This chapter has outlined a case study of the design and delivery of a course for future teachers undertaking a higher education course. The design of that course—*Learning with ICTs*—was guided by a mediated learning approach in which the design was driven by ICTs and by assessment for learning. Through describing the assessment undertaken, complemented by samples, and a synthesis of reflections by students, the chapter has provided some guidance for understanding the importance of the human dimension of technology in higher education. The chapter provided some insights into the potential for the role of e-portfolios theorized as enabling personal stories of learning using multimedia and hypermedia.

REFERENCES

- Albon, R., & Trinidad, S. (2001). Tapping out new rhythms in the journey of learning. In A. Herrmann & M.M. Kulski (Eds.), *Proceedings of the 10th Annual Teaching Learning Forum*. Perth, Australia: Curtin University of Technology. Retrieved November 16, 2005, from <http://lsn.curtin.edu.au/tlf/tlf2001/trinidad.html>
- Barrett, H. (2004a). *Electronic portfolios as digital stories of deep learning*. Retrieved May 3, 2005, from <http://electronicportfolios.org/digistory/epstory.html>
- Barrett, H. (2004b). *Electronic portfolio as digital story of learning: Digital storytelling as reflective portfolio*. Retrieved May 3, 2005, from <http://electronicportfolios.org/digistory/eportfoliostory.htm/>
- Barrett, H. (2005a). *What is an e-portfolio?* Retrieved May 10, 2005, from <http://electronicportfolios.org/digistory/epstory.html>
- Barrett, H. (2005b). *Researching electronic portfolios and learner engagement* (white paper). Retrieved September 13, 2005, from www.electronicportfolios.org/reflect/whitepaper.pdf
- Barrett, H., & Wilkerson, J. (2004). *Conflicting paradigms in electronic portfolio approaches*. Retrieved May 3, 2005, from <http://electronicportfolios.org/systems/paradigms.html>
- Becta Review. (2005). *The Becta review 2005 evidence on the progress of ICT in education*. Retrieved June 6, 2005, from www.becta.org.uk/page_documents/research/becta_review_feb05.pdf
- Bigum, C., & Rowan, L. (2004). Flexible learning in teacher education: Myths, muddles and models. *Asia-Pacific Journal of Teacher Education*, 32(3), 213-226.

- Chambers, J. (2001). *E-learning takes stage as next killer APP*. Retrieved June 16, 2005, from www.infoworld.com/articles
- Chatel, R. (2003). The power and potential of electronic literacy assessment: Eportfolios and more. *New England Reading Association Journal*, 39(1), 51-57.
- DiBiase, D. (2002). *Using e-portfolios at Penn State to enhance student learning*. Retrieved May 3, 2005, from www.e-education.psu.edu/portfolios/e-port_report.html
- Education Queensland. (2002a). *Productive pedagogies classroom reflection manual: Deep understanding*. Retrieved July 31, 2005, from http://education.qld.gov.au/public_media/reports/cirriculum-framework/productive-pedagogies/html/int-03.html
- Education Queensland. (2002b). *Productive pedagogies classroom reflection manual: Deep knowledge*. Retrieved July 31, 2005, from <http://education.qld.gov.au/publicmedia/reports/cirriculum-framework/productive-pedagogies/html/int-02.html>
- Education Queensland. (2002c). *Productive pedagogies classroom reflection manual: Narrative*. Retrieved July 31, 2005, from http://education.qld.gov.au/public_media/reports/cirriculumframework/productive-pedagogies/html/rec-03.html
- Education Queensland. (2003). *Information and communications technology continua*. Retrieved June 15, 2003, from <http://education.qld.gov.au/cirriculum/learning/technology/cont.html>
- Finger, G. (2005). *The final forum — learning with ICTs*. Retrieved June 3, 2005, from Learning with ICTs Web site in Learning@Griffith, Griffith University, Gold Coast campus.
- Finger, G., & Russell, G. (2005, July). *ICT's and teacher education: Digital portfolios — Digital storytelling, reflection and deep learning*. Paper presented at the Australian Teacher Education Association Conference at Surfers Paradise, Queensland.
- Fraser, B. J. (2003). Preface. In M.S. Khine & D. Fisher (Eds.), *Technology-rich learning environments: A future perspective*. NJ: World Scientific.
- Holloway, I., & Wheeler, S. (1996). *Qualitative research for nurses*. London: Blackwell Science.
- Holmes, D., Hughes, K., & Julian, R. (2003). *Australian sociology: A changing society*. Frenchs Forest: Pearson Education.
- Holzl, A. (1999). Flexible learning: Can we really please everyone? *Educational Technology and Society*, 2(4). Retrieved May 30, 2005, from http://ifets.ieee.org/periodical/vol_4_99/formal-discussion_1099.html
- Josselson, R., & Liebich, A. (1993). *The narrative study of lives*. Newbury Park: Sage.
- Ketcheson, K. A. (2001). Public accountability and reporting: What should be the public part of accreditation? In J.L. Ratcliff, E.S. Lubinescu, & M.A. Gaffney (Eds.), *How accreditation influences assessment* (pp. 83-93). San Francisco: Jossey-Bass.
- Paulson, F. L., & Paulson, P. (1994). Assessing portfolios using the constructivist paradigm. In R. Fogarty (Ed.), *Student portfolios*. Palatine: IRI Skylight Training & Publishing.
- Roblyer, M. (2004). *Integrating educational technology into teaching*. Upper Saddle River: Pearson Education.
- Roffe, I. (2002). E-learning: Engagement, enhancement and execution. *Quality Assurance in Education*, 10(1), 40-50.
- Roffe, I. (2004). *Innovation and e-learning: E-business for an educational enterprise*. Cambridge: Cambridge Printing.

Information and Communication Technologies

Russell, G., & Finger, G. (2004, July). Teacher education in an online world: Future directions. *Paper presented at the Australian Council for Computers in Education Conference, Research, Reform, Realise the Potential*, Adelaide.

Trinidad, S. (2003). Working with technology-rich learning environments: Strategies for success. In M. S. Khine & D. Fisher (Eds.), *Technology-rich learning environments: A future perspective* (pp. 97-113). NJ: World Scientific.

This work was previously published in Technology and Diversity in Higher Education: New Challenges, edited by Y. Inoue, pp. 81-103, copyright 2007 by IGI Publishing, formerly known as Information Science Publishing Publishing (an imprint of IGI Global).

Chapter 2.36

Learning–Supported Decision–Making: ICTs as Feedback Systems

Elena P. Antonacopoulou
University of Manchester, UK

K. Nadia Papamichail
University of Manchester, UK

ABSTRACT

The biggest challenge for any organization is managing the disperse nature of knowledge across a diverse set of knowledge carriers. The role of ICTs in supporting and extending the organizational memory is of particular concern. This chapter contributes to our understanding of the challenges the Digital era presents us by proposing a socio-technical framework, which emphasizes feedback as the critical link connecting social systems and technical structures. The main thrust of the framework is the alignment of social structures and social actors in ways that seek to integrate different modes of learning with different models of decision-making. This integration is to be supported by a range of decision-learning structures (in ICT systems), which create different feedback levels. These feedback levels are the main focus of

the chapter which makes a valuable contribution in extending debates of learning, decision-making and their relationship demonstrating the inherent challenges of the digital era in using ICTs as social as much as technical tools.

INTRODUCTION

A trend that is common to many organizations in the post-industrial society (Bell, 1976) is the volume, dispersion and complexity of the information available that has a significant bearing on efforts to ‘manage’ knowledge and support organizational and individual learning to meet strategic objectives. The ‘social life of information’, as Brown and Duguid (2000) eloquently demonstrate is affected by a multitude of social forces such as: economic conditions, international forces,

technology and changing assumptions. While Information and Communication Technologies (thereafter ICTs) are predominantly seen as tools supporting information management, their role in relation to learning and knowing in organizations is still embryonic. A review of the decision support literature, shows that a number of methodologies (predominantly ICT based) have been proposed in an effort to overcome the inherent subjectivity in the process of decision-making. For example, many decision support tools seek to find ways in which objective information can be successfully collected, categorized and distributed to support decision-making. Decision-making can be supported both by ICT-based decision support systems, as well as the dominant assumptions and values that determine the practices of a community of decision makers.

This point is critical in the analysis the chapter seeks to pursue, because it seeks to capture the dynamic interactions between the human and technological dimensions and to highlight the significance of feedback systems as mechanisms that convey powerful cultural meanings that carry collective knowledge in a codified form giving sense to the actions taken in relation to making a decision. Therefore feedback systems reflect the social structures that support information flows in organizations in the way existing lessons learned are codified, stored and distributed among members of a community.

The objective of this chapter, therefore, is to propose a socio-technical framework for supporting decision-making by exploring how learning modes facilitate knowledge transfer and feedback in relation to ICT-assisted knowledge management initiatives. ICTs as feedback systems that act as knowledge codification devices reveal both the sense-making process shaping individual interpretations, as well as the knowledge structures that form part of the organizational memory. Therefore, understanding how decision makers learn to make decisions would be of considerable value, as it would help highlight more forcefully how

the subjectivity in the decision-making process develops and how it can be potentially worked with to enhance the effectiveness of decisions. Essentially learning how to take decisions is akin to saying learning how to learn. This view locates as central to the effort to support decision-making the question of whether learning could be one of the purposes of making decisions and indeed if there is a 'best' way of learning in relation to decision-making.

For the purpose of this analysis decision-making is defined as:

A learning-supported process which is embedded in the learning culture and climate of the social context in which it takes place, has the capacity to evolve through the processing of information and the building of knowledge by developing interpretations based on the evolving organizational memory.

The discussion begins with an overview of the role of learning, knowledge and sense-making in the context of decisions. The analysis then examines the relationship between learning and decision-making by reviewing the three modes of learning that have dominated our understanding of learning in organizations. The way different levels of feedback and degrees of knowledge transfer that shape decision making are then discussed in relation to the ICTs. A socio-technical framework for supporting decision-making and learning is proposed identifying three feedback levels. The chapter concludes with an overview of future trends and challenges in the development of decision support systems in the Digital Era.

DECISION-MAKING AS A LEARNING-SUPPORTED PROCESS

Even though our understanding of the nature of decision-making as a complex process and a multifaceted phenomenon has come a long way

(see for example Langley, Mintzberg, Pitcher, Posada, & Saintmacary, 1995; Mumford, 1999), a persistent issue remains that decisions are based on the information available and the interpretations that decision makers impose as they make sense of the information available. If we accept that decision-making involves a large degree of sense-making (Weick, 1995) then perhaps the challenge is to examine how decision makers learn to make sense of the information they have available, how they use their own knowledge [both tacit and explicit (Nonaka & Takeuchi, 1995)] in formulating the understanding that then guides their repertoire of assumptions, as well as their actions in relation to taking a decision.

The view of decision-making as a learning-based rather than information-based process is relatively unexplored in the existing literature. The only reference to decision taking as a learning process is made by Arie de Geus (1999) and Ackoff (1999), both of who acknowledge that it is important to understand how learning takes place, however, they do not actually examine what is the relationship between learning and decision-making. In this section we make the case for a learning-based view of decision-making by first discussing the main issues and controversies in understanding the role of learning in the context of decisions. From the analysis we also identify some of the principles of a learning-supported approach to decision-making considering also the role of ICT's and other decision support systems. We begin by reviewing the main modes of learning.

Modes of Learning

The development of learning theory over the years has commanded the attention of many researchers and reflects the emergence of a number of 'schools of thought' each proclaiming to have a better grasp of what learning is and how learning takes place. In an extensive review of the learning theories, Burgoyne and Stuart (1976, 1977) identified at least

eight "schools of thought" which they discuss using metaphors in relation to their main principles and applications, as well as, their assumptions about the nature of people. In similar fashion, *Merriam and Caffarella* (1991, p. 138) discuss four main theories of learning — Behaviourist, Cognitivist, Humanist and Social and Situational Learning — and discuss their main principles in relation to their orientation to learning. Table 1 summarizes the main characteristics of each of these theories and the basic assumptions about how adults learn.

Table 1 shows that the orientation of different learning theories over the years has moved from notions of conditioning and indoctrination, towards autonomy and self-direction. Further realization that learning consists of unstructured, discontinuous and often unconscious aspects has generated more interest in the experiences people in organizations encounter and the actions they take (Marsick & O'Neil, 1999). Experiential learning and action learning theories aimed to address this issue by placing importance on the social, cultural and political aspects surrounding the learning process. This view has found more voice in recent contributions promoting a situated view of learning in organizations, integral to the functioning of communities of practice (see Wenger & Snyder, 2000; Lave & Wenger, 1991). These perspectives have also helped bring to the forefront greater consideration of the psychoanalytic, emotional and aesthetic aspects of learning (see Antonacopoulou & Gabriel, 2001; Scherer & Tran, 2001).

The development of learning theory illustrates the difficulty of capturing the complexity and diversity of learning from any one single perspective. This is best reflected in the lack of an agreed definition as to what learning is. Earlier theories considered learning as a change in behavior, which results from the acquisition of knowledge and skills. Many researchers have actually defined learning in these terms (e.g., Bass & Vaughan, 1966). The definitions of learning assume that

Table 1. Learning theories and their orientation

| Aspect | Behaviourist | Cognitivist | Humanist | Social and situational |
|-------------------------------------|---|---|---|---|
| Learning theorists | Thorndike, Pavlov, Watson, Guthrie, Hull, Tolman, Skinner | Koffka, Kohler, Lewin, Piaget, Ausubel, Bruner, Gagne | Maslow, Rogers | Bandura, Lave and Wenger, Salomon |
| View of the learning process | Change in behaviour | Internal mental process (including insight, information processing, memory, perception) | A personal act to fulfil potential | Interaction /observation in social contexts. Movement from the periphery to the centre of a community of practice |
| Locus of learning | Stimuli in external environment | Internal cognitive structuring | Affective and cognitive needs | Learning is in relationship between people and environment. |
| Purpose in education | Produce behavioural change in desired direction | Develop capacity and skills to learn better | Become self-actualized, autonomous | Full participation in communities of practice and utilization of resources |
| Educator's role | Arranges environment to elicit desired response | Structures content of learning activity | Facilitates development of the whole person | Works to establish communities of practice in which conversation and participation can occur |

the change in behavior is relatively permanent and that practice and experience are an important ingredient. Learning defined in these terms is often associated with taking action towards resolving problems (e.g., Argyris, 1982; Thomas & Harri-Augstein, 1985). However, as researchers increasingly recognized that learning is not always a structured, continuous and conscious process, learning has been defined as a process of gaining a broader understanding and the awareness of the

personal meaning of experiences which does not necessarily result from the acquisition of new knowledge as much as a rearrangement of the existing knowledge (e.g., Gagné, 1983; Revans, 1982). Learning has been increasingly defined in broader terms to capture the complexity of thinking, as well as acting and researchers have more recently described learning as a process of reframing meaning, transformation and liberation (e.g., Antonacopoulou, 1998; Kolb et al., 1991;

Schön, 1983). The recognition that learning is a dynamic and emergent process encourages a more integrative framework of interacting variables which arrests learning as a *space* of action, interaction and transaction than simply a means of filling knowledge gaps (see Antonacopoulou, 2002a). From this perspective, learning emerges from the interconnection of various personal and contextual factors. In other words, learning does not only depend on the individual's motivation and personal drive, but on the reinforcement of learning within the environment as well. This point stresses the situated and contextual specificity of learning and signals that different modes of learning allow learners to use feedback from the interaction with the environment as the basis of improving how and what they learn (see Antonacopoulou, 2002b).

The most widely known modes of learning to reflect this point are the distinctions made by Argyris and Schön (1974) between *single-* and *double-loop learning* and (Bateson, 1972) with reference to *deutero* or *triple-loop learning*. These modes of learning are chosen as the focus of analysis because, unlike other types or modes of learning promoted in the existing literature, they have feedback loops at their core. Figure 1 represents diagrammatically the three modes of learning.

Essentially, it could be argued that single-loop learning is predominantly concerned with identifying and correcting a problem and depending on the consequences if the problem persists, because the actions taken failed to address it, then one has to consider alternative actions. Double-loop learning on the other hand, still propounds a problem-solving mentality at the core of learning activity however, unlike single-loop learning it seeks to detect and correct a problem but also modify underlying norms and objectives, which have guided the implementation of the initial action. Finally, deutero (triple-loop learning) is concerned with learning to learn. Learning does not stop when a problem is solved or when new

actions are taken to prevent it from happening again, nor is it enough to review one's assumptions. One must also actively seek to reflect, inquire and develop new strategies for learning. Romme and van Witteloostuijn (1999, p. 439) echo this point when they suggest that while double-loop learning "involves reframing ... [and] learning to see things in new ways," triple-loop learning requires "developing new processes or methodologies for arriving at such re-framings." In triple-loop learning not only are norms questioned, but embedded assumptions of how we think and learn are re-examined.

From this brief overview of learning modes it is evident that the main difference between them lies at the level one seeks to use feedback as a means of rethinking whether one's actions in relation to *why* one learns (e.g., solving problems or taking decisions) are also consistent with *how* and *what* one learns. These issues are perhaps better evident in the role of learning in supporting a range of organizational processes such as decision-making.

The Relationship Between Learning and Decision Making

It is increasingly recognized that a number of key organizational processes have learning at their core. de Geus (1997) propounds the view of planning as learning, while Whittington (2001) explores strategizing as [learning] practice. In this chapter we make the case for decision-making as learning-supported considering that decision-making itself, as others have already argued, entails several learning principles.

Decision-making has been described as a "knowledge-intensive activity with knowledge as its raw materials, work-in-process, by-products and finished goods" (Holsapple, 2001). Yet, to-date we have limited empirical evidence that shows what forms of knowledge constitute the process of making decisions, how such knowledge is produced and utilized, how different stakeholders

Learning-Supported Decision-Making

formulate their knowledge, and what impact the different knowledge they bring has on the process of decision-making. These issues suggest that a key priority in understanding the nature of decision-making is to understand first the way knowledge that serves decision-making purposes evolves as different human, technological and social conditions interact and create conditions that shape the nature of decision-making. Therefore, we need to move beyond the view of decision-making as a step process based on knowledge components, to understand decision-making as a complex process of learning possibilities.

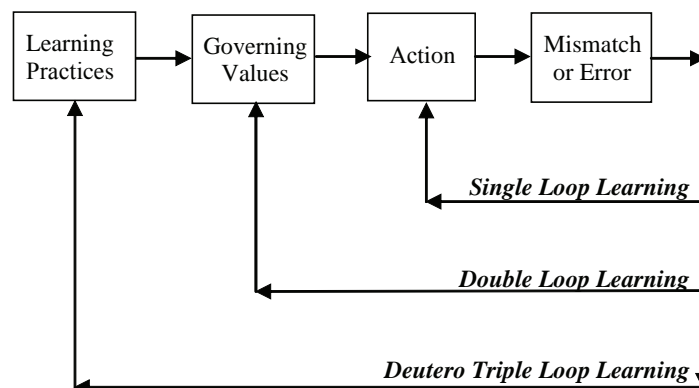
One of the key principles critical to decision-making is feedback. This suggests that at the core of making a decision lies knowledge and insights gained from past and current experiences which can affect significantly the kind of decision made, as well as the way decisions are reached. Beach (1990) supports this view in his 'Image Theory', showing how decision-related knowledge influences how a decision is made. Beach identifies three distinct but related images: the decision maker's values and principles (image 1); his/her goals and agenda (image 2); and his/her plans, tactics and forecasts (image 3) about what (s)he expects (s)he will accomplish from the decision. Therefore, one's mental models are not only restrictive of one's ability to make decisions they are also restrictive of one's ability to learn.

This reveals an intimate relationship between learning and decision-making. In the same way that learning is a necessary requirement for decision-making, decisions have to be made to create learning. This would seem to be at the core of what decision-making as a learning-based process could be all about — namely that decisions are possibilities that are shaped by the *purpose* they seek to address. This means that in the same way learning is contextual and situated, decision-making is particular and idiosyncratic to the actors (people and social dynamics between them) and structures (systems that define the boundaries of interaction between social actors, e.g., technology) involved with shaping the purpose of decision-making. Feedback mechanisms are critical in balancing the known with the unknown. Based on these principles the next section examines how ICT systems can be employed as feedback mechanisms capable of codifying knowledge and conducive to learning-supported decision processes.

ICTs for Supporting Learning-Based Decision Making

Despite the common perception of a decision support system as a particular tool, the widespread view is that “the term decision support system is an umbrella term to describe any and every

Figure 1. Three modes of learning



computerized system used to support decision making in an organization” (Turban & Aronson, 2001, p. 14). The concept has evolved from management information systems in the '60s and '70s through to expert systems and group decision support systems in the '80s to data warehouses, business intelligence tools and portals in the '90s (Power, 2002).

Our understanding of how such technologies are used in organizations has improved over the years. Researchers and practitioners developed frameworks that highlighted the behavioral aspects of decision support technologies and explored the information needs of decision makers (Simon, 1960; Gorry & Scott Morton, 1971; Davis, 1974; Sprague & Carlson 1982). A significant milestone came with the development of expert systems and artificial intelligence tools. These technologies enhanced the knowledge-based capabilities of decision aiding tools (Silverman, 1994).

While the users of traditional decision support systems are usually expert decision makers, the users of intelligent decision support systems that incorporate expert systems technology can be novices. They range from non-experts that need advice or training, to experts that seek the advice of an expert system to validate their own opinion. Only a small number of expert systems replace rather than support decision makers (Edwards, Duan, & Robins, 2000). In decision analysis applications, the intended users of intelligent tools include the facilitator, the actors, and the D.I.Y. users who directly interact with a decision-aiding tool (Belton & Hodgkin, 1999). Depending on their education, training, expertise, beliefs and experiences different decision makers reach decisions and apply actions to different levels of success (Turban & Aronson, 2001). As Marakas (2002) points out there is not currently a bandwidth limitation between a network and a computer but rather between a computer interface and the brain of a decision maker.

A new generation of decision support tools such as data warehouses and data mining was introduced in the '90s. Companies have implemented data warehouses and employed data mining and business intelligence tools to improve the effectiveness of knowledge-based decisions and gain competitive advantage (Heinrichs & Lim, 2003). Other primary decision support systems include OLAP (Online Analytical Processing) and Web-based decision support tools (Shim et al., 2002). Executive (or enterprise) information systems allow managers to drill down into data while offering highly interactive graphical displays (Bolloju, Khalifa, & Turban, 2002). Intelligent agents and strategic decision support systems support the formulation of strategy and improve organizational performance (Carneiro, 2001). Collaborative systems offer facilities ranging from supporting groups of decision makers to coordinating virtual teams (Shim et al., 2002). All these technologies can become available on the Web to reduce costs, allow easy access to information and therefore improve efficiency. In this context, ICTs such as intranets and extranets can be constructed to provide decision support (Power, 2002).

The preceding paragraphs show that decisions support systems offer a diverse range of functionalities. They support decision making at different levels ranging from acquisition, checking and display of data to interactive evaluation and ranking of alternatives (French & Papamichail, 2003). The aim of this section is not to provide an exhaustive list of decision aiding tools but rather to illustrate how such technologies can be used to enhance learning in decision processes. Using the same classification of modes of learning given in the previous section, we discuss how different types of decision support systems support the three modes of decision-learning.

Single-loop decision-learning. A wide range of tools can be employed to facilitate the implementation of decisions through better knowledge and understanding of the decision context and content.

Learning-Supported Decision-Making

For example, databases and on-line sources offer easy access to explicit forms of decision-related data. Executive information systems and other business intelligence tools such as OLAP products and visualization packages, provide on-the-fly data analysis so that managers become aware of problems and monitor the implementation of their strategies. Expert systems support control activities such as monitoring, diagnosis, prescription and planning. Data mining techniques (e.g., artificial neural networks, genetic algorithms, rule induction, case-based reasoning) convert raw data into more meaningful and actionable forms of knowledge by finding patterns in historical data and learning from past examples (see for example Bose & Mahapatra, 2001).

Another technology that can facilitate learning through inferences from history is an experience database that contains decision problems or opportunities that ended in failure or success. Such databases can be coupled with case-based reasoning (Shaw, Subramaniam, Tan, & Welge, 2001) or rule-based system tools (Hunter, 2000) to facilitate the retrieval of cases or identify partial matches. Their main contribution is that they allow individuals to learn about past decisions, as well as respond to the challenges of the future without reinventing the wheel or repeating mistakes (Croasdell, 2001).

Single-loop technologies improve actions through access to repositories of explicit knowledge and better understanding of the decision problem. Even though they promise to improve the efficiency and effectiveness of decision-making, it is important to acknowledge their limitations. Walsham (2001) gives the account of the manager of a multinational company who described the intranet of his company as a large warehouse that nobody visits. Organizations need to give incentives and motivate individuals to access repositories and learn about new ICTs.

Double-loop decision-learning. A common decision rule that individuals adopt when they are unable to reach a decision is to get an expert

to explore the decision problem and provide them with a briefing (Janis, 1989). In such a setting, directories of experts or 'people finder' databases can be particularly useful. Eliciting expertise from one or more experts, however, requires interaction (Huber, 2001) and ICTs that support this include e-mail, online chat, mailing lists, newsgroups and on-line conferences.

If experts are not available, expertise is scarce in a domain, or there is the need to elicit and permanently archive the experiences of valued employees then 'lessons-learned' systems should be considered. They differ from experience databases that codify information about a decision problem because they capture expertise and meta-knowledge (e.g., the reasoning behind a decision and the company's agreed values and beliefs that justified a particular decision). Orr's (1990) ethnographic study of Xerox's maintenance engineers is an illustration of this point.

As decision makers are facing time and space challenges, computer-supported collaborative environments promise decision-making teams to perform tasks faster, more accurately, and with fewer resources (Maybury, 2001). They provide services such as workflow management and shared applications, as well as, a variety of facilities including text chat, audio-and video conferencing, shared whiteboard and shared and private data spaces. Such systems enable parallel or serial interpretations of data by experts who interact synchronously or asynchronously to extract, process and disseminate information to decision makers. However, these technologies are platform and software dependent, the users have to enter a specified online place and the group members are not always aware of other participants and their activities, which inhibits communication and group work (You & Pekkola, 2001). Therefore, collaborative environments have not been successful in decision environments that require negotiation and knowledge sharing (Walsham, 2001).

Knowledge that flows from different sources contributes to collective meanings (Croasdell, 2001). In large organizations, it is important to integrate knowledge sources and provide a knowledge map that binds the knowledge components together (Preece et al., 2001). Concept maps, semantic networks and frames (Liaw & Huang, 2002) can also overcome information overload problems.

Single-loop technologies make knowledge retrievable whereas double-loop technologies contribute to learning by making meta-knowledge and individuals with decision-making expertise accessible. Advanced collaborative support tools can increase decision-making interactions. The collective experiences of individuals provide background knowledge for understanding decision-making processes, policies, culture, and practices, and could therefore improve the effectiveness of decision making (Croasdell, 2001).

Deutero decision-learning. Communicating knowledge through an electronic medium does not necessarily improve human communication and action (Walsham, 2001). Online data and knowledge repositories, e-mail messages and newsgroup archives cannot always codify the deep tacit knowledge that is needed for decision-making. Most companies are starting to realize that leveraging knowledge through ICTs is not always attainable (McDermott, 1999). Face-to-face interactions that allow participants to give and take meaning by interpreting a range of verbal messages and nonverbal clues, as well as mentor relationships between new and experienced recruits can enhance the continual inter-subjective communication between decision makers (Walsham, 2001). Electronic media such as video conferencing and on-line chat can be used to create virtual teams and eliminate the need for some expensive face-to-face meetings (Maznevski & Chudoba, 2000). Virtual teams however, cannot outperform face-to-face teams in terms of communication effectiveness and their members report lower levels of satisfaction compared to

face-to-face team members (Warkentin, Sayeed, & Hightower, 1997).

Reaching a consensus in a group of decision makers is often difficult to achieve. Individuals have to convey their thoughts, understand the viewpoints of their colleagues, and interpret other people's mental models. Thus, it can be argued that decision-making is the result of a learning process in which a community of people develops a common language, deals with a context-specific issue, and has a specific purpose and reasons about actions. Organizations ought to acknowledge, support and nurture these 'communities of practice' that encourage knowledge sharing, learning, and change (Walsham, 2001; Wenger & Snyder, 2000). Participants of communities of decision-making practice will share ideas, experiences, and know-how, and will adopt innovative and creative approaches to problem-solving and decision-making. This can prove to be an effective way of sharing deep decision-making knowledge.

From this overview, it is evident that there are a number of well-established ICT tools and approaches that support decision-making by facilitating knowledge transfer and feedback. Therefore, ICTs could potentially play a vital part in stimulating and supporting feedback mechanisms between actors and structures affecting decision-making and learning. Their fundamental contribution perhaps lies less in the codified knowledge they can transfer and more in the momentum they can create so that awareness of learning opportunities can be acknowledged and integrated in the decision-making process. Moreover, ICTs can be a valuable mechanism for capturing and extending the current organizational discourse (Grant, Keenoy, & Oswick, 1998). These points are central to the socio-technical framework of learning-supported decision processes discussed next which emphasizes feedback systems as the social structures that support knowledge flow in organizations.

A SOCIO-TECHNICAL FRAMEWORK FOR SUPPORTING LEARNING-BASED DECISION MAKING

As evident from the review of the three learning modes, the nature of feedback is shaped in relation to the problem-driven approach to learning. Equally it is noticeable that many of the decision-making models are also problem-driven. An example would be Simon's (1960) behavioral model, which is based on the principle of 'bounded rationality' and assumes that decision makers try to be rational, but their rationality is bounded partly by their representation of the decision problem (Barthélemy, Bisdorff, & Coppin, 2002). Sprague and Carlson (1982) have enhanced Simon's model by adding a previously implied 'Implementation' step. This is the final stage of the decision process where the decision makers implement their chosen alternative by taking action, and monitoring performance and effectiveness. If there is a mismatch between reality and a desired state, and the outcome of the action taken does not meet expectations, then the decision process or a part of it is repeated.

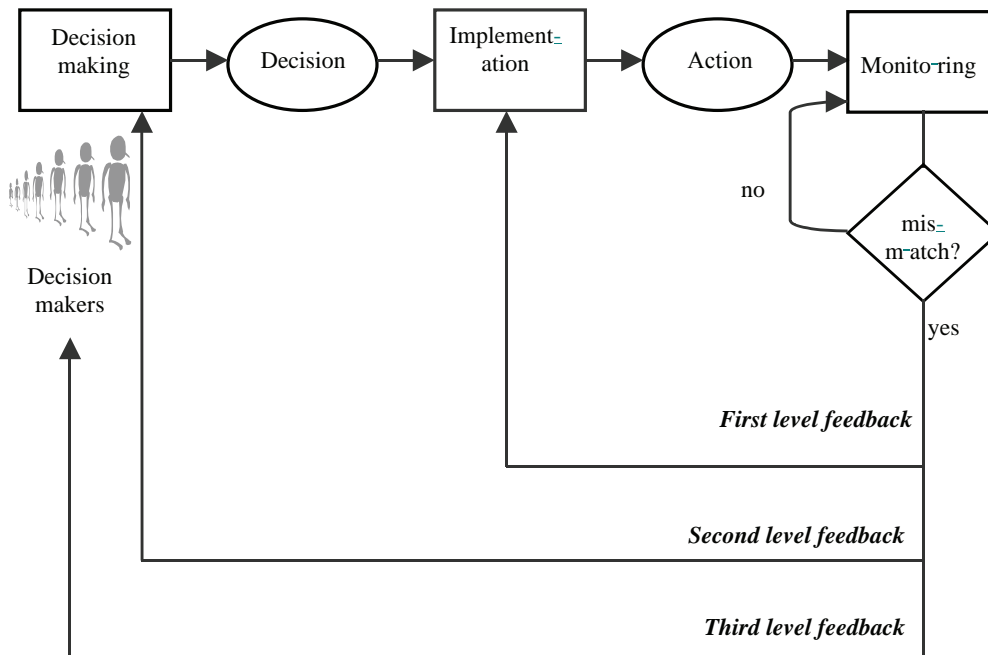
Therefore, the relationship between learning and decision-making reflects that they share a common structure in the way both assume the process of learning and decision-making takes place. This structure tends to be seen predominantly as linear underpinned by feedback mechanisms, which provide a cyclical approach to the way learning and decision-making unfold. The decision-learning model discussed in the previous section however, also shows that feedback mechanisms are dynamic and complex and not simply technological tools (in the various DSS solutions) which act as information depositories. In developing a socio-technical framework of learning-supported decision-making, it is important to capture the dynamic nature of feedback systems

reflecting both the way ICT systems are part of the social structure which allows information to progress from meaningless data to meaningful knowledge and from knowledge to insightful learning. We seek to capture these points in the three levels of feedback, which we argue underpin the socio-technical framework of decision-learning. Figure 2 presents the three levels of feedback diagrammatically.

First-Level Feedback

This first level of feedback reflects a mode of decision-making geared towards implementing a solution to a perceived problem supported predominantly by single-loop learning. By virtue of this rather basic process of decision learning, the role of feedback systems is to extract, process and disseminate basic available *information* to develop an understanding of the perceived problem so that the best possible solution can be reached. While this level of feedback may appear rather simplistic in essence it may well be that the nature of the issue at hand requires only a basic processing of the information at hand. The typical ICT systems that can be used to facilitate this process include data marts, data warehouses, knowledge repositories, OLAP products and executive information systems. Such decision support systems assemble flows of knowledge from different sources and assist decision makers in making sense of the relevance and significance of information to a particular decision problem. Essentially, these ICT systems would be part and parcel of the existing information structure which would reduce decision times and costs to detect and correct problems in a routine setting. Their capability to extract, process and disseminate information is vital in facilitating learning in organizations (Harvey, Palmer, & Speier, 1998) and can be further enhanced using artificial intelligence techniques (Bhatt & Zaveri, 2002).

Figure 2. A socio-technical framework for supporting learning-based decision making



Second-Level Feedback

The mode of decision making at the second level of feedback extends the focus well beyond the decision itself and seeks to explore the decision-making process itself. This implies that decision-makers are concerned to improve not only the decisions they make but the way they take their decisions. Essentially therefore, the focus is to critically reflect on the implicit assumptions that underpin the current decision-making structures and through this process seek to develop new understanding. The double-loop learning process that underpins the focus of decision-making provides a useful feedback platform to translate available information into valuable *knowledge* which feeds back to current decision-making practices critical insights into the values and perceptions which underpin them. Fundamentally, second level feedback to some extent disrupts social structures that support decision-making and learning by bringing to the forth greater awareness of the

actual process of learning and taking decisions. This very approach of looking critically at the way a process takes place can be greatly supported by ICT systems which have the capacity to overcome the inherent subjectivity embedded in learning and decision practices. For example, collaborative support tools (Maybury, 2001) can be used to facilitate interactions with expert decision makers who can provide insight into the content, context and process of decision making. Architectures of decision support systems that codify problem solving strategies in new entities called model marts and model warehouses have recently been introduced (Bolloju et al., 2002). Emerging technologies such as virtual reality could be used to represent experiential rather than formal forms of knowledge (Beynon, Rasmequan, & Russ, 2002). Therefore, second-level feedback encodes rich experiences and expertise, improves the efficiency of decision-making, and contributes to identity formation by reflecting on the meanings decisions made create and not just on the meanings that shape decision-making.

Third-Level Feedback

The third level of feedback, essentially embraces learning as central to both the decision-making and learning process. In other words, it extends the focus of decision-making and learning on the people performing this process by virtue of their actions not just assumptions. Consequently, the focus of decision-making would be reflecting on the process of learning to take decisions rather than the decision-making process itself. This also would extend to the approach to learning which would also be concerned with learning how to learn (Bateson, 1972). The feedback systems therefore, would be concerned with reflecting the social structures that support learning to learn using ICT systems that provide mechanisms for capturing and supporting the learning process. Even though ICTs that enhance discourse and communication can facilitate learning (Robey, Boudreau, & Rose, 2000), they cannot always substitute the importance of face-to-face meetings and informal communication. However, decision practices have changed in the recent years and organizations are now forced to support geographically dispersed teams of decision makers. ICTs such as videoconferencing and group support systems allow the exchange of social cues—in the case of text-based tools the cues are known as ‘smileys’ or ‘emoticons’—and in doing so facilitate and enrich communication (Shim et al., 2002). Such ICTs therefore, could be embedded in the organizational discourse and facilitate communicational exchanges by addressing linguistic interpretations, cognitive representations and reciprocal learning (Barthélemy et al., 2002). The main characteristics of the three feedback levels are summarized in Table 2.

Therefore, it would be idealistic to suggest that learning-supported decision-making would be reflected through deuterio learning, supported by deuterio decision-learning (in the use of ICTs) in an approach that facilitates decision-making based on feedback level three. The socio-techni-

cal framework of decision-making needs to be based on a balanced approach between social systems and technical structures so that different feedback levels can be effectively integrated to support different stages in the decision-making and learning process. ICT systems can form the backbone of different levels of feedback in capturing the dominant discourse and its associated social structures. This point suggests that the socio-technical framework relies on the homogeneity within the heterogeneity of decision-makers which is never settled or fixed but constantly in progress as multiple perspectives given and perspectives taken are negotiated as part of the emerging organizational discourse.

FUTURE TRENDS

The biggest challenge for any organization is managing the disperse nature of knowledge across a diverse set of knowledge carriers. The role of ICTs in supporting and extending the organizational memory is of particular concern. The proposed socio-technical framework discussed in this chapter seeks to address the above concerns by promoting learning both as central to decision-making but also as one of its purposes. At the core of the proposed framework lies the need to seek feedback systems as the point of connection between the way social structures shape the information available into meaningful knowledge and the way ICT systems manage the available information in ways that this is fed to users in a timely fashion and in an actionable form.

The use of ICTs to support knowledge management initiatives can only be of benefit, when the main focus is on supporting the development and communication of human meaning (Edwards, 2001). The challenge is to build tools that recognize the sense-reading (i.e., intelligent interpretation and understanding) and sense-giving (i.e., account of one’s experience) nature of the decision-making activities (Walsham, 2001),

Table 2. The characteristics of three levels of feedback

| <i>Feedback level</i> | <i>First Level</i> | <i>Second Level</i> | <i>Third Level</i> |
|-----------------------------------|--|---|--|
| <i>Source of feedback</i> | Knowledge repositories, search engines | Lessons-learned systems, experts | Communities of practice |
| <i>Type of feedback</i> | Passive | Active | Organic |
| <i>Attitude of decision maker</i> | Reactive | Reactive/Proactive | Proactive |
| <i>View of decision making</i> | Atomistic | Group | Social |
| <i>Focus</i> | Decision content, context, process | Values and assumptions | Decision-making capabilities |
| <i>Tactic</i> | Make knowledge easily retrievable | Make meta-knowledge and experts easily accessible | Set up and nurture communities of practice |
| <i>Purpose</i> | Improve decision-making efficiency and effectiveness | Improve decision quality | Improve decision-making capabilities |

and address the complexities of the interconnected and knowledge-intensive decision processes of the future (Courtney, 2001).

Therefore, future research that seeks to support learning-based decision-making, needs to address systematically these issues and identify mechanisms that can support the development of learning communities for decision practice. As the socio-technical framework to decision-learning propounds, there is a need to balance personal and collective priorities in relation to learning and decision-making, thus maintaining the critical balance of their situated, contextual and emergent nature (Antonacopoulou, 1999).

Clearly we do acknowledge that in this chapter we lay only the foundations of the socio-technical framework of decision-learning and there is clearly a lot more work that needs to be done to overcome the inherent limitation of the current representation of the feedback systems which does not fully capture the dynamism that emphatically underpins the socio-technical approach that

ICT systems can support. Notwithstanding the limits of representation (at least diagrammatic representation), we feel confident that this framework makes a valuable contribution in extending debates of learning, decision-making and their relationship demonstrating the inherent challenges of the digital era in using ICTs as social as much as as technical tools.

CONCLUSION

This chapter contributes to our understanding of the challenges the digital era presents us by proposing a socio-technical framework, which emphasizes feedback as the critical link connecting social systems and technical structures intended to support the transformation of information into actionable knowledge supported by meaningful learning strategies. The analysis presented explored the social life of information in the context of decisions and with an emphasis on the role

of ICTs as key feedback systems supporting a learning-based approach to decision-making. In proposing a learning-supported view of decision-making, the discussion identified some of the key principles of the socio-technical framework. The main thrust of the framework is the alignment of social structures and social actors in ways that seek to integrate different modes of learning with different models of decision-making. This integration is to be supported by a range of decision-learning structures (in ICT systems), which create different feedback levels. These combined, have a bearing on the alignment between decision actions in relation to what, how and why one learns. This alignment however, is acknowledged to be fraudulent, with a number of challenges not the least of which is how one learns to balance personal and collective learning priorities.

ACKNOWLEDGMENT

We would like to thank the members of the GNO-SIS Research Group for their valuable discussions. Special thanks are due to Prof. Simon French and two anonymous referees for their comments on earlier drafts of this chapter.

REFERENCES

- Ackoff, R. L. (1999). On learning and the systems that facilitate it. *Reflections*, 1(1), 14-24.
- Antonacopoulou, E. P. (1998). Developing learning managers within learning organisations. In M. Easterby-Smith, L. Araujo & J. Burgoyne (Eds.), *Organisational Learning and the Learning Organisation: Developments in Theory and Practice* (pp. 214-242). UK: Sage Publications.
- Antonacopoulou, E. P. (1999). Learning structures and their social construction: A European perspective on management education. *Comportamento Organizational E Gestao*, 5(2), 69-86.
- Antonacopoulou, E. P. (2002a). *Learning as space: Implications for organisational learning*. Paper presented at the Third International Conference on Organisational Knowledge, Learning and Capabilities, Athens, Greece.
- Antonacopoulou, E. P. (2002b). *Revisiting the what, how and why of managerial learning: Some new evidence* (Working paper series). Manchester, UK: Manchester Business School.
- Antonacopoulou, E. P., & Gabriel, T. (2001). Emotion, learning and organizational change — Towards an integration of psychoanalytic and other perspectives. *Journal of Organizational Change Management*, 14(5), 435-451.
- Argyris, C. (1982). *Reasoning, Learning and Action*. San Francisco, CA: Jossey-Bass.
- Argyris, C., & Schön, D. A. (1974). *Theory In Practice: Increasing Professional Effectiveness*. San Francisco, CA: Jossey-Bass.
- Barthélemy, J. P., Bisdorff, R., & Coppin, G. (2002). Human centered processes and decision support systems. *European Journal of Operational Research*, 136(2), 233-252.
- Bass, B. M., & Vaughan, J. A. (1966). *Training in Industry: The Management of Learning*. London: Tavistock.
- Bateson, G. (1972). *Steps to an Ecology of the Mind*. New York: Ballantine Books.
- Beach, L. R. (1990). *Image Theory: Decision Making in Personal and Organizational Contexts*. New York: John Wiley & Sons.
- Bell, D. (1976). *The Coming of the Post-industrial Society*. Harmondsworth: Penguin.
- Belton, V., & Hodgkin, J. (1999). Facilitators, decision makers, DIY users: Is intelligent multi-criteria decision support for all feasible or desirable? *European Journal of Operational Research*, 113(2), 247-260.

- Beynon, M., Rasmeyan, S., & Russ, S. (2002). A new paradigm for computer-based decision support. *Decision Support Systems*, 33(2), 127-142.
- Bhatt, G. D., & Zaveri, J. (2002). The enabling role of decision support systems in organizational learning. *Decision Support Systems*, 32(3), 297-309.
- Bolloju, N., Khalifa, M., & Turban, E. (2002). Integrating knowledge management into enterprise environments for the next generation decision support. *Decision Support Systems*, 33(2), 163-176.
- Bose, I., & Mahapatra, R. K. (2001). Business data mining — a machine learning perspective. *Information & Management*, 39(3), 211-225.
- Brown, S. J., & Duguid, P. (2000). *The Social Life of Information*. MA: Harvard Business School Press.
- Burgoyne, J., & Stuart, R. (1976). The nature, use and acquisition of managerial skills and other attributes. *Personnel Review*, 5(4), 19-29.
- Burgoyne, J., & Stuart, R. (1977). Implicit learning theories as determinants of the effect of management development programmes. *Personnel Review*, 6(2), 5-14.
- Carneiro, A. (2001). The role of intelligent resources in knowledge management. *Journal of Knowledge Management*, 5(4), 358-367.
- Courtney, J. F. (2001). Decision making and knowledge management in inquiring organizations: toward a new decision-making paradigm for DSS. *Decision Support Systems*, 31(1), 17-38.
- Croasdell, D. T. (2001). IT's role in organizational memory and learning. *Information Systems Management*, 18(1), 8-11.
- Davis, G. (1974). *Management Information Systems: Conceptual Foundations, Structure, and Development*. New York: McGraw-Hill.
- de Geus, A. (1997). *The Living Company: Growth, Learning and Longevity in Business*. London: Nicolas Brealey.
- de Geus, A. (1999). Strategy and learning. *Reflections*, 1(1), 75-81.
- Edwards, J. S. (2001). Editorial. *European Journal of Information Systems*, 10(2), 71.
- Edwards, J. S., Duan, Y., & Robins, P. C. (2000). An analysis of expert systems for business decision making at different levels and in different roles. *European Journal of Information Systems*, 9(1), 36-46.
- French, S., & Papamichail, K. N. (2003). *Decision Behaviour, Analysis and Support*. Teaching notes. United Kingdom, Manchester Business School.
- Gagné, R. M. (1983). *The Conditions of Learning* (3rd ed.). New York: Holt, Reinhart and Winston.
- Gorry, G., & Scott Morton, M. (1971). A framework for management information systems. *Sloan Management Review*, 13(1), 50-70.
- Grant, D., Keenoy, T., & Osrick, C. (eds.). (1998). *Discourse and Organization*. London: Sage Publications.
- Harvey, M., Palmer, J., & Speier, C. (1998). Implementing intra-organisational learning: A phased-model by intranet technology. *European Management Journal*, 16(3), 341-354.
- Heinrichs, J. H., & Lim, J. S. (2003). Integrating Web-based data mining tools with business models for knowledge management. *Decision Support Systems*, 35(1), 103-112.
- Holsapple, C. W. (2001). Editorial — Knowledge management support of decision making. *Decision Support Systems*, 31(1), 1-3.
- Huber, G. P. (2001). Transfer of knowledge in knowledge management systems: unexplored issues and suggested studies. *European Journal of Information Systems*, 10(2), 72-79.

Learning-Supported Decision-Making

- Hunter, A. (2000). Automated text classification. *Knowledge Management*, 9-10.
- Janis, I. L. (1989). *Crucial Decisions — Leadership in Policymaking and Crisis Management*. New York: The Free Press.
- Kolb, D. A., Lublin, S., Spoth, J., & Baker, R. (1991). Strategic Management Development: Experiential Learning and Managerial Competencies. In J. Henry & D. Walker (Eds.), *Creative Management* (pp. 221-231). London: Sage & The Open University.
- Langley, A., Mintzberg, H., Pitcher, P., Posada, E., & Saintmacary, J. (1995). Opening up decision-making — The View from the Black Stool. *Organization Science*, 6(3), 260-279.
- Lave, J., & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Lehner, J. M. (2002). Metaphors, stories, models: A unified account of decisions — Part 1: Making sense of the decision context. *Reason in Practice*, 2(1), 33-44.
- Liaw, S.-S., & Huang, H.-M. (2002). How Web-technology can facilitate learning. *Information Systems Management*, 19(1), 56-61.
- Marakas, G. M. (2002). *Decision Support Systems and Megaputer* (2nd ed.). Prentice Hall.
- Marsick, V. J., & O'Neil, J. (1999). The many faces of action learning. *Management Learning*, 30(2), 159-176.
- Maybury, M. (2001). Collaborative virtual environments for analysis and decision support. *Communications of the ACM*, 44(12), 51-54.
- Maznevski, M. L., & Chudoba, K. M. (2000). Bridging space over time: Global virtual team dynamics and effectiveness. *Organization Science*, 11(5), 473-492.
- McDermott, R. (1999). Why information technology inspired but cannot deliver knowledge management. *California Management Review*, 41(4), 103-117.
- Merriam, S. B., & Caffarella, R. S. (1991). *Learning in Adulthood: A Comprehensive Guide*. San Francisco, CA: Jossey-Bass.
- Mumford, E. (1999). *Dangerous Decisions — Problem Solving in Tomorrow's World*. New York: Kluwer Academic/Plenum Press.
- Nonaka, I., & Takeuchi, H. (1995). *The Knowledge Creating Company*. New York: Oxford University Press.
- Orr, J. (1990). Sharing Knowledge, celebrating identity: community memory in a service culture. In D. Middleton & D. Edwards (Eds.), *Collective Remembering* (pp. 168-189). London: Sage Publications.
- Power, D. (2002). *Decision Support Systems: Concepts and Resources for Managers*. Westport: QuorumBooks.
- Preece, A., Flett, A., Sleeman, D., Curry, D., Meany, N., & Perry, P. (2001). Better knowledge management through knowledge engineering. *IEEE Intelligent Systems & Their Applications*, 16(1), 36-43.
- Revans, R. W. (1982). *The Origins and Growths of Action Learning*. Sweden: Chartwell-Bratt.
- Robey, D., Boudreau, M.-C., & Rose, G. M. (2000). Information technology and organisational learning: A review and assessment of research. *Accounting, Management and Information Technologies*, 10, 125-155.
- Romme, S., & van Witteloostuijn, A. (1999). Circular organizing and triple loop learning. *Journal of Organizational Change Management*, 12, 439-453.

- Scherer, K. R., & Tran, V. (2001). Effects of emotion on the process of organizational learning. In M. Dierkes, A. B. Antal, J. Child & I. Nonaka (Eds.), *Handbook of Organizational Learning and Knowledge* (pp. 369-394). Oxford: Oxford University Press.
- Schön, D. A. (1983). *The Reflective Practitioner*. New York: Basic Books.
- Shaw, M. J., Subramaniam, C., Tan, G. W., & Welge, M. E. (2001). Knowledge management and data mining for marketing. *Decision Support Systems*, 31(1), 127-137.
- Shim, J. P., Warkentin, M., Courtney, J. F., Power, D. J., Sharda, R., & Carlsson, C. (2002). Past, present, and future of decision support technology. *Decision Support Systems*, 33(2), 111-126.
- Silverman, B. G. (1994). Unifying Expert Systems and the Decision Sciences. *Operations Research*, 42(3), 393-413.
- Simon, H. A. (1960). *The New Science of Management Decisions*. New York: Harper and Row.
- Sprague, R. H., & Carlson, E. D. (1982). *Building Effective Decision Support Systems*. Englewood Cliffs, NJ: Prentice Hall.
- Strati, A. (1999). *Organization and Aesthetics*. London: Sage Publication.
- Thomas, L. F., & Harri-Augstein, E. S. (1985). *Self-Organised Learning: Foundation of a Conversational Science for Psychology*. London: McGraw-Hill.
- Turban, E., & Aronson, J. E. (2001). *Decision Support Systems and Intelligent Systems* (6th ed.). NJ: Prentice Hall.
- Walker, S. (1975). *Learning and Reinforcement*. London: Metliven.
- Walsham, G. (2001). Knowledge management: The benefits and limitations of computer systems. *European Management Journal*, 19(6), 599-608.
- Warkentin, M. E., Sayeed, L., & Hightower, R. (1997). Virtual teams versus face-to-face teams: An exploratory study of a Web-based conference system. *Decision Sciences*, 28(4), 975-996.
- Weick, K. (1995). *Sensemaking in Organizations*. Thousand Oaks, CA: Sage Publications.
- Wenger, E. C., & Snyder, W. M. (2000). Communities of practice: The organizational frontier. *Harvard Business Review*, 78(1), 139-145.
- Whittington, R. (2001). *Learning to Strategise: Problems of Practice* (Research Papers Series 20): SKOPE.
- You, Y., & Pekkola, S. (2001). Meeting others — supporting situation awareness on the WWW. *Decision Support Systems*, 32(1), 71-82.

This work was previously published in Social and Economic Transformation in the Digital Era, edited by G. Doukidis, N. Mylonopoulous, and N. Pouloudi, pp. 271-288, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.37

Reframing Information System Design as Learning Across Communities of Practice

Kevin Gallagher

Florida State University, USA

Robert M. Mason

University of Washington, USA

ABSTRACT

This article frames the requirements definition phase of systems design as a problem of knowledge transfer and learning between two communities of practice: IS designers and system users. The theoretical basis for the proposed approach is Wenger's (1998) framework for social learning, which involves three dimensions: alignment, imagination, and engagement. The article treats the requirements definition task in systems design as a set of activities involving mutual learning and knowledge transfer between two communities of practice (CoP) along these three dimensions. In taking this approach, the article maps the results of past research on the systems design process onto this CoP framework and illustrates that the proposed framework encompasses the same activities used by traditional methods of require-

ments definition. However, this approach focuses attention on the learning that must take place between the two CoPs and thereby helps resolve some of the inherent shortcomings of prior efforts and approaches. The framework provides both a more encompassing conceptual lens for research on improving the requirements definition task and practical guidance for managers who are charged with a systems design project.

INTRODUCTION

Requirements definition is a critical step in systems development that requires the identification of information needs and knowledge of a system's processes (Nelson & Coopriider, 1996; Vessey, 1994). Historically, researchers examined the requirements-definition stage of system design

as a process of inquiry (Boland, 1978; Salaway, 1987). Problems with identification, articulation, and communication of information needs have long been identified with the challenges of information system design (Boland, 1987). There have been different approaches in attempting to meet these challenges, but none has completely resolved the issues.

Land (1998) notes that because systems are so different, a contingency approach—using different methods for different types of systems—is appropriate. Others have suggested more structured analyses of the design process itself, establishing metrics for requirements engineering (Costello & Liu, 1995) and developing tools for each aspect of the problem (Nature_Team, 1996). Some researchers have suggested that the process of design must remain flexible and that a management structure that encourages an evolutionary design process is associated with greater effectiveness (Ravichandran & Rai, 2000). In considering software project risk and software quality, organizational issues as well as technical issues are important (Wallace, Keil & Rai, 2004). Others also emphasize the critical nature of human-intensive dimensions of the process (Tamai, 1993). It also has been noted that evolutionary designs are necessary as complexity increases (Mens & Eden, 2005). Larman (2004) argues that an “agile” and iterative design process is key to software development success.

The approach that we want to explore in this article emphasizes these human-intensive dimensions of the design process. Although the design process involves many actors (Lamb, 2003), we want to focus on two roles: the designer (who has technical knowledge) and the user (who has knowledge of the application and context of use). The conceptual approach is one that considers requirements definition as an instance of knowledge acquisition (Byrd, Cossick & Zmud, 1992).

Recently, organizations and researchers have begun investigating the potential of knowledge transfer (Alavi & Leidner, 2001) to make organiza-

tions more effective when engaging in information intensive work. Such knowledge transfer is necessary because clients are not sure what is possible and are unclear about their needs, and IT designers thus are unable to work toward an outcome that meets clear specifications (as in designing a product for production) (Larman, 2004).

To date, however, conceptualizations of knowledge transfer in software development do not completely capture the complexity and richness of this process by which clients and designers work together. As Polanyi (1966, p. 4) says, “We know more than we can tell.” Regardless of how well we articulate knowledge, it always contains a tacit dimension. Hence, simple inquiry is insufficient for the requirements definition process because it is able to access only explicit, leaky knowledge (Von Hippel, 1994). The information transferred through traditional elicitation approaches is only part of what someone knows, and it rarely includes *how* or *why* they know it (Lanzara & Mathiassen, 1985).

Because of the tacit dimension of knowledge involved in most tasks and processes, it is difficult, if not impossible, for people to articulate exactly what it is that they need prior to design. Even if they can articulate what they need, the system development effort is hampered if the system developers do not understand why and how users need what they need. With an understanding of the why’s and how’s of information, developers can be more innovative in their delivery of requirements. For example, unless developers understand which information is used together and how it is connected, they will be unlikely to find ways to combine and simplify tasks.

If we keep the traditional concept of inquiry as the basis for eliciting requirements, the effort must always be incomplete. The language or metaphor of “inquiry” or “capturing requirements” is part of the problem. The choice of metaphor can inhibit the range of approaches to information systems (Mason, 1991), and recently the metaphor of “engineering” has been questioned as the basis

for approaching software development (Bryant, 2000).

What is needed is an approach that engages users in such a way that they can elucidate not only what they know, but also how and why they know it. In addition, users must learn about how systems in general, and this system in particular, will be developed. An improvement over current approaches is to engage designers so that they really understand what the users are telling them, and to ensure that they effectively share their knowledge of both the systems and the processes for which they are developing technology (Boland, 1978). To accomplish this, both users and developers must share their knowledge and learn from each other (Boland, 1978; Churchman & Schainblatt, 1966). In short, what is needed is a process of mutual learning in which designers and users engage in a process of learning from each other.

In order to work toward such a process, we turn to the concept of a community of practice (Lave & Wenger, 1991). The concept, first used to help understand situated learning, refers to a group of people defined by an interest in a specific subject or problem who collaborate to share ideas and resolve issues common to the group. In this article, we posit that information system (IS) designers and IS users belong to two distinct communities of practice (CoPs) as they work together in a systems development context. The system designers comprise one community and the users for which the system is being designed comprise the other (Churchman & Schainblatt, 1965). The term “users” may cover many roles, including managerial, and in the following we may use “managers” to provide a specific context for the discussion or simply say “users” for the generic situation. The requirements definition phase of IS design requires that these two groups engage in mutual learning both to share knowledge and to develop new mutual understandings of the possibilities as a system design emerges. The knowing of managers (or other users) is formed

by a very different practice than the knowing of IT professionals (Brown & Duguid, 2001), resulting in different ways of knowing (Boland & Tenkasi, 1995). Knowing is not easily shared across these two groups because of their different histories and perspectives.

The article extends Wenger’s (1998) design for social learning within a CoP (p. 236) to learning across two communities of practice. Wenger’s model comprises three dimensions: alignment, engagement, and imagination. We apply this framework of social learning across the two CoPs (i.e., managers and designers) and show that the framework not only is consistent with prior research on the information system design (ISD) process but also suggestive of how the design process can become more effective.

The remainder of the article comprises three sections. The next section, Social Learning, reviews the concept of social learning and distinguishes it from simple knowledge transfer. This section further illustrates why the characteristics of social learning are the characteristics required for an effective requirements definition process.

The subsequent section presents an architecture for social learning. It reviews the three dimensions of Wenger’s model for social learning in a community of practice and notes that factors considered essential to the requirements definition phase of the system development process can be mapped onto these dimensions.

The final section summarizes the application of the model for information system design, outlines issues in implementing the architecture, and discusses the implications for research and practice.

SOCIAL LEARNING

Knowledge and Knowing

Viewed from a social learning perspective, knowledge is social, not individual (Brown,

2002), and is a matter of our competence with respect to some valued enterprise (Wenger, 1998). Knowledge encompasses aspects of experience, action, and the accomplishment of some activity. In this perspective, knowledge is more than stored information, even more than codified and structured information.

It is helpful to distinguish “knowing” from “knowledge.” In common usage, “knowledge” brings with it the context of an accumulation of facts and “know what.” On the other hand, use of the term “knowing” conveys more of a sense of engagement in a process of learning and becoming. Knowing is not only an accumulation of facts, but an accumulation and assimilation of experiences and learning that alter who we are as well as what we know. As we learn *about*, we also learn *to be* (Brown & Duguid, 2001). Levels of participation or nonparticipation reveal a sense of relation, familiarity, and belonging to the situation. These aspects of identity development affect one’s modes of involvement and willingness to engage in activities. The attributes of identity are developed, and reciprocally supported, through the process of learning.

We are constantly engaged in accomplishing activities and we typically become more proficient with experience. Our knowing, therefore, resides in our practice (Cook & Brown, 1999), which is how we accumulate experience and situated ways of knowing. Participation is our “knowing in action,” so a design processes can benefit from participation by those who know the existing process.

Apprenticeship and Communities of Practice

Communities of practice provide a theoretical framework for understanding how the dynamics of social structures influence learning and practice. The origins of communities of practice are grounded in apprenticeship and their ability to support situated learning through social coparticipation

(Hanks, 1991; Wenger, 1998). Understanding how apprenticeship promotes learning within a community can help in understanding how learning can occur across communities. Learning through practice is exemplified in apprenticeship, whereby a community regenerates itself through a process of participation and training. When the transfer of explicit knowledge is supported by sharing the practices in which it makes sense, it is possible to *understand* its meaning in a way that makes it most useful, actionable, and purposeful.

Participation is the key to developing and sustaining communities of practice, but observation also plays a critical role by allowing one to participate on the periphery of a community. While the master remains engaged in the craft, the apprentice learns by means of “legitimate peripheral participation” (Lave & Wenger, 1991), observing the practices and developing the tacit dimension of knowing. By engaging in practice, the master is able to communicate more than what can be said and the apprentice is able to learn more than what can be heard.

The roles of a community’s members are not rigidly defined; however, a key to apprenticeship is that members can engage in varying roles simultaneously. Legitimate peripheral participation supports learning without requiring members to acquire all of the necessary knowledge for full membership in that community. In this way, a member can span the boundary of a community and still be able to observe, understand, and learn. Participation and observation (nonparticipation) together define our levels of engagement as we employ these modes of engagement in attaining knowledge of our own communities and other communities from which we may learn.

To participate on the periphery allows one access to a community through passive modes of observation and similar activities that do not overly dominate or eliminate participation altogether. This is exemplified by active listening. Conversely, marginality is a mode of nonparticipation that stifles participation, as exemplified

by listening in on a conversation in which the terminology is foreign. In both cases, there is exposure to a community of new information. The first situation offers a mode of nonparticipation that facilitates learning. In the second, the learning becomes stifled.

Apprenticeship is offered here as the starting point of a model to use when designing a way for two communities to come together, share knowledge, and learn. In the case of requirements definition, it may be enlightening to consider the IT professionals to be apprentices to the user community (Beyer & Goltzblatt, 1995) and the users to be apprentices to the IT community. Through apprenticeship, the participants learn about practice. To make “know that” useful requires appropriate “know how” that we can only gain through practice in both senses of the word: to do and to improve (Brown & Duguid, 2001). The need to involve users in system design has been a long held belief for requirements definition; however, involving IT in the practices of the users is less established, but has the potential to be quite revealing.

Knowing as a Challenge for IS Design

The challenge for IS design is to enable participation by both users and designers in a process that both conveys knowledge and enables knowing. In any social process, our experience informs our knowing, but the structure of the relevant social arrangement orients and guides our experiences. We develop personal histories from experience, and, through practice, we negotiate and form the meanings we give to things. Identity is how we see our role in the process that then influences our level of engagement.

Both users and designers must be engaged in the process of knowing about the other’s needs and the opportunities afforded by alternative designs. Engagement is a social process, one not naturally emerging nor easily brought about by fiat.

Prior researchers have acknowledged the social aspects of information system design. For example, political arrangements in organizations and dynamics of relative power among design participants can influence the degree to which they feel safe participating in activities (Hayes & Walsham, 2001). Others have noted the importance of the relationship between users and designers in the design process (Beath & Orlikowski, 1994; Hirschheim & Klein, 1994; Ives & Olsen, 1984). Mutual learning can only take place when users and designers are able to engage in effective modes of participation when they are involved in requirements definition activities. Through appropriate modes of participation, requirements are informed both by what the participants know and by how and why they know it

What we want to accomplish in the IS design process is to enable both designers and users to engage in a learning process that enables safe but effective participation in the design activities. The apprenticeship model of social learning in a community of practice, coupled with Wenger’s (1998) architecture for social learning (p. 237), provides a model for such a process.

AN ARCHITECTURE FOR SOCIAL LEARNING

Processes of social engagement differ in their ability to support learning. Figure 1 illustrates Wenger’s (1998) architecture for social learning in a community of practice, showing arrangements for alignment, imagination, and engagement. When engaged in practices across communities, the support of such social arrangements can facilitate a sense of belonging for members that helps to ensure participation and learning. Collectively, the three dimensions enable members of the community to learn with each other. The architecture provides a framework for considering the requirements of the process of IS design, particularly the requirements definition phase of this process.

The three dimensions are interdependent and, in fact, have inherent tensions among them. For example, a structure that assures close coordination for alignment can inhibit imagination and engagement. Conversely, imagination without alignment can result in activities that do not contribute to the overall learning process.

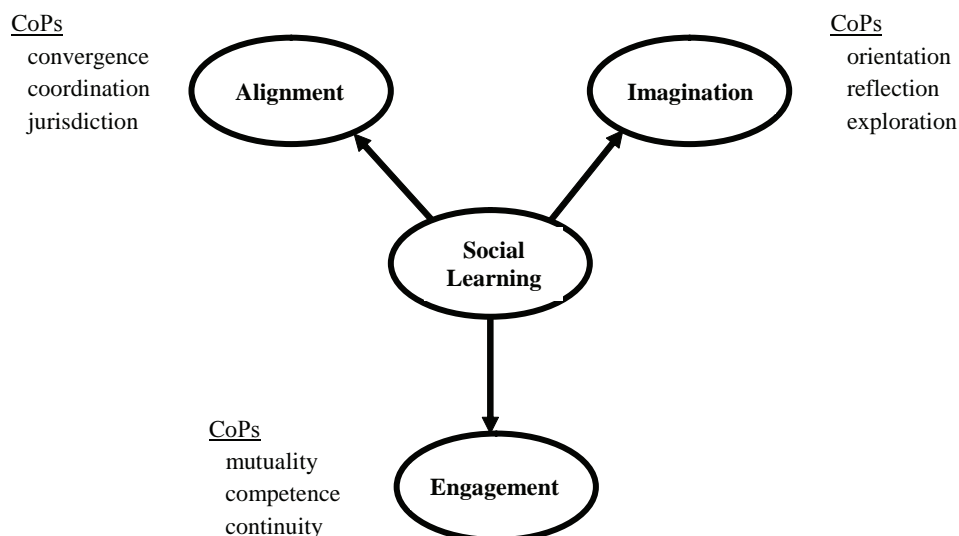
Alignment ensures coordination of the community's activities and resources toward achieving an objective. In the case of system design, this means achieving a fit between the local needs of a business unit and the new design. Learning is important to such a practice, as working through the development of a design raises new questions from which participants can learn about the existing system (Kyng & Morten, 1995). However, there are many ways to establish a fit during design, some of which may inhibit future flexibility (Allen & Boynton, 1991) and lead to rapid obsolescence or an inability to adapt. Alignment alone is not enough to support learning. A community of practice, and perhaps more importantly, the interaction between two communities, must also support what Wenger labels *imagination*.

In Wenger's terms, imagination provides the opportunity to create new possibilities. The ben-

efits of creativity and innovation in the development of systems are well established in the field of information systems (Cougar, 1996). However, creativity without the appropriate information as to the possibilities and constraints of a design or an appropriate vision of the future may lead to poor implementation (Zmud & Apple, 1992). Therefore, a process of mutual adaptation is necessary to achieve an improved design and a successful implementation (Leonard-Barton, 1993). Mutual adaptation can be viewed as an accommodation of both alignment and imagination that can be accomplished through learning.

The third dimension of Wenger's design, the concept of *engagement*, represents active involvement in the negotiation of meaning during the learning process. Engagement requires appropriate modes of participation. Appropriate modes of engagement by participants can ensure a balance between alignment and imagination. By supporting participants' engagement in a social process, it becomes far more difficult for any one set of perspectives or goals to dominate the process. However, engagement is difficult to ensure. Psychologically, individuals must feel it is safe for them to engage in an activity, that it

Figure 1. Wenger's architecture for social learning



will be a meaningful investment, and that the personal and professional resources that are necessary for participation are available to them (Kahn, 1990).

In the apprenticeship model of learning, engagement in practice by the bearers of knowledge will assist in their grasping, articulating, and transferring knowledge to others. Furthermore, peripheral participation by those who are in apprenticeship roles facilitates their ability to appropriate the meanings conveyed in specifications by those engaging in the design process. In sum, engaging in the practice of design can help us to understand and transfer what we know.

The challenge in employing Wenger's design for learning in the IS design process is balancing the tensions inherent in each of the three dimensions (See Figure 2 below.). Traditionally, IT departments have been concerned with alignment. They feel a need to align themselves with business strategy, with user functions, with business processes, and with organizational objectives (Chan, Huff, Barclay & Copeland, 1997; Reich & Benbasat, 1996). They have perceived standardization of systems and control over the design process as the key to alignment (Kirsch, 1996). However, with excessive alignment, imagination is curtailed and success becomes elusive (Baskerville & Stage, 1996). Excessive imagination and creativity, on the other hand, can lead to idiosyncratic designs and unworkable heterogeneity, reducing the ability to share, diffuse innovations, and efficiently develop new systems.

The quest for alignment makes its necessary for IT and users to work together. Yet, mutual engagement in these activities is in direct tension with the development of functional expertise within the organization. It also raises organizational tensions around leadership and decision making, between working together and understanding who has jurisdiction. As many IT scholars have claimed, partnership is key to IS success (Henderson, 1990). Partnership addresses the tension between conflicting power bases in the organization, but a

successful design environment must also address the tension between imagination and alignment. Wenger's design for learning recognizes the need to balance these tensions in the design of a learning environment that will support the appropriate modes of engagement and thereby facilitate and balance the tension between alignment and imagination.

The information system design (ISD) literature is consistent with this three-dimensional framework of learning in a community of practice. The literature on use of methods and controls is consistent with Wenger's dimension of alignment. The need for imagination during system design is supported by the ISD research on learning by doing, performed through modeling and prototyping. Research on user participation and involvement supports the need for engagement.

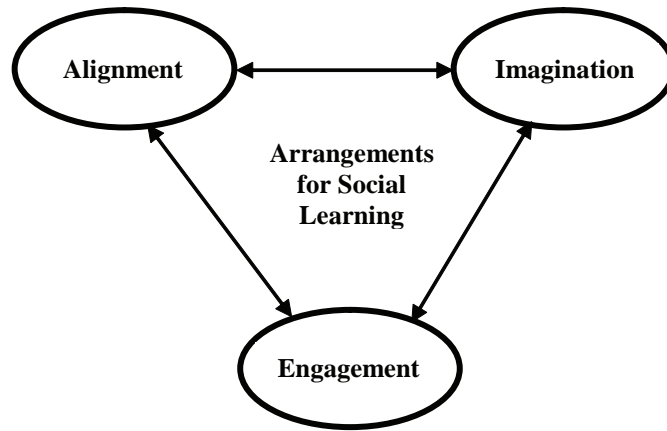
The next section discusses the commonalities between Wenger's framework and the ISD literature, explains further the facilities used to implement the model, and highlights the challenges of applying the principles and balancing the tensions in the ISD setting.

Alignment

In Wenger's model (Figure 1), alignment is comprised of three facilities: *convergence* provides a common focus; *coordination* provides methods and procedure; and *jurisdiction* provides policies and procedures. Similar themes are found in the IS literature, which describes the need to pursue objectives, employ standard methods, and control the design process.

Objectives are defined based on user needs and the possibilities the system affords, negotiated through a social process of mutual adaptation (Leonard-Barton, 1993). Through methods, activities are organized to achieve these objectives. Yet, methods often give primacy to designers over users (Beath & Orlikowski, 1994) or to problem solving over alternative rationalities (Boland, 1979). Thus, formalizing methods serves to structure

Figure 2. Wenger's architecture for social learning adapted for requirements determination



activities, thereby imposing controls that promote and suppress certain behaviors.

The IS design process requires more than obedience to method, it must also be a reflective activity (Iivari, 1987). System design requires iterative and adaptive planning as the acquired experience and learning from each sub phase informs the ongoing effort (Iivari, 1987). Thus, development efforts must recognize the need to balance iterative development with complimentary methods of control.

Control is complicated by the fact that coordination and communication necessary to complete the tasks spans organizational departments (Kirsch, 1997). A complex relationship exists between efficiency and quality. Different strategies of control lend themselves to different situations. Informal methods of control are used when understanding of the process and outcome measures are inexact (Ouchi, 1979) and depend on social strategies (Eisenhardt, 1985). Self-control relies on the motivation of individuals, and in IS it is strongest among personnel who take part in defining work procedures (Kirsch & Cummings, 1996).

Clan is another informal control characterizing a group that is dependent on one another to achieve a common objective (Ouchi, 1980). Boland (1979) distinguishes “control over” from “control with”

in order to distinguish bureaucratic processes from those where shared values and beliefs serve as the basis for coordinated action. Through appropriate selection of members and use of appropriate training and socialization processes, individuals in a group can develop a stronger sense of identity and commitment (Kirsch, 1996). Appropriate activities serve as rituals to reinforce acceptable behaviors. The development of identity and commitment are equally vital components in apprenticeship, where methods of training and socialization are employed to facilitate learning directed toward achieving objectives. In the end, certain modes of control, especially in excess, can have a negative impact on both engagement and imagination.

Imagination

Imagination is comprised of three facilities (Wenger, 1998): *orientation* provides a location relative to the organization; *reflection* provides facilities for comparison and evaluation; and *exploration* provides opportunities for envisioning, creating and testing new ideas. Again, similar themes are found in the IS literature that emphasize a need to understand situational context and explore possibilities through processes that support discovery and innovation.

Systems requirements are the first step in defining possibilities for new information technologies. As previously noted, the development of system requirements is often conducted through inquiry and other elicitation methods, intended to identify user needs. Yet, this step is highly prone to unintended influence through bias and error (Salaway, 1987). In addition, interviewing can close down inquiry, if motivated to solve problems rather than explore the appropriateness of different possibilities for an organizational situation (Boland, 1979).

Another method of elicitation is the use of design tools, such as computer assisted software engineering (CASE) or use cases, which help users describe the organizational situations in which they are involved and convey what they know (Lanzara & Mathiassen, 1985). Such tools help users move from the current situation to the enactment of a new one (Lanzara & Mathiassen, 1985). For instance, redirecting the attention away from the existing system and refocusing on a new realm of possibilities (Wastell, 1999) is one such example. To reframe a situation leads to a discovery of possibilities.

Drawing on theories of action, Lanzara and Mathiassen (1985) are critical of most existing tools. They suggest that better tools are needed to bring the “background into the foreground” by offering ways to make procedure more explicit, thereby relating descriptions to the actual settings. This advances a user’s opportunity to question the appropriateness of existing solutions, challenge their adequacy, and take more responsibility for initiating a more positive action.

Similarly, prototyping enables a common reference point for users and developer, which helps to develop a mutual understanding and draw out and refine user requirements (Alavi, 1984). Reifying what is known helps to reveal what is not fully understood and offers alternative active techniques for articulating and defining existing situations that allow the designs and users to engage in a social process of simultaneous definition, design, and discovery.

To summarize, there is great support in the IS literature for imagination in the design process. There also is great concern regarding the mutual understanding of context among users and designers, which is necessary to define the present situation and to inform an effective process of discovering new possibilities. Furthermore, the tools we have available are limited in their ability to support and encourage these activities. Tools alone are not sufficient without the social and human elements that can encourage and inform their use; engagement provides these elements.

Engagement

Engagement is facilitated by *mutuality* though: reciprocity and interdependence, which provides opportunities to form and share perspectives; *competence*, which supports the occasion for applying knowledge and exercising judgment; and *continuity*, which supports mechanisms of memory, which work as repositories for information created through social encounters. Similarly, IS research has found that the design process and subsequent adoption of a technology benefit from user involvement, which enhances confidence and acceptance of the technology (Hartwick & Barki, 1994; Ives & Olsen, 1984).

Including users in the design process involves more than their presence, however; it also requires overcoming conflicts of interest and effects of authority (Mumford, 1983, p. 31). Often users are given relatively passive roles, despite being required to sign off on requirements (Beath & Orlikowski, 1994). As a result, patterns of user participation vary according to who controls the selection of features and the coordination of activities (Kirsch & Beath, 1996). Participation, therefore, is often token or compliant, rather than shared.

The participative design (PD) movement highlights empowerment of users as important in their ability to influence the overall design process (Hirschheim & Klien, 1994). Joint application

design (JAD) is designed to actively engage users and designers in activities, often away from their usual work settings and organizational roles, recognizing the importance that altering structures has on the dynamics of a design process.

One way that JAD involves users is through modeling and prototyping. Models support the development of shared understanding between users and developers, thereby building confidence in what is established as knowledge during inquiry. Prototypes serve to cultivate user participation and help build credibility and establish good working relations.

As with alignment and imagination, there is great support in the IS literature for engagement as a key component of RD success, but there is concern about our ability to successfully nurture it. The following section discusses the results from several researchers who have provided insight into approaches and tools that may help to overcome some of the most frequently encountered impediments to successful alignment, imagination, and engagement in the RD and ISD processes.

Summary: Designing an ISD Process for Social Learning

Table 1 illustrates the parallels between Wenger’s model of social learning, an apprenticeship model,

and the factors judged important to successful design from the ISD literature. What remains is the construction of social learning processes that enable a project to implement and balance these factors.

Designing Structures for Social Learning

The social process of ISD, whereby users and developers collectively define requirements, is complicated in that participants may differ in their backgrounds, cognitive styles, personality, job characteristics, organizational circumstances, affiliations, or location (Robey & Markus, 1984). As one might expect, this leads to differing interpretation, confrontation, and misunderstanding.

A major concern, therefore, is that the discourse required for an effective process of inquiry is distorted in traditional organizational structures. Altering the structure of a design process through choices regarding the number of participants, the activities conducted, and the role of users and designers can offer greater opportunity for users to raise issues, question the appropriateness of choices, make and demand commitments, and express attitudes and concerns (Hirschheim & Klien, 1994).

Table 1. Correspondence between Wenger’s model and information system design literature

| Dimension | Community of Practice | ISD Literature |
|-------------|---|---|
| Alignment | <ul style="list-style-type: none"> • convergence • coordination • jurisdiction | <ul style="list-style-type: none"> • objectives • methodology • control |
| Imagination | <ul style="list-style-type: none"> • orientation • reflection • exploration | <ul style="list-style-type: none"> • context • possibilities • discovery |
| Engagement | <ul style="list-style-type: none"> • mutuality • competence • continuity | <ul style="list-style-type: none"> • participation • self efficacy • joint tasks |

Nonaka and Takeuchi (1995) show that through organizational design actions enacted through structured mechanisms, knowledge creation is facilitated. Churchman and Schainblatt (1965) note that researchers and managers viewed problem-solving differently and propose a dialectic approach to manager-researcher communication. Boland (1979) found that structuring problem-solving processes in ways that are enabled by differing rationales encouraged participants to share their knowledge and arrive at different types of solutions. Different processes for understanding and applying knowledge are influenced by the controls placed over the process of user-designer interaction.

Altering the structures of user-designer interaction may provide benefits beyond improved specifications or overcoming user resistance. Bringing users into close interaction with designers promotes social sense making (Boland, 1984) and shared understanding (Nelson & Coopriider, 1996). Information analysis, extended to include the context within which data are interpreted, also provides design mechanisms that can support self-reflection (Boland, 1979).

In summary, the IS literature shows support for the notions resident in Wenger's design for social learning. However, it does not explicitly address the tension inherent in alignment, imagination, and engagement. By exploring structures that balance these tensions, the process of system design may benefit, as we demonstrate in the next section.

Resolving and Managing Tensions as a way of Explaining Successes and Failures

In this section, we revisit three previously published studies to illustrate the value that the social learning model adds to the literature in information system design. The studies we examine used three different methods: controlled experiments, field research, and comparative analysis of previ-

ously collected case studies. The authors of each study include in their data and their analysis consideration to all three of the dimensions in our model: alignment, engagement, or imagination. However, in each study, one of the dimensions is used as the primary focus of investigation and therefore becomes a primary explanation for the results and the authors' understanding of what distinguishes effective from ineffective design processes.

For each study, we offer an alternative explanation that encompasses the original differentiating characteristics but offers additional insights into how to manage the process of information systems development. With these insights, the tensions among all three dimensions are included in the management framework rather than emphasizing one dimension of the model over the others. Consequently, this research contributes to the research literature by emphasizing the need to balance the dimensions in the model, and the result is a broader perspective on the practice of managing the system development process.

Boland (1978)

In the first study we examined, Boland (1978) addressed the question of how a user is involved in system design. Employing an experimental research design, "two radically different processes of interaction between a systems designer and a manager were compared in an information system design exercise." The author refers to the first as traditional and the later as an alternative. The first process was conducted by having the designer interview the manager. Afterward, the designer made suggestions for the design. In the second process, there was an initial sharing of information followed by a period of mutual suggestion and critique by each participant.

In the study, the structure (methodology and control) influences the interaction between the user and the manager. Based on how this protocol or interaction takes place, the problem solution is

derived. The author states “the alternative interaction approach produced higher quality designs with important implementation advantages.” From these results, Boland suggests that the protocols “may help to define different problems, and thereby produce different, but equally rational, solutions.” As stated in the article, “the structure of their interaction is defined as the protocols or accepted patterns they follow in punctuating their exchange of messages.” Using the model proposed in this research, the causal direction between the dimensions inferred in this statement is quite clear. Alignment, which includes methodology and control, sets the stage for how users and designers will engage in the process. The author also states, “the structure of their interactions serves as the context for the generation, interaction, and interpretation of ideas between them. The protocols they followed are seen as a source of rationality in the design process, as they guide in bounding the problem space, drawing inferences, and defining an ‘appropriate’ information space.” From the social learning model perspective, the protocol influences design activities, or, in other words, the causal direction inferred is (the words of our model) “alignment affects imagination.”

A richer explanation, employing the proposed social learning model, is that the alternative process resolved tensions in the process and, compared with the traditional process, struck a better balance in what was emphasized as important. Protocols, as a part of a prescribed methodology, served to organize the process or inquiry, but as exhibited in the study, they may not engage users in ways that promote knowledge transfer or afford the ability to imagine the design of an innovative system. The alternative process certainly undertook a different rationality, as the author went on to discuss, but it also undertook a more balanced approach across the three dimensions of the proposed model. By having participants first share information, then describe solutions and discuss pros and cons, both engagement and imagination were enhanced.

Wastell (1999)

In the second study we analyzed, Wastell (1999) also viewed social structure as a vehicle for learning and as a critical element in information system design. The study involved field research and employed an action research approach. Opportunities for design to influence the structure of interactions between participants or the development environment and the way it is managed and controlled are surfaced in the study. Three case studies are described. In each case, the author suggests approaches, and then describes how these changes improved performance. Using a theoretical perspective from psychology, the author proposed that antilearning defenses create difficulties for information systems design.

Stress and anxiety, arising from the group defenses of those involved in the system development effort are at the center of this approach. For example, following traditional protocols allows participants to adhere to prescribed behavior rather than engaging the participants from other groups in a common set of tasks. The approach to improving method and involvement are to reduce stress and defense avoidance behaviors. As prescribed by the author, modeling and other activities of design provide the design process with transitional objects, which facilitate involvement by designers and managers. As a result, the use of these objects promotes a learning environment, or transitional space. Thus, use of transitional objects “can facilitate the change process by providing a source of support through the transition, redirecting the anxieties that could otherwise lead to erection of defenses.”

In this framework, one role of the project manager is to maintain, rather than create, this learning environment. Thus, Wastell places the focus of his investigation, and prescriptions for improvements, on the process of modeling and designing. These concepts are incorporated in the imagination dimension of the proposed model.

For example, in one of three cases the author uses in the article, the company, Acme, is described as exhibiting “overly fastidious attention to notational detail and the aesthetics of diagrams . . . and users complained that they would be presented with large sets of diagrams which they found difficult to understand; one commented that ‘we did not know what we were doing or why we were doing it.’” The author’s diagnosis of the problem was that these methods of design “provided IS professionals with an illusion of control.” Users “drew back from the real job of analysis, of engaging with users in an open and frank debate about IS requirements.”

Using the author’s proposed framework, the causal direction of this theoretical approach is that imagination influences both the engagement of users and designers and the alignment or management of the process by which design is conducted. The prescription offered by the author is that design activities should be used as transitional objects. The use of these objects facilitates the creation of a transitional space. This space is a structure that promotes learning, allowing designer and managers to safely engage in activities. Once created, management must try to support the existing environment, which is quite different from the idea that methods and controls are needed to ensure the effectiveness of a process.

The author sums up the problem in this case as a situation in which “a highly prescriptive methodology is imposed by fiat” compared with an alternative that works better. The alternative, described in a similar case study, is a process in which practitioners create their “own methodological ideas before consolidating these experiences into new working practices.”

Using the social learning framework model, we might explain the findings as one in which there was a shift in emphasis from a strong adherence to an ineffective method toward greater emphasis on both modeling and engagement of users and designers. The emphasis has moved toward greater engagement of users and what

is described as a more “experimental” approach to development, and created a transitional space for those involved in the project. In this social learning explanation, the shift is toward a greater balance between the engagement and imagination dimensions of the model.

Kirsch and Beath (1996)

In this third study, the researchers again analyzed participation in system development projects. Kirsch and Beath (1996) analyzed data from eight case studies as a way to understand the relationships between different modes of involvement, the processes of coordination between designers and manager, and the product of the design effort. The process of user involvement is examined in terms of how involvement is actually enacted, as apposed to how methodologies may be prescribed in the literature. The authors examine this relationship from several directions in discussions at the end of the article, but their initial focus in terms of theoretical direction of causation is that participants will enact a methodology, rather than just following it blindly. The product of design is also examined by looking at who makes the selection of system features.

These authors focus on the effect of involvement, or engagement as defined in the social learning model. The study identified three different patterns of user participation: token, shared, and compliant. Each is shown to have different implications for a set of outcomes: task-system fit of the resulting system and management of conflict among these outcomes.

The authors propose that these patterns (token, shared, and compliant user involvement) vary in terms of who contributes technical and domain knowledge to the project and who controls feature selection. Involvement by users also influences the coordination mechanisms employed, the level of conflict, and how these conflicts are resolved. The data are examined in a number of ways, but the emphasis is placed on understanding how engagement influences the process by which the

project is coordinated (alignment) and by which the system is designed (imagination).

To the first point, the authors state that the “enactment [of user involvement] is as much the choice of the client as it is the choice of systems developers.” This leads the authors to suggest that methods might focus less on the way that designers should try to engage users but more on developing mechanisms to elicit user knowledge. To the second point, regarding the influence of user involvement on the modeling and design process or the effect of engagement on imagination, the authors conclude that high user involvement is not always necessary for task-system fit. The findings show, however, that when the system design features were derived by a process of negotiation between users and designers, the process yielded two of the three highest quality designs in terms of task-system fit.

Using our social learning model, an alternative explanation is that the processes that engaged users and designers took into account what participants do (imagination) and how the learning process is managed (alignment). As a consequence, the engagement process struck a better balance among the three dimensions in the proposed model. Engaging in a complex and often ambiguous process can be troublesome, especially if there is a great deal of conflict. In this study of eight cases, the three cases that had the highest rating overall had the least conflict. And while selection of features plays an important role in determining fit, as pointed out by the authors, feature selection does not have to be controlled by users. But their engagement and participation in negotiating the design process yielded the two cases with the highest ranking overall.

Summary: Additional Insights Using the Social Learning Model

As noted, each of these studies discussed the interaction of the three dimensions in the proposed social learning model. In each study, causal

inference was not the primary object of their investigation, as each study undertook a process perspective in their research approach, which we acknowledge and appreciate. These studies collected and reported rich sets of data and offered thoughtful and insightful analysis, enabling us to revisit them from the perspective of the tensions inherent in the social learning model.

By using these particular studies as a baseline, we are able to explore alternative explanations for the results of each. That is, we can offer different, richer explanations for how the studies unfolded, and more importantly, how the results came about. The studies started with different foci: Boland with control and method, Wastell with modeling and design, and Kirsch and Beath with user involvement. As a result, the three studies examined their data using different theoretical perspectives and thereby derived very different causal explanations of what occurred.

The social learning model does not resolve the conflicting direction of causation implied by these earlier studies. Instead, the learning model provides a “both/and” rather than an “either/or” explanation. Our model shows the relationships between the dimensions in the model as inter-related, with tensions that need to be resolved, rather than the need to optimize any one of the dimensions.

Finally, we note that all three studies demonstrate the need to balance engagement and imagination. While Boland found that more engagement was related to more and better designs, and Wastell found that the activities of design helped to engage the two communities in a more effective social process, Kirsch and Beath found that varying combinations of user and designer involvement has differing effects, dependent on many other factors. As a consequence, simply trying to increase involvement of users does not necessarily lead to better designs. Alternatively, the availability of an innovative or a structured design processes will not insure users’ participation, nor can the design process insure that those users will acquire a sense of involvement.

DISCUSSION AND CONCLUSION

This article has posited that the necessary exchange of knowledge between the designers and the users of information systems during the design process may be viewed as exchanges between two communities of practice. The article further suggests that the apprenticeship model of learning is an appropriate model for this knowledge exchange in which there is mutual learning. In this model, the user is the apprentice to the designer (when learning of technical capabilities) and the designer is the apprentice to the user (when learning of the system requirements and use). Apprenticeship conceptualizes knowledge as constituted in action, so separating the tacit from the explicit is not possible. Our knowledge exists in our competencies to perform or engage in action, and these competencies are formed in our learning through the negotiation of meaning. It is through this mutual apprenticeship process that we can grasp and articulate the meanings of the information we need to transfer. Mutual apprenticeship is a means by which both communities can learn, enabling the sharing of both the tacit and explicit dimensions of each knowledge domain.

Apprenticeship is the most accessible example of the benefits of both participation and nonparticipation and how the evolution of shared histories and development of the roles played by the apprentice and the master bring about the transfer of knowledge. If a master is asked to merely explain certain knowledge to the apprentice, the conversation would be flawed by the misunderstanding arising from the differing interpretations of the words that were used. However, through a process of engagement in a situated practice, development of competencies, and the evolution of identities, knowledge is transferred across communities via the apprenticeship model. The architecture for learning provides focus for balancing the tensions among alignment, imagination, and engagement.

Changes in structure can allow a community to move beyond just transferring “know what” to sharing greater degrees of “know how” and “know why.” By engaging in common practices, communities can understand greater degrees of the tacit dimension that exists in all knowledge (Brown & Duguid, 2001). However, even communities who work at the same practices can have differing ways of knowing. These differences result in knowledge being sticky and difficult to transfer, and they demonstrate the social dimensions of knowledge arising from the situated ways in which practices may develop.

By altering modes of participation in line with an apprenticeship model of learning and by supporting alignment and imagination through each community’s engagement in practice, managers can reduce the difficulties of sharing knowledge across the communities of users and designers. Perhaps of greater value, the knowledge shared across these communities, through altering modes of participation and balancing dimensions of the learning process as defined in Wenger’s model, can result in greater degrees of “know how” as well as “know what.” Furthermore, communication of related practice associated with the knowledge transferred and communication of the historical reasons for the practices used and the meaning appropriated in activities express aspects of a “know why” dimension embedded in the community’s way of knowing. Each of these changes should yield more creative designs and systems that have a greater degree of alignment with the organization’s goals.

We examined several cases of success and failure from the perspective of the causal explanations put forth by the investigators and using the model proposed here. In particular, we found it enlightening to compare the balance among the three dimensions of the model in successful and unsuccessful projects, which showed how the former had exercised a better balance than the latter. Ultimately, alignment, imagination, and engagement must all be supported, but focusing

too heavily on one dimension may disrupt the balance among them. Similarly, the various modes of participation in the apprenticeship model have the potential to benefit a learning process, but their implementation as changes to an overall process may have very subtle influences based on the number of participants and their role in the organization.

The model provides important insights into how apprenticeship and knowing across communities can contribute to the theory and practice of information system design. Through the development of learning environments that span communities and support engagement of practice and appropriate modes of participation, organizations can create, focus, and transfer system knowledge through an apprenticeship model of learning. For information systems researchers, the model provides new opportunities for examining and evaluating requirements definition approaches. All of the issues raised in this article require further investigation. Many opportunities exist for future research to further understand, validate, and extend this work.

For practitioners, the model provides insights into the importance of context in understanding what is known in organizations and the importance of practice in forming the way that we know it. For project managers and executives, creating an environment in which both designers and users are encouraged to be both masters and apprentices may well prove to be a critical factor for project success.

REFERENCES

- Alavi, M. (1984). An assessment of the prototyping approach to information systems development. *Communications of the ACM*, 27(6), 556-563.
- Alavi, M., & Leidner, D. E. (2001). Review. Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 25(1), 107-136.
- Allen, B. R., & Boynton, A. C. (1991). Information architecture: In search of efficient flexibility. *MIS Quarterly*.
- Baskerville, R. L., & Stage, J. (1996, December). Controlling prototype development through risk analysis. *MIS Quarterly*, 481-503.
- Beath, C. M., & Orlikowski, W. J. (1994). The contradictory structures of systems development methodologies: Deconstructing the IS-user relationship in information engineering. *Information Systems Research*, 5(4), 350-377.
- Beyer, H. R., & Goltzblatt, K. (1995). Apprenticing with the customer. *Communications of the ACM*, 38(5), 45-54.
- Boland, R. J. (1978). The process and product of systems design. *Management Science*, 24(9).
- Boland, R. J. (1979). Control, causality and information system requirements. *Accounting, Organization and Society*, 4(4), 259-272.
- Boland, R. J. (1984). Sense-making of accounting data as a technique of organizational diagnosis. *Management Science*, 30(7), 868-882.
- Boland, R. J. (1987). In-formation in information system design. In R.L. Boland & R.A. Hirschheim (Eds.), *Critical issues in information systems research*. New York: Wiley.
- Brown, J. S., & Duguid, P. (2001). Knowledge and organization: A social-practice perspective. *Organization Science*, 12(2), 198-213.
- Brown, J. S., & Duguid, P. (2002). *The social life of information*. Boston: Harvard Business School Press.
- Boland, R. J., & Tenkasi, R.V. (1995). Perspective making and perspective taking in communities of knowing. *Organization Science*, 6(4), 350-372.
- Bryant, A. (2000). It's engineering Jim ... but not as we know it. Software engineering: Solution to the software crisis, or part of the problem? In

Proceedings of the 22nd International Conference on Software Engineering (pp. 78–87), Limerick, Ireland.

Byrd, T. A., Cossick, K. L., & Zmud, R. W. (1992). A synthesis of research on requirements analysis and knowledge acquisition techniques. *MIS Quarterly*, 16(1), 117-138.

Carmel, E., Whitaker, R. D., & George, J. F. (1993). PD and joint application design: A transatlantic comparison. *Communications of the ACM*, 36(4), 40-48.

Chan, Y. E., Huff, S. L., Barclay, D. W., & Copeland, D. G. (1997). Business strategic orientation, information systems strategic orientation, and strategic alignment. *Information Systems Research*, 8(2), 125-51.

Churchman, C. W., & Schainblatt, A. H. (1965). The researcher and the manager: A dialectic of implementation. *Management Science*, 11(4), 69-87.

Cook, S. D. N., & Brown, J. S. (1999). Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing. *Organization Science*, 10(4).

Costello, R. J., & Liu, D.-B. (1995). Metrics for requirements engineering. *Journal of Systems and Software*, 29(1), 39-63.

Cougar, J. D. (1996). *Creativity & innovation in information systems organizations*. Danvers: Boyd & Fraser.

Eisenhardt, K. M. (1985). Control: Organizational and economic approaches. *Management Science*, 31(2), 134-149.

Hanks, W. F. (1991). *Forward in situated learning: Legitimate peripheral participation*, by Lave, J. and E. Wenger, Cambridge, UK: Cambridge University Press.

Hartwick, J., & Barki, H. (1994). Explaining the role of user participation in information system use. *Management Science*, 40(4), 440-465.

Hayes, N., & Walsham, G. (2001). Participation in groupware-mediated communities of practice: A socio-political analysis of knowledge working. *Information and Organization*, 11, 263-288.

Henderson, J. (1990, Spring). Plugging into strategic partnerships: The critical IS connection. *Sloan Management Review*, 7-18.

Hirschheim, R., & Klein, H. K. (1994, March). Realizing emancipatory principles in information systems development: The case for ETHICS. *MIS Quarterly*, 83-109.

Iivari, J. (1987, September). The PICO model for information systems design. *MIS Quarterly*, 401-419.

Ives, B., & Olsen, M. (1984). User involvement and MIS success: A review of research. *Management Science*, 30(5), 586-603.

Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal*, 33(4), 692-724.

Kirsch, L. J. (1996). The management of complex tasks in organizations: Controlling the systems development process. *Organization Science*, 7(1), 1-21.

Kirsch, L. J. (1997). Portfolios of control modes and IS project management. *Information Systems Research*, 8(3), 215-239.

Kirsch, L. J., & Beath, C. M. (1996). The enactments and consequences of token, shared and compliant participation in information systems development. *Accounting, Management and Information Technology*, 6(4), 2221-154.

Kirsch, L. J., & Cummings, L. L. (1996). Contextual influences on self-control of IS professionals engaged in systems development. *Accounting, Management and Information Technologies*, 6(3), 191-219.

- Kyng, M., & Morten (1995). Representations of work: Making representations work. *Communications of the ACM*, 38(9).
- Lamb, R., & Kling, R. (2003). Reconceptualizing users as social actors in information systems research. *Management Information Systems Quarterly*, 27(2), 197-235.
- Larman, C. (2004). *Agile and iterative development: A manager's guide/Craig Larman*. Boston: Addison-Wesley.
- Larzara, G. F., & Mathiassen, L. (1985). Mapping situations within a system development project. *Information and Management*, 8, 3-20.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.
- Leonard-Barton, D., & Sinha, D. K. (1993). Developer-user interaction and user satisfaction in internal technology transfer. *Academy of Management Journal*, 36(5).
- MIS Quarterly*, 25(1): 107-136
- Markus, M. L., & Robey, D. (1988). Information technology and organizational change: Causal structure in theory and research. *Management Science*, 34(5), 583-598.
- Mason, R. M. (1991, Fall). The role of metaphors in strategic information systems planning. *Journal of Management Information Systems*, 8(2), 11-30.
- Mens, T., & Eden, A. H. (2005). On the evolution complexity of design patterns. *Electronic Notes in Theoretical Computer Science*, 127(3), 147-163.
- Mumford, E., & Olive, B. (1967). *The computer and the clerk*. London: Routledge & K. Paul.
- Nature_Team. (1996). Defining visions in context: Models, processes and tools for requirements engineering. *Information Systems*, 21(6), 515-547.
- Nelson, K. M., & Coopride, J. G. (1996, December). The contribution of shared knowledge to IS group performance. *MIS Quarterly*, 409-432.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford University Press.
- Ouchi, W. G. (1979). A conceptual framework for the design of organizational control mechanisms. *Management Science*, 25(9), 833-848.
- Polyani, M. (1966). *The tacit dimension*. Garden City, NY: Doubleday and Co.
- Reich, B. H., & Banbasat, I. (1996). Measuring the linkage between business and information technology objectives. *MIS Quarterly*, 20(1), 55-82.
- Robey, D., & Markus, M. L. (1984, March). Rituals in information system design. *MIS Quarterly*, 5-15.
- Salaway, G. (1987). An organizational learning approach to information systems development. *MIS Quarterly*, 11(2), 245-264.
- Tamai, T. (1993). Current practices in software processes for system planning and requirements analysis. *Information and Software Technology*, 35(6-7), 339-344.
- Vessey, I., & Conger, S. A. (1994). Requirements specification: Learning object, process and data methodologies. *Communications of the ACM*, 37(5), 102-113.
- Von Hippel, E. (1994). Sticky information and the locus of problem-solving-implications for innovation. *Management Science*, 40(4), 429-439.
- Wallace, L., Keil, M., & Rai, A. (2004). How software project risk affects project performance: An investigation of the dimensions of risk and an exploratory model. *Decision Sciences*, 35(2), 289-321.

Reframing Information System Design as Learning Across Communities of Practice

Wastell, D. G. (1999). Learning dysfunctions in information systems development: Overcoming the social defenses with transitional objects. *MIS Quarterly*, 23(4), 581-600.

Wenger, E. (1998). *Communities of practice: Learning, meaning and identity*. Cambridge University Press.

Zmud, R. W., & Apple, L. E. (1992). Measuring technology incorporation/infusion. *Journal of Product Innovation Management*, 9(2), 148-155.

This work was previously published in International Journal of Technology and Human Interaction, edited by B. C. Stahl, pp. 15-32, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.38

The Transformation Model

Kathleen P. King
Fordham University, USA

ABSTRACT

The journey of transformation is a model of professional development developed, grounded in research of 205 educators, and based on a framework of adult learning begun in 1997. Transformative learning is a theory that describes the experience and cognitive process by which adults critically evaluate previously unexamined beliefs, values, or assumptions; try new beliefs, values, and assumptions to determine the fit for themselves; and then develop a dramatically new perspective of their worldview (Mezirow, 1978). This article describes how the author developed a mixed quantitative and qualitative tool to more broadly gather and analyze data about this experience. The work focuses on two major groups of traditional adult learners: English as second language learners and adult basic education learners. The journey of transformation represents a refinement of the 10-stage transformative learning theory model, one which is dynamic and interactive among the stages. The model emphasizes an environment of support for technology learning and encour-

ages a role for practice and experimentation with technology that recognizes the fluid, nonlinear process of such learning.

INTRODUCTION

The journey of transformation is a model of professional development that has been developed, grounded in research of 205 educators, and based on a framework of adult learning starting in 1997. It was fully presented in the literature in 2002 and 2003 in a two volume book, *Keeping Pace with Technology+* (King, 2002b, 2003).

Origins of the theoretical basis of this model are the adult learning theory of transformative learning (Mezirow, 1978). Transformative learning is a theory that describes the experience and cognitive process by which adults critically evaluate previously unexamined beliefs, values, or assumptions; try new beliefs, values, and assumptions to determine the fit for themselves; and then develop a dramatically new perspective of their worldview. Mezirow's original study was a

small group of adult women returning to college later in life.

King developed a mixed quantitative and qualitative tool in 1997 to begin to more broadly gather and analyze data about this learning experience. From 1997-2002, King focused his work on educators and two major groups of traditional adult learners (English as Second Language [ESL] learners and Adult Basic Education [ABE] learners). The studies of educators extended from not only educators of adult educators, but also k-12 educators and professors in higher education.

King's basic perspective was to "throw a wider net" of data gathering in order to identify broader patterns of transformative learning experiences than in traditional studies in the field that typically numbered 5-15 participants.

The journey of transformation represents a refinement of the 10-stage transformative learning theory model as it is experienced among k-12 educators (volume 1) and professors (volume 2) learning educational technology (King, 2002b, 2003, 2004). This new integrated model has four major stages: fear and uncertainty; testing and exploring; affirming and connecting; and new perspectives.

As an entirety, this experience is not linear; it is one which is dynamic and interactive among the stages. The learning experienced in the model of the journey of transformation is recognized as resulting in fundamental transformations of educators' perspectives and practice of teaching and learning.

The significance of the model includes many dimensions, not limited to the fact that it brings adult learning theory to a place of practical application across educational contexts. The model emphasizes an environment of support for technology learning and encourages a role for practice and experimentation with technology that recognizes the fluid, nonlinear process of such learning.

BACKGROUND

The Research

In the extended study, which grounded the journey of transformation, 205 participants included 155 women and 50 men. These participants had 0-40 years (M=10.53) experience in teaching at k-12, adult, and higher education environments. Their ages ranged from 30-39 years old (King, 2002, 2003).

Analysis of the data revealed that 84% of the respondents had experiences of perspective transformation through this context and followed a distinct pattern of development that emerged as the journey of transformation model (King, 2002b, 2003). This model may be defined as a four-stage integrated model of transformative learning experienced within the context of educational technology learning, resulting in fundamental transformations of educators' perspectives and practice of teaching and learning. The four stages of the journey of transformation are fear and uncertainty; testing and exploring; affirming and connecting; and new perspectives. Frequently having to learn technology or new aspects of technology under pressure served as a "disorienting dilemma" that was characterized by fear and uncertainty (King, 2004).

Research and Theory

The stages of the journey have linkages with Mezirow's (1978) theory of transformative learning. However, the journey's stages do not represent single actions. Instead they are continuums of experience. Specifically in this model, transformative learning is revealed when "educators' learning journeys of *development*, their *disequilibrium* which promotes learning, and their learning that includes *reflective abstraction*, and the construction of *structures/meaning*" (King, 2004, p. 12, italics in original).

In terms of *development*, instead of one single learning moment, this model emphasizes a direction that some educators follow. That is a pathway that leads to perspective transformation, as adult learners engaged in research-grounded professional development in educational technology.

Much like Rogers' (1995) theory of the diffusion *process* of innovations, the model is a journey. In contrast to his theory, however, this model includes *constructions of meaning*, and ways of understanding that go beyond the innovation and is more fully explained through the adult-learning theory of transformative learning.

The journey of transformation is a *reflective abstraction* that starts with a process of questioning, and analysis, and leads to the individuals' development and empowerment. The *disequilibrium* of transformative learning also is evidenced in the beginning stages of the journey of transformation, as educators face their growing confusion and fears regarding educational technology learning.

Understanding educators in these ways can be powerful paradigms and frameworks for those who work with them. Considering that educators can experience these changes in perspective and related practice, developers, instructional technologists, and other educators involved in assisting them can gain new insight into faculty members' needs. Such perspectives of possibilities can change the focus of professional development. Instead of solely focusing on skill acquisition or instrumental learning, the journey of transformation highlights the educator as a self-directed adult learner and professional. This focus sets the stage for emancipatory learning.

The Model's Stages Explored

While full explanations and descriptions of the model and stages are found in the literature, brief descriptions are provided here:

Fear and uncertainty. Learning a new skill set can be uncomfortable for adults, but learning

technology seems to especially generate fear and anxiety. Part of this increased emotion may be due to the high value the general public and business place on technology knowledge. In beginning sessions, the teacher/facilitator may be nurturing and supporting participants' initial efforts to complete guided computer activities. Within this first stage of the journey, learners especially need to build confidence in their facilitator as the one who will provide support and guidance.

The fear-and-uncertainty stage reveals concrete examples of how our technology-based culture can leave the novice emotionally stranded and isolated from solutions. Looking at the emotional, affective side of this dilemma and questioning it confirms that educational technology learning needs to address much more than instrumental learning.

Testing and exploring. Educators gain confidence to pursue more activities and begin to reach an exploration mode. They typically are no longer limited to a script of instructions but explore different functions and applications on their own. Educators begin to see similarities among programs and anticipate how they likely function. As learners explore on their own, they gain autonomy.

Teachers describe the second stage of the journey of transformation as the time when they are engaged in testing, exploring, and gaining confidence with the use of educational technology. Many times they indicate that they were questioning their prior beliefs and ideas about teaching and learning. By increasing their confidence in educational technology, they also begin to explore how they might implement new teaching methods with their students.

Affirming and connecting. During this stage, teachers are acquiring more instruction, planning how to use knowledge, and testing new connections or syntheses, regarding the teaching and learning in which they have been engaged. For example, they may describe how they have realized that the collaborative learning they have

The Transformation Model

experienced can be used in their classes. In addition they begin to realize that using technology should be integrated with and consistent with, rather than separated from, their prior educational knowledge and practice.

In these ways, in this stage, some educators will realize how they can *connect* their teaching experience with technology. That is, these educators use their teaching expertise to apply technology in new ways. Often as educators design classroom materials, they also are implementing them week-by-week within their classrooms. While engaging in developing curriculum that integrates technology, the journey of transformation includes their affirming, connecting, and discussing how they might further develop their teaching practice. Perhaps they begin to look at teaching and learning from a new perspective as this stage opens up new possibilities? Others may affirm and stretch the possibilities for their educational practice or philosophy as they build upon and *scaffold* with one another's experiences.

New perspectives. It is critical to note that the "final stage" of the "journey" may be reached in days, months, or years. The timetable for the journey for every individual is different. Usually at the new-perspectives stage, educators have invested much time and work in overcoming challenges, exploring new technologies, and beginning to develop new instructional and curricular materials.

Many of these educators reach beyond their prior boundaries, both conceptual and curricular, to see possibilities previously unseen. In this final stage of new perspectives, teachers reflect more completely, develop new ideas, evaluate their merit, and perceive learning and meaning in new ways. These educators are carefully and thoughtfully reexamining their grade-levels and content areas to determine where technology can be integrated, scaffolded, transformed, and used to benefit their curricular goals and consolidate their direction.

Like the new school or collaborative classroom, typically the professional development classroom is "noisy" at this point. Teachers are engaged in dialogue, discussion, teamwork, and debate, while they are creating, evaluating, and redesigning interdisciplinary and cross grade-level curriculum that will maximize the benefits of technology. Additionally, they experience freedom in their roles and abilities; this is a manifestation of emancipatory learning. Often empowerment clearly permeates these accounts provided in the reflective journals of the educators.

SUMMARY

This research revealed that while educators are learning educational technology, they can have transformative experiences. These learning experiences may include new visions of teaching and the classroom, transitioning from being a "received knower" to a "constructed knower" in educational technology and interacting with educational technology professional development as emancipatory learning rather than instrumental (Cranton & King, 2003).

Furthermore, it was demonstrated in this research that when educators learn technology and build on their professional expertise, they may experience changes, not only in their personal and professional perspectives of individuals, teachers, and learners, but also as practitioners. That is, they may fundamentally change their educational practice in lasting ways. (King, 2002a, b). For example, in this study, it was recounted how these educators often moved from teacher-centered to learner-centered learning models and expanded their view of the classroom to create more active, constructivist, and transformative experiences. Instead of professional development focusing only on instrumental learning (skills training or theory transmission), these professional development experiences presented learning opportunities for educators to fundamentally change. The changes

they experienced were in their actions of reflection, self-examination, and redefinition of their perspectives, purposes, and practices. This model revealed concrete examples of a reflective practitioner being developed through the adult-learning model of transformative learning in educational technology professional development. In this case, we have a nexus of teacher-education theory and adult-learning theory being demonstrated through this research and articulated in this model.

Main Focus of the Article

The major focus of the journey of transformation has been to further identify the characteristics of adult learners and educators, in particular, as they engage in learning technology for educational application. Cranton and King (2003) provide a solid overview of the background theory of transformative learning, and how it provides for an open-ended, generative, and constructivist approach to professional learning. A chapter within the larger volume by King and Lawler (2003) describes the literature, practice, and trends in professional development for teachers of adults, examining how the learning of technology in this manner provides a different paradigm for researchers and theorists alike.

The significance and implications of this journey of transformation model, the impact on understanding educators, transformative learning, professional development, and future research may be examined. Realizing the potential that changes in teaching and learning resulting from the journey of transformation can have on educators, their students, colleagues, and institutions, those interested in educational reform may find some direction in this model.

This model focuses on the growth and development of educators learning technology. In this way, the research offers the opportunity to understand faculty needs and explore their potential as professionals and individuals in powerful theoretical and practical ways. New possibilities arise with

this model, and the result of these findings may include changes in professional development planning, delivery, and follow-up. However, equally important is that those involved in the professional development of educators need to be prepared for changes in the lives and work of educators.

Solely providing traditional workshops may not lead to radical change; it likely will not be the entire answer. Instead educational organizations should design and develop continuing programs of educational technology learning, where adult learning is anticipated and supported on an ongoing basis (Cranton & King, 2003; King, 2004, 2005).

Future Trends

In regards to research, discussion, and development of multiple points of inquiry, additional research about this model needs to be pursued. Such research could further test the model and provide modifications and refinements for diverse settings. For example, the model may be examined among faculty in community colleges and within different disciplines, such as business, nursing, the sciences, and the arts. The exploration of the relationships between other adult-learning theories (i.e., andragogy and self-directed learning) and the model can be examined to see what emerges as similarities and differences, and how the model fits among these paradigms. The journey of transformation offers a different perspective on educational technology learning that also may be further explored through the variables of learning styles, personality types, and organizational cultures (King, 2005; King & Wang, 2006).

CONCLUSION

Finally, it must be clarified that this model of the journey of transformation is intended to provide an understanding and vision of educators' learning and development. It has never been intended

The Transformation Model

to confine learners to predetermined outcomes or timelines. Instead it is quite the opposite. The model is based on an educational philosophy of radical pedagogy and social constructivism, as is transformative learning, which embraces an open-ended journey: a constructivist opportunity for educators through professional development. It provides a new perspective for our field, a framework for understanding, practice, and further inquiry. Not meant to confine, it supports a perspective that all educators have their own distinct experiences from which to grow.

REFERENCES

- Cranton, P., & King, K. P. (2003). Transformational learning as a professional development goal. In K. P. King & P. A. Lawler (Eds.), *New perspectives on designing and implementing professional development for teachers of adults, New directions in adult and continuing education* (pp. 31-38). San Francisco: Jossey-Bass.
- Freire, P. (1970). *Pedagogy of the oppressed*. New York: Continuum.
- Freire, P. (2006). *Pedagogy of the oppressed*. In K.P. King and V. Wang (eds.). *Comparative adult education around the globe* (pp. 195-206). PR China: Zhejiang University Press (North American Distribution: BX Media LLC)
- Giroux, H. (1988). *Teachers as intellectuals: Toward a critical pedagogy of learning*. New York: Bergin & Garvey.
- King, K. P. (2002a). A journey of transformation: A model of educators' learning experiences in educational technology. In J. M. Pettitt & R. P. Francis (Eds.), *Proceedings of the 43rd annual adult education research conference*, (pp. 195-200). Raleigh, NC: North Carolina State University.
- King, K. P. (2002b). *Keeping pace with technology: Educational technology that transforms. Vol. One: The challenge and promise for K-12 educators*. Cresskill, NJ: Hampton Press.
- King, K. P. (2003). *Keeping pace with technology: Educational technology that transforms. Vol. Two: The challenge and promise for higher education faculty*. Cresskill, NJ: Hampton Press.
- King, K. P. (2004, December). Furthering the theoretical discussion of the journey of transformation. *New Horizons in Adult Education*. Retrived June 5, 2006, from <http://education.fiu.edu/newhorizons/journals/volume18no4Winter2004.pdf>
- King, K. P. (2005). *Bringing transformative learning to life*. Malabar, FL: Krieger.
- King, K. P., & Lawler, P. A. (Eds.). (2003). *New perspectives on designing and implementing professional development for teachers of adults. New Directions in adult and continuing education, No. 98*. San Francisco: Jossey-Bass.
- King, K. P., & Wang, V. (Eds.). (2006). *Comparative adult education around the globe*. Hangzhou, PR China: Zhejiang University Press (North American Distribution: BX media LLC)
- Mezirow, J. (1978). *Education for perspective transformation; Women's re-entry programs in community colleges*. New York: Teacher's College, Columbia University.
- Rogers, E. (1995). *Diffusion of innovations* (4th ed.). New York: The Free Press.

GLOSSARY

Diffusion of Innovation: The study of how, why, and at what rate new ideas and technology spread through cultures (Rogers, 1995).

Journey of transformation: a model of professional development of educational technology which is based on the adult learning theory of transformative learning (King, 2002, 2003, & 2004).

Radical pedagogy: an educational philosophy that focuses on social change as the goal of education. (See Paulo Freire, Henri Giroux).

Transformative learning: an adult learning theory characterized by 10 stages. It is understood as an experience of critical questioning of beliefs and assumptions as individuals examine the framework from which they have been viewing their world. Originated in the work of Mezirow (1978).

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 2, edited by L. A. Tomei, pp. 26-31, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.39

The Influence of Constructivist E-Learning System on Student Learning Outcomes

Thanakorn Wangpipatwong

King Mongkut's University of Technology Thonburi, Thailand

Borworn Papisratorn

King Mongkut's University of Technology Thonburi, Thailand

ABSTRACT

In this article, the study of how a constructivist e-learning system affects students' learning outcomes was explored and a two-phase study was designed. The first study sought to create a constructivist e-learning environment (CEE) and discover how students expected their learning outcomes under CEE. CEE is composed of three constructs, which are exploration, collaboration, and construction. The statistical results showed the high level of student expectation on every construct. Consequently, constructivist e-learning system (CES) was developed. In the second study, CES was used in the actual classroom environment. The purpose was to compare the learning outcomes and knowledge development of students who studied the course using CES with those of students who learned it under a traditional learning environment. A

T-test method was used to analyze the learning outcomes. The results showed that students who used CES had better learning outcomes and knowledge development than students who did not use CES.

INTRODUCTION

E-learning refers to an alternative method of teaching and learning using all electronic media, including the Internet, network, audio/video tape, and CD-ROM. For the past few years, the use of e-learning to conduct teaching and learning in educational institutes has rapidly increased along with the development of information technology. E-learning has an advantage of enabling students to learn from anywhere and at anytime. E-learning also provides a one-stop service for teachers and learners in order to

create and deliver educational content quickly, effectively, and economically (Ong, Lai, & Wang, 2004).

In the past, e-learning researches have focused more on learning objects. The IEEE Learning Technology Standards Committee defines learning objects as “any entity, digital or non-digital, which can be used, re-used or referenced during technology-supported learning” (Shepherd, 2006). However, students may not improve learning outcomes by using only learning objects. Recently, the focus of e-learning has shifted from defining, sharing, and reusing learning objects to emphasizing learning activities based on the concept of learning design, which emerges as one of the most significant recent developments in e-learning (Yu, Zhang, & Chen, 2006). The key principle in learning design is to develop learning activities that are performed by different learners in the context of learning (Koper, 2006). The objective of learning design is also to assist students to effectively learn by creating and managing their learning processes (Pan & Hawryszkiewicz, 2004).

Regarding learning design, e-learning has blended with learning theory in order to try to improve learning outcomes. The learning methods, such as independent learning, active learning, self-directed learning, problem-based education, simulations, and work-based learning are based on constructivist learning theory (Reiser, 2001). The e-learning design in this study, therefore, is based on constructivist learning theory.

This study was divided into two phases. The first phase was to create constructivist e-learning environment (CEE) and to explore the expected student e-learning outcomes on CEE. The objective of this step was to investigate what learning outcomes students might expect by using a statistical method. Consequently, based on CEE, the constructivist e-learning system (CES) was developed. The second phase was designed as an experimental research that focused on the comparison of actual student e-learning outcomes. The

CES was used in the classroom environment. The student learning outcomes between students in traditional classroom environment and constructivist e-learning environment were compared. The statistical method (t-test) was also conducted to test the significance in this study.

REVIEW OF LITERATURE

Constructivist Learning Theory

The constructivist learning theory has emerged as a prominent approach to teaching during the past decade. The research of Dewey, Piaget, Vygotsky, and Jonassen, among others, provides historical precedents for constructivist learning theory. Constructivist learning theory represents a paradigm shift from education based on behaviorist theory to education based on cognitive theory. In a constructivist learning environment, students have better learning outcomes than in traditional learning environment (Parker & Becker, 2003, Tynjala, 1999).

Among many definitions of constructivist learning theory, the most common characteristic is that they all focus on activities and environments rather than on learning objects. Knowledge is constructed by learners and not transmitted by an instructor. Dewey (1938) believes that knowledge emerges only from situations in which learners have to draw them out of meaningful experiences. Piaget (1960) indicates that learners are active and constructive in making sense of their environment. Piaget (1975) believes that learning should be attained through well-defined stages by active participation of a learner. Vygotsky (1978) focused more on learning activities. In addition, Jonassen (1994) suggested that the constructivist learning should emphasize less on the sequence of instruction and emphasize more on the design of the learning environment. He also pointed out that constructivist environments stress situated problem solving tasks. In conclusion, construc-

tivist learning is an educational approach that effectively motivates learners by enabling a more active, explorative and interactive learning process. In other words, through the learning process, learners construct knowledge within a constructivist learning environment.

CONSTRUCTIVIST E-LEARNING ENVIRONMENT (CEE)

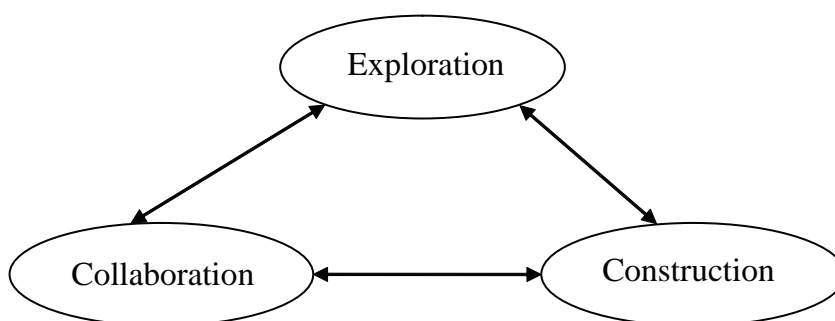
Constructivist learning is considered to be the ideal pedagogy for e-learning. First, constructivist learning focuses on a student's learning experience rather than an instructor lead teaching method. In an e-learning environment, an instructor's role is to help students develop their knowledge and give students a degree of choice such as what to study, where to study, and how to study. Students are placed at the center of the learning experience. Second, constructivist learning sees students as an active participant in their learning experience rather than a passive participant. In an e-learning environment, context is also an important part for student learning. E-learning forces students to explore information, make connections, and build knowledge. Finally, constructivist learning sees learning as a social experience.. E-learning easily enables communication among students without the barriers of time and place; collaboration is crucial.

In recent literature, the following constructivist e-learning researches can be found. Chuang and Tsai (2004) studied on the preferences toward the constructivist internet-based learning environments. Zhang, Zhou, Briggs, & Nunamaker (2005) studied the influence of interactive video in constructivist e-learning environment. Zualkeman (2006) designed the framework for developing authentic constructivist e-learning environments using game-based learning as a medium. Moreno, Gonzalez, Castilla, et al., (2006) applied constructivist e-learning to a computer architecture and engineering course using Moodle platform. Puntambekar (2006) developed constructivist, distributed learning environment (CoDE) and used an online graduate course in order to study the process of collaboration.

For constructivist e-learning applications, computer-supported collaborative learning (CSCL) is widely studied. Many systems have been developed based on CSCL and considered to be constructivist learning applications such as CSILE (computer supported intentional learning environments), which functions as a collaborative learning environment (Scardamalia & Bereiter, 1994). CoVis (collaborative visualization) is an integrated software environment that incorporates visualization tools for open-ended inquiry (Edelson, Pea & Gomez, 1996).

Puntambekar (2006) designed the constructivist e-learning environment called CoDE. CoDE uses two main cognitive tools to help students

Figure 1. Constructivist e-learning environment (CEE)



construct knowledge. The first tool is called Reflective Notebooks. Reflective Notebook was designed to help students analyze ideas and write a reflective essay into the system. The other tool is Discussion Tool, which is designed to support group working for students.

This research proposes an alternative design of learning environment called CEE. CEE consists of three constructs which are exploration, collaboration, and construction, as shown in Figure 1.

Exploration is one of the main approaches in the constructivist learning theory (Murphy, 1997, Stager, 2001). An exploration activity can be defined as searching information resources to comprehend the information and to acquire knowledge (Kashihara, Kinshuk, Oppermann, et al, 1998). The exploration activities include search, variation, experimentation, play, flexibility, discovery, or innovation (March, 1991). In a real world situation, students prefer to learn by exploration in the context of a real task. They need to perform, rather than taking time out to work through the documentation in a task-independent manner (Rieman, 1996). Exploration is also a favored approach to encourage students to seek knowledge independently and to manage the pursuit of their goals (Murphy, 1997). Knowledge that is generated by exploration activities is often new knowledge (Katila, 2002). To help in the exploration process, instructors can use hyperlinks to link other useful online resources to allow students to journey on a process of discovery. Search engine is also a knowledge retrieving tool that assists students to construct new knowledge (Liaw, 2005).

Collaboration is also considered to be a key feature of constructivist learning theory. Collaboration is a characteristic of a powerful learning environment which results in active construction of knowledge (Van Merriënboer & Pass, 2003). Through a process of collaboration, students have an active and constructive role in the learning environment (Dewiyanti, Brand-Gruwel, Jochems, et al., 2004). The interaction between individual

and collaborative learning activities is part of knowledge construction (Puntambekar, 2006, Yli-Renko, Autio, & Sapienza, 2001) and contributes to higher learning performance in the learning environment (Wang & Newlin, 2000).

Writing is suitable for tasks where the aim is to foster understanding, change, and develop student thinking skills (Tynjala, 1999). Constructivist learning theory encourages student writing activities in order to reflect on student knowledge development. Therefore, the construction component, in this study, is designed for writing or recording students' reflection.

Reflective learning is another main characteristic of the constructivist learning theory (Jonassen, 1994). Reflection improves the knowledge creating potential of all students. When students have an opportunity to discuss and explain, they improve their learning (Pirulli & Recker, 1994). In addition, reflection helps students establish the linkage between theory, research, observations, and experiences (George, 2001).

STUDY 1: EXPECTED E-LEARNING OUTCOMES ON CEE

Hypotheses

The objective of this study is to understand the student's expectation on their learning outcomes under each component of constructivist e-learning environment. The hypotheses applied to the study 1 are:

- H1: The average value of expected e-learning outcomes on collaboration is greater than 3
- H2: The average value of expected e-learning outcomes on exploration is greater than 3
- H3: The average value of expected e-learning outcomes on construction is greater than 3

Methodology

Participants

Participants were students of an introduction to computer course at Bangkok University. At the beginning of the semester, a random sample of 600 students out of the total population of 4200 received an e-mail that described the study and provided a link to where the questionnaire could be completed. Four hundred sixty three students (77.17%) responded to the e-mail. The size of valid responses conforms to finite population sampling formula (Yamane, 1973), along with a 95 percent confidence level and a 5 percent precision level. The demographic data of these participants are shown in table 1.

Instruments

The data for this study were gathered by means of a questionnaire. The questionnaire included four major sections: (a) demographic information, (b)

expected outcomes from collaboration process, (c) expected outcomes from exploration process, and (d) expected outcomes from construction process.

The participants were asked to determine the range of expected learning outcomes from each construct by indicating 1 as Very Low level; 2 as Low; 3 as Moderate; 4 as High; and 5 as Very High. Mean rating points were then distributed to the following scale classification levels such as Very Low (1-1.80); Low (1.81-2.60); Moderate (2.61-3.40); High (3.41 –4.20); and Very High (4.21 to 5.00). Findings from the questionnaires could determine the current level of expected learning outcome from CEE.

Reliability Assessment

The internal consistency reliability of items in each construct was examined using Cronbach's alpha to confirm the adequacy of the measures for testing the hypotheses. The results in each construct are presented in table 2. The reliability

Table 1. Demographic data of participants in study 1

| Demographic Characteristics | Frequency | Valid Percent (%) |
|-------------------------------|------------|-------------------|
| Gender | | |
| Male | 169 | 36.5 |
| Female | 294 | 63.5 |
| Age | | |
| 17 | 1 | 0.2 |
| 18 | 122 | 26.3 |
| 19 | 227 | 49.0 |
| 20 | 73 | 15.8 |
| 21 | 19 | 4.1 |
| 22 | 12 | 2.6 |
| 23 | 7 | 1.5 |
| 24 | 2 | 0.4 |
| Faculty | | |
| Accounting | 5 | 1.1 |
| Business Administration | 175 | 37.8 |
| Communication Arts | 235 | 50.8 |
| Economics | 1 | .2 |
| Fine and Applied Arts | 3 | .6 |
| Humanities | 3 | .6 |
| Laws | 35 | 7.6 |
| Science | 6 | 1.3 |
| Number of Participants | 463 | 100 |

Table 2. Cronbach's alpha reliability coefficients

| Construct | Cronbach's Alpha | Number of Items |
|---------------|------------------|-----------------|
| Collaboration | .883 | 6 |
| Exploration | .781 | 2 |
| Construction | .853 | 3 |

Table 3. Means of expected learning outcomes

| | N | Mean | Std. Deviation |
|---------------|-----|-------|----------------|
| Collaboration | 463 | 3.486 | .752 |
| Exploration | 463 | 3.893 | .886 |
| Construction | 463 | 3.647 | .796 |

of all constructs shows a high level of internal consistency above the recommended minimum level of .70.

RESULTS

Table 3 shows the average expectation of student learning outcomes for each construct. Referring to the hypothesis, the mean value of collaboration construct, exploration construct, and construction construct are 3.486, 3.893, and 3.647, respectively. The results show that the level of student expected learning outcomes is high for all constructs.

One sample t-test was used to test the hypotheses. Table 4 shows the results which indicate that the mean value of collaboration construct is significantly greater than 3 at significant level 0.05. The mean value of exploration and construction constructs are also significantly greater than 3 at significant level 0.001. Therefore, hypothesis 1, 2, and 3 are supported.

STUDY 2: THE COMPARISON OF E-LEARNING OUTCOMES

Research Model and Hypotheses

The results from study 1 show that the level of expected learning outcomes on each construct of CEE was high. This result could imply that students believed the CEE constructs could help them develop their knowledge. Therefore, the constructivist e-learning system (CES) was developed based on CEE as shown in Figure 2.

In this study, CES was used to create the constructivist e-learning environments. The objective was to compare learning outcomes between students who used the CES and students who studied in the traditional learning environment. This study also examined the knowledge development between students who used the CES and students who studied in traditional learning environments. The subject used in the experiment is "Introduction to Computer," which is normally taught in the traditional classroom environment.

The Influence of Constructivist E-learning System on Student Learning Outcomes

Table 4. Results of one sample t-test

| | Test Value = 3.0 | | |
|---------------|------------------|-----------------|-----------------|
| | t | Sig. (2-tailed) | Mean Difference |
| Collaboration | 2.459 | .014* | .086 |
| Exploration | 11.979 | .000*** | .493 |
| Construction | 6.661 | .000*** | .247 |

* $p < 0.05$, *** $p < 0.001$

Figure 2. Constructivist e-learning system (CES)

The screenshot shows the CES interface for the course 'IT 201 – Introduction to Computer'. The header includes the CES logo and the instructor's name, Thanakorn Wangpipatwong. The main content area is divided into several sections:

- Interactive Board:** Shows 30 students are talking at 10:15:22 am.
- Current Topics:** Lists 3 topics being discussed, including 'Input device (Meaning)', 'Bus (Type)', and 'Memory (Type and Speed)'. It also indicates that the instructor is in the room.
- Collaborative Board:** A section for collaborative learning.
- Latest Topics:** Lists 10 topics posted today, including 'How to make computer more efficiency', 'How to connect to the Internet', and 'How to upgrade CES'.
- Archived Topics:** Lists 1,534 archived topics, including 'Upgrade your better than buy a new one', 'How computer is working', and 'Flash technology'.
- Exploration and Discovery Tool:** A section for exploring and discovering new information.
- Search:** A search bar with a 'Go' button.
- Dictionary:** A section for looking up terms.
- Favorite Link/History:** A section for saving favorite links and history.
- Knowledge Construction:** A section for constructing knowledge.
- Mind Mapping:** A section for creating mind maps.
- Working Topics:** A section for working on topics, including 'How to upgrade CPU', 'Type of CPU', and 'Step'.
- Knowledge Management:** A section for managing knowledge, including 'How to connect to the Internet' and 'Type of Memory'.

This subject introduces basic concepts of computer and internet technologies. An instructor in the class was prepared to use CES as a tool, integrating with constructivist learning activities. The instructor was also prepared to understand the concept of constructivist learning theory and how to use the activity in the classroom. The same instructor taught the same content as in traditional classroom environment. The duration of the lecture in both classes was 13 weeks.

The hypotheses applied to Study 2 are:

- H4: Students who use the CES in traditional face-to-face classroom environment will achieve better test scores than students who do not use it in traditional face-to-face classroom environment.
- H5: Students who use the CES in traditional face-to-face classroom environment will achieve better knowledge development than students who do not use it in traditional face-to-face classroom environment.

Methodology

Participants

Two class sections were randomly selected for the research experiment—Section T and C. Section T was taught in traditional learning environment. Section C was taught in constructivist e-learning environment using CES as a tool. Both sections had the same amount of time for lectures. Students who enrolled in the course had no prior knowledge about the teaching method. There were 31 students in section T and 28 students in section C. The demographic data of students in both classes is shown in Table 5.

The average GPA of students from both groups are shown in Table 6. Although the average GPA values from each group are slightly different, the results from statistical analysis (t-test) displays no significance ($p=.434$). Therefore, GPA was considered not to be effective to the research experiment.

Instrument

The independent sample t-test analysis was used to compare the mean values of test results between two groups. There were five tests in this study—test 1, 2, 3, 4, and 5. Test 1 was designed as a pre-test and was administered at the beginning of the semester to measure student prior knowledge. The other four tests were administered in order to measure the learning outcomes. Since the class had two sessions, test 2 was taken at the end of the first session before the midterm examination date. Test 3 was a midterm examination. Test 4 was designed as a post-test and was taken at the end of last session before final examination date. Finally, test 5 was a final examination. The test 3 and test 5 schedules were pre-announced to students before the test date. However, students did not know the test date of test 2 and test 4 before they took the test. The potential test scores ranged from 0 to 100. All tests were closed book and closed notes.

Table 5. Demographic data of participants in study 2

| | | Section | |
|--------|--------|---------|----|
| | | T | C |
| Year | 1 | 31 | 28 |
| Gender | Male | 14 | 12 |
| | Female | 17 | 16 |
| Age | 17 | 0 | 1 |
| | 18 | 9 | 10 |
| | 19 | 16 | 15 |
| | 20 | 5 | 2 |
| | 21 | 1 | 0 |
| Total | | 31 | 28 |

Table 6. Independent sample t-test of GPA

| | Section T (Mean) | Section C (Mean) | t-value | Sig. (2-tailed) |
|-----|------------------|------------------|---------|-----------------|
| GPA | 2.38 | 2.50 | -.788 | .434 |

The Influence of Constructivist E-learning System on Student Learning Outcomes

Test 1 and test 4 covered the general information about computer and information technology. The question types in both tests were similar, but questions in test 4 were more specific and difficult. The questions in test 2 were about how to use Microsoft Word and Microsoft Excel as they were part of the learning objective in the lecture content. Test 3 and 5 covered all the lecture contents of midterm and final, respectively. Table 7 summarizes all test descriptions and schedules.

Results

Table 8 displays a mean score for each test and section. Notice that all mean scores from section C are higher than the mean scores from section T, which means hypothesis 4 is supported. However, regarding t-test analysis, the mean score of section

T from test 1 is not significantly different to the mean score of section C ($p=.429$). Because test 1 is a pre-test, it can be concluded that student backgrounds in computer and information technology of both sections are not different.

An independent-sample t-test was also used to determine if there were any significant mean differences between class sections from test 2 to test 5. As in Table 8, the results showed that test 2 and test 4 are significantly different ($p<.05$). For test 3 and test 5, despite the higher score on section C, the results show no significant difference between section T and C.

Considering the development of student knowledge from pre-test (test 1) to post-test (test 4), the results show significant improvement for both sections ($p<.001$), as shown in table 9. However, the mean difference of student improvement in

Table 7. Description and schedule for all tests

| | Description | Schedule |
|---------------------------|--|------------------------------|
| Test 1 (Pre-test) | General information about computer and information technology | Before class started |
| Test 2 | MS Word and MS Excel | One week before midterm exam |
| Test 3 | Fundamentals of computer system, process concept, and storage devices | Midterm exam |
| Test 4 (Post-test) | General information about computer and information technology (more difficult than test 1) | Last week before final exam |
| Test 5 | Introduction to computer network, the Internet, Web design and development | Final exam |

Table 8. Independent sample t-test between section T and section C

| | Section T (Mean) | Section C (Mean) | t-value | Sig. (2-tailed) |
|---------------|------------------|------------------|---------|-----------------|
| Test 1 | 55.484 | 58.571 | -.796 | .429 |
| Test 2 | 69.301 | 83.334 | -2.157 | .036* |
| Test 3 | 66.258 | 70.214 | -1.159 | .251 |
| Test 4 | 67.903 | 80.357 | -3.522 | .001* |
| Test 5 | 58.839 | 58.929 | -0.31 | .976 |

* $p<0.05$

Table 9. Paired sample t-test of test 1 (pre-test) and test 4 (post-test)

| Pair T-test Between Test1 and Test4 of | Mean Paired Differences | Standard Deviation | t-value | Sig.(2-tailed) |
|--|-------------------------|--------------------|---------|----------------|
| Section T | -12.419 | 14.712 | -4.700 | .000*** |
| Section C | -20.536 | 9.461 | -11.485 | .000*** |

*** $p < 0.001$

section C is much higher. Therefore, hypothesis 5 is supported.

DISCUSSION AND CONCLUSION

This study proposed an alternative design of constructivist e-learning. The two-phase study was aimed at examining the extent of constructivist practices when applied to traditional classroom environment using constructivist e-learning system. According to the literature review, the constructivist e-learning environment (CEE) was designed. CEE is composed of three constructs, which are collaboration, exploration, and construction. Study 1 was conducted in order to evaluate what students expected from each CEE construct toward learning outcomes. The results from study 1 showed that students' expected learning outcomes from each CEE construct were significantly high. In addition, exploration construct had the highest mean scores. This implies that students believe most of their learning outcomes are from the exploration process. Possibly, the new knowledge gained from the exploration process is more obvious than the others. For example, when students needed information in the Internet, they searched and found it. They would feel immediately that they gained new knowledge. Collaboration construct, by the way, has the lowest effect on students' expected learning outcomes. This situation occurs because students may not receive the new knowledge every time they collaborate with others.

To strengthen the value of the research results, the constructivist e-learning system (CES) was developed and used in the actual classroom environment. The experimental research was designed in study 2. Two class sections were used in the experiment. According to the t-test analysis, the average GPA of students between sections were not significantly different. Therefore, GPA was not the factor that affected the study results. In other words, it could imply that the learning outcomes from each section occurred from the learning process.

The pre-test was also administered in both sections in order to evaluate student background knowledge in computer and information technology. The statistical findings showed that there were no significant differences of student background between each group. As a result, we could also eliminate student background on computer and information technology from the factor that affected the student learning outcomes.

The findings from study 2 showed that students who used the CES in traditional face-to-face classroom environment achieved better test scores than do students who did not use CES. However, it is interesting that only two tests (test 2 and test 4) had significant mean difference but the other two tests (test 3 and test 5) had not. Notice that the test date of test 3 and test 5 were announced before the test. It could be possible that students in both sections had a better preparation for test 3 and test 5 before the tests, which, therefore, yielded to closed results between section T and section C.

The significant difference of results between test 2 and test 4 would imply that students who

learned in constructivist e-learning environment had a better knowledge development than students who learned in traditional learning environment. As stated before, student background knowledge on computer and information technology were not different, and student took the test by not knowing the test date. Therefore, students needed to use their knowledge developed from learning process to answer the tests.

The results from statistical analysis of pre-test and post-test also confirmed the previous findings. The results showed that the mean difference of students in section C was much higher than those in section T, although knowledge improvements of both sections were significant. Therefore, it could be concluded that students who studied in constructivist e-learning environment had a better knowledge development than students who studied in traditional learning environment.

Although the research results supported all hypotheses, many aspects should be discussed. First, we found that students were apparently unfamiliar with the constructivist learning environment. The expectation of knowledge acquisition from an instructor was high. However, students had more understanding on the new role as time went by. In fact, students seemed to be happier studying in the constructivist e-learning environment. Second, we found the same result as Puntambekar (2006) that students expected an instructor to take the lead in every discussion and waited for instructor feedback before they continued to other discussions. Therefore, the instructor should understand the facilitator role and encourage students to continue learning in constructivist e-learning environment.

Concerning to the use of the CES, we also found many interesting aspects. First, using collaboration tools in the CES helped students learn not only from their own group but also from other groups. Since the students were capable of seeing all of the ideas within the CES, they could build knowledge from a broader point of views. Second, students who were familiar with the computer and

internet had more fun using and learning by the CES than students who were not. It seemed that they did not have to worry about how to use the CES. They just concentrated on how to study and learn by using the CES. Finally, students seemed to have more focus on studying when using the CES. With a traditional teaching, some students might use the web, or msn when listening to a teacher. These activities did not happen when students used the CES unless they already finished the assignment.

There are some limitations in this study that should be noted. First, the use of student subjects from Bangkok University may limit the generalization of the results. Second, the findings from using the CES in classroom environment were obtained from a single study. In fact, only the Introduction to Computer course is used in the experiment. Therefore, studying CES in other courses may be needed. Caution should be taken before generalizing the findings, as well. Finally, a teacher who intends to use CES should understand the constructivist learning concept in order to utilize the CES tools.

REFERENCES

- Chuang, S., & Tsai, C. (2004). Preferences toward the constructivist internet-based learning environments among high school students in taiwan. *Computers in Human Behavior*, 21(2), 255-272.
- Dewey, J. (1938). *Experience and education*. New York: Macmillan.
- Dewiyanti, S., Brand-Gruwel, S., Jochems, W., & Broers, N. J. (2004). Students' experiences with collaborative learning in asynchronous computer-supported collaborative learning environments. *Computers in Human Behavior*, 23(1), 496-514.
- Edelson, D., Pea, R., & Gomez, L. (1996). Constructivism in the collaboratory. In B. G. Wilson

- (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 151-164). Englewood Cliffs, NJ: Educational Technology Publications.
- George, S. E. (2001). Learning and the reflective journal in computer science. *Australian Computer Science Communications*, 24(1), 77-86.
- Jonassen, D. H. (1994). Thinking technology: Toward a constructivist design model. *Educational Technology*, 34(3), 34-37.
- Kashihara A., Kinshuk, Oppermann R., Rashev R., Simm H., & Toyoda J. (1998). Towards sharable intelligent assistance for learning-by-exploration. SIG Technical Notes in Japanese Society for Artificial Intelligence, SIG-IES9703, JSAI, (pp. 1-6)Shizuoka, Japan,.
- Katila, R. (2002). New product search overtime: Past ideas in their prime? *Academy of Management Journal*, 45(5), 995-1010.
- Koper, R. (2006). Current research in learning design. *Journal of Educational Technology & Society, International Forum of Educational Technology & Society*, 9(1), 13-22.
- Liaw, S.-S. (2005). Developing a web assisted knowledge construction system based on the approach of constructivist knowledge analysis of tasks. *Computers in Human Behavior* 21(1), 29-44.
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71-87.
- Moreno, L., Gonzalez, C., Castilla, I., Gonzalez, E., & Sigut, J. (2006). Applying a constructivist and collaborative methodological approach in engineering education, computers & Education, in press.
- Murphy, E. (1997). *Constructivist checklist*. retrieved August 18, 2005, from <http://www.stemnet.nf.ca/~elmurphy/emurphy/cle4.html>
- Ong, C.-S., Lai, J.-Y., & Wang, Y.-S. (2004). Factors affecting engineers' acceptance of synchronous e-learning systems in high-tech companies. *Information & Management*, 1(6), 795-804.
- Pan, W., & Hawryszkiewicz, I. (2004, December 5-8). A method of defining learning processes. In R. tkinson, C. McBeath, D. Jonas-Dwyer, & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference* (pp. 734-742). Perth,. <http://www.ascilite.org.au/conferences/perth04/procs/pan.html>
- Parker, J.R., & Becker, K. (2003). Measuring effectiveness of constructivist and behaviourist assignments. In CS102, Proceedings ITiCSE'03 ACM, (pp. 40-44).
- Piaget, J. (1960). *The child's conception of the world*. Totowa, NJ: Littlefield, Adams.
- Piaget, J. (1975). *The construction of reality in the child*. Ballantine Books.
- Pirolli, P., & Recker, M. (1994). Learning strategies and transfer in the domain of programming. *Cognition and Instruction*, 12(3), 235-275.
- Puntambekar, S. (2006). Analyzing collaborative interactions: Divergence, shared understanding and construction of knowledge. *Computers & Education*, 47(3) 332-351.
- Reiser, R. (2001). A history of instructional design and technology. Part 2: A history of instructional design. *Educational Technology, Research and Development*, 49(2), 57-67.
- Rieman, J. (1996). A field study of exploratory learning strategies. *ACM Transactions on computer-Human Interaction*, 3(3), 189-218.
- Scardamalia, M., & Bereiter, C. (1994). Computer support for knowledge building communities. *Journal of the Learning Sciences*, 3(3), 265-283.
- Shepherd, C. (2006). Objects of Interest. Retrieved from <http://www.fastrak-consulting.co.uk/tactix/Features/objects/objects.htm>.

The Influence of Constructivist E-learning System on Student Learning Outcomes

- Stager, G.S. (2001, July 7-25). *Constructionism as a high-tech intervention strategy for at-risk learners*. National Educational Computing Conference, Building on the Future 1. Chicago, IL
- Tynjala, P. (1999). Towards expert knowledge? A comparison between a constructivist and traditional learning environment in the university. *International Journal of Educational Research* 31(5), 357-442.
- Van Merriënboer, J. J. G., & Paas, F. (2003). Powerful learning and the many faces of instructional design: Towards a framework for the design of powerful learning environments. In E. De Corte, L. Verschaffel, N. Enstwestle, & J. J. G. Van merriënboer Eds.), *Powerful learning environments: Unravelling basic components and dimensions*. Oxford: Elsevier Science.
- Vygotsky, L. S. (1978). *Mind in society: The development of the higher psychological processes*(Cambridge , MA: Harvard University Press).
- Wang, A. Y., & Newlin, M. H. (2000). Characteristics of students who enroll and succeed in psychology web-based courses. *Journal of Educational Psychology*, 92,137-143.
- Yamane, T. (1973). *Statistics: An introductory analysis*, (3rd Ed.). New York, NY:Harper & Row.
- Yli-Renko, H., Autio, E., & Sapienza, H. J. (2001). Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal*, 22(6-7), 587-613.
- Yu, D., Zhang, W., & Chen, X. (2006). New generation of e-learning technologies. In *proceedings of the First International Multi-Symposiums on Computer and Computational Sciences (IMSCCS'06)*.
- Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker, J. F. Jr. (2005). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information Management*, 43 (1), 15-27.
- Zualkernan, I. A. (2006). A framework and a methodology for developing authentic constructivist e-Learning environments. *Educational Technology & Society*, 9 (2), 198-212.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 4, edited by L. A. Tomei, pp. 21-33, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.40

A Wireless Networking Curriculum Model for Network Engineering Technology Programs

Raymond A. Hansen
Purdue University, USA

Anthony H. Smith
Purdue University, USA

Julie R. Mariga
Purdue University, USA

ABSTRACT

Wireless networking is experiencing explosive growth, both in market size and the number of new standards and technologies. Effectively educating students, both at the undergraduate and graduate level, with the abilities to evaluate, implement, and integrate wireless networks should be a key part of any information technology (IT) education program for the foreseeable future. The Computer & Information Technology Department (CIT) at Purdue University is in a unique position to fulfill this educational need

through its wireless networking curriculum. This curriculum currently offers three courses within the network engineering technology program, covering topics from 802.11 networking to 3G cellular, wireless network security and management to WWAN technologies. Each course includes trend analysis of wireless networking in order to effectively prepare students for employment in this area. This paper discusses the existing wireless networking curriculum by providing a brief perspective of previous course content and detailing each current course in the areas of prerequisite knowledge, intended audience, course content, and lecture/laboratory integration.

BACKGROUND AND HISTORY

Constant analysis of material presented in a course is critical for its success. As a market evolves, it is important to monitor, report, and reflect those changes through the course material. In this instance, the explosion of the wireless networking sector provided a wealth of new information. The wireless networking industry has a historical growth rate greater than 10% per year and grew by nearly 15% in 2005. Additionally, the market is expected to increase an additional 35% by the year 2010 in the United States alone (*Wireless Telecommunication Services Industry Profile, 2006*). Since wireless networking has experienced and continues to experience tremendous growth, it was important that the CIT department analyze the existing wireless networking course being offered.

The CIT department currently offers two baccalaureate degrees. The first is a BS in information systems technology (IST) and the second degree offering is a BS in network engineering technology (NET). Each of these degrees accounts for roughly half of the student population of the department, which is currently at 550 students. Additionally, there are several areas of specialization within each degree that allow students to concentrate their studies on a specific focus within the IT field. This breakdown can be seen in below. The students who are progressing towards a BS in NET are the primary audience of the courses detailed in this paper.

In 2002, there was only one course being taught that covered wireless technologies. This course, however, concentrated heavily on wireless communications instead of wireless networking technologies. The course relied heavily on the mathematics and science behind signal propagation and the radio interface, as well as the standards and working groups of the telecommunications industry. While these fundamentals are important for students to understand (Reisman, 2005), a movement towards the applications of these

fundamentals to businesses and industries was needed (Goscinski et al., 2005). Additionally, the laboratory component had very little correlation to the material presented in lecture. The laboratory objectives that the students were completing were not sufficient in providing a solid understanding of wireless networking, and it was not supplying them with the information and knowledge of the emerging technologies of the time. The desire was to move the course away from a largely signal engineering-based course to a network engineering course, in order to equip the students with the necessary knowledge and experience for the current wireless network environment.

The original course has been modified and is now the first of three wireless networking courses that are taught in the CIT department. It is listed as CIT 346—Wireless Networks and is offered as a junior-level course. CIT 346 now provides the fundamentals of 802.11-based wireless networks, basic signaling, and modulation technologies and the importance of proper network design and implementation. Also, the laboratory component is tied directly to the material presented in lecture. The laboratory experience also has been improved by explicitly stating assignment objectives (what tasks are to be accomplished) and requiring responses to “knowledge items” (what knowledge should be gained by accomplishing the specified tasks). This requires each student to be able to directly apply material covered during the lecture to the specific tasks performed during the weekly laboratory assignments. For example, in one laboratory assignment, students are to build a multi-access point wireless network and perform a seamless handoff from one AP to another AP, using a client device, while a second client device runs frame/packet capture software to record the traffic. The “knowledge item” for this exercise is for each student to be able to identify the frames required to successfully complete the handoff and be able to discuss their ordering and what function each frame performs. This exercise ties directly to the lecture material concerning 802.11

Figure 1. CIT degrees and specializations

| | | |
|--------------------------------|---|---|
| | CIT | |
| B.S. Degrees | IST | NET |
| Areas of Specialization | Database Administration Systems Integration Application Development | Wireless Networking Network Security & Forensics |

framing and provides reinforcement on this topic to the student.

An additional undergraduate course was created to concentrate on the topics of wireless network security and management. This course is listed as CIT 499—Advanced Wireless Network Security and Management and is offered to students with a senior-class standing who have successfully completed CIT 346. This 400-level course allows students to focus entirely on topics of wireless security and management, which include focus areas in current security standards, thwarting attacks, and equipment vulnerability testing. This course also presents additional information concerning wireless network management and security techniques. The laboratory portion of the wireless network security and management course allows students to gain valuable experience and knowledge on securing and managing enterprise-class wireless networks by finding flaws and vulnerabilities. The laboratory objectives are defined in such a way as to direct students towards a solution without giving them detailed instructions on how to complete a task. Similar to the CIT 346 laboratory, the CIT 499 laboratory uses “knowledge items” to ensure students are able to directly apply lecture materials to laboratory experience.

Lastly, the CIT department offers a graduate-level course that concentrates on cellular and wireless wide area networking (WWAN) tech-

nologies. This course is listed as CIT 581—Topics in Advanced Wireless Networking and is offered to graduate students and senior-level students. This course examines the evolution of cellular networks in both the United States and abroad, in addition to discussing the emerging WWAN standards and technologies of 802.16 and 802.20. These topics cover approximately half of the semester. Students are required to perform research on a wireless topic that interests them and then present their research/findings to the class. This includes a 15-20 page publication-quality paper as well as a 30-minute presentation and the subsequent discussion.

The creation of the graduate-level course has enabled the creation of the WWAN laboratory on the roof of Knoy Hall of Technology. This WWAN laboratory was begun as a simple wireless backhaul evaluation scenario and quickly grew to an environment for testing and evaluating many different WWAN technologies. The laboratory is ideally suited for testing many different scenarios, due to the diverse landscape surrounding the university. These scenarios include “extending the enterprise,” which utilizes the equipment to replace the wired wide area infrastructure of an organization, to providing rural broadband wireless access, and more. The WWAN laboratory allows the students of the CIT 581 class to complete a semester project that integrates the material covered in the lectures with a hands-on approach to WWAN designs and implementations. This hands-on study also allows students to compare characteristics, such as security, throughput, quality of service (QoS), and reliability, of equipment from different vendor.

What does the future hold for the wireless network curriculum in CIT? It will certainly include the continual examination of the emerging technologies in each of these areas and applying those new technologies to the curriculum to keep students on the leading edge. The future also will include the development of an additional undergraduate course that will concentrate on

the emerging network capabilities of radio frequency identification (RFID), Bluetooth, and wireless mesh networks. This emerging course will include identifying the specific requirements of the micro-sized networks of RFID and Bluetooth, in addition to detailing the LAN and WAN capabilities and interactions of meshed and grid networks and how they differ in function, applicable standards, and performance.

Courses

The following is a discussion of the existing wireless networking courses offered by the Department of Computer and Information Technology in the Network Engineering Technology area of specialization.

CIT 346—Wireless Networking

Prerequisite Knowledge

In order to fully understand the concepts presented in CIT 346, there are two courses that are needed to ensure the student will have a solid foundation of knowledge to build upon. The first prerequisite is the successful completion of CIT 330—Local Area Networking and Systems Administration. This course provides the framework for understanding how LANs function and provides an introduction to systems administration techniques. The second prerequisite is the successful completion of ECET 374—Digital Telecommunications offered by the electrical and computer engineering technology department solely for the CIT's NET specialization. This course provides an introduction to the signaling characteristics, modulation techniques, multiplexing, and appropriate protocols and standards of digital communications. ECET 374 requires the completion of two calculus courses and one statistics course, which are second-tier prerequisites for CIT 346.

Audience

This is a 300-level undergraduate level course for students in the Computer & Information Technology Department, majoring in Network Engineering Technology (NET), who have an interest in the expanding field of wireless networking. CIT 346 assumes no formal education in wireless communications or networking systems. This course is available as an elective for Electrical and Computer Engineering Technology students who have fulfilled the specified prerequisites.

Course Concepts

CIT 346 focuses primarily on the area of wireless local area networks (WLAN). The course initially introduces students to wireless principles, behavior, and theory, propagation patterns of various antennas, performance, and coverage differences between the various standards (e.g., 802.11a, b, and g) as well as basic network architecture. With this basic framework, the course moves to the topics of wire-line network integration, large-scale wireless network design, and wireless network security and management. The course ends with an introduction to cellular technologies. The following list briefly details the progress of CIT 346 through the semester, starting with week one and finishing with week 16.

- Course introduction and overview
- 802.11 MAC
- 802.11 framing
- 802.11 management operations
- WLAN communications
- Basic RF and antennas
- Site survey and deployment analysis
- 802.11 PHYs
- WLAN security and management
- 802.11a and 802.11g
- WLAN challenges, troubleshooting, trends, and future standards

- Introduction to cellular concepts
- GSM, GPRS, and EDGE
- CDMA technologies
- Other WWAN technologies

The laboratory portion of CIT 346 is vital to the success of the students. The laboratory objectives are structured to reinforce the information presented in the lectures by allowing the student to directly observe and interact with equipment to reach a defined set of objectives. The following list shows the topics covered in the CIT 346 laboratory.

- WLAN fundamentals
- Roaming and handoff
- Antenna diversity
- Site survey techniques
- Basic WLAN security
- Network design recommendations
- WLAN management
- WLAN integration

Figure 2 shows the progress of material presented and the correlation between lecture and laboratory materials for CIT 346.

Advanced Wireless Network Security & Management—CIT 499

Prerequisite Knowledge

In order for the student to be able to fully grasp the material presented in lecture and lab, there are

two prerequisite courses for this undergraduate course. First is the successful completion of CIT 346. This course provides the foundation information of how wireless networks operate and provides an introduction to the security and management concepts that will be detailed in CIT 499. Second, the successful completion of CIT 343—Advanced Systems & Network Administration is mandatory. CIT 343 expands on the systems administration knowledge gained in CIT 330 and provides the students with hands-on knowledge of the UNIX and Linux operating systems. This knowledge is vital to the success of the student in the Advanced Wireless Security & Management course because a majority of the tools and utilities used in the laboratory are Linux/UNIX based.

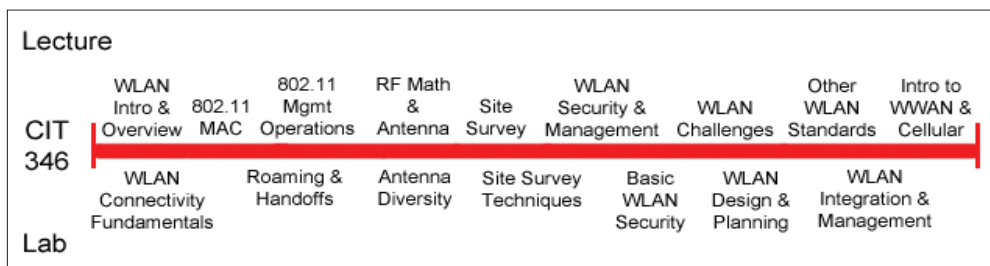
Audience

This course is a 400-level undergraduate course that expands on the security and management topics that were briefly covered in CIT 346. CIT 499 assumes that students fully understand signaling and RF basics, as well as the operations of WLANs as covered in CIT 346. CIT 499 is also available to graduate students who have an interest in the security and management topics involved with operating and maintaining a wireless network in an enterprise environment.

Course Concepts

CIT 499 concentrates on the security and management of WLANs. It starts with a short review of

Figure 2. CIT 346 course topic timeline



details from CIT 346 and then immediately delves into the security issues of current WLAN installations. This initial material exposes the inherent lack of security in all wireless systems and then discusses techniques to mitigate those risks. The course then moves to WLAN design and other management fundamentals. The following list shows the basic concepts covered in CIT 499.

- 802.11, basic RF review, and security models
- Antenna design
- WLAN vulnerabilities
- WPA
- 802.11i/WPA2
- EAP protocol and methods
- Authentication servers
- Encryption and key management
- Auditing WLAN/WWAN
- WLAN/WWAN design fundamentals
- WLAN/WWAN policies
- Wireless management standards and protocols
- WLAN, WWAN, and cellular integration
- Legislation concerning wireless networks and communications

The laboratory portion of CIT 499 gives students hands-on experience in the topics covered in the lectures. The objectives of the laboratory assignments are designed to give the students the basic skill set to design, secure, protect, and manage an enterprise wireless network. These labora-

tory exercises correspond to the topics covered in lectures and are shown in the following list.

- Intrusion techniques
- WEP vulnerabilities
- EAP method performance
- EAP method vulnerabilities
- WLAN VPN/WPA/802.11i performance evaluations
- WLAN/LAN integration and monitoring

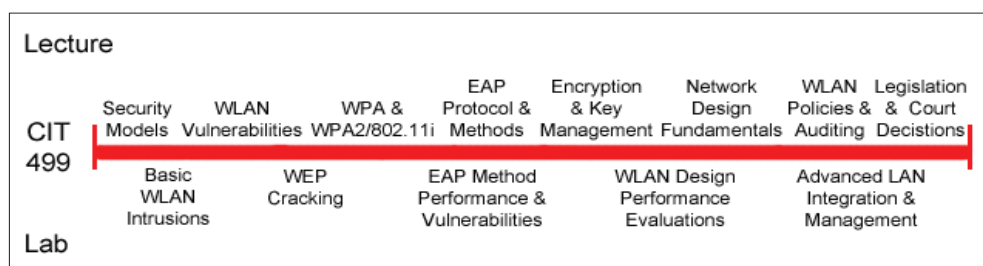
Figure 3 shows the progress of material presented and the correlation between lecture and laboratory materials for CIT 499.

Selected Topics in Advanced Wireless Networking—CIT 581

Prerequisite Knowledge

In order for the student to be able to contribute to the in-class discussions in CIT 581, there are several prerequisites that must be satisfied prior to enrollment in this course. First, a basic understanding of RF and wireless fundamentals is assumed. In addition, it is assumed that students are knowledgeable of IT, in general, and possess an in-depth knowledge of telecommunications and networking. This usually means the successful completion of CIT 346. This course is intended primarily for graduate students, but a select number of senior-level students are allowed to enroll, if they meet two criteria. They must earn

Figure 3. CIT 499 course topic timeline



an overall grade of 80% or higher in CIT 346, and they must receive the signature of the professor indicating that they are aware they must perform at the graduate-student level.

Audience

This is a graduate-level course for students interested in advancements in selected topics of wireless communication systems. CIT 581 may be a selective for students from undergraduate majors in the CIT department, provided they meet the prerequisite requirements.

Course Concepts

CIT 581 concentrates on the cellular industry and its technologies as well as incumbent and emerging WWAN technologies. The course begins with an introduction to cellular systems and their evolution, which leads into discussions on cellular concepts and standards, such as PCS, GSM, and cdma2000. CIT 581 then covers the emerging 802.16 and 802.20 technologies and standards. This portion of the course lasts for approximately eight weeks. The following list shows the topics covered during the initial portion of CIT 581.

- Introduction to cellular technologies and fundamentals
- PCS
- GSM
- GPRS
- EDGE
- cdma2000 & cdmaOne
- EV-DO and EV-DV
- 802.16 & 802.20
- 4G definitions
- Link viability determination

The remainder of the semester is used by students to make presentations on areas and topics they have individually researched. The information presented by each student corresponds to

a 15-20 page publication-quality paper that is submitted to the professor for evaluation. The topics that are presented by the students change each semester as students choose topics that appeal to their interests within the framework of the course. Previous topics that have been presented by students are shown in the following list:

- high-speed handoffs in wireless data networks,
- location-aware wireless devices and applications,
- the feasibility of municipal-provided wireless networks,
- free space optics, and
- RFID applications and challenges.

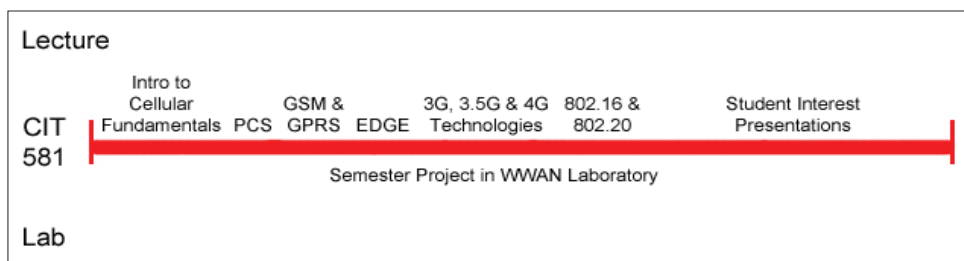
Students apply lecture material to real-world situations through use of the Knoy Hall WWAN laboratory. This allows students to operate and evaluate many different types of WWAN equipment in a diverse set of circumstances. Previous projects have included point-to-point link evaluations, wireless Internet service provider (ISP) simulations, and WWAN integration into an enterprise LAN/WAN.

Figure 4 shows the progress of lectures and student presentation topics throughout the semester for CIT 581 and the corresponding semester project.

SUMMARY

The CIT department at Purdue University offers three courses in the wireless networking field. These courses have been designed to provide students with an appropriate amount of detailed information and hands-on knowledge to benefit them in the workplace. Each of these three courses in wireless networking emphasizes a specific area within that field. CIT 346 covers the introduction to wireless networking and concentrates on wireless local area network technologies. CIT 499 covers

Figure 4. CIT 581 course topic timeline



detailed topics on wireless network security and management in both local and wide area networks. CIT 581 introduces and examines cellular and other wireless wide area network technologies. Each of these courses utilizes a laboratory component to provide hands-on experience with the material covered in lectures. The future of the wireless curriculum is certain to expand through continual examination of emerging technologies and expansion of existing technologies.

REFERENCES

Goscinski, A., Campbell, M., Dew, R., Horan, P., Newlands, D., Rough, J., et al. (2005). An IT bachelor degree using modern technologies to illustrate core concepts and principles and building generic skills, education and information technologies. *Education and Information Technologies*, 10(4), 361-379.

Datamonitor (2006). Wireless telecommunication services industry profile: United States (June, 2006). London, UK: Datamonitor Plc. Retrieved July 26, 2006, from Business Source Premier database <http://search.ebscohost.com/login.aspx?direct=true&db=guh&AN=21655539&site=bsi-live>

Reisman, S. (2005). Quality IT education strikes out. *IT Professional*, 7(3), 16-17.

Wireless Telecommunication Services in the United States: Industry Profile. (2006). *Wireless Telecommunication services industry profile: United States, 1-19*. Retrieved July 26, 2006, from Business Source Premier database.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 2, edited by L. A. Tomei, pp. 51-59, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.41

Agent-Based Architecture of a Distributed Laboratory System

Hong Lin

University of Houston-Downtown, USA

ABSTRACT

We present a method for designing the architecture of an agent-based e-educational system. We demonstrate the effectiveness of our method by its application in the design of a computational grid built to be an environment for lab activities. An integrated lab package was developed to allow students to utilize the grid services and support the learning process. Our architectural design strategy ensures an outstanding feature of the system: It allows lab modules to be added into the system in an incremental fashion while ensuring the correctness of the system. Students are recruited in our research program to develop lab modules and build the grid. Initial use of the lab package indicates that it allows lab activities to be performed more efficiently and it enhances the learning effectiveness.

INTRODUCTION

Agent-oriented design has become one of the most active areas in the field of software engineering. The agent concept provides a focal point for accountability and responsibility for coping with the complexity of software systems both during design and execution (Yu, 2001). Such a complex system typically cannot utilize the central control strategy, because it consists of loosely coupled self-contained functional units, each with its own mentality and behavior, because they are designed to deliver different services to different groups of clients. This brings unprecedented challenge to software engineering, because the design of such a system must ensure correct interaction among the functional units as well as correct implementation of each unit, probably running on different platforms. The emergence of intelligent agent conceptualization brings forth a modeling

tool deemed to be effective in coping with the issues in developing large-scale distributed systems (Paquette, 2001). In this approach, a distributed system is modeled as a set of autonomous, cooperating agents that communicate intelligently with one another, and interact with human users at the right time with the right information.

A distributed learning system is a typical complex distributed system that involves many dynamically interacting educational components, each with its own goals and needs for resources while engaged in complex coordination. It is very difficult to develop a system that could meet all the requirements for every level of educational hierarchy, since no single designer of such a complex system can have full knowledge and control of the system. In addition, these systems have to be scalable and accommodate networking, computing and software facilities that support a large number of simultaneous users concurrently working and communicating with one another (Vouk, Bitzer & Klevans, 1999). A special challenge in the design of an educational system is that it must be modular while having a distributed nature. Modularity is required so the system can be scaled to accommodate multiple course modules. In this article, we discuss the design of an online learning system that supports laboratory activities for computer science curriculum. The laboratory is performed in an educational grid. We use a multi-agent system (MAS) to design an infrastructure that allows for incremental development of lab modules.

We have studied the implementation of Collaborative Agent System Architecture (CASA) (Flores, Kremer & Norrie, 2001) with the chemical reaction model (CRM) (Banâtre, Fradet & Radenac, 2004, 2005a, 2005b). CASA can catch the interactive and dynamic nature of e-learning systems. Our research results are published in Lin (2005) and Lin and Yang (2006a). Following our existing work on the design methodology of MAS, we exploit this methodology in a project that aims at a grid for laboratory use in under-

graduate education. The new method will provide a solution to current problems in the design of a comprehensive environment to support lab activities in teaching courses on parallel/distributed systems and networks. Although great efforts have been put in the development of software lab packages (for example, the Phil_2000 lab package for introductory computer science courses), most of the labs are still ad hoc activities. Without a central controlling model, available computing resources cannot be effectively utilized. In addition, teachers and students may be discouraged to explore the use of advanced labs to enhance learning effectiveness, because they often have to repeat the same scenarios inefficiently in different labs due to lack of an integrated lab package. The unified model in chemistry-inspired languages will enable formal specification of an evolving system and provide a framework for top-down design of the entire system (Banâtre, Fradet & Radenac, 2004; Lin & Yang, 2006a, 2006b). This design strategy will lead to an architecture that enables incorporating lab modules into the lab package in an incremental fashion.

The organization of this article is as follows. Next, we will give some background that initiated our research project. Then, we articulate the design goal, design ontology and architecture of the designed system. A showcase is described, and the implications of the lab package to the education are discussed afterwards. Then, we discuss some related works and compare our system to other e-learning systems in the literature. Finally, we give concluding remarks and discuss the future works.

BACKGROUND

With the fast innovation of computer and communication technologies, computer curriculum is being adapted to accommodate teaching modules that enhance teaching effectiveness by utilizing frontier technologies. Apart from traditional

computer science curricula, information technology (IT) curricula strive to equip students with modern computer technologies defined by the current industrial desires. The Department of Computer and Mathematical Sciences (CMS) at the University of Houston-Downtown (UHD) is augmenting its computer science curriculum by an IT track. One of the most important parts of this project is designing labs that can be performed through the Internet. Our first step is implementing lab packages for our parallel computing and computer-networking courses in a grid that encompasses lab facilities centered at a Beowulf cluster. We will then extend our lab environment to include other computer science and mathematical courses.

The challenge we face, however, is that we need to build an infrastructure that will accommodate multiple courses in different disciplines. The main problems we are solving are: 1) to define an interface extensible to incorporate more lab modules and customizable to different course structures; and 2) to establish a computational backbone that provides services for various lab activities, such as testing a parallel program, producing network phenomena and analyzing performance. Performing these activities requires coordination among multiple nodes. The architecture of the system requires extensibility and scalability to accommodate multiple course modules.

To address the first problem, we follow the practice we had when we built the lab package for our introductory computer science course. One of the outstanding features of this package is a lab explorer that allows students to browse through lab activities. Another feature is click buttons, which invoke programs through the interface. We adopt the same structure in the lab package we designed for our parallel computing and networking courses.

To address the second problem, we need to build an array of servers that run on a computational grid. A grid is a system of networked computing and storage sources (see *Grid.org*) that allows the

sharing of information and computational powers. The grid is also a platform on which experiments of distributed data processing and computation can be exercised. Services are provided by different nodes of the grid. The design of the grid must meet certain criteria so the incorporation of any unit fits into the long-term blueprint. For example, as mentioned, the underlying infrastructure must support incremental and dynamic addition of lab exercises into the lab package. This is to support ongoing construction of closed labs for courses in parallel computing, computer networking and other courses (Lin & Nguyen, 2005). On the other hand, however, the complexity of the system makes the design of its infrastructure difficult. Our existing research results suggest that the agent model is a powerful tool to solve problems in a distributed system. Therefore, we use agent technology to build the architecture of the grid to manage the coordination and communication among the nodes and handle load balancing issues. We envision that our practice will provide a solution to the problem of immersing current technologies into educational efforts.

THE PROJECT

Goals and Objectives

The barrier in front of us is the integration of various networking technologies into one client/server model to provide a uniform lab environment for different lab activities. Given the targeted use of this solution, we need to define and implement the infrastructure that balances functionality and reliability. This leads to development of an educational grid, which is an integrated environment for resource management, lab module development and lab activity support. The architectural design of the grid should focus on system topology, interactions among system units and dynamic features of the system, without involving proprietary platform information, such as the operating systems

on individual nodes, programming languages for program units and vendor-specific machine features. With MAS modeling, interfaces among system units will be formally specified, and design and deployment of each functional unit, such as a lab module, will not affect other units or cause any revision on the overall system.

As described above, an agent system provides an architectural model for a distributed networking system. As an active research area, the study in agent technology strives to apply intelligent information-processing technologies to complex software systems. Features of an agent system have been summarized in the literature. For example, according to Griss and Pour (2001), an agent shows a combination of a number of these characteristics: autonomy, adaptability, knowledge, mobility, collaboration and persistence. These features exist in different types of MAS, such as collaborative agents, interface agents, reactive agents, mobile agents, information agents, heterogeneous agents and economic agents (Weiss, 2003). The chemical reaction model is a high-level computational model that makes the minimum assumptions on the underlying computing platforms. It has no artificial sequentiality and it has higher-order program composition operations. It can specify the dynamic features of an MAS succinctly without involving any assumptions on proprietary computing platforms. This article focuses on the architectural design of the agent-enabled grid, the integrated laboratory and their impact on the education. We omit technical details about the chemical reaction model (Interested readers can refer to our publications for explanations of our methods). In Lin (2005), a sequence of case studies shows that features of various agent systems can be grasped by the chemical reaction model succinctly. In Lin and Yang (2006a, 2006b), we give comprehensive examples of specifying a course material maintenance system using the chemical reaction model. In addition, part of our work in constructing the cluster is presented in Lin and Nguyen (2005).

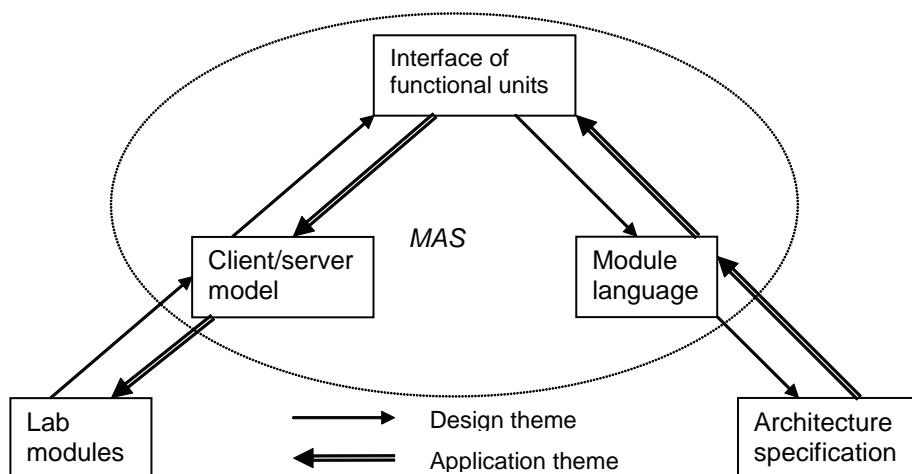
The Design

The project includes a sequence of major steps: grid construction, lab design, client/server model definition, the definition of the interface of functional units and the agent-based architecture construction. Our plan can be described as a pyramid-shaped model, illustrated in Figure 1.

The system is designed using a bottom-up strategy (the Design Theme). We constructed the grid and design lab modules using existing toolkits: Globus Toolkit 4, Java and Apache Server. The services provided by the system are implemented in client/server architecture. A Java-based user interface delivers the services on the Web. A master server forms a gateway to re-direct client requests to other servers. Multiple servers interact with one another through formally defined interfaces to cooperate in fulfilling client requests. In our system, all functional units, including servers, are modeled as an agent. Each agent is then designed in the module language we have proposed for specifying MAS (Lin & Yang, 2006a). The overall system is specified in the chemical reaction model. In Figure 1, we can see the MAS is the conceptual model for implementing grid services, and the interfaces of functional units define the interaction among functional units and are the central part of the agent system. The interface also separates the architectural design from the design of individual functional units.

Adding/deleting services or features in the grid can be done in a top-down strategy (the Application Theme). If a service of a new type is to be added into the system, for example, it is added into the architectural specification. Through an automatic transformation procedure (Lin & Yang, 2006a), the specification is re-written into an MAS in the module language. The actual program that codes the services is then incorporated into the system through the standard interface. Therefore, updating services or lab exercises in the system will not cause any changes in other parts of the

Figure 1. The pyramid model of the project



system, and correctness and reliability of the system can be ensured to the maximum extent.

In the following sections, we give more detailed descriptions of the steps in the design theme.

The Grid

In creating a computing environment suitable for running programs in different disciplines involving distributed processing, we construct a Beowulf cluster and create a grid node from this Beowulf cluster with bus-based communication connectivity and use it as a dedicated computing resource and platform for experimenting parallel computations with regular communication patterns. This makes experiments on various network topologies feasible and, therefore, allows us to evaluate parallel programs on different architectures. The grid is then built by incorporating networked classroom computers using Globus Toolkit 4 software. The grid uses the most prevailing networking technology so that the labs designed for the computer networking course will give the students an image of the operations in the real-world networks. The cluster is virtually incorporated into the grid to provide a platform for experimenting operations in parallel computing and networking, such as dynamic

load balancing, non-uniform memory access and dynamic routing in networks. One of the nodes of the cluster is configured as the master node, which runs the master server. The master server coordinates the services provided by servers on various nodes of the cluster. The Web server with the graphical user interface (GUI) of the lab will run on an up-front Windows machine and the Web server communicates with the master server for any services.

The Lab Package

We set the criteria that guide the development of lab package to achieve effective utilization in teaching the concepts in parallel computing, grid computing and networks. The lab design plays an important part in the system, because it is used as the target application of the methods we are developing. The comprehensive lab package runs on the grid. The lab package includes an interface, written in Java Applets to allow Web access, and a stack of servers running in the background (mainly on cluster nodes) to incorporate services into a unified environment. We have implemented two labs in the above Java framework and will continue to develop more labs. These labs will be used to investigate client/server computing model

and interfaces of functional units, which are the foundations of our multi-phase architectural design methodology. The targeted versatility of our lab package requires the following features:

- **Scalability:** We can add new nodes into the grid or delete nodes from the grid.
- **Extensibility:** The design of the lab environment should make it possible to incorporate other software packages to enhance the functionality.
- **Customizability:** Object-oriented design of the architecture and standardized interfaces of objects should ease lab composition.
- **Accessibility:** The lab software should create an interface for users to control node activities through the Web browser.
- **Robustness:** The client-side component of the lab software should ensure the correctness of the program before loading it onto the grid for execution.

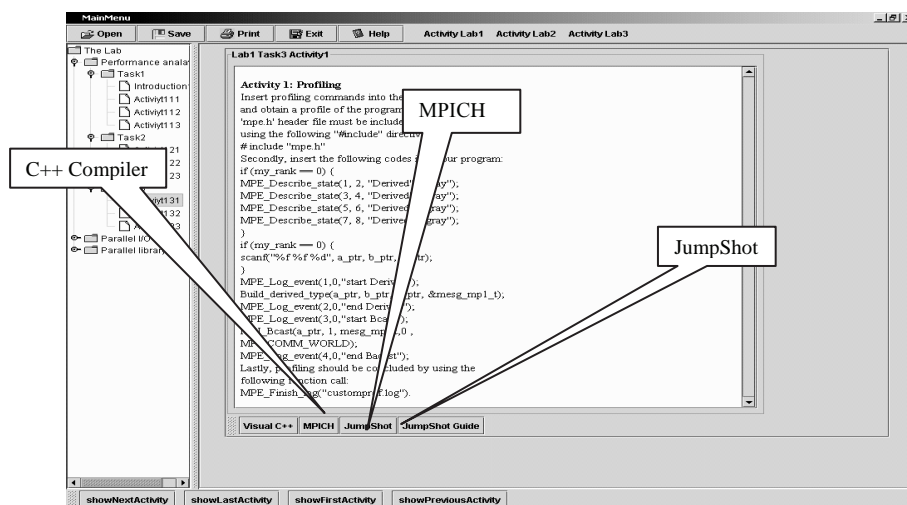
These features impose special requirements on the client/server computing model for delivering services.

Client/Server Model Definition

Each service is implemented in a client/server model. Servers are running in cluster nodes. Different servers may run on different nodes to achieve load balancing. Services are ordered by clicking a button on the user interface. For example, Figure 2 shows a snapshot when a parallel program is loaded onto the cluster. Three buttons are displayed on the bottom of a text window to allow the compilation, execution and profiling of the program.

Since all lab activities are performed in the client/server model, a master server is designed to act as a backbone of the whole lab architecture. Auxiliary servers are designed to perform various network activities, such as database searches, data encryption/decryption and address translation, and are deployed in different nodes in the grid. The lab software allows the students to start, monitor and terminate a program on any particular node of the grid. With this feature, students can experiment service configurations in a distributed system and examine how network features affect the performance of the system. An incorporated node manager provides the students, via GUI, a list of available nodes in the grid where they can

Figure 2. Starting servers through the interface



select a set of nodes for running the program. A separate window can be opened for each node to monitor the activities ongoing on the particular node. Figure 3 shows a snapshot of the node manager. Once a node is selected from the dropdown menu (on the lower left side), a pop-up window (in the center) is displayed to allow configuration of services and monitoring of activities carried out by the servers. Configuration of services on a node is done by clicking the toggle buttons. For security reasons, all services are predefined.

Interfaces of Functional Units

Functional units of the system include servers, clients and resources. Resources in our system are self-contained functional units that serve as information sources. For example, a database is wrapped by an agent that provides basic data storage and retrieve services. Standard interfaces of functional units allow modular design and incorporation of the system and allow information sharing.

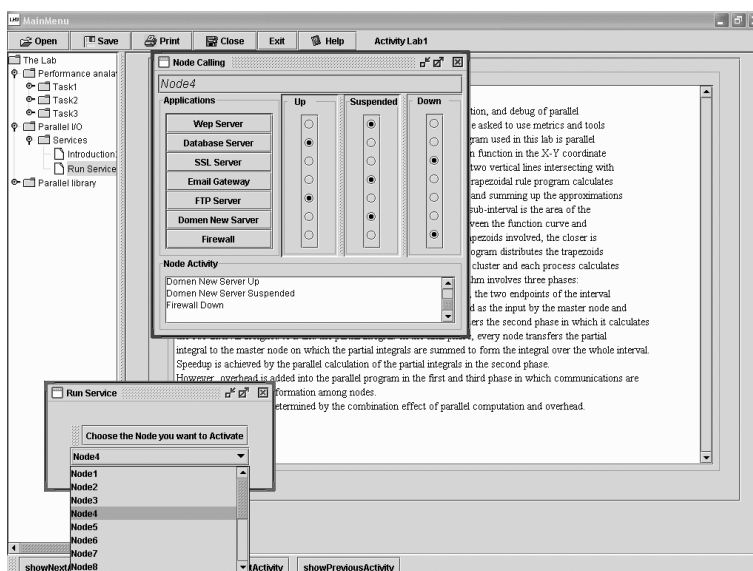
Given the complexity of the system, the definition of interfaces of agents is a critical part of

the system design. The interfaces are defined in the computation model that supports the chemistry-inspired languages, which are employed to specify the agent-based system architecture and facilitate a transformational method to implement the system (Lin, 2005; Lin & Yang, 2006a).

A SHOWCASE

We have laid out a list of labs for our parallel computing and networking courses that have been chosen as the first test-bed of our system. These labs are carefully designed based on the goals of the course set forth in its syllabus and our teaching experience. Lab topics are either typical topics of the area or problems tackled within the course projects. The lab design emphasizes the operability and vividness as well as the manifestation of the basic concepts and typical technologies. We also address the role played by the cluster when we design the labs. For example, one lab allows students to analyze the performance of a parallel program on the cluster. This lab aims to help students understand the metrics studied in the classes

Figure 3. A snapshot of the node manager



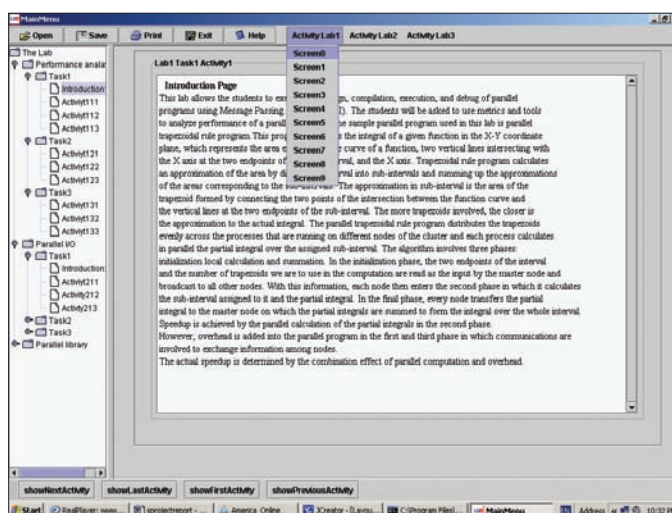
— that is, speedup and efficiency — to measure the performance of a parallel program. Other labs are designed to help students understand the topology of the connection in a distributed system, the use of collective communication operations in scientific programming, the concept of communicators that facilitates structured communications in Message Passage Interference (MPI), the load balancing techniques in combinatorial search and so forth. In the following, we describe the scenario of the lab on the performance analysis of a parallel program.

This lab allows students to use standard metrics to analyze the performance of a parallel program. The students predict the performance of the parallel program they choose, load the program onto the cluster, compile and run the program, and then compare the predicted results to the experimental results. As illustrated in Figure 4, one lab session is organized in a series of tasks and each task into a series of activities. In this lab, students study some standard measurement criteria —that is, speedup and efficiency — for performance analysis of parallel algorithms in Task 1 Activities 1 and 2, and predict the speedup and efficiency of the chosen program given the size of the problem input and the number of nodes

in Activity 3. Task 2 requires the students to load the chosen program onto the cluster and then compile the code. The students can click on the C++ Compiler button at the bottom of the page to compile the code once the loading is finished. Task 2 Activity 1 walks the students through the program loading process; Activity 2 asks students to compile the code. The code is then checked in Activity 3 by a program to ensure its correctness. Erroneous code causes the students to be asked to correct the code until it is errorless. In Task 3, students can analyze the experimental performance of the program by using MPICH JumpShot profiling software and compare the experimental results to the theoretical predicts done in Task 1. In Activity 1, students are required to insert profiling commands into the program and obtain a profile of the program by running it. In Activity 2, students start up the JumpShot program from the program menu to obtain a Gantt chart of the program. The students then calculate the actual performance data by using the logged timing data, and compare the experimental results to the predicted. This is done in Activity 3.

Figure 5 shows some snapshots of the lab activities. Figure 5(a) shows the window that takes the student’s responses to performance

Figure 4. The main window of the lab platform

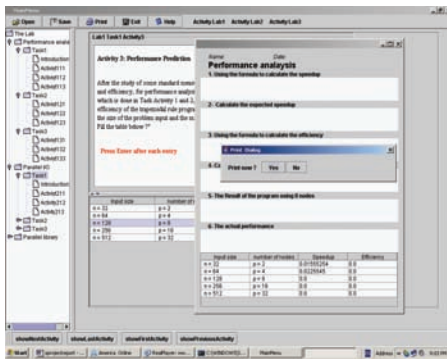


prediction questions. Figure 5(b) shows the moment when the student opens a program through a dialog window and monitors the execution of the program through a pop-up window. Figure 5(c) shows a text window in which the student adds profiling statements into the program.

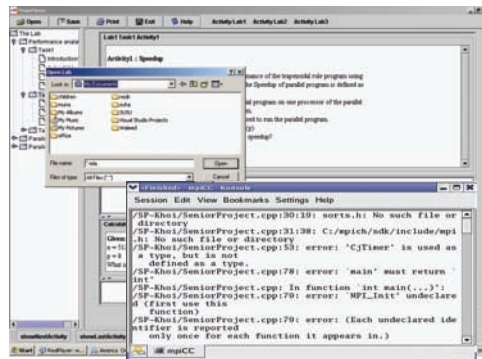
It would be useful to review the problems a teacher may encounter in the teaching process and how the system addresses these problems. Performance analysis of parallel programs is a typical topic of a parallel computing course. An experiment on performance analysis involves the use of several tools; that is, the compiler of parallel programs, a host file to select nodes to run the program, the shell command to execute the program and a profiling program to perform a posteriori analysis. Without an integrated platform, students often spend a lot of time probing the use of these tools instead of focusing on the problem to solve. In addition, since the students

must handle the aspects of the experiment piece by piece, they are given unnecessary access right to the system resources. In our system, all lab activities are performed through a uniform interface and jobs are handled by the client/server execution model. Although students do not access the grid directly, the tools to use are available through the client interface (accessibility). On the other hand, students can only run programs allowed through the interface. This reduces the chances for them to run malicious or malfunctioning programs (robustness). The teachers are given the authority to incorporate a different set of programs into a different lab module (extensibility). A dynamically computed master host list contains the currently available nodes in the grid. The students can choose to use the master host list as the default or form their own host list to test their programs (scalability).

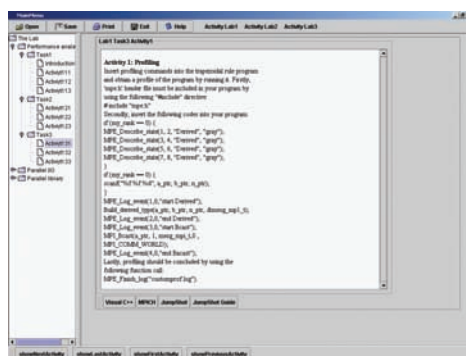
Figure 5. Snapshots of lab – performance



a. Performance prediction



b. Compilation and execution



Perhaps the first benefit brought forth by this system is time efficiency in general. It typically took a whole class meeting for the students to do a closed lab. Except for those well-prepared students — for example, those with prior experience — the students spent a large portion of their time in learning how to use the tools. A lot of students were not able to finish the labs in the end of the class session and had to take the labs as their homework. With the integrated toolkit, the students can basically follow the instructor through the whole lab in one class session. The reason for this is that the software helps the students focus on the main theme of the lab and exempt them from taking care of unnecessary details. For example, when compiling or running an MPI program, the students no longer need to know what command to use and what command options to use. Time efficiency is especially important for a minority serving institution (MSI) such as UHD, which has limited resources and a student body of diverse academic preparations.

It is notable that the lab package makes feasible a lot of experiments that were not easy previously. With the integrated lab platform, it is fairly easy to repeat the experiment without switching between platforms. A problem that recurred frequently in this lab is use of an erroneous program. To avoid spending time in correcting compile-time errors, the students were asked to use a program that was developed and tested in previous course works. We did not allow the students to use a program that came alone with the software package because we wanted the students to be exposed to different behaviors of the system in different application contexts. In the performance analysis lab, the students were required to draw a speedup function curve by analyzing the profile of the first few results obtained by using a sample number of nodes. The function curve was then used to predict the performance of the program on different numbers of the nodes. If there was a significant discrepancy between the predicted result and the experimental result, the students would be asked to repeat the experiment to remove the deviation

caused by temporary problems. Recurring discrepancy would need further analysis by taking the machine features and load balancing features of the program into account, which was usually taken as homework.

RELATED WORKS

Greer McCalla Vassileva Deters, Bull and Kettel (2001) elaborated the lessons learned from several large-scale, real-world deployments of the I-Help agent-based peer-help learning support system. Gavrilova, Voinov and Lescheva(1999) described a project of an intelligent MAS for distance learning using Learner-model approach. Thaiupathump, Bourne and Campbell (1999) investigated the effects of applying intelligent agent techniques to an online learning environment. They created the knowbots that automated the repetitive tasks of human facilitators in a series of online workshops. The findings indicated that the use of knowbots was positively associated with higher learner completion rates in the workshops. Baylor (1999) defined three major educational potentials for agents as cognitive tools: 1) as assistants, managing information overload; 2) serving as a pedagogical expert; and 3) creating programming environment for the learner. All of these works focus on supporting learning models using intelligent agents instead of addressing the complexity of the distributed learning systems.

On the software engineering side, a number of Architecture Description Languages (ADLs) have recently been proposed to cope with the complexity of architectural engineering. These include Rapide (Luckham, Kenney, Augustin, Vera, Bryan & Mann, 1995), Darwin (Magee & Kramer, 1996), Aseop (Garlan, Allen & Ockerbloom, 1994), Unicon (Shaw, DeLine, Klein, Ross, Young & Zelesnik, 1995) and ACME (Garlan, Monroe & Wile, 1997). ADLs provide constructs for specifying architectural abstractions in a formal notation and provide mechanisms for reasoning about the architecture. They focus

on defining architectural elements that can be combined to form a configuration. Few research efforts aim at truly defining an architectural description language for MAS.

Some formal languages have been proposed to address design issues of MAS. They focus on construct abstractions that can capture “social” behaviors of agents, such as beliefs, desires and intentions (BDI). Unfortunately, none of them is a complete formal system based on a finished computation model, and they are still under development. For example, SkwyRL-ADL (Faulkner & Kolp, 2002) is proposed as a BDI-MAS language to capture a “core” set of structural and behavioral abstractions, including relationships and constraints that are fundamental to the description of any BDI-MAS architecture. As it is still striving for a fully defined set of abstractions, it does not clarify the relationship of the architectural model to the underlying computation model and, therefore, does not serve as a language that encourages program design by derivation or transformation. Another attempt for addressing the architectural design of MAS is presented in Kokar, Baclawski and Eracar (1999), where control theory-based architecture for self-controlling software is developed. This model aims at a framework to accommodate formal methods for specification of agent functionality and inter-agent communication. However, no formal language is developed to facilitate the formal design. Instead, the author is attempting to use existing languages such as Extensible Markup Language (XML), DARPA Agent Markup Language (DAML), and (Unified Modeling Language (UML) to implement his vision.

CONCLUSION AND FUTURE WORKS

We present a method for designing a computational grid that supports online lab exercises, as part of our IT track of curriculum design. A lab package is designed to support the learning process in

courses of parallel computing and networking. The grid is centered at a Beowulf cluster, which provides a computational backbone of the grid, and services are deployed in distributed nodes of the computing networks and organized by an MAS. The agent conceptualization successfully addresses high-level architectural design issues, such as scalability, extensibility and modularity. We have developed the lab package with a framework that accommodates different lab activities in different courses. Although the depicted system is still in the development phase, the foundations have been established. The approach we use allows us to design the architecture that supports the development of modular components and allows the modules to be added in an incremental fashion.

The system is being developed in different levels of the pyramid model concurrently. We have designed several lab modules and used them in our parallel computing classes. Although the lab packages are not as stable and full-functioning as commercial software, they present the complex concepts in an integrated programming environment and give the students a starting point to acquire more sophisticated design techniques. We continue to involve students in the design and improvement of the lab modules in the form of senior projects and student research programs. The grid has been fully established and is being tuned for the best performance. The peak High Performance Linpack (HPL) benchmark performance of 16 nodes is 18Gflops at this point.

We try to avoid touching hard issues in our lab activities. For example, issues relating to load balancing and network congestion require deep analysis that need other algorithms and tools. We will, however, integrate more tools into the system so that more experiments can be performed.

We will add more lab modules into the system to support experiments on parallel/grid computing, computer networking, security, databases, programming languages and other courses in an incremental fashion. By including more and more lab modules, we envision a new classroom culture

that inspires more practice-oriented learning. With the grid as the computing base, we set our long-term goals at information sharing among multiple institutions and cross-campus collaborations in developing and evaluating course modules as well as research collaborations.

ACKNOWLEDGMENT

This research is supported through Scholars Academy of University of Houston-Downtown from the US Army Research Office Award #W911NF-04-1-0024.

REFERENCES

- Banâtre, J.-P., Fradet, P. & Radenac, Y. (2004, July). *Chemical specification of autonomic systems*. Proceedings of the 13th International Conference on Intelligent and Adaptive Systems and Software Engineering (IASSE'04).
- Banâtre, J.-P., Fradet, P. & Radenac, Y. (2005a). Principles of chemical programming. In S. Abdenadher & C. Ringeissen (Eds.), *Proceedings of the 5th International Workshop on Rule-Based Programming (RULE'04)*, 124, ENTCS, 133-147.
- Banâtre, J.-P., Fradet, P. & Radenac, Y. (2005b). Higher-order chemical programming style. *Proceedings of Unconventional Programming Paradigms, LNCS, 3566*, 84-98.
- Baylor, A. (1999). Intelligent agents as cognitive tools for education. *Educational Technology, XXXIX*(2), 36-41.
- Faulkner, S., Kolp, M. (Isys). (2002). *Towards an agent architectural description language for information systems* (technical report). School of Management, the Catholic University of Louvain (UCL).
- Flores, R.A., Kremer, R.C. & Norrie, D.H. (2001). An architecture for modeling Internet-based collaborative agent systems. In T. Wagner & O.F. Rana (Eds.), *Infrastructure for agents, multi-agent systems, and scalable multi-agent systems*, LNCS1887 (pp. 56-63). Springer-Verlag.
- Garlan, D., Allen, R. & Ockerbloom, J. (1994). *Exploiting style in architectural design environments. Proceedings of SIGSOFT'94: Foundations of Software Engineering*, 75-188.
- Garlan, D., Monroe, R. & Wile, D. (1997). ACME: An architecture description interchange language. *Proceedings of CASCON 97*, 169-183.
- Gavrilova, T., Voinov, A.V. & Lescheva, I. (1999). Learner-model approach to multi-agent intelligent distance learning system for program testing. *IEA/AIE 1999*, 440-449.
- Greer, J., McCalla, G., Vassileva, J., Deters, R., Bull, S. & Kettel, L. (2001). Lessons learned in deploying a multi-agent learning support system: The I-Help experience. *Proceedings of AIED'2001*, 410-421.
- Griss, M. & Pour, G. (2001). Accelerating development with agent components. *Computer, IEEE*, 37-43.
- Kokar, M.M., Baclawski, K. & Eracar, Y. (1999). Control theory-based foundations of self-controlling software. *IEEE Intelligent Systems*, 37-45.
- Lin, H. (2005). A language for specifying agent systems in E-Learning environments. In F.O. Lin (Ed.), *Designing distributed learning environments with intelligent software agents*, (pp. 242-272). Hershey, PA: Information Science Publishing
- Lin, H. & Nguyen, K. (2005, May 18-20). Classroom simulation of massive parallel computing. *Proceedings of The 16th IASTED International Conference on Modeling and Simulation (MS 2005)*, 45-50.

- Lin, H. & Yang, C. (2006a). Specifying distributed multi-agent systems in chemical reaction metaphor. *The International Journal of Artificial Intelligence, Neural Networks, and Complex Problem Solving Technologies*, 24(2), 155-168.
- Lin, H. & Yang, C. (2006b). Specification of multi-agent systems in the gamma language. *Proceedings of the Canadian Conference on Electrical and Computer Engineering (CCECE2006)*, 35-38.
- Luckham, D.C., Kenney, J.J., Augustin, L.M., Vera, J., Bryan, D. & Mann, W. (1995). Specification and analysis of system architecture using Rapide. *IEEE Trans. on Software Engineering*, 336-355.
- Magee, J. & Kramer, J. (1996). Dynamic structure in software architectures. *Proceedings of the 4th Symposium on the Foundations of Software Engineering (FSE4)*, 3-14.
- Paquette, G. (2001). Designing virtual learning centers. In H. Adelsberger, B. Collis, & J. Pawlowski (Eds). *Handbook on information technologies for education & training, series international handbook on information systems*, (pp. 249-272). Springer-Verlag.
- Shaw, M., DeLine, R., Klein, D.V., Ross, T.L., Young, D. M. & Zelesnik, G. (1995). Abstractions for software architecture and tools to support them. *IEEE Trans. On Software Engineering*, 314-335.
- Thaiupathump, C., Bourne, J. & Campbell, J.O. (1999). Intelligent agents for online learning. *Journal of Asynchronous Learning Networks*, 3(2), 1-19.
- Vouk, M.A., Bitzer, D.L. & Klevans, R.L. (1999). Workflow and end-user quality of service issues in Web-based education. *IEEE Trans. on Knowledge and Data Engineering*, 11(4), 673-687.
- Weiss, M. (2003). *A gentle introduction to agents and their applications*. Retrieved from www.magma.ca/~mrw/agents/
- Yu, E. (2001). Agent-oriented modeling: Software versus the world. *Proceedings of the Agent-Oriented Software Engineering AOSE-2001 Workshop Proceedings. LNCS 2222*, 206-225.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 2, edited by L. Tomei, pp. 45-57, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.42

A Project–Based Learning Approach: Online Group Collaborative Learning

Jianxia Du

Mississippi State University, USA

Byron Havard

Mississippi State University, USA

James Adams

Mississippi State University, USA

ABSTRACT

A framework for Online Group Collaborative Learning is illustrated in this paper. The foundation of the framework is based on Piaget's concepts of assimilation and accommodation and Vygotsky's theory of social interaction. This paper examines how an online project-based learning approach affected students' cognitive skills development and motivation, and explored factors leading to successful collaborative projects. The results indicated that, in a project-based online group environment, unique characteristics exist for leadership style and individual role, goal setting and project management, accountability and commitment, peer supportive relationships, individual

accomplishment and group accomplishments, and mixed gender and race group preference.

INTRODUCTION

The value of collaborative learning is widely recognized because of its positive effects on social, cognitive, and metacognitive development. One advantage of collaborative learning is that it provides students opportunities for self-reflection and joint construction of knowledge, and this environment frequently leads to higher levels of task-related interaction and behavior (Johnson, Johnson, & Stanne, 1986). When students are able to participate in active learning activities,

they find learning more pleasurable and satisfying than non-participative events.

Small group dynamics have been studied in educational contexts since the 1970s. Research indicates that small groups facilitate learning as compared to individual learning (Bruffee, 1999; Hamm & Adams, 1992; Johnson et al., 1986) and that peer group work has significant impacts on varied learning outcomes in both face-to-face and online learning environments (Bruffee, 1999; Harasim, 1990; Scardamalia & Bereiter, 1996; Uribe, Klein, & Sullivan, 2003). Although much of cooperative learning research initially focused on face-to-face cooperation at the elementary school level, now it is extending gradually into higher education, which is the focus of this study.

Positive interdependence promotes group cohesion and a heightened sense of belonging to a group, which can be achieved through the task, resources, goals, rewards, roles, or environment (Brush, 1998). Individual accountability refers to the extent to which students are individually accountable for jobs, tasks, or duties, and was introduced to counter the free-rider effect (some students would deliberately not invest any or little effort). Both principles, however, relate to the group dynamics phenomena of group cohesion and social loafing (Du & Havard, 2003) and thus apply to any form of small group learning. Bosworth and Hamilton (1994) proposed a process-oriented design method for online group-based learning that focused on fostering the envisioned group interaction that is thought to enhance learning instead of focusing on the formal product of such interaction. This method tends to be the dominant view in most institutions providing higher education and centers on five elements that directly shape group interaction: learning objectives, task type, level of prestructuring, group size, and the technological tool used.

The need for systematic design of online learning is amplified by some observations that exhibit conflict regarding coordination during group interaction. These observations that suggest

conflicts are more likely to occur in asynchronous online settings compared to face-to-face settings, since group members are not present at the same time or place. Also, the lack of presence concerning immediate feedback and face-to-face setting makes asynchronous communication unnatural. Clearly, some support should be designed to help students overcome difficulties in group coordination during asynchronous collaboration.

Group performance effectiveness depends on the group's use of its alternate opinions and on the handling of increased coordination (Shaw, 1981). Roles, stated functions/duties, or responsibilities that guide individual behavior and regulate intragroup interaction (Hare, 1994) can promote group cohesion and responsibility (Boud, Cohen & Sampson, 1999) and thus can be used to foster positive interdependence and individual accountability (Hedberg, 2003). In addition, roles can stimulate a group member's awareness of the overall group performance and each member's contribution. Finally, roles appear to be most relevant when a group pursues a shared goal requiring a certain level of task division, coordination, and integration of individual activities.

Despite the potential benefits of collaborative learning, several studies reveal that collaborative learning does not always lead to the desired outcome. For example, free collaboration does not systematically produce learning (Dillenbourg, 2002), and researchers report large variations in the quality of interaction and learning outcomes (Lehtinen et al., 2000). Other variations may include, but are not limited to, the length of studies, the technology used, differences in research methodology used, and the quality of the group processes (Shaw, 1981; Strijbos et al., 2004). Students who have experienced negative online experiences perceived those experiences as weaknesses of online learning. These problems were most often caused by delayed feedback from instructors (Laszlo & Kupritz, 2003), lack of self-regulation and self-motivation, sense of isolation, monotonous instructional methods (Wang, Sierra, & Folger,

A Project-Based Learning Approach

2003), and poorly designed assignments (Hedberg; 2003, Thomas 2000). Problems in collaborative group projects include social loafing, free riding, disorder due to poor leadership and member role identification, low motivation through no common goal, and poor management of tasks.

In this study, we argue that collaborative learning has moved beyond the question whether it is effective in accelerating knowledge construction, but we focus on the conditions under which these type of learning environments were optimally effective. The purpose of this study was to investigate students' perceptions of online group collaborative learning and to examine how an online project-based learning approach affected students' cognitive skills development and motivation. This study will identify specific group dynamics and factors leading to successful collaborative projects.

A THEORETICAL FRAMEWORK FOR ANALYSIS OF THE COLLABORATIVE LEARNING PROCESS

Constructivism is a term used to describe a number of different theories. Two dimensions were focused on in this study; namely, the knowledge construction process of individual learners and knowledge construction as a socially situated process (Driscoll, 1994).

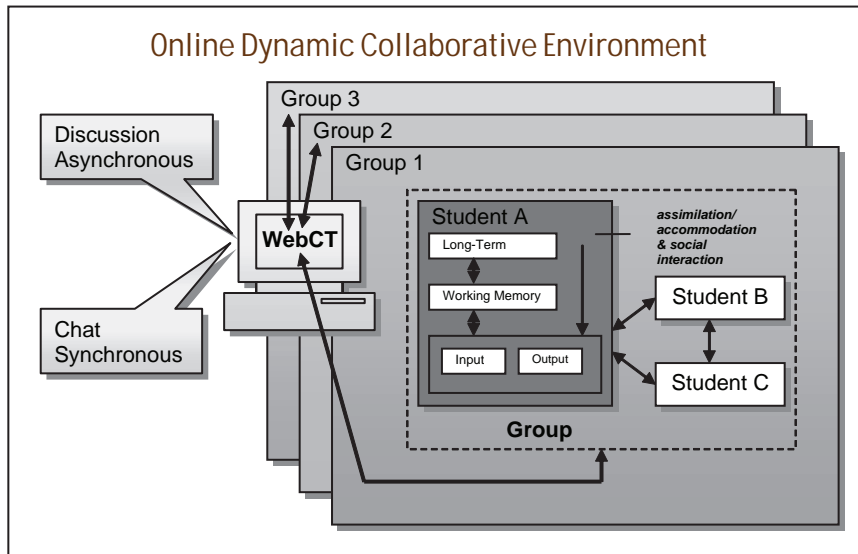
The individual learner constructs knowledge by adapting previously constructed schemes. This view is based on Piaget's theory and the concepts of assimilation and accommodation. This process of schema construction and reconstruction implies the selection of stimuli from the project-based environment; continuous storage; and retrieval of schemas between long-term memory and working memory in order to organize, elaborate, refine and/or integrate these schemas. This overall process is monitored by metacognitive processes. These processes help the learner to be selective in

stimulus selection, storage, retrieval, and response organization (Popolov, Callaghan, & Luker, 2002). The online setting influences this complex of cognitive activities in interaction with the nature of the project-based environment.

The knowledge construction process may also be seen as socially situated. This view is based on Vygotsky's theory of social interaction, where the interaction between people plays an important role. This is where the social part of social constructivism becomes evident. The interaction among learners in the online environment is expected (1) to incite the learner to make explicit the actual level of schema development by writing down his or her ideas, and (2) to demand from the learner an explicit comparison of his or her schema and those of others in order to defend or criticize them. As such, the interaction demands further elaboration and organization of the schema at the point that collaboration enters. This theoretical description implies that learning in the online environment depends on the amount of schema exploitation activities and the amount of explicit comparison and contrasting. The more these activities are invoked, the higher the level of knowledge construction to be expected.

Figure 1 provides a graphical representation of the theoretical base for the present study. This scheme is an extension of the framework used in previous research (Hare, 1994; Kitchner, 1983). It integrates social constructivist principles and concepts derived from the information processing approach to learning (Dillenbourg, 2002). We consider three elements or levels regarding learning: individual processes, group member processes, and group environment processes (see Figure 1). Individual learning is depicted through an information processing perspective with sensory receptors providing input, refined through short- and long-term memory and exhibited through output. Individual input and output are affected and refined through social interaction, where familiar information is assimilated and new information is accommodated. Learning

Figure 1. Graphical representation social constructivist principles and concepts derived from the information processing approach to learning



continues at the group environment level, where group input and output are refined through review and critique by other groups.

FRAMEWORK APPLICATION IN ONLINE GROUP COLLABORATION

The online learning environment for this course was created in WebCT, a database-driven, Web-based course management system designed to support online learning environments (Hutchins, 2001). The database elements available in WebCT enable the instructor to record, manage, and support the activities and interactions of a large number of students. This multimedia design for an instruction course is required of all students enrolled in the Master of Science in Instructional Technology (MSIT) program. Students enrolled in the MSIT program and in this course represent a wide range of diverse backgrounds. They reside throughout the states of Mississippi, Tennessee, and Alabama. Each semester, approximately 30 students are enrolled in this course.

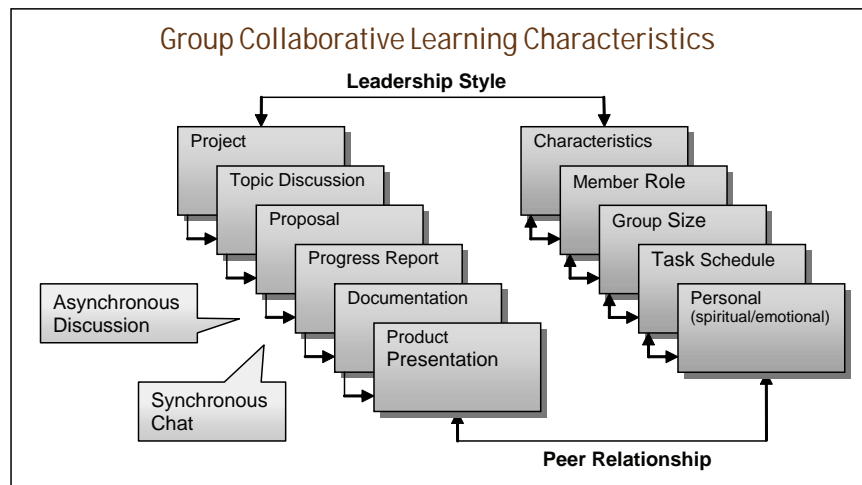
In Figure 2, leadership style and peer relationships have a dramatic effect on the nature and outcome of the final product in a project-based learning environment. Both project and group characteristics are impacted by their related characteristics, leadership style, and peer relationships (see Figure 2). This project is sequential in nature with each phase channeling into the next. Peer relationships and leadership style within a group are interrelated, impacting each phase of the project.

Framework Application

We applied the framework during two semesters of a graduate level multimedia design for instruction course. The purpose of this course was to provide students with an overview of hypermedia/interactive multimedia technology by working with various hypermedia/multimedia tools. Students were introduced to the design and production process of developing multimedia applications and were provided the opportunity to learn various tools, concentrating on different

A Project-Based Learning Approach

Figure 2. Effect of leadership style and peer relationships on the nature and outcome of the final product in a project-based learning environment



aspects of the technology, such as text, graphics, audio, animation, and video. By working with these tools, students were expected to develop the skills and understanding required for the creation of instructional tools for application in education and industrial settings. Students were required to apply design principles necessary for the creation of hypermedia/multimedia in developing multimedia-based applications. Several important aspects about this environment regarding skill development, theoretical and technical issues, and the application skills and knowledge toward the successful development of a comprehensive multimedia instructional product (Popolov, Callaghan, & Luker, 2002; Slavin, 1995) were examined. Through online group communication using the asynchronous discussion feature and synchronous chat available through WebCT, students' skills and knowledge regarding multimedia development were enhanced. The social aspect of the learning environment was critical (Vygotsky, 1978). This required focused attention by the instructor, as knowledge is socially constructed and enhanced through peer-to-peer and instructor-to-peer communication (Boud, Cohen & Sampson, 1999; Kitchner, 1983; Kitchner & King, 1981).

In the multimedia process, students worked in groups and took on different roles. The contexts for learning in this course were primarily interactive, collaborative, multi-disciplinary, and student-centered. Students were required to participate actively in weekly discussions regarding specific multimedia development topics. Assignments on learning different tools were given to assess application skills, and students were required to write a research and reflective paper on hypermedia/interactive multimedia instruction. Group projects for the semester developed and assessed students' ability to comprehensively apply the theoretical and technical requirements for multimedia design for instruction. Students worked together in teams of four or five students to develop an instructional Web site as the final course project. The tools used for project development included Macromedia® Dreamweaver, Fireworks, Flash, and Hyperstudio®. The general target audience for the site included prospective students and teachers. Deliverables beyond the completed Web site included a project proposal, a project progress report, project documentation, and a final presentation of the final product. The project proposal was intended to describe the in-

structional problem, the specific target audience, the instructional or training context, and the objectives to be achieved. The formal project progress report required groups to provide status on their project, including work completed and tasks planned for completion. Project documentation, similar to a detailed design document, revealed details about the product that was developed, justification and use of an instructional design model for product development, audience analysis, formal instructional content, learning objectives, media selection, instructional strategy employed, and assessment. Finally, project documentation concluded with a description of the formative evaluation process and findings. Each group presented its final product to the class. Every member of each group was expected to take an active role in the final presentation.

FINDINGS

Accountability and Commitment

Almost all the students reported accountability, responsibility, unselfishness, commitment, and dedication as major attributes that ensured the success of online collaboration. Students felt that their online collaboration on the project was more successful, because students in their group exhibited these characteristics. If a student had to be absent from meetings, legitimate reasons such as a death in the family or in a friend's family, work, or having to take care of other family obligations were the norm. Being absent did not prevent the student from being accountable. These students returned to the group concerned about what went on during online discussions in which they were absent and what their assignments were without having to be told by other students in the group. Exhibiting these attributes of accountability and commitment seemed to be contagious within the groups. The more one group member exhibited these traits, the more these traits seemed to become

a norm for the behavior of the rest of the group members. There was an unspoken appreciation shown by the rest of the group when members participated with this level of commitment, because the rest of the group members seemed to exhibit the same level of behavior when they had to be absent. Complete commitment to the success of the project was exhibited not just by one but by most of the group members, since leadership with accountability and commitment were practiced.

Leadership Style and Individual Role

Group dynamics were affected by the leadership style of the online group coordinator. Three groups had female coordinators; two groups had male coordinators. The leadership style exhibited in the group that produced the best results came from a leader who coached the team by stepping back and letting team members shine. This leader quietly led them to meet deadlines and goals and to follow the outline of the project, while allowing them to make decisions for the successful completion of the project. The leader allowed the team members to lead, to shine, to be successful, and to feel complete ownership of the finished product, which was not any one individual team member's project, but the project of the committed, concerted efforts of the group. Because group members had ownership in the project and were made to feel the importance of their input, the final project was much more advanced than would have been achieved otherwise. A leadership style that promoted inclusiveness, pride, self-confidence, participation, and understanding created a much more productive and self-reliant team that was able to produce beyond the norm. A leader that was more interested in the performance of the team and the quality of the finished product rather than self-recognition produced the more successful product.

One group leader stepped down at mid-semester due to overwhelming outside responsibilities.

A Project-Based Learning Approach

No one assumed the leadership position, and that group was ineffective for four weeks; without instructor directives, the group would have failed the project assignment. Two groups had young leaders, who were expected to be at risk, but gained momentum as the semester progressed. Both of the young group leaders initially had difficulty organizing and influencing cooperation from the team members, but gradually, with the help of their more experienced team members, the teams became focused. One leader, a manager by profession, seemed to be the most effective and influenced the team to produce the best project in the class. Another team was highly inexperienced in Web skills and had a leader with a lack of course subject knowledge, who was hesitant to lead with firm direction in the beginning. Eventually, this leader pulled the group together to produce a good project.

Individual Accomplishments and Group Accomplishments

Some groups and some leaders experienced individuals who were more interested in their individual accomplishments than the accomplishments of the team. A few individuals with high Web skills quickly developed the vehicle for the final project, but the results were not necessarily compatible with the project goals. Because of existing skills in Web development that some individuals possessed in the group, they may have wanted to take on the design and development of the project without taking into consideration the input of the other team members. Realizing they could produce a product because of their skills did not necessarily mean that their product would excel as much as a product that included the input and talents of all members of the group. The time limitations and the complexity of this project naturally required that it be a group project, thus requiring the talents and input of everyone on the team. Group members questioned and worked through compatibility of design with team project goals, until the design fit the project idea and

theme. Although team members were appreciative of the individual's Web design skills, they wanted their input heard and a finished product that met the guidelines of the project. Team members did not want an individual's accomplishments to overshadow or overrule the accomplishments of the team. Leadership styles definitely affected the group dynamics of each team. These leadership styles included (1) style that produced the best finished product, (2) lack of leadership when one leader had to step down, (3) inexperienced leaders who just needed some practice, and (4) group leadership that required leaders to refocus members who were interested in their accomplishments instead of the team's.

Setting Goals and Managing Team Project

Setting goals and managing the team project assisted the teams in successfully bonding and completing its project. Students reported that setting a common goal and establishing a bonding within the group by dedicated students was critical in the process of team development and achieving success. Due to the complexity of the project and the amount of time required to complete it, students explained that this kind of dedication and bonding was vital to the success of the team and the assignment. In addition, it was important for a team to plan, to manage, and to meet the timeline; it was equally important for the team leader to delegate teamwork in order to accomplish tasks on time. Missing deadlines and not remaining on schedule also caused a much less polished product at the end of the semester.

Accepting responsibility for group assignments and following through in a timely manner with those assignments affected group productivity. Not only were missed or late assignments an indicator of an individual's lack of dedication to the team, but it also indicated the lack of dedication the team member had to the project. A team member without dedication who missed or was late with assignments caused other team members

to be late and sometimes miss their assignments, also. Teams that had definite deadlines and frequent communication were able to build more powerful projects than those who had frequent absences and did not honor deadlines. Teams that worked together to demand participation from each member were also more successful. If a team member was not meeting assignment deadlines and goals, improvement would be gained from pressure by the team leader and the other members of the group. It appeared that no one in any group wanted to be singled out as the unproductive member. Although there were exceptions, the united strength of the team was much more powerful than just a single individual's leadership role.

Most of the groups referred to their project proposal plans and final project guidelines to evaluate their own development stages and notes. Groups who did not practice referring to their project proposal or the project guidelines consequently had project omissions and components that did not relate or fit their design. Often, there were discussions on adding or eliminating parts concerning the project design, and the limitations were not always skill-based. There was a concern that the element did not comply with the project goals or would have to be restructured to fit the project goals. When met with these types of obstacles, the successful groups looked outside the team for advice or help. They either consulted with the instructor, professionals whom they viewed as knowledgeable, online sources, or friends who had experience in a particular area. The successful groups viewed limitations as obstacles to overcome, not as roadblocks for which there was no way around.

Positive Peer Support Spiritually and Emotionally

Peer support served as a positive element in groups and helped to support students spiritually and emotionally through the difficult parts of the

project development phases. Several students mentioned "friendship" and "trust" as enjoyable online collaborative learning experiences. This meant "close friends getting along well" and "giving a helping hand to a struggling member." Students seemed to draw inner strength and purpose when they felt appreciated and were complimented by their fellow group members. This caused the student to be more likely to seek help when needed and to give help where needed. Developing this type of relationship was a gradual process as the group members worked through the obstacles of producing the final project. Gradually, when one member produced a good idea, another member complimented that member and so forth. This process of positive team feedback helped to make the individual team members more self-confident, thus producing a more self-confident team. This positive peer relationship also enabled the students to openly discuss problem areas and to avoid any potential disagreements. Group members were less likely to engage in disagreements when they had this positive relationship. They could work out any disagreements maturely by openly discussing and agreeing on possible solutions. This positive peer relationship produced group members who were more productive and who engaged in the timely completion of the final project.

Preference for Mixed Gender and Race Groups

Students preferred mixed gender and race groups for their online discussion groups. In one group, the instructor chose a white male as group leader of a predominately African-American female group. Initially, the group leader was apprehensive about his ability to lead this group, as was the group about having him as their leader. When the group of African-American women saw that the group leader was not domineering, was inclusive, was open to them taking on leadership roles, and wanted their ideas and participation, they all got together with the leader and produced

A Project-Based Learning Approach

an outstanding product. Based on observations, African-American students perceive group work as a comfortable environment in which to work. When conflicts occurred with group participation, African-American students were willing to provide explanations for their conflicts and to openly resolve the conflict as soon as possible. When African-American students missed an online discussion session, they were quick to seek follow-up information about what they missed. Resistance to group work appeared to be based on lack of some required skills, rather than lack of cooperation to participate in the group. They were only concerned with not being able to assist with certain needs within the group and were not concerned about having to work in a group.

CONCLUSION

Successfully completing a project assigned to an online group was dependent on a number of factors. How successful the project was depended on the leadership style of the group leader, with the most important factor being the success of the group as the main concern. Setting goals and accepting responsibility for the group's project were also major factors in the success of the finished product. These were not just the team leader's goals and responsibilities but were also the entire group's. Groups also felt that they were more successful with their project when they followed the guidelines and the proposal for the project. Peer support during the development of the group project was a very important part of the success of the project. Students felt that, without the spiritual and emotional support of their peers, the project would not have been as successful. If one were looking for a negative factor in online group collaboration, it would not be found in gender or race group preferences. Students worked together regardless of the race or gender of their group members and expressed a preference for having mixed races and genders in their groups.

They felt that the variety of contributions from different races and genders were very important to the group work.

REFERENCES

- Bosworth, K. & Hamilton, S.J. (Eds.). (1994). *Collaborative learning: Underlying processes and effective techniques*. San Francisco, CA: Jossey-Bass Publishers.
- Boud, D., Cohen, R., & Sampson, J. (1999). Peer learning and assessment. *Assessment and Evaluation in Higher Education*, 24(4), 413-426.
- Bruffee, K. (1999). *Collaborative learning: Higher education, interdependence, and the authority of knowledge* (2nd ed.). Baltimore, MD: Johns Hopkins University Press.
- Dillenbourg, P. (2002). Over-scripting CSCL: The risks of blending collaborative learning with instructional design. In P.A. Kirschner (Ed.), *Three worlds of CSCL: Can we support CSCL?* (pp. 61-91). Heerlen: Open Universiteit Nederland.
- Driscoll, M.P. (1994). *Psychology of learning for instruction*. Boston: Allyn and Bacon Erlbaum.
- Du, J.X. & Havard, B. (2003). A framework for deep learning in distance education. *Delta Pi Epsilon*, 45(3), 204-214.
- Hamm, M. & Adams, D. (1992). *The collaborative dimensions of learning*. Norwood, NJ: Ablex Publishing.
- Harasim, L. (1990). Online education: An environment for collaboration and intellectual amplification. In L. Harasim (Ed.), *Online education: Perspectives on a new environment* (pp. 39-64). New York: Praeger.
- Hare, A.P. (1994). Types of roles in small groups: A bit of history and a current perspective. *Small Group Research*, 25, 443-448.

- Hedberg, J.G. (2003). Ensuring quality e-learning: Creating engaging tasks. *Educational Media International*, 40(3-4), 175-186.
- Hutchins, H.M. (2001). Enhancing the business communication course through WebCT. *Business Communication Quarterly*, 64(3), 87-94.
- Johnson, D., Johnson, R., & Stanne, M. (1986). Comparison of computer-assisted cooperative, competitive and individualistic learning. *American Educational Research Journal*, 23(3), 382-392.
- Kitchner, K.S. (1983). Cognition, metacognition, and epistemistic cognition: A three-level model of cognitive processing. *Human Development*, 26, 222-232.
- Kitchner, K.S. & King, P.M. (1981). Reflective judgment: Concepts of justification and their relationship to age and education. *Journal of Applied Developmental Psychology*, 2, 89-116.
- Laszlo, F. & Kupritz, V.W. (2003). The identification of online learning motives in use by undergraduate students. *Delta Pi Epsilon Journal*, 45(1), 63-72.
- Lehtinen, E., Hakkarainen, K., Lipponen, L., Rahikainen, M., & Muukkonen, H. (2000). Computer supported collaborative learning: A review. In H. Meijden, R. Simons, & F. De Jong (Eds.), *Computer supported collaborative learning in primary and secondary education. A final report for the European Commission, Project 2017* (pp. 1-46). Nijmegen: University of Nijmegen.
- Popolov, D., Callaghan, M., & Luker, P. (2002). Tying models of learning to design of collaborative learning software tools. *Journal of Computer Assisted Learning*, 18(1), 46-47.
- Scardamalia, M. & Bereiter, C. (1996). Computer support for knowledge-building communities. In T. Koschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm* (pp. 249-268). Mahwah, NJ: Lawrence Erlbaum Associates.
- Shaw, M.E. (1981). *Group dynamics: The psychology of small group behavior* (3rd ed.). New York: McGraw-Hill.
- Slavin, R.E. (1995). *Cooperative learning: Theory, research and practice*. Boston: Allyn and Bacon.
- Strijbos, J.W., Martens, R.L., Jochems, W.M.G., & Broers, N.J. (2004). The effect of functional roles on group efficiency: Using multilevel modeling and content analysis to investigate computer-supported collaboration in small groups. *Small Group Research*, 35(2), 195-229.
- Thomas, J.W. (2000). *A review of research on project-based learning*. Retrieved on December 10, 2000, from <http://www.bie.org/tmp/research/researchreviewPBL.pdf>
- Uribe, D., Klein, J.D., & Sullivan, H. (2003). The effect of computer-mediated collaborative learning on solving ill-defined problems. *Educational Technology Research and Development*, 51(1), 5-19.
- Vygotsky, L.S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.
- Wang, M., Sierra, C., & Folger, T. (2003). Building a dynamic online learning community among adult learners. *Educational Media International*, 40(1-2), 49-61.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 1, Issue 4, edited by L. A. Tomei, pp. 13-24, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.43

Task–Oriented Online Discussion: A Practical Model for Student Learning

Byron Havard

University of West Florida, USA

Jianxia Du

Mississippi State University, USA

Anthony Olinzock

Mississippi State University, USA

ABSTRACT

A dynamic task-oriented online discussion model for deep learning in distance education is described and illustrated in this chapter. Information, methods, and cognition, three general learning processes, provide the foundation on which the model is based. Three types of online discussion are prescribed: flexible peer, structured topic, and collaborative task. The discussion types are paired with tasks encouraging students to build on their adoptive learning, promoting adaptive learning and challenging their cognitive abilities, resulting in deep learning. The online discussion model was applied during two semesters of an online multimedia design for instruction graduate-

level course. The strategies for creating dynamic discussion serve to facilitate online interactions among diverse learners and assist in the design of assignments for effective interactions. The model proposed and the strategies for dynamic task-oriented discussion provide an online learning environment in which students learn beyond the course goal.

INTRODUCTION

The purpose of this study was to apply a theoretical model in an actual online discussion context. Deep learning, the holistic acquisition of higher-order skills (such as analyzing, interpreting and

evaluating) exhibited through higher-order problem solving (Entwistle & Ramsden, 1983), serves as the educational goal for this model. Deep learning, according to Weigel (2001), is “learning that promotes the development of conditionalized knowledge and metacognition through communities of inquiry” (p. 5). The theoretical underpinnings of the model may be applied to many diverse educational environments. This chapter offers distance learning educators strategies within the proposed model that will enhance online courses. The model reveals an approach to distance learning that fosters and encourages deep learning for higher-order thinking. Application of this model in distance learning may be applied to a variety of online courses to enhance student learning.

THEORETICAL FRAMEWORK

Several researchers have contributed to the effort of understanding the learning process. Their conclusions can help in the process of developing models for analyzing the distance learning process. Henri (1992) developed an analytical model that can be used by educators for a better understanding of the learning process. This model was developed to emphasize five dimensions of the learning process exteriorized in the message: participation, interaction, social, cognitive and metacognitive dimensions. Henri’s model provides information on participants as learners and on their ways of dealing with a given topic. Oliver and Mcloughlin (1996) suggested some changes to Henri’s analytical model. They recognized five kinds of interactions: social, procedural, expository, explanatory and cognitive. Oliver and Mcloughlin’s model has been used for analyzing the different kinds of communication in distance learning and traditional teaching.

The model of deep learning for distance education (see Figure 1) is established through the categorization of the five kinds of interactions

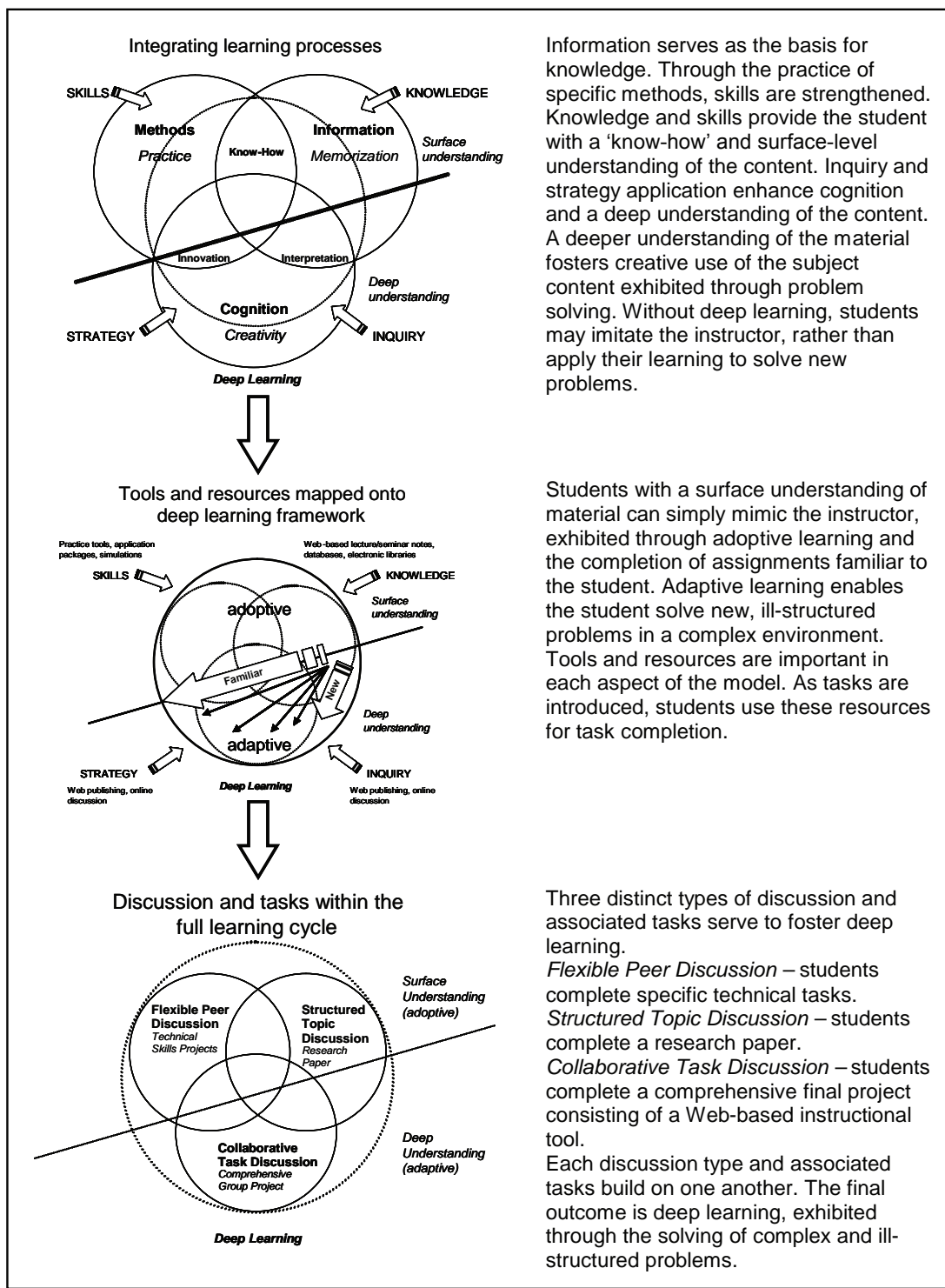
proposed by Oliver and Mcloughlin (1996) into three general processes: information, methods and cognition (Du & Havard, 2003). The first stage of integrating these learning processes is the acquisition of knowledge, representing a surface level of understanding. Skill development, the second stage of the model, is often accomplished through drill and practice. Students operating at these two levels develop a ‘know-how’ of the material, but on a very limited basis. The third stage represents cognition, where inquiry and strategy application assist students in learning to solve problems. A deeper understanding of the material fosters creative use of the subject content. Without deep learning, students will simply imitate the instructor, rather than apply their learning to new problems.

New and complex assignments require students to build on their existing knowledge of a topic, challenging them to systematize this information with newly acquired information in a variety of ways (Laurillard, 1984). Greene (1995) emphasizes that imagination can help people create new orders, bring pieces together, assemble or reassemble patterns. The foundation of deep learning relies on assignments that encourage inquiry and creativity. Thayer-Bacon (2000) stresses that “reason is an invaluable tool to help us construct quilts of knowledge” (p. 148). Reason can aid one to filter useful and useless information, organize them into meaningful entity, retrieve previous knowledge and ultimately gain new or deeper understanding.

Problem-based learning provides the rich context in which higher-order thinking is essential for problem resolution. Students working through a difficult ill-structured problem have more opportunity to develop a much deeper understanding than students who simply memorize information or develop specific skills without context (Tiene, 2002). Through innovative assignments, students can inquire about the process they are using rather than inquire about the product or answer to a specific question (Ruberg, Moore, & Taylor, 1996).

Task-Oriented Online Discussion

Figure 1. The information, methods and cognition model with two layers



Information serves as the basis for knowledge. Through the practice of specific methods, skills are strengthened. Knowledge and skills provide the student with a 'know-how' and surface-level understanding of the content. Inquiry and strategy application enhance cognition and a deep understanding of the content. A deeper understanding of the material fosters creative use of the subject content exhibited through problem solving. Without deep learning, students may imitate the instructor, rather than apply their learning to solve new problems.

Students with a surface understanding of material can simply mimic the instructor, exhibited through adoptive learning and the completion of assignments familiar to the student. Adaptive learning enables the student solve new, ill-structured problems in a complex environment. Tools and resources are important in each aspect of the model. As tasks are introduced, students use these resources for task completion.

Three distinct types of discussion and associated tasks serve to foster deep learning.

- Flexible Peer Discussion** – students complete specific technical tasks.
- Structured Topic Discussion** – students complete a research paper.
- Collaborative Task Discussion** – students complete a comprehensive final project consisting of a Web-based instructional tool.

Each discussion type and associated tasks build on one another. The final outcome is deep learning, exhibited through the solving of complex and ill-structured problems.

Two fundamental concepts inherent in the proposed model are adopt and adapt (see Figure 1). Students with a surface understanding of material can effectively adopt what the instructor does. They may simply mimic the instructor. Students are unable to adapt their learning to unique situations because they have not developed a deeper learning of the material. They lack the strong grasp of the material required to adapt to a complex problem-based environment. Assignments familiar for the student measure surface learning, while new and innovative assignments measure a student's deep learning. Adoption and adaptation become very important when change is introduced in the distance learning environment regarding the material students are learning. It is not enough to adopt what the instructor teaches. Encouraging students to effectively adapt to changes in the distance learning environment requires students to think for themselves rather than rely on learning guidance from the instructor (Brookfield, 1982). In this type of distance learning environment, the instructor acts as a facilitator, requiring students to take more responsibility in the learning process. The role of facilitator is complex, but through the proposed model, techniques and student activities are diagrammed to assist in reducing this complexity.

APPLICATION OF THE MODEL

Distance learning requires special course design techniques, special methods of communication, as well as special organizational and administrative arrangements (Moore, 1989). To further explore the model of deep learning for distance education, we applied the model during two semesters of a graduate-level multimedia design for instruction course. Learning technologies were mapped to learning processes. Students began the full learning cycle with resources supplied by the instructor. These include: (a) Web-based lecture with seminar notes, (b) databases for details related

to specific concepts, (c) electronic libraries for additional reference material, and (d) CD-ROMs as supplemental information, in addition to the formal course content. These resources served to provide the foundation on which knowledge of the course topics were based. This multimedia design for instruction course is required for all students enrolled in the Master of Science in Instructional Technology (MSIT) program. Students enrolled in the MSIT program and in this course represent a wide range of diverse backgrounds. They reside throughout the state of Mississippi, Tennessee and Alabama. Each semester, approximately 30 students are enrolled in this course. The purpose of this course is to provide students with an overview of hypermedia/interactive multimedia technology through working with various hypermedia/multimedia tools. Students are introduced to the design and production process of developing multimedia applications and are provided the opportunity to learn various tools, concentrating on different aspects of the technology: text, graphics, audio, animation and video. Through working with these tools, students are expected to develop an understanding and the skills required for the creation of instructional tools for application in education and industry settings. Students are required to apply design principles necessary for the creation of hypermedia/multimedia when developing multimedia-based applications.

Learning Environment

The course simulates practices in the multimedia industry. Students work in groups and take on different roles in the multimedia development process. The contexts for learning in this course are primarily interactive, collaborative, multidisciplinary and student-centered. Students are required to actively participate in weekly discussions regarding specific multimedia development topics. Assignments on learning different tools are given to assess application skills. Students must write a research and reflective paper on

hypermedia/interactive multimedia instruction. Group projects for the semester both develop and assess students' ability to comprehensively apply the theoretical and technical requirements for multimedia design for instruction. Through these activities, we have observed students developing deep thinking in higher-order problem solving, from the foundation of surface understanding to deeper understanding exhibited by problem resolution.

WebCT served as the online learning environment for this course. WebCT is a database-driven, Web-based course management system designed to support online learning environments (Hutchins, 2001). The database elements available in WebCT enable the instructor to record, manage and support the activities and interactions of a large number of students. There are several important aspects about this environment regarding skill development, theoretical and technical issues, and the application skills and knowledge towards the successful development of a comprehensive multimedia instructional tool (Popolov, Callaghan, & Luker, 2002). Through online group communication using the asynchronous discussion feature and synchronous chat available through WebCT, students' skills and knowledge regarding multimedia development are enhanced. The social aspect of the learning environment is critical (Vygotsky, 1978). This requires focused attention by the instructor, as knowledge is socially constructed and enhanced through peer-to-peer and instructor-to-peer communication (Boud, Cohen, & Sampson, 1999; Kitchner, 1983; Kitchner & King, 1981).

Application of the model within the context of a distance learning environment will be described. The strategies used through model application may assist others in implementing the model within their own distance learning environments. The information, methods and cognition model serves to foster and encourage learning and, specifically, deep learning in an online environment. Through implementation of the three-stage model, we have

established a learning environment that supports problem-based learning with synchronous and asynchronous tools for students to collaborate on set problems, share resources, post solutions, and compare and review answers from other groups (Graham & Scarborough, 1999; Popolov, Callaghan, & Luker, 2002).

Online Discussion and Tasks

A structured and moderated online discussion may be defined as a Web-based bulletin board for peer learners to communicate and collaborate, where the instructor takes active responsibility to structure, scaffold and moderate the collaboration. The proposed model of information, methods and cognition involves a number of activities and assignment tasks that provide powerful contexts for learning course content. The structure of the bulletin board is divided into the three processes related to the model. Through this structure, a number of key skills are demonstrated by students in the higher-order problem-solving process; from surface understanding to deeper understanding.

Students complete assignments requiring them to apply their surface learning and develop their deeper learning. The difficulty of the assignments progresses, challenging students to hone their abilities and problem-solving skills. Scaffolding is important throughout the process, and is most pronounced during the first two assignments. As students' deep learning develop and their competence to accomplish the assignments increase, the necessity to scaffold is reduced (Gredler, 1997). The assignments in this course consist of two technical projects, a theoretical research paper and a comprehensive technical and theoretical final group project. The purpose of these assignments and their structure is to scaffold students' learning from surface to deep. Online discussion is used extensively in this course as a means to develop deeper learning. The WebCT bulletin board is composed of three categories; technical, theoretical and comprehensive, corresponding to

the three general process of the model; information, methods and cognition.

Flexible Peer Discussion. Students use Dreamweaver and Fireworks as the multimedia development tools for this course. Within the technical category of the bulletin board, discussion points are further categorized into topic technical issues, practice issues and peer discussion. Students are presented two questions per week within the topic technical issues related to the technical aspects and use of Dreamweaver and Fireworks. Students must respond to the question presented and must also critique one other peer's response. Students are also presented with weekly practice assignments, progressing in difficulty. As they work through the assignments they must post one question regarding an issue they encountered while working on the assignment. They must also answer at least one peer's question that was posted. The peer discussion category of the bulletin board is available for open discussion about Dreamweaver and Fireworks, and students are required to post at least one new item they learned while using either of these multimedia development applications.

Structured Topic Discussion. The theoretical category of the bulletin board consists of three questions posed to the students over a 3-week period prior to the middle of the semester. Through focused and concise answers, students are able to develop the foundation for their theoretical research paper. Students are encouraged to discuss the question and offer opinions on how the question may be addressed. Responses do not occur immediately; instead, students spend time clarifying the questions among themselves. Discussion occurs during the week. Towards the end of the week, students begin to formulate and post their responses. Discussion continues as students submit their responses. Students must also critique two other peers' responses each week. In the critique, students must provide constructive criticism and assist in further developing each peer's topic. The questions are meant to be a

guide to assist students in topic development. The first question guides students towards describing how the specific multimedia development tools in the course may be used. They must cite their reading assignments within their response to support their claims. The second question focuses on instructional design principles. There are two required textbooks for this course and journal articles provided by the instructor, posted online, which serve as additional reading. Students must describe how the instructional design principles are applied in an actual multimedia development project, including details related to learner and context. Students must work together in groups to complete the final comprehensive project. The third question requires students to propose a group project they will collaborate on and submit as their final comprehensive project. Their responses must include details regarding the learner, instructional context, subject content and the needs for the proposed multimedia instruction. They must provide a rationale for the development tools they wish to use. They must also describe the instructional strategy they will use and describe why they chose that particular strategy. After submitting responses to all three questions, students must then complete a theoretical research paper.

Collaborative Task Discussion. The outcome of the comprehensive final project is a Web-based instructional tool. The project combines the technical aspects and theoretical issues discussed online during the semester. The groups must apply the instructional design principles towards the development of a "real" Web-based educational product. Three progress points during final project development are meant to focus students towards the desired outcome in a professional manner. These points consist of a proposal presentation, progress report and a final project and presentation with documentation. The groups are composed of five students, with one serving as the coordinator. Asynchronous and synchronous discussion occurs among the groups. The bulletin board is used by the group for introductions. The group must decide

which member will accomplish what task based on the proposed project. The topic is decided on through discussion and deliberation among the group members. Each member proposes a topic and must negotiate online to determine which topic the group will agree on for the final product. As group members begin gathering information on their chosen topic, they post this for other group members. Discussion and clarification is often necessary as the information is refined (Flynn & La Faso, 1972). Synchronous chat offers the group opportunities to discuss issues in real time. Specific chat dates and times are decided on through the bulletin board. Students meet in their group's chat room to discuss issues with the instructor and to present their proposal and progress report. Each group conducts their final presentation through chat with the instructor present. Students receive immediate feedback from the instructor and must respond to questions posed by the instructor regarding the final product.

The proposed model and the design of the discussion activities applied within the model provide students both adoptive and adaptive learning opportunities. The technical and theoretical discussion aspects occur as students complete the first two assignments. This provides a strong surface level of understanding regarding the multimedia development tools used in this course. The theoretical portion of the discussion, as students respond and critique one another's responses to the three questions posed by the instructor, provides students with a strong surface understanding of the instructional design principles for multimedia development. Students begin moving towards adaptive learning as they begin focusing their efforts on the final comprehensive project. Through asynchronous and synchronous discussions regarding the development of the instructional product, students move from surface to deep learning. The learning is adaptive, as they are creating a product to fulfill an instructional need where no right or true answer exists.

FINDINGS

The information, methods and cognition model provides very powerful contexts for learning the course content. The assignments encourage students to interact with the course content, to read and explore beyond the immediate setting and to reflect on what is being read (Warschauer, 1997). At the same time, the assignments encourage and support many other useful skills, including negotiation, written communication, diversity, constructive criticism, strategy development and execution, and reflection.

When the assignments undertaken by the students exposed to this form of learning environment are examined in the light of a model proposed by Bennett, Dunne, and Carre (1999), its capacity to support students achieving deep understanding immediately becomes evident. Based on the model we have proposed, the distance learning setting helped and encouraged students to practice and develop higher-order thinking across the full range of information, methods and cognition. The following major points emphasize the importance of the activities when applying the model in a distance learning course.

The assignments required learners to plan their steps, explore the domain and work towards a goal. Similar to Fenwick (2002), students perceived their most valuable learning was related to two main areas: group process and self-knowledge. In the process, they needed to confront unexpected outcomes and hurdles, reflect and judge their progress, and use a variety of learning strategies to develop their solution. In the group setting, students were required to work with others and maintain a good working relationship throughout the semester. On a day-to-day basis, they needed to be cooperative and attentive to the group's needs, defend their own stance, negotiate, and give and accept criticism.

The assignments required students to apply various technologies available to them in the learning environment. These include e-mail,

chat and bulletin board. Through the strategies for dynamic discussion, students consolidate the large amounts of information obtained and discuss how to delineate the importance and value of the information towards assignment completion. They needed to interpret the information and balance the multiple perspectives presented. Succinct summaries of the information required reflection and critical thinking.

Students' reflections on the course based on e-mail, collaborative discussion and chat demonstrate their positive attitudes regarding the course. Their satisfaction with the structure of the online environment was expressed in the individual student evaluations gathered at the end of the semester. Through their final documentation submitted with their final product, students described their appreciation for their diligent work.

Finally, in terms of managing assignments, these activities compelled students to identify sub-tasks and conceptualize the problem they were required to solve and how it could best be managed. The activities required the students to formulate a plan and execute the course of action, and reflect on the directions and outcomes. Each member of the group takes on specific responsibilities, executes tasks to benefit the group, and works together with team members towards achieving a common goal; a finding similar to other research (Hinds & Weisband, 2003; Dehler & Parras-Hernandez, 1998). Amid differing opinions and perspectives, groups were highly capable of resolving the problems assigned throughout the course.

CONCLUSION

Online discussion strategy is imperative for student learning. Many distance learning courses experience high attrition rates that result from factors such as students feeling isolated, unmotivated, overwhelmed or unchallenged in online courses. Based on the model proposed in this chapter,

dynamic task-oriented discussions (e.g., flexible peer, structured topic and collaborative task) in these two classes encourage participation in all aspects of the requirements for course completion. Students are made to feel as if they are part of a community, where their input is valued by their peers and where their suggestions are encouraged (Blumenfeld, Marx, Soloway, & Krajcik, 1996). The supportive environment created in this type of discussion serves to assist students that may feel overwhelmed by the course requirements. Motivation to learn and share ideas is encouraged and evolves naturally as the course progresses. Continuous peer review of posted responses to items challenges each student to provide their best input for the learning community created through dynamic task-oriented discussion.

Discussion is an integral part of an online course. As students work through the assignments, the importance of discussion and the sharing of ideas and opinions cannot be ignored. The assignments in this course require extensive peer-to-peer discussion throughout the semester to achieve the desired outcomes for the course. Through the structure of the dynamic task-oriented discussion presented in the model, students engage in discussion as part of assignment completion. In a sense, the discussion and the assignment cannot be separated; both act as a means for attainment of the course goal. The nature of online interactions and communications must be understood by both instructors and instructional designers (Pincas, 1998). The strategies we have proposed for creating dynamic task-oriented discussion serve to facilitate online learning among diverse individuals and assist in the design of assignments for effective interactions.

Providing students with a learning environment that will assist them in achieving the course goal is important, but we must look beyond the boundaries of a single course. The model proposed and the strategies for dynamic task-oriented discussion provide an environment in which students learn beyond the course goal, paving the way

from surface to deep learning. Students build on the adoptive learning taking place through assignments designed to promote adaptive learning and challenge their cognitive abilities, resulting in deep learning. Students' cognitive process is challenged through learning to use collaborative tools, learning to work collaboratively on complex learning assignments, and learning how to collaborate at a distance both asynchronously and synchronously.

REFERENCES

- Bennett, N., Dunne, E., & Carre, C. (1999). Patterns of core and generic skill provision in higher education. *Higher Education, 37*(1), 71-93.
- Blumenfeld, P. C., Marx, R. W., Soloway, E., & Krajcik, J. (1996). Learning with peers: From small group cooperation to collaborative communities. *Educational Researcher, 25*(8), 37-42.
- Boud, D., Cohen, R., & Sampson, J. (1999). Peer learning and assessment. *Assessment and Evaluation in Higher Education, 24*(4), 413-426.
- Brookfield, S. (1982). Independent learners and correspondence students. *Teaching at a Distance, 22*, 26-33.
- Dehler, C. & Parras-Hernandez, L.H. (1998) Using computer-mediated communication (CMC) to promote experiential learning in graduate studies. *Educational Technology, 38*(3), 52-55.
- Du, J. X., & Havard, B. (2003). A framework for deep learning in distance education. *Delta Pi Epsilon, 45*(3), 204-214.
- Entwistle, N., & Ramsden, P. (1983) *Understanding student learning*. London: Croom Helm.
- Fenwick, T. J. (2002). Problem-based learning, group process and the mid-career professional: Implications for graduate education. *Higher Education Research & Development, 21*(1), 5-21.
- Flynn, E. W., & La Faso, J. F. (1972). *Group discussion as a learning process*. New York: Paulist Press.
- Graham, M., & Scarborough, H. (1999). Computer mediated communication and collaborative learning in the undergraduate distance education environment. *Australian Journal of Educational Technology, 15*(1), 20-46.
- Gredler, M. E. (1997). *Learning and instruction: Theory into practice* (3rd ed.). Upper Saddle River: Prentice-Hall.
- Greene, M. (1995). *Releasing the imagination: Essays on education, the arts, and social change*. San Francisco: Jossey-Bass.
- Henri, F. (1992). Computer conference and content analysis. In A. Kaye (Ed.), *Collaborative learning through computer conferencing* (pp. 117-136). Berlin: Springer-Verlag.
- Hinds, P., & Weisband, S. (2003). Knowledge sharing and shared understanding in virtual teams. In C.B. Gibson & S.G. Cohen (Eds.), *Virtual teams that work: Creating conditions for virtual team effectiveness* (pp. 21-36). San Francisco: Jossey-Bass.
- Hutchins, H. M. (2001). Enhancing the business communication course through WebCT. *Business Communication Quarterly, 64*(3), 87-94.
- Kitchener, K. S. (1983). Cognition, metacognition, and epistemic cognition: A three-level model of cognitive processing. *Human Development, 26*, 222-232.
- Kitchener, K. S., & King, P. M. (1981). Reflective judgment: Concepts of justification and their relationship to age and education. *Journal of Applied Developmental Psychology, 2*, 89-116.
- Laurillard, D. (1984). Styles and approaches in problem-solving. In F. Marton, D. Hounsell, & N. Entwistle (Eds.), *The experience of learning* (pp. 124-143). Edinburgh: Scottish Academic Press.

- Moore, M. (1989). Three types of interactions. *The American Journal of Distance Education*, 3, 1-6.
- Oliver, R., & McLoughlin, C. (1996). *An investigation of the nature and form of interactions in live interactive television*. Melbourne: Australian Society for Educational Technology. (ERIC Document Reproduction Service No. ED396738).
- Pincas, A. (1998). Successful online course design: Virtual frameworks for discourse construction. *Educational Technology and Society*, 1(1), 14-25.
- Popolov, D., Callaghan, M., & Luker, P. (2002). Tying models of learning to design of collaborative learning software tools. *Journal of Computer Assisted Learning*, 18(1), 46-47.
- Ruberg, L. F., Moore, D. M., & Taylor, C. D. (1996). Student participation, interaction, and regulation in a computer-mediated communication environment: A qualitative study. *Journal of Educational Computer Research*, 14(3), 243-268.
- Thayer-Bacon, B. J. (2000). *Transforming critical thinking: Thinking constructively*. New York: Teachers College Press.
- Tiene, D. (2002). Exploring current issues in educational technology using a problem-based approach to instruction. *Educational Technology*, 42(1), 14-22.
- Vygotsky, L. S. (1978). *Mind in society*. Cambridge: Harvard University Press.
- Warschauer, M. (1997). Computer-mediated collaborative learning: theory and practice. *Modern Language Journal*, 81(4), 470-481.
- Weigel, V. (2001). *Deep learning for a digital age: Technology's untapped potential to enrich higher education*. San Francisco: Jossey-Bass.

This work was previously published in Integrating Information & Communication Technologies into the Classroom, edited by L. A. Tomei, pp. 154-166, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.44

An Analysis of Student Persistence in Online Education

Steven F. Tello

University of Massachusetts Lowell, USA

ABSTRACT

This study examines the relationship between instructional interaction and student persistence among adult students in online courses. A survey research methodology was used to examine the frequency and the method of instructional interaction in online courses, student attitudes regarding instructional interaction, and the reasons online students provide for persisting in, or withdrawing from, online courses. The results indicate that student perceptions regarding the contribution of asynchronous, discussion forum use combined with frequent use of asynchronous discussion account for 26% of the variance in course persistence rates. Consistent with the literature on adult student dropout, the findings identify additional situational and institutional barriers to persistence among students in online courses. The findings suggest that strategies to facilitate student persistence in online courses

should address online instructional techniques, faculty development, technology development, and program development.

INTRODUCTION

The growth and popularity of the Internet and the World Wide Web among students and faculty at institutions of higher education across the country has coincided with the expansion of online distance education programs. As institutions of higher education expand online course offerings, it is important to identify strategies that promote student participation and success in online courses and programs. One obstacle to student success in online courses is student withdrawal or dropout, a failure of students to complete a course and/or program of study. Research suggests that online courses have significantly higher dropout rates

than face-to-face courses (Carr, 2000; Levy, 2005; Simpson, 2004; Terry, 2001).

While a number of factors have been identified as contributors to student dropout, few research studies have examined the classroom factors contributing to a student's decision to withdraw from, or persist in, a course or program of study (Barefoot, 2004; Simpson, 2004; Tinto, 2002). One factor that is consistently identified as contributing to student achievement, satisfaction, and persistence in face-to-face college classrooms is interaction. A significant body of research documents the role of student and faculty interaction in supporting positive learner outcomes on the traditional college campus (Kuh & Hu, 2001; Pascarella & Terenzini, 1991; Tinto, 2002). More recently, researchers have identified a clear relationship between faculty interaction and student perceptions of learning and student satisfaction in online courses (Jiang & Ting, 2000; Roblyer & Wiencke, 2004; Shea, Frederickson, Pickett, Pelz, & Swan, 2001; Swan et al., 2000). This study examined the impact of instructional interaction on student persistence among adult students in online courses while also examining the reasons online students provide for persisting in, or withdrawing from, online courses. Specifically, this study examined the relationship of persistence to (a) the frequency of instructional interaction, (b) the method of instructional interaction, and (c) student attitudes regarding interaction and their online course experience.

LITERATURE REVIEW

Relationship Between Interaction and Persistence

The importance of interaction between students and teacher in supporting positive learner outcomes among campus-based undergraduate students is well-documented (Pascarella & Terenzini, 1991; Tinto, 2002). Pascarella's work

distinguishes between formal (academic) interaction that occurs within the classroom and informal (social) interaction that occurs outside the classroom. Studies have found that the frequency and content of formal and informal interaction between instructors and undergraduate students in on-campus courses are correlated to gains in student achievement (Kuh & Hu, 2001; Pascarella & Terenzini, 1991), student persistence (Terenzini & Pascarella, 1980; Tinto, 1987), and degree completion (Tinto, 1987). Kuh and Hu found that as students progress from freshman to senior year, their frequency of interaction with faculty increases and shifts from social to academic or career-related interactions.

More recently, a number of researchers have examined the role of interaction in supporting positive learner outcomes among online students. Arbaugh (2005) found a strong, positive relationship between interaction in online courses and both perceived student learning and student satisfaction. Shea and his colleagues found that prompt instructor feedback and quality feedback (as reported by student respondents) are each positively related to levels of perceived student learning and satisfaction (2001). Hay, Hodgkinson, Peltier, and Drago (2004) found that instructor-to-student interaction and student-to-student interaction are each positively associated with student ratings of online course effectiveness.

Student persistence addresses a student's commitment to complete a course and program of study. Persistence is considered a positive outcome measure as compared to dropout, which is the negative equivalent outcome (Cookson, 1988; Simpson, 2003). Much of the literature on persistence and dropout draws its theoretical framework from the research conducted by Vincent Tinto. Tinto's model of college student dropout suggests that persistence is an outcome of the student's academic and social integration into that institution's community (Tinto, 1987). While Tinto's research was conducted primarily on undergraduate students in residential four-year

colleges and universities, later researchers applied a similar theoretical framework to different student groups including undergraduate commuter students, (Pascarella & Chapman, 1983), undergraduate students enrolled in correspondence courses (Sweet, 1986), distant learners enrolled in video-based college (Towles, Ellis, & Spencer, 1993), and online college students (Willging & Johnson, 2004). These studies suggest that Tinto's model of college student dropout provides a framework for understanding the relationship between student-faculty interaction and student persistence in environments beyond those examined by Tinto himself.

Interaction in Online Education

The terms interaction and interactivity are sometimes used interchangeably in the distance education literature (Anderson & Garrison, 1998; Smith & Dillon, 1999); however, a close review of the literature suggests that interactivity defines aspects of a delivery system, while interaction defines a two-way communications process (Moore, 1989; Moore & Kearsley, 1995; Wagner, 1994). This distinction is important and supports the focus of this study on the communication process between student and teacher and among students. Computer mediated communication (CMC), a central characteristic of online education, uses e-mail, chat, and computer conferencing systems to facilitate communication between students and teachers and among students (Kearsley, 2000; Turoff & Hiltz, 1995).

For the purposes of this study, instructional interaction is defined as directed communication regarding course content and topics between the instructor and students or among students in the online course. This definition is consistent with previous researchers' efforts to refine the definition of interaction to reflect the communication process that occurs in distance education courses (Moore, 1989; Wagner, 1994).

In addition to focusing the definition of instructional interaction on the exchange of course-related information between instructor and students, the emergence of different methods of communication in online courses (e.g., text chat, e-mail, discussion forums) suggests the need to specify methods of interaction. Kearsley (1995) suggests that a distinction must be made between immediate (synchronous) interaction and delayed (asynchronous) interaction. Synchronous interactions are supported through text-chat, audio-chat, desktop video conferencing, and emerging groupware applications, while asynchronous interactions are supported by tools such as e-mail and electronic discussion forums (Collison, Elbaum, Havind, & Tinker, 2000; Kearsley, 2000; Salmon, 2000). This distinction regarding the method of interaction is important since it affects the provision of feedback to the learner, a concept that Freedman, Tello, and Lewis (2003), Holmberg (1995), Smith and Dillon (1999), and others identify as critical to the learning process. Synchronous methods of interaction can provide immediate feedback to learners while, asynchronous methods of interaction can provide the learner with more control over where and when the instructional interaction occurs (Moore & Kearsley, 1995).

Characteristics of Adult Students

The student population participating in this study was composed primarily of adults enrolled in online courses offered by a continuing education division at a major public university. The majority of students enrolled in this program are age 25 or older (85% of students were age 25 or greater during the study period). This age range is consistent with the literature that finds that adults, aged 25 or older, compose the majority of students enrolled in continuing education programs. As part-time students with multiple responsibilities, the student role held by adults tends to be secondary to other roles as family members, workers, and community members (McGivney, 2004; Morgan

& Tam, 1999; Simpson, 2003). This distinction has particular implications when examining adult student dropout and persistence since these other primary roles place demands on adults that may interfere with their ability to complete a course or program of study.

Researchers have categorized the reasons adult students drop out of college into situational barriers, institutional barriers, and dispositional barriers (Cross, 1981; Morgan & Tam, 1999; Simpson, 2003). Situational barriers arise from a student's life situation and can include cost, lack of time, family responsibilities, and job responsibilities. Dispositional barriers are related to a student's attitudes and self-perceptions as a learner. Institutional barriers include institutional policies and practices that impede adult participation (e.g., inconvenient course times, extensive prerequisites or program requirements, inconvenient location).

METHOD

Purpose and Overview

A non-experimental, correlation study was conducted that examined the relationship between instructional interaction and student persistence in online education. This study utilized a survey research methodology and records review to investigate the relationship between instructional interaction and student persistence. Specifically, this study asked:

1. Is there a relationship between the frequency of instructional interaction and levels of student persistence in online courses?
2. Is there a relationship between the method of instructional interaction and student persistence in online courses?
3. Do other variables emerge as correlates of persistence among students in online courses?

An important aspect of research on persistence and dropout is contact with those students who withdraw from a course or program of study (Simpson, 2003; Turoff & Hiltz, 2000). For this reason the study also asked:

4. What reasons do online students provide for persisting in, or withdrawing from, their online courses?

Participants

The online learning program that participated in this study is operated by a public university located in New England. This university offers online programs in education, engineering, management, information technology, liberal arts, and the health professions at the undergraduate and graduate level. The online program enrolled 5450 students in 264 course sections during the year this study was conducted.

The online program uses a course management system (CMS) for the development and teaching of online courses. The CMS allows faculty to develop course materials that are then accessed by students online via a Web browser. All faculty teaching in the online program participate in a training program that introduces online pedagogy and instructs faculty in how to use the CMS to develop and teach an online course. The CMS used by the program supports both asynchronous and synchronous communication methods. These methods include synchronous text-based chat, asynchronous text-based discussion forums, and asynchronous e-mail lists.

Sample

The population for this study included 1569 undergraduate and 51 graduate students enrolled in 76 online courses offered in the fall semester by the continuing education division of a public university. The unit of analysis for persistence data (i.e., data from students who maintained enroll-

ment throughout the semester) was each online course. Criteria for selection included:

1. The instructor agreed to allow presentation of a survey tool to all students in the course.
2. The instructor agreed to allow researchers to review course communications.
3. The course met enrollment-based survey response rates.

Participating courses included all of the disciplines offered online by the program at the time of the study.

Following approval by the University's Institutional Review Board, an e-mail was sent to all online instructors requesting permission to survey their students at the end of the semester. If permission was granted, the option to complete an online survey was presented to students when they logged into their online courses during the last three weeks of the study semester. Once a student completed an online survey for a course, they were no longer presented with the option to submit a survey for that course. Upon submission of a survey, student identification data were separated from student response data, protecting the anonymity of individual students.

Response Rates

Persister survey data were collected from students enrolled in each course during the last three weeks of the semester. Student responses were grouped by course, and per course response rates were calculated. A total of 714 online surveys were returned for the 52 courses that met the participation criteria, representing an overall 64% response rate. Courses that met the response rate criteria closely reflected the distribution of disciplines in the overall online program and included four graduate and 48 undergraduate courses.

Non-persisters (i.e., students who filed paperwork with the Registrar's Office declaring

withdrawal from a course prior to the final grading period) were identified through a review of course enrollment records. The non-persister group included 138 students who administratively withdrew from a course in the online program prior to the end of the 14-week semester. Students who withdrew from multiple online courses were asked to complete a non-persister survey for only one course. The sample was reduced to 102 non-persisters after removing students who withdrew from multiple courses, as well as five students with out of country or undeliverable mailing addresses.

A paper copy of the non-persister survey was mailed to each non-persister along with a \$2.00 cash incentive. Two follow up contacts were made with non-respondents, one by mail and one by telephone, asking if they would prefer to complete the survey over the telephone with a trained research assistant. The response rate among non-persisters was 45%, representing 25 of the 52 courses participating. While this low response rate prevented comparison of responses at the course level, it did assist in identifying reasons why individual, non-persisters withdrew from online courses as well as situational differences between students who were persisters and non-persisters.

Instrumentation

This study utilized a survey research methodology to collect data regarding instructional interaction in online courses and student attitudes to their online course experience. An online survey was developed to collect data regarding the online course experience of students who maintained enrollment in their online course throughout the 14-week semester. This 37-item survey collected data regarding student demographics and characteristics; the frequency and method of interaction in each online course; and student attitudes toward interaction, their online course experience, and the contribution of interaction methods (available online at <http://frontpage.uml.edu/faculty/stello/>

survey.htm). Students could only submit one survey per registered online course.

A non-persister survey was developed that included items similar to the demographic, interaction, and attitude items contained in the online student survey, but also solicited the students' reasons for dropping out of their online courses (available online at <http://frontpage.uml.edu/faculty/stello/survey.htm>).

Independent Variable

The independent variable in this study is instructional interaction. For the purposes of this study, instructional interaction is defined as directed communication regarding course content and topics between the instructor and students or among students in an online course (Kearsley, 1995; Wagner, 1994). This study examined two aspects of instructional interaction, the frequency and the method of instructional interaction. Frequency of instructional interaction refers to how often students and instructors, and students and students, interact regarding course related materials. Frequency of interaction data were collected through persister surveys. Students responded to two items on the survey on a 5-point Likert scale asking them to indicate how frequently they used course communications tools to communicate with their instructor regarding course matters and how frequently they used course communications tools to communicate with their classmates regarding course matters. Per course Frequency of Instructor Interaction scores ranged from 2.12 to 4.00, with a mean score of 3.10 ($SD = .41$). Per course Frequency of Student Interaction scores ranged from 1.25 to 3.86, with a mean score of 2.59 ($SD = .54$). A strong, positive correlation between frequency of instructor-to-student and student-to-student interaction ($r_{50} = .68, p < .001$) suggested the creation of an Interaction Index as an overall measure of instructional interaction within each course. The sample mean Interaction Index score was 2.83 ($SD = .44$). Per course

Interaction Index scores ranged from a low of 1.97 to a high of 3.93.

Method of instructional interaction refers to whether the interaction within a course occurred asynchronously, using the discussion forum or e-mail lists, or synchronously, using the online chat tool. Correlational analysis between the method of instructional interaction and course persistence rates required the creation of three method of interaction indexes. These three indexes reflected the overall interaction on the part of instructors and students within each method of interaction per course. A reliability analysis of the three items composing each index revealed coefficient alphas of .92 for the Chat Method Index, .93 for the Discussion Method Index, and .77 for the E-mail Method Index. Once the three Method of Interaction Indexes were calculated, the distribution of course scores and descriptive statistics were reviewed for each index (Table 1).

Intervening Variables

Two attitude indexes were developed to examine student satisfaction with each online course along with student attitudes to dimensions of interaction. Previous research suggests that student satisfaction with individual online courses is a key indicator in a student's decision to persist or dropout of a course (Chyung, Winiecki, & Fenner, 1998; Jun, 2005; Levy, 2005). Additional research has also established a clear relationship between faculty interaction and student perceptions of learning and student satisfaction in online courses (Arbaugh, 2005; Hay et al., 2004; Jiang

Table 1. Means and standard deviations for three method of interaction indexes

| Index | M | SD |
|-------------------------|------|------|
| Chat Method Index | 8.08 | 1.66 |
| Discussion Method Index | 9.00 | 2.00 |
| Email Method Index | 6.97 | 1.02 |

& Ting, 2000; Roblyer & Wiencke, 2004; Shea et al., 2001; Swan et al., 2000). Each index provides a composite, ordinal measure of the variables under examination (Babbie, 2001).

Students were asked to indicate their level of agreement on a 4-point Likert scale with three statements examining their satisfaction with their online course. A reliability analysis conducted with these three items resulted in a coefficient alpha of .89, with item to total correlations between .56 to .92, suggesting a high degree of reliability and the creation of an attitude to course index. Student responses to these three items were summed at the course level and a mean Attitude to Course value was calculated for each course.

Students were asked to indicate their level of agreement on a 4-point Likert scale with four statements examining dimensions of instructional interaction: (a) timeliness of instructor feedback, (b) utility of instructor feedback, (c) amount of instructor communication, and (d) amount of student communication. A reliability analysis conducted with these four items resulted in a coefficient alpha of .91, with item to total correlations ranging from .55 to .86, suggesting a high degree of reliability. Student responses to these items were summed at the course level and a mean Attitude to Interaction value was calculated for each course.

Three items on the persister survey examined student attitudes toward the use of each method of interaction. These course contribution by method items examined the strength of student agreement with the following statement: "Overall, would you say (method) contributed to your online learning experience?" Student responses for the three Contribution by Method items were grouped at the course level, and descriptive statistics were calculated. An initial review of the distribution of per course responses for each item approximated a normal distribution, supporting the use of these items for correlational analysis.

Dependent Variable

Student persistence, the dependent variable in this study, is considered a positive outcome measure but is often quantified through the measurement of its negative equivalent outcome, dropout. Student persistence was measured by examining enrollment rosters for participating courses at the end of the two-week Add/Drop period (Total Course Enrollment) and again after final course grades were submitted. The examination of course enrollment rosters assisted in identifying the number of students who administratively withdrew (i.e., students who filed paperwork to withdraw) from their online course after the two-week Add/Drop period (Voluntary Dropout) and the number of students who failed or took an incomplete for a course (Involuntary Dropout). A final course enrollment was calculated by subtracting Voluntary Dropout and Involuntary Dropout from the Total Course Enrollment, then dividing this number by the Total Course Enrollment.

The per course persistence rate provided a measure of the percentage of students completing each online course. The 52 courses that met the persister survey response rate criterion for this study had a mean persistence rate of .80 (SD = .11), meaning 80% of the students enrolled in online courses selected to participate in this study completed the course with a passing grade. Persistence rates among courses ranged from a low of 42% to a high of 100%.

Characteristics of Persisters and Non-Persisters

Demographic data (Table 2) were collected via the online student survey from students who maintained enrollment in their online course through the end of the semester (persisters). Comparable demographic data were also collected for non-persisters who participated in the telephone survey or who completed and returned a mail survey.

An Analysis of Student Persistence in Online Education

Table 2. Contingency table analysis between persisters and non-persisters in regard to demographic and situational characteristics of respondents

| | Persister | Non-persister | χ^2 | <i>p</i> value |
|-------------------------------|----------------|---------------|----------|----------------|
| Total Sample | <u>n</u> = 714 | <u>n</u> = 46 | | |
| | % | % | | |
| Characteristics | | | | |
| Age at time of survey (years) | | | 2.97 | .23 |
| 18-24 | 14.9 | 20.5 | | |
| 25-44 | 67.2 | 54.5 | | |
| 45 or older | 17.9 | 25.0 | | |
| df=2 | | | | |
| Gender | | | 0.88 | .35 |
| Male | 52.8 | 45.7 | | |
| Female | 47.2 | 54.3 | | |
| df=1 | | | | |
| Primary adult role | | | 1.03 | .79 |
| Student | 8.5 | 6.8 | | |
| Parent | 20.1 | 15.9 | | |
| Working professional | 63.1 | 65.9 | | |
| Other | 8.3 | 11.4 | | |
| df=3 | | | | |
| Hours worked per week for pay | | | 3.19 | .20 |
| 30 hours or less | 21.1 | 13.6 | | |
| 31-40 hours | 26.7 | 20.5 | | |
| More than 40 hours | 52.2 | 65.9 | | |
| df=2 | | | | |
| Children under 18 at home | | | 0.95 | .33 |
| Yes | 45.2 | 37.8 | | |
| No | 54.8 | 62.2 | | |
| df=1 | | | | |
| Years of Internet usage | | | 2.95 | .09 |
| 1-3 Years | 9.9 | 2.2 | | |
| More than 3 Years | 90.0 | 97.8 | | |
| df=1 | | | | |

Note: Values represent % within persister and non-persister groups.

A two-way contingency table analysis was conducted to evaluate differences between persisters and non-persisters in regard to these characteristics. This review suggests that in many respects, these two groups are quite similar. Both groups are distributed similarly, with no significant differences noted, in respect to age, gender, primary adult roles, presence of children in the home, and Internet use experience. A larger percentage of non-persisters report working more than 40 hours per week; however, this difference was not statistically significant.

A larger percentage of persisters report being enrolled in a certificate or degree program (15.5% difference), and a larger percentage of persisters indicate that they intend to take another online course in the next semester (28.7% difference). A two-way contingency table analysis was conducted to evaluate the difference between persisters and non-persisters in regard to both their enrollment in a program and their intent to take another online course (Table 3). Persisters were significantly more likely to be enrolled in a degree or certificate program than non-persisters were and were also significantly more likely to indicate that they intended to take another online course in the subsequent semester.

Frequency of Interaction

This research asked if there is “a relationship between the frequency of instructional interaction and levels of student persistence in online courses.” An examination of the scatterplot comparing Course Persistence Rate and the Interaction Index scores did not identify a linear relationship between these variables (Figure 1).

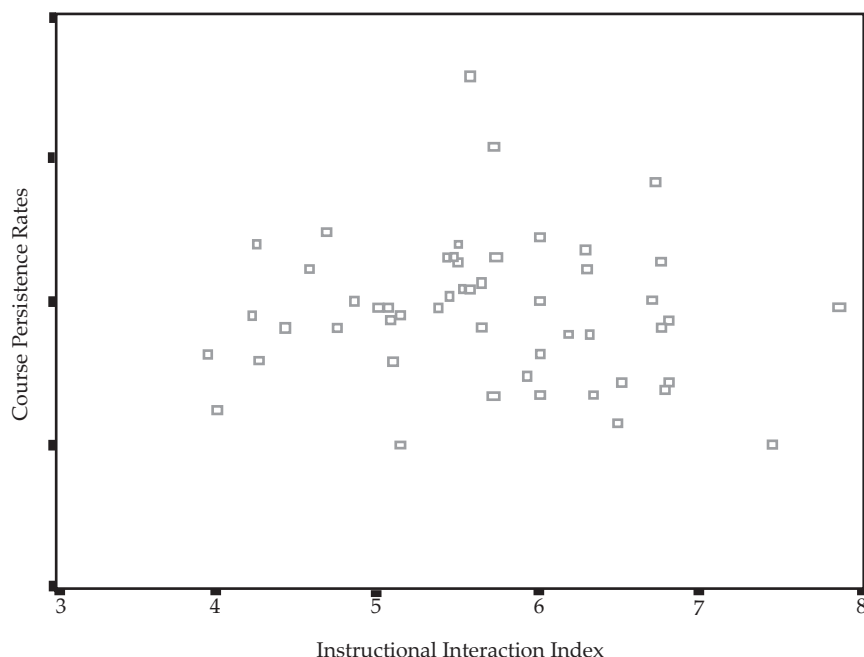
A strong positive correlation was observed between the frequency of instructor-to-student interaction and the frequency of student-to-student interaction within the online courses participating in this study. A Pearson Product Moment Correlation conducted between the course scores for Frequency of Instructor Interaction and Frequency of Student Interaction confirmed a positive correlation between frequency of instructor-to-student and student-to-student interaction, significant at $r_{50} = .68, p < .001$. The strength of this correlation suggests that as the frequency of instructor-to-student interaction increases in a course, the frequency of student-to-student interaction also increases.

Table 3. Contingency table analysis between persisters and non-persisters in regard to certificate/degree status and intent to return

| | Persister | Non-persister | χ^2 | p value |
|----------------------------|-----------|---------------|----------|---------|
| Enrolled in Degree Program | | | 5.03* | .03 |
| Yes | 72.0 | 56.5 | | |
| No | 28.0 | 43.5 | | |
| | N=714 | N=46 | | |
| Intent to Return | | | 15.74*** | .000 |
| Yes | 86.4 | 57.7 | | |
| No | 13.6 | 42.3 | | |
| | N=469 | N=26 | | |

Note: Values represent % within persister and non-persister groups.
 $df=1, * p < .05, ** p < .01, *** p < .001$

Figure 1. Course persistence rates by frequency of interaction index scatterplot



Method of Interaction

The second research question asked if “there is a relationship between the method of instructional interaction and student persistence in online courses.” A series of scatterplots was constructed pairing each of the Method of Interaction Indexes to Course Persistence Rates (Figure 2).

An examination of scatterplots comparing course persistence rates with each method of interaction index did not suggest a linear relationship between these variables; however, our earlier review of the mean Method of Interaction scores (Table 1) suggests that some differences exist in how each course used each method of interaction.

Student Attitudes to Interaction

A third research question asked if “other variables emerge as correlates of persistence among students in online courses.” The persister student survey asked respondents to consider how other aspects

of interaction contributed to their online course experience. These data were used to examine the relationship between persistence and student attitudes to interaction, student attitudes to the online course experience, and student attitudes regarding the contribution of a specific interaction method.

Strong, positive correlations, as indicated in Table 4, were observed at the course level between Student Attitudes to Interaction and: (a) the frequency of instructor-to-student interaction, (b) the Discussion Method Index, and (c) the E-mail Method Index. Similar positive correlations were observed at the course level between Student Attitudes to Online Course and the same three variables. These findings suggest a strong, positive relationship between the use of asynchronous methods of interaction by the instructor within a course (i.e., discussion forum, e-mail lists), and positive student attitudes toward that course. A modest, positive correlation was observed between Student Attitudes to Interaction and Course Persistence Rates, $r_{52} = .30$, $p < .05$.

Three course level measures, Course Contribution by Method, examined students' perceptions regarding the contribution each method of interaction made to their online learning experience. A strong positive correlation was observed between Course Persistence Rates and the Course Discussion Contribution scores, $r_{52} = .42$, $p < .01$ (Table 5).

A multiple regression analysis was conducted to evaluate how well the contribution by method variables and method of interaction indexes predicted persistence. The predictors included the three contribution of method variables and the three method of interaction indexes. The Course Persistence Rate was the criterion variable. A stepwise multiple linear regression analyses was conducted. The Contribution by Discussion Method variable and the Discussion Method Index were significantly related to the Course Persistence Rate, $F(2, 48) = 8.87$, $p = .001$. The sample multiple correlation coefficient was .51, indicating that approximately 26% of the variance in the course

persistence rate in the sample can be accounted for by the linear combination of these two measures. The remaining Contribution by Method and Method of Interaction variables did not add to the predictive value of the equation.

Reasons for Withdrawal

As discussed earlier in the Literature Review, student dropout is a complex phenomenon caused by multiple factors. This study has established that 26% of the variance in the study's course persistence rates can be attributed to the use of asynchronous discussion forum for activities that students perceive as contributing to the course learning experience. In order to better understand the range of factors contributing to a student's decision to persist or dropout, both the persister survey and non-persister survey asked respondents to provide reasons for persisting in, or withdrawing their online courses. Student responses were grouped into situational and institutional barriers

Figure 2. Course persistence rates by three method indexes

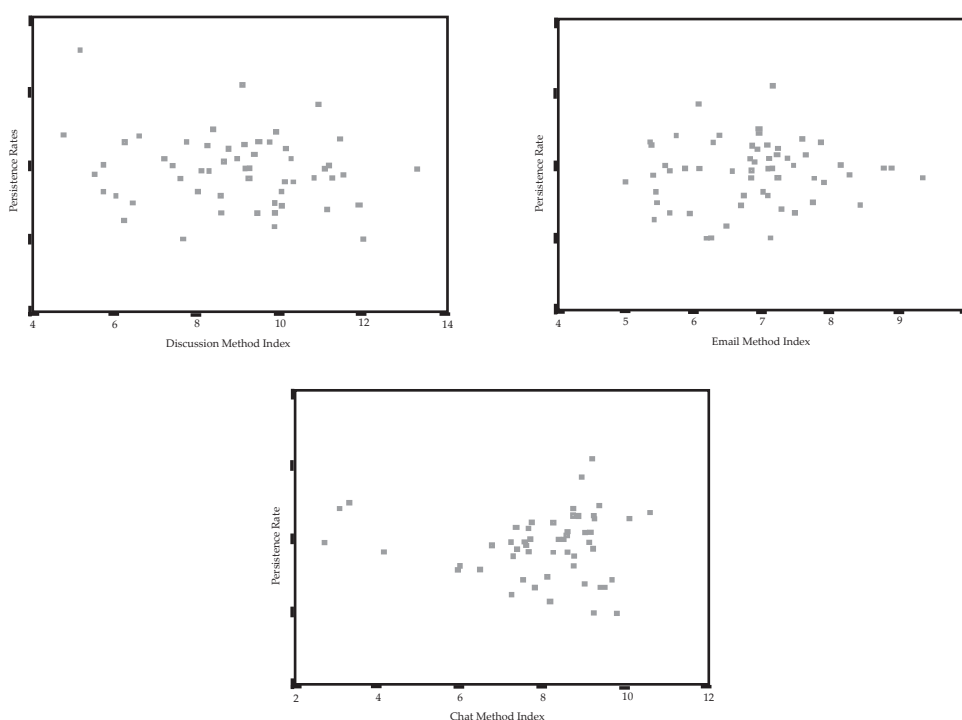


Table 4. Intercorrelations of per course attitude scales by per course frequency and method of interaction scores

| | Attitude to Interaction | Attitude to Course |
|--|-------------------------|--------------------|
| N = 52 | | |
| Frequency of Instructor (to Student) Interaction | .62*** | .41** |
| Frequency of Student (to Student) Interaction | .22 | .07 |
| Chat Index | .15 | .09 |
| Discussion Index | .55*** | .39** |
| E-mail Index | .43** | .41** |

2-tailed significance, *p<.05, **p<.01, ***p<.001

Table 5. Intercorrelations of per course contribution items to course persistence rates

| | Persistence Rate | n |
|--|------------------|----|
| Chat Contribution | .008 | 51 |
| Discussion Contribution | .416** | 52 |
| E-mail Contribution | .226 | 52 |
| 2-tailed significance, * p < .05, ** p < .01, *** p < .001 | | |

as discussed earlier (Figure 3). Situational barriers accounted for 62% of the reasons non-persisters provided for withdrawing from their online course. The primary reason identified by non-persisters for withdrawing from their online course was work commitments (30%).

In contrast, persisters identified institutional barriers (46%) slightly ahead of situational barriers (40%) as the reason they did not intend to take a future online course (Figure 4). The primary institutional barrier persisters identified was that the course they required was not offered online (29%). Only one persister identified work commitments as a reason for not taking a future online course.

The analysis conducted to examine this research question suggests there may be differences between non-persisters and persisters in regard

to their commitment to complete a program of study as well as the impact the number of hours worked per week has on a student's ability to persist in their online studies. This analysis also suggests that instructor interaction accounts for a modest percentage of the reasons students provide for dropping (11%, non-persister, Figure 3) or not enrolling in a future online course (11%, persister, Figure 4).

DISCUSSION

The results of this study suggest that the relationship between student persistence in online education and the use of asynchronous discussion forums is mediated by student attitudes toward their respective online courses and the perceived

An Analysis of Student Persistence in Online Education

Figure 3. Percentage distribution of non-persister reasons for withdrawal

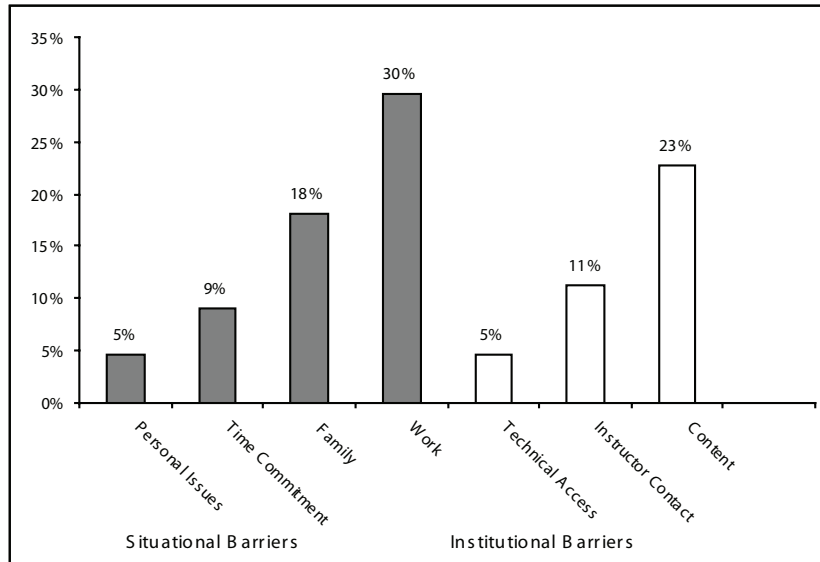
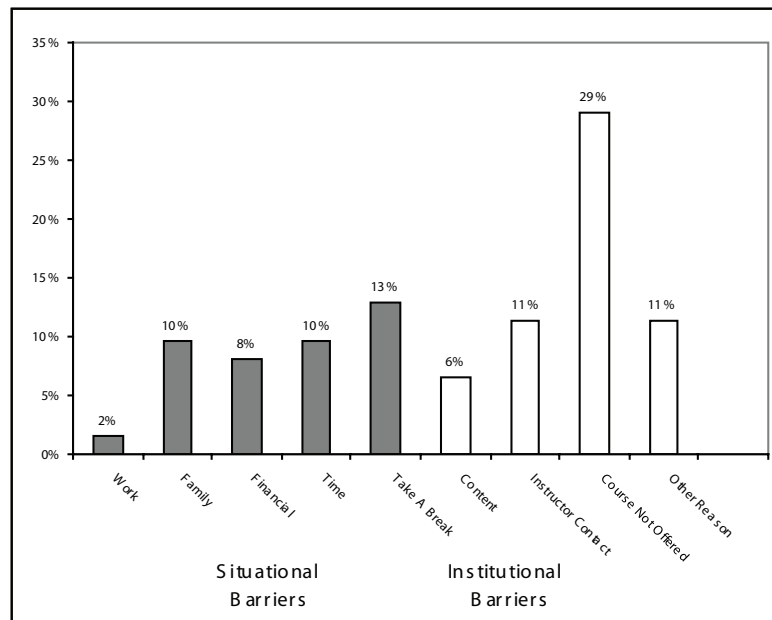


Figure 4. Persister reasons for not taking another online course



educational contribution of discussion forum use. The data indicate that student attitudes to interaction and student perceptions regarding the usefulness of particular methods of interaction are positively related to course persistence rates. Factors such as the timeliness of instructor feedback, appropriateness of instructor feedback, and amount of course-related communications can positively or negatively impact student attitudes toward the course and their decision to persist or drop out of an online course.

In addition to the correlational analysis discussed previously, this study examined situational and demographic characteristics of students enrolled in online courses.

While persisters and non-persisters were similar in many ways, several differences emerged between the groups that may influence their decision to persist or withdraw. A larger percentage of non-persisters reported working more than 40 hours per week for pay. A significantly larger percentage of persisters were enrolled in a certificate or degree program, and a significantly larger percentage of persisters indicated that they intended to take another online course in a subsequent semester. Situational barriers—comprised primarily of student work commitments, student family commitments, and student time commitments—accounted for the majority of reasons non-persisters provided for withdrawing from their online course.

Taken together, the results of this study suggest that adult learners, facing demands on their time from family, work, and school commitments, respond favorably to properly structured asynchronous course activities such as the discussion forum. These findings have implications for online faculty development programs, the design and development of new online programs, as well as for the technology we use to “conduct” online courses. Online program administrators should thoughtfully consider these results as they pilot new blended programs, which require on-campus meetings, and introduce synchronous video

technologies, which require students to meet online at the same time as the instructor. While a number of factors influence a student’s decision to persist or dropout, it will become increasingly important for online program administrators to control institutional factors that support student participation and success.

REFERENCES

Anderson, T. D., & Garrison, D. R. (1998). Learning in a networked world: New roles and responsibilities. In C. C. Gibson (Ed.), *Distance learners in higher education* (pp. 97-112). Madison, WI: Atwood.

Arbaugh, J. B. (2005). Is there an optimal design for online MBA courses? *Academy of Management Learning & Education*, 4(2), 135-149.

Babbie, E. (2001). *The practice of social research* (9th ed.). Belmont, CA: Wadsworth/Thomson Learning.

Barefoot, B. O. (2004). Higher education’s revolving door: Confronting the problem of student dropout in U.S. colleges and universities. *Open Learning*, 19(1), 9-18.

Carr, S. (2000, February 11). As distance education comes of age, the challenge is keeping the students. *Chronicle of Higher Education*, 23, A1.

Chyung, S., Winiecki, D., & Fenner, J. (1998). A case study: Increase enrollment by reducing dropout rates in adult distance education. Madison, WI: *Distance Learning '98: Proceedings of the Annual Conference on Distance Teaching & Learning* (August 5-7, 1998). (ERIC Document Reproduction Service No. ED422848).

Collison, G., Elbaum, B., Havind, S., & Tinker, R. (2000). *Facilitating online learning: Effective strategies for moderators*. Madison, WI: Atwood.

- Cookson, P. S. (1988). Persistence in distance education: A review. In M. G. Moore (Ed.), *Contemporary issues in American distance education* (pp. 192-204). Oxford: Pergamon Press.
- Cross, P. K. (1981). *Adults as learners: Increasing participation and facilitating learning*. San Francisco: Jossey-Bass.
- Freedman, S. C., Tello, S. F., & Lewis, D. (2003). Strategies for improving instructor-student communication in online education. In F. Albalooshi (Ed.), *Virtual education: Cases in learning & teaching technologies* (pp. 156-168). Hershey, PA: IRM Press.
- Hay, A., Hodgkinson, J., Peltier, W., & Drago, W. A. (2004). Interaction and virtual learning. *Strategic Change*, 13, 194-204.
- Holmberg, B. (1995). *Theory and practice of distance education*. New York: Routledge.
- Jiang, M., & Ting, E. (2000). A study of factors influencing students: Perceived learning in a Web-based course environment. *International Journal of Educational Telecommunications*, 6(4), 317-338.
- Jun, J. (2005). Understanding e-dropout. *International Journal of E-Learning*, 4(2), 229-240.
- Kearsley, G. (1995). The nature and value of interaction in distance learning. In M. F. Beau-doin (Ed.), *Distance education symposium 3* (pp. 83-92). University Park, PA: Pennsylvania State University.
- Kearsley, G. (2000). *Online education: Learning and teaching in cyberspace*. Belmont, CA: Wadsworth/Thomson Learning.
- Kuh, G. D., & Hu, S. (2001). The effects of student-faculty interaction in the 1990s. *The Review of Higher Education*, 24(3), 309-332.
- Levy, Y. (2005). Comparing dropout and persistence in e-learning courses. *Computers & Education*, 48(2), 185-204.
- McGivney, V. (2004). Understanding persistence in adult learning. *Open Learning*, 19(1), 33-46.
- Moore, M. G. (1989). Three types of interaction. *American Journal of Distance Education*, 3(2), 1-6.
- Moore, M. G., & Kearsley, G. (1995). *Distance education: A systems view*. Belmont, CA: Wadsworth.
- Morgan, C., & Tam, M. (1999). Unraveling the complexities of distance education student attrition. *Distance Education*, 20(1), 96-108.
- Pascarella, E. T., & Chapman, P. W. (1983). A multi-institutional, path analytic validation of Tinto's model of college withdrawal. *American Educational Research Journal*, 20, 87-102.
- Pascarella, E. T., & Terenzini, P. T. (1991). *How college affects students: Findings and insights from twenty years of research*. San Francisco: Jossey-Bass.
- Roblyer, M. D., & Wiencke, W. R. (2004). Exploring the interaction equation: Validating a rubric to assess and encourage interaction in distance education. *Journal of Asynchronous Learning Networks*, 8(4), 25-37.
- Salmon, G. (2000). *E-moderating: The key to teaching and learning online*. London: Kogan Page.
- Shea, P., Frederickson, E., Pickett, A., Pelz, W., & Swan, K. (2001). Measures of learning effectiveness in the SUNY Learning Network. In J. Bourne & J. Moore (Eds.), *Elements of quality online education* (Vol. 2, pp. 31-54). Needham, MA: Sloan-C Press.
- Simpson, O. (2003). *Student retention in online, open and distance learning*. London: Kogan Page.
- Simpson, O. (2004). The impact on retention of interventions to support distance learning students. *Open Learning*, 19(1), 79-95.

- Smith, P., & Dillon, C. (1999). Comparing distance learning and classroom learning: Conceptual considerations. *The American Journal of Distance Education, 13*(2), 6-23.
- Swan, K., Shea, P., Frederickson, E., Pickett, A., Pelz, W., & Maher, G. (2000). Building knowledge building communities: Consistency, contact and communication in the virtual classroom. *Journal of Educational Computing Research, 23*(4), 389-413.
- Sweet, R. (1986). Student drop-out in distance education: An application of Tinto's model. *Distance Education, 7*(2), 201-213.
- Terenzini, P. T., & Pascarella, E. T. (1980). Toward the validation of Tinto's model of college student attrition: A review of recent studies. *Research in Higher Education, 12*, 271-282.
- Terry, N. (2001). Assessing enrollment and attrition rates for the online MBA. *THE Journal, 28*(7), 64-68.
- Tinto, V. (1987). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago: University of Chicago Press.
- Tinto, V. (2002). Linking learning and living: Exploring the role of the college classroom in student departure. In J. Braxton (Ed.), *Reworking the student departure puzzle* (pp. 81-94). Nashville, TN: Vanderbilt University Press.
- Towles, D. E., Ellis, J. R., & Spencer, J. (1993). *Student persistence in a distance education program: The effect of faculty-initiated contact*. Lynchburg, VA. (ERIC Document Reproduction Service No. ED360931).
- Turoff, M., & Hiltz, R. S. (1995). Designing and evaluating a virtual classroom. *Journal of Information Technology for Teacher Education, 4*(2), 197-215.
- Turoff, M., & Hiltz, R. S. (2000). *ALN evaluation methods*. Symposium conducted at the Sixth Sloan-C International Conference on Online Learning, Nov. 4-5. Adelphi, MD: University of Maryland University College.
- Wagner, E. D. (1994). In support of a functional definition of interaction. *The American Journal of Distance Education, 8*(2), 6-28.
- Willging, P. A., & Johnson, S. D. (2004). Factors that influence students' decision to dropout of on-line courses. *Journal of Asynchronous Learning Networks, 8*(4), 105-118.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 3, edited by L. A. Tomei, pp. 47-62, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.45
Transitioning from
Face-to-Face to
Online Instruction:
How to Increase Presence and
Cognitive/Social Interaction in an
Online Information Security
Risk Assessment Class

Cindy S. York

Purdue University, USA

Dazhi Yang

Purdue University, USA

Melissa Dark

Purdue University, USA

ABSTRACT

This article briefly reviews two important goals in online education: interaction and presence. These are important goals in online education because they are linked to learning and motivation to learn. The article provides guidelines and an extended example of how to design an online course in information security in a manner

that will enhance interaction and presence. This article's contribution is to provide guidelines with a corresponding extended and concrete example for those who are tasked with designing and delivering online courses. Although the guidelines and example were targeted to the field of information security, they can be readily adopted by other disciplines.

INTRODUCTION

Although online education can offer convenience and flexibility for learners, it is not without challenges. Frequently, online education is no more than instructor notes and lecture materials posted on a Web site, perhaps with some required discussion. Much online instruction is designed, developed, and delivered without careful consideration of foundational instructional design principles. Research has shown that online courses that lack substantive and meaningful interaction, coupled with a sense of presence (feeling as though belonging in a virtual environment), contribute to a sense of isolation, unsatisfying learning experiences, and high dropout rates (Aragon, 2003; Bennett, Priest, & Macpherson, 1999; Glickman, 2003; Moore & Kearsley, 1996). The goal of this article is to provide a set of online course design guidelines based on research findings and best practices to enhance interaction and sense of presence, which are two critical factors that impact learning and motivation to learn in online courses (Moore, 1992; 1993; Muirhead, 1999; Richardson & Swan, 2003). Finally, an example is provided for applying the guidelines to transition a face-to-face class to an online class, using an information security risk assessment class. In order for these guidelines to make sense, we start with a brief discussion of interaction and presence.

Interaction

Moore (1989) identified three major types of interaction: a) learner-content, b) learner-instructor, and c) learner-learner. Learner-content interaction refers to the amount of substantive interaction occurring between the learner(s) and the content. Content could be in the form of text, radio, television, and/or audiotape. Participant interaction (learner-learner and learner-instructor) refers to the engagement of the learners and instructor in the learning and teaching process. It also refers to dialogue between and/or among different

participants in online learning environments. Thus, interaction is more than a communication exchange; interaction occurs when objects, actions, and events mutually influence one another (Wagner, 1994). Instructional interaction is meaningful communication that challenges learners' thinking, shapes the acquisition of knowledge in meaningful ways, and changes learners, moving them toward achieving their goals. Effective interaction is not necessarily more interaction, rather it is interaction resulting in learners thinking in new and more profound ways. While the literature and research confirmed the importance of interaction in the learning process (Muirhead, 2001), online learners frequently do not interact at sufficient levels and/or in substantive ways with the instructor or other learners in online courses. The lack of appropriate and deep interactions is a common inadequacy of current online courses (Bennett et al., 1999).

Presence

Closely related to interaction is the concept of presence. From the learner's perspective, presence is the "sense of being in and belonging in a course and the ability to interact with other students and an instructor although physical contact is not available" (Shin, 2002, p. 22). Presence also refers to the "involvement, warmth, and immediacy" (Danchak, Walther, & Swan, 2001, p. 1) learners experience during communication and interaction with others in the online learning environment. According to Picard (1997), an online course that conveys affective or emotional information to learners will lead to a higher sense of social presence and interaction. Leh (2001) found lack of interaction, originally due to lack of physical and face-to-face contact, in online learning environments leads to a sense of isolation (or lack of social presence). On the other side, an appropriate level of interaction promotes a better sense of social presence (Rovai, 2001). Research also has shown social presence is positively re-

lated to learner satisfaction, perceived learning (Richardson & Swan, 2003), and learning success (Rifkind, 1992; Tu, 2000). In other words, a good sense of social presence influences interaction and interaction influences students' sense of social presence. Together, appropriate interaction and presence lead to increased cognitive activity and also cognitive activity at higher levels, resulting in more meaningful learning in online learning environments. While these relationships are known, many designers, developers, and instructors of online courses do not consciously implement instructional methods and techniques that will effectively increase interaction and social presence. We asked ourselves why. The answer, we believe, is that they have not had access to pedagogically content-based guidelines grounded in research. With this information, we turn to the guidelines.

GUIDELINES FOR PROMOTING INTERACTION AND PRESENCE IN AN ONLINE COURSE

There are four main components to consider when transitioning a traditional face-to-face course to an online version: a) introductions, b) organization, c) instruction, and d) feedback. There are techniques to use for all four of these components that will allow students to be more socially and cognitively interactive and present in an online course.

Introductions

Much of the current literature on online courses emphasizes the value of creating a learning community among the online participants. According to Hanna, Glowacki-Dudka, and Conceição-Runlee (2000), "a learning community is a group of people who have come together to form a culture of learning in which everyone is involved in a collective effort of understanding"

(p. 14). This sounds great, but as an instructor you are probably asking what techniques can be used to accomplish this task. "You need to build a climate that will foster professional learning or collaboration by crafting communications that support a sense of safety in the discussion areas" (Collison, Elbaum, Haavind, & Tinker, 2000, p. 30). You want students to share their experiences with each other, but this is difficult unless they feel comfortable with each other. There are a number of strategies that can be used to foster this feeling of community.

In the course content discussion area, start with a social icebreaker for students to introduce themselves. This should be a non threatening type of interaction that "breaks the ice of using technology to communicate," (Conrad & Donaldson, 2004, p. 47) is participant focused versus academic content focused, and requires reading and responding to other postings (Conrad & Donaldson, 2004). Conrad and Donaldson (2004) list and describe a number of different types of ice breakers. For example, BINGO requires everyone to post a short biography on the discussion board. The instructor then e-mails everyone a bingo card with something from everyone's posting in a box. Students must then determine which box belongs to which student and fill in the correct name. Another possible icebreaker is TWO TRUTHS AND A LIE. Students post two truths about themselves and one lie. Other students then try to determine which is the lie. This is most fun when the truths are so outrageous it is hard to distinguish them from a lie.

Another method to help foster the feeling of community is to have a page dedicated to the biographical sketches and pictures of the students. This could also be a social space with a title, such as lounge, hallway, or water cooler, where students can discuss any off-content topics. Students need a space provided just for "*social dialogue* or simple chitchat" (Collison et al., 2000, p. 20). This helps prevent clutter in the content-discussion area and encourages students to contact each other via e-mail, instant messaging, or chat.

As the facilitator of this community, you will want to send an opening message to each student or post one on the content-discussion board. It should be a warm, welcoming message, perhaps with a friendly photo. The opening message should include a question requiring a response from students. This first message will set the tone for the class; it also can serve as a model for online discussions.

Organization

There are a number of organizational strategies to use to help increase interaction and presence in an online class. As the instructor, you will want to hold “online” office hours. This can either be a specified time when you will be answering e-mail or using instant messenger to “chat” with students either synchronously and privately. Another strategy is to provide job aids on how to use the technology employed in the course, which allows the technology to become invisible as students become more familiar with using it.

The course syllabus should consist of more than taking the face-to-face paper copy and making it digital. In an online course, the syllabus needs to include things such as guidelines for discussions, definition of roles, and so forth, and to function as a contract between instructor and students. In addition to content traditionally included in a syllabus, you should include contact information for student technical difficulties. Instead of listing “participation” or “online attendance” and the point value, define what participation entails. For example, we suggest the participation grade be based on the quality of the postings and not just the quantity. Participation could include posting on an asynchronous discussion board, showing up for a synchronous chat, working on a team project, and so forth.

One strategy to help foster quality asynchronous postings is to ask the students to send private e-mails for single comments, such as “I liked your last posting” or “I agree.” According to Moore and

Kearsley (1996), this helps prevent cluttering the discussion board; they encourage only postings that will contribute to the “community’s pool of knowledge (p. 151).” Do not discourage positive comments like this, because they contribute to the social presence of the community.

Another strategy is to group students into teams of three or four and have them write up what they believe are good ground rules for discussions and participation. For example, what to do if someone reads all the postings, but does not post any. These could be posted in a forum that explains discussion board procedures and guidelines. Guidelines that include a posting with “emoticons” for students unfamiliar with how to express text-based emotions are helpful (e.g., ☺ means smiling or happy). In addition, some students might use abbreviations that are now common in Internet-based chat, such as LOL or “laughing out loud.” These small additions can add personality to the text-based “voices” of the participants. In a face-to-face classroom, physical presence is displayed through “voice, body language, intonation, expressions, [and] gestures” and helps communication (Ko & Rossen, 2004, p. 12). In the online environment, participants rely solely on text-based communication and need to avoid words that could be misinterpreted, such as sarcasm, inappropriate jokes, and so forth. Thus everyone in the community must demonstrate a culture of respect, so participants “feel what they say matters and is valued by the other members of the community” (Collison et al., 2000, p. 30).

An additional aspect of the syllabus that needs to be addressed is the schedule. The schedule is the lifeline of the online course. Students will look to this to effectively manage time. Therefore, it is critical to present course content in a consistent manner, either all up front or on a regular schedule. This will reduce confusion and promote consistent checking of the site by students. Keep in mind not everyone is logged on when an assignment is posted. Give approximately a week for assignments, to allow for those who log in

later in the week. This is one of the advantages to online learning: the ability to log on anytime of the day or night. You could require everyone to log in every two to three days to ensure they have the most up-to-date information. Supplying information, such as due dates, in more than one location on the course Web site is also a good idea as some students might look in different locations for information.

Instruction

There are a number of different instructional techniques to use when attempting to increase presence and interaction in an online class. Collaboration can be fostered in small or large groups of students. If you choose to have large class projects, there are grouping considerations. Before grouping the students into teams they will work with for the large class project, consider pairing them up for a smaller assignment, such as an article critique or peer review. This helps foster feelings of comfort when learning how to work with others over distance. When assembling teams for a large class project, groups of four are typically the optimum number. Encourage collaboration to prevent the group from splitting up the work, then putting it together to turn in; you want them to “construct their learning together” (Palloff & Pratt, 2005, p. 39). Also, explain to the students why it is important that they work collaboratively and that it is a requirement.

Palloff and Pratt (2005) discuss the importance of collaboration, saying it promotes critical thinking skills and helps to foster the feeling of community. There are a number of ways to do this online. Students first can do the work individually and bring it to the group for critique and to certify the correctness of the papers. Then the instructor can pick one student randomly to answer the questions studied by the group or choose one paper from the group to grade with everyone in the group receiving that grade. A second technique is to provide different team members with the

charge of finding different information. This is called information interdependence, or the jigsaw strategy, where students have the different pieces needed to complete the puzzle. In order for all the team members to do well on the assignment, they need to rely on the information the rest of the team members have learned. Hence, the students are held accountable for teaching the material to their team members. Another technique is to have the team devise a “charter” or team agreement delineating the different roles individuals will play, how they will interact, and different project deadlines. It is helpful to provide a sample charter, so students know what is expected of them. Some possible roles are secretary, liaison to the instructor, organizer, discussion board poster, and so forth. These roles might change during the project’s phases. Have the team create a team name; this helps with team identification on the discussion board and also with a sense of community. To encourage team buy-in, give the team choices in determining project topic. Monitor the team’s progress and intervene if there are participation problems. Johnson, Johnson, and Holubec (1991) state that there are three reasons an instructor should intervene:

1. To correct misunderstandings or misconceptions about task instructions and the academic assignments they are completing;
2. To correct the absence, incorrect use, or inappropriate use of collaborative skills; [and]
3. To reinforce the appropriate or competent use of collaborative skills. (pp. 6:29)

In addition, tips for online conflict resolution could be included as a job aid (Palloff & Pratt, 2005). When assessing the collaborative assignment, perhaps include peer evaluations in the grading criteria. This can help prevent noncontributing team members. In addition, ask each team member to write a reflection on what they did to contribute to the project, and how they tackled their role and task throughout the process.

As many online courses are taught using mainly asynchronous discussion boards, there are discussion strategies and activities that encourage interaction and a sense of presence online. A main goal is to ensure there is a high level of interaction and dialogue. This can be facilitated by using different types of questions, activities, and presentations.

Questions

When posting discussion questions, the instructor does not always need to be the initiator. After the instructor has modeled question facilitation, allow students, or pairs of students, to take turns facilitating different discussion topics. This allows students to see that each participant in the community is as valuable as the instructor because every participant shares personal experiences to help the community learn. It also allows participants to see multiple perspectives. During online discussion, it is important to provide the discussions with a distinct beginning and end to prevent information overload and frustration among students (Conrad & Donaldson, 2004). Different types of questions can help encourage critical thinking, such as questions asking for more evidence, questions asking for clarification, open-ended questions, hypothetical questions, cause and effect questions, and summary and synthesis questions (Palloff & Pratt, 2005). In addition, you or the discussion topic facilitator should write a wrap-up paragraph summarizing the main points of the discussion, including students' names and the different points they made, which contributes to the feeling of presence.

Activities

Different types of activities can take place on a discussion board. The typical threaded discussion can get boring to students who read numerous posts. Some activities to increase interaction are the following: a) role playing, b) debates, c)

simulations, d) case studies, e) outside experts, f) sharing related personal/professional experiences, and g) electronic virtual field trips. In addition to these asynchronous activities, consider having a few required synchronous discussions. It should be noted, however, synchronous discussions tend to be more social; therefore, they are usually more effective at fostering social interaction than cognitive interaction. Guest lecturers via audio or video conferencing and synchronous large group sessions, where the instructor uses a whiteboard to demonstrate a problem, also can be used. If the instructor must present some sort of lecture to provide information to the class, include meaningful interactive links, discussion threads, and other activities to make the lecture interactive.

Presentations

Online course technologies often allow for different types of presentations. Individuals can post papers, PowerPoint presentations, and other documents in discussion threads. However, how do you have a group do a presentation to the entire class? If the students have access to software, such as Breeze, Camtasia, or Articulate, they can create multimedia presentations the class can watch. If this type of software is not available, students can prepare a discussion thread led by the team to present their project. Teams also can create simple Web sites to showcase their projects.

Feedback

The final component we are going to discuss is the use of feedback, which is essential to fostering interactivity. Online feedback should consist of both instructor-to-student and student-to-student (or peer) feedback. Responding to individual e-mails asking the same questions can get redundant; therefore, encourage students to post questions on the discussion board, so everyone will benefit from the response. In addition, provide a discussion

forum that allows students to provide feedback about the course; perhaps these are recommendations for improvement or lessons learned that can be shared with future classes.

No matter the activity students are involved in, provide opportunities for individual as well as group practice and feedback; this may be the first online class they have taken. In addition, the instructor should respond to all student queries. Make sure responses are prompt if it is a technical question. If there is a delay in responding, explain the reason. Instructor feedback should offer detailed analysis of student work and suggestions for improvement, along with additional hints and information to supplement learning. These can be private, via e-mail, or public to a team via the discussion board. If a student is not accessing the site enough, the instructor can send informal e-mails to see if the student is having problems in terms of the technology. The instructor should send encouraging supportive e-mails to individuals on an ongoing basis. Include questions that require the student to respond, thus drawing them into active participation.

Students should complete peer reviews for student-to-student feedback. This provides the reviewer the opportunity to focus on others' interpretations and the original writer to receive multiple perspectives. Provide guidelines and the rubric to be used for grading. Both the instructor and the students should use "track changes" in Microsoft Word documents to provide feedback, so everyone can see changes made, comments, or notes that include questions. Also try to get feedback from participants about their progress. This can be done through direct questions, assignments, quizzes, polls, and questionnaires.

THE ONLINE INFORMATION SECURITY CLASS EXAMPLE

This section of the article begins with a brief overview of how to introduce and organize the

online information security course. Next, there is an in-depth focus on three weeks of instruction, explaining how the course was transitioned from face-to-face instruction to an online format. While this specific example focuses on an information security course, the purpose of the example is simply to enact the guidelines. The guidelines can be generalized to other topics and fields in technology education.

Introductions for Building a Learning Community

When building a learning community in a face-to-face security assurance class, the instructor tends to have class introductions and perhaps an ice breaker activity. For an *online* security assurance class, the instructor needs to facilitate a learning community in a similar, yet different way. The instructor needs to provide a Web-based orientation to both the online environment and the course materials. An opening message should be sent by instructors, including a question requiring a response from students. In order to allow students to get to know each other early in the course, online ice breaker activities that are via discussion boards as well as having students work in virtual teams to produce a visual presentation about the team are useful. In addition, a space is provided on the class Web site for students to post their digitized images. The instructor also should encourage students to contact each other via e-mail and chat.

Course Organization

When organizing a face-to-face security assurance class, the instructor has a syllabus that includes a schedule, required textbook, and office hours. In the online version of the security assurance class, the instructor needs to go further. In addition to the online syllabus, the instructor needs to post a schedule with hyperlinks to that day's information as well as discussion and par-

participation guidelines and requirements. Links to online readings, in addition to the listed textbook, are included. Furthermore, the instructor needs to hold online office hours when the students can be sure to reach him or her immediately.

Instruction—Week One

Perform Asset Identification and Classification

In the first week of the face-to-face security assurance class, the instructor provides the students with readings on the risk assessment process and various models. She also presents a lecture to provide them with additional information. A discussion ensues about asset identification. They look at the different authors and different information provided in order to compare and contrast what each author said. They also discuss the purpose in the risk assessment process. In addition, the class brainstorms assets in the k-12 setting. The instructor assembles small groups and has the students apply asset identification to the k-12 setting. The groups then compare their new list to the other groups' lists. As a class, they then group information assets (types of data, part of classification). FIPS 199 is discussed as a classification scheme for sensitivity of assets. For homework, students are asked to apply FIPS 199 to their list and write a critique of the usability of FIPS 199. They can revisit the first readings to discuss their classifications.

In the online security assurance class, the instructor provides the students with links to readings and Web sites about the risk assessment process and various models. She also posts a short lecture (approximately 10 minutes) with a PowerPoint presentation via Breeze to provide them with additional information. A discussion forum is started in which the instructor poses an initial question about asset identification. The students have two to three days to respond. The instructor assigns different students to read different

authors to gain different information about risk assessment models. Concurrently, the instructor creates a new discussion forum for students to a) post a summary of their article, b) then compare their article to other postings, and c) discuss the purpose of models in the risk assessment process. The students again have two to three days to respond. The instructor creates a new discussion thread to brainstorm information assets in the k-12 setting and posts an initial questions. She has students individually apply asset identification to the k-12 setting then post their responses. She organizes students into groups of three or four and provides them group discussion forums. She has each group create one new list and has groups compare/contrast lists with each other. She also has groups apply a classification scheme to their list as well as write a group critique of FIPS 199. Groups also discuss their classification, according to the first readings they did. The students have four to five days to respond.

Instruction—Week Two

Perform Threat Identification

In the second week of the face-to-face security assurance class, the instructor provides the students with readings on information security threat analysis and classifications of threat types. As a class, they discuss how different threats might correlate to different assets. This is done first in small groups, then together in one large group discussion. The instructor also presents them with information on methods for identifying types of threats. She provides them with existing reports (FBI CIC Survey to Crime Data) and tells them where they can get this type of information for typical threats in other organizations. She asks the students if they can try to generalize to their organization, and how they would monitor their own employees/network/system. She poses the question, "How are you going to get clients to

think about modeling their threats before we go out to the client? Where we do actual threat identification?”

In the online security assurance class, the instructor provides the students with links to readings on information security threat analysis as well as Web sites about classifications of threat types. The students have two to three days to read this information. The instructor creates a new discussion forum about how different threats might correlate to different assets. Students are first assigned to small group discussion areas to answer a posted question. Then students discuss their findings in a large group discussion area. Students have two to three days to respond. Another discussion thread is created about methods for identifying types of threats. The instructor posts open-ended questions about the following: existing reports (FBI CIC Survey to Crime Data); where to get information; typical threats in other organizations; how the students could generalize to their organization; and how to monitor their own employees/network/system. In addition the instructor posts a fourth question: “How are you going to get clients to think about modeling their threats before we go out the the client, where we do actual threat identification?” Students have the same two to three days to respond.

Instruction—Week Three

Perform Vulnerability Identification

In the third week of the face-to-face security assurance class, the instructor provides a lecture and PowerPoint presentation on the three types of vulnerabilities— people, policy, and technology—and about establishing criteria for assessing vulnerability. She asks the students to individually develop an evaluation checklist (for policy) to take into a company. The instructor presents information about technical vulnerability. For example, she discusses the reporting tools companies and schools are likely to have as well as passive scan-

ning tools. The class goes to a computer lab as a group and experiments with a variety of these tools. The students are provided criteria to evaluate different types of scanning tools: purpose, when to use, cost, and advantages/disadvantages; this is done in small groups. For homework, students are put into small groups and asked to select a tool. They are then provided with a flawed system with known vulnerabilities to run their tool against. They must then take, analyze, and report their findings.

In the online security assurance class, the instructor provides the students with links to readings and Web sites on the three types of vulnerabilities—people, policy, and technology—and about establishing criteria for assessing vulnerability. She also posts a short lecture (approximately 10 minutes) with PowerPoint presentation via Breeze to provide them with additional information. She asks the students to individually develop an evaluation checklist (for policy) to take into a company and submit this to the online assignment drop box. Students have two to three days for this. Students are then put into small groups, where each student presents his/her checklist to the other group members. The small group is then tasked with coming up with a “Best of Breed” checklist, using their individual checklists. The instructor presents information about technical vulnerability via an audio presentation. For example, she discusses the reporting tools and passive scanning tools that companies and schools are likely to have. The instructor provides links to demonstration software for students to experiment with different types of these tools. She posts a list of criteria along with an example for students to evaluate different types of scanning tools: purpose, when to use, cost, and advantages/disadvantages; she assigns this to be done in small groups and posted within three days. The students also are requested to select one tool per small group. They are then provided a flawed system with known vulnerabilities to run their tool against. This system is

accessed via a virtual private network (VPN). The groups of students must then take, analyze, and report their findings on the discussion board within three days.

SUMMARY

The goal of this article was to provide guidance to faculty who are tasked with transitioning face-to-face instruction into distance learning. More specifically, these guidelines for an online course and the example of one are meant to provide readers with action steps that can be taken to improve the level and nature of interaction as well as students' sense of presence. The ultimate goal, of course, is to produce equally, if not more effective, results from online learning. Our hope is that faculty who attempt to use these guidelines will see increased learning and motivation to learn among their distance learning students.

REFERENCES

- Aragon, S. R. (2003). Creating social presence in online environments. In S. R. Aragon (Ed.), *Facilitating learning in online environments* (pp. 57-68). San Francisco: Jossey-Bass.
- Bennett, S., Priest, A., & Macpherson, C. (1999). Learning about online learning: An approach to staff development for university teachers. *Australian Journal of Educational Technology*, 15(3), 207-221.
- Collison, G., Elbaum, B., Haavind, S., & Tinker, R. (2000). *Facilitating online learning: Effective strategies for moderators*. Madison, WI: Atwood.
- Conrad, R-M., & Donaldson, J. A. (2004). *Engaging the online learner: Activities and resources for creative instruction*. San Francisco: Jossey-Bass.
- Danchak, M. M., Walther, J. B., & Swan, K. P. (November 2001). *Presence in mediated instruction: Bandwidth, behavior, and expectancy violations*. Presented at the annual meeting on Asynchronous Learning Networks Conference, Orlando, FL.
- Glickman, N. W. (2003). *The veterinary distance learning program at Purdue University: Factors associated with persistence and dropout*. *Digital Dissertations*, 64(11), 4018B. (UMI no. 3113802): Purdue University, West Lafayette, IN.
- Hanna, D.E., Glowacki-Dudka, M., & Conceição-Runlee, S. (2000). *147 practical tips for teaching online groups: Essentials of web-based education*. Madison, WI: Atwood.
- Johnson, D. W., Johnson, R. T., & Holubec, E. J. (1991). *Cooperation in the classroom*. Edna, MN: Interaction Book Co.
- Ko, S., & Rossen, S. (2004). *Teaching online: A practical guide* (2nd ed.). New York: Houghton Mifflin.
- Leh, A. S. (2001). Computer-mediated communication and social presence in a distance learning environment. *International Journal of Educational Telecommunications*, 7(2), 109-128.
- Moore, M. G. (1989). Editorial: Three types of interaction. *The American Journal of Distance Education*, 3(2). Retrieved January 24, 2005, from http://www.ajde.com/Contents/vol3_2.htm#editorial
- Moore, M. G. (1992). Distance education theory. *The American Journal of Distance Education*, 5(3), 1-6.
- Moore, M. G. (1993). Theory of transactional distance. In D. Keegan (Ed.), *Theoretical principles of distance education* (pp. 22-38). New York: Routledge.
- Moore, M., & Kearsley, G. (1996). *Distance education: A systems view*. Belmont, CA: Wadsworth Publishing Company.

Transitioning from Face-to-Face to Online Instruction

- Muirhead, B. (1999). *Attitudes toward interactivity in a graduate distance education program: A qualitative analysis*. Parkland, FL: Dissertation.com.
- Muirhead, B. (2001). Practical strategies for teaching computer-mediated classes. *Educational Technology & Society*, 4(2). Retrieved September 12, 2005, from http://ifets.ieee.org/periodical/vol_2_2001/discuss_summary_jan2001.html
- Palloff, R. M., & Pratt, K. (2005). *Collaborating online: Learning together in community*. San Francisco: Jossey-Bass.
- Picard, R. W. (1997). *Affective computing*. Cambridge, MA: MIT Press.
- Richardson, J. C., & Swan, K. (2003). Examining social presence in online courses in relation to students' perceived learning and satisfaction [Online]. *Journal of Asynchronous Learning Networks*, 7(1), 68-87.
- Rifkind, L. J. (1992). Immediacy as a predictor of teacher effectiveness in the instructional television classroom. *Journal of Interactive Television*, 1(1), 31-38.
- Rovai, A. P. (2001). Building and sustaining community in asynchronous learning network. *Internet and Higher Education*, 3(2000), 285-297.
- Shin, N. (2002). Beyond interaction: The relational construct of 'Transactional Presence.' *Open Learning*, 17, 121-137.
- Tu, C. H. (2000). Strategies to increase interaction in online social learning environments. In *SITE 2000*. Proceedings from the Society for Information Technology and Teacher Education International conference. Norfolk, Va.: AACE, 2000. (ED 444 550).
- Wagner, E. D. (1994). In support of a functional definition of interaction. *The American Journal of Distance Education*, 8(2), 6-29.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 2, edited by L. A. Tomei, pp. 41-50, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.46

Project–Based Online Group Collaborative Learning Characteristics

Jianxia Du

Mississippi State University, USA

Byron Havard

University of West Florida, USA

James Adams

Mississippi State University, USA

Gang Ding

East China Normal University, Republic of China

Wei-Chieh Yu

Mississippi State University, USA

ABSTRACT

This chapter illustrates a framework for online group collaborative learning based on Piaget's concepts of assimilation and accommodation and Vygotsky's theory of social interaction. This chapter examined how an online project-based learning approach affected students' cognitive skills development and their motivation, and

explored factors leading to successful collaborative projects. The findings indicated that in a project-based online group environment unique characteristics exist for leadership style and individual role, goal setting and project management, accountability and commitment, peer supportive relationships, individual accomplishment and group accomplishments, and mixed gender and race group preference.

INTRODUCTION

The value of collaborative learning is widely recognized because of its positive effects on social, cognitive and metacognitive development. One advantage of collaborative learning is that it provides students opportunities for self-reflection and joint construction of knowledge, and this environment frequently leads to higher levels of task-related interaction and behavior (e.g., Johnson, Johnson, & Stanne, 1986). When students are able to participate in active learning activities, they find learning more pleasurable and satisfying than non-participative events.

Small-group dynamics have been studied in educational contexts since the 1970s. Research indicates that small groups facilitate learning as compared to individual learning (e.g., Johnson, Johnson, & Stanne, 1986; Hamm & Adams, 1992; Bruffee, 1999), and that peer group work has significant impacts on varied learning outcomes in both face-to-face and online learning environments (e.g., Harasim, 1990; Scardamalia & Bereiter, 1996; Bruffee, 1999; Uribe, Klein, & Sullivan, 2003). Although much of cooperative learning research initially focused on face-to-face cooperation at the elementary school level, it is now gradually extending into higher education, which is the focus of this study.

Positive interdependence promotes 'group cohesion' and a heightened sense of 'belonging' to a group; and can be achieved through the task, resources, goals, rewards, roles or the environment (Brush, 1998). Individual accountability refers to the extent to which students are individually accountable for jobs, tasks or duties, and was introduced to counter the 'free-rider effect': some students would deliberately not invest any (or little) effort. Both principles, however, relate to group dynamics phenomena 'group cohesion' and 'social loafing' (Du & Havard, 2003), and thus apply to any form of small-group learning. Bosworth and Hamilton (1994) proposed a process-oriented design method for online group-based learning

that focused on fostering the envisioned group interaction thought to enhance learning instead of focusing on the formal product of such interaction. This method tends to be the dominant view in most institutions providing higher education and centers on five elements that directly shape group interaction: learning objectives, task type, level of pre-structuring, group size and technological tool used.

The need for systematic design of online learning is amplified by some observations that exhibit conflict regarding coordination during group interaction. These observations suggest conflicts are more likely to occur in asynchronous online settings compared to face-to-face settings (Du & Havard, 2005), since group members are not present at the same time and/or place. Also, the lack of presence concerning immediate feedback and face-to-face setting make asynchronous communication 'unnatural.' Clearly, some support should be designed to help students overcome difficulties in group coordination during asynchronous collaboration.

Group performance effectiveness depends on the groups' use of their alternate opinions and on the handling of increased coordination (Shaw, 1981). Roles, stated functions/duties or responsibilities that guide individual behavior and regulate intra-group interaction (Hare, 1994) can promote group cohesion and responsibility (Boud, Cohen & Sampson, 1999) and, thus, can be used to foster 'positive interdependence' and 'individual accountability' (Hedberg, 2003). In addition, roles can stimulate a group member's awareness of the overall group performance and each member's contribution. Lastly, roles appear to be most relevant when a group pursues a shared goal requiring a certain level of task division, coordination and integration of individual activities.

Despite the potential benefits of collaborative learning, several studies reveal that collaborative learning does not always lead to the desired outcome. For example, free collaboration does not

systematically produce learning (Dillenbourg, 2002), and researchers report large variations in the quality of interaction and learning outcomes (Lehtinen, Hakkarainen, Lipponene, Rahikainen, & Muukkonen, 2000). Other variations may include, but are not limited to, the length of studies, technology used, differences in research methodology and the quality of the group processes (Shaw, 1981; Strijbos, Martens, Jochems, & Broers, 2004). Students who have experienced negative online experiences perceived those experiences as weaknesses of online learning. These problems were most often caused by delayed feedback from instructors (Laszlo & Kupritz, 2003), lack of self-regulation and self-motivation, sense of isolation, monotonous instructional methods (Wang, Sierra, & Folger, 2003), and poorly designed assignments (Hedberg, 2003; Thomas, 2000). Problems in collaborative group projects include social loafing and free riding, disorder due to poor leadership and member role identification, low motivation through no common goal and poor management of tasks.

In this chapter, we argue that collaborative learning has moved beyond the question whether it is effective in accelerating knowledge construction, but should focus on the conditions under which these types of learning environments were optimally effective. The aim of this chapter is to describe students' perceptions of online group collaborative learning and examine how an online project-based learning approach affected students' cognitive skills development and motivation. This study will identify specific group dynamics and factors leading to successful collaborative projects.

A Theoretical Framework for Analysis of the Collaborative Learning Process

From a constructivist perspective, knowledge is constructed via interactions between and among the learner and the social world (Crotty, 1998).

Accordingly, learning will be enhanced when students are supported by and engage in 'meaning-making' experiences (Jonassen, 1999). Cognitive tools provide the means through which many constructivist learning activities are enacted, enabling a wide array of affordances with which individuals access, manipulate and otherwise construct knowledge (Jonassen & Reeves, 1996; Lajoie, 2000). Tools play especially important roles in student-centered learning environments (Land & Hannafin, 1996, 1997), where problems are framed in authentic and meaningful contexts, learners engage problems using multiple resources and tools, and knowledge construction is facilitated using technological as well as human scaffolds (Hannafin et al., 1999).

Constructivism is a term used to describe a number of theories. Two dimensions were focused on in this study: the knowledge construction process of individual learners and knowledge construction as a socially situated process (Driscoll, 1994).

The individual learner constructs knowledge by adapting previously constructed schemes. This view is based on Piaget's theory and the concepts of assimilation and accommodation. This process of schema construction and reconstruction implies the selection of stimuli from the project-based environment, continuous storage and retrieval of schemas between long-term memory and working memory in order to organize, elaborate, refine and/or integrate these schemas. This overall process is monitored by metacognitive processes. These processes help the learner to be selective in stimulus selection, storage, retrieval and response organization (Popolov, Callaghan, & Luker, 2002). The online setting influences this complex of cognitive activities in interaction with the nature of the project-based environment.

The knowledge construction process may also be seen as socially situated. This view is based on Vygotsky's theory of social interaction, where the interaction between people plays an important role. This is where the 'social' part of 'social construc-

tivism' becomes evident. The interaction between learners in the online environment is expected (a) to incite the learner to make explicit the actual level of schema development by writing his or her ideas down, and (b) to demand from the learner an explicit comparison of his or her schema and that/those of others as to defend or criticize them. As such, the interaction demands further elaboration and organization of the schemas at the point collaboration enters. This theoretical description implies that learning in the online environment depends on the amount of schema exploitation activities and the amount of explicit comparison and contrast. The more these activities are invoked, the higher the level of knowledge construction to be expected.

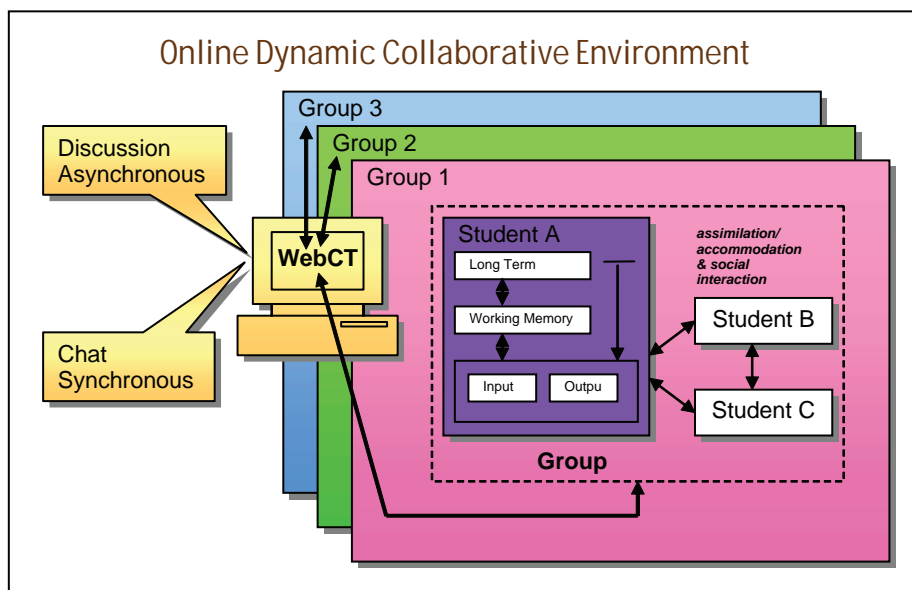
Figure 1 provides a graphical representation of the theoretical base for the present study. This scheme is an extension of the framework used in previous research (Hare, 1994; Kitchner, 1983). It integrates social constructivist principles and concepts derived from the information processing approach to learning (Dillenbourg, 2002).

We consider three elements or levels regarding learning: individual processes, group member processes and group environment processes (see Figure 1). Individual learning is depicted through an information processing perspective, with sensory receptors providing input, refined through short- and long-term memory, and exhibited through output. Individual input and output is affected and refined through social interaction, where familiar information is assimilated and new information is accommodated. Learning continues at the group environment level, where group input and output is refined through review and critique by other groups.

Framework Application in Online Group Collaboration

The social constructivist notion of interactivity described above was used as a theoretical framework for building an online collaborative learning. The online learning environment for this course was created in WebCT. WebCT is a database

Figure 1. Graphical representation of social constructivist principles and concepts derived from the information processing approach to learning



driven Web-based course management system designed to support online learning environments (Hutchins, 2001). The database elements available in WebCT enable the instructor to record, manage and support the activities and interactions of a large number of students. This multimedia design for instruction course is required of all students enrolled in the Master of Science in Instructional Technology (MSIT) program. Students enrolled in the MSIT program and in this course represent a wide range of diverse backgrounds. They reside throughout the state of Mississippi, Tennessee and Alabama. Each semester, approximately 30 students are enrolled in this course.

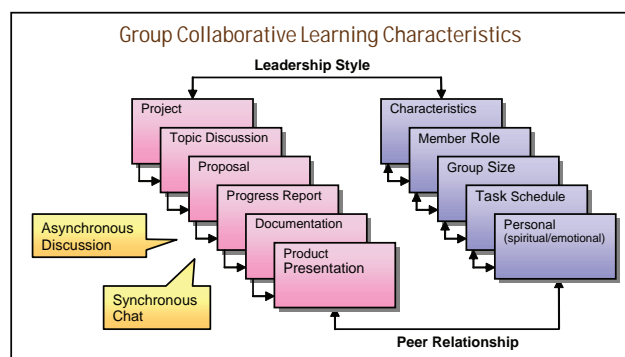
In Figure 2, leadership style and peer relationships have a dramatic effect on the nature and outcome of the final product in a project-based learning environment. Both project and group characteristics are impacted by their related characteristics, leadership style and peer relationships (see Figure 2). This project is sequential in nature, with each phase channeling into the next. Peer relationships and leadership style within a group are interrelated, impacting each phase of the project.

Framework Application

We applied the framework during two semesters of a graduate-level multimedia design for instruction

course. The purpose of this course was to provide students with an overview of hypermedia/interactive multimedia technology by working with various hypermedia/multimedia tools. Students were introduced to the design and production process of developing multimedia applications and provided the opportunity to learn various tools concentrating on different aspects of the technology: text, graphics, audio, animation and video. By working with these tools, students were expected to develop the skills and understanding required for the creation of instructional tools for application in education and industrial settings. Students were required to apply design principles necessary for the creation of hypermedia/multimedia in developing multimedia-based applications. Several important aspects about this environment regarding skill development, theoretical and technical issues, and the application skills and knowledge towards the successful development of a comprehensive multimedia instructional product (Popolov, Callaghan, & Luker, 2002; Slavin, 1995) were examined. Through online group communication using the asynchronous discussion feature and synchronous chat available through WebCT, students’ skills and knowledge regarding multimedia development were enhanced. The social aspect of the learning environment is critical (Vygotsky, 1978). This required focused attention

Figure 2. Leadership style and peer relationships effect on the nature and outcome of the final product in a project-based learning environment



by the instructor, as knowledge is socially constructed and enhanced through peer-to-peer and instructor-to-peer communication (Boud, Cohen, & Sampson, 1999; Kitchner, 1983; Kitchner & King, 1981).

In the multimedia process, students worked in groups and took on different roles. The contexts for learning in this course were primarily interactive, collaborative, multi-disciplinary and student-centered. Students were required to actively participate in weekly discussions regarding specific multimedia development topics. Assignments on learning different tools were given to assess application skills, and students were required to write a research and reflective paper on hypermedia/interactive multimedia instruction. Group projects for the semester both developed and assessed students' ability to comprehensively apply the theoretical and technical requirements for multimedia design for instruction. Students worked together in teams of four or five in developing an instructional Web site as the final course project. The tools used for project development included Macromedia Dreamweaver, Fireworks, Flash, and Hyperstudio. The general target audience for the site included prospective students and teachers. Deliverables beyond the completed Web site included a project proposal, project progress report, project documentation and final presentation of the final product. The project proposal was intended to describe the instructional problem, specific target audience, instructional or training context and objectives to be achieved. The formal project progress report required groups to provide status on their project, including work completed and tasks planned for completion. Project documentation, similar to a detailed design document, revealed details about the product that was developed, justification and use of an instructional design model for product development, audience analysis, formal instructional content, learning objectives, media selection, instructional strategy employed and assessment. Finally, project documentation concluded

with a description of the formative evaluation process and findings. Each group presented their final product to the class. Every member of each group was expected to take an active role in the final presentation.

FINDINGS

Accountability and Commitment

By online, we mean that most learners are likely to be geographically isolated, studying perhaps from home but with full access to all of the necessary resources via Internet connection. Materials (such as lecture notes) and processes (such as assignment submission) will be electronic, and interaction will be either synchronous (e.g., via chat-rooms or videoconferencing facilities) or asynchronous (e.g., via e-mail or discussion lists). By collaborative, we mean that despite their differing locations, most learners will conduct most of their learning in groups. Such groups are likely to be wholly virtual in the sense that their component members may never meet face to face. They are, however, in all other respects very real, and group members will be highly reliant on each other for the quality of their learning.

Almost all students reported accountability, responsibility, unselfishness, commitment and dedication as major attributes that ensured the success of online collaboration. Students felt that their online collaboration on the project was more successful because students in their group exhibited these characteristics. If a student had to be absent from meetings, legitimate reasons such as a death in the family or in a friend's family, work or having to take care of other family obligations were the norm. Being absent did not prevent the student from being accountable. These students returned to the group concerned about what went on during online discussions in which they were absent and what their assignments were without having to be told by other students in the group.

Exhibiting these attributes of accountability and commitment seemed to be contagious within the groups. The more one group member exhibited these traits, the more these traits seemed to become a norm for the behavior of the rest of the group members. There was an “unspoken” appreciation shown by the rest of the group when members participated with this level of commitment, because the rest of the group members seemed to exhibit the same level of behavior when they had to be absent. Complete commitment to the success of the project was exhibited not just by one, but by most of the group members, where leadership with accountability and commitment were practiced.

Leadership Style and Individual Roles

Group dynamics were affected by the leadership style of the online group coordinator. Three groups had female coordinators, two groups had male coordinators. The leadership style exhibited in the group that produced the best results came from a leader who coached his or her team by stepping back and letting team members “shine.” The leader quietly led them to meeting deadlines and goals and following the outline of the project, while allowing them to make decisions for the successful completion of the project. The leader allowed the team members to lead, to shine, to be successful, and to feel complete ownership of the finished product, which was not any one individual team member’s project, but the project of the committed, concerted efforts of the group. Because group members had ownership in the project and were made to feel the importance of their input, the final project was much more advanced than would have been achieved otherwise. A leadership style that promoted inclusiveness, pride, self-confidence, participation and understanding created a much more productive and self-reliant team that was able to produce beyond the norm. A leader that was more interested in the performance of

the team and the quality of the finished product rather than self-recognition produced the more successful product.

One group leader stepped down at mid-semester due to overwhelming outside responsibilities. No one assumed the leadership position and that group was ineffective for 4 weeks, and without instructor directives the group would have failed the project assignment. Two groups had young leaders whom were expected to be at risk, but gained momentum as the semester progressed. Both of the young group leaders initially had difficulty organizing and influencing corporation from the team members, but gradually, with the help of their more experienced team members, the team became focused. One leader, who was a manager by profession, seemed to be the most effective and influenced the team to produce the best project in the class. Another team had high inexperience in Web skills and a leader with a lack of course subject knowledge who was hesitant to lead with firm direction in the beginning. Eventually, this leader pulled the group together to produce a good project.

Individual Accomplishments and Group Accomplishments

By learning, we mean that in group learning environments less emphasis is likely to be placed on memorization, rote learning and cramming for examinations, and more on real-world abilities, such as communication, problem-solving and articulation of solutions. Some groups and some leaders experienced individuals who were more interested in their individual accomplishments than the accomplishments of the team. A few individuals with high Web skills quickly developed the “vehicle” for the final project, but the results were not necessarily compatible with the project goals. Because of existing skills in Web development that some individuals possessed in the group, they may have wanted to take on the design and development of the project without

taking into consideration the input of the other team members. Realizing they could produce a product because of their skills did not necessarily mean that their product would excel as well as a product that included the input and talents of all members of the group. The time limitations and the complexity of this project naturally required that it be a group project, thus requiring the talents and input of everyone on the team. Group members questioned and worked through “compatibility of design with team project goals” until the design fit the project idea and theme. Although team members were appreciative of the individual’s Web design skills, they wanted their input heard and a finished product that met the guidelines of the project. Team members did not want an individual’s accomplishments to overshadow or overrule the accomplishments of the team. Leadership styles definitely affected the group dynamics of each team. These leadership styles included: (1) one that produced the best finished product, (2) lack of leadership when one leader had to step down, (3) inexperienced ones who just needed some practice, and (4) one that required refocusing members who were interested in their accomplishments instead of the team’s.

Setting Goals and Managing Team Project

Setting goals and managing the team project assisted the teams in successfully bonding and completing their project (Pate, Du, & Havard, 2004). Students reported that setting a “common goal” and “establishing a bonding” within the group by “dedicated students” was critical in the process of team development and achieving success. Due to the complexity of the project and the amount of time required to complete it, students explained that this kind of dedication and bonding were vital to the success of the team and the assignment. In addition, it was important for a team to plan, manage and meet the timeline, and equally important for the team leader to delegate

teamwork to accomplish tasks on time. Missing deadlines and not remaining on schedule also caused a much less polished product at the end of the semester.

Accepting responsibility for group assignments and following through in a timely manner with those assignments affected group productivity. Not only were missed or late assignments an indicator of an individual’s dedication to the team, but also indicated the dedication the team member had to the project. A team member without dedication who misses or is late with assignments caused other team members to be late and sometimes miss their assignments, also. Teams that had definite deadlines and frequent communication were able to build more powerful projects than those who had frequent absences and did not honor deadlines. Teams that worked together to demand participation from each member were also more successful. If a team member was not meeting assignment deadlines and goals, improvement would be gained from pressure by the team leader and other members of the group. It appeared that no one in any group wanted to be singled out as the unproductive member. Although there were exceptions, the united strength of the team was much more powerful than just a single individual’s leadership role.

Most of the groups referred to their project proposal plans and final project guidelines to evaluate their own development stages and notes. Groups who did not practice referring to their project proposal or the project guidelines, consequently, had project omissions and components that did not relate or fit their design. Often, there were discussions on adding or eliminating parts concerning the project design, and the limitations were not always skill-based. There was a concern that the element did not comply with the project goals or would have to be restructured to fit the project goals. When met with these types of obstacles, the successful groups looked outside the team for advice or help. They either consulted with the instructor, professionals whom

they viewed as knowledgeable, online sources or with friends who had experience in a particular area. The successful groups viewed limitations as obstacles to overcome, not as roadblocks for which there was no way around.

Positive Peer Support Spiritually and Emotionally

Peer support served as a positive element in groups and helped to spiritually and emotionally support students through the difficult parts of the project development phases. Several students mentioned “friendship” and “trust” as enjoyable online collaborative learning experiences. This meant “close friends getting along well” and “giving a helping hand to a struggling member.” Students seemed to draw an inner strength and purpose when they felt appreciated and were complimented by their fellow group members. This caused the student to be more likely to seek help when needed and to give help where needed. Developing this type of relationship was a gradual process as the group members worked through the obstacles of producing the final project. Gradually, when one member produced a good idea, another member complimented that member and so on. This process of positive team feedback helped make the individual team members more self-confident, thus producing a more self-confident team. This positive peer relationship also enabled the students to “openly discuss problem areas . . . and to avoid any potential disagreements.” Group members were less likely to engage in disagreements when they had this positive relationship. They could maturely work out any disagreements by openly discussing and agreeing on possible solutions. This positive peer relationship produced group members who were more productive and engaging in timely completion of the final project.

Preference for Mixed Gender and Race Groups

Students preferred mixed gender and race groups for their online discussion groups. In one group, the instructor chose a white male as group leader of a predominately African American female group. Initially, the group leader was apprehensive about his ability to lead this group, as was the group about having him as their leader. When the group of African American women saw that the group leader was not domineering, was inclusive, was open to them taking on leadership roles, and wanted their ideas and participation, they all got together with the leader and produced an outstanding product. Based on observations, African American students perceive group work as a comfortable environment in which to work. When conflicts occurred with group participation, African American students were willing to provide explanations for their conflict and to openly resolve the conflict as soon as possible. When African American students missed an online discussion session, they were quick to seek follow-up information about what they missed. Resistance to group work appeared to be based on lack of some required skills, rather than lack of cooperation to participate in-group. They were only concerned about not being able to assist with certain needs within the group and were not concerned about having to work in a group at all.

CONCLUSION

Using a socio-cultural view contained in this study as a valuable theoretical framework, individual students in small groups can utilize their own information stored in their working memory and long-term memory interactively with others

in their group to organize output that becomes relevant for the other learners, thus providing a meaningful collaborative online learning situation. This active engagement in the learning process when jointly working on a learning task with others becomes meaningful when students are allowed to mutually explain the learning contents, give feedback to the contributions of other group members, and asking and answering questions (Du & Havard, 2005).

Successfully completing a project assigned to an online group was dependent on a number of factors. How successful the project was depended on the leadership style of the group leader, with the most important factor being the success of the group as the main concern. Setting goals and accepting responsibility for the group's project were also major factors in the success of the finished product. These goals and responsibilities were not just the team leaders', but also the entire groups'. Groups also felt that they were more successful with their project when they followed the guidelines and their proposal for the project. Peer support during the development of the group project was a very important part of the success of the project. Students felt that without the spiritual and emotional support of their peers, the project would not have been as successful. If one were looking for a negative factor in online group collaboration, it would not be found in gender or race group preferences. Students worked together regardless of the race or gender of their group members and expressed a preference for having mixed races and genders in their groups. They felt that the variety of contributions from different races and genders was very important to the group work.

The findings of this study can also be used to help identify patterns in which online discussion is conducted effectively in conjunction with course context and individual characteristics for enhancing learning growth. Knowledge of such patterns can facilitate new designs and improvement of online collaborative learning.

REFERENCES

- Bosworth, K., & Hamilton, S. J. (Eds.). (1994). *Collaborative learning: Underlying processes and effective techniques*. San Francisco: Jossey-Bass Publishers.
- Boud, D., Cohen, R., & Sampson, J. (1999). Peer learning and assessment. *Assessment and Evaluation in Higher Education*, 24(4), 413-426.
- Bruffee, K. (1999). *Collaborative learning: Higher education, interdependence, and the authority of knowledge* (2nd ed.). Baltimore: The Johns Hopkins University Press.
- Crotty, M. (1998). *The foundations of social research: meaning and perspective in the research process*. London: Sage.
- Dillenbourg, P. (2002). Over-scripting CSCL: The risks of blending collaborative learning with instructional design. In P. A. Kirschner (Ed.), *Three worlds of CSCL: Can we support CSCL?* (pp. 61-91). Heerlen: Open Universiteit Nederland.
- Driscoll, M. P. (1994). *Psychology of learning for instruction*. Boston: Allyn and Bacon Erlbaum.
- Du, J. X., & Havard, B. (2003). A framework for deep learning in distance education. *Delta Pi Epsilon*, 45(3), 204-214.
- Du, J. X., & Havard, B. (2005). Dynamic online discussion: Task-oriented interaction for deep learning. *The Journal of Educational Media, International*, 42(3), 207-218.
- Hamm, M., & Adams, D. (1992). *The collaborative dimensions of learning*. Norwood: Ablex Publishing.
- Hannafin, M. J., Land, S., & Oliver, K. (1999). Student-centered learning environments. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. II, pp. 115-140). Mahwah: Lawrence Erlbaum Associates.

- Harasim, L. (1990). Online education: An environment for collaboration and intellectual amplification. In L. Harasim (Ed.), *Online education: Perspectives on a new environment* (pp. 39-64). New York: Praeger.
- Hare, A. P. (1994). Types of roles in small groups: A bit of history and a current perspective. *Small Group Research*, 25, 443-448.
- Hedberg, J. G. (2003). Ensuring quality e-learning: Creating engaging tasks. *Educational Media International*, 40(3-4), 175-186.
- Hutchins, H. M. (2001). Enhancing the business communication course through WebCT. *Business Communication Quarterly*, 64(3), 87-94.
- Johnson, D., Johnson, R., & Stanne, M. (1986). Comparison of computer-assisted cooperative, competitive and individualistic learning. *American Educational Research Journal*, 23(3), 382-392.
- Jonassen, D. (1999) Designing constructivist learning environments. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. II, pp. 215-239). Mahwah: Lawrence Erlbaum.
- Jonassen, D. H., & Reeves, T. C. (1996). Learning with technology: Using computers as cognitive tools. In D.H. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 693-719). New York: Macmillan.
- Kitchner, K. S. (1983). Cognition, metacognition, and epistemistic cognition: A three-level model of cognitive processing. *Human Development*, 26, 222-232.
- Kitchner, K. S., & King, P. M. (1981). Reflective judgment: Concepts of justification and their relationship to age and education. *Journal of Applied Developmental Psychology*, 2, 89-116.
- Lajoie, S. P. (2000). *Computers as cognitive tools: No more walls* (vol. 2). Mahwah: Lawrence Erlbaum Associates.
- Land, S. M., & Hannafin, M. J. (1996). A conceptual framework for the development of theories-in-action with open-ended learning environments. *Educational Technology Research & Development*, 44(3), 37-53.
- Land, S., & Hannafin, M.J. (1997). Patterns of understanding with open-ended learning environments: A qualitative study. *Ed. Tech. Research & Dev.*, 45(2), 47-73.
- Laszlo, F., & Kupritz, V.W. (2003). The identification of online learning motives in use by undergraduate students. *Delta Pi Epsilon Journal*, 45(1), 63-72.
- Lehtinen, E., Hakkarainen, K., Lipponen, L., Rahikainen, M., & Muukkonen, H. (2000). Computer supported collaborative learning: A review. In H. Meijden, R. Simons, & F. De Jong (Eds.), *Computer supported collaborative learning in primary and secondary education. A final report for the European Commission, Project 2017* (pp. 1-46). Nijmegen: University of Nijmegen.
- Pate G., Du, J. X., & Havard, B. (2004). Instructional design: Considering cognitive learning needs of older learners. *International Journal of Instructional Technology and Distance Learning*, 1(5), 38.
- Popolov, D., Callaghan, M., & Luker, P. (2002). Tying models of learning to design of collaborative learning software tools. *Journal of Computer Assisted Learning*, 18(1), 46-47.
- Scardamalia, M., & Bereiter, C. (1996). Computer support for knowledge-building communities. In T. Koschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm* (pp. 249-268). Mahwah: Lawrence Erlbaum Associates.
- Shaw, M. E. (1981). *Group dynamics: The psychology of small group behavior* (3rd ed.). New York: McGraw-Hill.
- Slavin, R. E. (1995). *Cooperative learning: Theory, research and practice*. Boston: Allyn and Bacon.

Project-Based Online Group Collaborative Learning Characteristics

Strijbos, J. W., Martens, R. L., Jochems, W. M. G., & Broers, N. J. (2004). The effect of functional roles on group efficiency: Using multilevel modeling and content analysis to investigate computer-supported collaboration in small groups. *Small Group Research, 35*(2), 195-229.

Thomas, J. W. (2000). *A review of research on project-based learning*. Retrieved December 10, 2000, from www.bie.org/tmp/research/researchreviewPBL.pdf

Uribe, D., Klein, J. D., & Sullivan, H. (2003). The effect of computer-mediated collaborative learning on solving ill-defined problems. *Educational Technology Research and Development, 51*(1), 5-19.

Vygotsky, L. S. (1978). *Mind in society*. Cambridge: Harvard University Press.

Wang, M., Sierra, C., & Folger, T. (2003). Building a dynamic online learning community among adult learners. *Edu. Media International, 40*(1-2), 49-61.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 188-202, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 2.47

Using “Blended Learning” to Develop Tertiary Students’ Skills of Critique

Paul Lajbcyier

Monash University, Australia

Christine Spratt

Monash University, Australia

ABSTRACT

Devising pedagogical strategies that will engage students in ways that will assure the development of their skills of critique and analysis presents a challenge to tertiary teachers. This chapter draws on data from a recent case-based evaluation study to argue that innovative assessment and the development of social presence in online learning environments can contribute to developing skills of critique and analysis in tertiary students. The chapter is underpinned by the belief that creative thinking about curriculum issues must continue to lead debates about tertiary pedagogy, the use of educational technologies and online learning. It concludes by posing implications for further research in pedagogical practices in tertiary settings; in particular, it presents a discussion of the potential of “blended learning” and “variation theory” for leading such research.

INTRODUCTION

Pedagogical approaches embedded in constructivism mean that tertiary teachers ought to offer students opportunities to be active learners. Such approaches should see students engaged in learning tasks that are relevant and directed towards mutually conceived learning outcomes and that such engagements ought to be reflective communities of learning (Marton & Trigwell, 2000). We believe this is imperative in undergraduate and postgraduate classrooms, particularly where such classrooms are becoming more diverse. Here we acknowledge the growth in full-fee paying international students; the imperatives of information and communication technologies to develop pedagogical models of flexibility; “creeping credentialism” – that is, the imperative for life-long learning and qualifications as one crucial step in assuring career

progression; as well as the demands of increasingly sophisticated learners.

Therefore, tertiary education ought to exploit students’ existing knowledge and experience. It ought to engage learners in meaningful, relevant and authentic learning experiences, including assessment tasks. Such a curriculum approach aims to promote opportunities for active learning and collaboration where students are engaged in deep learning experiences that develop their capacities to be self-reflective and critical. Deep learning is considered to be critical and transformative, where students develop the capability to:

relate ideas to previous knowledge and experience; check evidence and relate it to conclusions; examine the logic of argument cautiously and critically; become actively interested in the course content; and look for patterns and underlying principles. (Marton, Hounsell, & Entwistle, 1998, p. 19)

This chapter uses a case-based evaluation study of a curriculum unit¹ to raise broader issues related to the design of online learning environments, the potential of social presence in such environments and innovative assessment to influence successful learning outcomes. As a case study, it provides “an evidentiary boundary around which to discuss educational problems” (Walker, 2001, p. 10). In this case, the educational problem concerned engaging students in forms of discourse in an online environment to develop their skills of critique, analysis and decision making.

THE STUDY FOCUS

In previous years, students in this particular unit (a postgraduate unit concerned with financial computation and investment decision-making²) claimed that they enjoyed the unit and assessment tasks very much because they were aligned with their practical, applied interest in investments. While students appreciated the link between the

assignments, the unit coordinator (the first author) was often dissatisfied and disheartened with what he considered was limited critical debate and discussion amongst the student cohort around substantive curriculum content.

To be a literate investor, it is essential that investment decisions be based on a prudent process, including: sound reasoning (considering all available resources), ongoing monitoring of investment performance and the incorporation of new information to modify risk exposure. A discourse among student peers, where they are given opportunities to reflect, debate and compare investment performance, is an ideal way to encourage this process. While the students in the unit are forced, weekly, to present their developing investment portfolios to their peers (and hence to monitor their investment performance), the unit coordinator believed that a potentially more valuable ongoing discourse of critique and analysis was not occurring both inter and intra group as much as he had hoped. In other words, a new strategy was needed, as it became apparent that students were not engaged in an ongoing discourse about their investment decisions as hoped in their large groups (of 10). Instead, only those students responsible for investment decisions on any one week were considering the issues involved in changing their portfolios.

Curriculum renewal is iterative and requires academic teachers to reflect critically on their practice and engage students and other stakeholders in the processes of pedagogical research and evaluation. While the evaluation in this case-based study broadly investigated the student experience in the unit, it focused on investigating the way in which the integrated assessment strategy especially achieved the desired outcomes and the way in which students engaged online to complete the assessment tasks and meet the unit’s goals of developing skills of critique and analysis through debate and discourse. The study aimed to illuminate the following key questions:

- In what ways do electronic discussion fora promote the development of skills of critique and analysis through online debate and discourse?
- How does assessment as a learning strategy in online environments assist in developing the skills of critique and analysis?

Online Course Strategy

The unit is conducted in a flexible delivery mode and used WebCT to support this approach. Flexible delivery means an approach where the development of an online learning environment supports the on-campus experience in an integrated manner. In this case, the online environment was used to enhance learning and provide a degree of flexibility for students in where and how they studied. This is essentially one form of 'blended learning', and is discussed in more detail later.

The unit supported a well-designed and innovative assessment strategy that relied heavily on peer learning and group work. The unit coordinator wanted to create an assessment strategy that would create learning opportunities as well as measure learning outcomes. In doing so, the assessment strategy also created opportunities for students to be engaged in activities that were relevant and authentic to their employment settings.

The unit's pedagogical approach attempted to create a bridge between the pre-existing group assignment and an e-moderated online discussion group to encourage a discourse of critique and analysis that the unit coordinator suspected would ultimately contribute to the development of critical investment decision-making skills. He anticipated the potential challenges of e-moderation and chose to base his approach on the work of Salmon (2000, 2002), which he believed would provide a pragmatic structure and useful guiding principles.

STUDY METHODOLOGY

The study incorporated three principle data collection strategies. First, students' views of teaching in the unit were surveyed using the university-supported standard evaluation of teaching questionnaire (Monquest survey), which is part of its institutional quality improvement strategy. The Monquest survey was analyzed through the university's quality teaching unit.

Second, students' views of the online environment were surveyed. Students were asked to complete a questionnaire developed by the co-authors to gather more specific data about the unit assessment strategy. The unit coordinator devised the WebCT survey on the basis of the desired learning outcomes and his particular interest in ascertaining whether the student cohort believed they had met his intended pedagogical goals. Therefore, the WebCT survey was constructed to gather data about students' perceptions of the benefits of the online environment in promoting critical debate and discussion in the substantive content areas of the unit. The authors were particularly interested in investigating whether the students believed the unit developed their capacity to make investment decisions. Furthermore, the WebCT survey aimed to gather data about the perceived benefits of the online environment in promoting inter- and intra-group collaboration. The WebCT survey included 25 statements that students were asked to rate (the range was completely agree-completely disagree) on a 5-point Likert scale.

Third, students who had responsibility over the course of the unit as team leaders of designated peer learning groups agreed to participate in a focus group interview. Team leaders were interviewed, as it was believed they would bring a particular perspective to the study and would be able to comment particularly on the way the groups interacted in relation to the learning goals that were anticipated. Seven team leaders (three male, four female) agreed to participate in the

focus group discussion. Team leaders appeared to be chosen by each group as a result of their own actions, such as organizing meetings (i.e., taking the initial step and showing some kind of leadership role, such as e-mailing others). As one student explained, “whoever spoke the most got to be leader!” The second author and a research assistant conducted the focus group interview using a semi-structured interview schedule. The qualitative data were transcribed, and the two interviewers analyzed the qualitative responses, isolated key themes and collaboratively annotated a summary of findings.

STUDY RESULTS

Of the student cohort (n=94), 49 completed the Monquest survey and 49 completed the WebCT survey (a return rate of 52% for each survey). The students were first-time users of WebCT. Some experienced technical issues and were unable to use the synchronous online facility, chat, until mid semester. There were no major technical issues encountered. All students accessed the online environment from home as their primary access point.

The Monquest Survey

The Monquest survey data revealed that the students were highly satisfied with the unit, with 80% of students scoring very good or good responses for six of seven responses for the “Teaching Feedback” and four of five for “Subject Feedback” questionnaires.

The WebCT Survey

The WebCT survey data indicated that, with respect to the unit assessment strategy, the group work assignments were preferred over the individual assignment. Table 1 illustrates the WebCT survey responses. Students recognized that the unit coordinator aimed to develop an integrated assessment approach as a means of giving more coherence to the unit assessment as a learning strategy.

Further, with respect to the use of the online discussion forum to foster critical debate and discussion:

- Students felt that the online chat forum did not make the group assignment any easier.

Table 1. Responses to WebCT survey

Panel 1

| Survey Question# | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|------------------|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|
| Average | 2.5 | 2.5 | 2.7 | 2.6 | 1.8 | 2.4 | 2.8 | 2.9 | 1.7 | 1.8 | 1.8 | 2.4 |
| % | 63% | 66% | 81% | 75% | 8% | 56% | 92% | 100% | 0% | 3% | 2% | 59% |

Panel 2

| Survey Question# | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Average | 2.5 | 2.6 | 2.6 | 2.5 | 1.9 | 2.6 | 2.1 | 1.8 | 1.9 | 2.4 | 2.4 | 2.5 | 1.9 |
| % | 61% | 69% | 73% | 61% | 15% | 71% | 31% | 7% | 17% | 56% | 54% | 61% | 10% |

Note: Average is the average response (between 1-5) and % is the normalized average response (normalized so that the highest response obtains 100% and the lowest 0%).

- Students were neutral on value of the discussion forum (i.e., bulletin board).
- Students felt that the same amount of debate would have occurred without the online chat forum.
- Students liked to compare the performance of their group with the others using tools provided in the online site.

Focus Group Interview of Team Leaders

The focus group interview data suggested that students saw the online environment as a useful adjunct to the pedagogical structure of the unit. The focus group interview data identified that the online environment was highly valued as a single point of access to reference material, bringing resources together in one place; “the immediacy of it was great” and they liked the fact that “there was one point of reference for unit material.” The following discussion expresses our analysis and interpretation of the focus group interview with the WebCT survey data.

DISCUSSION

Creating an Online Learning Environment

Structured asynchronous online groups were established by the unit coordinator specifically to progress his aim to foster more discourse and debate as a precursor to skill development in investment decision-making. Interestingly, as noted earlier, the WebCT survey indicated that students were “neutral” on value of these discussion fora and felt that the same amount of debate would have occurred without the online chat forum.

However, this was neither reflected in the focus group interview nor in a very visible indicator; that is, the documentary evidence of the use of the

online spaces. These spaces were used frequently and we believe relatively effectively by students. We acknowledge that the focus group interview was comprised of team leaders only; however, we argue that their insight into the groups’ online engagement, coupled with the nature of the text evidence in the online discussion spaces (approximately 698 separate postings over the semester), demonstrates how the student cohort became adept at using the online discussion to meet their perceived needs.

Moreover, the synchronous chat facility was used by students in the absence of any intention in the pedagogical design from the unit coordinator. The synchronous chat facility came to be used by these strategic learners as a means of solving an immediate educational challenge: in this case, to assist them to prepare for the group presentations.

While the survey evidence of neutrality with regard to the discussion fora offers little of itself, the perceived value of the discussion fora and chat is highlighted beyond neutral in light of the focus group interview data. A substantial quantity of material in the form of discussion postings over the course of the semester was generated. This provided some evidence that students were engaging in discussion and debate in the way that the unit coordinator aimed to foster. However, the data generated from the discussion fora and the chat facility were not systematically analyzed as part of this study, and this is addressed subsequently.

In the focus group interview, students recognized that the success of any online discussion (synchronous or asynchronous) lies in their sense of its responsiveness. However, they were quick to point out that they felt, “it was not as good as face-to-face” and, importantly, that “its usefulness depends on the individual and their motivation.” As one student explained, in chat, “you can’t see how people are reacting, if they are arguing with you,” and this can be a disadvantage in gauging the success of the discussion.

Social Presence in Online Learning Environments

Rourke, Anderson, Garrison and Archer (1999, p. 2) see social presence “as the ability of learners to project themselves socially and affectively into a community of inquiry.” These authors draw on the work of Tinto (1987, cited in Rourke et al., 1999, p. 4) when they argue that social presence “supports cognitive objectives through its ability to instigate, sustain and support critical thinking in a community of learners.” There is now an extensive literature that explores the way in which the discourses of text-based computer conferencing environments can develop critical thinking and other desirable cognitive skills in learners. Indeed, as Garrison, Anderson and Archer (2001, p. 1) argue, the acceptance of such environments and the way in which the higher education community has written about them, “has far outpaced our understanding of how this medium should best be used to promote higher-order learning.”

Ostensibly, our intention for this case was the latter. In the context of this case study, the synchronous and asynchronous online groups served various purposes for students, and the signifiers of social presence that were evident (interaction, dialog, responsiveness of the teacher and student peers) may account for the way the students came to value the asynchronous online discussion and the synchronous chat. Furthermore, in this study, social aspects conducive to learning came into the use of chat, but the social elements were developed or formed *outside the online chat and discussion groups*, in the face-to-face environment that the unit already required of them (weekly lectures and tutorials).

However, the online chat and discussion groups were enhanced by those social bonds, which students claimed made it easier to work in online groups because of the pre-existing knowledge of personalities. One student also commented that working online “allowed us to talk more person-

ally within the context of the large lecture class.” Overall, online chat was seen to be useful as a collaborative tool to reach an educational goal (for example, preparing the presentation) and did contribute to maintaining the social relationships required for learning groups to function effectively.

Those who are researching in this field generally take one of two approaches, according to Garrison et al. (2001, pp. 5-7): those who look to investigate “absolute characteristics” of critical inquiry, such as logic, depth and completeness in discussion; and those who are interested in what they call a more “heuristic measure” of critique, where the effectiveness of the process of critical thinking is judged by participants. This supports the more recent and growing appreciation that measures of quality in online discussion are often difficult to gauge and time consuming to analyze (Gerbic & Stacey, 2003). Gerbic and Stacey (2003) review the changing emphasis from quantitative to qualitative research and evaluation approaches in the online learning environments of text-based computer mediated communication spaces. There is increasing evidence for this in the related literature (Agostinho, 2005). For example, in a recent study that explored the dynamics of networked e-learning groups, McConnell (2005) drew on both ethnography and grounded theory to explore the way in which e-learning groups reached their desired learning outcomes. He analyzed the transcripts of three e-learning groups as they collaborated to develop a defined product. The groups were undertaking a postgraduate professional qualification and the program was conducted entirely online.

We accept that the study reported here may well have benefited from a deeper, some might argue more rigorous discourse analysis of the text posted in the asynchronous discussion fora. However, we were more interested in the personal beliefs and perceptions that students had about the value of the fora in developing critical thinking skills and enhancing their experience of learning

in the unit. In other words, we were interested in what students’ perceptions of the unit were and the way it evolved for them as a learning experience, and this is more attuned to Garrison et al.’s (2001) ‘heuristics’ mentioned above.

While the focus group interview identified that the students saw the chat facility as a pragmatic solution to the educational need to meet to discuss their collaborative presentation, they did value the opportunity to talk, plan and debate online at a time convenient to them. The asynchronous discussion fora also played an important role in enabling the student groups to confer and discuss issues in ways that accommodated the unit’s learning objectives and their personal lives. Yet, there was evidence that they did not see this as fundamental to their success in the unit or their personal perception of how they learned and developed their skills in critique for investment decision-making.

Online Learning and Assessment

In a recent paper with Eley (Eley, Lajbcyier, & Spratt, 2005), we investigated some common assumptions about group learning and group assessment practices. The two key assumptions investigated were whether indeed assessment tasks or project outcomes reflect some aggregate of the individual group members’ learning and that contribution to group functioning is sensitive to variation in that learning. In that study, we developed:

measures for individual students’ contributions to group processes, for individual students’ influence on the topic understanding of their group peers, and for the influence of the overall group experience on personal learning and understanding. (Eley, Lajbcyier, & Spratt, 2005, p. 1)

That study was positioned within the framework of the unit reported in this chapter but undertaken subsequently to the evaluation this

chapter reports. We were interested in that study in exploring whether the group-directed project work was a valid measure of an individual’s performance or learning. Typically, group work is encouraged in the tertiary environment. The same mark is given to all the group members, even if they have not all equally contributed to the group project. Eley, Lajbcyier and Spratt (2005) permitted groups to (anonymously) self assess and then tried to validate these marks by linking group performance with individual learning objective performance.

The “quality of group assignment outcome” seems *not* to relate to individual students’ attainment of the objectives associated with that group work. That is, the a priori “hunch” was that group outcomes would relate to individual learning. However, we found that group outcomes do not relate terribly well to individual “learning from the group experience” performances. How might we imagine a group operating in such a way that good group cohesion results in higher group assignment quality, yet has minimal influence on the learning attained by the individual group members? Put another way, if you were a member of a group, and the aim was simply to maximize the mark that the group attained for the group product outcome, with no account needing to be given to the learning of the “lesser abled” members, then how might you most efficiently coordinate and organize who does what? These findings open questions a bit more fundamental about the structuring of group activities than just the “how do we make group marks more valid” issue that was our entry into the area reported here and in Eley, Lajbcyier and Spratt (2005).

In that paper, we concluded that:

... in the final analysis, individual learning should be assessed individually. We caution that the present study is just one within a particular instructional context. But if the findings here prove generalizable, then maybe we should re-define group projects to be not assessment opportuni-

Using “Blended Learning” to Develop Tertiary Students’ Skills of Critique

ties, but a form of learning experience. (see Lejk, Wyvill, & Farrow, 1999)

Given the possible influence of contingencies discussed above, we might need to find ways to structure them to ensure that students commit and participate. This might mean not modeling group projects on workplace project teams, but rather deliberately designing them to encourage the student learning behaviors that we desire. But the simple conclusion here is that we cannot assume that individual assessments necessarily or directly derive from project outcomes. Perhaps this was an unfounded expectation in the first place. (Eley, Lajbcyier, & Spratt, 2005, p. 9)

The assessment strategy reported in this study was set in the pedagogical context of peer and group learning. Working in groups of about 10 students, all students were required to help decide on (virtual) investments across five market sectors, with the aim of maximizing their returns over the period of the project. The groups were constrained in their choice: They had to choose one company out of two for each of the five sectors (this was done to contrast the differing decisions made by different groups). Each group met at least once per week to review its portfolio and decide on any investment changes. The learning objectives associated with the project involved the use of various information sources in the making of investment decisions. These sources included company balance sheets, financial news media, technical price action reports and macroeconomic indices. The intent was for students to recognize that investment decisions are inherently ambiguous and are not uniquely determined by the range of information available.

The unit coordinator took pains to describe the assessment transparently and to make his expectations of the students unambiguous. The evaluation data revealed that students were very positive in their appreciation of the clarity and unambiguous nature of the assessment strategy.

They felt they knew what was expected of them. They valued the way each lecture clearly outlined its aims and the relationship to assessment. They valued the way the lecturer was able to refer to the assessment tasks at various times in more detail over the course of the semester. They believed this assisted their understanding of what was expected of them. In the context of the assessment strategy, students generally felt that the “group work allowed members to see how they were faring compared to other members and other groups and their members.” They believed this helped them learn and also contributed to developing their skills of analysis. The asynchronous discussion groups and the use of online chat enabled students to make their decisions about investments. They see these online strategies as complementing in a “supplementary way” the “negotiation that went on” in preparing investment decisions for the assessment tasks required. In conjunction with the assessment strategy, engaging in the online chat especially allowed them to be “task focused.”

We feel confident that the students’ perception of the success of the assessment strategy for them vindicates our attempts to be self-critical of our assessment practices. This critique reflects the recent growing interest in improving student learning through assessment and its place more strategically as a measure of institutional quality (Falchikov, 2001, 2005; James, McInnis, & Devlin, 2002; Knight, 2002). Given the mainstreaming of e-learning in higher education, then certainly assessment in e-learning environments will be similarly investigated (Gipps, 2005).

A cursory review of the assessment literature reveals that there is growing interest in using assessment to *lead* learning rather than simply *measure it* (James et al., 2002). We know that learners are ‘strategic,’ and our cohort in this study certainly presented themselves as such; they were generally employed in demanding professional positions in the field of financial computing and were studying to achieve their particular goals. The unit assessment, therefore, becomes

an important (some would argue the primary) indicator of curriculum expectations for students. Associated with the interest in using assessment to lead learning is the role that assessment feedback plays in learning, and this is also becoming more prominent in the literature (Hounsell, Hounsell, Litjens, & McCune, 2005; Carless, 2006). Indeed, Carless (2006) puts forward a strong argument for the idea of ‘feed forward’ rather than feedback in the context of what he calls ‘learning-oriented assessment’ (LOA).

In LOA as he describes it, “learning comes first, both in the way the term is literally constructed and as a matter of principle which seeks to emphasize the learning aspects of assessment” (Carless 2006, p. 4). In other words, learning, not measurement, is emphasized and reconceptualizing feedback as ‘feed forward’ can assist students in taking what they have learned and how they have understood it to progress forward to future work. These ideas sit well with the deeper pedagogical approach of the unit reported here and with the research that we undertook into the assessment strategy specifically reported in Eley, Lajbcyier and Spratt (2005).

Blended Learning and Variation Theory

Intellectually, we were convinced of the potential of peer learning and peer assessment as effective and legitimate pedagogical strategies. However, we were attempting this in a relatively new learning environment. If we called this environment ‘blended learning,’ then most readers would anticipate that we were discussing some form of combination of traditional (that is face-to-face) pedagogies with an online component. While this was so for us in this case (mixing online learning with face-to-face experiences), we must acknowledge the controversy surrounding the use of the term ‘blended learning’ in current debates about e-learning in tertiary education.

In the contemporary e-learning literature in both higher education and corporate training settings, ‘blended learning’ has become ‘amorphous’ (Oliver & Trigwell, 2005) in that there is considerable debate about ‘blended learning’ as a unifying descriptor for particular forms of technologically supported teaching. Oliver and Trigwell (2005, p. 17) identified three common definitions of the term that they go on to critique; these are:

1. The integrated combination of traditional with Web-based approaches
2. The combination of media and tools employed in an e-learning environment
3. The combination of a number of pedagogic approaches, irrespective of learning technology.

Oliver and Trigwell (2005) suggest that the first of these is the most common interpretation. They go on to present a comprehensive critical review of the literature and suggest that there are as many definitions of ‘blended learning’ as there have been of e-learning or online learning since the emergence of the Internet. They consider the array of definitions unhelpful and the remainder of their paper analyzes and critiques the three key definitions they identified. While we accept that clearly elucidated definitions are central to ensuring collective understandings among communities of scholars, be they teachers or researchers, we do concede that in the messy ‘low lands of practice’ (after Schön, 1995), clarity in definitions is often of less immediate interest to practitioners than scholars on the ‘high hard ground of theory’ (Schön, 1995). This is not meant to be flippant or to deny the importance of definition, per se, in research traditions. However, while Oliver and Trigwell’s (2005) arguments for a reinterpretation of the term blended learning may be honorable, practitioners continue to confront definitional quagmires regarding anything to do with flexible, online or e-learning as they busy themselves trying

to innovate and keep abreast of the rapidly changing learning environments created by advances in technology and research.

Martin and Oliver’s (2005) critique highlights a number of other important issues; one is that the majority of the definitions of ‘blended learning’ are “teacher centered” in that they are “all described from the perspective of the teacher, the instructor or the course designer” (p. 18). This, of course, is the key to their critique and one that may be helpful for those of us who see teaching more as the ‘context’ for learning (after Green, 1998) rather than an end in itself. If blended learning is conceived less as a ‘teaching methods approach,’ face-to-face with online tasks or integrated multi-media for example, and more as a learning approach that develops ‘variation’ for students in learning engagements, then Oliver and Trigwell (2005, p. 22) believe that blended learning could be a defensible term, and therefore “redeemed.”

The ‘variation’ they allude to here is a reference to variation theory, which suggests that for learning to occur, “variation must be experienced by the learner” (Oliver & Trigwell, 2005, p. 22). Variation theory has evolved from the early and highly influential work of Marton and Saljo (1976a, 1976b), which investigated qualitative differences in learning.

Variation theory is based on the idea that:

For learning to occur, variation must be experienced by the learner. Without variation there is no learning. Discernment is at the core of our ways of experiencing the world around us. (Oliver & Trigwell, 2005)

Where discernment is about the experience of ‘difference,’ variation becomes the context for discernment. The unit coordinator in our case was trying to find ways to create engaging learning opportunities so students would become active participants and collaborators on their own to develop their critical skills in investment decision

making. If we liken the learning design of peer learning and peer assessment within our blended learning environment as an attempt to promote ‘discernment’ in students, then the strategy begins to be unpinned by Marton and Trigwell’s (2000) variation theory.

The original impetus for the unit coordinator to reconsider and redevelop his pedagogical approach was his desire to promote particular cognitive skills; moreover, given his student cohort, he was also interested in progressing learning approaches that would be relevant for them and develop his students in their professional practice. Given the complex globalized world in which his students find themselves, this means that he was interested in preparing them to be able to function as professionals in settings of change. Marton and Trigwell (2000, p. 385) see variation theory as a means of explaining this; how “participation in one practice can prepare for participation in another practice.”

While they argue that learning theories have traditionally seen this intellectually as a question of similarity, it is in their view a question of difference. In other words, as they explain:

The experience of similarity between two situations is a function of the pattern of variation between all other situations. (Marton & Trigwell, 2000, p. 386)

In the context of blended learning environments and in keeping with the ideological basis of constructivism in learning, we can see that variation theory might help explain how and why students engaged in learning environments have variable experiences and learn differently. It may also assist in framing pedagogical research that will investigate longitudinally, the influence of blended learning environments in tertiary settings on change in professional practice from the learners’ perspective. In the context of the case discussed in this chapter, it may be that we now have grounds to reconsider the pedagogic of the

unit in light of this more contemporary research in blended learning and variation theory.

CONCLUSION AND IMPLICATIONS FOR RESEARCH AND PRACTICE

This chapter used a specific case report to illuminate the way in which assessment can be harnessed to foster deep learning of critical inquiry skills in tertiary students. It also provides evidence that students believe they benefit from use of an online learning environment constructed as a pedagogical support strategy, a form of blended learning.

There is an expansive and growing literature that explores many aspects of online learning environments in tertiary settings. It would be fair to say that in recent years this literature has begun to explore the importance of social presence and teaching presence as key determinants in improving the instructional effectiveness of online learning (Chih-Hsuig, 2001; Garrison, Anderson, & Archer, 2001; McConnell, 2005; Murphy, Smith, & Stacey, 2002; Stacey, 2002; Stacey & Rice, 2002). Social presence and teacher responsiveness, and the way in which sociality develops is important in developing the interaction that contributes to positive cognitive learning experiences. Indeed, it is these kinds of experiences that have been cited as predictors of successful e-learning groups generally and in cohorts similar to that reported in this case study, as the majority of the cohort was full-fee paying international students (Chih-Hsuig, 2001). The study results, despite some contradictions in conjunction with the experience teaching the unit, have led us to be confident that the social learning that can be engendered in peer learning groups online is potentially a powerful learning adjunct.

We have acknowledged that there was some contradiction between the survey findings and the focus group interview findings. Overall, students felt that the online environment in this

unit, including the discussion forum and chat forum, were not fundamental to the deep learning that was trying to be instilled. Students believed that this kind of approach to learning could have been achieved without the online learning site. Despite this, however, we can suggest that online environments can be used effectively as successful pedagogical support. Students are well aware of the importance of motivation and social presence (what they have characterized as “responsiveness” in this study) to successful learning in synchronous and asynchronous discussion fora and integrating online teaching environments with assessment tasks that are relevant and practical to support successful learning outcomes.

Students recognized the online experience as providing a complimentary or supporting role in attaining the deep learning objectives of the unit: not essential but somewhat helpful. The students recognized that the unit instilled collaborative discourse, debate and decision making in investment decisions, and that they understood how investment decision processes can “incorporate debate and discussion and how that can lead to better investment decisions.” However, they did not attribute the attainment of this knowledge purely to the online environment or the technology per se.

It is well recognized that “transforming a course by integrating new technologies is an increasingly common example of educational change and innovation” (Allen, Wedman, & Folk, 2001, p. 104). We acknowledge that assessing the efficacy of sustainable curriculum change brought about by technology innovation requires the application of longitudinal research approaches, such as that described by Allen, Wedman and Folk (2001). Moreover, our review of the more contemporary research in blended learning environments and learning theories—in particular, variation theory—as discussed by Marton and Trigwell (2000) and Oliver and Trigwell (2005) raises many new questions for research in the setting of e-learning environments.

Given this and based on the study reported here, as well as the issues raised by the literature in social and cognitive presence, blended learning, variation theory and peer assessment, new questions for research might include: If social presence and teaching presence are predictors of success in e-learning environments, how can they be modeled in academic practice? What kinds of research approaches in e-learning settings can help us explore the influence of social engagement on cognitive learning in groups? In what ways can synchronous and asynchronous e-learning environments be created to foster the development of skills of critique, analysis, debate and decision-making? How might variation theory support the development of blended learning environments? In what ways ought assessment to be structured to have a positive impact on students' attitudes to learning so that it is conceived as integral to the teaching context for learning? How do students perceive differences in a peer group assessment as a learning experience and the assessment of the learning attained because of it? How do we make group marks more valid?

REFERENCES

- Agostinho, S. (2005). Naturalistic inquiry in e-learning research. *International Journal of Qualitative Methods*, 4(1), 1-13.
- Allen, G., Wedman, J., & Folk, L. (2001). Looking beyond the valley: A five-year case study on course innovation. *Innovation in Higher Education*, 26(2), 103-119.
- Biggs, J. (1999). *Teaching for quality learning at university*. Buckingham: The Society for Research into Higher Education.
- Burbules, N., & Bruce, B. (2000). *Theory and research on teaching as dialogue*, 1-40. Retrieved January 15, 2006, from www.isrl.uiuc.edu/~chip/pubs/dialogue.html
- Carless, D. (2006). Learning-oriented assessment: Conceptual basis and practical implications. *Innovations in Education and Teaching International*, 43(4), in press.
- Cheng, C., & Warren, M. (2000). Making a difference: Using peers to assess individual student's contributions to a group project. *Teaching in Higher Education*, 5(2), 244-255.
- Chih-Hsuig, T. (2001). How Chinese perceive social presence: An examination of interaction in an online learning environment. *Educational Media International*, 38(1), 45-60.
- Eley, M., Lajbcygier, P. & Spratt, C. (2005). How valid are group marks as a proxy for the individual learning that comes from group assignment and project work? In C. Rust (Ed.), *Improving student learning: Diversity and inclusivity* (pp. 137-148). Oxford: Oxford Centre for Staff and Learning Development.
- Falchikov, N. (2001). *Learning together: Peer tutoring in higher education*. London: Routledge Falmer.
- Falchikov, N. (2005). *Improving assessment through students' involvement*. London: Routledge Falmer.
- Garrison, R.D., Anderson, T., & Archer, W. (2001). Critical thinking. Cognitive presence and computer conferencing in distance education. *American Journal of Distance Education*, 15(1).
- Gerbic, P., & Stacey, E. (2003, October 1-4). Evidence for sustainable e-learning in quality online learning communities: A purposive approach to content analysis. *The 16th ODLAA Biennial Forum Conference Proceedings*, Canberra.
- Gipps, C. (2005). What is the role of ICT-based assessment in universities? *Studies in Higher Education*, 30(2), 171-180.
- Green, B. (1998). Teaching for difference: learning theory and post-critical pedagogy, In D.

- Buckingham (Ed.), *Teaching popular culture: Beyond radical pedagogy* (pp. 176-197). London: UCL Press.
- Hounsell, D., Hounsell, J., Litjens, J., & McCune, V. (2005, August 23-27). Enhancing guidance and feedback to students: Findings on the impact of evidence-informed initiatives. Paper presented to the *European Association for Research on Learning and Instruction, (EARLI) 11th Biennial Conference*, Nicosia, Cyprus.
- James, R., McInnis, C., & Devlin, M. (2002). *Assessing learning in Australian universities*. Major report and electronic resource site from Centre for the Study of Higher Education, University of Melbourne. Retrieved January 15, 2006, from www.cshe.unimelb.edu.au/assessinglearning/
- Knight, P. (2002). The Achilles' heel of quality: The assessment of student learning, *Quality in Higher Education*, 8(1), 107-115.
- Laurillard, D. (1995). *Rethinking university teaching: A framework for the effective use of educational technology*. London: Routledge.
- Marton, F., Hounsell, D., & Entwistle, N. (1997). *The experience of learning: Implications for teaching and studying in higher education*. Edinburgh: Scottish Academic Press.
- Marton, F., & Saljo, R. (1976a). On qualitative differences in learning 1: Outcome and process. *British Journal of Educational Psychology*, 46, 4-11.
- Marton, F., & Saljo, R. (1976b). On qualitative differences in learning 11: Outcome and process. *British Journal of Educational Psychology*, 46, 115-27.
- Marton, F., & Trigwell, K. (2000). Variato est Mater Studiorum. *Higher Education Research & Development*, 19(3), 381-395.
- McConnell, D. (2005). Examining the dynamics of networked e-learning groups and communities. *Studies in Higher Education*, 30(1), 25-32.
- Murphy, K., Smith, P., & Stacey, E. (2002, December 3-6). Teaching presence in computer conferencing: Lessons from the United States and Australia. *Proceedings of the International Conference of Computers in Education (ICEE 2002)*.
- Oliver, M., & Trigwell, K. (2005). Can 'blended learning' be redeemed? *E-Learning*, 2(1), 17-26. Retrieved January 15, 2006, from www.e-learningcentre.co.uk/eclipse/Resources/blended.htm
- Rourke, L., Anderson, T., Garrison, D.R., & Archer, W. (1999). Assessing social presence in asynchronous text-based computer conferencing. *Journal of Distance Education*, 14(2), 2-18. Retrieved January 15, 2006, from www.cade.athabasca.ca/vol14.2/rourke_et_al.html
- Salmon, G. (2000). *E-moderating: The key to online learning*. London: Routledge Falmer.
- Salmon, G. (2002). *E-tivities: The key to active online learning*. London: Kogan Page.
- Schön, D. (1995). Knowing-in-action: The new scholarship requires a new epistemology. *Change*, November/December, 27-34.
- Stacey, E. (2002). Social presence online: Networking learners at a distance. *Education and Information Technologies*, 7(4), 287-294.
- Stacey, E., & Rice, M. (2002). Evaluating an online learning environment. *Australian Journal of Educational Technology*, 18(3), 323-340.
- Walker, R. (2001). *Case study, case records and multimedia*. Centre for Applied Research in Education, University of East Anglia. Retrieved January 15, 2006, from www.uea.ac.uk/care/people/RW_recent_writing/final_14_09.html

ENDNOTES

¹ At Monash University, a ‘unit’ is equivalent to 13 weeks of full-time study. This unit was a postgraduate unit in Financial Computation.

² The majority of the student cohort were full-fee paying international students working in professional fields related to financial computation and investments.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L.Tomei, pp. 1-18, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 2.48

Using a Blended Model to Improve Delivery of Teacher Education Curriculum in Global Settings

Vivian H. Wright

University of Alabama, USA

Ronnie Stanford

University of Alabama, USA

Jon Beedle

University of Southern Mississippi, USA

ABSTRACT

This chapter describes how teacher educators have used a blended approach, online and traditional delivery, to structure course content for its international master's program. The authors discuss challenges they had to overcome, lessons learned, and students' reflections on the blended approach.

INTRODUCTION

The delivery of teacher education courses and/or total programs at overseas sites is often compli-

cated and plagued with problems because of the distance between the home university and the location of the students. The Office of International Programs in the College of Education at The University of Alabama offers Master of Arts degree programs in elementary education and secondary education in five locations in Latin America: Asuncion, Paraguay; Bogota, Colombia; Lima, Peru; Mexico City, Mexico; and Quito, Ecuador. The students in these degree programs are teachers in private, United States (U.S.)-type, pre-K-12 schools. The delivery method used in the past has involved sending a professor to the foreign location for about 2 weeks to teach a 3-semester-hour graduate course. The course

schedule consists of approximately 3 hours of class Monday through Friday, and 3 to 6 hours of class on Saturday. Two weeks of this daily schedule creates a considerable amount of pressure and strain for the professor in attempting to deliver a quality course in a short period of time, and a large burden on the students who, while taking the course, are also engaged in full-time pre-K-12 classroom teaching. In addition, access to library research materials and other course materials has been complicated because of problems associated with transporting these materials to the country where the course was taught.

Educational technology allows organizations the ability to modify courses and curriculums and, at the same time, become more flexible in their delivery (Kvavik, 2002). Graves (2001) predicted that higher education is moving toward a more student-centric approach and away from the traditional instructor-focused environment. Electronic access to information allows students the opportunity to explore, discover, create and communicate more efficiently than in the past. Virtual classrooms can allow for more creative ways to collaborate and communicate without “the constraint of a physical classroom” (Lao & Gonzales, 2005, p. 471). With these new opportunities come new challenges to serve students at all levels and from locations around the world. The challenges include how to create a system that both works and is user-friendly. Creating an online component through a Web-enabled course has the potential to give instructors and students a greater opportunity for interaction and learning (Dabbagh & Schmitt, 1998) and can possibly provide opportunities for the students to become acquainted with the course assignments/materials and their peers in advance of the beginning of the course. In this chapter, we will describe how we have used computer-based instruction via the Internet and a course management system (WebCT) to create a blended model of course delivery for students that provides a good mixture

of technology-based instruction and traditional professor-led classes.

THE CHALLENGE

Electronic access of information allows students the opportunity to explore, discover, create and communicate more efficiently than in the past. With these new opportunities come new challenges to serve students at all levels and from locations around the world. Challenges include creating a system that works efficiently; is reasonably user-friendly; and offers opportunities for the students to become acquainted with the course materials, the instructor and their peers in advance of the instructor’s on-site arrival. An additional challenge is creating ways technology can extend the learning timeline of the course through activities, assignments and/or assessments that occur after the instructor has departed the overseas location. Lao and Gonzales (2005) noted that instructors who teach online should consider how to “capitalize on the different technological components to make learning meaningful for students” (p. 472).

Our format begins with about 2 weeks of technology-based learning activities prior to the arrival of the professor at the overseas site. The course design includes communication tools, such as e-mail, discussion boards and online chats. Educational hyperlinks are located on the home page so students can access additional course-related references and materials before the instructor arrives. Course content sections are posted on the course WebCT home page, listing assignments to be completed prior to the instructor arriving. These sections also include the syllabus, assignment summary, reading list, course links, course topics, library use instructions, examples of student work, glossary, calendar, and instructions for after the instructor leaves. Such a design provides students with extensive

learning activities that the professor extends and amplifies during the 2 weeks he or she is teaching the students in a “normal” face-to-face teaching format. When the professor returns to the U.S., WebCT technology and other online technologies make it possible for students to continue to complete assignments, receive feedback on those assignments and communicate with the instructor regarding questions, readings or discussions of course content. Thus, the technology has allowed us to extend the time frame of the course from the traditional 2 weeks of intensive professor-led instruction to a more relaxed blend of technology and traditional course delivery that lasts 6 weeks or beyond. Our pilot research with several courses and instructors has convinced us that this blend of technology and face-to-face teaching has many advantages for delivery of a teacher education curriculum overseas.

In the past few years, major universities have supplemented traditional library holdings with electronic databases of information that may be searched in a variety of ways. Given the correct set of circumstances (i.e., all of the technology works!), this information can be accessed from any location on the planet. It is now possible to locate, access, read, download and print articles from professional journals that are electronically housed in university library databases. In addition, computer technology and the Internet have made creating, editing and sending course information fast and inexpensive. The technology can include textual information and multimedia content. Similarly, computer technology has made it possible for students to create responses to class assignments and send these to the professor via e-mail or other electronic portals.

In our discussion, we describe how we have used technology to structure courses and course content. In addition, we discuss a variety of problems that had to be overcome to use the technology to maximum effect. We also present results of student evaluation and feedback. Although we describe how we have used technology to assist

with course delivery in Latin American, a point to be made is that the technology can be used anywhere the course instructor and the students are separated by distance and/or where limited instructor-student time together is a factor in student learning. We feel that this concept has important implications for how teacher education professors interact with students in all learning environments.

Initial Blended Delivery Experiences

The first course in which we used WebCT was *Modern Elementary/Secondary School Programs*, which was taught in Lima, Peru. The course is an examination of the K-12 school in terms of its overall programs and the trends, issues and problems that impact the school and student learning. In this course, WebCT was used to present a variety of course information to the students. Access to WebCT and the University’s computer system was made available to students 2 weeks prior to the professor’s arrival in Lima. The materials posted on the WebCT site included the course syllabus, directions for use of University of Alabama online library journal databases, pre-course reading assignments and the specific requirements of writing assignments, including grading rubrics and “good” examples of those assignments. Providing such guidelines and examples helps guide the students through an online experience and online discussions, providing advance organization and structure (Lim, 2004). The pre-course readings were accessed by students via the Internet through the use of electronic databases in the University of Alabama College of Education Library. The result was that students had accomplished significant work prior to the first day of class. Students had prior information and experiences in the course, which allowed the instructor to “hit the ground running” on the first day of the class.

The second pilot course using WebCT was an elective course entitled *Computer-Based In-*

structional Technology at the Quito, Ecuador site. The instructor began the class online via WebCT 2 weeks prior to arrival in Quito. Assignments and postings were due up to 2 weeks after the instructor's departure.

The course had 12 main links from the home page. These included sections for before the instructor arrives, syllabus, assignment summary, reading list, course links, course topics, library use instructions, examples of student work, glossary, calendar, discussion board, and instructions for after the instructor leaves. As Deubel (2003) suggested, we used various media throughout the Web site and included colorful graphics and animation useful in directing and keeping the students' attention and focus. Careful guidance by the instructor attempted to provide students with the necessary skills and tools to access the vast relevant resources on the Internet. Prior experience has indicated the necessity to consistently update and enhance the online courses, not only from semester to semester, but within the current semester as well. Palloff and Pratt (2001) suggested instructors typically will have a much more positive outlook on using Web-enhanced courses if they are given the freedom to make adjustments each time the course is taught. Additionally, it is essential that instructors understand how to upload content and other information to the Web site to make changes or add more materials. As in the research of others working with boundaries of locations (Ho & Burniske, 2005), we found that employing a teaching assistant and, in our case, an instructional technology graduate student, is helpful in working with faculty and students in troubleshooting problems that may occur in relation to technology.

For students, online discourse may be one of the most important characteristics of pedagogy used to benefit and facilitate effective communicative practice (Pittinsky, 2003). Some of the guidelines we followed are given by Palloff and Pratt (2001) and included collaborative assignments, posting of assignments so that peers can provide feedback,

online areas to communicate (discussion boards and e-mail) and requesting a certain number of posts per week to the course Web site.

Following the two initial courses with the blended delivery model, we have had experience with several other courses taught in the overseas sites. One use of technology that was explored was providing overseas students with sample papers written by previous students in the course being taught. In a prior semester, the course professor assigned research papers on a variety of topics. The student's task was to provide a definition of the topic and discussion of how the topic related to elementary and/or secondary school issues. Students were limited to a final product of three pages maximum, including a brief references list. When these papers were graded by the professor, the students made the suggested corrections and gave the professor the edited copy via e-mail attachment. Thus, a mini-library consisting of about 55 edited, electronic papers existed. The professor created a number of CDs that contained the full set of papers and took these to the Latin American location for distribution to students. In teaching a course with a relatively short timeline, the students were given "good" examples of student work, which was used as the basis to begin their assignment. Their assignment was to use the on-campus electronic journal databases to update each paper with the latest references from the literature. In addition, for each topic, class discussion was used to identify new ideas, concepts, points of significance and relationships to other topics.

Another technology-based technique that extended the learning timeline of the course was delaying the final examination until a week or more after the professor had completed the on-site teaching and had departed for the U.S. This simply involved securing a computer lab at the local school at the Latin America site, getting one of the local school administrators to give and proctor the examination, and having the students

send their examination answers to the professor via e-mail.

Delaying the final examination created multiple advantages. After 2 weeks of classes, the students were tired and in no mood to write a 2-plus hour discussion examination. The delay in the exam gave students additional time to read and study. The students were in favor of the delay and reported they felt much better prepared for the examination. The instructor graded the exams and sent each student an e-mail regarding the exam evaluation and final course grade.

Student Evaluations

There were 20 students in the Lima class. In this class, the majority of the use of technology was dealing with front loading of assignments. These included specific reading assignments, a first draft of one short research paper and initial research for a second short research paper. Thus, WebCT was used to make assignments, teach students how to use the library databases, show students examples of “good” work and present specific criteria for grading some assignments. Typical of student comments and feedback are the following items from the end of course assessment:

This was AWESOME!! It makes so much more sense to give the assignments (or readings) ahead of time so students can do thorough research and actually take in what is being read instead of rushing around once the course started. I would hope MORE instructors would use this method. Teacher and student satisfaction as well as student learning would increase!

It is very useful to have the info prior to the course. It allows for some preliminary work to be done, which is then reflected upon during the course. Additionally, the work is spread out over a longer period than the 2 weeks of class time.

Other students commented: “I loved this! I

appreciated the info ahead of time.” and, “I liked it. I felt prepared for the 1st class—it used my time better—I love having access to the database.”

Fourteen Quito students were enrolled in the Computer Applications course. The students received e-mail instructions on how to enroll in the WebCT course and how to locate and complete the first assignment. Once this first assignment was completed, students were then directed fully from the WebCT instructions for each topic associated with the class. Tutorials on how to complete the assignments and links to helpful Internet sites were all part of the WebCT course. Additionally, students were required to use the WebCT e-mail tool to communicate with the instructor and others enrolled in the class. Students also completed several assignments via the discussion board. After the instructor’s on-site teaching, and, on her return to campus, the instructor queried the students via the discussion board on their blended course delivery experience. Overall, the comments were positive and students enjoyed and appreciated the interactivity of the course. One student noted: “This is a good way to keep in touch with the teacher and also with the rest of the students. With this page we can read what the other classmates think about a certain topic, which is good.” Another student wrote: “Overall, the WebCT experience for me has been technologically enriching and challenging, but not beyond comprehension with some effort.”

Of the problems students noted in this discussion posting, most were associated with logging onto the course Web site with the first assignment, presented online in portable document files (PDFs) format. One student commented, “I don’t feel confident and sure about if I’m doing the correct job. I had problems with topic one, because my computer couldn’t open it.” Another wrote:

It took me a while to find the ‘Log in to WebCT’ button because it seems to be only “a title.” When I opened the page, all my attention was drawn to the different options listed for students,

faculty/staff and other. I just didn't realize that the button was in front of me, so I think that it could help others if you add a 'click here to ...' next to the login button.

A couple of the students noted that the calendar tool had not been updated promptly as assignment due dates were adjusted, with one student writing, "Another recommendation would be to allow students to have the original tentative calendar with the teacher's entries and to create a new one with the modifications that the teacher sends afterwards."

In addition to articulating the problems they experienced, several students noted positive attributes regarding the feedback, instructions and interactivity with other students. For example, one student wrote, "In terms of logging in to the program, I did not have any problems ... instructions sent via e-mail were clear." Another commented, "The system is user friendly, I have found clear instructions and tutorials. There are many helpful links, too." Another student wrote that he was surprised more instructors do not use an online component, writing, "I have been really surprised how little and how rarely this technology has been taken advantage of." Finally, a student noted, "It has the possibility to unite people over vast distances."

What We Learned

Potential problems that must be addressed before the class begins deal with issues relating to student enrollment in the WebCT course and the necessity of each student acquiring a university-wide login and password for use with all university-related technology systems. It was imperative that students be "officially" enrolled early to ensure they received their university-wide account information in order to access the Web site and the university's online library databases. A registration problem sometimes occurs with short-term courses offered during the middle of a semester.

Most university registration systems are set up to enter student enrollment data at the beginning of the semester. Adding student registration information into the university's student database at an odd time (i.e., other than the beginning of the term) can be a major challenge. Student information services can vary, and traditional identifiers, such as a social security numbers, student numbers or other "passwords" may not always apply. These details were addressed with the University's administrative structure prior to "registering" the class and with sufficient lead time to get all contact procedures working before students were informed that they could access the University's technology infrastructure. Additionally, a library tutorial was created and posted on the WebCT course home page in both PDF and Hyper Text Markup Files (HTML) formats. From past instructor experiences with online supplements, we were aware that some students' network connections at home, work or school were of limited bandwidth and the use of PDF files would result in longer download times, therefore requiring our use of html files in addition to PDF files. Network security, preferences and connectivity vary at each Latin American site. It is helpful to create a list of programs being used and any specific technological needs and questions prior to the course starting. Typically, each school has designated technical support personnel who can help troubleshoot and anticipate potential problems.

It was our goal to not give students too much technology in the beginning but to scaffold the technology into the course by allowing the students to become familiar with WebCT through the "Before Instructor Arrives" assignment on the home page. This process worked well with the pilot courses, with the exception of some students who did not have an Adobe Reader loaded on their machines and therefore could not read the PDF file. This problem created additional e-mails between the instructor and students prior to the instructor's arrival on-site. We noted this for

future revisions to the Web site. It is important to constantly note and work toward eliminating any problems that might occur with the technology. With the International Programs office located in one country and the students located in another, it is sometimes difficult to understand some of the problems students might encounter. The instructors for the pilot courses maintained field notes of all problems encountered throughout the weeks of instruction in an effort to better inform future instructors using the WebCT model. For example, some students had problems learning to access and manipulate the library databases, and other students had problems properly posting to the threaded discussions.

The Murphy's Law dictum "Anything that can go wrong will!" certainly applies to using technology through a platform such as WebCT, especially when it is accessed through the security maze of a university-based computer system. The debugging process can be lengthy and trying. Students get easily frustrated and short tempered when things don't work "as advertised." Professors need to be prepared to devote a large amount of time to trouble shooting and assisting students with a variety of problems. There are also networking issues related to accessing the university's WebCT server and the library's database server from Latin American countries. These issues of access and connection speed continue to present challenges.

CONCLUSION

The students involved in our blended delivery courses believed there were many advantages to using this approach. Our philosophy is that the blended teaching approach offers a number of advantages. Students gained supplementary content through the online instruction, while gaining additional skills and knowledge using Web-based materials and interacting with their peers and instructor. Student access to educational research through library electronic databases is a major

asset in increasing the quality of teacher education via distance education. The students must be able to e-mail the instructor with any problems or questions about the course before the instructor's arrival at the course site. Another important issue is the ability of the instructor to respond to student inquiries in a timely manner.

Planning is a key component in making the blended delivery methodology model work to its maximum potential. The instructor must carefully think through the entire course and plan the total learning experience well in advance of the first class. It has been helpful for the authors to think of the course in three components: (1) prior to the instructor's arrival; (2) while the instructor is on site; and (3) after the instructor departs. Each of these components may be elaborated as follows:

Prior to the instructor's arrival:

- Selection of the course delivery software and learning the limits of its use are essential. Many educational institutions are making a commitment to a course management system. Potential technology-based instructors are advised to determine if a particular platform is supported by their institution and to secure in-house staff development regarding its use.
- Planning the course should entail creation of assignments that the students will be asked to complete prior to, during and after the professor's time of face-to-face instruction. In addition to the assignments, methods of providing students with instructor feedback must be created.
- Instructions to students for using various aspects of the technology must be created and tested. Everything that students will be asked to do should be tested using technology infrastructure equivalent to what students will be able to access in their home location.

While the instructor is on-site:

- Instruction should include follow-up and feedback to students regarding assignments made prior to the instructor's arrival on-site.
- Instruction should be designed to take maximum advantage of student learning achieved prior to the instructor's arrival.
- Instruction can be slanted toward creating conditions and situations that will most effectively support learning assignments to be completed after the instructor departs.
- Student evaluation of the use of technology prior to and during the instructor's time on site should be secured. It is recommended that both formal and informal student feedback be solicited.

After the instructor departs:

- Methods of completing final course assignments and communicating these to the instructor must be in place.
- Opportunities for students to communicate with each other regarding assignments and learning activities should be considered. It is important for students to communicate with the instructor, but it is equally important for students to communicate with each other.
- Evaluation of student learning should be considered, especially how to effectively structure any examinations that may be needed.
- Methods should be created through which the instructor can provide students with feedback regarding their individual learning and the major elements of learning experienced by the entire class. Too often, students do "end of course" work and have no idea of its value or validity. The use of technology after instruction is formally concluded makes such feedback possible.

Success in implementing our past courses and future courses for the International Programs office will continue to rely on continuous evaluation and instructor/student reflections. Instructors should be trained on the use of WebCT tools (or the course management system of choice). Students should also receive advance instruction through the development of tutorials or extensive e-mail instruction prior to first use. Students in the pilot courses appreciated clear instructions in addition to the immediate feedback of the instructor and the interaction WebCT tools afforded them with the other students enrolled. Overall, our experience with the blended delivery approach of Web-based instruction coupled with traditional professor-led classes has encouraged us to continue to experiment with and refine the process.

REFERENCES

- Dabbagh, N., & Schmitt, J. (1998). Redesigning instruction through Web-based course authoring tools. *Educational Media International*, 35(2), 106-110.
- Deubel, P. (2003). An investigation of behaviorist and cognitive approaches to instructional multimedia design. *Journal of Multimedia and Hypermedia*, 12(1), 63-90.
- Graves, W. H. (2001). Transforming traditional faculty roles. In C.A. Barone & P.R. Hagner (Eds.), *Technology-enhanced teaching and learning: Leading and supporting the transformation on your campus* (pp. 35-44). San-Francisco: Jossey-Bass.
- Ho, C., & Burniske, R.W. (2005). The evolution of a hybrid classroom: Introducing online learning to educators in American Samoa. *TechTrends*, 49(1), 24-29.
- Kvavik, R. B. (2002). E-business in higher education. In R.N. Katz & Associates (Eds.), *Web portals & higher education: Technologies to*

Using a Blended Model to Improve Delivery of Teacher Education Curriculum in Global Settings

make IT personal (pp. 41-68). San-Francisco: Jossey-Bass.

Lao, T., & Gonzales, C. (2005). Understanding online learning through a qualitative description of professors and students' experiences. *Journal of Technology and Teacher Education*, 13(3), 459-474.

Lim, C. P. (2004). Engaging learners in online learning environments. *TechTrends: Linking*

Research & Practice to Improve Learning, 48(4), 16-21.

Palloff, R. M., & Pratt, K. (2001). *Lessons from the Cyberspace classroom: The realities of online teaching*. San Francisco: Jossey-Bass.

Pittinsky, M. S. (2003). Transformation through evolution. In M.S. Pittinsky (Ed.), *The wired tower: Perspectives on the impact of the Internet on higher education* (pp. 1-11). Upper Saddle River: Pearson Education.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L.Tomei, pp. 51-61, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 2.49

Developing Staff Training in Virtual High Schools

Chris Thompson

Elmbrook Schools, USA

Zane L. Berge

UMBC, USA

ABSTRACT

As virtual high schools grow in numbers across America more interest is generated in how to successfully plan and implementing them. Part of planning, implementing, and sustaining successful virtual schools includes delivering quality professional development that has a positive impact upon students' achievement. This article focuses on three virtual schools at different stages of maturity in order to describe such a model.

INTRODUCTION

Virtual schools are a rapidly growing phenomenon in American elementary and secondary (k-12) education (Berge & Clark, 2005). They are the latest and potentially the most controversial manifestation of the electronic learning (e-learning) revolution in schools. As Clark and Else noted in 1998, "For the foreseeable future, the World

Wide Web ... is likely to serve as an umbrella technology uniting distance education media for distributed learning ... Virtual schooling is the next wave" (Clark & Else, 2003, pp. 35-36).

Distance education in today's virtual schools describes not only the education of the students enrolled, but also the professional development programs used to train the faculty and support staff working for each online school. This article briefly profiles three virtual schools, each at a different stage of development, yet each dependent upon a successful and sustained distance education program for its professional staff, in order to remain viable long into the future. As virtual schools become more accepted by the public and the attention given to the online schools shifts from their sources of funding to their standardized test scores, a model for sustained distance training and education must be in place to deliver quality professional development that can positively impact students' achievement scores on standardized tests for each school's online student population.

There are three virtual schools used in this article to explore improvements to staff development. Electronic Classroom of Tomorrow is the largest k-12, electronic school in the United States, serving almost 7,000 students. The second school is the IQ Academies high school, which is just completing its inaugural year and proudly claims its 203 students a success. The third school is entirely virtual, and to date imaginary, but ideal in its delivery of distance training and education to its staff and faculty. The first two schools provide examples that collectively will serve as the foundation for a successful professional development program. The Virtual I.D.E.A.L. school will serve as a model for future management consideration. Taking into consideration what is known about barriers to online learning, best practices in virtual schools, and how to sustain virtual schools, success of schools that take into account the Virtual I.D.E.A.L. program will ultimately have a positive impact on the long-term status and its ability to service each of its students' needs.

The ECOT

The Electronic Classroom of Tomorrow (ECOT) was founded in 2000 and today serves as the largest online k-12 school provider in the United States, serving almost 7,000 students (ECOT, 2004). Based in Columbus, Ohio, this school enrolls only Ohio residents, drawing from a student and teacher population that is geographically spread across the state. Like most public, state-sponsored chartered schools, the ECOT high school provides a workstation and Internet access for each student and partners with course-content providers to offer curriculum through a course-management system. Each teacher begins with the provided course content and is able to adapt it to meet the needs of his or her class. Special education teachers are also available, modifying the course content and classroom activities for the students identified with special needs (B. Hartge, personal communication, June 23, 2005). Like traditional

classrooms, each special education student has an individualized education program (IEP), which is meant to guide and document specially designed instruction for each student with a disability, based on his or her unique academic, social, and behavioral needs (IEP, 1999). While serving the needs of a very diverse student population and growing at an incredibly rapid rate in its five years, ECOT approaches each school year as a work-in-progress, tweaking the system to better serve the changing needs of its online student population.

IQ Academies

The Waukesha IQ Academies (IQ) was the first virtual high school in the state of Wisconsin, opening its doors Sept. 1, 2004. Wisconsin's open enrollment laws require students wishing to attend a school district other than their home district to apply to those districts during a three-week window in February of each year. While a student has until Aug. 31 to decide if he/she will attend another district, if the student does not apply in February, the opportunity to enroll somewhere other than the home district is lost (Wisconsin Department of Public Instruction, 2005). Last year, the IQ, a public charter school affiliated with the 13,000-student Waukesha School District (Waukesha School District, 2004) located 20 miles west of Milwaukee, had nearly 500 students apply during the open enrollment process, with 220 enrolling by Sept. 1. In February 2005, IQ accepted more than 1,000 applications for open enrollment and anticipated its actual enrollment to be 600 students on Sept. 1, 2005 (K. Diener, personal communication, April 14, 2005).

IQ was created to better meet the needs of students that, for a variety of reasons, did not believe their needs were being adequately addressed. Students requiring an alternative education, traveling the United States, or who were traditionally homeschooled, did not have an educational system

Developing Staff Training in Virtual High Schools

that was working for them. The Waukesha School District recognized these needs, and in less than 10 months, energized its resources to put into place a complete online virtual high school.

Because of its affiliation with an existing school district and an agreement with the Waukesha Teachers Association Union, all IQ teachers are employees of the Waukesha School District and most continue to teach in the classroom in addition to their online work. In its first year, IQ had one full-time instructor and 27 part-time teachers, teaching as little as 1/12th of their instructional time in the online environment. Each instructor received a computer, but was not given Internet access, under the assumption that most instructors continued to teach in a district building with Internet access. It is hoped that with the increased enrollment projections, at least five to six teachers can be hired full-time for IQ, allowing the online teaching faculty to dedicate more of their time to their online responsibilities. As could probably be expected, in some cases, it was believed that in-person classroom needs consistently trumped online classroom needs, frustrating both student and staff. More full-time online staff will help address the challenge of trying to wear both hats as an online and in-person instructor.

Distance Training and Education Efforts for Faculty

Neither IQ nor ECOT fit cleanly into any one of Schreiber's (1998) stages of technological maturity that indicate an organization's readiness to successfully implement distance training and learning (see Appendix A). Due to the nature of their business, both schools met the stage two requirement, having the necessary infrastructure and technological capability to delivery online education and training. IQ may fall a little short because of the decision to not provide home Internet access to its staff. Nonetheless, all teachers still had access either at home or at school. Furthermore, IQ's full-time staff of two (principal

and secretary) simply cannot be expected to train, develop procedures, and evaluate the needs of its staff, which are also stage two expectations. Hopefully as it grows in size and resources, IQ can transition from a stage one school, providing separate and sporadic learning events, to an organization that is more established and consistent in its training efforts.

ECOT's size and experience allow it to meet more of the stage two requirements, including approaching distance education and training with a more interdisciplinary team and maintaining adaptability and flexibility in its course offerings. By establishing a mentoring program and its formation of a partnership with the University of North Florida to develop research-based, online faculty training solutions, ECOT approaches stage three but has yet to fully commit and embrace distance training of its staff as a core belief and philosophy.

Staff Development Efforts

Ironically, for staff development, both IQ and ECOT use on-the-ground instruction as their primary mode of delivery. The fact that both virtual high schools maintain in-person education and training for most, if not all, of their staff development may not be as much of a contradiction to their focus on online education as it first seems. Rather, a mixed-mode delivery of online and in-person professional development recognizes that each school must first build a learning community among its staff members, most of whom have been trained in a in-person environment, before engaging students in their respective online communities. While not taking advantage of some of the online efficiencies, it seems both institutions are most comfortable with a blended model of professional development delivery.

IQ offered one week of primary instruction to all faculty members before its inaugural school year, and, because all teachers currently or formerly taught in the district, it was not difficult

to arrange such in-person training. The training consisted of four parts:

- Exploring online teaching and how it compares with in-person teaching
- A mini-course simulation
- Technical skills training
- How to effectively communicate with the online student.

Because most of the course content is provided for the instructor, the training was focused on the supplemental, but very important, aspects of a course, such as classroom management, facilitating discussion, course expectations, and school policies. With more full-time staff projected for future school years, it is hoped that IQ can at least begin to have virtual faculty meetings as a first step in the distance training process.

ECOT has an established system of in-person training four times a year, lasting for two to three days, and held at various locations around the state. ECOT takes advantage of this opportunity to also hold parent-teacher conferences for students in that particular geographic section. ECOT's in-person sessions may include some technical skills training on new products or features but more often includes training on school initiatives, such as competencies and state test scores. Because state test scores are extremely public figures and are oftentimes the measure of a school's success (or failure) in the eye of John Q. Public, it is not uncommon for new charter schools and traditional brick-and-mortar schools alike to place great emphasis on achieving higher test scores. Because the state test is not yet online and must be proctored, the challenges presented in the coordination of a state standardized test at an online high school are incredible, doubling the need for all staff members' active participation at testing time.

Feedback for Staff Development

ECOT also has established an effective system for collecting feedback on training needs, incorporating suggested education and training opportunities into their quarterly meeting. This supports one of Rosenberg's (2001) five areas of transformation, when describing the new era of training and instruction, the ability to move training from cycle time to real time. Historically, training has taken some time to cycle from concept to delivery; but today, real-time turnaround is necessary and critical. ECOT's ability to turnaround its training needs from one quarter to the next demonstrates real-time training and instruction to its faculty members.

VIRTUAL I.D.E.A.L.

The Virtual I.D.E.A.L. (IDEAL) school does not exist. It serves here as a model to point toward considerations that need to be made when managing a virtual high school. IDEAL was established five years ago. It maintains manageable growth, its students test high on the required state exams, its staff is well-qualified, and its distance education and training program would be described by Schreiber (1998) as beyond stage four. The IDEAL school is just that, yet it somehow strives to be more. What makes its distance education and training program the best? Its practices are based on research, experience, self-reflection, and successful partnerships with industry experts.

A Strong Beginning

A well-trained staff is critical for sustaining IDEAL's programs and to meet the needs of students. Training staff at IDEAL begins with a structured program for beginning distance in-

structors, following many of the topics identified in IQ's training. The difference between the two is that IDEAL takes advantage of the particular strengths of in-person and online instruction. Rosenberg (2001) notes, "With all the potential of e-learning, it might be easy to dismiss traditional classroom training as completely antiquated—of no value down the road. Although e-learning has a great deal to contribute, it does not mean the end of a classroom learning" (p.120). Similar in concept to ECOT, the IDEAL school gives all incoming staff an assessment to determine the level of individual technical and instructional skills. Tobin (2004) cites ever-changing teacher competencies to justify the need for the development of competencies for online teachers as well as continuing professional preparation and training for online teachers. This assessment is based on the Educational Technology Standards and Performance Indicators established for all teachers by the International Society for Technology Education (ISTE, n.d.). ISTE identifies six areas of focus:

1. Technology operations and concepts
2. Planning and designing learning environments and experiences
3. Teaching, learning, and the curriculum
4. Assessment and evaluation
5. Productivity and professional practice
6. Social, ethical, legal, and human issues.

Because of its virtual nature, special emphasis is placed on needed technical skills, and any technical remediation is completed before the first week of distance training. In addition to the preweek assessment and technical training, new instructors also are required to complete online learning objects that introduces available administrative and support services, tutorials on copyright and policy issues, and an exploration unit on the components of a successful online course. IDEAL also uses its preweek session to have the instructors introduce themselves, de-

scribe their background, and share some of their personal interests. Completing these components online before the actual in-person session demands preparation, encourages camaraderie, and builds skill development, similar to what the instructors will soon be expecting from their students.

Finally, the week of training arrives and sessions are presented on the following items:

- Distance learning technology and its impact on learners
- How distance instruction ties in with the institutional mission
- Fundamentals of and assistance with course development and adaptation
- Techniques for encouraging interaction
- Development of back up and contingency plans
- An opportunity for addressing concerns (Clay, 1999).

Each session builds upon the previous and adequately connects the school's mission and vision with the online classroom teacher's responsibilities and expectations. One unique way that IDEAL uses to insure this connection is made by its new teachers is through formative and summative assessments. Instructors are quizzed and must complete practice exercises demonstrating formative, or short-term, learning. Instructors also must demonstrate summative learning, evaluated by how effectively they are able to implement training topics into their own virtual classroom, measured by a three-month, six-month, and nine-month classroom "visit and evaluation." To help insure their success, trainers teaching the introductory sessions to new teachers can earn financial incentives based on their students' ability to connect session training with students' classroom learning. Success in the classroom is evaluated by the administrators' ability to quantify interactivity, learning, and growing, something that remains quite a challenge in an online school. Sunal, Sunal, Odell, and Sundberg,

(2003) offer a Checklist for Online Interactive Learning (COIL), which centers on four main topics: student behavior, faculty-student interaction, technology support, and the completeness of the learning environment. Classroom teachers at IDEAL appreciate such an assessment because it is research based and can provide data to support both successes and future opportunities in their virtual classrooms.

The successful integration of online training and in-person training reinforces Rosenberg's (2001) other indicators necessary to transform distance training and instruction. Using online training both as a precursor to live instruction and as a follow up to classroom training deftly blends the strengths of the two modes of instruction. Holding the trainers accountable for their instruction and subsequently holding the instructors accountable for implementing what they have learned, encourages all participants to make the connection between training and performance. And, finally, by maintaining online materials, information can remain current and accessible when needed (e-Learning, pp.7-8).

Variety

As IDEAL's training program moves beyond the first weeks, variety becomes an integral part of its continued success. Just as teachers need to find ways to reach students of all learning styles, distance training programs need a variety of opportunities for learners with varying styles and preferences. Clay (1999) advocates for online programs that include mentoring, group sessions, one-on-one labs, printed materials, listservs, regular discussion sessions, and observation of others' courses. Not only does the variety address the needs of different learning style, but most of the learning options allow educators the opportunity to explore skills and technologies they could ultimately use in their classroom as part of their own instruction. Clay acknowledges the reinforcement of skills as valuable by noting

that "experience shows that training simply won't 'take hold' unless support is ongoing, with job-embedded opportunities for practice" (1999).

Knowledge Management

Rosenberg (2001) describes online training that is supported by expert modeling and stories, learning from others' mistakes, and having the opportunity to reuse information after learning. The reuse of information refers to knowledge management, and, once again, IDEAL is at the forefront of the virtual training field. Where as training and instruction is focused on specific learning outcomes, is sequenced for memory retention, and may contain presentation, practice, feedback, and assessment components, knowledge management focuses on the organization of content, is sequenced for optimum reference, and is centered primarily on effective presentation (Rosenberg, 2001). IDEAL's knowledge management archives contain many how-to's, alternative instruction and assessment strategies, and many tutorials on school and student policies and procedures. The database is easy to search and tracks hits on various information modules, to help identify future training and instruction opportunities.

Identifying and Assessing Needs

IDEAL's ability to use data from the knowledge management archives is vital to the proper identification of future training needs. While feedback and user input is another valuable collection tool, the data provides not only a basis from which to start, but also a means to measure progress over time to determine the success of training and instruction efforts. The power of data in sustaining distance training efforts cannot be overstated. Data can justify a major investment in new software or additional support expenses. In IDEAL's case, data can be used to demonstrate competency and achievement of individual or school goals,

and it also can be used to challenge both staff and students to raise the bar higher in all forms of instruction and learning. Identifying and assessing needs for distance training is an important aspect of Rosenberg's (2001) learning architecture and the IDEAL's continued success.

Variety of Teaching Methods

IDEAL's successful preweek assessments, remediation, and topical learning objects, combined with its week of in-person instruction, added to its extensive knowledge management database, and integrated into a system that stresses accountability, data-driven decisions, and constantly assessing learning and training needs, allows its well-trained staff to focus its distance education and training efforts on larger, school-wide initiatives. No longer are instructors learning how to make templates in Microsoft Word, but instead are using discussion board software to consider how to improve literacy, create common assessments, improve communication channels with parents and students, and how to align curriculum to state and national standards. In another chat room instructors are brainstorming at how to integrate more team-building exercises into the curriculum, while others are comparing classroom statistics to identify instructor strengths and areas for improvement. IDEAL is able to remain at the forefront of distance education and training through its continued creative use of online learning tools and its desire to tackle challenging issues facing most high schools today.

Barrier to Sustaining Distance Education

Cho and Berge (2002) identify 10 barrier clusters to establishing successful distance education and training programs:

1. Technical expertise
2. Administrative structure

3. Evaluation/effectiveness
4. Organizational change
5. Social interaction and quality
6. Student support services
7. Threatened by technology
8. Access
9. Faculty compensation and time
10. Legal issues

Ohio's ECOT seems to have already addressed many of these barriers. Through its preassessment, technical training, and quality internal support, its teachers are technically competent and can adapt to new technologies. It has provided a computer and high-speed Internet access for its staff members and pays its faculty well compared to brick-and-mortar institutions. ECOT's quarterly meetings encourage social interaction and community, and its willingness to accept feedback and evaluation helps include all staff in the development of the training process. ECOT's needs seem to revolve around an integrated learning architecture and a more substantial investment in online training opportunities for its staff. Like most schools, it struggles with implementing accountability and successfully managing the rapid growth of its student and teaching populations. While it has already started initiatives concerning competencies and state test scores, better use of its online resources will allow it to reach a new level of success when addressing organizational issues and goals.

Wisconsin's IQ has taken the first step towards sustaining distance education and training just by entering the virtual high school arena, yet there is certainly room for improvement. Faced with a small administrative staff, limited student support services, less provisions for faculty access, and no unique compensation packages, the challenges ahead of IQ are formidable but not impossible. As enrollment increases, more full-time teaching and administrative staff will generate increased opportunities for online collaboration and the development of a knowledge management sys-

tem. Two more years of experience will solidify its new instructor training initiative and perhaps lead to a preassessment to determine both teaching and technical skills. Increased administrative support may allow for more detailed assessment of classroom instruction and measurable student learning. The key to IQ's future success is continued growth and constant evaluation of the support services and offering instructional opportunities to its teaching faculty.

CONCLUSION

The IDEAL school focuses on the future. While it may be impossible for any one school or district to achieve the comprehensive success of the distance education and training efforts modeled by IDEAL, various components and strategies are attainable and can be matched in terms of quality and sustainability. The IDEAL school may best serve as a reminder that a school's commitment to its teaching staff is constant and unending, and consistent and determined effort is required year in and year out.

These three virtual schools are each at different stages of maturity. Successful and sustained distance education and training for all three schools revolves around continued growth, organizational commitment, quality resources and instruction, and measures of accountability. Not surprisingly, these factors are really not much different than the standards of success identified by brick and mortar institutions. By examining the current status of staff training that exists in a virtual high school and planning the direction a model program should have, school administrators can better plan to close the gap, while overcoming common barriers and identifying staff development needs.

REFERENCES

- Berge, Z. L., & Clark, T. (2005). *Virtual schools: Planning for success*. New York: Teachers College Press.
- Cho, S. K., & Berge, Z. L. (2002). Overcoming barriers to distance training and education. *Education at a Distance* [USDLA journal] (16) 1. Retrieved September 15, 2006, from http://www.usdla.org/html/journal/JAN02_Issue/article01.html
- Clark, T., & Else, D. (2003). Distance education, electronic networking, and school policy. In D. R. Walling & J. F. Jennings (Eds.), *Virtual schooling* (pp. 31-45). Bloomington, IN: Phi Delta Kappa Educational Foundation.
- Clay, M. (1999). Development of training and support programs for distance education instructors. *The Online Journal of Distance Learning Administration* (Fall). Retrieved on September 15, 2006, from <http://www.westga.edu/~distance/clay23.html>
- Diener, K. (2005). Principal, Waukesha IQ Academies. Interview conducted via the phone on April 14, 2005.
- Electronic Classroom of Tomorrow (ECOT). (2004). *High school*. Retrieved September 15, 2006, from <http://www.ecotohio.org/highschool.html>
- Hartge, B. (2005). Personal correspondence.
- Individualized Education Program (IEP). (1999). L.D in depth. *LD Online*. Retrieved September 15, 2006, from http://www.ldonline.org/ld_in-depth/iep/iep.html
- International Society for Technology Education (ISTE). (n.d.). *Educational technology standards and performance indicators for all teachers*. Retrieved September 15, 2006, from http://cnets.iste.org/teachers/t_stands.html

Developing Staff Training in Virtual High Schools

Rosenberg, M. (2001). *E-learning: Strategies for delivering knowledge in the digital age*. New York: McGraw-Hill.

Schreiber, D. A. (1998). Organizational technology and its impact on distance training. In D. A. Schreiber & Z. L. Berge (Eds.), *Distance training: How innovative organizations are using technology to maximize learning and meet business objectives* (pp. 3-18). San Francisco: Jossey-Bass Inc., Publishers.

Sunal, W. D., Sunal, S. C., Odell, R. M., & Sundberg, A. C. (2003). Research-supported best practices for developing online learning. *The Journal of Interactive Online Learning*, 2(1), 1-40. Retrieved September 15, 2006, from <http://www.ncolr.org/jiol/issues/PDF2.1.1.pdf#search=%22Sunal%20%22Research-supported%20best%20practices%20for%20developing%20online%20learning%22%22>

This work was previously published in the International Journal of Information and Communication Technology Education, Vol. 3, Issue 2, edited by L. A. Tomei, pp. 32-40, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.50

A Model for Effectively Integrating Technology Across the Curriculum: A Three-Step Staff Development Program for Transforming Practice

John Graham

Robert Morris University, USA

George W. Semich

Robert Morris University, USA

ABSTRACT

Technology training for college faculty has become an important part of the mission of colleges and universities today. Funding is allocated toward not only purchasing new technologies but also training faculty to use these technologies with their students in the classroom to better prepare them for the information workplace. Our interest at Robert Morris University was to develop a sequential staff development model that would not only help train faculty, but also help them apply and eventually integrate technology with their students across all of the academic disciplines. This model looks at three key phases of staff development: the training phase, the application or use phase,

and the final phase of integration that involves a transformation from the teacher-centered to the learner centered classroom.

INTRODUCTION

Today, nearly everyone at the university level, from chief information officers, deans, department heads, technology directors, and faculty, is committed to preparing students who can compete technologically in this fast-paced competitive work environment. Simultaneously, university budgets are bulging with technology requests, state and national standards are requiring higher levels of technology competence, and teaching

via technology is being heralded as a valuable instructional tool at all levels of the educational spectrum. Wiske (2004) advocates the use of a pedagogical framework that provides criteria for productively using technologies for deepening understanding, while the International Society for Technology Standards, through its National Educational Technology Standards (NETS) project (Thomas, 2004) is providing educational leaders with guidance in developing national standards for technology. Yes, effective use of technology is being considered a 21st century skill, just as important as communications, problem solving, and effective decision making.

One approach to meeting this demand is to simply teach for equipment and product usage, thus requiring courses focused on attainment of specific technology core standards of achievement. However, perhaps a more generalist and surely beneficial approach is to effectively integrate technology throughout the instructional process, thereby, exposing students to proper technology use while concurrently improving the learning process. Easier said than done! At Robert Morris University, although some courses have been developed to meet specialized technology course requirements, the primary goal is to effectively integrate technology across the curriculum. In order for successful technology integration to occur, however, there needs to be a strong link between content and delivery and that the use of technology will be most effective when technology use is based on sound instructional theory.

PROBLEM STATEMENT

With the aforementioned to set the stage, data was gathered about the use of technology by faculty and students before formulating a staff development model which faculty can use to effectively integrate technology across the curriculum. Given the importance of technology in teaching and learning, the primary question to be answered was:

How can this institution initiate a staff development program that can help faculty move from training, to use or application, and finally to the integration of technology to transform practice?

BACKGROUND

In recognizing the importance of technology, Robert Morris University (RMU) has provided state-of-the-art presentation classrooms. Teachers have access to an LCD projector, a computer, and a VCR for instructional purposes. Many of the classrooms, however, have additional resources including a smart cart, a touch screen, a document camera, cabling for a laptop, and a recording device. The RMU goal is to use technology to enhance the learning environment so that it is participative, customized, and student centered.

An academic technology committee is also in place and consists of representatives from both the administrative and support staff of the university as well as faculty from each of the six schools. A full-time faculty member, who is also on the committee, serves as the director of instructional technology. While the director works more closely with faculty on an individual basis, the committee, on the other hand, reviews concerns of the faculty/staff, initiates new directives, oversees the technology planning process, monitors the budget, and sets short- and long-range technology goals for the university.

THE TECHNOLOGY SURVEY

During the 2001-2002 academic years, RMU designed a survey instrument to measure the degree of technology usage at RMU for a wide array of pedagogical tools. Particularly, the instrument helped to determine the faculty and student usage across all programs at the university. Five basic categories of technology usage were surveyed: Internet/Web-based activities, PowerPoint, mul-

timedia classroom technology, electronic library searches, and technology integration. These categories were chosen as they were indicative of the variety of technologies and facilities that faculty and students can access at RMU. The survey results ultimately guided the university in planning for the ongoing integration of technology for instructional purposes.

Full-time faculty was asked to complete the surveys based on how technology is used in their courses; that is, both technology used by the faculty and required of the students. Furthermore, faculty was asked to forecast the types of technologies they would be using three years ahead to fall 2004. It was not surprising to learn that faculty anticipated using technologies in Internet/Web-based activities, PowerPoint, multimedia classroom technology, and electronic library searches in 70% or more of the sections taught. The results of the technology integration were not so positive. Table 1 shows the percentage of sections by department in which faculty expected to integrate technology by fall 2004.

Based on these findings and supported by our need to have faculty effectively integrate technology into their specialized curriculums, a three phase technology model was designed that would encourage faculty to work toward true integration of technology into the classroom by transforming

the classroom into a student-centered, technology supported learning environment.

DEVELOPMENT OF THE MODEL

Our first step, however, was to review the related literature on the subjects of technology training, technology use, and technology integration as they relate to staff development for faculty. It was important in the development of an applied model to emphasize three separate sequential phases critical to effective technology implementation and enhanced student learning. Combining these three phases into one generic staff program also seemed to us to be far more chaotic and probably much less residual in terms of successful classroom application since each phase requires a sequential level of competency to develop self confidence and fluidity with faculty. Thus, the suggested model of staff development included these three distinct phases: the training phase, the use or application phase, and the integration phase. However, as with many colleges and universities, the transition to the third phase of technology integration not only requires faculty to learn how to apply technology but also how to change the classroom into a learning center that promotes student application of technology. In short, this dramatic third phase presents the great-

Table 1. Technology integration

| Department | Percentage of Sections |
|-------------------------------|-------------------------------|
| Communications | 50% |
| Computer Information Systems | 95% |
| Education and Social Sciences | 47% |
| Marketing and Management | 44% |
| Accounting | 20% |
| Finance and Economics | 13% |
| Science | 43% |
| Mathematics | 50% |
| Engineering | 75% |

A Model for Effectively Integrating Technology Across the Curriculum

est challenge since it embraces both philosophic and operational changes in teaching.

In a major study by the U.S. Congress' Office of Technology Assessment (1995), it was noted that a lack of teacher training is one of the greatest roadblocks to integrating technology into the curriculum. Thus, the first phase of the model was the training phase, which was a very basic approach to demonstrate to faculty how to operate the instructional technologies. The director of technology implemented small group training sessions in each academic school at the university. These sessions emphasized the step-by-step operations of the technology with numerous opportunities for individual faculty to experience direct hands on training. The sessions also highlighted the special features of the technology as a powerful teaching tool. To illustrate, most of the classrooms have a Crestron Controller Unit with a computer, projection system, recording and playback VCRs, tape recorder/player, document camera, and rear mount recording camera. Shifting through these various modes and demonstrating multiple and single operations of each piece of equipment gave faculty the heighten incentive to move to our second phase of using the new technologies. Since it was also suggested in the research (Shelton & Jones, 1996) that the training should occur outside the school day to remove additional responsibilities of teaching and/or advising students, the university provided training sessions later in the day. Finally, in this first phase the training sessions focused on the individual differences and specific strengths of participants, which help faculty to personalize the technology training. This aspect of teaching technology according to individual strengths and weaknesses is well supported by the research (Boe, 1989; Browne & Ritchie, 1991; Shelton & Jones, 1996). A lack of confidence and feeling uncomfortable with learning new technologies as suggested by Rosen and Wail (1995) might prevent the faculty from eventually using it.

In the second phase, the faculty actually used the new technology. This meant that much of their

technology use would be extensions or modifications of the teaching methods they presently practice. For example, those who were traditionally using the chalkboard or whiteboard would shift to using PowerPoint slides to deliver classroom notes. Essentially, state of the art equipment, including LCD projectors, computers, the Internet, VCRs, document cameras, and so on would replace older technology such as overhead projectors, flipcharts, paper handouts, and so on. This was the most logical transition since it supported using the new technologies from Phase I, and yet it allowed faculty to utilize familiar teaching methods. The primary goal in the model was to have faculty see the value of training and applying technologies to update and upgrade their present teaching approaches in the classroom. The added benefit of working with new technologies as a means of motivating students might renew their interest in delivering the course curriculum. Hardy (1998) reviewed existing studies on teacher attitudes to develop a profile of technology used by teachers and concluded that access to equipment, administrative support, and time did not have the impact that the teacher's own confidence level would have in really using technology. Thus, in this second phase, the faculty would apply the technology training they received to their own pedagogical teaching methods, and then move toward the goal of integrating technology and transforming the classroom from a teacher-centered to student-centered learning environment.

The third and final phase of the model, the integration phase, includes a systematic plan for staff development, as supported by Stager (1995), which places the teacher/student at the center of the learning experience and provides a meaningful background for learning. This phase is more of a transformation of traditional teaching since it requires a shift in roles placing primary emphasis on the learner. Honey and Spielvogel (1999), profess that this transformation changes the classroom in that it defines new teacher roles and heightens student interaction. The student

becomes the central focus in the classroom. The teacher assumes the role of coach or facilitator while students work in teams collaboratively (Jones, Valdez, Nowakowski, & Rasmussen, 1995; Kupperstein, Gentile, & Zwier, 1999). It is possible that this new role may even involve connecting with other schools perhaps in various locations around the world. It is as Bransford, Brown, and Cocking (1999) suggested that technology could support learning in five ways (p. 195):

- To bring exciting curricula into the classroom that is based on real-world problems and that involves students in finding their own problems, testing ideas, receiving feedback, and working collaboratively with other students or practitioners beyond the school classroom.
- To provide tools and scaffolds that enhance learning, support thinking and problems solving, model activities and guide practice, represent data in different ways, and are part of a coherent and systematic educational approach.
- To give students and teachers more opportunities for feedback, reflection, and revision, including those where students evaluate the quality of their own thinking and products, have opportunities to interact with working scientists, receive feedback from multiple sources which include their peers, and experience cognitive tutors and coaching in areas where improvement is needed.
- To build local and global communities that are inclusive of teachers, administrators, parents, students, practicing scientists, and other interested community people, expanding the learning environment beyond the school walls.
- To expand opportunities for teacher learning that includes helping teachers to think differently about learners and learning, to reduce the barriers between students and teachers as learners, to create new partner-

ships among students and parents, and to expand communities of learners that support ongoing communication and professional development of teachers.

Faculty must also begin modeling the technology themselves by implementing technologies like presentation software, online discussions, databases, spreadsheets, and smart boards (Duhaney, 2001; Schrum & Dehoney, 1998). This serves to motivate students to learn and use technologies and provides opportunities for both faculty and students to share new ideas relative to technology application within the learning process. Initially, faculty use of word processing programs and other software programs were sufficient, but they are no longer considered the only indicator of technology integration (Wetzel, Zambo, & Buss, 1996; Yidrim, 2000). In short, faculty needs to not only become adept at integrating technology in the classroom, they subsequently need to have students take control of using the new technologies to enhance learning.

THE MODEL AT RMU

The model consists of three stages or phases that are all inclusive of a comprehensive technology based staff development program.

Training → Using → Integrating (**TUI**)

As detailed in the preceding development section of this paper, the main goal was to move faculty quickly beyond the first two phases into the final, most critical, phase of technology integration in the classroom. Johnson and Liu (2000) noted, "Everybody is talking about technology integration, but few practicing teachers profess to know exactly how to proceed." They don't know how to proceed because the new technology presents a new challenge not only in how to use it, but also in how to work with students to truly

A Model for Effectively Integrating Technology Across the Curriculum

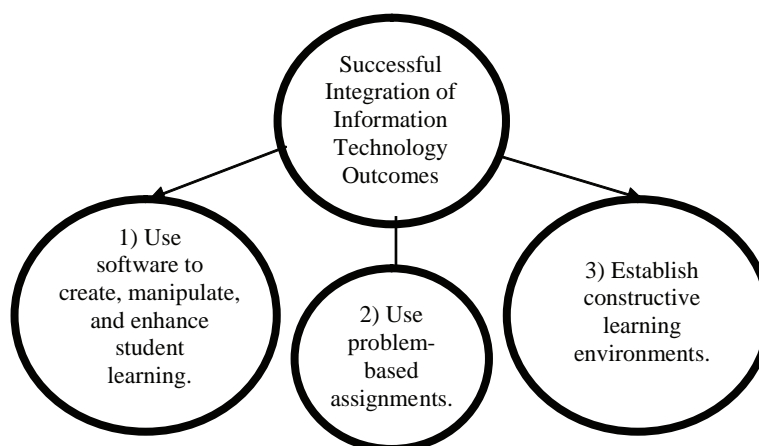
integrate technology into human learning. In this proposed model, the goal was to give the faculty in all the academic disciplines the opportunity to advance to this level.

The starting point for the integration phase was to shift from an instructional group and individualized mode to a learning/sharing model or learning community model. Faculty across the academic disciplines who were integrating technology and modeling learner-centered classroom scenarios would assist in working with other faculty who had worked through the first two phases of the model in their classrooms — the training and use phases. Duhaney (2001) emphasized that it is an important step for instructors to model technology applications such as software, online discussions, databases, spreadsheets, smart boards, and so on. This practice will encourage students to use the new technologies in their class work and in the construction of products for class assignments. Hence, “pedagogical design experts” and facilitators of learning were identified, whom Fullen (2000) argued are needed to change or transform existing teacher roles in the classroom. Faculty across the academic disciplines were integrating technology in ways that students were both learning and integrating technology. The current research (Bitner & Bitner, 2002; Guha, 2003;

Hruskocy, Cennamo, Ertmer, & Johnson, 2000; Mouza, 2002; Schmid, Fesmire, & Lisner, 2001; Walsh & Vannatta, 2001) also stresses support systems that involve technicians, administrators, and peers working together to assist in preparing faculty to successfully integrate technology into their academic disciplines. The task can be overwhelming for faculty since it requires learning new skills and transforming the traditional model of the teacher-centered classroom into a student or learner-centered classroom that promotes integrating technology to better enhance learning. One very useful technology integration model considered was John and Liu’s (2000) model of technology integration (see Figure 1). This model placed emphasis on student-centered learning in the classroom. The Johnson and Liu model was especially helpful since it was based on a National Educational Standards (NETS) program in the state of Florida and focused on how students used technology for productivity in the classroom. This was their critical first step toward successful transformation of teaching and learning.

The Johnson and Liu model, which exemplified the principles of constructivist education, defined integration for the third phase of the staff development model. Their study included student use of the National Educational Technology Standards

Figure 1. Johnson and Liu integration model



(NETS) and focused on how these students were productive by applying technology creatively to complete projects in the public school classroom. The goal was to apply this constructivist model at the university. Given the fact that many of the faculty had reached competency at the first two phases, it seemed logical to assume that they would embrace the idea of expanding their learning set and would consider applying new and innovative ways of applying technology, including placing special emphasis on student use of the technology in the classroom.

The starting point was to identify faculty who were presently functioning in the third phase and subsequently involve them in helping to work with their teaching colleagues. This faculty group would offer the support system that Zhao (2002) noted as a strong factor for innovative computer integration activities in the classroom. It was also important to have the technology director and technology savvy administrators be a part of this team, which is supported by much of the current research (Schmid et al., 2001). This team approach in the third phase offered faculty a cooperative learning model that fostered a learning community for technology integration. The following section includes examples that demonstrate this faculty driven, learning community approach.

LEARNING COMMUNITY APPROACH EXAMPLES

A faculty member from the CIS department demonstrated how to use Web Surveyor, a user-friendly, online survey research tool that facilitates the development of surveys, the collection of data, and the generation of reports. It was particularly useful for both faculty and students who are engaged in the research process. Since Robert Morris has recently placed added emphasis on scholarship, this should provide a valuable service to faculty who may in turn apply these software techniques in their classrooms.

A business faculty member demonstrated SPSS software for the applied use of statistical applications for both faculty scholarship and for use with student research work. This session also provided opportunities for extended software use and continued individualized support for interested faculty.

A communications faculty member demonstrated using online resources that could be used in the classroom. One of the featured sites was MERLOT, which provided a wide range of technology-applied topics designed primarily for faculty and students. These learning materials covered the arts, humanities, math/statistics, social sciences, education, and technology/science, which connected with all of the academic disciplines.

A business teacher education faculty member demonstrated MS Excel for grade book application. Many faculty members wanted to learn how to create a vertical lookup table for translating numerical grades into letter grades. This session had heightened benefit for all faculty interested in moving from the paper grade book to the electronic grade book.

STATUS OF THE INTEGRATION PHASE AT RMU

The integration phase of the model has, in effect, started to evolve over the past year. Presently, our newly hired dean of academic services is overseeing technology at the university and organizing separate technology committees for each of our six schools (business, communication and information systems, education, nursing, engineering, and adult continuing education). These committees will study ways the schools might better integrate technology within the respective disciplines. In turn, faculty and/or administrators from these committees will represent the schools at the university-wide technology committee, where all academic disciplines interact. The implementation

of these committees is sequential and collaborative in nature. Further, it is a cross-disciplinary approach that gives both variety to content and creativity in methods using modeling and mentoring to replace instruction and demonstration.

As previously noted, this third step of integration is in the infancy phase at Robert Morris University. It is a move toward making the technology meaningful in terms of both instructor delivery and student application. Further, it supports collaborative teaching and learning since faculty from across the disciplines share technology integration methods.

SUMMARY

The three steps to this model provide better opportunities for mastery at the various levels of learning. They are designed to establish competency at each phase of the process. Frankly, there are classrooms where teachers may have ideas about integrating technology but lack the technical training and pedagogical expertise to carry through with the lesson in an effective and efficient manner. By using a sequential staff development program, faculty will have the proper preparation and interest to pursue a more integrative approach of the technologies. Since each school and each academic discipline would have involvement, it would promote both intra and inter-departmental integration sharing sessions.

Ideally, this model might evolve into a type of specialized model such as writing across the academic disciplines where various methods, techniques, and approaches are shared across the disciplines. Furthermore, faculty could enter the staff development program at any of three phases depending on their level of competence. This is probably the most important aspect of this proposed staff training program since faculty have such varying levels of competence and interest in technology application. Integration of technology is the desired goal, but faculty needs to

move through the necessary steps to reach this level. Thus, it is believed that this model will significantly improve a faculty member's chances of successfully integrating technology across the curriculum in a way that will provide richer, more rewarding learning experiences for students.

REFERENCES

- Beyerbach, B., Walsh, B., & Vannatta, R. (2001). From teaching technology to using technology to enhance student learning: Pre-service teachers changing perceptions of technology inclusion. *Journal of Technology and Teacher Education*, 9(1), 105-127.
- Bitner, N. & Bitner, J. (2002). Integrating technology into the classroom: Eight keys to success. *Journal of Technology and Teacher Education*, 10(1), 95-100.
- Boe, T. (1989). The next step for advocates and the technology industry: Investing teachers. *Educational Leadership*, 29(3), 39-44.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (1999). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.
- Browne, D. L. & Ritchie, D. L. (1991). Cognitive apprenticeship: A model of staff development for implementing technology in the schools. *Contemporary Education*, 63(1), 28-33.
- Duhaney, D. C. (2001). Teacher education: Preparing teachers to integrate technology. *International Journal of Instructional Media*, 28(1), 23-30.
- Fullan, M. (2000, February). *Change forces: The sequel*. 2000 CHANGE Council Keynote Address presented at the annual meeting of the Association for Educational Communications and Technology, Long Beach, CA.

- Guha, S. (2003). Are we all technically prepared? Teachers' perspective on the causes of comfort or discomfort in using computers at elementary grade teaching. *Information Technology in Childhood Education Annual, 1*, 317-349.
- Hardy, J. (1998). Teacher attitudes toward and knowledge of computer technology. *Computers in the Schools, 14*(34), 119-136.
- Honey, M., Culp, K.M., & Spielvogel, R. (1999). *Using technology to improve student achievement*. Retrieved December 4, 2004, from <http://www.ncrel.org/sdrs/areas/issues/methods/techlgy/te800.htm>
- Hruskocy, C., Cennamo, K., Ertmer, P., & Johnson, T. (2000). Creating a community of technology users: students become technology experts for teachers and peers. *Journal of Technology and Teacher Education, 8*(1), 69-84.
- Johnson, D. L. & Lui, L. (2000). First steps toward a statistically generated information technology model. *Computers in the Schools, 16*(2), 3-12.
- Jones, B. F., Valdez, G., Nowakowski, J., & Rassmusen, C. (1995). *Plugging in: Choosing and using educational technology*. Washington, DC: Council for Educational Development and Research, and North Central Regional Educational Laboratory. Retrieved December 4, 2004, from <http://www.ncrel.org/sdrs/edtalk/toc.htm>
- Kuperstein, J., Gentile, C. K. & Zwier, J. (1999). *The connected learning community technology roadmap*. Retrieved November 23, 2004, from <http://www.microsoft.com/Education/vision/roadmap/default.asp>
- Mouza, C. (2002). Learning to teach with new technology: Implications for professional development. *Journal of Research on Technology in Education, 35*(2), 272-289.
- Rosen, L. D. & Weil, M. (1995). Computer availability, computer experience and technophobia among public school teachers. *Computers in Human Behavior, 11*(1), 9-32.
- Schmid, R., Fesmire, M., & Lisner, M. (2001). Riding up the learning curve — Elementary technology lessons. *Learning & Leading With Technology, 28*(7), 36-39.
- Schrum, L. & Dehoney, J. (1998). Meeting the future: A teacher education program joins the information age. *Journal of Technology and Teacher Education, 6*(1), 23-27.
- Shelton, M. & Jones, M. (1996). Staff development that works! A tale of four T's. *NASSP Bulletin, 80*(582), 99-105.
- Stager, G. S. (1995). Laptop schools lead the way in professional development. *Educational Leadership, 53*(2), 78-81.
- Thomas, L. G. (2004). *The NETS Project*. International Society for Technology Standards. Retrieved November 21, 2004, from http://enets.iste.org/nets_overview.html
- U.S. Office of Technology Assessment. (1995). *Teachers and technology: Making the connection*. Washington, DC. U.S. Government Printing Office. Retrieved December 4, 2004, from <http://www.wws.princeton.edu/~ota/disk1/1995/9541.html>
- Wetzel, K., Zambo, R., & Buss, R. (1996, Winter). Innovations in integrating technology into student teaching experiences. *Journal of Research on Computing in Education, 29*, 196-214.
- Wiske, S. (2004). Using technology to dig for meaning. *Educational Leadership, 62*(1), 46-50.
- Yidirim, S. (2000). Effects of an educational computing course on pre service and in service

A Model for Effectively Integrating Technology Across the Curriculum

teachers: A discussion and analysis of attitudes and use. *Journal of Research on Computing in Education*, 32(4), 479-495.

Zhao, Y., Pugh, K., Sheldon, S., & Byers, J. (2002). Conditions for classroom technology innovations. *Teachers College Record*, 104(3), 482-515.

This work was previously published in the International Journal of Information and Communication Technology Education, Vol. 2, Issue 1, edited by L. A. Tomei, pp. 1-11, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.51

Putting Enterprise Systems in a Larger ICT Context: A Pedagogical Framework

Thomas Rienzo

Western Michigan University, USA

J. Michael Tarn

Western Michigan University, USA

James Danenburg

Western Michigan University, USA

ABSTRACT

Many business schools are attempting to integrate their curricula with enterprise software, particularly enterprise resource planning (ERP) software. Although the introduction of ERP into the undergraduate academic curriculum offers students a potentially deeper understanding of business processes, it cannot by itself provide for students a connection between the adoption of robust information systems and a paradigm shift in the way that business organizations operate in a global, information-centric environment. Connecting a new global economy with enterprise systems requires a course much broader than ERP that places enterprise systems in a much larger information-communication technology (ICT)

context. This chapter presents a teaching model that provides that context, emphasizing the critical role of systems components and relationships, the central function of information in problem solving, and business perspectives of information from infrastructure to applications.

INTRODUCTION

Technology has consistently been applied to the education process, with differing levels of success. In many areas, real-world technology applications are being used in teaching, including applications like CAD/CAM software, simulation languages, and enterprise resource planning (ERP) software packages. Industrial trends in IT have been moving

from traditional models with disconnected applications to complex integrated models involving enterprise systems (ES). Changes in industrial practice have prompted changes in business information technology education resulting in a potpourri of teaching and learning methods, but academic institutions are increasingly focusing on enterprise software as a means of integrating curricula (Hejazi, Halpin, & Biggs, 2003; Johnson, Lorents, Morgan, & Ozmun, 2004; Markulis, Howe, & Strang, 2005; Michaelsen, Hobbs, & Stead, 2000). Joseph and George (2002, p. 51) suggest that ERP software can bring about more effective pedagogy in higher education enabling deeper understanding of course materials and a clearer vision of interlinked aspects of business activity. Practical experience with ERP software may help students appreciate related business processes, but the effects of the global information infrastructure extends far beyond integrated business software. Training with ERP and customer relationship management (CRM) systems do not communicate the economic, political, and social revolutions spawned by world-wide telecommunications, robust wide area networks, prolific and effectual hardware and software, and the incredible power of the Internet to connect everything to everything. Students should appreciate the paradigm shifts occurring in the way people live and work, which are every bit as liberating and tumultuous as the shifts that were initiated by the invention of printing in the 15th century and the industrial revolution in the 18th century. In this chapter, a high-level framework is presented to incorporate enterprise systems in a larger picture of evolving and adaptive organizational structures, and the business processes that enable them. The authors present a pedagogical model that links enterprise systems to information and communication tools, an understanding of systems, and the role of information in problem solving.

CONNECTING BUSINESS PROCESSES

Businesses judge their performance by outcomes produced by entire business systems, not individual components. While control and optimization of integrated business processes have been goals of business managers since the Industrial Revolution, tools *capable* of complex control and optimization of diverse business functions developed only recently. Prior to about 1990, little attempt was made to integrate large scope business activities because:

- Computer processing capabilities were limited.
- Computer hardware and software were costly.
- Specialized business activities needed customized software code created from scratch.
- Robust computer networks did not exist.

The 1990s was a watershed decade. It produced:

- Robust computer networks
- Greatly enhanced computing power
- The World Wide Web
- Expanded multi-nationalism and globalization

Businesses first encountered software capable of connecting the enterprise during the 1990s, and many were compelled to move forward with enterprise computer systems because they did not trust the ability of the information islands created by their computer legacy systems to be able to cope with the year 2000. There is no doubt that enterprise software is changing the face of business. Manufacturing companies who have

been under siege from “the China Price” are using enterprise software to improve productivity an astounding 4% *per year* since 1994 (Frichol, 2004). The top 100 SCM vendors generated about \$4 billion in supply chain application revenue in 2002. The Yankee Group estimates that supply-chain integration reduced total cost of ownership of value-added networks by about 15%. Forrester Research expects U.S. firms will spend an average of \$4.8 billion a year through 2008 to tune their entire supply network processes. International Data Corp estimates that the U.S. market size for CRM applications was about \$5.6 billion in 2002 with projections of \$10 billion by 2006. Giga Information Group approximates sales of core ERP software at \$13 billion, and it predicts growth of 4.8% annually through 2006 (Targowski & Rienzo, 2004). American business schools must address enterprise software to stay relevant to current business practice.

Enterprise systems should be taught as a discipline because corporate emphasis is currently focused on the enterprise. This emphasis will remain because there is great potential for wealth creation. Enterprise focus is a formidable undertaking, and tools and techniques required to truly integrate the enterprise are still developing. When learning about enterprise systems, students should develop an appreciation of the way businesses create and employ information, regardless of its source. And they should also develop an appreciation of the relationships that system components have to the larger whole.

Systems are infinite in their expansion and regression, and business managers responsible for systems must draw system boundaries in an appropriate scale and scope that affords them prediction, control, and performance needed to achieve their objectives. Business systems are engineered to accomplish a goal, and significant resources are employed to get them to work together smoothly. Business corporations have evolved into economic dominance through coordination of nearly-decomposable hierarchical

divisions and organizational identification (Simon, 2001). Nearly-decomposable systems maximize component independence and minimize the cost and effort of coordination and communication. Companies have separate, and nearly independent, departments optimizing sales, production, and logistics. Near-decomposability allows a corporate department to independently change many of its processes and procedures without concern for effects on other departments. As systems become more complex, nearly-decomposable architecture with its hierarchical subdivisions has been shown to be much more effective than architecture with less departmentalized interconnections. Simulations with genetic algorithms, have confirmed the dominance of near-decomposability in complex biological ecosystems (Simon, 2001). Near-decomposability can apply to any business system of activities. Once coordination and communication demands are minimized, the responsibility for the system can be assigned to any group that can accomplish the activities effectively. The phenomena of outsourcing and offshoring are direct consequences of near-decomposability.

As effective as nearly-decomposable systems are in business, they minimize rather than eliminate the need for coordination, communication, and control of different departments, divisions, or activities in a business. As the quality focus of the 1970s and 1980s demonstrated, there is wealth to be created, and competitive advantage to be gained, from coordination and communication of business component systems. Successful businesses ensure that the products obtained by the purchasing department perform well in production, and that accounting and sales personnel know when raw materials are in transit, production is scheduled, shipments are made, deliveries can be expected, and invoices issued. As business systems expand from individual to multiple companies, the demands of coordination, communication, and control intensify. If sufficiently robust methods of coordination, communication, and control exist, then nearly-decomposable ac-

tivities can occur wherever they can be carried out most efficiently. Enterprise systems provide those robust methods.

CURRENT STATE OF ENTERPRISE INFORMATION INSTRUCTION

Implementing a curriculum focused on the connections of enterprise systems as opposed to the more traditional management information systems approach can be very challenging and expensive. Many universities have undertaken the process by introducing enterprise or ERP business software packages into the classroom, focusing on hands-on exercises with gradually escalating requirements for student understanding of process activities and implications. Many universities recognize that direct enterprise software experience can be helpful to students, but utilizing software to provide students with an opportunity to learn business processes experientially is a challenging effort. Antonucci, Corbitt, Stewart, and Harris (2004) observed that some universities flourish in their implementation of enterprise or ERP business software packages and others flounder. Academic champions of enterprise software must struggle through the same exasperating climb up the ERP tower as their industrial counterparts. Holland and Light describe an industrial ERP maturity model (as cited in Antonucci et al., 2004) with three stages:

- **Stage 1:** Planning and implementation.
 - Stage 1 has an operational focus, concentrating on tasks and tracking. Planning should include a long-term strategic vision, but the vast majority of time and energy in phase 1 involves operational tasks.
- **Stage 2:** Adoption and utilization.
 - Stage 2 expands operational thinking to tactical use of real-time data spread throughout the enterprise to improve quality and efficiency.

- **Stage 3:** Strategic use of ERP.
 - Stage 3 takes a broad strategic focus involving all elements of the business supply chain. The ERP system is used to coordinate the business value chain and is often linked to other enterprise systems including Supply Chain Management and Customer Relationship Management software packages.

Academic institutions can expect to experience a similar journey of maturity with ERP implementations, progressing from operational tasks to strategic thinking and learning. Most are still at stage 1. Some universities have made significant progress in integrating enterprise or ERP business software packages courses in their curricula. Fedorowicz, Gelinas, Usoff, and Hachey (2004) provide a dozen tips to guide institutions of higher learning to integrate enterprise systems in their curricula in order to illustrate current best practices of business processes and expose students to technology they can expect to use in their business careers. They can be summarized as follows:

- Develop infrastructure.
- Train the converted.
 - Spend training money on those who will incorporate material and share information with other faculty.
- Start with concrete and develop more sophisticated learning.
- Build networks.
 - Within faculty, industry practitioners, ERP trainers and support people.
- Share information through academic alliances.
- Give students support.

Even though universities implementing ERP systems in their coursework can expect to move from less sophisticated to more sophisticated uses of the software, core coursework must provide a

larger framework under which the connections of enterprise software can be appreciated, and the capabilities of these systems can be seen as drivers for organizational transformation. Enterprise systems are not just making traditional business processes more efficient. They are contributing to the design and engineering of new processes. The impact of enterprise systems cannot be appreciated without recognizing organizational changes underway in the corporate world.

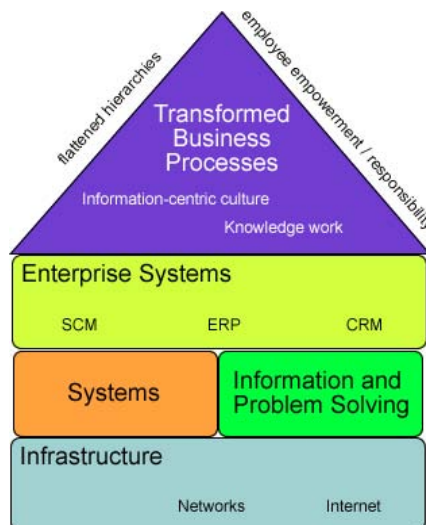
ENTERPRISE SYSTEM TEACHING MODEL

A model for enterprise teaching is shown in Figure 1. Infrastructure lays the foundation for enterprise system instruction. Students should receive a general overview of the components and tools of networks and the Internet, but a broad array of subjects can satisfy this requirement. Students cannot understand the connections of enterprise systems unless they recognize the technology systems that enable them. The unifying theme is *infrastructure*, lower level systems that allow

higher level ones to operate. Relating the familiar transportation infrastructure to components and relationships that form our modern information/communication infrastructure can be a useful analogy. Topics like telecommunications, LAN topology, network technologies, client-server systems, operating systems, programming languages, e-mail, electronic data interchange, and groupware prepare students to think about the roles of communication and information in modern businesses.

Following infrastructure, students should be introduced to generic business systems emphasizing the role components play in the larger business. General systems theory can be introduced to the students by explaining the characteristics of historic Cold War development of systems design and engineering. General systems understanding precedes the introduction of the systems life cycle and system development life cycle. Systems instruction is also an appropriate place to introduce organizational complexity and the increasing demands placed upon managers to balance the interests of shareholders and stakeholders in modern business. Information systems make it

Figure 1. Enterprise systems teaching model



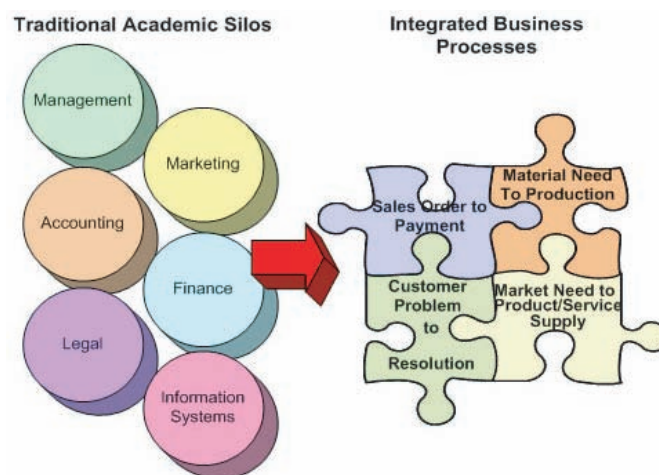
Putting Enterprise Systems in a Larger ICT Context

possible to cope with unprecedented demands to control and monitor many diverse aspects of business. An understanding of the role information plays in problem solving complements students' awareness of system components and relationships. Many business activities are problem solving activities. Students must understand that data can't solve problems but data is a critical starting point. Data must be analyzed, processed, and transformed into information, concepts, and knowledge in order to make prudent business decisions. Information systems play a critical role in process and analysis.

Infrastructure, systems, and problem solving prepare students for a discussion of enterprise systems that coordinate and integrate outputs from the many nearly-decomposable systems operating in business. By preceding the introduction of enterprise systems with the role of information and communication technology (ICT) in systems and problem solving, students can see enterprise software as part of business evolution. Enterprise systems can be seen as links in the business value chain. Supply chain management (SCM) links inbound logistics, operations, and outbound logistics. Customer relationship management (CRM) links outbound logistics, sales/marketing,

and service. Enterprise resource planning (ERP) links outputs of these systems as well as human resources, financial, and infrastructure support. Enterprise portals and electronic enterprises are included in enterprise systems discussions. The teaching focus involves moving from traditional business school discipline silos to integrated business processes as shown in Figure 2. Students should have an opportunity to work with enterprise software in class projects. Transformed business processes are the end result of enterprise systems. Paradigm shifts are occurring in business strategy, outsourcing, and substitution of technology for labor. Organization structures are experiencing flattened hierarchies, disintermediation, and networked alliances. Management is moving from task control to culture control with a pursuit of paradoxical goals. Knowledge is increasingly a source of wealth and knowledge workers are increasingly valued in the workplace. Information systems affect both our professional and personal lives with or without our knowledge or cooperation. The effects of the Information Age touch us all, and some of the changes in skill requirements, training, and attitudes occurring in modern workplaces are not comfortable.

Figure 2. Moving from academic silos to integrated business process



TEN LEARNING MODULES

Following the enterprise systems teaching model of Figure 1, a modern undergraduate business program can support the fundamental characteristics of presenting enterprise systems in a larger ICT context through the use of the following 10 learning modules:

Infrastructure

Network Infrastructure and Business Processes

An information infrastructure model is introduced with layers involving telecommunications, computer networks, the Internet, computer hardware/software, communication programs, and business application programs. Investments in telecommunications are described and different types of networks are discussed along with the role of servers and clients in those networks. Communication systems like e-mail, groupware, teleconferences, and electronic data interchange (EDI) are covered.

The Internet and its Business Applications

Internet technologies are introduced along with their history, governance, and protocols. Top-level domains of the World Wide Web are described. Languages of the Internet including HTTP, FTP, HTML, and XML are covered as are services like Internet search. Intranets and Extranets are introduced along with security concerns and network protection. Typical uses for each are presented. E-commerce and business models associated with e-commerce are described. Web services are described as heirs to e-commerce technologies pioneered by EDI. Architecture is modeled for e-commerce from a B2C and B2B perspective, and revenue associated with each is

discussed. Online payment systems are covered, as is public key infrastructure for secure on-line transactions. A short history of dot com companies is also provided. Students complete an Internet Services/E-Commerce project in which they compare service and commerce Web sites by specific criteria including ease of use, content/scope, privacy policies, customer service, and marketing techniques.

Systems

From Components to Business Process Integration

The systems perspective is introduced with general systems theory and a focus on components, relationships, and the role of components in a larger whole. A system definition is provided, expanded to information systems, and complexity of modern business systems is addressed. Information systems are presented as a means of coping with complexity. The system life cycle and system development life cycle are introduced with a brief history of system analysis and engineering. Quality management and project management are presented from a systems perspective. Students complete a systems project focusing on components and relationships of views relating to their majors. They create an input-process-output model of a company and examine critical perspectives for that particular business. Students calculate system complexity by calculating the number of pair-wise comparisons resulting from components they place in the views they believe are critical to their businesses.

Information and Problem Solving

From Data to Business Intelligence

The role of information in decision making is presented, exploring the way we move from data

to choices. Information richness and methods of problem solving are introduced. This module has a cognitive science focus and history. It looks at ways in which problem solving methods utilize traditional outputs of computer information systems, and more recent incorporation of artificial intelligence.

Transformed Business Processes

From Enterprise to Extended Corporation

Enterprise systems are introduced and connected to the business value chain introduced by Michael Porter (1985). Enterprise systems are presented as the glue of business activities from inbound logistics to customer service. They also impact Porter's support activities of procurement, technology, human resources, and infrastructure. Management information systems are introduced as well as their gradual evolution to knowledge management systems. Enterprise portals are presented as a gateway to the electronic enterprise controlled and optimized by supply chain management (SCM), customer relationship management (CRM), and enterprise resource planning (ERP) software systems. Enterprise software is also aligned with the Porter value chain.

Enterprise Systems Classification and Project

Characteristics of enterprise information systems are presented for accounting, human resources, marketing, legal, and operations. ERP components are categorized as business, operations, or management information systems and related to the Porter value chain. Students complete an exercise with ERP software working through an entire business process like purchase to payment or sales order to payment.

IT/Communication and Evolving Business Organizations

Shifts in business structure resulting from the control and optimization capabilities of integrated information systems are presented. Trends involving shifts in strategic resources, flattening hierarchies, network-centric work relationships, and virtual enterprises are addressed. Attendant changes in management responsibilities are described. The role of information in outsourcing and off-shoring is discussed, and knowledge workers are presented as a source of creating wealth.

IT for Business Transformation

The transformation of business from an industrial to an information mindset is explored. An industrial enterprise model is compared with an information enterprise model. The work system of the industrial model is focused on in-house standardization, hierarchical and task management, a disposable labor force, and separation of thinking and doing. The business organization is concerned with economies of scale and mass production. In contrast, the work system of the information model is focused on flexibility, immediacy, outsourcing, network and culture management, high trust relations, and the integration of thinking and doing. Its business organization involves economy of scope and mass customization.

Information: Past and Future

A historic look at information in society beginning with the invention of printing with movable type to the electronic global village of the 21st century is presented. This section deals with the movement from goods to services, increasing reliance on theoretical knowledge and creation of new "intellectual technology" based on computers and other smart machines. The "digital divide" which separates information "haves" from information "have nots" is discussed.

Social/Ethical Information Issues

The role of information in our culture is presented: values, life styles, security, privacy, cyber crime, and ethics. Global communication networks are both bringing the world together and driving it apart at the same time. Broadband and convergence are changing the way we work, shop, and entertain ourselves. Privacy and security are important issues in cyberspace with widespread information dissemination, protection of intellectual property rights, and identity theft. Ethics have new dimensions in the age of blogs and billions of pages on the World Wide Web. Information systems bring new problems from the standpoint of bioethics.

CONCLUSION

Enterprise systems provide an opportunity for students to experience the complexity of integrated business processes, but the complexity of business extends beyond the connections of enterprise systems. Technology provides new tools that permit businesses to re-engineer systems and relationships that offer new and exciting means of building wealth. Students must prepare to work in a global business environment that is continuously evolving, and they need a context to frame enterprise systems in new economic paradigms. As business students prepare to enter a connected world, they should do more than experience the technology that enables it. They should consider what technology means to their professional and personal lives. This chapter describes a course that is designed to position enterprise systems within the trends and challenges that are shaping the post-industrial age.

REFERENCES

- Antonucci, Y. L., Corbitt, G., Stewart, G., & Harris, A. L. (2004). Enterprise systems education: Where are we? Where are we going? *Journal of Information Systems Education, 15*(3), 227.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn brain, mind, experience, and school*. Washington, DC: National Academy Press.
- Bosco, J. (2004). *Is it possible to reform schools?* Paper presented at the New Futures for Learning in the Digital Age, Dublin, Ireland.
- Fedorowicz, J., Gelinas, U. J., Usoff, C., & Hachey, G. (2004). Twelve tips for successfully integrating enterprise systems across the curriculum. *Journal of Information Systems Education, 15*(3), 235.
- Frichol, M. (2004, November 17). *Microsoft business solutions manufacturing update*. Paper presented at the 2004 Microsoft Manufacturing Summit, Orlando, FL.
- Gackowski, Z. J. (2003, June). *Case/real-life problem-based experiential learning with information system projects*. Paper presented at the Information Science and Information Technology Education Joint Conference, Pori, Finland.
- Hejazi, S. S., Halpin, A. L., & Biggs, W. D. (2003). Using SAP ERP technology to integrate the undergraduate business curriculum. *Developments in Business Simulation and Experiential Learning, 30*, 122-125.
- Johnson, T., Lorents, A. C., Morgan, J., & Ozmun, J. (2004). A customized ERP/SAP model for business curriculum integration. *Journal of Information Systems Education, 15*(3), 245.

Putting Enterprise Systems in a Larger ICT Context

Joseph, G., & George, A. (2002). ERP, learning communities, and curriculum integration. *Journal of Information Systems Education*, 13(1), 51-58.

Markulis, P. M., Howe, H., & Strang, D. R. (2005). Integrating the business curriculum with a comprehensive case study: A prototype. *Simulation & Gaming*, 36(2), 250

Michaelsen, L. K., Hobbs, J., & Stead, R. (2000). *Experientially integrating the undergraduate curriculum*. Paper presented at the Academy of Business Education, Villanova, PA.

Porter, M. (1985) *Competitive advantage creating and sustaining superior performance*. New York: The Free Press.

Roschelle, J. M., Pea, R. D., Hoadley, C. M., Gordin, D. N., & Means, B. M. (2000). Changing how and what children learn in school with computer-based technologies. *Children and Computer Technology*, 10(2), 76-101.

Schacter, J. (1999). *The impact of education technology on student achievement*. Retrieved October 10, 2004, 2004, from <http://www.milkenexchange.org>

Simon, H. A. (2001). Complex systems: The interplay of organizations and markets in contemporary society. *Computational & Mathematical Organization Theory*, 7, 79-85.

Targowski, A., & Rienzo, T. (2004). *Enterprise information infrastructure* (4th ed.). Kalamazoo, MI: Paradox Associates.

This work was previously published in Enterprise Systems Education in the 21st Century, edited by A. Targowski and J. M. Tarn, pp. 202-212, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 2.52

An Embedded Collaborative Systems Model for Implementing ICT-Based Multimedia Cartography Teaching and Learning

Shivanand Balram

Simon Fraser University, Canada

Suzana Dragicevic

Simon Fraser University, Canada

ABSTRACT

Information and communication technologies (ICT) have created many new opportunities for teaching, learning and administration. This study elaborates a new embedded collaborative systems (ECS) model to structure and manage the implementation of ICT-based pedagogies in a blended learning environment. Constructivist learning, systems theory, and multimedia concepts are used in the model design and development. The model was applied to a third-year undergraduate multimedia cartography course. The findings show that regardless of student background, implementing effective ICT-based learning pedagogies can be managed using the ECS model.

INTRODUCTION

Integrating information and communication technologies (ICT)—specifically computers, networks, and the Internet—into higher education has created new opportunities for teaching, learning, and administration. Indeed, the role of ICT in the administration of the higher education process has been reflected in national initiatives such as the 1997 Dearing Committee of Inquiry into Higher Education in the United Kingdom (Dearing, 1997). One of the recommendations of the Dearing Committee was the adoption of national and local ICT strategies to improve the effective and efficient use of resources by U.K. education institutions. Canadian higher education

has echoed these strategies and has also increasingly used ICT in the improvement of the quality of distance-education models (Farrell, 1999). The diffusion of information and communication technology into higher education can be attributed to its potential to leverage education processes toward richer and more rewarding learning and management environments (Mitchell, 2002).

In teaching and learning, ICT is a platform on which key learning skills can be efficiently integrated into existing curriculum to boost learner motivation, deepen inquiry, accelerate learning, and widen participation among traditionally isolated groups (Hassell, 2000). Moreover, teaching core ICT skills such as computer operation and programming prepares students to function and succeed in an increasingly information-based society. However, some authors have pointed out that excessive optimism about the micro and mega benefits of ICT in education can develop into broken promises (Selwyn, 2002). These broken promises can adversely influence the adoption of ICT in educational contexts. While most educators agree that ICT has transformed the traditional education process and, hence, demands a new way of thinking, some have pointed out that achieving and verifying useful ICT educational benefits will require strong theoretical evidence, embedded analysis, and research to surmount the associated structural and cultural barriers (Kenway, 1996).

The utility of ICT in providing and retrieving information is of immense value to educators. Instructional designers are now better able to include a range of ICT-based pedagogy into curriculum design and delivery. Many accept that the technology itself does not ensure learning but acknowledge that it enhances traditional instructional systems to deal with modern-day literacy that is a key component of all education goals. Literacy is now generally considered as a multimedia construct (Abbott, 2001). Multimedia improves upon the traditional text and speech formats of interacting with knowledge by integrating other

forms of media, such as audio, video, and animations into the learning experience. This has made information more accessible and understandable. But the benefits of multimedia have also come with new challenges. Using multimedia in the classroom is a clear departure from traditional expectations and requires a new mindset and commitment from educators and administrators to ensure effective implementation. Challenges also arise due to the lack of consistent baseline experience to guide the integration of multiple media into the curriculum. Moreover, the wide range of multimedia tools available present a technical challenge to educators who must select instructional technologies to match pedagogical strategies and desired learning outcomes (Abbott, 2001). These challenges demand a flexible and systematic mechanism for managing multimedia tools in traditional learning. Systems theory provides a useful foundation to develop such a management mechanism. In systems theory, the key components of the process are identified and managed separately but as a part of an integrated and functional whole. The resulting systematic structuring ensures that valid models for pedagogy inform the learning process, and that the quality of education is maintained and improved through dynamic interactions between learners and educators.

The utility of ICT in promoting sharing and collaboration among learners is also highly desired. This is reflected in the many content management systems (CMS), such as WebCT (<http://www.webct.com>), that empower educators to implement synchronous and asynchronous collaborative environments in distance-learning models and in online support for face-to-face instruction or blended-learning models. Socially mediated constructivist learning theory, where learners explore and discover new knowledge, is the foundation for the collaborative learning paradigm. In face-to-face collaboration, individual and group interactions take place to varying degrees, and finding the appropriate balance is

one factor that influence teaching and learning effectiveness (Norman, 2002). Mediating these interactions with technology also presents challenges. Research has shown that non-technology learners in traditional learning settings who do not have access to desired levels of technology support are less willing to use and interact with the learning technology (Watson, Blakeley, & Abbott, 1998). This challenges educators to embed the ICT-based collaborative learning pedagogies into the curriculum structure and design.

The goal of this study is to elaborate on a new embedded collaborative systems (ECS) model for structuring and managing the implementation dynamics of ICT-based pedagogies in a blended learning environment. The specific questions addressed are as follows: How can we engage students in more meaningful learning activities to develop multiple skills of relevance? How can we achieve a useful balance between teacher-centered learning and student-centered learning? The literature on constructivist learning, systems theory, and multimedia education provides the theoretical basis for developing the model. The model was applied to a third-year undergraduate multimedia cartography course of 47 students with no prior knowledge of multimedia and with basic computing skills. The results show that regardless of student background, implementing effective ICT-based learning pedagogies can be managed using the ECS model.

PROMOTING MULTIPLE SKILLS OF RELEVANCE

The focus on the mastery of cognitive and technical skills in the modern-day classroom is a tendency inherited from traditional learning systems. There is now increasing evidence in the workplace to suggest that in the complex problem-solving environment of the real world, the ability to link classroom knowledge with soft skills is a requirement for success. The capabil-

ity to work in teams, being an enthusiastic and good communicator, infectious creativity, initiative, willingness to learn independently, critical thinking, analytical abilities, self-management, and ethical values are the main soft skills that are highly valued by employers. These new requirements place additional responsibilities on educators to impart knowledge or hard skills together with soft skills in teaching and learning activities so as to prepare learners to function beyond the classroom. This raises the question: How can we engage students in more meaningful learning activities to develop multiple skills of relevance? This question can be examined using a foundation of constructivist learning theory. In this theory, learning is characterized by shared goals and responsibilities, and knowledge is constructed in a discursive environment. Social networking and peer encouragement help motivation and aid individual learning experiences.

Collaborative and cooperative learning have their origins in constructivist learning theory. The goal of collaborative learning is to help learners display individuality and creativity in working with a group toward achieving targets. For collaborative tasks, rewards for achievements are allocated by comparative or normative evaluation systems. In cooperative learning, the focus is on efficiency and effectiveness in achieving a common goal in socially interactive settings (Piaget, 1926; Vygotsky, 1978). In this approach, rewards are allocated based on the quality or quantity of the group product measured against a predefined standard. Although collaborative and cooperative learning share similarities, they differ in their assumptions about competition. Collaborative learning assumes conflict as a part of learning, while cooperative learning tries to minimize this conflict (Bruffee, 1995). One way to resolve this contradiction is to implement the learning approaches in a way so as to extract the positive learning benefits from each.

BALANCING TEACHER-CENTERED AND STUDENT-CENTERED LEARNING

Implementing multiple learning skills activities requires a balance between teacher-centered and student-centered learning within the contact time limitations of the face-to-face classroom. Thus, efficient course management and structuring become important needs with which to keep track of the evolving course dynamics. Norman (2002) outlined a model that defines the interaction space among a set of agents and objects in the learning process. In the model, two sets of agents (instructors and students) and two sets of objects (course materials and course products) overlap to form a complex interaction space. This results in six intersecting areas that form regions where a combination of two or more agents or objects exists. The usefulness of this interaction model is that it shows the variety of interacting elements that require management during the learning process. But while the model provides a comprehensive description of the interactions, it does not deal explicitly with how to balance these dynamic interactions during the learning process. This raises the question: How can we achieve a useful balance between teacher-centered learning and student-centered learning? This question can be examined using a systems theory approach.

Systems theory can be used to manage the instructional tools used to facilitate teaching and learning among the agents. In this way, the theory guides the efforts in balancing the load between student-centered and teacher-centered learning. The theory considers the teaching and learning process to be composed of a set of tightly interrelated pedagogies that can be used to communicate and deliver educational content (Bertalanffy, 1969). Based on the systems approach, together with the constructivist paradigm, a wide range of possible pedagogies can be identified. Examples of these pedagogies include learning contracts, brainstorming, debate, observation,

simulation, case study, discussion, and forum. By integrating these approaches systematically, an equitable balance between teacher-centered learning that communicates knowledge and student-centered learning that integrates all levels of Blooms Taxonomy (knowledge, comprehension, application, analysis, synthesis, and evaluation) can be achieved.

MULTIMEDIA CARTOGRAPHY TEACHING AND LEARNING

The use of computer-based technologies in geography teaching and learning has a long and rich tradition (Gold et al., 1991). This stems from the influence of the quantitative revolution on many areas of the subject. Spatial information studies (encompassing geographic information systems and science, remote sensing, digital cartography, and spatial analysis) are a product of that quantitative influence. Over the last decade, ICT and specialized research software for geography, in general, and spatial information studies, in particular, has caused many changes to the community of research, learning, and teaching practices in these areas. Spatial information studies educators are now battling with how best to balance knowledge transmission with the necessary software practice in the learning process. The “cookbook” approach of traditional lectures and independent student learning of computer skills are two extremes in the learning spectrum of an increasingly computer-driven curriculum. Clearly, any solution must deal with establishing structures for an equitable distribution of the pedagogies across the curriculum and focus the pedagogies on skills students need for success in further studies and the workplace.

Cartography encompasses the art, science, and technology of making maps and requires diverse technical and creative skills for effective practice. The use of multimedia in cartography education serves two interrelated functions: as an

instructional tool and as a product development tool. Instructional frameworks to incorporate multimedia-based instruction into the curriculum must be consistent with existing theories of teaching and learning. This has been emphasized by a number of researchers (Alessi & Trollip, 2001; Benyon, Stone, & Woodroffe, 1997; Ellis, 2001; Najjar, 1996). The multiple representation (MR) framework allows the inclusion of knowledge domains within multimedia (Kinshuk & Patel, 2003). The MR approach involves the selection of multimedia objects, navigational objects, and the integration of multimedia objects in the representation of the knowledge domains. Teaching strategies and styles are also important factors in multimedia learning, as they impact learning. The benefits of multimedia education include improved learning retention, portability, modularity, enhanced visualizations, efficiency in instructional design, and learning consistency (Hede, 2002; Yildirim, Ozden, & Aksu, 2001).

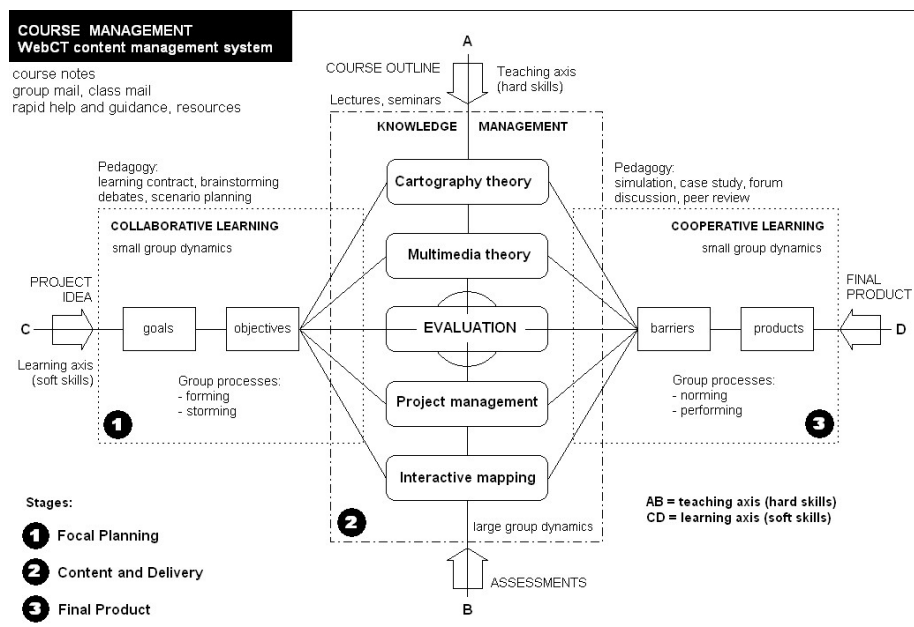
The use of multimedia authoring tools in designing course products enables learners to de-

velop and construct enhanced mapping products. This forms the basis of multimedia cartography, in which the paper map is transformed into an enhanced digital map that integrates multiple media to communicate visual and oral expressions of spatial information to the map reader (Cartwright, Peterson, & Gartner, 1999). These multimedia maps are accessed through CD-ROM, the Internet, or specially designed Web-mapping services. The benefits of multimedia maps include dynamic and multifaceted representation of space and time, superior map production and dissemination, improved information and knowledge transfer, and greater map accessibility.

EMBEDDED COLLABORATIVE SYSTEMS MODEL

The embedded collaborative systems (ECS) model is designed based on principles from constructivist learning theory and systems theory. The goal of the model is to improve the quality of student

Figure 1: The embedded collaborative systems (ECS) model



An Embedded Collaborative Systems Model

learning in the face-to-face classroom. This is achieved with a focus on the development of multiple learning skills and on independent learning. The model's structure is shown in Figure 1.

The collaborative, knowledge management, and cooperative working spaces are three distinct overlapping interaction spaces that are defined in the model. The overlapping structure strengthens the process and provides connectivity among the stages of focal planning of projects, delivery of course content, and preparation of final course products. The knowledge management workspace occurs in the classroom, where all students receive the same content through lectures and seminars. The collaborative and cooperative workspaces

occur during small group laboratory sessions or alternatively in informal meetings among students.

The teaching (AB) and learning (CD) axes serve as both workflow and information flow pathways in the model. These axes control the levels of hard and soft skills that are integrated in the learning experience. The hard skills or teaching axis deals with the substantive course content. This content is normally stipulated by institutional curriculum policies and is implemented using traditional pedagogical tools such as lectures, seminars, and panels. The knowledge management phase of the process is implemented in large groups to encourage critical thinking and

Table 1. Pedagogies and instructional media used in the ECS model

| Pedagogy | Description of the Pedagogy | Instructional Media | Stage in the ECS Model | Targeted Skills |
|---------------------------|---|---|-------------------------------|------------------------|
| <i>Presentation</i> | Instructor-centered lecture notes and student-centered communication of project results | Multimedia, videotape, graphic visuals, text | 1,2,3 | Hard and soft skills |
| <i>Discussion</i> | Exchange of ideas and opinions among students–students and teacher–students; discussions are guided by reflective questions | Graphic visuals, text | 1,2,3 | Soft skills |
| <i>Demonstration</i> | Instructor-centered presentation of example of skills to be learned; use of expert to present case study | Software, the Internet, graphic visuals | 2 | Hard skills |
| <i>Drill and Practice</i> | Exercises such as assignments to reinforce skills | Software, text | 2 | Hard skills |
| <i>Tutorial</i> | Individual learning through practice and feedback | Software, text, the Internet | 1,2,3 | Hard and soft skills |
| <i>Group work</i> | Small group work on defining projects and allocating tasks | Software, graphic visuals, text, multimedia | 1,3 | Soft skills |
| <i>Simulation</i> | Experimentation with small version of reality that is to be described and understood | Software, graphic visuals, text, multimedia | 1,3 | Soft skills |
| <i>Gaming</i> | A user-friendly environment for testing specific rules and their effects on determined goals | Software, text | 3 | Soft skills |
| <i>Discovery</i> | Problem solving through trial and error | Software, graphic visuals, text, multimedia | 1,3 | Soft skills |
| <i>Problem solving</i> | Applying skills to find solutions to real problems | Software, videotape, graphic visuals, audio, text, multimedia | 3 | Hard and soft skills |

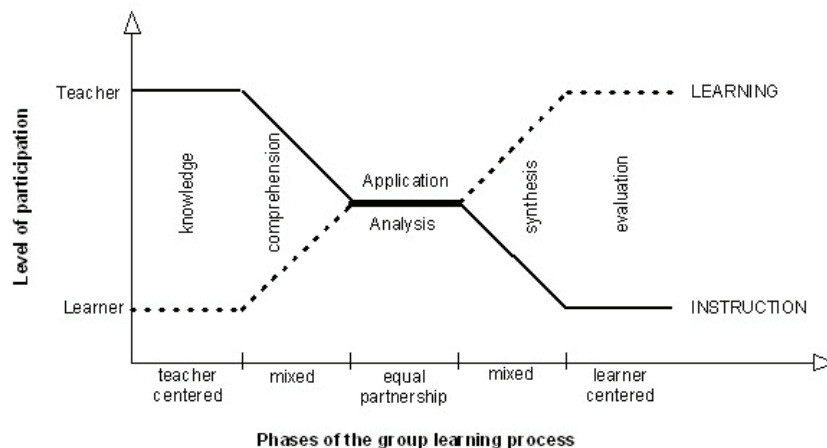
discussions. Students develop individual and active learning habits during all stages of the hard skills implementation. The course outline and content together with the assessment requirements drive the nature of the interactions that occur along the teaching axis.

The soft skills or learning axis characterizes the collective and social interaction experiences of students working to achieve targets in a group environment. Examples of pedagogies that can be used involve group projects, learning contracts, brainstorming, simulation, forum, discussions, and case studies embedded in real problem-solving contexts. The intersection of the learning and teaching axes provides an opportunity for formative evaluation. Formative evaluation is an important component of the process, as with it, we are able to establish how students are integrated into the learning experience and how satisfied they are with the learning environment. Formative evaluations include interviews and survey questionnaires, and corrective action is immediately implemented to control any identified imbalances. Evaluations take the traditional form of cognitive assessments using normative testing instruments.

The use of multiple pedagogies provides students with the opportunity to experience deeper learning as they master new concepts by manipulating and refining previous knowledge. The pedagogical tools and the instructional medium appropriate for each stage of the learning process are described and explained in Table 1. The flexibility of ECS model allows students to pursue topics of general interest during the group projects. This supports the assumption that learning is a lifelong process, and learners have a role in designing what they learn.

Achieving a balance between student-centered and teacher-centered learning is inherent in the ECS model. During the initial stages of the model implementation, teacher-centered cognitive learning is at a high level, whereas student-centered learning is at a low level (Figure 2). At the beginning of the collaborative stages, a progression is seen through a fuzzy period of mixed learning toward an equal partnership in learning between teacher and learner. Thereafter, students gradually become equipped with the skills and motivation to undertake active and independent learning. Eventually, instruction is replaced with independent learning, as the full spectrum of Blooms Taxonomy is covered. The

Figure 2. The dynamic phases of the group learning process



timing of the introduction of the collaborative and cooperative tasks coincides with the stages of the learning processes shown in Figure 2.

The ECS model is optimized for blended learning environments, where face-to-face instruction is supported and complemented by online instruction. Content management systems (CMS) such as WebCT (<http://www.webct.com>) offer comprehensive administration tools with which to deploy complex pedagogies that can emerge using the ECS model. The use of systems theory allows the educator to identify the major pedagogical components that will best achieve the desired learning outcomes. In addition, systems theory integrates the knowledge and pedagogy of the process through rigorous alternatives assessments. Each separate component of the process is analyzed for relevance and then integrated to consolidate and expand individual learning. This framework structures the learning environment, provides a mechanism for understanding interrelationships, and provides task balancing and process management benefits among others. The central aspect is that a systematic framework for group interactions is established that allows teams to define roles, define protocols for independent working, and devise strategies for individual accountability.

APPLICATION OF THE ECS MODEL

Cartography Course Background

The multimedia cartography course used to test the model was at the third-year undergraduate level and consisted of 47 students. The total contact duration was 13 weeks. Two hours of formal lectures and two hours of computer lab work were compulsory, guided sessions each week. The lectures were delivered to all students at the same time, while the computer labs were conducted in three sessions with not more than 20 students attending per session. The rationale for

multiple lab sessions was to ensure that students had access to computer resources and were able to receive individualized attention from the teaching assistant. The classroom and lab settings exposed students to both teacher-centered instructions and learner-centered instructions. Students initially had little knowledge of multimedia concepts, cartography theory, or relevant software tools. But this situation was ideal for investigating the ECS model for learning effectiveness among students and the management of the learning process.

Designing learning structures that stimulate and promote enhanced student motivation is perhaps the most crucial aspect of learning (Edstrom, 2002). Identifying motivations allows instructors to develop strategies for redirecting student goals toward more meaningful and rewarding learning experiences. A questionnaire survey was implemented at the beginning of the cartography course to determine student motivation and rationale. The open-ended anonymous question: *“What do you expect to achieve by attending this course?”* provided valuable responses (Table 2). Learning about Internet mapping and cartography principles was the most frequent statement given by students who responded. This indicated that student motivation was generally aligned with the course objectives, and hence, more time would be available for the instructor to focus on preparing engaging content. As is expected, some students were interested in software learning to improve their job prospects and others on obtaining the necessary credits toward graduation.

The open-ended anonymous question: *“What can the instructor and teaching assistant do during the lectures and labs to make you learn better?”* indicated that the most frequent expectation was for clearly explained example-based content (Table 3). The information obtained from the two questions guided the selection of pedagogical components in the ECS model, so that the learning process was balanced by student expectations and institutional curriculum policies.

Table 2. Motivation of students in the multimedia cartography course

| What do you expect to achieve by attending this course? | Frequency of Statements (%) (Number of Statements = 47) |
|---|--|
| Better understanding of mapping on the Internet | 13 (27.7) |
| Expand my knowledge of cartographic techniques | 12 (25.5) |
| Greater familiarity with the software to be used | 7 (14.9) |
| Academic credits and knowledge | 5 (10.6) |
| Others | 10 (21.3) |

Table 3. Students' suggestions for a better learning environment

| What can the instructor and teaching assistant do during the lectures and labs to make you learn better? | Frequency of Statements (%) (Number of Statements = 46) |
|--|--|
| Give clear and concise explanations | 8 (17.4) |
| Provide many examples during teaching | 7 (15.2) |
| Present the materials at a reasonable pace | 4 (8.7) |
| Make the content relevant and interesting | 3 (6.5) |
| Give well-organized lecture notes | 3 (6.5) |
| Make notes available ahead of lectures | 3 (6.5) |
| Others | 18 (39.1) |

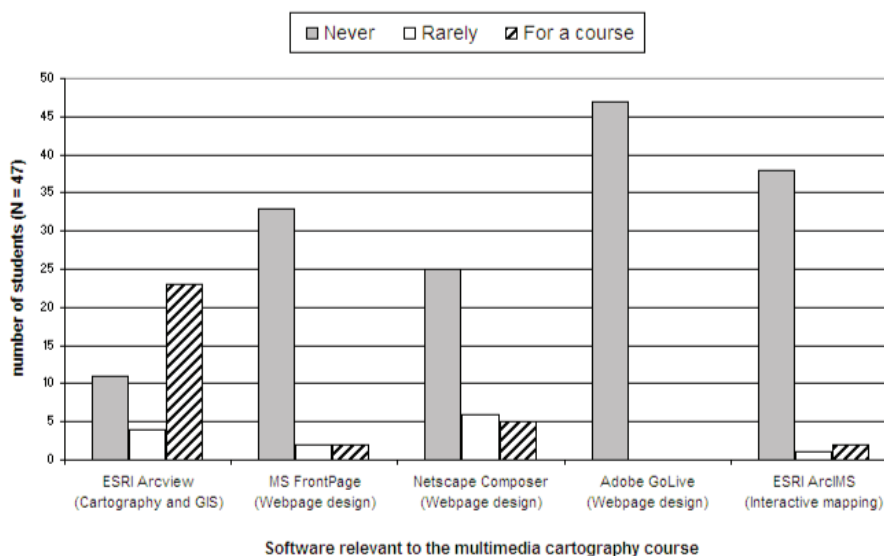
Content Structuring and Knowledge Management

The first 4 weeks were dedicated to formal lectures and guided practice on the use of software tools. Moreover, cases were analyzed and best practices extracted such that students became familiar with general practices in the subject area. This forms the knowledge management phase of the model, in which learning proceeds through incremental steps, and individual learning is emphasized. The subsequent weeks were structured so that knowledge management at an individual level and collaborative project at a group level reinforced each other for an enhanced learning experience. Formal lectures included concepts related to cartography, multimedia, Web mapping and project management theory (Figure 1). The

focus of the lectures was on case studies, and students were exposed to analytical, application, creative, communication, social, and self-analysis skills (Easton, 1982). Moreover, students were able to discuss their views freely and to listen to the views of peers. The group work and peer support operated both as additional instructions for students and as a forum for wider discussions within the course framework.

Of significance in this stage is the concept of Web-based mapping, which involves some level of computer networking knowledge (Figure 3). In a Web-mapping multimedia application, a digital map, once created, becomes a dynamic index to multimedia content. The map is hosted on a Web server, and a map server provides a dynamic link to a database to allow end users to query and interact with the map in the browser

Figure 3: Levels of use of relevant software



window. Although the learning curve for this particular type of mapping technology is steep, it was surprising to find that students were extremely motivated and committed to learning the software. Informal interviews revealed that the general source of this motivation came from the structuring of the learning outcomes at each stage of the process and the out-of-class support and help provided by the teaching assistant. Students were more committed and motivated when they could control how and when they learned.

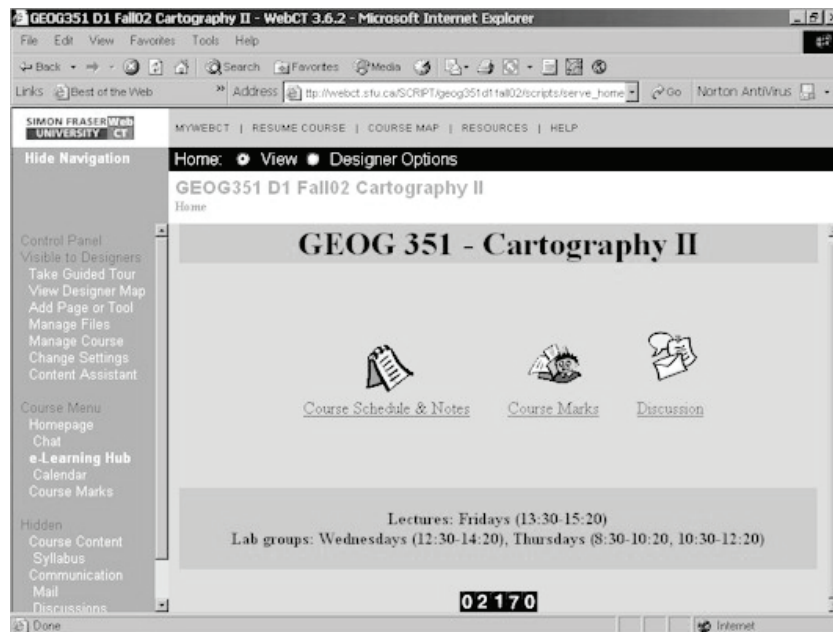
Accessing notes and supplementary materials before lectures ensures that students concentrate on synthesis and analysis rather than on note taking. The new electronic media make it easy to provide additional readings based on student needs, and the online environment provides a social space for continuous conversations and support among peers. Optimal learning occurs when students share knowledge among peers in a community of practice where ideas are evaluated and adapted. In order to manage the implementation of the model, the content management tool WebCT was used for managing mailing lists, discussions, and presentation of knowledge content (Figure 4).

The real-time facilities of the management tools were useful in fostering the “community spirit” outside of the classroom setting. The final multimedia cartography atlas products developed and implemented by students are documented on the Web (<http://www.sfu.ca/geog351fall02/>).

Collaborative and Cooperative Learning

In the collaborative learning exercise, learners were divided into nine groups (average of five students per group, some randomly and some based on individual preference), and step-by-step guidelines were given to each group on the final product to be achieved (designing and creating a professional multimedia atlas), and resources (books, journal papers, Internet Web sites) available for unraveling what is to be achieved. Tasks included mastering sets of specific learning objectives and finding ways to transfer that learning to the class as a whole. There was no briefing to students on group roles. Students reported that the first set of group discussions was difficult. This was expected, but students needed to learn

Figure 4: Model implementation using the WebCT content management system



how to cope in a new and unfamiliar social and learning environment. The leadership role was usually assigned to the student with much to say. That leader then assigns tasks, facilitates the discussions, and ensures that meaningful results emerge from the discussions. The weekly meetings provided time for critical reflections and perusal of new materials, ideas, perspectives, and further research. Each week, the instructor met with the group to evaluate problems and progress and to offer solutions strategies. Ideas were not imposed on the groups, and this was much appreciated by the learners. Moreover, learners agreed in principle to abide by “moral and ethical” conduct during the course.

Students were involved in the initiation and definition of a relevant project. Support was provided in the form of guidance about the format of the final products to be produced, potential areas for projects, course aims and expectations, time schedules, data resources, and project management information. In the design stage,

students were encouraged to develop a concept sketch of their product and to begin the process of tool selection and task allocation. There were many opportunities for students to consult with the course instructor and teaching assistant during this stage and, indeed, for the entire course. All members of the group were encouraged to participate in the creation, assembly, and layout of content so as to ensure a uniform individual learning experience. Internet resources and books were provided to help further the process. Each group identified a member to coordinate their activities and to maintain close liaison with the instructors. The final course products were presented to peers for review, and comments were gathered by the instructor and given to each group. This feedback was useful in improving the quality of the products and establishing a standardized level. This peer review also introduced critical and reflective practices into the process (Bazeli & Robinson, 2001).

The use of information technology together with communicating and working with peers was identified by students as contributing to the success of the project. There were instances in which some students were more focused on the technological tools and less on the content. The group-learning format ensured that group members provide focus and guidance to individuals. Evidence of this peer learning was reflected in the sophistication of the cartographic products and how these products quickly diffused and were adopted by other groups. The professionalism of the final products helped in motivating students toward greater learning and explorations.

Assessment and Evaluation

Evaluations have substantial gains for individual projects and progress in the field. Moreover, the use of new ICT technology has resulted in curriculum changes and may require new ways of evaluating students. In the collaborative modes of learning, the focus is on teamwork and communication skills, and appropriate measures of these are needed. An interim way of dealing with this is to use outside evaluators and student questionnaires. Also, multiple levels of evaluation can yield richer feedback from external, internal, and peer sources. Logging usage statistics and student interviews is another way to identify features of the course that are good and what improvements can be made so that future refinements of the process can be made.

Assessment materials were returned to students quickly, showing where improvements can be made. The exercise involved students preparing work individually and bringing it to the group. The small groups then integrated the materials using e-mail and face-to-face meetings. The small group work was then shown to the groups in a large-format presentation. The assessment also allows educators to learn about their work in a critical and reflective way so that rapid improvements can be instituted for the benefit of learners

(Gerber, 2002). The assessment for the cartography course was comprised of individual assignments, group mini-project presentations, individual participation, examination, and production of a final working group electronic atlas.

All students completed a questionnaire during the formal group presentations, and some students were randomly interviewed at the midway point in the course to obtain feedback toward formative evaluations. In the group presentations, each student was required to judge the presentations of the others on a 5-point verbal scale ranging from poor to excellent. Moreover, reasons for the judgments were also requested. The general trend of the responses was toward the favourable end of the judgment scale and was justified by the respondents on two main grounds—the sophistication of the tools and techniques used for creating the atlases and the non-duplication of these techniques across the groups. Students clearly indicated that these were attributed to the efficient small-group work and the collaborative settings in which they occurred. However, one shortcoming identified was the lack of time. While this was unavoidable given the constraints of the semester and curriculum, techniques and tools for time and project management were again reinforced such that facilities for handling this shortcoming were available to them beyond the course. Another shortcoming identified was the variation in skills within the groups. Although students recognized the difficult logistical problems that this can cause, they nevertheless felt that the group's experience would probably have been more rewarding with balanced skills. One way to deal with this is to make greater use of learning styles and skills inventory to categorize students into the small project groups. However, this will demand a trade-off between efficiency in the course logistics and effectiveness in implementing the ECS model. The two comments below characterize the general attitude of students:

“The projects and presentations overall were very impressive and obviously well thought out. The presentations give an overall view of the work-effort placed within each group.”

“In general I would like to say that all the atlas were very different concerning layout and information, but most of them were really very good.”

A summative evaluation in the later stages of the course elicited responses on the following questions using a 4-point scale (4 being most favourable):

- The assignments and lectures were [unrelated—well related]; mean score = 2.61 ($n = 36$)
- The exams and assignments were on the whole [unfair—fair]; mean score = 2.81 ($n = 36$)
- The marking scheme was on the whole [unfair—fair]; mean score = 2.92 ($n = 36$)

These results from the summative evaluations are inconclusive. While they indicate a general positive weight to the statements, the aggregations of different student backgrounds and experiences makes any interpretation uncertain. The issue of a learner capability to judge curriculum content and implementation is still unresolved in the literature. Nevertheless, the informal interviews and the level of accomplishment in the final atlas products provide strong indication that the collaborative learning process, as implemented using the ECS model, was indeed effective in managing and task balancing the components toward the intended products.

FUTURE TRENDS

The further development and integration of ICT into multimedia cartography education is dependent on three factors: access to ICT tools, instruc-

tors' knowledge of effective ICT use, and more studies on the benefits of ICT and multimedia in student learning. Access and instructor knowledge are issues best handled from the wider policies and practices of higher education administration. Systematic research is needed to further establish the role of ICT in learning.

The software and hardware needs for geography education are enormous. Centralized servers for demonstrating and hosting Web-mapping services, the multiplicity and constantly changing software tools, and the need to redesign current computer laboratories to accommodate collaborative group learning are some of the central considerations that will influence the wider adoption and diffusion of an ICT in the geography curriculum. A troubling issue for multimedia cartography teaching and learning is software licensing arrangements that can sometimes be a barrier to using certain software tools in the learning process. This, in some ways, dictates the eventual skills that students can achieve. Technology providers will need to seriously consider pricing mechanisms so that academic institutions are better able to afford and maintain basic technological infrastructures to implement core teaching and education programs. There has been some progress in this area, with mechanisms such as university campus licensing that enable widespread use of some software tools for teaching and research.

With the gradual expansion of the home as a center of learning, arrangements for students to use university resources at home promise to be a major issue, especially with respect to copyrights and off-campus licensing agreements. University libraries hold a key position in this regard. Already, electronic books, or e-books, are a common feature of many western university library catalogs, and there has been growing evidence to suggest that some of the more progressive university libraries have already begun to redefine their roles as information gateways to act as the intermediary between the user and information (Dowler, 1997).

Electronic data archives, multimedia reuseable learning object databases, subject portals, and continuing skills training for students are ways libraries have begun to accept their changing roles in university teaching and learning. A common thread in all the transformations has been the impact that ICT has brought to the university and classroom with respect to administration, teaching, and learning.

Existing models of multimedia cartography teaching and learning have been mostly descriptive. These models have been useful in understanding the mechanisms in operation and in enabling comparisons to be made across different learning contexts. The results from these studies have enabled educators to generally conclude that ICT and multimedia have positive benefits for learning. However, not much is known about the critical factors and how they influence learning. Systematic investigations of predictive models in diverse contexts provide the next steps for understanding the factors of ICT and multimedia that affect learning. Following along this line will be new learning tools, with which intelligent agents will guide learners through knowledge nodes and learning activities using hypermedia and multimedia in much the same way as the intelligent help assistant acts in the Microsoft Office software products.

CONCLUSION

The ECS model presented is based on a holistic perspective of learning as complex interactions between multiple agents, physical and social spaces, and instructional technologies. Although the model can be used in hypothesis testing, the main goal is to provide instructional designers and educators with a tool for managing the main factors that need to be considered when designing ICT-based pedagogies. This model provides the framework for good instructional and course-structuring design that takes into account the

diversity of learner styles and provides engaging interactions among students.

The use of ICT and multimedia pedagogy in cartographic education is still in the early stages of understanding and development. There are numerous possibilities and pitfalls. But given the early stages of diffusion of multimedia tools in education, the current focus among practitioners is on developing strategies and standardized protocols to produce effective multimedia components that blend engagement and entertainment into a single learning environment. Moreover, collaborative processes aid the pedagogical move toward student-centered learning.

The embedded collaborative systems model was developed to structure and understand the dynamics involved in the implementation of multiple learning skills activities. The implementation involved 47 students in a multimedia cartography course. The course was conducted in a blended learning environment, and discursive group learning was the foundation of the learning experience (Thorne, 2003). Each group defined project content, prepared a proposal, defended their proposal in front of their peers in a formal conference-type presentation, received feedback from peers, and used the feedback to improve their group's project. Also, the other groups judged each group on presentations. This forms the cooperative phase, where individuality and group opinions are merged for consensual learning.

In summary, the issues in this study, namely, how to implement effective (content and experience) multimedia cartography training and education to learners of diverse backgrounds, was addressed by the development and testing of a systems model for integrating the multiple facets involved in the education and training process. Within the systems model, the collaborative and cooperative learning strategies were integrated to promote individual and group development for effective multimedia cartography education and product development. The benefits of the ECS model include the following:

- Improves connectivity among the actors by embedded and continuous interaction
- Cultivates an attitude of independent learning through peer guidance and motivation
- Integrates multimedia information, thereby catering to a range of learning styles
- Provides ownership of the learning process through group and individual project management
- Develops individual social and learning skills and accountability

ACKNOWLEDGMENT

The authors acknowledge the financial support from the following sources: an International Council for Canadian Studies (ICCS-CIES) Scholarship and a Department of Geography (Simon Fraser University) Teaching Assistantship to S. Balram; and a Simon Fraser University President Research Grant to S. Dragicevic. The comments of Dr. David Kaufman, LIDC, Simon Fraser University are gratefully appreciated. The authors thank two anonymous referees for their comments and suggestions toward improving an earlier draft of the manuscript.

REFERENCES

- Abbott, C. (2001). *ICT: Changing education*. London; New York: Routledge Falmer.
- Alessi, S. M., & Trollip, S. R. (2001). *Multimedia for learning: Methods and development*. Boston, MA: Allyn and Bacon.
- Bazeli, M. J., & Robinson, R. S. (2001). Critical viewing to promote critical thinking. In R. Muffoletto (Ed.), *Education and technology: Critical and reflective practices* (pp. 69–91). Cresskill, NJ: Hampton Press.
- Benyon, D., Stone, D., & Woodroffe, M. (1997). Experience with developing multimedia courseware for the World Wide Web: The need for better tools and clear pedagogy. *International Journal of Human–Computer Studies*, 47, 197–218.
- Bertalanffy, L. v. (1969). *General systems theory; Foundations, development, applications*. New York: G. Braziller.
- Bruffee, K. A. (1995). Sharing our toys: Cooperative learning versus collaborative learning. *Change*, (January/February), 12–18.
- Cartwright, W., Peterson, M. P., & Gartner, G. F. (Eds.). (1999). *Multimedia cartography*. Berlin; New York: Springer.
- Dearing, R. (1997). *The National Committee of Inquiry into Higher Education*. Retrieved April 10, 2003 from the World Wide Web: <http://www.leeds.ac.uk/educol/ncihe/>
- Dowler, L. (Ed.). (1997). *Gateways to knowledge: The role of academic libraries in teaching, learning, and research*. Cambridge, MA: MIT Press.
- Easton, G. (1982). *Learning from case studies*. Englewood Cliffs, NJ: Prentice Hall International.
- Edstrom, K. (2002). Design for motivation. In S. Hailes (Ed.), *The digital university: Building a learning community* (pp. 193–202). London; New York: Springer.
- Ellis, T. J. (2001). Multimedia enhanced educational products as a tool to promote critical thinking in adult students. *Journal of Educational Multimedia and Hypermedia*, 10(2), 107–123.
- Farrell, G. (1999). The development of virtual institutions in Canada. In G. Farrell (Ed.), *The development of virtual education: A global perspective* (pp. 13–22). Vancouver, Canada: The Commonwealth of Learning.

- Gerber, R. (2002). Understanding how geographical educators learn in their work: An important basis for their professional development. In M. Smith (Ed.), *Teaching geography in secondary schools: A reader* (pp. 293–305). London: Routledge Falmer.
- Gold, J. R., Jenkins, A., Lee, R., Monk, J., Riley, J., Shepherd, I., & Unwin, D. (1991). *Teaching geography in higher education: A manual of good practice*. Oxford, UK; Cambridge, MA: Basil Blackwell.
- Hassell, D. (2000). Issues in ICT and geography. In T. Binns (Ed.), *Issues in geography teaching* (pp. 80–92). London; New York: Routledge.
- Hede, A. (2002). An integrated model of multimedia effects on learning. *Journal of Educational Multimedia and Hypermedia*, 11(2), 177–191.
- Kenway, J. (1996). The information superhighway and post-modernity: The social promise and the social price. *Comparative Education*, 32(2), 217–231.
- Kinshuk, & Patel, A. (2003). Optimizing domain representation with multimedia objects. In S. Naidu (Ed.), *Learning and teaching with technology: Principles and practice* (pp. 55–68). London and Sterling, VA: Kogan Page Limited.
- Mitchell, B. R. (2002). The relevance and impact of collaborative working for management in a digital university. In S. Hailes (Ed.), *The digital university: Building a learning community* (pp. 229–246). London; New York: Springer.
- Najjar, L. J. (1996). Multimedia information and learning. *Journal of Educational Multimedia and Hypermedia*, 5(2), 129–150.
- Norman, K. (2002). Collaborative interactions in support of learning: Models, metaphors and management. In S. Hailes (Ed.), *The digital university: Building a learning community* (pp. 41–56). London; New York: Springer.
- Piaget, J. (1926). *The language and thought of a child*. London: Routledge & Kegan Paul.
- Selwyn, N. (2002). *Telling tales on technology: Qualitative studies of technology and education*. Aldershot, Hants, England; Burlington, VT: Ashgate.
- Thorne, K. (2003). *Blended learning: How to integrate online & traditional learning*. London; Sterling, VA: Kogan Page.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Watson, D., Blakeley, B., & Abbott, C. (1998). Researching the use of communication technologies in teacher education. *Computers and Education*, 30(1–2), 15–21.
- Yildirim, Z., Ozden, M. Y., & Aksu, M. (2001). Comparison of hypermedia learning and traditional instruction on knowledge acquisition and retention. *The Journal of Educational Research*, 94(4), 207–214.

This work was previously published in Interactive Multimedia in Education and Training, edited by S. Mishra & R.C. Sharma, pp. 306-326, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.53

Computing Curricula: A Comparison of Models

Anthony Scime

State University of New York College at Brockport, USA

Christine Wania

State University of New York College at Brockport, USA

ABSTRACT

An analysis of eight computing model curricula verifies that there are significant differences between computing disciplines. While there are many courses in the models with the same or similar names, the courses may be completely different. By reverse engineering model course descriptions, the courses are compared to determine the inclusiveness of each course in each of the others. Although expected, these results are significant for colleges and universities establishing or revising computing programs.

INTRODUCTION

The use of computers has become ubiquitous in society today. Yet, most of society does not understand computing as a field of study. Even the computing professionals and academics are only now coming to understand the variances in

the computing disciplines (Landry, Pardue, & Longenecker, 2003).

Education, engineering, and medicine are more clearly understood disciplines. Grade level and subject matter divide the education disciplines. Distinctions are made in work and education between civil and mechanical engineering. People seek out surgeons or internists for different medical conditions. Of course, these disciplines are older than computing and have developed these specializations overtime.

Much specialization occurs because a discipline expands to the extent that individuals lack the capacity to assimilate all the disciplines' knowledge. As a result, subsets of knowledge emerge as specialties (Stark & Lattuca, 1997). The computer disciplines are beginning to form into specialized fields. These fields, however, do not derive from a common reference discipline, as civil and mechanical engineering derived from military engineering. Rather, the different computing specializations came from different

reference disciplines, primarily management, mathematics, or engineering (Scime, 2002c).

As a result of these various origins, computing professionals have organized themselves into different professional organizations to share information and promote the profession. These professional organizations provide guidance concerning the particular knowledge necessary to be successful in the profession. This in turn influences the academic programs. The most direct method professional organizations have used to influence academics is the curriculum model. These models describe the topics to be covered in a program's curriculum. Typically these topics are organized as semester length (15-week) courses. Some of the models provide detailed knowledge units, comprising the discipline's body of knowledge which are then organized into courses. Other models take a more subjective approach, providing just a course title, leaving it to the program developer to interpret course content.

While it is unlikely that an electrical engineer would be hired to design a distillation column (a chemical engineering task), industry hires entry-level employees for computing positions, often without regard for the specific computing program. Entry-level jobs such as programmer, help desk worker, or network or database administrator will go to graduates of any of the computing disciplines. This may be because the courses in the disciplines appear the same. While it is recognized that it no longer holds that the traditional career path is from programmer to systems analyst to project manager and eventually to IS manager (Urquhart, Perez, Rhoden, & Lamp, 1996), the differences in computing programs are not always appreciated in industry.

This study is an analysis of computing curriculum models to understand their similarities and differences. It begins with outlining the work performed in the profession, followed by a discussion of the models, and then a topic analysis of model courses, comparing individual courses to

one another and the models as a whole to each other.

REVIEW OF THE LITERATURE

Computing as a Profession

The members of the computing profession have come together in various professional societies. These organizations provide an outlet for the exchange of information and provide a venue for discussion forums about computing. These groups may be primarily composed of practitioners or academics.

Table 1 outlines the type of members in professional organizations sponsoring or endorsing a model curriculum. Although most organizations may have academic and practitioner members, the purpose of an organization may be more oriented to one type of member than the other. Likewise, some of the larger organizations may accommodate both the academic and practitioner equally well.

The fields of computer science, information systems, information technology, software engineering, computer engineering, management information systems, and so forth suffer from a confusion of terms. Information technology (IT) is both an umbrella term for the professions and disciplines that maintain information and develop the tools to maintain information, as well as the term for a separate profession and discipline under that umbrella.

Some of the professional organizations consider information technology as a separate profession and discipline, while others view it as the umbrella for all computing-related activities. As a separate discipline it focuses on the operation of computer machinery (IEEE Computer Society, 2004), or as application of programming, computer networking and hardware, databases, and Web technologies to solve user problems (IT Curricu-

Table 1. Professional organization membership

| Professional Organization | Membership | |
|--|------------|---------------|
| | Academics | Practitioners |
| Association for Computing Machinery (ACM) | X | X |
| ACM SIG for Information Technology Education (SIGITE) | X | |
| ACM SIG on Management Information Systems (SIGMIS) | X | X |
| ACM SIG on Supporting Group Work (SIGGROUP) | X | X |
| Association for Information Systems (AIS) | X | |
| Association of Information Technology Professionals (AITP) | | X |
| AITP's Special Interest Group on Education (EDSIG) | X | |
| Data Administration Managers Association International (DAMA) | | X |
| Decision Sciences Institute (DSI) | X | |
| IEEE - Computer Society (IEEE-CS) | X | X |
| Information Resource Management Association (IRMA) | X | X |
| Information Systems Audit and Control Association (ISACA) | | X |
| INFORMS Information Systems Society (INFORMS-IS) | | X |
| International Academy for Information Management (IAIM) | X | |
| International Association for Computer Information Systems (IACIS) | X | |
| National Association for Business Teacher Education | X | |
| Office Systems Research Association (OSRA) | X | X |
| Society for Information Management (SIM) | | X |

lum Proposal — Draft, 2002). The Information Resources Management Association considers IT a separate discipline for which they provide management expertise (Cohen, 2000).

As an umbrella term, IT is defined as a growth of computing beyond computer science (Denning, 1999). This includes involvement with the management of information resources or management of anyone working in information technology (Association of Information Technology Professionals, 2003). The Association for Computing Machinery considers information technology to be synonymous with the equally broad field of computing. It considers the major subdivisions of computing and information technology to be computer science, computer engineering, software engineering, and information systems (Association for Computing Machinery, 2001). To alleviate the confusion between IT the dis-

cipline and IT the umbrella, this article will use computing as the term for the umbrella over the entire range of computer-related disciplines and information technology as the term for the specific discipline.

Regardless of the professional society, computing involves the design, development, implementation, support, and management of software and hardware artifacts (ITAA, 1997). An artifact may be a chip, a device, a program or model, or a method to store and retrieve data. These artifacts are conceptualized, developed, modified, and supported by professionals who are knowledgeable in these activities (Freeman & Aspray, 1999). It is the job of academia to produce workers in all four categories. It is this last — the most abstract — definition that proves useful in establishing the roles of computing workers.

Computing Curricula

Conceptualizers are workers involved with the formation of ideas concerning the basic nature of a computer system artifact. They investigate new ways of processing, storing, transmitting, and representing information. These workers have job titles such as computer and information scientist, computer software engineer, and computer hardware engineer (Bureau of Labor Statistics, 2004b, 2004d, 2004e).

Developers are people who specify, design, construct, and test computing artifacts. They apply existing technology to new problems. Commonly the job titles are computer programmer, computer systems analyst, network systems and data communications analyst, computer software engineer, and computer hardware engineer (Bureau of Labor Statistics, 2004a, 2004b, 2004d, 2004e).

Computer workers who modify or extend a computing artifact work with existing hardware or software. Modifiers maintain systems by making improvements to increase the efficiency of information processing, storage, or communication. They may have job titles such as computer programmer, computer systems analyst, database administrator, network systems and data communications analyst, computer software engineer, and network and computer systems administra-

tor (Bureau of Labor Statistics, 2004a, 2004b, 2004c, 2004d).

Finally, there are those who support or tend the existing systems by delivering, installing, operating, maintaining, or repairing information artifacts. Supporters work at the interface between the computer system and the end user. These are the computer support specialists, and network and computer systems administrators (Bureau of Labor Statistics, 2004c).

The work categories students can expect to enter may be determined by their school's curriculum. Yet, all computing education consists of various technical, computer-oriented topics, ranging from a theoretical understanding of computing, through the design or support of practical applications for complex computer systems. In the development of the Information Systems 2002 (IS 2002) and Computing Curricula 2001 (CC 2001), curriculum models bodies of knowledge were developed (Gorgone et al., 2003a, 2003b; ACM, 2001). The courses in these models are organized into groups by general topic. These topics collectively represent the body of computing technical knowledge expected of graduates with a bachelor's degree (Table 2) (Scime, 2001a, 2002b). The depth of knowledge in each category varies with the program's intent for their graduates and the curricula model on which the program is based.

Table 2. Categories of courses in computing

| Category |
|---|
| Computer Literacy and Use of Software Tools |
| Overview of IT and the Relationship to Business |
| Computer Organization and Architecture |
| Programming, Algorithms and Data Structures |
| Networking and Telecommunications |
| Systems/Software Requirements Analysis and Design |
| Database and Information Retrieval |
| Project Management |
| Intelligent Systems |
| Social, Ethical, and Professional Issues |
| Internship and Design Program |

Curriculum Models

There are eight curriculum models (Table 3) designed to guide the undergraduate teaching of the computing disciplines of computer science, software engineering, information systems, management information systems, information technology, and computer engineering.

A Joint Task Force on Computing Curricula created by the Association for Computing Machinery and the IEEE Computer Society developed Computing Curricula 2001 (CC 2001). This model focuses on programs in theoretical and applied

computer science. It contains 47 introductory and intermediate courses, and 80 advanced courses. These courses are to be mixed and matched into specific models by a program implementer. This model provides for a total of 180 different combinations of courses (ACM, 2001).

The Information Resources Management Association/Data Administration Managers Association International (IRMA/DAMA) 2000 model takes a business approach to IS. It focuses particularly on the disciplines of information resource management and management information systems. It takes a management of data approach and includes the development of tools to main-

tain, communicate, and use data (Cohen, 2000). Taking a top-down approach to IS education, this model stresses learning general principles before specific implementation details. Central to the IRMA/DAMA curriculum is the recognition of information as a major organizational asset. This preparation for a computing profession revolves around the application of IT to business problems. Effective verbal and written communication, time management, leadership, and delegation of authority skills are stressed in this program.

The Model Curriculum for Information Systems (IS 2002) is sponsored by the Association

Table 3. Curriculum models

| Curriculum Model | Sponsoring and Endorsing Organizations | Model Date | Approach/ Focus |
|---|---|------------|---|
| Computing Curricula 2001 (CC 2001) | Association for Computing Machinery (ACM) IEEE - Computer Society (IEEE-CS) | 2001 | Computer Science Theory and Application |
| IRMA/DAMA Model Curriculum (IRM) | Information Resource Management Association (IRMA) Data Administration Managers Association (DAMA) | 2000 | Data/ Information Management |
| IS' 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (IS 2002) | Association for Computing Machinery (ACM) Association for Information Systems (AIS) Association of Information Technology Professionals (AITP) ACM Special Interest Group on MIS (SIGMIS) International Academy for Information Management (IAIM) INFORMS Information Systems Society (INFORMS-IS) AITP Special Interest Group on Education (EDSIG) International Association for Computer Information Systems (IACIS) Society for Information Management (SIM) Decision Sciences Institute (DSI) IEEE - Computer Society (IEEE-CS) | 2002 | Business Process Design and Development |
| Model Curricula for Information Systems Auditing at the Undergraduate and Graduate Levels (ISACF) | Information Systems Audit and Control Foundation (ISACF) | 1998 | Systems Auditing |
| The Information Systems-Centric Curriculum (ISCC '99) | Task Force of Industry and Academia | 1999 | Systems Engineering |
| IT Curriculum Proposal (IT) | ACM Special Interest Group on IT Education (SIGITE) | 2002 | User Application Development |
| Organizational & End-user Information Systems Curriculum Model (OEIS) | The Office Systems Research Association (OSRA) | 1996 | End-user Support |
| Guidelines for Software Engineering Education Version 1.0 (SEI) | Software Engineering Institute (SEI) | 1999 | Software Design and Construction |

for Information Systems (AIS), the Association for Computing Machinery (ACM), and the Association of Information Technology Professionals (AITP). IS 2002 is endorsed by five other organizations. The IS 2002 model provides for the technical aspects in information systems, as well as a foundation in business processes. The model comes from a body of knowledge developed by surveying practitioners and academics (Gorgone et al., 2003a, 2003b).

The Information Systems Audit and Control Foundation (ISACF) is the research branch of the Information Systems Audit and Control Association (ISACA). ISACA recognizes that technology has a significant impact on business, and that technology must be properly constructed and managed to assure sound business practices. This assurance is maintained through accounting and auditing control processes (ISACF, 1998). ISACF developed for the ISACA a model curriculum that is designed to meet the needs of the IS auditing profession in developing the knowledge and skills of future IS auditors. This model provides the academic preparation necessary to achieve professional certification as a Certified Information Systems Auditor. This requires an in-depth education in accounting and auditing, as well as computing.

The ISCC'99 (Information Systems Centric Curriculum) model was developed by a National Science Foundation-sponsored task force that included members from academe and industry. This model is intended to fit between pure computer science and management information systems. The focus is on the construction of the tools necessary for information management (Lidtke, Stokes, Haines, & Mulder, 1999). This curriculum looks at information as an enterprise asset that must be managed. This management can be accomplished through large-scale, complex information systems. This is an engineering development approach to information systems. However, it does not exclude interpersonal skills,

which are necessary in the teamwork environment of information systems development.

There is an IT Curriculum Proposal in draft form. The Information Technology Education Special Interest Group of the ACM (SIGITE) is developing it. The curriculum is oriented toward the use of computing applications to solve business problems. The model's approach considers the outcomes desired for graduates, and the incoming knowledge and skills of students. The curriculum proposal currently consists of four IT core topic areas: programming, networking, database, and Web technology (IT Curriculum Proposal — Draft, 2002).

The OEIS (Organizational and End User Information Systems) model developed by the Organizational Systems Research Association (OSRA) is aimed at analyzing end-user needs in the development of information systems and supporting end-user operation of information systems (OSRA, 1996).

The SEI model from the Software Engineering Institute follows an engineering approach, in that analysis and design before implementation is stressed in the solution of practical problems. The model suggests specialization in a specific domain, such as operating systems, embedded systems, applications software development, or large-scale information systems (Bagert, 1999).

Of course, most of the models have database and programming courses. But the emphases in the database courses are quite different (Calero, Piattini, & Ruiz, 2003; Johnson, Wilkes, Ormond, & Figueuroa, 2002). With the curriculum models and professional organizations each taking a slightly different approach to computing, it is clear that computing is becoming specialized. It is important to determine model similarities because few colleges or universities have the resources to staff multiple departments. Decisions must be made concerning the desired direction for a school's computing programs.

RESEARCH DESIGN

With curriculum models developed by different professional organizations, questions arise about the differences between the models. For example, it is reasonable to assume that a database course in one model would be the same as a database course in other models. However, Johnson, Wilkes, Ormond, and Figueiroa (2002) found that by doing a keyword analysis of database courses, there was no similarity between database courses in the models. Extending such an analysis to all courses in the model curriculums will show the degree of similarity between models and between model courses.

This is significantly valuable in the design of computing programs of study. Universities will be able to tailor the program to graduate specific categories of workers and will be able to evaluate the transferability of courses from other schools.

While IS 2002 and CC 2001 were derived from bodies of knowledge, the common denominator running through all of the models is the semester course. A course is a collection of related topics that can be presented in a 15-week semester. By reverse engineering the course descriptions and titles, the particular topics composing each course can be determined. By comparing these

topics course by course, as well as across the curriculums, the similarities between the models can be determined.

In preparing for the analysis, each course was assigned a course number that included a prefix identifying the model (Figure 1). Where available, these numbers match the numbering system given in the model.

Each course in each model was reviewed. Topics covered in the course were manually extracted from the course description and title. The topics are represented by keywords. After all courses were reviewed, the union of the sets of keywords was extensive, and some topics were represented by similar keywords. The keywords were reviewed, and those representing the same topic mapped into a common keyword (Figure 2). This reassignment reduced the number of keywords and strengthens the comparison process (Hearst, 1999).

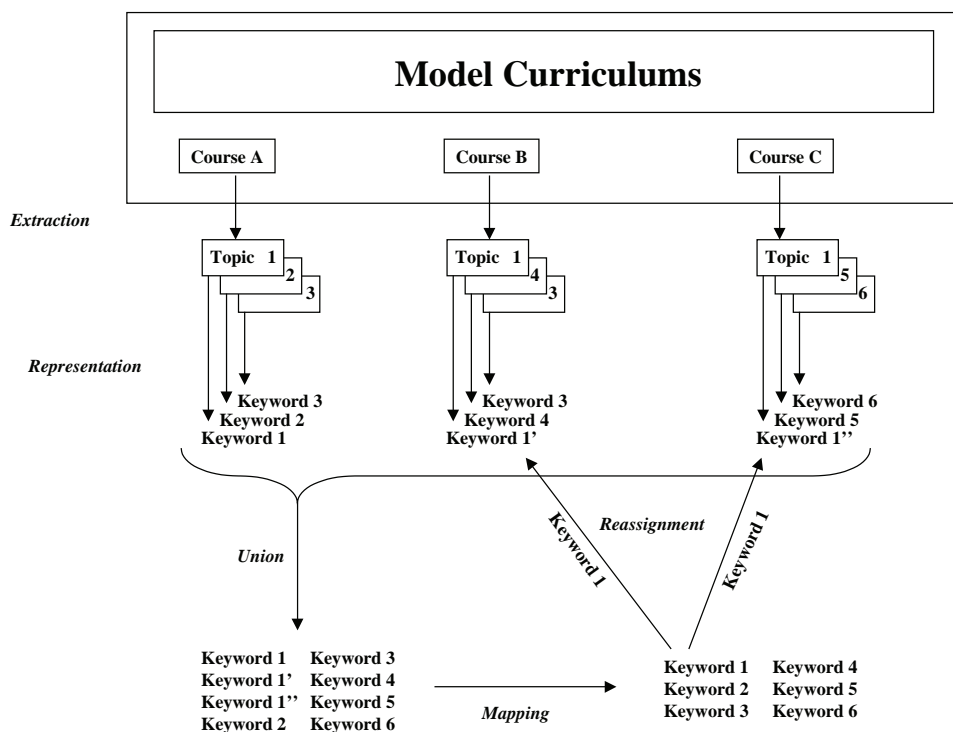
At a level above the course, computing curriculums all teach defined groups of topics (Table 2). These larger groups or categories are the super-topics that define computing. Courses were manually assigned to a specific category based on the majority of the topics in the course. One or more courses in a curriculum may be grouped together under these categories. It is the distribution of courses and topics between the categories that distinguish the computing disciplines (Scime, 2002c).

Comparisons were used to evaluate the similarity of the model curricula. Each model course was compared to all the other model courses by topic keywords. This tested the similarity of courses to each other. Each curriculum model as a whole was compared to each of the other models by topic keywords. In other words, all the keywords of all the courses in a model are compared to all the keywords of all the courses in the other models. This checked for the teaching of the same concepts in different configurations of courses.

Figure 1. Course number prefixes

| Course Number Prefix | Model |
|-----------------------------|--------------|
| CS | CC 2001 |
| IRM | IRM |
| SE | SEI |
| IS | IS 2002 |
| ISCC | ISCC'99 |
| IT | IT |
| OEIS | OEIS |
| ISACF | ISACF |

Figure 2. Reverse engineering of courses



DATA ANALYSIS

Course-to-Course Comparison

A count of the number of common topics and calculation of the percent of common topics in a pair-wise manner was completed. The percentage of common topic keywords pair-wise comparison between all courses showed that the two courses with the most similarity, sharing the most topics, were Professionalism and Ethics (SE4) from the Guidelines for Software Engineering Education Version 1.0 and Social and Professional Issues (CS280T) from Computing Curricula 2001. Eighty-eight percent of the topics in SE4 are also in CS280T. Likewise, 78% of CS280T is part of SE4. The Professionalism and Ethics (SE4) course description states that it “covers material on the historical, social, and economic issues in software engineering. It includes study of profes-

sional responsibilities, risks and liabilities, and intellectual property relative to software engineering profession” (Bagert, 1999). The course description for Social and Professional Issues (CS280T) “introduces students to the social and professional issues that arise in the context of computing” (ACM, 2001).

Courses that have significant similarities of 80% or higher are primarily in the CC 2001 curriculum; this is to be expected from the number of introductory and intermediate courses from which to choose. The 180 courses are divided into introductory, intermediate, and advanced computing groups; implementers select a type of course from each group. Within the introductory group, courses cover many of the same topics, which is where the greatest similarity arose. For example, CS103B (Principles of Object-Oriented Design) shares 83% of its topics with CS102I (The Object-Oriented Paradigm) and CS112H (Object-

Oriented Programming Techniques). This means that what is taught in CS103B is 83% similar to what is taught in CS102I and CS112H. Note that these courses would not be implemented in the same program. CS103B is an introductory course in the breath-first implementation strategy, CS102I is part of the imperative-first strategy, and CS112H hardware-first.

For courses between models, significant similar results (see Table 4) occur in primarily three categories—ethics, system analysis and design,

and software development/programming. These results support findings of a survey of computing deans. Looking for common knowledge areas within existing computing programs, without regard to matching the programs to any model curricula, it was found that there is a cluster of knowledge in the systems analysis and design and software development process across computing programs (Landry et al., 2003).

There are also cross-category similarities. Courses that provide an overview of comput-

Table 4. Different model courses sharing at least 60% of keywords

| This Model Course | which is in Category | is | of each Model Course | in Category |
|---|---|-----|--|---|
| SE4 - Professionalism and Ethics | Ethics | 88% | CS280T - Social and Professional Issues | Ethics |
| CS103O - Algorithms and Data Structures | Programming languages, algorithms | 80% | SE2 - Introduction to Computer Science for Software Engineers 2 | Programming languages, algorithms |
| CS280T - Social and Professional Issues | Ethics | 78% | SE4 - Professionalism and Ethics | Ethics |
| IRM7 - Communications Technology & IM | Networking | 75% | IT1 - Networking | Networking |
| CS291S – Software Development and Systems Programming | System analysis and design | 71% | IS2002.9 - Physical Design and Implementation in Emerging Environments | System analysis and design |
| SE8 – Software Construction and Evolution | System analysis and design | 71% | IS2002.9 - Physical Design and Implementation in Emerging Environments | System analysis and design |
| CS341- Programming Language Design | Programming languages, algorithms and data structures | 67% | IS2002.9 - Physical Design and Implementation in Emerging Environments | System analysis and design |
| | | | ISCC21 - Information Systems Architecture I | Programming languages, algorithms and data structures |
| | | | IT3 - Programming | Programming languages, algorithms and data structures |
| | | | SE8 - Software Construction and Evolution | System analysis and design |
| CS350 – Human-Centered Design and Evaluation | System analysis and design | 67% | ISCC42 - Human Computer Interaction and Methods | System analysis and design |
| | | | OEIS5 - Designing and Managing Organizational Training | System analysis and design |
| CS393 – Software Engineering and Formal Specification | System analysis and design | 67% | SE1 - Introduction to Computer Science for Software Engineers 1 | Programming Languages, algorithms |

continued on following page

Table 4. (cont.)

| | | | | |
|--|----------------|-----|---|------------------------------------|
| | | | SE2 - Introduction to Computer Science for Software Engineers 2 | Programming Languages, algorithms |
| | | | SE3 - Introduction to Software Engineering | System analysis and design |
| | | | SE9 - Software Design Project | Internship or design project |
| ISCC22 Computer Ethics I | Ethics | 67% | CS100B - Preview of Computer Science | Overview |
| | | | CS271S - Information Management | Database and information retrieval |
| ISCC44 – Dynamics of Change | Overview | 67% | OEIS3 - OEIS Planning and Design | System analysis and design |
| | | | OEIS5 - Designing and Managing Organizational Training | System analysis and design |
| ISCC52 – Computer Ethics II | Ethics | 67% | CS100B - Preview of Computer Science | Overview |
| | | | CS271S - Information Management | Database and information retrieval |
| CS130 - Introduction to the World-Wide Web | Software tools | 60% | IT4 – Web | Software tools |

ing are likely to cover material similar to more advanced courses, although in less detail. Also, systems analysis and design courses with a strong implementation emphasis cover topics that are also covered in software development/programming in another model. For example, 80% of the content of the CC 2001 course Algorithms and Data Structures (CS103O) is included in the SEI model's Introduction to Computer Science for Software Engineers 2 (SE2).

There are courses that contain parts of multiple courses. IS 2002's Physical Design and Implementation in Emerging Environments (IS2002.9) contains elements of three courses. It covers 71% of CS291S (Software Development and Systems Programming) and SE8 (Software Construction and Evolution), and 67% of CS341 (Programming Language Design). SE8 also contains 67% of CS341. The CC 2001 course Software Engineering and Formal Specifications (CS393) has 67% of its content in each of four SEI model courses: Introduction to Computer Science for Software Engineers 1 and 2 (SE1 and SE2), Introduction

to Software Engineering (SE3), and Software Design Project (SE9). ISCC'99 has two ethics half-courses (ISCC22 and ISCC52) in the model. These are half-courses because of a desire to teach ethics in stages as the students learn more complex material (Lidtke et al., 1999). These courses have 67% of their content covered in each of two CC 2001 courses, CS100B (Preview of Computer Science), an introductory overview course, and CS271S (Information Management), a database course at the intermediate level.

Model-to-Model Comparison

It is possible that the curriculum models spread the computing knowledge among the courses in a manner that produces the low similarity between courses. In other words, the topics are in each curriculum, but organized in courses in different ways. By aggregating the topics of a model into a single set, it is found that the number of distinct topics in a model varies from seven for ISACF to 180 for CC 2001. The ISACF model contains

Figure 3. Shared topics with IS 2002 (82 keywords)

| Model | Number of Keywords | Shared Keyword Topics | Percent of Model in IS 2002 |
|---------|--------------------|-----------------------|-----------------------------|
| IRM | 56 | 33 | 59% |
| OEIS | 64 | 25 | 39% |
| ISCC 99 | 50 | 22 | 44% |
| SEI | 50 | 23 | 46% |
| CC 2001 | 180 | 37 | 21% |
| ISACF | 7 | 6 | 86% |
| IT | 51 | 19 | 37% |

very limited course descriptions, thus restricting the selection of keywords. Therefore ISACF has a high and misleading correlation with all the other models. The CC 2001 model is designed to allow implementations great flexibility in course selection, dependent on the program emphasis desired. This model can provide courses for programs ranging from hardware-first, Web-based net-centric computing to breath-first, imperative, topic-based information management.

As a result of the breath possible in CC 2001, five of the model curriculums (IS 2002, ISCC 99, SEI, ISACF, and IT) share the most topic keywords with CC 2001. Because of CC 2001's variability in implementation, it is difficult to draw the conclusion that it leads to the most inclusive programs.

The other models do not have CC 2001's flexibilities. If CC 2001 is not considered, then with one exception, all the models have the majority of their topic keywords included in the IS 2002 model (Figure 3). IS 2002 is a 10-course model (82 keywords) with no electives. The exception is the OEIS model, which slightly more closely matches the IRM model, sharing 27 topic keywords.

CONCLUSION

By reverse engineering the curriculum models, the similarity between model curricula and model courses was analyzed. Limited similarity was

found, at best an 88% inclusion of one course in another. Only 13 courses of a total of 196 courses had 60% of their content in another course.

At the model level, CC 2001 has the flexibility to cover the material in the majority of models, assuming the appropriate selection of courses on implementation. IS 2002 is a fixed-size model with no elective courses, yet it incorporates more topics than seven of eight of the other models. This is a clear indication that IS 2002 has the most general scope of the models. Although one model, with only seven total keywords, matched IS 2002 at 86%, the remaining models were all below 60% in matching.

Clearly, the limited similarity of topics at both the course and model levels supports the concept that computing is a diversifying discipline. Just as engineering schools have diversified into different specialties (civil, mechanical, electrical, chemical, etc.), and industry engineering projects need some of each specialty, computing schools will develop different programs. The professional organizations have already specialized. Likewise, employers will come to realize they need different skills, which come from different programs, to support their computing needs.

Students require different knowledge dependent upon the role they will perform within computing. The curriculum studied helps determine the graduate's role. To select or develop a curriculum, a school needs to assess their objec-

tives and capabilities in providing graduates to the computing workforce. A school with a strong liberal arts tradition has a different philosophy than a technically oriented school. A large university may have schools of Computing and Business; the focus of each may require following different curriculum models. Some schools prepare students for further study, while others are oriented to the job market. Schools with an international or national focus have different objectives than schools providing entry-level professionals locally. Whatever the focus, the correct curriculum model must be chosen.

Those schools that lack the resources to provide multiple programs should select one of the models to produce a graduate having the knowledge of a conceptualizer, developer, modifier, or supporter. Not covering the same topics of the common technical core of computing knowledge is what makes the computing disciplines differ from one another. Some areas of the core are emphasized in different model curricula, and provide an orientation of knowledge toward one or more of the professional roles. The relationship of the emphasis of technical topics with the computing disciplines and professional roles supported by the curriculum models is of value in selecting a model as a beginning to program development. Attempting to generalize computing may lead to generalist graduates unsuitable for any professional position.

RECOMMENDATIONS FOR FURTHER RESEARCH

This study looked at the model curricula and found limited similarities between all model courses, as did Johnson et al. (2002) in database courses. The question that remains is how the models are being implemented at colleges and universities. In future work it will be interesting to study the course descriptions of selected schools to see which model they most closely follow.

There are two major accreditation associations that evaluate computer science, information systems, and so forth. The Association to Advance Collegiate Schools of Business (AACSB) accredits schools that provide higher education in business administration and management. The Accreditation Board for Engineering and Technology (ABET) accredits programs that provide higher education in engineering, technology, applied science, and computing. It is possible that a school of business receives AACSB accreditation and its information systems program receives accreditation from ABET. If the information systems program is not in the school of business, it may be accredited by ABET. There are hundreds of schools and programs around the world that have received one or both of these accreditations. These schools have certifiably good programs in computing. Many of the models discussed may satisfy the program accreditation of ABET or help in satisfying the accreditation criteria of AACSB. "How closely do accredited schools and programs follow one or more of the model curricula?" is an interesting question.

Another thread of investigation is the association between the models and major categories of workers. Are some models more suited to produce conceptualizers, developers, modifiers, or supporters? Although holistic analysis of worker categories supported by the models has been done (Scime, 2002c), this can be refined by topic analysis. If topics can be identified with these professional areas, then an abundance of topics in an area could lead to a model supporting one area over the others.

REFERENCES

ACM (Association for Computing Machinery). (2001). *Computing Curricula 2001*. IEEE Computer Society and the Association for Computing Machinery. Retrieved September 1, 2002: <http://www.computer.org/education/cc2001/index.html>

- Bureau of Labor Statistics (U.S. Department of Labor). (2004a). *Occupational outlook handbook, 2004-05 edition, computer programmers*. Retrieved May 5, 2004: <http://www.bls.gov/oco/ocos110.htm>
- Bureau of Labor Statistics (U.S. Department of Labor). (2004b). *Occupational outlook handbook, 2004-05 edition, computer software engineers*. Retrieved May 5, 2004: <http://www.bls.gov/oco/ocos267.htm>
- Bureau of Labor Statistics (U.S. Department of Labor). (2004c). *Occupational outlook handbook, 2004-05 edition, computer support specialists and systems administrators*. Retrieved May 5, 2004: <http://www.bls.gov/oco/ocos268.htm>
- Bureau of Labor Statistics (U.S. Department of Labor). (2004d). *Occupational outlook handbook, 2004-05 edition, computer systems analysts, database*. Retrieved May 5, 2004: <http://www.bls.gov/oco/ocos042.htm>
- Bureau of Labor Statistics (U.S. Department of Labor). (2004e). *Occupational outlook handbook, 2004-05 edition, computer hardware engineers*. Retrieved May 5, 2004: <http://www.bls.gov/oco/ocos266.htm>
- Bureau of Labor Statistics (U.S. Department of Labor). (2004f). *Occupational outlook handbook, 2004-05 edition, computer and information systems managers*. Retrieved May 5, 2004: <http://www.bls.gov/oco/ocos258.htm>
- Calero, C., Piattini, M., & Ruiz, F. (2003). Towards a database body of knowledge: A study from Spain. *SIGMOD Record*, 32(2), 48-53.
- Cohen, E. (ed.). (2000). *Curriculum model 2000 of the Information Resource Management Association and the Data Administration Managers Association*. Retrieved September 1, 2002: <http://www.gise.org/IRMA-DAMA-2000.pdf>
- Denning, P.J. (1999). Our seed corn is growing in the commons. *Information Impacts Magazine*. Retrieved September 20, 2000: http://www.cisp.org/imp/march_99/denning/03_99denning.htm
- Freeman, P. & Aspray, W. (1999). *The supply of information technology workers in the United States*. Washington, DC: Computing Research Association.
- Gorgone, J.T., Davis, G.B., Valacich, J.S., Topi, H., Feinstein, D.L., & Longenecker, H.E. (2003a). IS 2002 model curriculum and guidelines for undergraduate degree programs in information systems. *The DATABASE for Advances in Information Systems*, 34(1), 1-52.
- Gorgone, J.T., Davis, G.B., Valacich, J.S., Topi, H., Feinstein, D.L., & Longenecker, H.E. (2003b). Model curriculum and guidelines for undergraduate degree programs in information systems. *Communications of the AIS*, 11(1). Association for Information Systems. Retrieved from: <http://www.aisnet.org/Curriculum/IS2002-12-31.doc>
- Hearst, M.A. (1999, June). Untangling text data mining. *Proceedings of ACL'99: The 37th Annual Meeting of the Association for Computational Linguistics*, University of Maryland, USA. Retrieved December 12, 2003: <http://www.sims.berkeley.edu/~hearst/papers/acl99/acl99-tdm.html>
- IEEE Computer Society. (2004). *IEEE Computer Society strategic plan: 2004*. Retrieved May 6, 2004: <http://www.computer.org/csinfo/SP5-DRAFT7.pdf>
- ISACF. (1998). *Model curricula for information systems auditing at the undergraduate and graduate levels*. Information Systems Audit and Control Foundation.
- ITAA. (1997). *Help wanted: The workforce gap at the dawn of a new century* (p. 9). Arlington, VA: Information Technology Association of America.
- IT Curriculum Proposal—Draft. (2002, September). *Proceedings of the 2002 Conference for Information Technology Curriculum*, Rochester, NY.

Computing Curricula

Johnson D.W., Wilkes, F., Ormond, P., & Figueuroa, R. (2002). Adding value to the IS'97...curriculum models: An interactive visualization and analysis prototype. *Journal of Information Systems Education*, 13(2), 135-142.

Landry, J.P., Pardue, J.H., Longenecker Jr., H.E., & Feinstein, D.F. (2003). A common theme for IT degree programs. *Communications of the ACM*, 46(11), 117-120.

Lidtke, D.K., Stokes, G.E., Haines, J., & Mulder, M.C. (1999). *ISCC'99—An Information Systems-Centric Curriculum '99 Program Guidelines for Educating the Next Generation of Information Systems Specialists, in Collaboration with Industry*.

OSRA (Office Systems Research Association). (1996) *Organizational & end-user information system curriculum model*. Retrieved December 3, 2000: http://pages.nyu.edu/~bnol/osra/model_curriculum/

Scime, A. (2001a, November). Information systems draft accreditation criteria and model curricula. *Proceedings of the 18th Annual Information*

Systems Conference (ISECON 2001), Cincinnati, OH. Retrieved December 3, 2002: <http://isedj.org/isecon/2001/37c/Scime.pdf>

Scime, A. (2002b). Information systems and computer science model curricula: A comparative look. In A. Saber, S. Saber, & M. Dadashzadeh (Eds.), *Information technology education in the new millennium* (pp. 146-158). Hershey, PA: IRM Press.

Scime, A. (2002c). Information technology model curricula analysis. In E. Cohen (Ed.), *Challenges of information technology education in the 21st century* (pp. 222-239). Hershey, PA: Idea Group Publishing.

Stark, J.S. & Lattuca, L.R. (1997). *Shaping the college curriculum: Academic plans in action* (pp. 113-178). Needham Heights, MA: Allyn and Bacon.

Urquhart, C., Perez, A.A., Rhoden, C., & Lamp, J.W. (1996). Professional skills teaching in the IS curriculum: Issues of content, delivery and assessment. *Proceedings of the Australian Information Systems Curriculum Working Conference* (pp. 173-184), Melbourne, Australia.

This work was previously published in the International Journal of Information and Communication Technology Education, Vol. 1, No. 2, edited by L. Tomei, pp. 1-18, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 2.54

ICT-Enabled Education in Africa: A Sober Reflection on the Development Challenges

Shafika Isaacs

SchoolNet Africa, South Africa

ABSTRACT

This essay prompts critical thinking on the way ICT-enabled education programs in Africa have been conceptualized and implemented. It reflects mainly on the experiences of the African SchoolNet movement over the past decade. It highlights important lessons and demonstrates the beneficial effects of technology-enhanced learning programs on African learners and teachers who have had the privilege of being included in SchoolNet initiatives. However, it also shows that the accumulated interventions and programs to date remain insignificant in scale to catalyze a resounding shift toward resolving the crisis in Africa's education systems; it makes the case for integrated system-wide, locally led approaches that soberly takes account of the challenges imposed by globalization. The chapter traces the historical evolution of frameworks to promote African inclusion in the information society, and allusions are specifically made to the emergence of the NEPAD eSchools, and the Global eSchools and Communities Initiative of the UN ICT Task

Force, which hold the potential for advancing the frontiers of learning in Africa. Here, the author emphasizes, however, that these new initiatives need to draw on the accumulated learning and experience of the SchoolNet movement over the past 10 years in Africa to succeed. Finally, the chapter raises the dearth of evidence-based research made in Africa by Africans who would verify or refute the case for stronger investment in ICTs for education. It then proffers suggestions on areas for further research.

INTRODUCTION

Human resources are the essential infrastructure, without which technology means nothing. (Castells, 2001, p. 155)

The current practice of applying new information and communication technologies in the education systems in Africa is cause for concern. Much of the existing interventions have largely, although not exclusively, been informed by the discourse

on bridging the digital divide, ICT for development (ICT4D), and their concomitant supply-side approaches mainly suggested by international donors, and private-sector and development agencies. Often these engagements have not clarified Africa's vision for technology-enhanced learning beyond the setting of numerical targets for universal access and ICT literacy; neither have they been integrated within debates on achieving development goals beyond the narrow scope of digital-divide issues. Indeed, ICTs offer the potential for substantial improvement in education access and delivery, particularly in a developing-economy context. However, there remain obstacles of a systemic nature that militate against the realization of this potential. This systemic context is influenced by a parallel Northern-led discourse on bridging the digital divide on the one hand, and, in contradiction, an imposing framework of globalization that continues to foster social exclusion on the other hand.

This chapter critically discusses Africa's experiences with ICT for education (ICT4E) initiatives in current schooling systems. Because the author has been intimately involved in the African SchoolNet movement, there is a strong bias regarding this experience over the past 10 years. The chapter treats examples of the successful application of ICTs in African schools and their actual and potential developmental spin-offs with caution and warns of the disconnection with glaring social, infrastructural, economic, and political realities that militate against further system-wide success. The chapter further provides perspectives on future potential trends in ICT for education in African schools and concludes with proposals for Africa to proceed far more ambitiously in its drive to make the next century a truly African century.¹

CONTEXT

The global context within which ICTs enhance and support education systems in the developing

world is influenced by complex global, economic, political, and social forces that are intertwined with rapid technological innovation and diffusion. The emergence of globalization, shifts in learning and education paradigms, and shifts toward neoliberal economic-policy frameworks to support education delivery combine as powerful contextual influencing factors that affect the way in which ICTs have been adopted and diffused to support learning, teaching, and education systems in Africa.

Globalization and the Digital Divide

A general consensus prevails, albeit not unchallenged, that the world economy is in transition toward a global knowledge-based society that has been profoundly influenced by economic, social, political, and cultural globalization over the past three decades. It is widely believed that the rapid growth and impact of digital technologies have created the impetus for globalization and fueled exponential growth in society's ability to produce, consume, exchange, and distribute information and knowledge.

Castells (1999) asserts that new ICTs are at the root of new productivity sources, new organizational forms, and the construction of a global economy where brain power is seen as a prime resource and an increasingly dominant source of trade and global competitive advantage. Mansell and Wehn (1998) suggest that the term knowledge society has been coined to shift the emphasis from ICTs as determinants or drivers of change to technologies designed and implemented by people within their social, economic, and technological contexts. The rapid growth, innovation, and diffusion of ICTs takes place within existing uneven, embedded social relations, and a number of processes within the ICT sector contribute to continued disparities in the global distribution of wealth and economic power.

The digital divide is a broad allusion to the skewed distribution in the production, access, and

consumption of ICTs as mechanisms for social and economic development between and within countries. The concept also incorporates disparities in skill levels in the production and consumption of ICTs, literacy levels in the use of ICTs, varying constraints in enabling environments to promote ICT access and use, and the disparities in digital local content, particularly in countries with diverse multilingual communities. Hewitt de Alcantara (2001) correctly asserts that the digital divide is a function of existing development and socioeconomic divides, and within the digital divide itself, there are further manifestations of social imbalances biased against people in non-Latin language groups, rural communities, and girls and women. Hafkin and Taggart (2001) demonstrate how the digital divide is also a gender divide through extensive differential access, use, and production of digital technologies between girls and women in comparison with boys and men.

Shifts in Learning Paradigms

The transition toward a global knowledge-based economy has also coincided with a paradigm shift in learning and education systems. Information competencies and knowledge-society attributes are increasingly important requisites for participation in the knowledge economy, and education systems globally have begun to restructure to accommodate these requirements. The shift in learning and education systems is manifest in the growth of computer science as a school-based subject, the reform of curricula to suit the needs

of a developing knowledge-based economy, and the application and integration of ICTs in learning and teaching practice as well as the growing predominance of learner-centred, self-directed, social constructivist learning philosophies. The shift from traditional pedagogy premised on the transfer of knowledge by the teacher, didactic methods, and rote learning to outcomes-based, learner-centred, facilitative learning takes place both independently and under the influence of the growing application of ICTs. These changes are partly due to the development of ICTs and their specialized functionality in facilitating networking and collaborative learning, knowledge sharing, and interactive learning. ICTs are purported to support new ways of learning, provide lower costs for the delivery of education, facilitate flexibility in learning with diverse learner populations, and allow access to vast quantities of education resources. These are the much-vaunted advantages of e-learning or technology-enhanced learning that usher in new learning paradigms. Haddad and Draxler (2002) capture succinctly the way in which the paradigm shift would affect schooling in particular, illustrated in Table 1.

Neoliberalism and the Education Sector

There is also a widely held and contentious view that the predominance of macroeconomic policies premised on neoliberal economic principles have profoundly affected public-goods sectors like the education sector on a global scale. Neoliberalism is

Table 1. The new schooling paradigm (Source: Haddad & Draxler, 2002, p. 8)

| From | To |
|--|--|
| A school building | A knowledge infrastructure (schools, labs, radio, television, Internet museums...) |
| Classrooms | Individual learners |
| A teacher (as provider of knowledge) | A teacher (as a tutor and facilitator) |
| A set of textbooks and some audiovisual aids | Multimedia materials (print, audio, video, digital ...) |

an extension of the free-market economic framework propounded by Adam Smith with reference to the efficacy of market mechanisms to regulate economies. The framework promotes reduced state involvement in the economy, thereby allowing greater leeway for market regulation. Since the 1980s, there has been a notable shift away from Keynesian macroeconomic policy frameworks that promote state ownership of public-goods sectors and state welfare programs toward liberalized market economies that have also been a lynchpin of globalization. The effects on classical public-goods sectors like health, education, and indeed telecommunications cannot be ignored. Globally, governments have embarked on cuts in spending on education for programs to privatize public education and promote the increasing involvement of private companies in existent public-education institutions. The growth of private universities, schools, colleges, and even private preschools across the world as well as the availability of learning products and services by a growing number of private companies, particularly in the educational technology sector, are manifestations of this. Klein (2001) talks of the “branding of learning” with reference to the interventionist role of private corporations in education institutions in the USA and Canada, which are increasingly becoming manifest in the developing world and in Africa as well. In demonstrating the corporatisation of education, she says that the corporations “are fighting for their brands to become, not the add-on but the subject of education, not the elective but the core curriculum” (p. 89). She explains that private corporations have been allowed to let their branding interventions in schools largely because schools are “starved of new sources of income” (p. 95), but that school governing bodies have also attempted to impose limits on corporate intervention, especially if they threaten to affect the educational activities in the school.

Additional features of the neoliberal economic paradigm include the progressive liberalization of trade since the 1980s and early 1990s as

expounded by the World Trade Organization’s General Agreement on Trade and Tariffs, which now includes the General Agreement on Trade in Services (GATS). GATS also includes trade in education services. Daniel, Kanwar, and Uvalic-Trumbic (2005) note the effect of the GATS on cross-border higher education, and they reference two of the four modes of trade in the GATS that allude to cross-border supply and commercial presence as the most contentious in view of their effects on developing countries. Daniel et al. provide three examples of experiences in India, Jamaica, and Sierra Leone in demonstrating how huge unsatisfied demand calls for the expansion of access, how for-profit cross-border providers are active, and how these providers are of low quality despite the high costs of their offerings.

The flexibility of the global labor market, including the global teaching profession that encourages greater mobility of teachers, particularly from the South to the North, is another salient feature of the global economic system. Analysts have written about the “brain drain” in Africa and the developing world with reference particularly to Africa losing numbers of qualified and skilled teachers. The decline in government expenditure on social services, privatization, and the sale of public goods, including in the education sector, are further manifestations of a trend toward a liberalized global markets. The social implications of these policies globally are profound. Fiscal constraints in education have influenced job losses among teachers, downward pressure on salaries of teachers, and a stratification of education access rendering formal education increasingly out of the reach of poorer communities. In Africa, these developments are pivotal in influencing the extent to which new learning paradigms via technology-enhanced learning can make significant inroads in improving education systems and reaching larger numbers of African youth and teachers.

DEFINING THE DEVELOPMENT CHALLENGE

Governments have globally been challenged with meeting the growing demand for the delivery of affordable education services to its populace. Compared to global trends, African education lags behind dramatically with weak physical and institutional bases, the effects of natural and human-made disasters and conflicts having placed extreme pressure on African education systems. Many countries in Africa have also been victims of austere structural-adjustment programs that led to cuts in educational expenditure. Together with increasing debt burdens, problems with governance and democracy, the challenges imposed by globalization, and the devastating impact of HIV/AIDS, the basic human right of access to education has been denied to many (Addo, Butcher, & Isaacs, 2002).

Current debates also point to the need to look beyond the achievement of universal primary education to address the need for increasing enrollment and retention in secondary education. The latter is considered important for the socialization of young people and for their preparation to participate in the labor market. However, the achievement of universal primary education alone is a mammoth task. It is estimated that approximately 50% of youth of school-going age in Africa are not in school. According to the United Nations Development Program (UNDP) Human Report Office (2005), there is an estimated 43 million youth not in the formal school system in sub-Saharan Africa, of which an estimated 50% are girls. These categories of youth not in school are mainly child ex-combatants, "street kids," nomadic children, and child laborers.

In 2002, in 19 out of 44 African countries, more than half of all children did not complete primary education (United Nations Educational, Scientific, and Cultural Organization [UNESCO], 2005). HIV/AIDS, disability, conflict, and child-labor practices put millions of children at an extreme

disadvantage. In sub-Saharan Africa, more than 11 million children under the age of 15 have lost at least one parent to HIV/AIDS. Their opportunities to learn are seriously obstructed by the need to care for sick family members or contribute to household income (UNESCO, 2004).

The African region has a gross enrollment ratio in secondary schools of less than 40%, which is the lowest in the world despite the fact that the number of pupils has grown by 5.3% in from 1998 to 2002 compared to 4.4% growth in from 1990 to 1995. This low rate can be explained by the fact that an estimated 58% of children live in countries in Africa where lower secondary education is not compulsory (UNESCO, 2005).

Moreover, the quality of education is seriously undermined by a shortage of teacher supply globally, which is more acute in Africa. Shortcomings in the teacher professional development system, poor wages for teachers, and the recruitment of African teachers by developed economies are contributing factors. Above all, the HIV/AIDS pandemic appears to be eroding the teacher population dramatically. Recent figures from a World Bank report indicate the "HIV/AIDS kills teachers faster than they can be trained, makes orphans of students, and threatens to derail efforts by highly-infected countries to get all boys and girls into primary school by 2015."² That women constitute the majority of the teacher population in most countries also points to the gender disparities within this debilitating crisis.

This report quotes figures that illustrate a disturbing trend. For example, in the Central African Republic, 85% of teachers who died between 1996 and 1998 were HIV positive. In Zambia, 1,300 teachers died in the first 10 months of 1998 compared with 680 teachers in 1996.

HIV/AIDS will rewrite the teacher supply and demand equations on current projections. The implications are as yet poorly understood but evidently very extensive. New systems of training and deployment are likely to be needed to meet this challenge. Whilst this issue is outside

the scope of this essay, the devastating effects of the HIV/AIDS pandemic on education systems in Africa is crucial in absolute terms when considering the facilitative role ICTs can play. Acevedo (2005) expands on various ways in which ICTs can be applied in the design of development programs including in health and education that can support strategies to combat the devastating effects of the HIV/AIDS pandemic. The Mindset Network³ in South Africa, with its dedicated multimedia HIV/AIDS channel, is one example of the effective use of ICTs in sensitization and awareness raising for issues of prevention and treatment of the disease.

The Digital Divide has an African Face

The digital divide has its most extreme expression in Africa. Jensen (2002) states that of Africa's total population of 816 million in 2001, it is estimated that:

- 1 in 4 had a radio (200 million)
- 1 in 13 had a TV (162 million)
- 1 in 35 had a mobile phone (24 million)
- 1 in 39 had a fixed line (21 million)
- 1 in 130 had a PC (personal computer; 5.9 million)
- 1 in 160 use the Internet (5 million)
- 1 in 400 have pay TV (2 million)

These figures, he emphasizes, do not take account of the widespread sharing of resources. For instance, a whole village may use a phone line. Jensen explains that the general low level of economic activity means that technology is often unaffordable. Many African countries still have irregular or nonexistent electricity supplies, which makes ICT use problematic. Rail, road, and air transport is limited, and this infrastructure is needed to implement and support ICT infrastructure, as well as the increased social and economic activity that this technology should stimulate.

Many tax regimes define computers and cellular phones as luxury items. This adds to the price of these goods, the vast majority of which must be imported, thus making the technology even more unaffordable for most people. In addition, as noted above, the lack of skills together with the problem of the brain drain also makes widespread adoption of new technology difficult. All of the above issues are further complicated by a business climate that does not always encourage investment in Africa in ways that benefit the continent (Addo et al., 2002).

The digital divide in primary and secondary education is evident from the disparities in PC penetration in schools. It is estimated that the PC-to-student ratio in OECD (Organization for Economic Cooperation and Development) countries averages about 1:10 at the lower end and 1:5 at the higher end of the spectrum, according to a recent survey (OECD, 2005). In contrast, a country like Mozambique has 7,000 schools, of which in 2006, 80 schools had PCs, making the average PC-to-student ratio 1:630. Table 2 gives a general picture of PC access in African schools based on fieldwork guesstimates of the author in the absence of readily available accurate data. Hopefully, in the coming period, more accurate data will become available as increasing numbers of government ministries adopt comprehensive education-management and information-system programs. For now, the guesstimates in Table 2 will have to suffice.

Of these countries, Egypt has the highest percentage of computers in schools at 100%. The Egyptian Ministry of Education reports that each primary school has at least one multimedia lab with one PC, and each preparatory and secondary school has a computer lab of at least 10 PCs. This contrasts with the more economically developed South Africa, where only 6,000 schools currently have access to computers out of a total of 28,000. Howell and Lundall (2000) note the following factors in the South African context (but relevant generally, too) that prevent schools from using computers for teaching and learning:

Table 2. Computer penetration ratios at schools in selected African countries (2006)

| Country | Number of schools | Schools with computers | Percentage of schools with computers |
|--------------|-------------------|------------------------|--------------------------------------|
| Egypt | 26,000 | 26,000 | 100%* |
| Ghana | 32,000 | 800 | 2.5% |
| Mozambique | 7,000 | 80 | 1.1% |
| Namibia | 1,580 | 350 | 22.1% |
| South Africa | 28,000 | 6,000 | 21.4% |

- Insufficient funds
- Insufficient numbers of computers
- Lack of computer literacy among teachers
- Lack of subject teachers trained to integrate computers into learning areas
- The absence of a properly developed curriculum for teaching computer skills

While a number of inroads have been made since 2000 in South Africa, including dedicated rollout programs in various provinces and an e-education white paper, these factors remain as key obstacles in the achievement of universal access to ICTs in South African schools.

In addition, many of those schools that do have computers still do not have access to the Internet due to the exorbitant cost of bandwidth. The Internet can provide a wealth of learning resources that many African schools at present are not yet able to access because the costs of Internet access are prohibitive. In South Africa, of the estimated 6,000 schools that have access to PCs, only an estimated 2,500 have Internet access. The main obstacles faced by African schools with respect to Internet access specifically are the following:

- Lack of infrastructure generally and network infrastructure in particular
- High telephone and Internet costs
- Limited expertise and ICT skill levels
- Lack of enabling policy environment (Isaacs, 2002a)

The main barriers to ICT access in general relate to the small number of computers relative to the large numbers of teachers and students per school, the high cost of Internet access, and a dearth of technical skills to assist with troubleshooting and maintenance when computers break down. Notably, within this digital divide, greater gender disparities exist. Research of the experience in Africa shows that girls are further limited from school computer laboratories in some countries. A study commissioned by World Links for Development found that, in reality, it is harder for girls to access computer laboratories, particularly in Uganda and Ghana, especially after school hours (Gadio, 2001). These findings have been corroborated by Derbyshire (2003) and Isaacs (2002b).

The above is not a comprehensive overview, yet it succinctly captures the nature of the development challenge in African education.

AFRICAN FRAMEWORKS TO ACHIEVING QUALITY EDUCATION THROUGH ICTS

Already in 1948, education as a fundamental human right was proclaimed in the Universal Declaration of Human Rights. In an attempt to describe a vision for educational achievement in Africa, the international development community established the millennium development goals⁴

ICT-Enabled Education in Africa

(MDGs) in 2001. The goals related to education follow:

Goal 2: Achieve universal primary education

Target 3: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling

Goal 3: Promote gender equity and empower women

Target 4: Eliminate gender disparity in primary and secondary education, preferably by 2005, and to all levels of education no later than 2015.

(UN General Assembly Resolution A/56/326, September 6, 2001)

The details of the MDGs have their roots in the Dakar Framework of the World Education Forum. The Dakar Framework for Action set six “education for all” goals, which include the following:

- Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children
- Ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities have access to and complete free and compulsory primary education of good quality
- Ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life skills programmes
- Achieving a 50% improvement in levels of adult literacy by 2015, especially for women, and equitable access to basic and continuing education for all adults
- Eliminating gender disparities in primary and secondary education by 2005, and achieving gender equality in education by 2015, with a focus on ensuring girls’ full and equal access to and achievement in basic education of good quality

- Improving all aspects of the quality of education and ensuring excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills. (UNESCO, 2000)

However, educationists have criticized the MDGs and EFA for their lack of sufficient reference to education quality. Whilst it is an issue of much debate informed by varying philosophies and traditions of educational thought, it appears that a broad, standard definition as defined by UNESCO is for now generally accepted. Here, the definition of quality in education identifies the cognitive development of learners as the major explicit objective of all education systems. The role of education is to promote values and an attitude of responsible citizenship, and to nurture creative and emotional development (UNESCO, 2004). There is commonality in this definition with international legislation on quality such as the Convention on the Rights of the Child (1990) and the International Covenant on Economic, Social, and Cultural Rights.

From ISAD to NEPAD

However, the disconnection appears in clarifying the vision for technology-enhanced learning within a development context and linking such a vision to that espoused by the EFA, the MDGs, and related international conventions. Yet, in the many initiatives established to bridge the digital divide in Africa, almost all make reference to the importance of education in the context of developing an African response to the knowledge society. The historic Information Society and Development (ISAD) conference held in South Africa in 1996 officially introduced the African development community to the potential of ICTs. ISAD was a launching pad for the African Information Society Initiative (AISI), a framework that established the African mandate to use ICTs to

accelerate economic and social development. The AISI called for the creation of an African Learning Network that would comprise three pillars: the VarsityNet at the tertiary level, the OOSYNET for out-of-school youth, and the SchoolNet Africa.⁵ Since then, both the global and regional environment promoting ICT4D have grown. The New Partnership for Africa's Development (NEPAD), which represents a strategy for Africa's economic, social, and political renewal led by African heads of state, established an eSchools Program in 2002. One of its leading spokespersons announced that the vision of NEPAD eSchools is for every African secondary-school graduate to be ICT literate by 2014.⁶

Dearth of Evidence-Based Research

There is extensive literature on the experiences with the adoption and diffusion of ICTs in schools in both developed and developing economies in general. Usually, African economies are included in the general references to developing economies. However, it is widely known that many African economies are significantly poorer, with more than 40 referred to as the least developed countries and the highly indebted poor countries by the World Bank. The available literature on African experiences with ICTs in schools is limited mainly to desktop reviews with a dearth of evidence-based research that is premised on actual fieldwork reflective of the diversity of the continent. Within the limited research available, there is a substantial body of knowledge on the South African experience, and with this, the danger of extrapolating South African experiences as representative of the rest of the continent. There is also a very strong Anglophone bias in existing literature on ICTs in education in Africa with very little, if any, references to experiences in Francophone, Arabic, and Lusophone regions of Africa. A study of SchoolNets in nine African countries conducted by the IDRC (International Development Research Centre) in 1999, which also includes a French re-

port on the experiences in Senegal, represent one of the few field-based research works conducted by African researchers (James, 2004). Given the research limitations, perhaps this explains what appears to be a disconnection between general scholarly debates on development and education in Africa and policy and practitioner-based discussions at conferences on ICT for education. Hewitt de Alcantara (2001) correctly asserts that often the realities of the broader developmental challenges are not considered when addressing digital-divide issues, which are a function of the limitation with which notions of the digital divide have been conceptualized.

Debating the Benefits of ICTs for Education in Africa

Given the knowledge-production limitations with reference to Africa, the existing literature demonstrates increasing recognition of the developmental and educational benefits of introducing ICTs to schools (Alvarez et al., 1998; Byron & Gagliardi, 1998; Haddad & Draxler, 2002; World Bank, 2002). Some of these benefits include the following:

- ICTs can enhance education access and hence offer the potential for supporting the attainment of the Education for All goals. In places where books and qualified teachers are scarce, ICTs can provide access to vast quality educational resources and can facilitate the delivery of educational resources to large numbers of educators and learners relatively easily and cheaply. Importantly, though, access to educational resources should not be confused with automatic access to learning capability.
- ICTs enable access to networks of local and global learning and teaching communities, thereby facilitating collaborative learning.
- ICTs can enhance the quality of learning and teaching by offering new and different

learning opportunities through synchronous and asynchronous communication.

- ICTs support learner-centred, individualized, self-directed learning.

According to the African SchoolNet tool kit, ICTs also enable the development of knowledge-society attributes in students such as higher order thinking skills, lifelong learning habits, and the ability to think critically, communicate and collaborate, and access, evaluate, and synthesize information. They allow for the development of ICT skills and competencies in students as preparation for operating in an ICT-rich workplace and society, and they have the potential to address structural problems and deficits in education systems, such as using ICTs to enhance administrative and teaching efficiency; alleviate underresourcing in specific areas (e.g., a lack of textbooks or learning support materials); address equity issues through enabling equality of access to knowledge, resources, and expertise; or support teachers who may be under-equipped to deal with new teaching challenges (SchoolNet Africa & the Commonwealth of Learning, 2005).

Some have challenged the approach to the application of ICTs in education in Africa. Enslin, Lelliot, and Pendlebury (2000) contend that globalization, the learning society, and their related interconnected ideas on productivity, change, lifelong learning, and the learning organization have been theorized and conceptualized based on experiences and development in developed economies. They suggest that these concepts have a very different purchase in Africa and the way in which these ideas are currently theorized tend to distort our understanding. For them, patterns of educational provision, styles of teaching and learning, patterns of inclusion and exclusion, and empowerment and disempowerment in Africa have differed from those of Europe and North America. They argue that access to ICT brings on new forms of exclusion and risks that make stern demands on distributive justice because they

represent an opportunity cost for money not spent on food, shelter, and basic education.

They refer to a gung ho approach to ICTs in education that offers simplistic truths in a populist fashion, and suggest that the promise held by ICTs for the benefit of education and social change are false and misleading. They do not provide a concrete demonstration of these “truths,” however. They also refer to the very notion of learning as being undertheorized in some of these pivotal concepts and suggest that those who espouse the advantages of ICTs for education and social change do so from the perspective of developed economies where basic levels of education have already been universally achieved.

In education, they say that in practice, the claims on ICTs are neither strong nor self-evident: They offer superficially simple solutions to complex economic, education, and political challenges.

For them, ICTs are overspecified in terms of their technological sophistication. ICT programs have not considered local knowledge production or the functionality of education institutions, and concerns about the way political, social, and individual interests are differently served by different patterns of deploying technology in schools and institutions have not been considered.

Whilst this essay may share some of these concerns, it also proposes that Enslin et al.’s (2002) observations are insufficiently substantiated and outdated, and they have not researched the successes within African education adequately to justify such a pessimistic view. Evidently, no reference is made to any of the experiences of African SchoolNets and related organizations in any of the African countries in Enslin et al.’s paper.

Indeed, with the limited experience and codified knowledge of African interventions on ICTs in primary and secondary education under conditions of severe educational deprivation, one has to treat the potential of ICTs with caution. This is important also in considering the vastness and

diversity of the African continent and the varying local education contexts and abilities for the adoption and diffusion of ICTs in their education systems. Moreover, whilst ICTs may have potential for educational inclusion of Africa's youth, they may create new forms of exclusion. Some still believe that ICTs represent an opportunity cost compared to spending on more basic requirements such as teacher salaries and school infrastructure.

The fundamental question with reference to the developmental potential of ICTs remains thus: How can ICTs contribute toward the achievement of the educational vision to attain universal quality education under conditions of extreme educational deprivation? In the absence of a coherent African vision and strategy on ICT-enabled education in general and in formal primary and secondary education in particular, this question can only be answered based on what has been tried.

SCHOOL NETWORKING IN AFRICA

A number of African governments who subscribe to the UN system have developed EFA plans and strategies to attain the MDGs. Where reports of these are available, including the Global Monitoring Reports of UNESCO, very little, if any, is mentioned of progress made in the use of ICTs. In spite of this, however, even though they are not clearly linked to the attainment of EFA and the MDGs, various initiatives to promote ICTs in African schools have emerged over the past decade; chief amongst these are SchoolNets.

The African SchoolNet tool kit describes SchoolNets as country-level programs that operate at the interface between education and ICTs. SchoolNets promote the development of knowledge societies by connecting schools to the Internet; building connections among learners, teachers, and schools; sharing information and resources; and supporting e-learning in online networked environments. In Africa, up to 33 countries

have some form of SchoolNet process under way, all of whom participate in an umbrella network called SchoolNet Africa⁷ and related regional and international education networks. They assume various organizational forms—from government agencies located in ministries of education to nongovernment organizations—and they vary in size and scope of intervention depending on resource availability and local conditions.

Foremost among the concerns of SchoolNets is the promotion of universal access to ICTs in schools as a crucial starting point for the involvement of learners and teachers in ICT-supported learning opportunities. Here, access to infrastructure including electricity, telecommunications, and PCs are important prerequisites. Because most SchoolNets in Africa are products of donor and development-agency funding support, their interventions to achieve system-wide networked access to ICTs in schools have been extremely limited. At most, the total number of schools reached in Africa is estimated at 27,000 mostly secondary schools out of a total estimate of 600,000 schools on the continent. The majority of these schools are located in South Africa and Egypt, leaving an estimated 2,000 schools reached for the rest of Africa. Here, schools reached refer mainly to the existence of at least one PC lab consisting of at least 10 PCs. The PC-to-student ratios referred to earlier on are very high as a result (Isaacs, 2005a). As stated above as well, these do not always refer to PCs networked to the Internet.

Over the years, the African SchoolNet movement has revealed the fact that physical access to ICTs alone does not translate into enhanced educational outcomes, and that a number of related activities need to be established in order for a technology-enhanced learning system to work effectively at both the micro and macro levels. These include the following:

- The development of extensive technical-support capacity

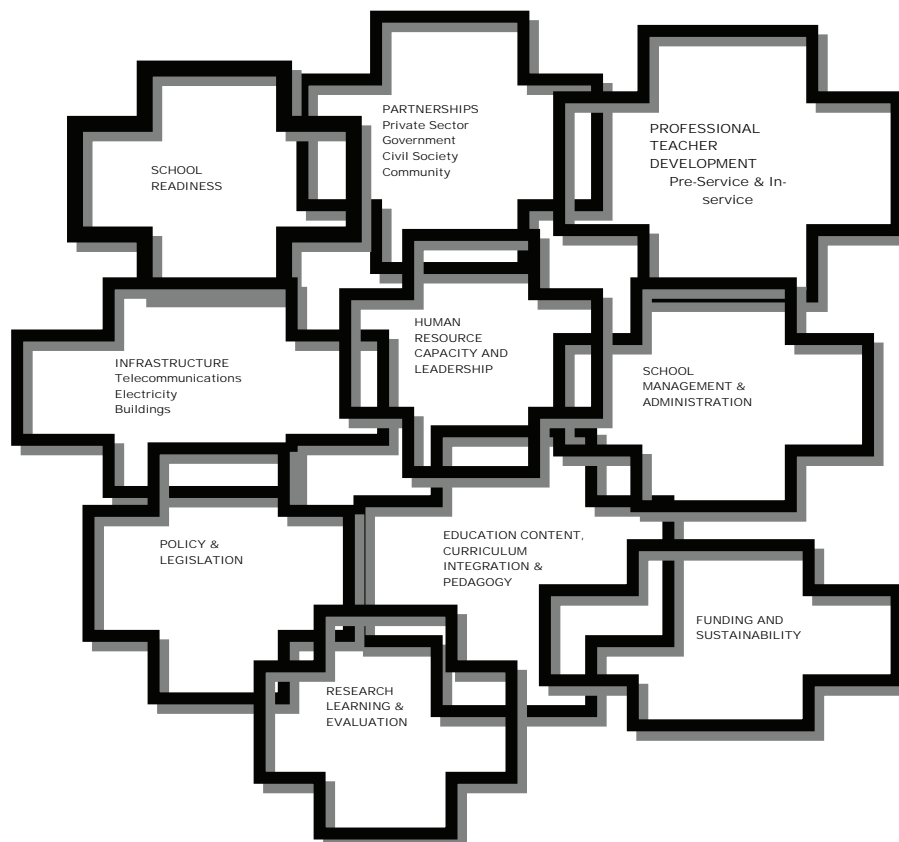
ICT-Enabled Education in Africa

- The professional development of teachers to be able to use ICTs as a learning-support tool
- The availability of appropriate digital education content and integration into school curriculum
- The availability of sustainable income streams to maintain the ICT infrastructure
- The establishment of monitoring and evaluation mechanisms for ongoing improvement
- The existence of an enabling policy environment that promotes access and use of ICTs in education

Given strong gender, rural-urban, and linguistic biases, conscious effort is also required to integrate these dimensions in a holistic approach to learning through the use of ICTs. These activities are depicted more clearly in a SchoolNet Value Chain, which was eventually established to encourage an integrated approach to the use of ICTs in African schools (SchoolNet Africa & the Commonwealth of Learning, 2005). The SchoolNet value chain is graphically depicted in Figure 1.

Importantly, too, the integration of ICTs in the learning process in the formal school system needs to be linked to their integration in the rest of the education pipeline to ensure continuity. This should include a strategy for ICT integration

Figure 1. The SchoolNet Value Chain



at the adult-basic, tertiary, and further education levels. Perhaps most importantly the connection of such a strategy to an overall macroeconomic plan geared toward the creation and development of a knowledge-based labor market to absorb and retain entrants flowing from the education sector is a crucial determinant of success. Few countries in Africa have adopted this holistic approach, albeit only at a policy level. These include Namibia, Botswana, Ghana, and South Africa. However, in practice, at the behest of the enormity of the development challenges, implementation has been very limited.

The current scale of intervention on ICTs in African schools is insignificant for any resounding widespread educational and developmental impact systemically. The scale varies from country to country, particularly when some countries like Namibia and Botswana have scales to their advantage given the lower school population relative to larger countries. However, within the confines of the limited scale of operations, considerable gains have been made in the promotion of online learning and the development of the knowledge-society attributes described above, which warrants serious consideration for further large-scale systemic interventions.

The main issues, successes, and challenges of some of the African SchoolNet organizations are documented elsewhere (Isaacs, 2004, 2005a, 2005b; James, 2004; SchoolNet Africa & the Commonwealth of Learning, 2005; SchoolNet South Africa, 2002).

Lessons Learned

One of the first lessons learned was that the attainment of universal access to ICTs needs to be part of an integrated strategy that considers the following:

- Subsidized rates for Internet access (called e-rates) to schools

- The use of both second-hand, refurbished PCs and new PCs
- The use of a range of ICTs not only confined to PCs, but that includes handheld devices such as cell phones, televisions, video, radio and print media
- The reduction of tariffs on imported ICTs designated for schools
- The use of free and open-source software and/or significantly subsidized proprietary software
- The establishment of effective technical support systems involving learners and teachers at a school level as well as technical service centres that provide education solutions to the school at least at the provincial and national levels
- The involvement of both school and non-school communities to support cost recovery
- Multistakeholder partnerships with the private sector, NGOs, community organizations, and government agencies at local and national levels

Almost all of these issues, with reference to sustainable ICT access alone, have been contentious and furiously debated within the network of practitioners and policymakers in Africa. On a small scale, various successful and sustainable models have been established such as that of the eSchools Network in South Africa, SchoolNet Namibia, SchoolNet Nigeria, and Computers for Schools Kenya (Isaacs, 2005a, 2005b).

It is argued that the SchoolNet movement (which includes those linked to the World Links program) has been technology-centred in its approach to ICT-enabled education in schools, and that less consideration has been given to the learning aspect of the technologies, and more importantly, their integration into improving the social systems at the school level. There is truth in this concern because the attempt at using ICTs

in the first place resulted in a preoccupation with issues of technology access, without which there can be no integration of any kind. Within this, the quest for workable technology solutions that were low cost and affordable, and which had the support of the major stakeholders, was an uphill battle that also required considerable learning over time. It would be myopic to suggest that these models can automatically be replicated and extended on a wide scale. However, within them lie ingredients of successful technology solutions for Africa that can be considered in the development and implementation of system-wide strategies.

The second major lesson is that teacher professional development, particularly in terms of ICT literacy and the use of ICTs to support learning, is central to their effective use in the learning process in schools. In practice, there have been many and varied teacher training programs (see research paper by SchoolNet Africa on teacher training, 2004) that focus both on ICT literacy as well as ICT use in learning and teaching. Again, the scale with which teacher training has taken place is extremely minimal. Here, African-owned models such as the Educator Development Network of SchoolNet South Africa, which is also available in French and Portuguese as well, and the pan-African and global teacher networks such as the African Teachers Network of SchoolNet Africa are examples of successful strides made in this arena. However, teacher training in many ways has also developed in a relative vacuum with limited consideration to the social and economic conditions of teachers. One example that stands out here is the dire lack of integration with the effects of the HIV/AIDS pandemic on the lives of teachers and learners and their professional development to use ICTs to enable learning (Isaacs, 2005d).

The third major lesson is that whilst content is king, more important are the learning strategies devised to ensure the educational use of the content. With reference to education content, however, there is a plethora of available cur-

riculum-based content, mainly in English, that have been produced in the developed economies. Notably too, a growing movement toward open education resources that make digital learning resources such as lesson plans, courseware, and so forth freely available on the Internet for use, reuse, sharing, and adaptation is a welcoming trend in e-learning globally. Indeed, it fosters an underlying principle of learning through sharing and highlights greater potential for access to learning resources for poor communities. Daniel (2005b) correctly highlights the accessibility, appropriateness, accreditation, and affordability of open education resources. An important lesson is that strategies that focus on the adaptation of content produced elsewhere together with strategies on the production and consumption of local curriculum content is an essential ingredient for the successful use in schools. Examples of content adaptation are the ways agencies in Kenya are adapting the curriculum content developed by Learnthings, which is based on the curriculum in the United Kingdom. The Thutong Portal, Mindset Learn in South Africa, and CurriculumNet in Uganda are examples of good practice in the development of local, digitized curriculum content on multimedia platforms coupled with strategies for learners and educators to use the resources. However, a few issues require considerable development and learning. These include a coherent approach on the use of local, indigenous languages in the development and use of education content and the need for policies on open education resource content and creative commons licensing. Given the critical discussion on education quality earlier on, it is also evident that processes of quality assurance and assessment in many existing content-related programs remain extremely limited.

What about the Learners?

Because much of the literature focuses more on the school and SchoolNets as units of analyses and less on the perspective of learners, one of

SchoolNet Africa's learner-based SchoolNet projects is discussed here: ThinkQuest Africa (TQA) typifies interventions that specifically aim to develop knowledge-society attributes among learners.

TQA (more recently called the Mtandao Afrika program)⁸ is a learner-centred educational contest based on an award system that promotes learning through the collaborative development of educational Web sites by teams of learners from different African countries, supported by teacher coaches. The process of involvement includes the selection of the team members, communicating with them over the Internet, the selection of the research topic, conducting research, and the technical development and design of the Web site. These activities require competencies in cross-cultural communication, planning, and Web design and Web-site development. One of the main objectives of the program is to encourage African learners to be producers of local knowledge through the production of African education content. A special award is presented to teams who also focus on the development of content in local, indigenous African languages. This Africanised approach to the ThinkQuest program was very important at the outset given that it was integrally linked to an international program, ThinkQuest Internet Challenge, which originated as a program in the USA in 1996, and which increasingly gained international recognition over the years. TQA as the African chapter of the contest was also designed to encourage more African participation in the program.

The program has been criticized for its focus as an Internet-based program that excludes the vast majority of African learners, thereby reinforcing the notion of new forms of exclusion espoused by Enslin et al. (2002). That it also assumes the form of a contest was cause for concern because it meant that some learners would be winners and others would be losers. Also, the program applied an elitist model of learning relative to a mass model that may be more relevant in an

African context. The program also laid claim to the production of education content although the quality-assurance process was reduced to the subjective considerations of the judges in the contest. With these criticisms in mind, SchoolNet Africa commissioned a study to determine the learning value of the program for African learners. The study conducted by Broekman (2002) asked the following important questions. What are African learners' experiences of participation in the ThinkQuest competition? What do they feel they have learned and what do learners believe they have contributed to online learning?

Broekman found that the learning that happened was extensive for the learners interviewed, and it included changes in attitudes and skill development. For most coaches and learners in the study, the social learning experiences were particularly significant, such as cultural sensitivity, new social understandings, tolerance, communication, creativity, and agency in a way that goes beyond the dynamics of the classroom, and which is developed primarily through working within a team as equals but with diverse backgrounds across race, gender, culture, geographical divides, resource divides, and histories. The program competition and its prizes, the opportunity to travel and meet participants, were major motivating factors for participation in the program. The participants also saw the program as more than a competition, but an opportunity for learning, "for changing thinking, outreach, and for an investment in national as well as personal development" (Broekman, 2002, p. 3). She found that the criteria for judging the sites produced by the learners included redress, inclusivity, and outreach. Furthermore, the competition was designed to motivate students to excellence, hence intrinsically limiting participation, but it also has broad educational goals, which imply mass participation. She noted a tension, however, between the notion of elitism used in this study as providing awards to a few, and mass participation, where many are recognized for their efforts. Here, she suggests

that mass participation would require considerable scaling up of the program at significantly increased costs. She proffers suggestions on ways to render the program more conducive to mass participation such as focusing on marginalized groups of learners working around connected centres in various African countries. That there has been a low number of African entries in the international contest historically, suggests that the program appeals more to an elite few, but also that African learners can produce excellent Web sites. She also found that in the competition, learning is learner driven, though in other models Web-site production is more coach or teacher driven.

Importantly, both learners and coaches in disadvantaged areas reported a sense of satisfaction with competing successfully against the more advantaged, for example, doing well by using older technology. An assessment of the sites produced suggested that they “put Africa on the map” through the production of local content. The production of quality Web sites are a resource for a wide range of target users as teaching and leaning resources, indicated by the comments of visitors to sites.

With the benefit of hindsight, the TQA program developed over the past 3 years to the extent that it involved larger numbers of African participants each progressive year. In 2004, the contest involved 1,034 learners and teachers compared to 709 during the previous year. The challenges faced by the TQA program are typical of all SchoolNet programs in Africa. The challenges of converting this extracurricular program into a mass program are linked to the challenge for universal access to ICTs in general. In the absence of mass access to ICTs, any SchoolNet program can be misconstrued as exclusive and elitist. The reality in Africa is that even primary education is a privilege.

If the alternative is to discourage SchoolNet-type initiatives in the face of severe poverty, then this means that the limited numbers of learners and teachers reached by SchoolNet programs

would be denied the learning possibilities, albeit limited, presented by these programs. This cannot be an alternative.

Instead, the limited strides made in Africa need to be encouraged as attempts at an extension to and in support of universal access to primary and secondary education. Herein lies the challenge.

Drawing on experiences from the World Links for Development Program, Hawkins (2002) details 10 lessons for ICT and education in the developing world:

- Computer labs take time and money but they work
- Technical support cannot be overlooked
- Noncompetitive telecommunications infrastructure, policies, and regulations impede connectivity and sustainability
- Wireless technologies are usually more effective
- Get the community involved
- Private-public partnerships are essential
- ICT initiatives should be linked to broader education reforms
- Training is fundamental
- Technology empowers girls
- Technology motivates students and energizes classrooms

Hawkins’ study corroborates the findings of Broekman (2002) and the research conducted by James (2004).

FUTURE TRENDS

The disconnections referred to extensively above will in all probability prolong for a while. The perspective for the next few years suggest that more and more African countries will in all likelihood develop national policies on ICTs in education in particular. There will be more debates on the value-added issues relating to open content and quality assurance in technology-enhanced learn-

ing, which opens the way for more research that would direct policy and practice in these areas.

There is hope for an expansion of ICT-enabled education programs in African schools, particularly with the prospect of growth of the NEPAD eSchools initiative given its more direct linkages with education decision makers at the highest level and its focus on reaching the remotest schools in rural areas. Furthermore, the emergence of the Global eSchools and Communities Initiative established by the UN ICT Task Force over the past year, with its bias toward Africa, holds the promise of increased qualitative intervention in the promotion of learning and teaching in schools and their surrounding communities.

Furthermore, a number of African countries are also taking bold steps both in collaboration with and independently of the NEPAD and Global eSchools initiatives. Countries like Namibia, Botswana, and Rwanda are cases in point. However, the success of all of these initiatives depend on the rigor of the conceptual framework and implementation strategies with which issues of ICTs in primary and secondary education are programmed in Africa. Here, the importance of drawing on the accumulated learning of 10 years of experience in the African SchoolNet movement is imperative.

In addition, in order for African ICT-enabled programs to yield developmental benefit and tackle the dire crises that they face, a combination of factors identified by Marcelle (2005) in her appraisal of the experience in the Caribbean would be worth considering. She suggests that ICT planning processes need to incorporate a combination of factors for success, which include the following:

- Strategic thinking
- Creative leadership
- Policies that are developmental in their objectives and that put people first

- Emphasis on impact evaluation and continuous monitoring
- Building on existing strengths and assets and facilitating continuous learning in planning and implementation
- Focus on sustainability and institution building
- Effective engagement with the global ICT community

Marcelle (2005) also suggests that it has been shown theoretically and practically that the market alone cannot ensure optimal provision or equitable distribution of public goods. Planning has to take account of market failure. However, Daniel (2005a) indicates that public goods like education need not only be supplied by the state. Governments alone do not have the resources to meet growing demand for education and are compelled to draw in stakeholders in the supply and sourcing of the education system. Daniel states this challenge pithily: “In an era of lifelong learning, there is simply no way that governments can provide at no cost, all the education that people will need throughout life. Governments will have to focus their contributions” (Daniel, 2005b, http://www.col.org/speeches/JD_0602IFCDinner.htm). Education has become both a public and a private good, but the onus still lies with the state to provide the leadership in the involvement of private firms in education in ways that foster greater access and affordability.

There still remains a need for more sober-minded reflection that can be supported by more evidence-based research that takes cognizance of Africa’s rich cultural and linguistic diversity, where knowledge production is the domain of local African researchers. Here, more work on the connections between the developmental realities, the educational challenges of reach and quality, and the role of ICTs is important, particularly from the perspective of the so called end users, that is, the learners.

CONCLUSION

The approach to ICTs for education in Africa has strongly been influenced by supply-side, external interventions. Often, this assumes the form of global funding becoming available or global institutions promoting the setup of projects in African countries with a predominantly Northern perspective on the South. Often, too, these initiatives assume the form of a given sum of money available for delivery within a short period of 3 years with limited strategy toward longer term sustainability. This causes problems systemically, some of which have been highlighted by this essay.

Linked to this approach has also been a predominant preoccupation with process issues and product development, and less with implementation and product use, perhaps because within a short time frame, process-related and product-development deliverables are less challenging than implementation-based deliverables. Here, the convention of numerous multistakeholder conferences, which, at huge costs, have often lent themselves to aggrandizement, rhetoric, and posturing with a conspicuous absence of follow-up action plans, have been a salient feature of the ICT4E and ICT4D sectors. It has been cynically implied that this sector is perhaps the most “conferenced” of sectors. Indeed, engagement in conceptual and practical issues among a community of practice and building networks that these conferences also achieve is important. However, the convention of practitioners and policy makers in a manner that adds concrete value to local implementation is potentially a more constructive way to utilize available resources.

Also, a number of global institutions would develop models, tool kits, portals, and such products with the expectation that they will be utilized in Africa, but with no investment in the active involvement, awareness raising, and training that would encourage local ownership, which in turn would facilitate better use of the products

in question. Above all, it can also be argued that so much investment is going into products and processes, but very few programs are taking seriously the attainment on a mass scale of access to the technologies. Without a strategy to attain universal access to ICTs by the mass of African youth and teachers, there can be no use of portals, tool kits, or e-learning models.

It is absolutely imperative that this paradigm shifts toward long-term, demand-led, locally owned and locally led systemic application that responds directly to local conditions and that can be converged with global processes. The establishment of SchoolNet Africa and later the NEPAD eSchools initiative have been attempts to promote models that foster this shift in paradigm. For example, SchoolNet Africa’s campaign for 1 million PCs for African schools has been one attempt at highlighting the importance of adopting a mass model that focuses on implementation.

Within this context, African leadership is unquestionably the lynchpin of success. Leadership that encourages the shift of current global supply-side approaches toward engagement and support of demand-led programs, leadership that fosters convergence of the myriad of parallel in-country projects toward coordinated investments of local resources and programs, leadership that redirects global investment and partnerships more toward mass implementation—this is perhaps the single most important ingredient in taking us one step closer to making this century the truly African century espoused by President Thabo Mbeki.

REFERENCES

Acevedo, M. (2005). *Pandemics in the network society: ICT in the time of AIDS*. Retrieved March 31, 2005, from http://www.undp.org/surf-panama/egov/docs/programme_activities/pmapping/ict_time_of_AIDS.pdf

- Addo, H., Butcher, N., & Isaacs, S. (2002). *School-Nets in Africa: A baseline scan*. Johannesburg, South Africa: SchoolNet Africa & IDRC.
- Alvarez, M. I., Roman, F., Dobles, M. C., Umana, J., Szuniga, M., Garcia, J., et al. (1998). Computers in schools: A qualitative study of Chile and Costa Rica. *Education and Technology Series, 1*(1).
- Broekman, I. (2002). *Learning possibilities of ThinkQuest in the African context*. Johannesburg, South Africa: SchoolNet Africa.
- Broekman, I., Isaacs, S., & Mogale, T. (2004). Contextualizing education in Africa. In T. James (Ed.), *The role of ICTs in networking institutions of learning: SchoolNet. Information and communication technologies for development in Africa* (Vol. 3). Senegal: IDRC & CODESRIA.
- Butcher, N. (2001). New information and learning technologies in South Africa: Pitfalls and possibilities. In C. Stilwell, A. Leach, & S. Burton (Eds.), *Knowledge, information and development: An African perspective*. Pietermaritzburg, South Africa: University of Natal School of Human and Social Studies.
- Byron, I., & Gagliardi, R. (1998). *Communities and the information society: The role of information and communication technologies in education*. Paris: UNESCO & International Bureau of Education (IBE).
- Castells, M. (1999). *Globalisation, information and social development* (Discussion Paper No. 114). Geneva, Switzerland: UNRISD.
- Castells, M. (2001). Information technology and global development. In J. Muller, N. Cloete, & S. Badat (Eds.), *Challenges of globalisation: South African debates with Manuel Castells*. Maskew Miller Longman.
- Cawthera, A. (2001). *Computers in secondary schools in developing countries: Costs and other issues*. London: Department for International Development (DFID), World Links for Development (WordLD), & the Human Development Network of the World Bank.
- Daniel, J. (2005a). *The private supply of public goods: Contradictions, challenges and choices*. Retrieved August 15, 2005, from http://www.col.org/speeches/JD_0602IFCDinner.htm
- Daniel, J. (2005b). *Speeches by Sir John Daniel and colleagues*. Vancouver: Commonwealth of Learning.
- Daniel, J., Kanwar, A., & Uvalic-Trumbic, S. (2005). ODL in an international context: Trends, prospects and challenges. In J. Daniel (Ed.), *Speeches by Sir John Daniel and colleagues*. Vancouver: Commonwealth of Learning.
- Derbyshire, H. (2003). *Gender issues in the use of computers in education in Africa*. London: Imfundo & DFID.
- Enslin, P., Lelliott, A., & Pendlebury, S. (2002). Promises of access and inclusion: Online education in Africa. In N. Blake & P. Standish (Eds.), *Enquiries at the interface: Philosophical problems of online education*. Oxford: Blackwell Publishers.
- Gadio, C. M. (2001). *Exploring the gender impacts of world links in some selected African countries: A qualitative approach*. Washington, DC: World Links.
- Haddad, W. D., & Draxler, A. (2002). *Technologies for education*. Paris: UNESCO & the Academy for Educational Development.
- Hafkin, N., & Taggart, N. (2001). *Gender, information technology and developing countries: An analytic study*. Washington, DC: USAID & Office of Women in Development.
- Hawkins, R. J. (2002). *Ten lessons for ICT and education in the developing world*.
- Hellman, J. A. (2003). *The riddle of distance education: Promise, problems and applications for development* (Technology Business and Soci-

- ety Program Paper No. 9). Geneva, Switzerland: UNRISD.
- Heppell, S. (2000). The online learning revolution in schools and beyond. In B. Lucas & T. Greany (Eds.), *Schools in the learning age* (pp. 51-56). London: Campaign of Learning.
- Hewitt de Alcantara, C. (2001). *The development divide in a digital age: An issues paper*. The Hague, Netherlands: United Nations Research Institute for Social Development.
- Howell, C., & Lundall. (2000). *Computers in schools: A national survey of information and communication technology in South African schools*. Cape Town Education Policy Unit, University of the Western Cape.
- International Labour Organization (ILO). (2001). *World employment report: Life at work in the information economy*. Author.
- Isaacs, S. (1997). *Consultancy-based SMME support programmes in Europe: What can South Africa learn?* Sussex, United Kingdom: University of Sussex Science Policy Research Unit.
- Isaacs, S. (2002a). ICTs in African schools: A multi-media approach for enhancing learning and teaching. *TechKnowLogia*, 32-34.
- Isaacs, S. (2002b). *IT's hot for girls: ICTs as an instrument in advancing girls' and women's capabilities in school education in Africa*. Retrieved August 10, 2005, from <http://www.un.org/womenwatch/daw/egm/ict2002>
- Isaacs, S. (2005a). Against all odds: Critical reflections on SchoolNet Africa. In *ICTs for education*. New York: United Nations ICT Task Force.
- Isaacs, S. (2005b). Empowering women in the information society: Towards a more concerted global and local effort. In G. Milward-Olivier (Ed.), *Maitland +20: Fixing the missing link*. United Kingdom: The Anima Centre.
- Isaacs, S. (2005c). Reaching MDG2: SchoolNet Africa. *I4D Online*. India: Centre for Development and Media Studies.
- Isaacs, S. (2005d). School networking in Africa. In V. Naidoo & H. Ramzy (Eds.), *Emerging trends in school networking*. Vancouver: Commonwealth of Learning.
- Isaacs, S., & Naidoo, V. (2003). *A Schoolnet value chain for Africa: An integrated model enhancing education through the use of ICTs*. Vancouver: The Commonwealth of Learning.
- James, T. (Ed.). (2004). *The role of ICTs in networking institutions of learning: SchoolNet. Information and communication technologies for development in Africa* (Vol. 3). Senegal: IDRC & CODESRIA.
- Klein, N. (2000). The branding of learning. In *No logo*. United Kingdom: Flamingo.
- Mansell, R., & Wehn, U. (Eds.). (1998). *Knowledge societies: Information technology for sustainable development*. New York: Oxford University Press for the United Nations Commission on Science and Technology for Development.
- Marcelle, G. M. (2000). *Transforming information and communication technologies for gender equality* (Gender and Development Monograph Series No. 9).
- Marcelle, G. M. (2005). Making the link between ICT and development: Lessons from the Caribbean. In G. Milward-Olivier (Ed.), *Maitland +20: Fixing the missing link*. United Kingdom: The Anima Centre.
- Organization for Economic Cooperation and Development (OECD). (2005). *Are students ready for a technology-rich world? What the PISA study tells us*. Retrieved January 28, 2006, from <http://www.oecd.org/dataoecd/48/61/36002531.ppt>
- SchoolNet Africa & the Commonwealth of Learning. (2005). *African SchoolNet toolkit*.

Retrieved January 28, 2006, from <http://www.schoolnetafrica.net/1500.0.html>

SchoolNet South Africa. (2002). *Audit of major educational ICT projects in South Africa*. World Economic Forum Global Digital Divide Initiative.

United Nations Development Program (UNDP) Human Report Office. (2005). *Sub-Saharan Africa: The human costs of the 2015 "business-as-usual" scenario*. Retrieved December 30, 2005, from http://hdr.undp.org/docs/publications/background_papers/2005/HDR2005_Note_Africa_Child_Mortality.pdf

United Nations Educational, Scientific, and Cultural Organization (UNESCO). (2000). *The Dakar framework for action, education for all: Meeting our collective commitments*. Paris: Author.

United Nations Educational, Scientific, and Cultural Organization (UNESCO). (2002a). *EFA global monitoring report 2002: Is the world on track*. Paris: Author.

United Nations Educational, Scientific, and Cultural Organization (UNESCO). (2002b). Statement of commitment. *The Eighth Conference of Ministers of Education of African Member States (MINEDAF VIII)*. Retrieved April 24, 2005, from <http://www.unesco.org>

United Nations Educational, Scientific, and Cultural Organization (UNESCO). (2004). *Education for all: The quality imperative. Summary: EFA global monitoring report 2005*. Paris: Author.

United Nations Educational, Scientific, and Cultural Organization (UNESCO). (2005). *Global education digest 2005: Comparing education*

statistics across the world. Montreal, Canada: UNESCO Institute of Statistics.

World Bank. (2002). *Distance education and ICTs for learning in Africa*. Washington, DC: Human Development Group, Africa Region, the World Bank.

ENDNOTES

- 1 Reference made in an opening speech delivered by Thabo Mbeki, president of South Africa 1999, delivered at the Conference on Education for African Renaissance in the 21st Century
- 2 [_http://lnweb18.worldbank.org/news/press-release.nsf/673fa6c5a2d50a67852565e200692a79/d85862c24b5d549d85256bb2006e517e?OpenDocument](http://lnweb18.worldbank.org/news/press-release.nsf/673fa6c5a2d50a67852565e200692a79/d85862c24b5d549d85256bb2006e517e?OpenDocument)
- 3 <http://www.mindset.co.za>
- 4 <http://www.millenniumgoals.org>
- 5 The AISI attempted a framework for intervention in education in Africa and proposed initiatives that would reach the tertiary, primary, and secondary levels as the basic education sectors. Hence, VarsityNet, OOSYNET, and SchoolNet in Africa as part of a broader African learning network were proposed. The formation of SchoolNet Africa is in fact a direct outcome of this proposal.
- 6 Speech by Professor Peter Kinyanjui at ICTs in African Schools Workshop, Botswana, 2003. For a full report see, http://www.schoolnetafrica.net/fileadmin/resources/Workshop_Report.zip.
- 7 <http://www.schoolnetafrica.net>
- 8 <http://www.mtandao-afrika.org>

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, and M. Acevedo-Ruiz, pp. 210-234, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Section 3

Information Communication Technologies Tools and Technologies

This section presents extensive coverage of various ICT-related tools and technologies that researchers, practitioners, and students alike can implement in their daily lives. These chapters educate readers about fundamental tools such as the Internet and mobile technology, while also providing insight into new and upcoming technologies and instruments that will soon be commonplace. Within these rigorously researched chapters, readers are presented with countless examples of the tools and technologies essential to the field of ICT. In addition, the impact of these various tools, as well as the current issue of ensuring equal access to them, is discussed within this collection of chapters.

Chapter 3.1

Internet: A Right to Use and Access Information, or a Utopia?

Inban Naicker

University of KwaZulu-Natal, South Africa

ABSTRACT

This study examines the impact of the Internet on a student society by investigating the effective use of the Internet at tertiary education. The main objectives of the studies were to determine whether the Internet is being optimally utilized at tertiary education, and to evaluate the level of utilization of the Internet. The study also identified problems experienced by students. A convenience sample of 95 undergraduate students was used at the University of KwaZulu Natal (Westville campus) (only information systems and technology (IS&T) students were included in the study because they had access to computers). The researcher compiled a questionnaire to collect the data. The study revealed that the activity that students mostly used was e-mail systems. The majority of the students (81%) have indicated there are insufficient computers for proper Internet usage. Fifty-eight percent of the students still use the library to access information. Seventy-four percent of the students have indicated that the Internet is easy to use.

INTRODUCTION

The Internet has been in a state of rapid evolution since its beginning in the late 1960s, and is currently evolving and growing faster than ever (Botha, Bothma, & Geldenhuys, 2004). Already the Internet has had an effect on the people who do business, study people who interact with each other, and how people live. However, one can expect to see more changes as society moves deeper into the 21st century. Cheung and Heung (1999) state that universities across the world are expanding their investment in Internet technologies and are promoting Internet usage in education. The study carried out by them showed that Internet usage was having a positive impact on students. The Internet can be a valuable tool at universities.

However, students are not optimally utilizing the Internet to its fullest advantage. They are not always using the Internet for academic use, and do not spend enough productive time on the Internet. An example of where students are misappropriating the Internet is the illegal downloading of

music and games.

This study will therefore briefly discuss the Internet and the impact it has on available information for tertiary students. It also explains the research methodology on how the data was collected and handled and it will discuss the results as well. Finally, some recommendations will be made.

LITERATURE REVIEW

This article discusses what the Internet is, how it is used, and its implications for tertiary usage. Much like the Concord leaving the competition in its jet stream at twice the speed of sound, nothing else has come close to the growth experienced by the Internet—not the industrial revolution, not the electronics revolution, and not even the computer revolution (Bothma, 2000). Berkeley (2004) defines the Internet as a network of networks.

According to Berkeley (2004), the Internet is the transport vehicle for the information stored in files or documents on another computer. The Internet itself does not contain information but is a mechanism for information dissemination and a medium for collaboration and interaction between individuals and their computers without regard for geographic location (Singh, 2002). Content created on the Internet ranges from simple e-mail messages to sophisticated sites incorporating sounds, images, and words. The Internet is therefore arguably one of the most significant technological developments of the late 20th century (Jagbora, 2003).

HISTORY OF THE INTERNET

Botha et al. (2004) note that the first baby steps, which eventually lead to the Internet as we know it today, were taken in the early 1960s at the height of the Cold War. The U.S. government

was looking for a way to maintain communications in the event of a nuclear attack. A team of engineers formed the Advanced Research Project Agency (ARPA), a part of the U.S. Department of Defense, teamed up with Rand Corporation to develop a network that could be used with confidence. Although the military did not decide to use this approach, it provided the basis of the Internet (Botha et al., 2004).

ARPAnet initially connected major computers at the University of California at Los Angeles, the University of California at Santa Barbara, Stanford Research Institute, and the University of Utah (Macura, 2004). According to Hughes (1994), ARPAnet was an experimental network designed to support military research. The idea was that every computer on the network could talk, as a peer, with any other computer. This early network proved so successful that soon other computer sites located within universities, government, and large organizations began linking to this network. Furthermore, this form of communication and the type of information that was shared over this network was very computer-orientated and user friendly (Bothma, 2000).

The Internet Working Group (INWG) was the first body to take up this role under the leadership of Vinton Cerf (known as the father of the Internet). ARPAnet's original standard for communication, developed by Cerf and Bob Kahn, became known as the network control protocol (NCP). As time went by, the NCP was superseded by a higher level and more sophisticated standard, known as the transmission control protocol/internet protocol or the TCP/IP. All networks joined together became known as the Internet (Botha et al., 2004).

GROWTH OF THE INTERNET

Clark (2003) notes that the Internet is the fastest growing technology in the world. Current estimates indicate that over half the estimated 200

million Internet users are in the United States. South Africa was ranked 25th in the world in terms of Internet connectivity (Clark, 2003). According to Singh (2002), it has taken 7 years to reach a 25% market share, as opposed to the telephone that took 35 years, and the television that took 26 years. A report states that 414 million people had Internet access at the end of 2000 and predicts that figure will almost triple to 1.17 billion by 2005. About 730 million of those will be using wireless devices such as Web-enabled cell phones to go online. In countries with low Internet penetration, most wireless Internet devices will be the primary or only Internet access device (eTForecasts ..., 2001).

According to a survey undertaken by a Canadian newspaper (General social survey ..., 2001), the survey found that people who use the Internet tend to be younger, have higher incomes, and more education than those who don't. About 70% of individuals aged 25 to 29 used the Internet, compared with 61% of those aged 35 to 39, and only 13% of seniors aged 65 and over. Individuals with university education were much more likely to use the Internet than those with less than a high school diploma. Among individuals 20 or older, 13% of those with less than a high school diploma used the Internet, compared with 79% with University education.

As far as South Africa is concerned, a recent study undertaken by Arthur Goldstuck and Cathy Stadler of Acuity Media Africa cited by Bothma (2000), revealed that the number of Internet users in South Africa, rated within the top 30 Internet user countries in the world, is estimated to be 1.2 million, expected to rise to 2 million by 2000.

SERVICES ON THE INTERNET

World Wide Web

The Web was created at CERN, Switzerland's nuclear research facility, by Tim Berners-Lee in

1989 (Bothma, 2000). He states that the term Web was coined by Berners-Lee in 1990 to describe information spanning the planet like a giant spider's Web, with threads linking knowledge and information from all over the globe, making it available to a worldwide audience. According to the article, the Web was originally conceived and developed to meet the demand for automatic information sharing between scientists working in different universities all over the world (What about CERN's ..., 2002). Hughes (1994) states that the initial project proposal outlined a simple system of using networked hypertext to transmit documents and communicate among members.

In 1991, an early WWW system was released to the high-energy physics community via the CERN program library. Early in 1993, the National Centre for Supercomputing Applications (NCSA) at the University of Illinois released a version of their browser. The world's First International World-Wide Web Conference was held at CERN in May. By the end of 1994, the Web had 10,000 servers, 2000 were commercial, and 10 million users (What about CERN's ..., 2002).

What is the World Wide Web?

According to Hughes (1994), the WWW is officially described as a wide-area hypermedia information retrieval initiative aiming to give universal access to a large universe of documents. It is basically a subset of the Internet and is a way of looking at and organizing the information on the Internet. The Web provides access to information on (Clark, 2003):

- Individuals, organizations, government (legal, commercial, and educational)
- Learning material
- Health services
- Journals and newspapers
- Virtual libraries, art galleries, and museums
- Virtual shopping malls

Internet

- Databases and archives
- Advertisements and promotional goods
- Pornography

The Web organizes information according to pages interlinked with each other using hypertext (Bothma, 2000). The current foundation on which the WWW functions is the programming language called hypertext mark-up language (HTML). Every document site, movies, sound file, or anything you find on the Web has a unique uniform resource locator (URL) that identifies what computer the thing is on, where it is within the computer, and its specific file name (Berkeley, 2004).

Web Browsers

The prerequisites for the WWW are a computer, a connection to the Internet, and a browser. The function of a Web browser is to interpret the programming language of the Web pages (HTML) and transform it into words and graphics. On each page, certain words, phrases, or even images are highlighted, and clicking on them causes the browser to go and find another page (What about CERN's ..., 2002). Berkeley (2004) describes a browser as a computer program that resides on your computer enabling the user to use the computer to view documents.

The first Web browser to become truly popular and capture the imagination of the public was NCSA Mosaic. Netscape is the browser that introduced most of all the remaining major features that define a Web browser as users know it. Boutell (2004), however, argues that Microsoft Internet Explorer is by far the most common Web browser in use. According to Bothma (2000), the most popular browser in use then was Microsoft's Internet Explorer with between 55-74% of the market share, followed by Netscape Navigator with between 26-35% of the market.

E-Mail

Lerner (2004) notes that e-mail is a message sent from one computer, known as a mail server, to travel over the Internet. Once it arrives at the destination mail server, it's stored in an electronic mailbox until the recipient receives it. To send e-mail, a connection to the Internet and access to a mail server, this forwards the mail. The standard protocol for sending e-mail is called simple mail transfer protocol (SMTP). The advantages of e-mail noted by Grant and McBride (2000) as: It's fast, cheap, and reliable.

File Transfer Protocol (FTP)

File transfer protocol (FTP) is the simplest and most secure way to exchange files over the Internet. The most common use for FTP is to download files from the Internet (Grant et al., 2000).

Internet Relay Chat (IRC)

Internet relay chat (IRC) is one of the most popular and most interactive services on the Internet. IRC lets people all over the world to participate in real-time conversations and was written by Oikarinen in 1988 (IRC, 2004).

Newsgroups

Newsgroups are a collection of messages pertaining to a particular subject. They are a combination of bulletin boards and newsletters, with each dedicated to a specific interest, hobby, profession, or obsession (Grant et al., 2000).

BARRIERS OF ENTRY TO INTERNET USAGE

According to Goble (2002), the barriers of entry to Internet usage are telecommunication costs, ISP costs, equipment costs, training and computer literacy, and language. These are discussed next

(Goble, 2002):

- **Telecommunication costs:** South Africa has only one authorized telecommunications company, Telkom. It has a monopoly and is the sole supplier of the country's telecommunication infrastructure.
- **Internet service provider (ISP) costs:** Internet access to users is provided by local ISPs. An ISP is a company that provides individuals or companies with access to the Internet, as well as other related services such as Web site development and/or the hosting of Web sites. It is usually a commercial organization that maintains a direct and permanent connection with the global Internet via the Telkom telecommunications infrastructure (Bothma, 2000). The initial cost is the purchase of a subscription and then a monthly charge for that subscription.
- **Equipment costs:** Access to the Internet implies that the correct equipment is available and configured. The majority of computer hardware is imported into South Africa from abroad. A&T cited by Goble (2002) recommends the following:
 - PC with a Pentium 90 processor or faster, Windows 95, 98, Me, NT 4.0 2000, or XP, Microsoft Internet Explorer 5.0 or higher
 - 128MB RAM
 - 40GB of unused hard disk space
 - A 32-bit colour display

This makes the cost of entry into this medium high for the average South African.

- **Training and computer literacy:** The Internet is a complex network of Web sites and Web pages developed independently and without any pattern. Users should be able to use the Internet, and tools such as e-mail, as effectively and efficiently as possible. Train-

ing in both the use of an Internet browser and the use of a PC is integral to being able to access the Internet (Goble, 2002). The average illiteracy rate in South Africa in 1999 was 15% of the total population. South Africa has a computer literacy percentage of 8% of the population (Goble, 2002).

- **Language:** The Internet was founded and based using the English language to send and receive information. Therefore, people who are unable to read, write, or speak English are excluded from communicating in this medium.

THE IMPACT OF THE INTERNET IN TERTIARY EDUCATION

In most universities, the Internet is already an important medium of communication, a way of enhancing access to educational resources and a means of creating interactive communities of learning (Pickering, 2000). Cheung et al. (1999) state that many universities across the world are expanding their investment in Internet technologies and are actively promoting Internet usage in university education. The study carried out by Cheung et al. (1999) showed that the Internet usage was found to have positive impacts on students learning. The potential role and use of the Internet in the provision of information services for both research and study in South Africa's tertiary institutions is no longer a highly debatable issue (Kaniki, 1999).

Fleck and McQueen (1999) argue that the Internet revolution arrived faster and with more complications than many institutions expected. They further state that the rapid development of search engines and the expanded use of the Web increased the demand for Internet-related services at universities. However, the Internet is unorganized and Web sites appear, disappear, move, or mutate on a daily basis. While the Internet is dif-

Internet

difficult to search, it is even more difficult to search it well. Moreover, the information found on the Internet has both useful and useless information co-existing (Jagbora, 2003). The rapid growth of some of the following places a real burden on institutions (Fleck et al., 1999):

- Pornography and hate sites, and downloading of useless information
- Interference with legitimate research and academic use
- Hacking, security
- Cost, growth
- Legal issues related to fair use, harassment, and so forth
- Chat rooms
- Access by non-students
- Competition with ISPs

There are thousands of Internet “home pages” which serve as information sources for institutions and organizations. Most Universities throughout the world have established their presence on the Internet, thereby making it possible for researchers to access past and current research publications. Prospective students can also access information on courses being offered by institutions as well as their admission requirements. Journals, magazines, newspapers, books, and archives provide another important avenue for the construction, publication, and circulation of texts (Jagbora, 2003).

Due to poor funding, university libraries ability to acquire new books and to subscribe to journals have been badly affected (Chifwepa, 2002). Academic libraries in South Africa are and will therefore increasingly come under pressure to provide Internet-based information services (Kaniki, 1999). While traditional library resources and services are suited for particular kinds of research and study information needs within the academia, the Internet is suitable for other needs and it can supplement traditional library services.

The question for academic libraries, should be not so much as to when will the Internet replace the library or how best will librarians counter the challenge but rather, as how best to incorporate the Internet into services offered by the library (Kaniki, 1999).

According to Dos Santos (1998), technological advances and explosive growth of the Internet are rapidly eliminating the time and space constraints inherent in the existing model. Dos Santos gives an example of where one can easily have students view a video of an instructor’s lecture from anywhere and at their leisure, and students can chat (using text, audio, or video) without getting together physically (Dos Santos, 1998).

The Internet provides an educational discourse in which learners can interact widely with other members of a learning community. Their interaction for learning can be immediate, prompt, widely shared, and resource supportive, which may not be possible in a traditional mode of teaching, confined by the classrooms physical condition (De Villiers & Cronje, 2001). Irdus and Latch cited by Katz and Yablon (2002) state that through the Internet, learning has become significantly more flexible and content sources much more accessible.

Taylor and Cohen (2001) note that the primary institutional processes where the Internet can have an impact on tertiary education are communication, information and research, teaching and learning, and services and commerce.

- **Communication:** Communications solutions available via the Internet include e-mail, instant messaging, individualized Web portals, video conferencing, listservs, and group calendaring.
- **Information and research:** The Internet has revolutionized the process of accessing and retrieving information.
- **Teaching and learning:** How an institution employs the Internet to facilitate teaching

and learning depends heavily upon its mission, vision, competition, and positioning. Examples of teaching and learning tools include: software such as WebCT, Blackboard, and Prometheus); online class content; audio/video capabilities; instructional chat rooms; and distance education.

- **Services and commerce:** Many services and commercial transactions benefit in terms of timeliness, accuracy, cost, convenience, and customer satisfaction.

INFORMATION OVERLOAD

Since the advent of the printing press, there has been increasing pressure on individuals to keep abreast and in control of information. The Internet has compounded the situation by increasing the volume of available information and the speed at which new knowledge becomes accessible (Rochat, 2002). He defines information overload as large quantities of varied sources of information received on a regular basis at a rate that limits assimilation and increased by unsolicited information. Lyman and Varian (2000) notes that 2.1 billion unique, publicly accessible Web pages are on the Internet, while 7.3 million are added per day. The “deep” or “invisible” Web (information generally inaccessible to software spiders, for example databases) is 500 times larger than the visible Web. Butcher et al., cited by Rochat (2002), list the factors that contribute to information overload:

- Information is collected to illustrate a commitment to rationalize and competence while information is sought to verify the information collected.
- Vast amounts of unsolicited information is received.
- Managers require information to support decisions made.

- Information is collected in case it is useful.
- Managers play it safe and obtain all information possible.
- When the person does not understand available information he/she feels overwhelmed by the information.

In an attempt to deal with the quantity of information, people have developed the following adaptive mechanisms (Rochat, 2002):

- **Chunking:** Gathering information on the basis of generic terms
- **Omission:** Skipping of information
- **Queuing:** Deferment of processing at peak times
- **Filtering:** Neglect or irrelevant information
- **Capitulation:** Escape from the task

Information overload is a problem in an evolving society. Similarly, there is no solution to handle the vast quantities of information that are faced with on a daily basis. The solution is summarized by Lyman et al. (2000) as the challenge is to learn to swim in that sea (of information), rather than drown in it.

INTERNET ADDICTION

Since the advent of high quality, low-cost hardware, and software, the development of a graphically based, easy-to-use method of accessing remote computer sites (i.e., the WWW), use of the Internet by students has increased dramatically. Institutions find that students cultures are created via e-mail, Web surfing, multiple user dungeons (MUDS, which are interactive, role-playing games), spending time in chat rooms, and homepage production. Students provide e-mail addresses as the preferred code of contact rather than telephone numbers. Although the Internet can

be a powerful tool for academic study and personal communication, for some people, Internet access can prove to be a temptation that is hard to resist. Pathological or problematic use of the Internet, also called “Internet addiction,” is a behaviour pattern that appears to be affecting more and more people, including students (Kandell, 1998). Kandell describes Internet addiction as a psychological dependence on the Internet regardless of the type of activity once logged off.

In research conducted over the past four years, psychologists have theorized that it is possible to become addicted to the Internet. The addiction has been named Internet Addiction Disorder (IAD). To be diagnosed with IAD, an individual must meet some of the criteria. These criteria include developing a tolerance to the Internet and increasing Internet usage steadily, developing withdrawal symptoms, and surfing the Internet for longer than was intended and socially isolating oneself from friends or family members (Kovach, 2001). Research, according to Friedenber (2002), estimates that about 3% of those who go online may suffer from problematic usage.

Kandell (1998) argues that university students as a group appear more vulnerable to developing a dependence on the Internet than most segments of society. Use of the Internet in society and on institutions is growing at an exponential rate. Although the Internet is a tool for gathering information and for interpersonal communication, dangers exist for those who make it the central focus of their lives. Research in this area is just starting, but more is needed to understand the full scope of Internet addiction and the most effective modes of treatment (Kandell, 1998).

PLAGIARISM ON THE INTERNET

Although plagiarism has been around as long as students have, the Internet has dramatically increased the ease of and opportunities for pla-

giarism. “Cyber-plagiarism” is the term used to describe the process by which students either copy ideas found on the Internet without giving proper attribution, or the process by which students download research papers from the Web, in whole or in part, and submit it as original work (Guide to plagiarism ..., 2004).

Plagiarism has never been easier than it is today. The Internet now makes it easy to find thousands of relevant sources in seconds, and in the space of a short time, plagiarists can find, copy, and paste together a term paper, article, or even a book. Because the material online is produced by writers of varying levels of quality and professionalism, it is often difficult for educators and editors to identify plagiarism. Even when an educator does suspect plagiarism, the sheer size of the Internet seems to work in the plagiarists favour (Plagiarism.org, 2004). According to Harris (1996), the most often plagiarized works on the Web are “links” sites, such as “Yahoo.”

Reasons for Plagiarism

The reasons for plagiarism are (Why students plagiarize ..., 2004):

- **Lack of research skills:** Many undergraduate students do not know how to search the library catalogue, search databases for journal articles, or use other reference sources.
- **Problems evaluating Internet sources:** Many students do not know how to critically evaluate Internet sources and this can impact on the students writing.
- **Confusion between plagiarism and paraphrasing:** Studies indicate that up to 60% of students cannot distinguish between paraphrased and plagiarized text. The problem is magnified when students need to paraphrase unfamiliar vocabulary and technical terms.

- **Confusion about terminology:** Terminology is another problem that perplexes students and compounds their confusion and anxiety. Many students do not understand the difference between a report and an essay, between exposition and argumentation.
- **Confusion about how to properly cite sources:** The lack of consistency among the different style guides compounds the problems that students experience when citing sources.
- **Poor time management and organizational skills:** Undergraduate students often do not have the time management or organizational skills necessary to complete a large research paper.

Strategies to Avoid Plagiarism

In order to avoid plagiarism, students should (Harris, 1996):

- Give credit whenever you use another person's idea, opinion, or theory.
- Put in quotations everything that comes directly from the text.
- Paraphrase.
- Check your paraphrase against the original text.

Another option would be to use a plagiarism-detection service. Turnitin offers a plagiarism-detection service that addresses this growing problem of plagiarism. In an Australian study, Turnitin.com detected 166 of the essays, or 9% of the total, had more than a quarter of their material pilfered from electronic sources. Fourteen percent of the essays had 5% or more of the material plagiarized (Foster, 2002).

INTERNET ABUSE

Cyber-Crime

The Internet remains an open network that offers users no guarantee of security, privacy, or integrity (Schoeman, 2000). Botha et al. (2004) defines cyber-crime as the use of the Internet and its technologies to commit crime on individuals or organizations. Security on the other hand, is the means by which crime can be reduced or eliminated. The increase in Internet security breaches can be attributed to the following aspects (Botha et al., 2004) such as: The Internet is an open system, and the communication path is inherently unsecured.

Hacking

Conlin cited by Botha et al. (2004) describes hacking as the obsessive use of computers to gain unauthorized access into corporate systems. There are two types of attacks (i.e., passive attack and active attacks). In a passive attack, the perpetrator simply monitors the traffic to try and learn secrets. In an active attack, the perpetrator tries to break through the defences (Schoeman, 2000).

E-Mail Abuse

Watson (2003) defines spam as simply unsolicited and bulk mail. Unsolicited means that the recipient didn't give consent to receive the e-mail. The content could be commercial such as advertisement or company newsletter, or non-commercial such as joke e-mails or chain letters. Flame mail is hate mail that is transmitted over the Internet. Hate mail is used to incite employees against each other, or against the organization. For example, in 2002, a member of staff sent an e-mail around the then University of Durban-Westville campus purporting to be from another member of staff, making comments about colleagues and the management of the University (Botha et al., 2004).

Viruses

Viruses are programs that have the ability to destroy computer files, programme files, and sometimes computer hardware. Virus scanners are necessary as they have caused a lot of damage over the past few years. According to experts, viruses represent a much bigger problem than hackers (Schoeman, 2000).

Privacy

Customers are often expected to fill in detailed forms when accessing certain sites. Unsecured sites expose the customer to abuse from cyber attackers. The attacker can very easily obtain the personal information of the customer, such as residential addresses, account numbers, and passwords. These could be used to send the customer spam, flame mail, or even personal abuse such as stalking and assault (Botha et al., 2004).

Downloading Music Off the Internet

Over the past few years, there have been many technological developments granting people the ability to download music off the Internet. By law, downloading a digital song violates the intellectual property rights of the artist, or in most cases, of the record companies who contracted those rights from the artist (Choi, 2002).

Universities need to make every effort to educate students about what they are doing when they download music from the Internet. Institutions need to monitor student shares on computers and electronic storage systems that belong to the Universities. They must ensure that MP3s and other copyright-protected materials are not readily available for download to users either on or off campus (Powell, 2003).

Pornography

Pornography is defined as pictures, writing, or other material that is sexually explicit and sometimes equates sex with power and violence. Adult-orientated sites make up less than 2% of all content on the Web. While sexually explicit material comprises only a small fraction of online content, that fraction is highly visible, controversial and accounts for a significant amount of Web traffic (Wright, 2004).

SUMMARY

The literature has shown that problems exist on the Internet. The following research questions were not answered:

1. Is the Internet usage at tertiary education moving towards less learning efficiency and more time spent for non-study purposes?
2. Are students spending enough “productive” time on the Internet?
3. Does the university have enough computers for Internet usage?
4. Does the Internet help students with their studies?

This section has discussed the review of the Internet and issues that affect students and their application of Internet searches for information. The next section will discuss the various methods used to collect the data.

METHODOLOGY

The main aim of this study is to determine whether the Internet is being optimally utilized in tertiary education for information purposes, and to evaluate the level of utilization of the Internet using the University of KwaZulu-Natal (Westville).

Sampling

Convenience sampling is used in exploratory research where the researchers are interested in getting an inexpensive approximation of the truth. As the name implies, the sample is selected because they are convenient. This non-probability method is often used during preliminary research efforts to get a gross estimate of the results, without incurring the cost or time required to select a random sample.

The sampling method used was convenience sampling. A sample of 95 was drawn from the institution for the study. The 95 respondents were comprised of:

- 40-first year students
- 30-second year students
- 25-third year students

Only information systems and technology (IS&T) students were used for the study, as they were easily accessible. Furthermore, information systems and technology students have access to computers to use the Internet readily. Postgraduate students were not included in the study as they were not readily available.

The study was conducted at the University of KwaZulu Natal (Westville campus). Also, there is no known documentation of studies done at the University of KwaZulu Natal (Westville campus) after an extensive search was done at the library.

The Instrument

The researchers compiled a questionnaire to collect the data and were handed out to students during their self-study sessions. According to Walonick (1997), questionnaires are special purpose documents that allow the researchers to collect information and opinions from respondents. Questionnaires allow the researchers to collect

data from a large number of respondents while maintaining uniform responses.

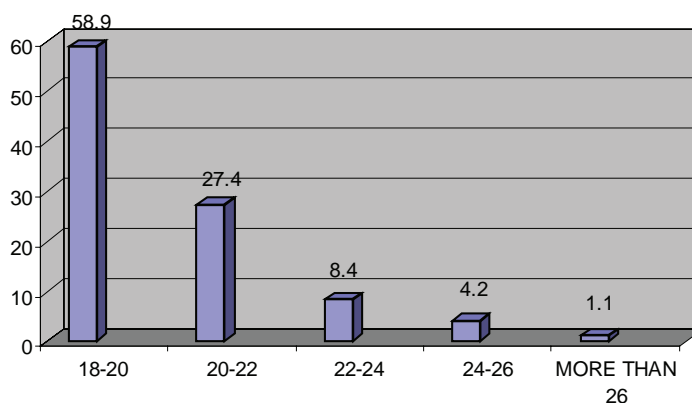
The researchers decided to use a combination of both open format and closed-ended questions. The questionnaire comprised of dichotomous scale questions such as yes or no type of questions, tick the correct box, and one ordinal scale question, where respondents were required to use ranking. The researchers will use the questionnaire to collect the data and will do a correlation analysis using SPSS after collating the data on an EXCEL spreadsheet.

PRESENTATION OF RESULTS

This section deals with the presentation and analysis of data collected. The aim of this is to obtain a measure of association between each of the given variables. The majority of the respondents (59%) fell into the age group between 18 to 20, followed by the 20 to 22 age group, which made up 27% of the sample. Respondents aged 22 to 24 accounted for 8%, followed by 4% in the 24 to 26 age category. The smallest group was older than 26 years (one respondent). The reason why this age group is so small is because tertiary education students are young and the majority of them starts university at an early age and often completes their degrees/diplomas within three to four years. This is probably the reason why majority of the respondents fell into 18 to 20 category.

The first large group (64%) spends less than 3 hours on the Internet. The second largest group (24%) spends 3-6 hours on the Internet. Nearly 10% of the respondents indicated that they spend between 6-12 hours using the Internet. The smallest group comprising of only one respondent uses the Internet more than 12 hours per week. It is evident that students are not spending a lot of time on the Internet. The reason why 64.2% of students spend less than 3 hours on the Internet is probably because of lectures or other activities/commitments. Only one respondent shows

Figure 1. Age distribution



that if a student uses the Internet for more than 12 hours, he or she could have an addiction problem. This agrees with the statement made by Kovach (2001) that students develop a tolerance to the Internet, and has an inherent desire to surf the Internet for longer periods of time. Psychologists have theorized, according to Kovach (2001), that it is possible to become addicted to the Internet.

Nearly 50% of respondents have made the attempt to learn the Internet on their own, and it can be stated that they are Internet literate. This finding substantiates the statement by Katz and Yablon (2002) that through the Internet, learning will become more flexible, and will be a way of enhancing educational resources. This finding also shows that lecturers are not assisting students on how to use the Internet since they only constitute 21% of the respondents. Nearly 19% of the respondents indicated that they were taught by friend/s to use the Internet. Ten percent of respondents have indicated that they were exposed to the Internet by means such as computer magazines, newspapers, etc.

Ease of Internet Usage

Figure 2 depicts how long students took before they were comfortable using the Internet. The majority of respondents (63.2%) indicated that they took a week before they were comfortable using the Internet. Goble (2002) notes that for the

beginner, the process of “surfing the net” is both taunting and difficult. Training in both the use of an Internet browser and the use of a computer is an integral part of being able to use the Internet. It is important for students to quickly get accustomed to using the Internet.

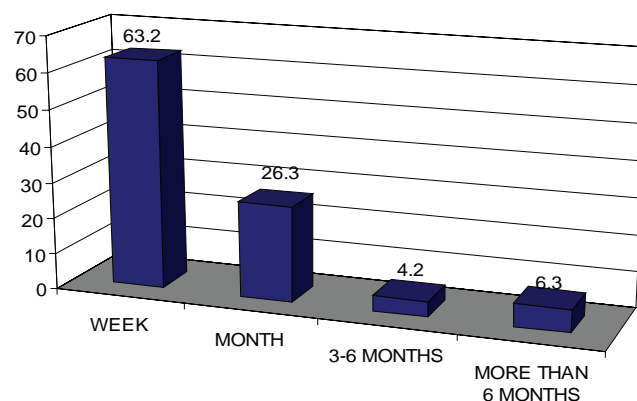
Reasons for Using the Internet

Table 1 illustrates the various uses of the Internet by the students. Students were asked to select what activities they do online such as surfing the net, sending e-mails, SMS, chatting, etc. The activity that the students rated as the most constantly used was e-mail (mean of 1.6), followed closely by academic use (mean of 1.4). Many students according to Kandell (1998) provide e-mail addresses as the preferred contact rather than the telephone numbers. Since Internet access is free at university, students have access to free Web-based e-mail systems such as yahoo and Webmail.

Table 1. Rating of online activities

| Description | Mean |
|--------------|------|
| E-mail | 1.6 |
| Academic use | 1.4 |
| Surfing | 1.3 |
| SMS | 0.8 |
| Chatting | 0.6 |
| Downloading | 0.3 |
| Online games | 0.3 |

Figure 2. Period taken for ease of Internet usage



The Internet is a tool that can be used to encourage and help students with their studies. This is in agreement with De Villiers and Cronje (2001), who stated that the Internet is one of the most powerful tools for providing learners and lecturers with independent and interactive learning. They further state that the Internet provides an educational discourse in which learners can interact widely with similar members of a learning community.

According to Clark (2003), the WWW is a network of interlinked pages, displaying text, hyper-text, images, sound, video, and data. The Internet provides online presence and information such as learning materials, health services, journals and newspapers, virtual libraries, virtual shopping malls, music, game centres, advertisement and promotional goods, software, pornography, junk, and the list goes on. Therefore, students have a variety of sites to surf from. However, research according to Friedenber (2002) estimates that about 3% of those who go online may suffer from problematic usage, and these users fall into one or more of four categories. The first group has a lack of impulse control, showing difficulty in controlling their inherent desire to stay for long periods of time. The next group goes online when they are lonely or depressed. The third group seeks social comfort on the Web. The last category, the one that university students are most likely to fit in, goes online to avoid coping with stress.

Sending SMSs via SMS sites was rated as the fourth most used activity (mean of 0.8) when students go online, followed closely by chatting (mean of 0.6). Today, SMS is a fast and popular way to send text based messages, especially amongst the youth. There are many SMS sites that allow users to send SMSs free of charge. The activity that students rated as seldom used was downloading of music and playing online games (mean of 0.3). There are several Web sites students can use to download music for free. Choi (2002) is of the opinion that downloading a digital song violates the intellectual property rights of the artist. Kandell (1998) states that although the Internet is an excellent tool for gathering information and for interpersonal communication, dangers exist for those who make it the central focus of their lives.

Time Constraints

Nearly 90% of the students indicated that they are being restricted to use the Internet because of time. From analyzing the results, the researchers are of the opinion that the reasons for students having insufficient time to utilize the Internet is probably because of lecture time and due to computer laboratories closing early.

The questionnaire included a final question where respondents could express their opinions

Internet

on what problems they encounter when using the Internet. The question was phrased as follows: "List 3 problems that you encounter when using the Internet?" Fourteen respondents have indicated that they do not have sufficient time to spend on the Internet because the computer laboratories close early (at 4:30 pm). One of the questions that were posed to students was how much extra time they would recommend for Internet usage at University.

The majority of the respondents (39%) indicated that they require 2-4 hours, followed by 25% of the respondents who have indicated that they require 1-2 hours. Twenty percent of the respondents have indicated that they require more than 4 to 6 hours. The smallest group of respondents (15%) indicated that they require more than 6 hours. It is evident from that the University should allow students adequate time for using the Internet.

The majority of the respondents (97%) indicated that they access the Internet mostly at the university. This is quite a high percentage, and the reason for this is that because university provides the student free access to the Internet. This is in agreement with the statement by Cheung and Haung (1999) who argued that a high percentage of university has an Internet presence and these institutions provide students with the ability to access the Web as well as e-mail and other related Internet activities.

In other first world countries, students have 24 hours access to the Internet. This is in agreement with Cheung et al. (1999) who stated that the Internet is available 24 hours a day in most first world countries. Furthermore, students who pay their fees may feel that they have to take advantage of the free Internet usage offered by the university. Only one student indicated that they use the Internet at home. None of the respondents have indicated that they use the Internet at an Internet café. This is probably because of the cost factor involved.

From the correlation analysis of where the respondents mostly access the Internet and the overall hours spent on the Internet per week, the data showed significance at the 0.01 level. The correlation analysis demonstrates the strength of the association between the two variables (i.e., where students access the Internet and the number of hours spent on the Internet (.41)). This result proved that there is a strong relationship between these two variables and it is impacting positively on the outcome of the study. The researchers find it difficult to comprehend how 3 hours can be adequate for efficient use of the Internet to be achieved. When reviewing the group that spent more than 12 hours, it raises much concern because this group could lead to Internet addiction. To re-iterate and support the researchers viewpoint, the study done by Kovach (2001) also suggests that if students have an inherent desire to surf the net for longer periods of time, it could lead to Internet addiction.

Availability of Computers and Usage of the Library

More than 81% of the respondents have indicated that there are insufficient computers. Goble (2002) recommends the following computer equipment as a market entry requirement for effective Internet usage at tertiary education:

- Pentium 4
- Windows 98, ME, NT 4.0 2000, or XP
- Microsoft Internet Explorer 5.0 or higher
- 128 MB RAM
- 20 GB of unused hard disk space
- A 32-bit- colour display

Nearly 58% of the respondents have indicated that they still use the library to access information. Jagbora (2003) states that printed materials in libraries have a certain fixity and finitude and this is probably the reason why students still use

the library to access information.

The correlation analysis of whether there are adequate computers at the university and if respondents are still using the library for information showed a significance at the 0.01 level (.412). This result shows that because of the inadequate number of computers, students are using the libraries. There are not sufficient computers in the labs because of equipment costs. This is in agreement with the statement made by Goble (2002). According to him, one of the barriers of entry for proper Internet usage is equipment expenses such as hardware and software, network cables, etc, and ISP (Internet service provider) costs. Goble (2002) noted that access to the Internet implies that the correct equipment is necessary and must be available.

Another reason why there are not enough computers in the labs is probably because of telecommunication costs. South Africa has only one authorized telecommunication company, Telkom. According to Goble (2002), it has a monopoly and is the sole supplier of the country's telecommunication infrastructure. Goble further notes that since there is no competition, normal market effects prevalent in first world countries such as the USA and UK cannot play any role in bringing down the cost of telecommunication, and this fundamental flaw in government policy has a ripple effect on all goods and services produced in this country as consumers absorb the non-competitive costs. Telkom's pricing is also not competitive with the rest of the world.

A large percentage of students (58%) still use the library as their primary source of information. This implies that students are not fully utilizing the Internet for information. The students are turning to the library for information rather than the Internet. Today university libraries have suffered serious setbacks in terms of funding. Chifwepa (2002) supports this statement by noting that due to poor funding, the libraries ability to acquire new books and to subscribe to journals has been

badly affected. Jagbora (2003) states that libraries have become crammed with millions of printed materials. So, looking for any kind of material in the library can be time consuming. Kaniki (1999) states that academic libraries in South Africa are increasingly under pressure to provide Internet-based information services. He goes on further to state that while traditional library resources and services are best suited for meeting particular kinds of research and study information needs within the academia, the Internet is best suited for other academia information needs and in other cases, it can supplement traditional library services. In the near future, the Internet could replace libraries. Therefore, students need to be taught the necessary skills on how to use the Internet before this conversion can take place.

The correlation analysis demonstrates the strength of the association between the use of the library to access information and the restriction due to time constraints. The correlation analysis showed significance at the 0.01 level (.166-not high). This is an important observation as the researchers feels that the fact that there is inadequate number of computers would therefore impact on the fact that the majority of students are still using the library.

The correlation analysis demonstrates the strength of the association between the two variables i.e. the adequate number of computers and the time constraints (.402). From the results, eighty one percent of the students indicated that the computers were inadequate for proper Internet usage. The result is important as it shows a direct relationship between these two variables. The inadequate number of computers results in the students waiting their turn and thus becomes a time constraint. This can possibly have a negative impact by discouraging students to use the Internet.

Search Engines, Online Databases, Library Catalogues, and E-Journals

Eighty-four percent of the respondents have indicated that they know how to use search engines. A low percentage of the respondents (30%) indicated that they are familiar with online databases, library catalogues, and e-journals. Universities must therefore take the necessary measures to educate students, especially final and postgraduate students how to use online databases, library catalogues, and e-journals. Roachat (2002) notes that the Internet has revolutionized the process of accessing and retrieving information. One method of achieving this is through online databases, library catalogues, and e-journals.

The correlation analysis of whether the respondents know how to use search engines or online databases, library catalogues, and e-journals showed significance at the 0.01 level (.28). The correlation analysis demonstrates the strength of the association between the two variables (i.e., the use of search engines and online databases, library catalogues, and e-journals). From the analysis of the data in Table 4.9, it would appear that the majority of students (84%) know how to use search engines. Therefore, the researchers is of the opinion that the large percent (70%) not familiar with online databases, library catalogues, and e-journals is possibly due to the fact that they have to pay for this service.

Jagbora (2003) supports this statement by stating that information found on the Internet has both useful and useless co-existing. Therefore, it is good that a large portion of students (84%) know how to use search engines because knowledge of how to use search engines will eventually reduce the time that the student spends in finding the appropriate information that he or she is looking for. Kaniki (1999) states that a user must have the knowledge and skills necessary to conduct complex searches and sieve through the vast information to choose the most appropriate he or she needs.

Nearly 38% have indicated that they depend on the Internet. This shows that the students are not using the Internet mainly for academic purposes. This illustrates a correlation at the 0.01 (.268) level between the dependency on the Internet to assist students with their studies and how much more time students require to use the Internet. The association does not display any casualty. These results indicate that students need to start using the Internet to assist them with their studies. Digital classrooms, supplemented with telecommunications media according to De Villiers and Cronje (2001) are currently being used in tertiary institutions world wide in the form of Web-based courses. If these digital classrooms are implemented in the near future at South African tertiary institutes, it could have a major impact on students by encouraging and improving their learning efficiencies.

Nearly 74% of the respondents have indicated that the Internet is easy to use. The Internet is not easy to use for some students probably because they don't have a basic knowledge of computers. Therefore, to use the Internet properly, students need to be both computer and Internet literate. Eighty six of the respondents have indicated that information from the Internet is easy to read and understand with a correlation of .666.

From the correlation analysis of where the respondent felt that the Internet is easy to read and understand, the data showed a high significance at the 0.01 level. This is in agreement with the statement by Goble (2002) who stated that although modern applications use picture icons and multimedia applications, information is still primarily text based and communication, especially e-mail requires the user to read and write. Jagbora (2003) stated that hypertext publications, incorporating live or moving images and real sounds defy easy classification, and multiple links to other documents and sites encourage new patterns of reading activity.

The Internet was founded and based using English language to send and receive information. English dominates the world of computing and Information Technology today. It is the most widely used computer language, being used by both developers and end-users. Most Web pages are written in English (Goble, 2002). Therefore, students who are unable to read write or speak English will find difficulty in using the Internet. The correlation analysis demonstrates the strength of the association (.725) between the two variables (i.e., use of search engines and the ease of using the Internet). The researchers are of the opinion that a greater percentage of the respondents (74%) find the Internet easy to use and therefore they are encouraged to use search engines.

CONCLUSION AND SUMMARY OF THE RESULTS

The results that were obtained from the data and presented in tables and graphs were discussed. The study aimed to find out how effectively students are using the Internet at tertiary education. The study revealed that students are not using the Internet responsibly i.e. for educational purposes only. They are using the Internet for their own personal uses such as surfing the net, sending SMSs via SMS sites, chatting, etc. A number of problems were identified regarding adequate computer equipment availability in the computer labs; and students being restricted to use the Internet because of time constraints. The study has also revealed that students are not utilizing the Internet to assist with their studies.

RESEARCH QUESTIONS

The following questions were presented in the literature review:

1. *Is the Internet usage at tertiary education moving towards less learning efficiency and more time spent for non-study purposes?*

The study revealed that students are using the Internet for other purposes rather than for academic usages but there was no conclusive evidence from the study that indicates that Internet usage at tertiary education is moving towards less learning efficiency. The study has revealed that the majority of students use e-mail as the most used activity when going online. Therefore, the university should implement a monitoring policy, which is discussed thoroughly in the recommendations.

2. *Are students spending enough productive time on the Internet?*

The findings from the study revealed that students are not spending enough time utilizing the Internet because of time constraints. Nearly 90% of the students have indicated that they are being restricted to use the Internet and 10% have indicated that time is not a problem. The majority of the students have indicated that they require 2-4 hours more. Therefore, UKZN should allow students sufficient time for using the Internet.

3. *Does the university have enough computers for Internet usage?*

It is evident from the study that the university clearly has a shortage of computers for proper utilization of the Internet. The majority of the students (80%) have indicated there are insufficient computers for proper Internet usage. One of the reasons why UKZN has a shortage of computers is because of equipment costs, student's negligence, and not taking care of the equipment. The University can reduce this problem with the help of sponsorship programs.

Internet

4. Does the Internet help students with their studies?

The study has revealed that students are utilizing the library as a source of information more often than the Internet. The researchers strongly believe that the main reason for this result is that there is a lack of computers available to the students. This problem will need to be addressed if the university intends moving forward and keeping in line with international levels of other universities.

RECOMMENDATIONS

Responsibility of University and Students

The University provides access to various computer resources such as the Internet. These resources are available to enhance the learning process and to achieve quality learning outcomes for students. It is the responsibility of the university to encourage students to become familiar with the Internet. Students should be taught the proper way to use the Internet and not to abuse e-mail, the WWW, and so forth. Students, particularly first years should be made aware of Internet abuse. Students must also use the Internet and computers responsibly. They must comply with the rules and regulations of the computer facilities in the university labs. System administrators must also be responsible for the correct and reliable operation of the network and computers.

Monitoring

It was revealed from the study that students are wasting time on the Internet by surfing the net, sending SMSs, chatting, downloading music, playing games, and so forth. There is a large amount of offensive material from the Internet.

The most common type of offensive material is pornography and hate sites. Visiting or downloading of this offensive material is considered overuse, and Internet usage is therefore being wasted. Given that there is no guaranteed means of preventing student's exposure to this kind of material, strategies need to be adopted. University needs to adopt a monitoring strategy.

The university must monitor student's activities when going online. They can achieve this with the assistance of Web monitoring software, which records which sites the student has visited. According to Grant et al. (2000), companies are using Web monitoring software that records an employee's e-mail sent and received and the sites visited. Grant et al. further state that some of the software is capable of ringing "alarm like" bells to alert management when employees are visiting pornographic sites.

Computer Equipment

The study has revealed that the university has a shortage of computers, and some of them are not in proper working conditions. Every effort has to be made by the university to insure the stability, performance, and reliability of the equipment. University should repair the computers that are not working properly.

Technicians should be available when a PC or other equipment is damaged and must try and rectify the problem immediately. Therefore at least one technician needs to be placed in the various computer laboratories. Students should be responsible. They must take care of the equipment in the computer laboratories. They should adhere to the following rules and guidelines:

- Clean up after finishing using a laboratory computer.
- Do not bring food or beverages into the computer laboratories.
- Do not steal or remove any piece of equipment from the computer laboratories.

- Do not swap around any equipment such as changing of keyboards, mouse, or other equipment from one computer to another.
- Do not alter data, software, or directories.
- Report all equipment faults immediately.
- Students should properly shut down their workstations.
- Report suspected viruses to the systems administrator.

In order for the equipment to be functioning properly, both university and students must be responsible for the equipment.

Sponsorships

The university can promote Internet usage via sponsorships programs. They can either apply for funding or new equipment. In 2003, the university built the Govan Mbeki lab via a sponsorship, but this is only one facility. There should be about three to five computer laboratories in university. The only way this can be achieved is through sponsorships. There should be more available computers in the library since students use the library as their primary source for information. Funds coming from sponsorships could also be used to upgrade existing computers.

Computer Laboratories

Students are being restricted to use the Internet because of time. The computer laboratories should be opened at 8:00 am and close at 18:00 pm instead of 16:30 pm. The laboratories should also be opened on weekends. However, this privilege should only be granted to third year and postgraduate students. When a student enters a computer laboratory, university must ensure that each student has a computer available at his/her disposal. Only authorized users must be allowed into the computer laboratories.

E-Mail Usage

E-mail is a tool used for communications, in which users must have a responsibility to use in an efficient, ethical, and lawful manner. Students must adhere to the following guidelines when using e-mail systems at university:

- Do not send messages that are offensive, harassing, obscene, or threatening.
- Do not send, create, or forward advertisements, chain letters, and other unsolicited mail (spam).
- Do not send excessive e-mail messages to recipients, either on or off campus.
- Do not send e-mail containing warnings or virus alerts to other university users.
- Do not flood another system, network, or user account with e-mail.

Downloading of Music and Other Large Graphic Files

Sites such as IMESH, Kazaa, and other download sites needs to be restricted from students. Downloading music form the Internet is considered copyright infringements and is illegal. Therefore, university needs to ensure that students are aware of the consequences of downloading music off the Internet. Powell (2003) recommends that universities need to monitor student's shares on computer and electronic storage systems that belong to the universities. Limits should also be placed on file sizes and the types of files that are downloaded.

Web Filtering Software/Firewalls

Installed on a computers server, this Web filtering software is able to filter inappropriate Web sites (such as online chatting, SMS sites, etc.) while still allowing useful ones to be accessed. A firewall is an access control gateway and determines what type of acceptable traffic may flow through it.

Policies

The university needs to implement policies, which are designed to regulate day-to-day online activities. Policies give users guidelines of what constitutes appropriate and inappropriate use of university computer resources. Policies outline in very clear terms what kind of Internet usage is permitted, what kind is not, and the consequences for violating the rules. Having a clear designed policy will enable the university to protect against wrong doings such as engaging in behaviour that impedes normal use of the network, Internet, or other resources, overloading the network with excessive data, pornography, etc.

If students are in breach of these university policies, the user's account or computer access including access to the computer labs must be suspended and students will be subject to the normal disciplinary procedures of the university.

FUTURE RESEARCH

- Future research needs to be conducted concerning the reasons why students are misusing the Internet at UKZN (Westville campus). These findings could identify some important factors that can improve Internet usage among university students.
- A comparative study should be conducted between other South African universities and even the Technikons. The study would be able to identify which institutions have a better Internet usage.
- Further research must be conducted with regards to the reasons why students are turning to university libraries rather than the Internet.
- The activities of university staff when they utilize the Internet should also be researched to determine whether they are abusing Internet facilities.

CONCLUSION

The study proved to be beneficial to both the researchers and the students. The aim of the study was to assess the effective usage of the Internet at tertiary level. The study explored the various aspects and factors relating to efficient Internet usage in terms of how this was perceived by the students. It was evident that the Internet is not being utilized efficiently and effectively by the students. This has raised much concern with the researchers in terms of what steps need to be taken in order to improve on this result. The researchers recommends further research in this field in order to improve on higher standards of education through the Internet, which will be beneficial to future students.

REFERENCES

- Berkeley, C. U. (2004). *What are the Internet, the World Wide Web, and Netscape?* Retrieved April 3, 2004, from <http://www.lib.berkeley.edu/teachinglib/guides/internet/whatis.html>
- Botha, J., Bothma, C., & Geldenhuys, P. (2004). *Managing e-commerce*. Pretoria: Juta & Co.
- Bothma, C. H. (2000). *E-commerce for South African managers*. Pretoria: Interactive Reality.
- Boutell, T. (2004). *What was the first Web browser?* Retrieved July 19, 2004, from <http://www.boutell.com/newfaq/history/fbrowser.html>
- Cheung, W. M., & Huang, W. (1999, August 13-15). An exploratory investigation of Internet usage and its impact in University education. In *Proceedings of the America's Conference on Information Systems*, Milwaukee (pp. 903-905). Retrieved April 1, 2004, from <http://aisel.isworld.org/pdf.asp?spath=/amics/1999/316.pdf>
- Chifwepa, V. (2002, April 10-12). Internet and information provision: The promises and challenges

- in African university libraries. In *Proceedings of the NetLab and Friends of Conference*, Lund, Sweden. Retrieved April 7, 2004, from <http://www.lab.lu.se/netlab/conf/chifwepa.html>
- Choi, S. (2002). *The ethics of downloading music*. Retrieved August 3, 2004, from <http://members.rogers.com/mrbuddy/ethicspaper.html>
- De Villiers, G. J., & Cronje, J. C. (2001, June). Longitudinal comparison of two presentations of an Internet based course for adult learners: A university case study. *SAJIM*, 3(1). Retrieved April 7, 2004, from <http://www.sajim.co.za/default.asp?to=peer1vol3nrl>
- Dos Santos, L. B. (1998, August 14-16). *Internet-based instruction: Experience with multi-university cooperative learning*. Presented at AMCIS 1998. Retrieved April 1, 2004, from http://aisel.isworld.org/pdf.asp?spath=/amics/1998/t26_02.pdf
- Fleck, R. A., & Mcqueen, T. (1999). *First Monday. Internet access, usage, and policies in colleges and universities*. Retrieved April 7, 2004, from http://firstmonday.org/issue4_11/fleck/index.html
- Foster, L. A. (2002). *Up to 14% of Australian university students may be plagiarizing from Web, study suggests*. Retrieved July 29, 2004, from <http://chronicle.com/free/2002/11/2002/12001t.htm>
- General social survey: Internet use*. (2001). Retrieved July 14, 2004, from <http://www.statscan.ca/daily/english/010326/d010326a.htm>
- Goble, R. C. (2002, September). The Internet—an enlist luxury or the people's necessity? *SAJIM*, 4(3). Retrieved April 7, 2004, from <http://www.sajim.co.za/default.asp?to=student2vol4nr3>
- Grant, D., & McBride, P. (2000). *Guide to the Internet: Getting your business online*. London: Butterworth-Heinemann.
- Guide to plagiarism and cyber-plagiarism*. (2004). Retrieved July 29, 2004, from <http://www.library.ualberta.ca/guides/plagiarism/index.cfm>
- Harris, P. K. (1996). *Copyright issues on the Web*. Retrieved July 29, 2004, from <http://iteslj.org/articles/harris-copyright.html>
- Hughes, K. (1994). *A guide to cyberspace*. Retrieved April 3, 2004, from <http://www.sr.net/srnet/enteringwww/guide.toc.html>
- IRC*. (2004). Retrieved July 19, 2004, from <http://www.Webopedia.com/TERM/I/IRC.html>
- Jagbora, K. O. (2003). *First Monday. A study of Internet usage in Nigerian Universities, Ille-Ille, Nigeria*. Retrieved April 1, 2004, from http://firstmonday.org/issues/issue8_12jagbora/index.html
- Kandell, J. J. (1998). *Internet addiction on campus: The vulnerability of college students*. Retrieved July 29, 2004, from <http://www.inform.umd.edu/CC/personal/~kandell/iacpbart.htm>
- Kaniki, M. A. (1999). *Internet use and training needs of staff of the ESAL consortium, KZN, SA: Partnership between historically disadvantaged and advantaged institutions (HDI's and HAI's)*. Retrieved May 18, 2004, from http://www.ifla.org/IV/ifla65/papers/041_115e.htm
- Katz, J., & Yablon, B. (2002, March). Who is afraid of university courses? *Educational Media International*, 39(1), 69-73. Retrieved July 29, 2004, from <http://search.epnet.com/direct.asp?an=6895099&dp=aph>
- Kovach, N. (2001). *Internet addiction a threat to college students*. Retrieved July 29, 2004, from <http://www.thepost.baker.ohiou.edu/archives3/jan01/012501/news1.html>
- Lerner, M. (2004). *Harness e-mail: How it works*. Retrieved July 19, 2004, from <http://www.learnthenet.com/english/html/20how.htm>

Internet

- Lyman, P., & Varian, H. R. (2000). *How much information?* Retrieved July 29, 2004, from <http://www.sims.berkeley.edu/how-much-info/>
- Macura, J. K. (2004). *Internet for you: Part 1: History of the net.* Retrieved August 3, 2004, from <http://www.rsna.org/tech/internet/internet1-1.html>
- Pickering, J. (2000). *The Internet in universities: Liberation or desensitisation?* Retrieved June 11, 2004, from <http://www.csv.warwick.ac.uk/~psrev/geosci.html>
- Plagiarism.org. (2004). Retrieved July 29, 2004, from <http://www.plagiarism.org/plagiarism.html>
- Powell, D. W. (2003). *P2P and MP3s: Staying out of the middle.* Retrieved August 4, 2004, from <http://www.educause.edu/ir/library/pdf/CRM0345.pdf>
- Rochat, C. (2002, June). Possible solutions to information overload. *SAJIM*, 4(2). Retrieved July 29, 2004, from <http://www.sajim.co.za/default.asp?to=student4vol4nr2>
- Schoeman, J. (2000, September). Web site security? Is the threat real? *SAJIM*, 2(2/3). Retrieved July 14, 2004, from <http://www.sajim.co.za/default.asp?to=student2>
- Singh, A. M. (2002). *The Internet-strategies for optimal utilization in South Africa.* Retrieved April 1, 2004, from <http://www.sajim.co.za/default.asp?to=peer4vol4nr1>
- Taylor, F. D., & Cohen, M. B. (2001). *Untangling the World Wide Web.* Retrieved July 26, 2004, from http://www.kaludisconsulting.com/pdf/KAL_Web_rev3.pdf
- Walonick, S. D. (1997). *Survival statistics.* Minneapolis: Statpac Inc.
- Watson, J. M. (2003, September). What is spam? *SA Computer Magazine*, 41-42.
- What about CERN's greatest achievements?* (2002). Retrieved July 19, 2004, from <http://public.Web.cern.ch/public/about/achievements/www/www.html>
- Why students plagiarize?* (2004). Retrieved July 29, 2004, from <http://www.library.ualberta.ca/guides/plagiarism/why/index.cfm>
- Wright, B. (2004, April). Fighting child pornography. *SA Computer Magazine*, 49-51.

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 209-240, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.2

The Nearest Some of Us Will Ever Come to Information Heaven

Buyile Ngubane
TransNET, South Africa

ABSTRACT

This study addresses the needs for a community computer centre (telecentre) for the community of Emkhambathini. This study was part of the information systems research exercise that was conducted by students. The problem that the researcher experienced was that Emkhambathini has no access to information and a need exists to ensure that this community joins the 21st century. The telecentre will also serve as a community upliftment tool. The data was collected using a questionnaire, it was collated and analysed using SPSS. The conclusion was that gender or employment does not play a role when there is a real need to access information.

INTRODUCTION

Advancements in information technology (IT) throughout the world have had an impact on the way people live their lives, communicate, and even on the way they do business. These developments have become part of people's daily lives and it has become important for everyone to embrace technology and all that comes with it. Unfortunately for rural communities, the advantages of using technology have not been utilized to their best advantage. This has encouraged researchers (i.e., Campbell, 1995; Etta, 2004; Sayed, 2003) in many parts of the world to focus their attention in finding ways in which technology can be used in the development of rural areas.

THE PROBLEM STATEMENT

Although there has been some progress on the use of information and communication technologies (ICT) as previously mentioned, rural people are still falling behind in these developments. The lack of progress is due to the lack of infrastructure and finance that has led to a situation where there are not enough computers in rural areas. Rural people do not have computer skills and the cost of computer equipment is high for people in rural communities. Previous studies (e.g., Benjamin, 2000; Fuchs, 2000; Richardson, 1998) have focused on the use of computers neglecting the benefits that can be obtained in the use of other technologies. This caused the government and private sector to intervene by providing shared facilities such as telecentres. The study will uncover other services that can be offered to rural areas in addition to computing.

The spread of ICTs in the last few decades has had an impact on work, leisure, culture, and social interaction (Sayed, 2003). The modern world is undergoing a fundamental transformation as the industrial society of the 20th century rapidly gives way to the information society of the 21st century. This dynamic process promises a fundamental change in all aspects of people's lives, including knowledge dissemination, social interaction, business practices, political engagement, media, education, health, leisure, and entertainment. The speed of global technological and economic transformation demands urgent action to turn the present digital divide into digital opportunities for all (Ryan, 2004).

ICTs can be used as tools to provide access to information to the underprivileged people in the rural areas. Given the characteristics of rural women and men, such as having little or no schooling, speaking only the local language, among others, they are among the last to reap any benefits. This calls for more creative and innovative ways to enable the use of ICTs in rural environments (Epodoi, 2002).

There have been many examples in recent years of the applications of distance-shrinking effects of ICT. These technologies have been used in the United States and other parts of the world as an aid to economic or community development in rural areas (Campbell, 1995). The fact that more than 2.5 billion people (over 40% of the planet's population) live in rural and remote areas of developing countries has encouraged researchers to look into ways that telecommunications can help improve the lives of these communities (ITU, 2003). In Africa alone, over 70% of people live in rural areas, and there is limited access to telephony outside of cities. Telecentre projects have sprung up throughout Africa in an effort to provide access to telephony and other ICTs in the content with the lowest access to these systems (Castells, 1998). Telecentres offer a promising route for rural communities of the developing world to break out of their isolation (Fuchs, 2000).

Definitions

Benjamin (2000) defines a telecentre as an organization offering telecommunication and other information services to a disadvantaged community. Etta (2004) defines a telecentre as a place whose primary goal is the public provision of tools to enhance communication and the sharing of information.

Chapman and Slaymaker (2003) define ICTs as those technologies that can be used to inter-link IT devices such as personal computers with communication technologies such as telephones and their telecommunication networks. Campbell (1995) defines a telecentre as a central location within a rural community or region equipped with computer and telecommunication equipment and services shared by users from a variety of sectors; the services are usually superior to those that the users often have themselves. It provides hardware, software, and support to a group of individuals and organizations that alone might

find them unavailable, difficult to understand, or more expensive.

This study will use the first definition because it also covers the issue of users and the kind of services available at telecentres. For the purpose of this study, a telecentre and a computer centre will have one meaning.

Telecentres as a Business Centre

In the work and debate around telecentres, some key themes have become clear, one is the business model. This can help answer the question of whether community centres should be economically self-sufficient, or rely on external funding of one kind or another (Benjamin, 2000).

A full telecentre costs around R20000. This buys around five phones, four computers, a photocopier, fax machine, printer, scanner, overhead projector, TV, video, and modem. The building is renovated with furniture and security being added. A mini-telecentre follows a model developed by the CSIR, a computer in a movable cabinet with a 3-in-1 (printer, copier, scanner) with phone lines and a modem, costing around R15,000. The turnover is usually around R8000 per month with a sizeable profit (Benjamin, 2000).

Fuchs (1998) argues for public funding of centres as a public facility similar to libraries and schools. However, Richardson (1998) notes that in developing countries, there is not enough money for such things and these projects should be run by self-sustaining entrepreneurs, anything else encourages incompetence and dependency. Benjamin (2000) further states that the rural telecommunications network must be operated as a commercial, entrepreneurial, profit-focused, and profitable enterprise as this will motivate the service provider to continually seek to maximize revenues and minimize costs. Their sustainability depends on them being run on business lines and charging enough money to users to keep the operation sustainable.

Fuchs (1998) argues that to create a tech boom in Africa will require African developers and entrepreneurs to join together in virtual, multinational companies to focus on developing African solutions to African problems. Balancing Act (2004) states that the central idea is that the public sector with donor support provides at a cost or low cost service for communities that are too poor to pay more. It is however important to ensure that the telecentre doesn't die when the donor moves on. And this can only be achieved because the local communities find that it serves their real needs and will continue supporting it (CINSA, 2004).

Policy

The advantages of rural communications and information technology collaboration may be becoming clearer to national policy makers (Campbell, 1995). Issues relating to policy about telecentres have generated interest in South Africa and the government is committed to addressing the inequalities of the past. This was seen in the reconstruction and development programme, which states that, "The aim of the telecommunications sector will be to provide universal, affordable access to all as rapidly as possible within a suitable and affordable telecoms system" (Benjamin, 2000). In South Africa, all telecentres are established in line with the Telecommunications Act of 1996, aimed at ensuring the supply of low-cost, local communication services to South Africa's townships and rural areas (Matsepe-Casaburi, 2003). She argues that guaranteeing the communications access rights are a state obligation as public security or education especially when market driven initiatives can't do it.

Sound and effective policy is the key to making sure that ICTs bring solutions that connect to real problems, otherwise it is likely that initiatives will be small scale and have little impact on the system (Sayed, 2003). According to Sayed

(2003), policy makers will also need to consider the following:

1. Who will pay for ICTs in schools and how?
2. What is the role the private sector should play?
3. What is the appropriate balance between investing in training and infrastructure, such as software and hardware?
4. What kind of software will be used?
5. How schools that obtain ICTs and infrastructure will cover recurrent costs (e.g., Internet access and maintenance)?

Festa (2003) further states that government involvement is a crucial point in the establishment of telecentres, for example if computers are to be installed in a certain area and there is no electricity, the government has to act fast to connect the area.

More policies concerning software and hardware have been adopted by governments. South Africa has adopted an official policy promoting the use of open-source software but stopped short of jettisoning proprietary applications (Festa, 2003). The new policy by Africa's wealthiest nation expresses a preference for open-source applications when proprietary alternatives don't offer a compelling advantage. The policy reads in part, "The primary criteria for selecting software solutions will remain the improvement of efficiency, effectiveness, and economy of service delivery by the government to its citizens," which was drafted and published in a final version. Open-source software (OSS) offers indirect advantages. Where the direct advantages and disadvantages of OSS and proprietary software are strong and where circumstances in the specific situation do not render it inappropriate, opting for OSS will be preferable. "Elsewhere in the policy, the government pledged to promote 'fair and impartial treatment' of open-source software in procure-

ment, create 'opportunities for trial use,' and take advantage of 'the opportunities presented by the OSS movement to promote access to information for citizens'" (Festa, 2003).

The State Information Technology Agency (SITA) has already helped the government save millions of rands by implementing open source in the public sector. According to Moseki (2003), the Northern Cape provincial government is the largest user of open source software, while the Western Cape government also uses an OSS-based document management solution and bases its portal on the system's platform. The department of land affairs uses Linux and is about to implement Oracle on Linux. Open source software is as good if not better than commercially available software. In many cases, it's more stable and more reliable. Unlike most proprietary software, OSS is available at little or no cost. Festa (2003) argues that South Africa and Africa will not be able to afford the investments in imported technology that are required to be a participant in the global information society if conventional approaches are followed. The government expects that OSS, by contrast, will provide flexibility (Festa, 2003).

Services

There is no magic formula for a successful local ICT's appropriation process. It depends on local specifications, and the designs should be relevant to local needs. There is no single successful model applicable to all; success depends on the capacity of adapting the model to best of local opportunities and synergies. No local plan or solution should be designed far away from the community. Top down solutions tend to be big failures.

Telecentres can also provide services in areas such as education, health care, local democracy, and small business support (Benjamin, 2000). The Mogalakwena Hewlett Packard project provides lessons daily for both adults and youngsters ranging from computer literacy to call centre training,

computer repairs, business, and science and technology training. In the past year, the i-Community has trained more than 1,000 people, including municipal councilors and staff, traditional healers, health officials, students, and members of the wider public (BuaNews, 2003).

Distance learning is also an area that can be enhanced by the use of telecentres, it is much easier for rural people to study through distance learning close to their homes than going to city universities, a privilege many of them can't afford (Eggers, 2000). The term telecentre has been used to describe a range of services that include call centres and facilities offering fax. Among the services offered will be videoconferencing and telehealth communications so that patients can avoid, for example, a helicopter ride to a hospital when a teleconference with a physician attended locally by a nurse might instead render the diagnosis and treatment plans (Romberg, 1999). According to Eggers (2000), ICTs can help improve the level of governance in rural areas by allowing the public to access government services like grant application, marriage applications, and business support.

Etta (2004) argues that in addition to all these points, services should be designed in accordance with public needs. Time and space should be allocated for different user types like women and younger users. Booths for privacy in addition to sensitivity to human functions and functioning e.g. availability of toilets, fans should also be cared for. Etta (2004) also argues that efforts should be made to develop subsidised services and group rates (e.g., for women, students, or members). Time banding where cheaper rates can be given for off peak periods and differential pricing must be implemented.

Training and Skills

Fuchs (2000) states that a first step in training is often to demonstrate how the equipment and

facilities available in a telecentre can work for the communities they are located in. Secondly, time must be spent helping locals, teachers, or entrepreneurs understand the value of information and the tools that can be used to access it.

According to CINSAs (2004), the processes that need to be redefined and implemented are:

1. Grow accurate awareness as to what is possible.
2. Establish a shared vision around measurable goals.
3. Establish a widespread skills development and citizen engagement strategy.
4. Establish a sustainable process for encouraging ongoing learning, skills sharing and innovation.

The need for basic literacy, computer skills, and training in the use of ICT applications remains a challenge for rural areas. Language barriers and the complexity of personal computer operation have been shown to hinder Internet diffusion (ITU, 2003). Matsepe-Casaburi (2003) agrees that in South Africa, there is limited capacity to operate affordable and sustainable ICT facilities, and there is also low utilization of ICT services due to limited training and skills.

Gaster (2003) adds that management and technical training and ongoing backup need to be built in because if the managers do not have the imagination or skills to search the internet, he or she won't be able to transmit them to others. Managers should also be able to handle money, organize, plan, mobilize, and teach. He states that centre managers are not only facility managers, they are trainers, facilitators, and motivators. It is essential that they receive special attention and training so they can develop a strategic vision of their role, raise community awareness, train for a productive ICT use, and facilitate the appropriation process.

Problems

Excitement about new ICTs is tempered by long-standing problems in development (Hafkin & Odame, 2002). Parkinson (2004) states that the reason is a combination of lack of resources and because a commitment does not generally exist at the policy level. A striking observation is the absence of old and disabled people at the telecentres. Fewer women than men use telecentre services in practically all of the countries and facilities (Etta, 2004).

The problems of gender inequality are, in most areas women are marginalized with respect to ICTs. Their needs are often different from those of males and this need to be addressed at planning phases of these centres. Etta argues that addressing the gender issue goes beyond promoting equal access and use of the facilities.

In other countries, an inferior level of service from the existing telephone system, the lack of organizational capacity to coordinate such projects, and the lack of leadership to make it happen (Campbell, 1995). Ryan (2004) found that the Kgautswane computer centre in the Northern Province, South Africa succeeded against all odds such as no power, telephones, funds, or trained personnel. They only had power from a generator. Etta (2004) states that examples of more sustainable community telecentres were found in Phalala (South Africa) and Guédiawaye (Senegal).

Benjamin (2000) argues that major telecentres are an overkill to provide basic telephony. They use too much capital for the services they deliver, have difficulty in recovering running costs, and can not be reproduced in the numbers required to provide widespread access. One problem is competition, which has reduced the turnover of the telecentre in Thembisa. Etta (2004) notes that most of the telecentres experienced management problems, ranging from poor attitudes, to weak management, and the absence of adequate technical skills, inadequate equipment and high cost of equipment maintenance and services

Parkinson (2004) adds that fragmented and isolated initiatives often lack knowledge, resources, and expertise. They may not know even about things like open source software, or depth of their understanding of its relative advantages and disadvantages compared to proprietary software may be limited. Staff at these centres often has fairly limited technical expertise, and they often do not know how to implement open source or have access to relevant technical support. Further, because so many of these centres are struggling to get by financially, they cannot afford the luxury of experimentation with solutions that may cost them in the short term but benefit them in the long term. If investment in ICTs for development is to be sustainable, it needs a proper long-term plan that considers these ongoing costs. Hafkin et al. (2002) states that as a result of all these problems in Africa, most of the population remains unable to afford access to computers and the Internet, and reliance on imported software and a closed IP regime slows local development of technology.

Rural areas are low dense and this means ground based telecommunications networks are costly per user (Campbell, 1995). Telecentres are therefore facing technical and infrastructure problems in all countries. These include power failures or interruptions, poor connectivity, computer failures, printer breakdowns, non-functioning software, obsolete or unusable equipment, complex management arrangements, security failure, and policy failures (e.g., import duties or taxes on equipment (Etta, 2004)).

The power problems in Malawi have made the implementation of ICTs impossible and as a result of this, a project that involves laying high voltage cables over a distance of 220 kilometres from the Matambo power station in Mozambique's north-western Tete province to Phalula, 60 kilometres north of Malawi's commercial capital, Blantyre has been started. The project is aimed at ending the frequent power failures in Malawi that are caused by prolonged environmental degradation

along the Shire river-site of the hydro-electric plants that form Malawi's main source of power (Etta, 2004).

Existing Infrastructure

Infrastructure has proven to be the first thing that demands attention before any project can be started. Matsepe-Casaburi (2003) proposes that the same cables that are being laid to bring electricity to rural areas should have the capacity to be used for ICT services. Benjamin (2000) agrees that existing institutions must be used where possible. BuaNews (2003) notes that the Mogalakwena Hewlett Packard project has succeeded by placing computers in libraries, schools, community centres, municipal offices, clinics, and traditional authority halls across the municipality

The Kgautswane Computer Centre has been used more than initially expected and as a result, there is pressure to add more computers (Ryan, 2004). According to Parkinson (2004), local schools can also play a role by introducing younger generations to computers, e-mail, and Internet. School computer labs are increasingly offering public use after-hours. But low Internet penetration rates and limited infrastructure outside of the major urban hubs indicate universal access is an ambitious goal. Etta (2004) argues that cheaper hardware and software should be developed (e.g., thin client solutions and telecentres should be used to pilot them).

Sayed (2003) argues that the debate over which technologies are appropriate and relevant in development has received little attention in the developing world context. One further cause for concern is the difficulty in obtaining good quality software at a reasonable price. Software is not only expensive initially but even if free in the first instance, as with Microsoft's recent promise to South Africa's public institutions, the cost of renewing the license prohibits many institutions from using it. One target of private sector involvement should therefore be ensuring that developing

countries have access to sustainable software that is tailored to their needs (Sayed, 2003).

RESEARCH QUESTIONS

Although the literature attempted to solve all the problems as described, certain issues still need attention. These are:

1. Why does the South African government take such a long time to create computer centres?
2. How will the community benefit from such a computer centre?
3. What other benefits are there for the community?
4. Can this help in other terrains?

CONCLUSION OF THE LITERATURE

There is evidence that important support for the MDGs can be achieved with the use of ICTs. The Internet offers extensive development opportunities, particularly for people in rural areas and living in poverty. Wireless Internet technologies can allow developing countries to leapfrog generations of telecommunications. Connecting local communities in developing regions to the Internet will have a positive impact on education and their health system. The Internet complements locally available information, improves and accelerates knowledge flows, and can be used to deliver innovative education models to remote areas (Eggers, 2000).

Support should therefore be given to start, maintain, and run telecentres because they perform a primary development function for information and education, which is considered a basic and important human right. telecentres are to information what schools are to education and health centres to health and bodily well being (Etta, 2004).

Telecentres still appear to be a good idea. Market-based mechanisms may be penetrating, but it is questionable that they are sufficient to address social inequities and maximize the potential of ICTs for rural development. While current research hasn't produced any easy-to-follow instructions on how telecentres are done, it has found broad support and validation for the idea amongst rural and other disadvantaged populations. Amongst these communities, access to communication tools is highly valued. However, implementing telecentres successfully in Africa remains a rare art mastered to-date only by a very few skilful social entrepreneurs. Creating access for all through telecentres remains a distant goal and the passage to reach it, a mystery (Balancing Act, 2004). The next section will discuss the research methodology.

RESEARCH METHODOLOGY

In this section, the researchers discuss the choice of methodology that was used in this study. It will also cover issues like sampling, questionnaire administering and data analysis.

How This Study Will Be Conducted

A quantitative research approach has been adopted for this study because the aim of the study is to come up with solutions relevant to the rural people in rural areas. This approach will help in the understanding of rural areas in their context (Ihde, 1977).

The motivation for doing quantitative research, as opposed to qualitative research, comes from the observation that, if there is one thing that distinguishes humans from the natural world, it is our ability to talk! Quantitative research methods are designed to help researchers understand people and the social and cultural contexts within which they live. Kaplan and Maxwell (1994) argue

that the goal of understanding a phenomenon from the point of view of the participants and its particular social and institutional context is an important feature of research. For this study, the need to collect quality data from different people and the fact that reliable results should be found before any telecentre project can be started has necessitated this choice of approach.

The Questionnaire

A questionnaire was designed to accomplish two main objectives: the first one was to maximise the proportion of subjects answering the questionnaire—that is, the response rate; and the second one was to obtain accurate relevant information for the survey. The questions were also divided into personal questions like age and gender, and knowledge questions like “How would you rate your level of computer competency?”

The researchers first explained to respondents that the questionnaire was anonymous and that the information they gave was intended for the research purposes only. A detailed explanation of the purpose of the study was given. The questionnaire was also made available in IsiZulu, as most rural people do not speak English fluently.

Sampling

The research was conducted from a sample of 125 randomly selected rural people residing in a rural area of Emkhambathini (Camperdown) outside Pietermaritzburg. This sample is taken from one district with the population of about 180 people according to municipal records. Respondents were chosen in no particular order to allow diversity in their responses. This was done by visiting them in their homes and in other public places such as the tribal authority offices and clinics. Random sampling was adopted for its ability to allow every member of the community to get an equal opportunity of being selected for participation.

After completion of this process, all questionnaires were analyzed using SPSS and graph plotters to derive possible conclusions from answers given by users. Graphs and charts were used for the purpose of presenting the findings in a user friendly and understandable format. The relationships between the different variables measured will be determined by computing correlations based on the Stockburger (1996) model.

This information and all data gathered from other sources such as popular press articles will lead to the finalization of the research results. The literature review also formed part of the data analysis process. Upon completion of the data analysis, the researchers derived answers to the research questions.

DISCUSSION OF RESULTS

The aim of this section is to provide a detailed explanation on all responses gathered by using questionnaires. The analysis also utilises other existing literature to support (validate) the findings of this research study. One hundred twenty-five questionnaires were distributed to the Emkhambathini community. Of the 125 questionnaires, 123 questionnaires were collected and two questionnaires were never returned to the researcher. Of the 123 questionnaires returned, one was considered unusable, as the respondent had ticked more than one response and in some cases left the response blank. The following analysis is therefore based on the 122 responses that the researcher considers usable. The return rate is therefore 98%.

Fifty-nine percent of the participants were females and this is attributed to the nature of rural life as women are still expected to remain at home and take care of the house and children while men go to the cities to find employment. This is supported by a study conducted by Ryan (2004) in African countries. He argues that old traditions have led men to believe that it is their

duty to be responsible for income generating while women look after children. Lack of employment opportunities in the rural areas is a problem.

Nearly all (97%) of the population studied is African, 2% is coloured, and only 1% is white. The Emkhambathini area is a deep rural area and the researcher could not find people of other races in the area except for those who came to work on government projects. Rural people still live in the ways their forefathers lived. Their need for farming has made them to occupy these rural areas. ITU (2003) states that agriculture is probably the mainstay of the economy in rural areas. It is further cheaper for them to survive outside the cities. They found that about 58% Africans are living in impoverished rural areas of South Africa.

Age of Respondents Who Participation in the Study

Table 1 reflects the age groups of the respondents. The biggest age group is 20 years to 29 years (30%), followed closely by the 0 years to 19 years group (29%). A further explanation of these figures would be the fact that older rural people are mostly uneducated and usually avoid participating in things they perceive to concern education (Etta, 2004). They referred the researchers to their children who attend school.

Table 1. Age distribution

| | Respondents | Percentage |
|--------------|-------------|------------|
| 0-19 | 36 | 29 |
| 20-29 | 36 | 30 |
| 30-39 | 27 | 22 |
| 40-49 | 18 | 15 |
| 50+ | 5 | 4 |

The results show that of the 122 responses gathered, 60 went to secondary school and that 45 respondents had gone to tertiary institutions. The educational level measured was taken as the highest level of education reached which means that it also took into account the people who have dropped out of school. The pass rate at matric level in rural schools is low which has led to rural students not being able to go beyond secondary education. Another problem facing rural students is that tertiary education is expensive for them. Six respondents ignored this question possibly because they had no formal education to select.

Employment

Of the 122 responses, 57 (47%) respondents answered that they were employed. This consists mostly of teachers and people working as unskilled workers (like construction). Epodoi (2002) made a similar finding that more employed people in rural KwaZulu-Natal were engaged in the teaching profession than in any other type of paid employment. In bringing ICTs to this community, people will benefit, as this will provide them with tools to gather new knowledge. Also, the integration of services like youth portals and government information give them the opportunity to access services like internships and skills development initiatives. Telecentres also provide them with the opportunity to learn new skills that they could have not afforded to go to educational centres to learn. They access information to help them start businesses through government grants. All respondents answered this question showing interest in issues of employment.

Table 2. Employment

| | Respondents | Percentage |
|------------|--------------------|-------------------|
| Yes | 57 | 47 |
| No | 65 | 53 |

Only 37% of the respondents have reached tertiary levels of education, which presently is the only level a rural student can learn computing, as rural schools do not offer these facilities. Due to the complexity of computers, most people in Africa will never own a computer (Ryan, 2004). Campbell (1995) states that by their very nature, rural communities do not produce economies of scale that make it less expensive to provide an advanced telecommunications infrastructure, powerful computers, and well developed networks. Etta (2004) agrees that the need for basic literacy, computer skills, and training in the use of ICT applications remains a challenge for rural areas. The low level of computer literacy presents a challenge in the implementation of telecentre projects as it requires that expertise be imported from urban areas, which might increase the cost of implementation. This was also supported by Sayed (2003) who states that because technicians were not obtainable locally many technology projects have failed to realize their goals.

Training to Use the Computer

Of the 25% of respondents who stated that they could use a computer 21% have received formal training at a university, technikon, or college. None of the respondents indicated that they have obtained an IT related Diploma or degree, but stated that they have learned the basics of computing as part of their studies. Others have taken computer courses at private colleges but these institutions are not available in rural areas. The results agree with the statement made by Campbell (1995) which states that in urban areas, single organizations such as large corporations, school systems, and city government can operate systems that are beyond the reach of any single entity in any rural community. Access remains an obstacle to rural participation in the ICT arena. Only three respondents had access to computers at school.

Table 3. Computer literacy level

| | Respondents | Percentage |
|--------------------|-------------|------------|
| Beginner | 35 | 21 |
| Medium | 12 | 10 |
| Expert | 3 | 2 |
| None | 66 | 54 |
| No response | 6 | 5 |

The Level of Computer Literacy

More than 50% of respondents indicated that they are completely illiterate and six respondents ignored this question. Only 41% of the respondents indicated that they have some knowledge of computers. Twenty-one percent specified they their knowledge is limited. Most of them only know word processing and are not able to use tools like the Internet effectively. Rural people have not been able to access these tools because of the disadvantaged background and due to the lack of infrastructure. Benjamin (2000) argues therefore that the legacy of apartheid is as strong in the telecommunications as other parts of life.

Money Available for Computer Training

It appears from Table 4 that rural people think it is important to get a certain level of computer training. Twenty-five percent of the respondents indicated they are prepared to up to R150.00 for their training. These people chose the minimum amount and there are several reasons for this. Firstly, most rural people don't know how much computer training is worth in practice. Adverts usually promise free training with participants required to pay around R75.00 for administrative costs. This has led these rural people to believe that computer training is cheap. Not having enough information on service fees is a concern in the deployment of ICT solutions and the need to grow awareness arises (CINSA, 2004). Secondly, they

Table 4. Money for training

| | Respondents | Percentage |
|----------------------|-------------|------------|
| 100.00-150.00 | 31 | 25 |
| 150.00-250.00 | 24 | 20 |
| 250.00-350.00 | 16 | 13 |
| 350.00+ | 20 | 16 |
| Nothing | 30 | 25 |
| No response | 1 | 10 |

might believe that computer training is for the rich and they don't have enough money to afford it or they do not see its importance in a rural setting. This is supported by Campbell (1995), who states that when payment is involved to access information, people at rural information centres are less likely to have disposable income to spend. They hesitate to use family food, education, and clothing money for information. Twenty percent might pay up to R250.00, which is enough money in many cases to cover essentials of basic computing like word processing, spreadsheets, e-mail, and Internet.

More than 15% of the respondents are prepared to pay more than R350.00 to receive computer training. This number probably consists of people who have already received basic training and feel they need advanced training like programming. They have been exposed to computer training and know it can be an expensive exercise. Telecentres can help them in areas such as education, health care, local democracy, and small business support (Benjamin, 2000). On the other side these people might be coming from the group that has never used a computer before and have always regarded computers as expensive equipment that are only available to the urban communities. This has made them believe it is more expensive to learn anything about computers. This is an area that must be addressed in the establishment of telecentres in rural areas. There is a need to develop subsidised services and group rates (e.g., for women, students, or members) (Etta, 2004).

The last group of respondents is not willing to pay anything for training. Their reasons can range from the fact that the unemployment rate in rural areas is very high and people do not have money to use on training. Others are old people who see no value in learning new tools like computing. There is also a belief that telecentres are for the elite educated (Etta, 2004).

The results confirm the fact that rural people are falling behind in the advances in technology. Only nine respondents own a computer at home indicating that rural people do not know about computers or cannot afford computers. Ryan (2004) agrees that most people in Africa will never own a computer in their lifetimes. Telecentres provide a solution to introduce them to the information society and bridge the digital divide and will enable the community to share resources and information. This will allow the people who already have a certain understanding of computers to help the community members who do not know how to use computers. Rural people and organizations must be organized to work together and pool resources and demand (Campbell, 1995). Telecentres also provide an alternative to buying a computer and refrain from spending maintenance costs allowing this to become the responsibility of the centre authorities. Ninety percent of the respondents would like to own a computer. This figure corresponds to the previous discussion of people who do not have a computer at home. People show an interest in owning their own computers and believe that having computers will improve their standard of life in terms of skills. It enables them to access the Internet. They want to use the Internet for job searching and learning about opportunities on the Internet. It shows they understand that ICT are a condition for freedom in the modern world (Eggers, 2000).

Amount of Money to Spend to Own a Computer

A number of respondents are prepared to pay amounts above R4000.00 to buy computers. This confirms that some rural people understand the value of computers and the contribution they have in development. More than 85% of the respondents are prepared to buy computers for their personal use. Computers have the potential to help leapfrog the development process and empower communities (Epodoi, 2002).

Lack of infrastructure has been the biggest threat to the implementation of telecentres in rural areas. Nearly 60% of the respondents do not have an alternative place to access computers. This number indicates that rural people are still living outside the information society. Telecommunications connectivity in developing countries is usually available only within the capital and in major centres. Yet the majority of the population lives outside these cities (Ryan, 2004).

To find out the kind of alternative places available to this community the researchers asked them to explain where they can alternatively access computers. Nearly 40% responded to the question.

Most respondents only use computers at work (Sayed, 2003). Second largest is that of users at a local school with 17 responses. The people who have access to a computer at the local school are

Table 5. Monetary value spent on PCs

| | Respondents | Percentage |
|------------------------|--------------------|-------------------|
| 500.00-1000.00 | 28 | 23 |
| 1001.00-2000.00 | 15 | 12 |
| 2001.00-4000.00 | 21 | 17 |
| 4000.00+ | 40 | 33 |
| No response | 18 | 15 |

Table 6. Access to PC

| | Respondents | Percentage |
|----------------|-------------|------------|
| Local school | 17 | 14 |
| Public library | 3 | 2 |
| Internet café | 5 | 4 |
| At work | 19 | 16 |
| Other | 5 | 4 |
| No response | 73 | 60 |

teachers and other people doing administrative work at these schools. If the schools can be used in the establishment of telecentres, more people will be able to access computers. This view was supported by Benjamin (2000) who proposes that existing institutions be used to establish telecentres. In the Northern Province, a secondary school has been used to establish a telecentre and they are control of this facility (Ryan, 2004). Matsepe-Casaburi (2003) made a similar proposal about the use of normal community institutions to speed ICT implementation in rural areas.

The majority of the people do not have an alternative place to access computers, which confirms that the alternative places previously mentioned are not available to the whole community. Sayed (2003) argues that there are two views in the public about telecentres and ICTs in general. In this community of Emkhambathini the optimistic view is that the establishment of a community computer centre will bring advantages to the community. It will bring development and open up opportunities that never existed before. This is particularly encouraging to the researchers as it indicates community readiness for ICT implementation. According to CINSAs (2004), establishing a shared vision around measurable goals is an important part of the implementation process. Fuchs (2000) agrees that the first step is often to demonstrate how the facilities in a telecentres can be made to work for community. In this community, this task looks simpler as most people support the establishment of a telecentre.

The responsibility of who will finance community initiatives like computer centres has been a key theme in the debate around telecentres (Benjamin, 2000). The majority of the people (84%) thought it is the government’s responsibility to build community computer centres. This was influenced by the background that rural people come from, which has made them dependent on the government for their needs. These people often think the government is the only institution that can afford these services. Their view is supported by Fuchs (1998) who argues for public funding of centres just like the funding given to schools and public libraries. About 10% of the respondents suggested that business people are the ones who should finance this initiative. Although there are no big businesses in the rural areas, the new movement of popular government officials to the business sector has made rural people to think these people are rich and can finance any project in the community. Benjamin (2000) also supports that telecentres must be run by profit-focused organizations to encourage quality service.

Use of the Computer Centre

Responses were collected into four categories. The first was community empowerment where 30% of the respondents indicated that they would use the computer centre to teach youth life-skills and starting community projects. The projects mentioned ranged from HIV/AIDS awareness, adult basic education, and youth empowerment. This can go a long way in improving lives and governance in the rural community (Eggers, 2000)

Table 7. Uses of telecentres

| | Respondents | Percentage |
|-----------------------|-------------|------------|
| Community empowerment | 37 | 30 |
| Computing business | 9 | 7 |
| Education | 53 | 44 |
| Internet and e-mail | 13 | 11 |
| No response | 10 | 8 |

Only nine respondents wanted to start their own businesses in the computer centre (e.g., typing assignments and curriculum vitas). Some respondents already had businesses and believe the telecentre would give them added advantages. Also, access to government information like business registration records and tax records will be of benefit to small rural businesspeople. More than 40% of the respondents view the establishment of the computer centre as an opportunity for them to improve their education, learn skills like computer literacy skills, e-mailing, and also to take courses online. ICTs are known to bring about distance shrinking possibilities (Campbell, 1995). The computer centre is therefore seen as a tool to promote information literacy and provide access to information.

Correlation Between Gender and Employment

The correlation between gender and employment in the community was calculated and reflects that more males are employed than are females. Sixty percent of the males in the study are employed. In Table 8a and 8b, the correlation between gender and employment is presented. The correlation is -0.122 indicating a weak negative correlation. The researchers find that gender and employment are independent of each other. This means that whether a person is male or female that will not influence his or her chances of employment. Gender equality is an important issue in the establishment of telecentres as women have needs that are different from males (Campbell, 1995).

Table 8. (a) Gender and employment, (b) correlation between gender and employment

| | Yes | No |
|--------|-----|----|
| Female | 30 | 42 |
| Male | 27 | 23 |

(a)

| | | Gender | PC Usage |
|----------|---------------------|--------|----------|
| Gender | Pearson Correlation | 1 | -.011 |
| | Sig. (2-tailed) | . | .902 |
| | N | 122 | 122 |
| PC Usage | Pearson Correlation | -.011 | 1 |
| | Sig. (2-tailed) | .902 | . |
| | N | 122 | 122 |

(b)

Table 9. Gender and the ability to use computers, (b) correlation between gender and the ability to use computers

| | Yes | No |
|--------|-----|----|
| Female | 18 | 54 |
| Male | 13 | 37 |

(a)

| | | Gender | PC Usage |
|----------|---------------------|--------|----------|
| Gender | Pearson Correlation | 1 | -.011 |
| | Sig. (2-tailed) | . | .902 |
| | N | 122 | 122 |
| PC Usage | Pearson Correlation | -.011 | 1 |
| | Sig. (2-tailed) | .902 | . |
| | N | 122 | 122 |

(b)

As a result, women find themselves marginalised in the implementation of ICTs.

Correlation Between Gender and the Ability to Use Computers

Table 9a shows that more males can use computers as compared to females. Table 9b reflects a correlation of -0.011 indicating a weak negative correlation between the variables. This correlation is very close to 0.00 and indicates that there is no linear dependence between a person's gender and the ability to use a computer. It implies anyone can learn to use a computer and gender plays no part in determining that. For this study this information is necessary as it tells the researchers that the services must be designed to the same standards for both males and females. It shows that women also have the potential to learn computers. In other countries, it has been discovered that fewer women use telecentres than men (Etta, 2004).

Correlation Between Gender and Educational Level

Table 10a indicates that females are more educated than males. This might be as a result of the fact that males are more likely to drop out of school and seek employment to support their families while females continue with their studies. Table

10b shows that the correlation between these variables is -0.03 which is a weak negative correlation. The variables are not dependent and an increase on one variable does not necessary imply a decrease on the other or vice-versa. Education plays an important role in the establishment of telecentres as the services must be developed to meet the educational level of the public. The fact that females are more educated as compared to males indicates that females will be more suitable to lead the development of a telecentre. It will also allow them to play a constructive role in the process leading to the establishment so that their needs are taken care of (Etta, 2004).

Correlation Between Education and Computer Literacy

In order to determine whether the level of education of respondents had any influence on whether they have learned a certain level of computing, a correlation was calculated between the two variables. Table 11a shows that people who have tertiary education are more computer literate followed by those who have secondary education. The study had found that most people have received formal training in computers and also the number of people who had access to a computer at work was larger.

Table 10. (a) Gender and the level of education, (b) correlation between gender and the level of education

| | Primary | Secondary | Tertiary | Other | No response |
|---------------|---------|-----------|----------|-------|-------------|
| Female | 5 | 34 | 30 | | 3 |
| Male | 5 | 26 | 15 | 1 | 3 |

(a)

| | | Gender | Education |
|------------------|---------------------|--------|-----------|
| Gender | Pearson Correlation | 1 | -.030 |
| | Sig. (2-tailed) | . | .741 |
| | N | 122 | 122 |
| Education | Pearson Correlation | -.030 | 1 |
| | Sig. (2-tailed) | .741 | . |
| | N | 122 | 122 |

(b)

The Nearest Some of Us Will Ever Come to Information Heaven

Table 11. (a) Education and the computer literacy, (b) correlation between education and computer literacy

| | Beginner | Medium | Expert | None | No response |
|--------------------|----------|--------|--------|------|-------------|
| Primary | 2 | 1 | | 5 | 2 |
| Secondary | 17 | | | 41 | 2 |
| Tertiary | 15 | 10 | 3 | 17 | |
| Other | | | | 1 | |
| No response | 1 | 1 | | 2 | 2 |

(a)

| | | Education | Computer Literacy |
|--------------------------|---------------------|-----------|-------------------|
| Education | Pearson Correlation | 1 | -.097 |
| | Sig. (2-tailed) | . | .287 |
| | N | 122 | 122 |
| Computer Literacy | Pearson Correlation | -.097 | 1 |
| | Sig. (2-tailed) | .287 | . |
| | N | 122 | 122 |

(b)

Table 12. (a) Gender and willingness to pay for training, (b) correlation between gender and the willingness to pay for computer training

| | 100-150 | 150-250 | 250-350 | 350+ | Nothing | No response |
|---------------|---------|---------|---------|------|---------|-------------|
| Female | 19 | 10 | 10 | 14 | 18 | 1 |
| Male | 12 | 14 | 6 | 6 | 12 | |

(a)

| | | Gender | Pay for Training |
|-------------------------|---------------------|--------|------------------|
| Gender | Pearson Correlation | 1 | -.072 |
| | Sig. (2-tailed) | . | .429 |
| | N | 122 | 122 |
| Pay For Training | Pearson Correlation | -.072 | 1 |
| | Sig. (2-tailed) | .429 | . |
| | N | 122 | 122 |

(b)

Table 11b shows the correlation between the two variables to be -0.097. This weak negative correlation indicates the absence of a linear relationship between the two variables. This supports the researchers claim that people might have taken computer courses at institutions that do not require any level of prior learning like matric. This result is a reflection of the availability of people who can be trained to work as trainers and managers in the telecentre. Sayed (2003) notes that technology projects have failed because technicians were unobtainable locally and staff were not sufficiently trained to make the most of the technology.

Correlation Between Gender and the Willingness to Pay for Computer Training

Table 12a shows that females are more willing to pay for computer training. The reason for this can be that males are responsible for supporting the family and feel that the money they have must not be diverted to buying things like computers. The study also found that more males are employed as compared to females. Table 12b shows a weak negative correlation of -0.072, which implies that there is no significant correlation between the

measured variables. From this table it can be said that the gender of respondents has no influence on the decision to pay for computer training but factors like employment and level of income have an indirect influence on this decision.

Correlation Between Gender and Ownership of a Computer

The researchers wanted to know if there is any relationship between gender and the ownership of computers. Using Table 13a and 13b, it appears that only five females and four males have computers at home. Although more males do not own computers, the difference is too small to suggest that females have more access to computers than males. The correlation coefficient is -0.064, the result indicates that for both males and females the number of people owning computers in this rural area is very low. This further indicates that more training will be required in order to get the people used to computers. Fuchs (2000) agrees that the first step is training, to demonstrate how the equipment and facilities available in a telecentre can be made to work for the communities where they are located.

Correlation Between Gender and View on the Establishment of a Computer Centre

Table 14a shows that the majority of male and female respondents are in support of the establishment of a computer centre for their community. Table 14b shows that the relationship between the two variables has a correlation of only 0.001, a weak positive correlation. This coefficient is too close to 0.0 to suggest any linear dependence between the variables. This means that whether the respondent was a female or a male they all felt a computer centre would improve the conditions of life in the community. This is because all rural people suffer the same problems of underdevelopment regardless of their gender. The result means that the whole rural community will welcome the establishment of a computer centre which is very important in order for the project to be sustainable (Sayed, 2003).

Correlation Between Education and Employment

Table 15a is a reflection that more than 70% of the people with tertiary education are employed,

Table 13. (a) Gender and ownership of a computer, (b) correlation between gender and ownership of a computer

| | Yes | No | No response |
|---------------|-----|----|-------------|
| Female | 5 | 65 | 2 |
| Male | 4 | 46 | |

(a)

| | | Gender | Own Computer |
|---------------------|---------------------|--------|--------------|
| Gender | Pearson Correlation | 1 | -.064 |
| | Sig. (2-tailed) | . | .484 |
| | N | 122 | 122 |
| Own Computer | Pearson Correlation | -.064 | 1 |
| | Sig. (2-tailed) | .484 | . |
| | N | 122 | 122 |

(b)

Table 14. (a) Gender and the view on the establishment of a computer centre, (b) correlation between gender and a person's view on the establishment of a computer centre

| | Yes | No | No response |
|---------------|-----|----|-------------|
| Female | 64 | 6 | 2 |
| Male | 44 | 5 | 1 |

(a)

| | | Gender | Computer Centre |
|------------------------|---------------------|--------|-----------------|
| Gender | Pearson Correlation | 1 | .001 |
| | Sig. (2-tailed) | . | .988 |
| | N | 122 | 122 |
| Computer Centre | Pearson Correlation | .001 | 1 |
| | Sig. (2-tailed) | .988 | . |
| | N | 122 | 122 |

(b)

Table 15. (a) Education and employment, (b) correlation between education and employment

| | Yes | No |
|--------------------|-----|----|
| Primary | 4 | 6 |
| Secondary | 16 | 44 |
| Tertiary | 32 | 13 |
| Other | 1 | |
| No response | 4 | 2 |

(a)

| | | Education | Employed |
|------------------|---------------------|-----------|----------|
| Education | Pearson Correlation | 1 | -.315** |
| | Sig. (2-tailed) | . | .000 |
| | N | 122 | 122 |
| Employed | Pearson Correlation | -.315** | 1 |
| | Sig. (2-tailed) | .000 | . |
| | N | 122 | 122 |

Note: ** Correlation is significant at the 0.01 level (2-tailed)

(b)

while 26% with secondary education are employed. Table 15b shows a significant correlation of -0.315. This means that the services offered at the telecentre must focus on improving the education level of the people, which will in turn improve their chances of getting employment or starting their businesses (Eggers, 2000).

Employment and Who Should Finance Computer Centre Projects

In this study, the researchers looked at a model for community computer centres. This is important in determining whether computer centres should be economically self-sufficient, or rely on external funding of one kind or another (Benjamin, 2000).

Table 16a shows the relationship between people's employment status and their view on

who should take responsibility to establish the computer centre. Among the people who indicated they were employed, 75% states that it is the government's responsibility to finance the establishment of a computer centre. These people take the government as the only source of finance for developmental projects like schools and clinics. They believe that this is part of government initiatives the RDP, GEAR and the Black Economic empowerment. Although these people are employed, they are not prepared to finance this project as the community. Nearly 90% of the unemployed people also see it as the government's responsibility to provide finance for the project. Their opinion is shared by Fuchs (1998) who argues for public funding of centres, as a public facility similar to libraries and schools. It is worth noting that the South African government passed the Telecommunications Act of 1996 to speed

Table 16. (a) Employment and views on who should finance the computer centre, (b) correlation between employment and views on who should finance the computer centre

| | The Community | Businesses | Government | No response |
|-----|---------------|------------|------------|-------------|
| Yes | 2 | 12 | 43 | |
| No | 2 | 2 | 58 | 3 |

(a)

up the supply of ICTs to rural areas. More than 20% of the employed people stated that self-sustaining entrepreneurs must finance this project. The reason that can be given is that these people are working for big businesses and have been exposed to the way these projects are handled. A good example is that of the Mogalakwena HP i-Community (BuaNews, 2003)

Table 16b displays the correlations between the variables. A significant positive correlation coefficient of 0.236 was found. Although a positive correlation exists, it is not strong enough to suggest that there is linear dependency. There are obviously other factors that might have led to people's opinion on the issue. The past political system left rural areas out of the developments in the country and they now feel that because there is a new system, the government must correct past imbalances.

CONCLUSION

In this section, a discussion of the results collected from the respondents was presented by means of tables and charts. In examining the results of this study, it was found that the majority of the population of Emkhambathini is characterised by high illiteracy rate, high unemployment, high level of male absenteeism, and poverty. The results indi-

| | | Employed | Financier |
|-----------|---------------------|----------|-----------|
| Employed | Pearson Correlation | 1 | .236** |
| | Sig. (2-tailed) | . | .009 |
| | N | 122 | 122 |
| Financier | Pearson Correlation | .236** | 1 |
| | Sig. (2-tailed) | .009 | . |
| | N | 122 | 122 |

Note: ** Correlation is significant at the 0.01 level (2-tailed)

(b)

cate a negative level of readiness in the community for ICT initiatives. More programmes aimed at the reduction of poverty and unemployment must be started to address the problems faced by rural people in accessing ICTs. Government and private sector programmes must also be focused in the provision of necessary infrastructure like electricity, water and roads as these might hinder the supply of ICTs to rural areas. Festa (2003) made similar remarks in his study.

CONCLUSION AND RECOMMENDATIONS

Information access in the lives of rural people around the world has become important and this study focused on their use for rural development. The advancements in technology must be used to help rural communities take advantage of the digital opportunities. The need to bridge the digital divide between the urban and rural communities has encouraged many researchers to investigate the implementation of ICTs in rural communities. This study makes a contribution by investigating the establishment of a computer centre for a rural community of Emkhambathini (Camperdown).

SUMMARY OF THE STUDY

The lack of proper infrastructure and finance in rural areas has prevented rural people from accessing the new opportunities that come with ICTs. The high costs of computers, low levels of education, unemployment, and poverty are some of the many things affecting rural development. This has made the government and the private sector start initiatives aimed at speeding rural development. The communities now have the task of ensuring that these initiatives contribute to their development by participating in their planning and implementation.

The study was carried out in the rural area of Emkhambathini to make a contribution in the resolving of these problems. The researchers randomly distributed 125 questionnaires to the community. The questionnaires were then collected and analysed using SPSS, which gave the results that were discussed. The findings are based on these results.

The Main Findings

The study wanted to investigate the feasibility of establishing a community telecentre for a rural community and the overall result of this study found to be that the centre can be established in this community. The area studied had access to electricity, which plays an important role in the implementation of ICTs in rural areas.

The study also wanted to establish if any rural people have computer knowledge and what they would best use the computers for. The finding was that the level of computer literacy in the community was very low in that only 31 respondents knew how to use computers. This indicates that the project must focus on the training of the community to use computers and other services that do not require computer knowledge must be offered. These projects include a government information centre where leaflets can be given to the community to read. This will improve gov-

ernment understanding in the community. The community was interested in using the telecentre for educational purposes. These include distance learning, adult basic education, and computer studies. The community computer centre must also address issues of community empowerment like life skills, youth development, and small business development. This can be achieved by the provision of information to the community and connecting them to government departments and other organisations offering help to small businesses.

Business Model

The study focused on the question of a business model that should be adopted for telecentres. The popular view on the business model for telecentres is that the government in partnership with the private sector must be responsible for establishing telecentres. For this study, the researchers find that the community of Emkhambathini would like the government to take responsibility for telecentres. Taking into account that this rural community is poor and cannot afford the costs of running a telecentre, the researcher agrees with this view. The fact that more than 80% of the community stated that the government must provide support similar to that given to public schools and libraries helped to make this conclusion.

Policy

Realising the importance of the role played by policy makers in the establishment of community computer centres, the researcher reviewed literature by other authors in the theory. This study has found that South Africa already has a policy on telecentres which is the Telecommunications Act of 1996 (this act specifies guidelines on the how to establish telecentres). The reconstruction and development programme also addressed the issue of telecentres but unfortunately, both of these policies still fail to achieve their goals because

of a lack of funds and information on the part of the local governments who are the ones to drive these initiatives. The researchers conclude that local councilors who are in daily contact with the people do not understand the different policy documents of the government.

Government involvement must also contribute to other projects like electricity, water, and sanitation, as these are important infrastructural requirements for telecentres. This means that the South African government must start drafting other policy documents to address the rural telecentre situation.

These policies must consider the following:

1. The role of the private sector.
2. What kind of software and hardware will be used.
3. How will the running costs be recovered?

Services

The research found that people would most use the telecentre for educational purposes. It was discovered that the level of education in the community was low and people wanted to improve their education and acquire more knowledge through the telecentre. Services that are aimed at improving the conditions of living for the community must be provided. These include Telehealth, distance education facilities, youth portals to house organisations like Umsobomvu Youth Fund, and the Youth Commission for the people to get information that can help address the high levels of unemployment and illiteracy. The telecentre should also be used to provide information for small businesses as this is an alternative to unemployment. For the success of these services, the Internet plays a crucial role to provide a platform for communication and information sharing. It must also be used to help schoolchildren in their assignments, as there is no local library in the community. This will improve the quality of assignments the students complete,

as they normally have limited information for this purpose.

Training and Skills

In any rural community, computer literacy levels are low because of limited resources to learn these skills. Training is therefore needed in this community, as 75% of the community cannot use computers. The study found that the rural community of Emkhambathini would need training before the telecentre project can succeed.

Infrastructure

The findings supported the fact that the infrastructure in this community is not as bad as in most other communities studied before. The community already has access to electricity, water, and tar roads. Although only a few individuals have access to their own telephone lines, the community has access to phone shops, which means providing Internet is possible.

Research Questions

Why Does the South African Government Take Such a Long Time to Create Computer Centres?

According to the findings of this study, the South African government does have a programme at the national level to create computer centres but slow delivery shows the lack of commitment by the provincial and local governments. This can be a result of a lack of information and funds for these projects. The rural communities are facing other problems such as limited electricity, clean water, health facilities, education facilities, and limited tar roads. The local governments prioritise these neglecting the telecentre projects, which are viewed as a luxury.

How Will the Community Benefit from Such a Computer Centre?

As discussed previously, the community will use the computer centre to improve their education and acquire new knowledge. Information about child nutrition, agriculture and tertiary institutions application procedures will be provided by use of leaflets or through the Internet. For a rural community this information is important as they do not have access to experts like the urban communities. For local business, the computer centre will enable them to obtain information on stock prices and free business training on the Internet. The government departments will find a place to make available information about grants, bursaries and other useful services.

Computer literacy in the community will be improved through the provision of computer classes at cheaper rates. This will also help in creating employment opportunities for the local trainers who have an understanding of computers.

What Other Benefits are There for the Community?

The telecentre can be used as an incubator for small business and youth will have a chance to form co-operatives and take advantage of the governments youth empowerment programme. For teachers and health workers in the community this centre will give them a chance to improve their knowledge, which will in turn ensure that the quality of service is kept in line with developments in their fields.

Can This Help in Other Terrains?

The study did not only focus on the use of computers in the telecentre but also looked at other fields that might benefit from the telecentre. Apart from the fields of education, business, and health,

which have been discussed in the previous pages, the telecentre can be used by government to train municipal councilors and staff on local government policies and update them on the policies being adopted at national level. This will help speed government service delivery and address the slow creation of computer centres as the information will easily get to the local government. Training on computer repairs, call centres, and science and technology are other terrains that will benefit.

RECOMMENDATIONS

Training

The researchers recommend that computer skills training be incorporated into the normal school curriculum to address the problem of high illiteracy in the community. The telecentre must, as its first priority, offer training to the community at low rates so that they are able to use the services offered effectively.

Infrastructure

As rural schools do not have modern facilities to house a computer centre, the telecentre must be built as a separate building that is reachable and accessible to the whole community. This involves taking into consideration disabled people, children, and female needs.

Government Involvement

The government must, in addition to drafting policy documents, set up a formal committee to lead the establishment of telecentres. The committee must be allocated a budget similar to that given to other departments for this purpose. The government must also embark on a fundraising programme to attract big businesses to sponsor telecentres. This has been achieved in the

Mogalakwena Hewlett i-Community project. Government supported companies like Telkom, Transnet, and others must also be encouraged to sponsor telecentres.

Staff Requirements

The researcher recommends that the governments SETA learnership project be used to recruit information technology graduates to work at the telecentres while they receive experiential training. This will decrease staff costs and help give unemployed graduates work experience, which will help them in applying for employment.

CONCLUSION

The advantages that come with the use of ICTs in the lives of ordinary people have started to show in South Africa. Although the South African government is determined to improve the lives of rural people, more support is still needed from the communities, the private sector, and international investors to address the imbalances of the past.

This research study has shown that the rural communities are disadvantaged in terms of accessing technology and information. The digital divide that exists between the urban and rural communities has played a contributory factor in deepening the crisis of poverty, malnutrition, high unemployment, high illiteracy, and other social ills in these communities. The lack of information can be easily addressed through the establishment of telecentres that will provide a single point of information and its sharing. It has been shown that information is an important part of a human's life and its unavailability isolates one from the progresses in real life. Telecentres are possibly a cheaper way of speeding rural development. It is the conclusion of this study that it is possible to establish a telecentre for the rural community of Emkhambathini.

REFERENCES

- Balancing Act. (2004). *The road to telecentre success remains mysterious*. Retrieved May 11, 2004, from <http://www.cinsa.info/portal>
- Benjamin, P. (2000). *Telecentre 2000*. Retrieved May 14, 2004, from www.communitysa.org.za/docs/intafrica.doc
- BuaNews. (2003). *Limpompo's rural i-Community*. Retrieved September 28, 2004, from http://www.southafrica.info/pls/procs/iac.page?p_t1=690&p_t2=1823&p_t3=2717&p...
- Campbell, C. (1995). *Community technology centres: Exploring a tool for rural community development*. Retrieved July 2, 2004, from http://www-unix.oit.umass.edu/~ruralma/CTC_ToC.html
- Castells, M. (1998). *The information age 3: End of millennium*. Retrieved September 28, 2004, from http://www.communitysa.org.za/africaict/report_intro.htm
- Chapman, R., & Slaymaker, T. (2003). *Beyond the digital divide: Harnessing ICTs for rural development*. Retrieved March 29, 2004, from <http://www.cinsa.info/portal/index.php?option=articles&task=viewarticle&artid=54#>
- CINSA. (2004). *Lessons on sustainability from Alaskan villages*. Retrieved May 4, 2004, from <http://www.cinsa.info/portal/index2.php?option=content&task=view&id=129&pop=1&pag>
- Eggers, I. (2000). *Mali's centres of information*. Retrieved May 4, 2004, from http://www.findarticles.com/p/articles/mi_m1309/is_2_37/ai_66579838
- Epodoi, R. (2002). *Bridging the gender gap: Women in the information society*. Retrieved March 20, 2004, from http://www.findarticles.com/p/articles/mi_m1309/is_4_40/ai_114007090

The Nearest Some of Us Will Ever Come to Information Heaven

- Etta, F. (2004). *The experience with community telecentres*. Retrieved September 28, 2004, from <http://www.acacia.org.za/telecentres.htm>
- Festa. (2003). *South Africa embraces open source*. Retrieved September 28, 2004, from <http://www.zdnet.co.uk/print/?TYPE=story&AT=2129893-39020381t-10000002c>
- Fuchs, R. (1998). *Literature review for the telecentre 2000 study*. Retrieved June 28, 2004, from <http://www.communitysa.org.za/T2000LitRev.htm>
- Fuchs, R. (2000). *If you have a lemon make lemonade*. Retrieved August 4, 2004, from <http://web.ask.com / www.idrc.org.sg/en/ev-8785-201...>
- Gaster, P. (2003). *Piloting telecentres in Mozambique: Learning the hard-won lessons*. Retrieved March 29, 2004, from <http://www.cinsa.info/portal/index.php?option=articles&task=viewarticle&artid=111>
- Hafkin, N. J., Odame, H. H. (2002). *Gender, ICTs, and agriculture*. Retrieved March 29, 2004, from <http://www.cinsa.info/portal/index.php?option=articles&task=viewarticle&artid=16#>
- Ihde, D. (1977). *Experimental phenomenology: An introduction*. New York: State University of New York.
- ITU. (2003). *New technologies for rural applications*. Retrieved August 15, 2004, from <http://www.eldis.org/static/DOC10547.htm>
- ITU. (2004). *New technologies for rural applications*. Retrieved March 16, 2004, from <http://www.cinsa.info/portal/index.php?option=articles&task=viewarticle&artid=45>
- Kaplan, B., & Maxwell, J. (1994). *Qualitative research in information systems*. Retrieved October 14, 2004, from <http://www.qual.auckland.ac.nz/>
- Matsepe-Casaburi, I. (2003). *South African community telecentres face problems*. Retrieved September 28, 2004, from <http://www.info.gov.za/speeches/>
- Moseki, M. (2003). *South Africa launches open source centre*. Retrieved September 28, 2004, from http://www.southafrica.info/pls/procs/iac.page?p_t1=690&p_t2=1823&p_t3=3376&p...
- Parkinson, S. (2004). *Open source and public access*. Retrieved September 27, 2004, from <http://www.cinsa.info>
- Richardson, D. (1998). *Rural telecentre in a box*. Retrieved August 24, 2004, from <http://www.telecommons.com/uploaddocuments/Telecentreinbox.htm>
- Romberg, D. (1999). *Wireless links remote regions—satellite technology brings wireless communications to Newfoundland: Technology Information*. Retrieved May 20, 2004, from http://www.findarticles.com/p/articles/mi_m0CGC/is_18_25/ai_54593952
- Ryan, M. (2004). *Computer centre lets impoverished village take first step into digital era*. Retrieved August 20, 2004, from <http://www.govtech.net/magazine/gt/2000/sept/poverty/computercenter.php>
- Sayed, Y. (2003). *Missing the connection? Using ICTs in education*. Retrieved June 15, 2004, from <http://www.id21.org/insights-ed01/insights-issued01-art001.html>
- Stockburger, D. (1996). *Introductory statistics: Concepts, models, and applications*. Southwest Missouri State University Sehrt.

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 307-341, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.3

Establishing a “Knowledge Network” of Local and Regional Development Subjects

Olexandr Molodtsov

National Academy of Public Administration, Ukraine

INTRODUCTION

Efficiency of collective action, aimed at social development, in many ways depends on the level of being well-informed and the intensiveness of knowledge sharing between the social agents, which are the professional corporate communities in this domain. Modern information technologies allow influencing the social development by establishing of Internet networks for geographically separated social agents who collaborate on the basis of “horizontal” communications. From this point of view, the Internet can be considered a catalyst of inter-group communication and an instrument for decentralized projection of social development. There has been no sociological research conducted in Ukraine to find out the ef-

ficiency level of cooperation between social agents using an Internet network to share information and knowledge concerning local and regional development. But even a general overview of the Ukrainian Internet shows an unsatisfactory state of such cooperation. Indirectly, this is proved by the data regarding the Internet content for 2002, which demonstrates that scientific research and educational organizations represented only 4.4% of the Internet content (Bryzhko, , Tsymbaliuk, Orekhov, & Galchenko, 2002, p. 101). We have all the grounds to state that computer databases existing in Ukraine do not meet the requirements of the local and regional development. Further, they do not contribute sufficiently to the professional growth and development of the professional communities’ ethical standards.

In the present situation, the environment for virtual information is one of the effective mechanisms enabling global changes on all levels of social modernization—international, national, regional, and local. As a result, this mechanism has to become an element of special public information policy and a key factor of strategy-building activity of social agents who act in the sphere of local and regional development. Thus it is suggested that the following elements of information processes need to be revisited:

- a. information (knowledge);
- b. type of communication, setting the modes of behavior in the information space; and
- c. type of social agents (participants) that form the value and goal structure of the information space.

These components in whole should give us an answer about the possibility of effective information interaction in the sphere of local and regional development in general but particularly relevant to the Ukraine.

As one of the resources, information is also an object of separation, and in this sense it is an object of information policy. In the purely administrative aspect, this last concept for the most part is interpreted as trends and methods of independent institutional objects—a state, its individual agencies, bodies of local self-governance, organizations, and institutions dealing with information collection, dissemination, and storage. The purely administrative context of information policy, in spite of wide variety of tasks that should be accomplished in the course of this activity, consists of the quantitative monitoring of information flow. Judgment about information openness and closeness of an information policy object are made on the basis of quantitative assessment of information flow index. In this perspective, information stands as an object of information policy. This orientation of the government authority’s

activity has achieved some success, which is demonstrated in particular by the establishment and functioning of the unified Government Web Portal and the setting into operation of the new communication trunk and zonal fiber-optical lines. The issue of information “electronic governance” systems and their implementation into public administration (E-Government) is also being developed (Klimenko & Litvinov, 2003), as well as variants aimed at broadening the possibilities of public access to the Internet. Further, the number of local self-governance bodies using the Internet for managerial purposes and for ensuring transparency of their work is gradually extending (Baiev, 2003). This gives us the ground to assert that the State of Ukraine, in the purely technical perspective, has the primary characteristics of an Information Society. The technological basis available allows a large information array of the activities of central, regional and local authorities, to become available for a wide circle of societal users.

However, the situation with regard to the control functions over the effectiveness of information is different. This task is a more difficult one for the subject of information policy. A useful information policy has to implement its policy in such a way that allows particular information to reach an appointed target group and results in an expected effect. In such circumstance, the task group (social agent) becomes an object of information activity, while information develops a meaning of an administration influence tool. From that standpoint, information should be viewed as a complex of information measures, which are aimed at changing behavior and attitude towards the knowledge of certain social groups. These measures create possibilities of extending the sphere of power of the state through methods of civil influence that, according to the Declaration of the World Summit on the Information Society, also include information methods (The World Summit on the Information Society, 10-12 December 2003, Ge-

neva, Switzerland, <http://www.e-ukraine.com.ua/viewnews/press/31>). The efficiency of such work can't be evaluated quantitatively, but only on the basis of the successful functioning of such social agents (corporate professional groups) on social development. This orientation (task) of information policy becomes especially significant when the matter concerns social agents, whose activity takes place outside the bounds of administrative subordination to the public authorities. In this case the concept of authority influence (Gavrilov, 2003) can be used, meaning that activity of government agencies is aimed at the dynamics of their relations with social agents, where the elements of public administration are absent.

CONFIGURATION OF INFORMATION AND COMMUNICATION SYSTEM OF LOCAL AND REGIONAL DEVELOPMENT

In every stage of social development, a state has to determine and regulate at a legislative level those societal elements and interrelations which serve its strategic goals (Atamanchuk, 2003). This state function becomes more important under conditions of market-driven economies in a pluralistic society. If social agents are not administratively subject to the state, only legislative and information tools through administrative influence can be used. Because of this, they (objects of information influence) will maintain their vital social activity, at the same time serving the purposes of social development. At the declarative level, the Ukraine government agency has already defined the subjects of local and regional development. Associations of local self-government bodies and their unions, as well as agencies of local and regional development are recognized as institutional subjects. The regulation of the legal status of associations and other voluntary unions of local self-government bodies is outlined in the

bill, “On local self-governance in Ukraine.” The government has also prepared a draft Law of Ukraine “On the principles of regional development stimulation,” which provides for creation of the Regional Development Agencies Network.

This conception of regional policy and the above-mentioned bills override any other structures, which one way or another are the agencies of local and regional development. Also included in this list are state regional training, retraining and excellence centers for managers of local government institutions and municipal companies, non-governmental training institutions¹, scientific institutions—academic institutes, universities, branch research institutes, state research organizations that execute the orders of budget and private organizations, “brain centers”—non-governmental research institutions specializing in the sphere of local self-governance; consulting firms and other similar institutions; information and analytical editions covering the matters of local and regional development. The potential of individual social agents should not be disregarded and these include—employees of local public institutions, working in the information and analytical divisions, subdivisions of local development; a certain part of state employees, who create information products concerning local and regional development². Some experts working in this field can act effectively expressing interests of larger elements of development infrastructure.

The groups listed above represent the configuration of an information and communication system of local and regional development, which is now spontaneously forming on the Internet without any external coordinating influence. This effort allows the observation of the processes of growth and self-organization of this system, which promotes engaging people and organizations into information bonds of various societal levels. Some of the agents of local and regional development are already involved on the Internet and in the analytical centers networks of Ukraine

in particular (Analytical Centers of Ukraine Network, <http://www.intellect.org>). This process lacks systematic character and coordination from the point of view of the creation of information resources. Most of the organizations involved function separately one from another. There is not enough information about their particular specializations and the market for consulting services. They don't have a clear idea of the experience and work results of each other, while institutions of local government receive scanty information about existence and consulting possibilities from many of them. Hence the unique experiences, document packages, knowledge, which are formed by every agent, remain untapped for the purposes of cohesive social development. Thus the conditions for synergetic effect as a result of combined activity of separate social agents of local and regional development have not been created.

It seems sensible to adopt an approach that makes use of ICT itself to solve this problem. The optimal way of addressing this can be found in creating information resources as a classified knowledge system, accessible for agents of local and regional development and other users regardless of their geographical location. Such networks to satisfy the needs of professional and special interest groups already exist in the developed countries. Many of these are known as “knowledge networks” because they meet the needs in information and knowledge exchange. Palmer and Richards (1999) are convinced that creation of new knowledge in the future will occur not in the frameworks of separate organizations, but in such knowledge networks. However, there is another point of view, asserting that significance of the Internet is exaggerated by commercial organizations for the sake of publicity. There is good reason to lean toward a positive estimation of network cooperation because it neither cancels nor changes the traditional forms of information and knowledge exchange. It reinforces the effect

of the creation of new ideas, accelerates the formation processes of the social idea, and provides transparency and accessibility.

There are some useful examples of successful international information networks, designed for professional and civic groups. The SIGMA Program (Support of Public Administration Improvement in the Countries of Central and Eastern Europe), which is a knowledge network has been created in 13 countries to support public administration reform. SIGMA provides network members with access to experienced specialists in the field of public administration, comparative information and technical knowledge related to the Public Administration Service. It provides material and the technical basis for establishment of a knowledge network between the subjects of state administration in Central and Eastern Europe, as well as between them and their colleagues in other countries (SIGMA Program, <http://www.oecd.org/puma/sigmaweb>). An information and knowledge base concerning local and regional development is located in the LOGIN (The Local Government information network) international network. This program which has functioned since 1999, is engaged in accumulating, processing and distribution of information and knowledge, designed for the needs of local self-governance (of local and regional development) through the Internet. Through a simple interface at the program's Web site, any user can learn about member organizations, to get in touch with them and receive current information on communication events, training programs, etc. (The Local Government information network, <http://www.logincee.org>.) The library fund, containing 2,000 documents on the different fields of action of local self-governance bodies, is a knowledge network of this program.

The availability of an international network doesn't remove the necessity of the need for the creation of similar national Ukrainian network. Especially because the access to the LOGIN li-

brary fund demands knowledge of one of three languages: English, French or German. The Cities and Communities Association of Ukraine, which has recently become a LOGIN Program partner and is creating its own library fund, doesn't provide for the needs of an expert. However addressing the problems of the Ukraine is not limited to the creation of a knowledge network. Mavko (2003), analyzing methodological principles of regional strategies in Ukraine, indicates that successful strategic planning for regional development in the Ukraine also requires the establishment of an institution of professional strategic planning consultants. The author of this article believes that it is necessary to form a municipal consulting institute with larger functions, which should be included into the wider context of system reforms covering administrative, administrative-territorial, municipal reforms, and the context of national regional policy. Together with other factors, creation of information network of local and regional development is an effective means of forming this socially important institution.

Information Stratification and Structure of Information Resources of a Local and Regional Development Network

The relevance of the content of information resources is determined by the field of their use. Therefore, it is considered useful to distinguish between scientific, social, economic, political, legal and other types of information. All of these in one way or another deal with local and regional development. However, generalised knowledge cannot be taken as an absolute truth in the information space. Knowledge is always subjective, because it depends upon the context of social agent activity and on its cognitive abilities. In this sense, information is a raw material transforming into knowledge as a result of its independent search and analysis. That knowledge, in turn, is

a foundation for autonomous decision making according to specific problems and activity of a social agent. For better understanding of such an approach to knowledge it is recognized that some information better resembles a real phenomenon having specific characteristics (Berger & Lukman, 1995). Indeed, any information has meaning of cognitive construction only if it is interpreted as reflection of a real existing phenomenon. Therefore formation of an interactive communication orientation in local and regional network will depend firstly, on the sense of one's presence in the information space as an equal communication partner, and secondly, on a creative and constructive attitude towards the information coupled with a high level of confidence in its author.

Every social agent, depending on his specialization, is using certain components of the information resources for creating the new knowledge. These are not new for a society in a general sense but are new for the developed knowledge. There should be information reflective of all agents' views on local and regional development in the network. The information resource related to a general destination should include knowledge determining the motivational dynamics of the social agents institutional behavior and constructions of their social roles in the context of particular local and regional development paradigms based upon their own decisions. The process of role distribution, which should be understood as an habitualization process, is of great importance for network cooperation, since it should result in connecting knowledge to specific activity types (typification). Playing roles and making decisions requires specific knowledge of specific situations, understanding of connections between goals and methods of their achievement. Thanks to typification and specification of knowledge of independent social agents, desegregation into components of local and regional development problems and goals then takes place. In that aspect we can question the necessity of social agents information stratification inside the network community.

Establishing a “Knowledge Network” of Local and Regional Development Subjects

Information stratification is a necessary component of network cooperation, since the creation of local and regional development information resources anticipates a lot of mental work and the elaboration of new knowledge in the form of models, algorithms, programs or projects of solving certain problems, etc. That can be achieved only by common efforts. A state has a particular role to play in the creation of information resources, presented on the Internet, as a social development coordination center. The Ukraine only has one Legislative Act determining the state position regarding the Internet use for the purpose of social development. This is the Decree of the President of Ukraine, formulating the basic tasks of development of the national constituency of the Internet and providing a wide access to it (<http://www.president.gov.ua/officdocuments/officdecrees/101228133.html>). However it doesn't include the legal requirements of Web-page content of any executive authority, or use of the Internet for organizing problem discussions and draft resolutions. But nevertheless, it guarantees the state support of the infrastructure development for delivering information services through the Internet. The creation of electronic resources of local and regional development on competitive basis could become a part of such state support. The strategy of carrying out competitive projects is already worked through in the context of Ukrainian-wide contests for local self-government development projects and programs, which were established in 2003. According to the Conception of National Electronic Information Resources Formation, created information resources should become available in this way (<http://www.kmu.gov.ua/z1/portal/search>).

From the point of view of a general approach to defining the structure of local and regional development information resources, the following basic positions can be distinguished. It consists of:

- a. Analytical analysis on national policy in the field of local and regional development, its primary problems and priority guidelines (constitutive and prediction knowledge);
- b. Information on informative and consultative abilities of local and regional development subjects, scale of their activity, specialization, experience, and personnel; and
- c. Innovation funding of local and regional development (best practices, methods of problem solving, etc.).

More detailed structuring requires further research. In conclusion, I would like to mention that the classification used in the context of information stratification for professional network entities implies distinguishing basic, advanced, and innovative knowledge. The above-mentioned classification is acceptable for knowledge networks of local and regional development, though it should be reinterpreted. This subject can be bounded by the establishing principles that should be followed in the course of network collaboration and creation of information resources, and which can be viewed as the conclusion to the above-stated material. These should include the principles of:

1. Partnership, to define interactive communication type in the virtual space;
2. Trust, to ensure implementation of the interactive communication type;
3. Information resource positioning, to ensure good user targeting;
4. Objectivity, to convert information into knowledge adequate to actual problems;
5. Integration, to build an integrated information resource on key problems of local and regional development; and
6. Optimal information volume.

REFERENCES

Analytical Centers of Ukraine Network. (n.d.). Retrieved from <http://www.intellect.org>

Atamanchuk, G. V. (2003). Nekotoryje problemy poznania gosudarstvennogo upravleniia. *Zbirnyk naukovykh prats' Ukrainiskoi Akademii derzhavnogo upravlinnia pry Prezydentovi Ukrainy*, 1, Kyiv: "UADU" Publishing House, 5-18.

Baiev, V.V. (2003). Rozuminnia novoi paradygmy elektronnoho vriaduvannia na mistsevomu rivni. *Zbirnyk naukovykh prats' Ukrainiskoi Akademii derzhavnogo upravlinnia pry Prezydentovi Ukrainy*, 1, Kyiv: "UADU" Publishing House, 151-158.

Berger, P. (1995). *Lukman T. Sotsial'noe konstruirovanie real'nosti. Traktat po sotsiologii znania*. Moscow: Publishing House.

Bryzhko, V.M., Tsymbaliuk, V.S., Orekhov, A.A. & Galchenko, O.N. (2002). *E-buduschee i informatsionnoe pravo*. Kyiv: Publishing House.

The Decree of the President of Ukraine. (2002). *On measures to develop the national sector of the global information network and to provide for wide access to the Net in Ukraine* (Pro zahody schodo rozvytku natsionalnoi skladovoi globalnoi informatsiinoi merezhi ta zabezpechennia shyrokogo dostupu do tsiei merezhi v Ukraini). Retrieved from <http://www.president.gov.ua/officdocuments/officdecrees/101228133.html>

Gavrilov, N.N. (2003). *Fenomen gosudarstvennoi vlasti naroda*. Sebastopol: Publishing House.

Klimenko, I.V., and Litvinov, G.S. (2003). Problemy vnedreniia informatsionnoy sistemy "elektronnoe pravitelstvo" v gosudarstvennom upravlenii. *Zbirnyk naukovykh prats' Ukrainiskoi Akademii derzhavnogo upravlinnia pry Prezydentovi Ukrainy*, 1, Kyiv: "UADU" Publishing House, 98-105.

The Local Government information network. (n.d.). Retrieved from <http://www.logincee.org>

Mavko, P. (2003). Polityko-administratyvni ta metodologichni zasady regional'nykh strategi v Ukraini. *Aspekty samovriaduvannia*, 2(18), 24-28.

Palmer, J., & Richards, I. (1999). Get knetted: Network behaviour in the new economy. *Journal of Knowledge Management*, 3(3), 191-202.

SIGMA Program. (n.d.). Retrieved from <http://www.oecd.org/puma/sigmaweb>

The World Summit on the Information Society. (2003, December 10-12). Geneva, Switzerland. Retrieved from <http://www.e-ukraine.com.ua/viewnews/press/31>

KEY TERMS

Habitualization: The process of assimilation of certain social practices. Using the term "habitus" has long-standing traditions in the European socio-philosophical discourse. Berger and Lukman use the term because of its polysemy. "Habitus" can take on the meaning of habit, custom, inclination, development pattern (biol.), and so on.

Information and Communication System of Local and Regional Development: A system that combines all the subjects on the basis of common principles to realize information and communication interaction for local and regional development.

Information Process: The process of information products' creation, collection, processing, accumulating, storage, search, dissemination, and use.

Information Resources of Local and Regional Development: An organized entity of information products, which are created and

disseminated for local and regional development needs.

Information Space: The aggregate of all determined objects, subjects and information ties between them, which function and interact to provide for information needs of people, professional corporate communities, subject of local self-governance, region, society and state.

Information Stratification: The role distribution between the information interaction objects according to the amounts and types of information products, the creation of which is based on specialization in a specific activity sphere and on its scale.

Knowledge Network: The conventional name for an information and communication system, the framework of which includes information interaction and mutually beneficial collaboration of corporate professional groups for the purpose of information and knowledge exchange.

Municipal Consulting: The system (institution) and type of management consulting, the objects of which are the subjects of municipal scope of activity. A separate form of municipal consulting is giving consultations regarding issues of local and regional development. In the Ukraine, municipal consulting as a social institution is at the formation stage.

National Information Policy: The aggregate of basic trends and methods of the state activities, involving the information collection, storage, usage and dissemination.

Social agent of Local and Regional Development: The corporate professional structure working in the field of local and regional development. The meaning of the notion of “agent” indicates the fact of independent determination by this structure of the strategy of its activity.

ENDNOTES

- ¹ In the framework of the Community Partnership Program, five training centers operate in Donetsk, Lviv, Kharkiv, Kherson, and Cherkasy, which are financed by the “Ukraine–USA” Foundation. These centers provide consulting services to the bodies of local self-government, with the training itself being only one of the forms of consulting activity.
- ² Consultations and other information products concerning some issues of local self-government activities are provided by: the Department for Contacts with Local Authorities and Local Government Institutions of the Verkhovna Rada of Ukraine, Central Administration for the Public Service of Ukraine, Department of Regional Policy of the Ministry of Economy and the European Integration of Ukraine, Department on Contacts with Local Authorities of the Secretariat of the Cabinet of Ministers of Ukraine, Assistance to the Local Government in Ukraine Fund of the President of Ukraine.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 289-294, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.4

Sex Tourism and the Internet: Information, Amplification, and Moral Panics

Jerry Eades

Ritsumeikan Asian Pacific University, Japan

ABSTRACT

This chapter examines the relationship between the Internet and sex tourism. It argues that interest in sex tourism in the media erupted in the early 1990s, about the same time that the Internet itself was becoming popular. The relationship between the two was both positive and negative. On the one hand, the Internet has allowed members of sexual subcultures to contact each other and for new forms of sex tourism to be marketed. On the other hand, the Internet also provided a platform for those opposed to sex tourism to raise the profile of the issue, in the process conflating images of sex tourism with those of Internet pornography, pedophilia, and child abuse, particularly in relation to tourism destinations in the Southeast Asian region. It has therefore aided the amplification of moral

panics surrounding these issues. This sensational coverage has, however, tended to overshadow other forms of sex tourism, including those in which consenting adults meet together in resorts of clubs for recreational sex with each other. Thus, while the Internet has created moral panics and led to crackdowns in certain sections of the sex tourism market, it has allowed other alternative lifestyles to flourish on an unprecedented scale in an increasingly liberalized environment.

INTRODUCTION

Probably no sector of the tourist market has been more affected by the rise of the Internet than that of sex tourism. In fact, as will be shown below, until the advent of the Internet, “sex tourism”

as a concept was rarely discussed in the media, even though sex as a motivation for travel has a very long history. But the relationship between sex tourism and the Internet also is extremely complex and contested, as befits such a controversial subject.

In this chapter, I first argue that the emerging literature on sex tourism has, in general, tended to concentrate on the commercial provision of sex to the exclusion of other types of sex tourism, with the greatest attention being given to the relations between prostitutes and tourists in Southeast Asia.

Second, I argue that in relation to this particular type of tourism, the Internet has proved a double-edged sword. Even though it has provided greatly enhanced opportunities for members of a wide variety of sexual interests, orientations and subcultures to contact and interact with each other, it also has provided an environment in which certain types of sex tourism have been increasingly demonized by the media, civil society, and the politicians, resulting in the imposition of increasingly severe regulation and sanctions in a number of countries. The Internet has greatly assisted the stereotyping of the “sex tourist” as typically an overweight middle-aged Western male on the prowl for underage sex victims in the main Asian tourist resorts. This in turn has resulted new type of crime being brought onto the statute books in many countries, such as accessing and downloading child pornography. It also has made it possible for interest groups such as ECPAT (originally “End Child Prostitution in Asian Tourism”)¹ to get their message across more effectively, increasing the pressure on governments to take action. In the mid-1990s, a number of countries introduced new legislation controlling the extraterritorial sexual activities of their nationals, and a number of well-publicized prosecutions have taken place since. Media reporting and its dissemination on the Internet have generally contributed to the sense of moral

panic and indignation surrounding this issue, as well as conveying the comforting impression that something is being done about it, a questionable assumption given the small number of prosecutions and the large number of tourists.

My third argument, however, is that prostitution in Southeast Asia is only part of the story. Elsewhere, other forms of sex tourism involving consensual sex between tourists are flourishing, having been greatly facilitated and supported by the Internet. Far from experiencing increasing pressure from the law, these activities in some countries are enjoying an increasingly liberalized legal environment. The Internet acts both as an important source of information for the participants, as well as (to judge by the massive popularity of some of the sites where this information is disseminated) a significant source of entertainment for the casual *cybervoyeur*.

The chapter is therefore divided into five main parts. In the first, I discuss the definitions of sex tourism current in the literature, and the paradigms of its main variables offered by previous writers. The crucial variable, I will argue, is that of the power relations between participants in sexual activity. Where sex tourism involves the free participation of consenting adults with broadly equal power and rights in the relationship, there are clearly moral and legal problems than when some of the participants are coerced into sex because they are poor, vulnerable or under age.

Second, I look at the stages through which sex tourism typically develops in particular countries, in relation to other processes of economic growth and the development of a tourist market.

Third, I look at the growth of interest in sex tourism in the media, using online databases of press material that have developed into an important research tool in the last decade. Press databases are not only a good source of information on the topic, but also good indicators of the fluctuations of public interest in different countries concerning these issues over time. Here, I discuss

how specific issues turn into moral panics speeded by the Internet, attracting both media attention and official action.

Fourth, I look at those types of sex tourism that have not generated as much moral indignation as those involving prostitution or the exploitation of children, though clearly they are flourishing and even expanding, both in cyberspace and in the flesh.

In the final section, I consider the policy implications of all this, for social theory and the future of sex tourism.

DEFINING SEX TOURISM

In general terms, sex tourism is not difficult to define: tourism in which the primary object is sexual activity, either sexual contact with others (local sex workers, other tourists) or sexual stimulation and arousal, usually leading to orgasm either alone or in company. However, the forms and sites of sex tourism have evolved considerably over the years, particularly as sex has become a less tabooed subject of discussion in the developed countries, and as would-be entrepreneurs (including organized crime) have devised new forms of sexual activity and exploitation for the purposes of profit.

In their pioneering monograph on sex tourism, Ryan and Hall offer the following thoughts on defining their subject:

Sex tourism may be defined as tourism where the main purpose or motivation of at least part of the trip is to consummate sexual relations. It might be thought that these relationships are usually of a commercial nature. However, the apparent solidity of such a definition soon starts to fade as the marginalities and states of sexuality start to be explored in more depth. ... Although sex tourism exists throughout the world, it has come to be primarily associated with the travel of tour-

ists, usually male, in the developed world to less developed countries. One of the main attractions is the important cost differential that exists in the provision of both tourist and sexual services in the developing world compared to such provision in the industrialized world ... Therefore one of the key issues which these present work addresses is the relationship between visitor and prostitute ... (2001, p. x)

This initial definition points the way to much of their subsequent discussion. Although they state that the meaning of “sex tourism” is extremely wide, and need not necessarily involve a commercial transaction, they do nevertheless devote most of their time to male sex tourists buying sexual services in developing countries, particularly Thailand.

But despite this focus, they first offer three other sets of insights into the general nature of the field. The first concerns the range of activities and the variable degree of physical contact involved in sex tourism:

The sex tourism industry also takes different forms ranging from the production of videos, through to nude dancing in which no physical contact occurs and the tourist acts as voyeur, and tourism-related prostitution, of which there are several major forms. (Ryan & Hall, 2001, p. xi)

The key variable here is that of physical contact, though in practice dividing lines are fuzzy. For instance, exotic dancing is nowadays difficult to separate from lap dancing, and that can involve a considerable degree of physical contact, usually depending on how much the observer is prepared to pay (Lewis, 2002; Liepe-Levinson, 1998). It also can act as the curtain-raiser for other forms of sexual activity, to be negotiated separately.

Their second insight is a set of dichotomies through which different types of sex tourism can be differentiated from each other, according

to whether the sexual activity is (a) voluntary or exploitative; (b) commercial or non-commercial and (c) enhancing or degrading for self-identity (Ryan & Hall, 2001, p. 49). The third of these is problematic, as is quite possible given the transient nature of sexual excitement that clients find their self-identity enhanced during the transaction itself, only to feel degradation later. The other two variables yield a four-fold table, one cell of which (non-commercial exploitative sex) seems of limited importance, while the three others more likely to arise in the real world. Recent literature suggests that many sex workers rate their work positively and reject their stereotyping as “victims” (e.g., Kempadoo, 1998, p. 2 and later chapters in the same volume), but it is usually commercial. Child prostitution would fall into the category of commercial and exploitative, while consensual sex between fellow tourists could be classified as voluntary and non-commercial—though whether it is ultimately identity enhancing or degrading for the participants is more difficult to ascertain objectively. But what we are left with here is the broad distinction between commercial sex (whether involving exploitation, by definition as some feminists would argue, or voluntary action) and consensual non-commercial sex.

Other models are of course possible, and I would suggest four continua which would extend those of Ryan and Hall to cover a wide range of sex-tourism activities. The first is the extent to which these activities are purely local or regional in nature (such as locally based swinging) to those which become the object of tourism, for example, commercially developed clothing optional and other “adult” resorts and the various casual and institutional activities that go with them. A second continuum is the extent to which participation in sexual activity is the object of the exercise, rather than just viewing sex. This differentiates, for instance, the voyeur from the participant at dogging or swinging sites, and strip shows from prostitution, though lap dancing with

bodily contact (Lewis, 2002) or audience participation in sex shows (Liepe-Levinson, 1998) are intermediate cases. A third dimension is how far the participants are professional sex workers, as opposed to casual amateurs, similar to the commercial-noncommercial dichotomy of Ryan and Hall. Clearly where professional sex workers are involved, there are economic and legal implications which do not arise when consenting adults are meeting for the free exchange of sex. It also may relate to a fourth dimension, the power relations between the participants, and the extent to which the sex workers themselves are willing participants in these activities, in other words Ryan and Hall’s voluntary-exploitative dichotomy. Over the last two decades, as sex tourism has become an issue on the international radar, it has become clear that there are some extremely unpleasant forms of human trafficking involved, though in other cases participants may enter the sex industry on a more voluntary basis with a longer term goal in mind, as described for Dominica by Brennan (2004a, 2004b) or the Filipina hostesses and entertainers in Japan described by Garcia Dizon (2004, 2006). Finally, there is the question which most concerns this chapter, the extent to which the Internet has impinged on or amplified each of these types of activity.

THE DEVELOPMENT OF SEX TOURISM

A third group of insights into sex tourism provided by Ryan and Hall (2001, chapter 7, based on Hall 1992) arise out of a developmental model they present of its origins. The stages are those of (a) indigenous prostitution, (b) economic colonialism and militarization, (c) substitution of international tourists for occupation forces and rapid economic development (Hall, 1992) and (d) the internationalization of legal and political responses.

Their argument can be summarized as follows. In many of the countries of East and Southeast Asia, the sex industry has a long history, going back to indigenous institutions in precolonial times. Even though they discuss mainly the origins of prostitution in Southeast Asia, it could be argued that this applies especially to Japan and China. Historically, many cities have had zones of license, in which sex industries and other forms of entertainment have flourished. These date back to the ancient world, where many of them were paradoxically associated with temples, perhaps not surprising given a large influx of religious pilgrims interested not only in religion (for typical instances in the literature, see Flemming, 1999; Lerner, 1986; Rosner, 1998; Toorn 1989). In the early modern state, many cities developed entertainment zones, perhaps the best example being that of the Yoshiwara in Edo (Tokyo), also located near one of the largest temple complexes in the city (Bornoff, 1991; Longstreet & Longstreet, 1970; Seidensticker, 1983; Seigle, 1993).

The Yoshiwara brought together the worlds of *kabuki* theater, *sumo* wrestling and the sex industry, with both female and male (Leupp, 1995) sex workers. This was the floating world of the great Edo print artists, and *shunga* or erotic pictures formed a large part of their output, despite official disapproval and censorship. Yoshiwara survived as a zone of prostitution into the 20th century, when it was closed down by a government concerned with public morals and the spread of sexually transmitted disease. Ironically the area is now the site of a large number of “soapland establishments” where sex workers provide sexual services within the context of giving the clients a bath (Bornoff, 1991; Seidensticker, 1990). China had a similar tradition of courtesans, which in the 20th century also developed into a large-scale prostitution industry in major cities such as Shanghai, with close links with both gangsters and politicians (Hershatter, 1997; Lintner, 2002).

In the 20th century, therefore, the rise and transformation of the sex industry took place under the influence of colonialism and the presence of the military. As Ryan and Hall (2001, p. 140) put it:

In this stage the occupied culture's general acceptance of various forms of prostitution has been used as a justification for economic or military enforced prostitution or, as in the case of Japanese militarism in the 1930s and 1940s, was used as a means of exercising power on host populations. In addition, this stage commences the economic dependency of certain sections of host societies on the selling of sexual services as a means of economic growth and development. For example, in the case of Taiwan, hot spring resorts which provided for the spatial concentration of tourist-related prostitution activity were first developed under the Japanese colonial era between 1895 and 1945.

As Japanese colonialism and emigration expanded in the early 20th century, networks of Japanese brothels were set up around the world, into which Japanese women from poorer families were recruited to service a largely Japanese clientele (e.g., Yamazaki, 1990). As is well known, during the Pacific War, the Japanese forced large numbers of non-Japanese women into prostitution as “comfort women” to service the imperial army throughout the region (Hicks, 1995; Watanabe, 1995). Less well known but increasingly well documented were the American arrangements to provide “rest and recreation” or “R&R” facilities for their troops, in Korea, the Philippines and elsewhere. It has been estimated that since the Second World War, up to a million Korean women have been involved in one way or another servicing the sexual needs of American servicemen (Lie 1995; Matsu & Sharnoff, 1977; Moon, 1997, 1999; Soh, 1996). Similarly, there were an estimated 12,000 registered and 8,000 unregistered

hostesses in Olongapo City in the Philippines, serving the Subic Naval base and Clark Air Force Base (Law, 2000; Moselina, 1979; Philippine Women's Research Collective, 1985). Local city ordinances were changed to regulate the trade, and clear prostitutes off the streets and into clubs, a profitable source of income for local business (Claire & Cottingham, 1982). Similarly, the growth of the sex industry in Thailand stemmed partly from contracts to provide R&R services for the American troops fighting in Vietnam (Bishop & Robinson, 1998).

In the third of Ryan and Hall's stages, therefore, governments promoted sex work for the military, which later gave way to government-promoted sex work as a way of attracting foreign tourists. Prostitution and the commoditization of sex were presented as patriotic, promoting economic development, and creating jobs for the rest of the country. In Thailand, the process was helped by the image of the country promoted by popular culture, in the form of the *Emmanuelle* novels and films. Manderson (1997) suggests that Thailand was irrelevant to the plot of the original Sylvia Krystel film, which appeared in 1974: it was just a western soft-porn fantasy that could have been located anywhere. Nevertheless, it did help reinforce the image of Thailand as a sexual paradise in the Western tourist industry, and Patpong was soon firmly established in the guidebooks as a must-see site, the center of the burgeoning sex industry (Manderson, 1992). Thailand also established a reputation as a center for gay tourism, thanks to its comparative tolerance of homosexuality (Jackson, 1997, 2003; Sanders, 2002). Increasingly, sex tourism was becoming a literary theme, as shown by the success and notoriety of the work of Michel Houellebecq.

An important feature of the growth of sex tourism in post-war Asia was the emergence of Japan as the region's first economic superpower. After the Second World War, Japan had gone through its own occupation experience, and this continued

for many years in Okinawa, which remained under American administration until 1972. Relations between the population of Okinawa and their American neighbors have remained difficult, and there have often been sexual undertones to the relationship, as when American servicemen were involved in the rape of a young Okinawan girl in 1995 (Eldredge, 1997). But as the Japanese economy revived, Japan began to play an increasingly important part in the regional sex industry as consumers. The group solidarity of the Japanese salarymen was often reinforced by works outings to popular *onsen* (hot springs) and other resorts in Japan, and some of these outings involved having a good time with local sex workers (for examples, see Constantine, 1993). As the Japanese economy expanded, this Japanese tradition of company sex tourism increasingly moved offshore, and trips to Thailand, the Philippines and even China as described below, became common (Bornoff, 1991; Brown, 2000). The Japanese also began to receive adverse comment in the press, and Japan started to come under increasing international pressure to clean up its act.

The Japanese response was in part to import the sex workers into Japan itself. With the increasing level of education in Japan, the falloff in the birthrate, and the increasing prosperity of the nation as a whole, the traditional sex industry itself started to collapse and run out of recruits. The solution was to simply import girls from countries which Japanese tourists had long since been patronizing to fill the gap. As the bubble economy expanded in the late 1980s, so did the population of foreign migrants. Some of the women coming in were brought in by organized crime under highly exploitative conditions: pay was poor, passports were seized, and much of the money the girls earned went straight back to the brokers who had brought them as payment for transport, accommodation and loans incurred on the way (Brown, 2000). Others came in more independently, one of the incentives being the

chances of finding a husband in Japan. By the 1980s, there was a severe shortage of potential brides in some parts of the country, particularly in the rural areas, and in smaller towns and cities where the population was dropping rapidly. Foreign brides were an obvious solution to the problem. Even though there were problems with many of the marriages, they did at least legitimate the women's presence in Japan, and the birth of children with Japanese citizenship further strengthened their rights of residence (Garcia Dizon, 2004). Many Thai and Filipina women came in under special "entertainment" visas as a cover for their employment as hostesses or sex workers, and there were numerous complaints from women in the Philippines when the quota of visas was drastically reduced at the end of 2004 (Garcia Dizon, 2006).

The restructuring of the Asian sex tourism market from a military to civilian clientele leads into the fourth stage proposed by Ryan and Hall (2001), that of rapid economic development and international controls. Korea and Taiwan, like Japan, have gone through a period of high speed economic growth, and their birthrates also have fallen, the implication being that they too will probably follow the Japanese pattern of the collapse of the domestic sex industry, followed by the offshoring of sexual encounters and/or the importation of sex workers from elsewhere in the region. Meanwhile, sex tourism continues to flourish elsewhere in the region (Brown, 2000), including the Philippines (Law, 2000), Thailand (Bishop & Robinson, 1998; Seabrook, 2000; Truong, 1990), Vietnam (Marsh, 2006), Cambodia (Cater, 1995), and China (Jeffreys, 2004).

In the period from September to December, 2003, a particularly colorful scandal in China was widely reported by the international media. The affair, with its heady mixture of sex and nationalism, generated a considerable body of discussion and debate, much of which can be readily tracked down in the press databases.² It concerned a party

of Japanese tourists from Osaka who reportedly had stayed at a hotel in the Chinese resort city of Zhuhai from 16-18 September. They had been joined there by a large contingent of Chinese women, and the result was widespread and prolonged sexual activity. The authorities were alerted and raided the hotel: after investigations, 14 people were prosecuted in December 2003 for their part in arranging the event, and sentenced to varying periods of imprisonment. The two most serious offenders were given life sentences. The Japanese tourists returned to Japan, and attempts to extradite three of them back to China were refused. The company concerned denied any wrongdoing in the affair, though they received a large number of indignant telephone calls and emails from the outraged public. The hotel in Zhuhai, together with another one where similar events were said to have taken place, was closed for a time, but eventually allowed to reopen under stricter controls than before. A number of local security officials were dismissed, presumably for allowing all this to happen on their watch.

Several features of the affair are noteworthy. The first is the vagueness about the numbers of people involved, and the extent of what actually happened. The number of Japanese men involved is variously given as 185, 285, or 400. The number of sex workers involved ranges from about the same as the men in some accounts to as many as 500 in others. Presumably over the three days of the party, people came and went so figures are understandably hazy. In any case, clearly a large number of people were involved and the event required a considerable amount of planning.

Second, because the Japanese were involved, discussions in the media drew heavily on Sino-Japanese history, increasing the sense of outrage at what had happened. In fact, it appears from other sites on the Internet that the hotels in Zhuhai had a reputation for being good places to find sexual companionship, at more reasonable prices than other cities in the region (Zhuhai is close to Canton,

Macau, and Hong Kong). So what happened there was probably not unprecedented—apart perhaps from its sheer scale. Most of the participants were probably blissfully unaware that the date of their trip to China coincided with the anniversary of the “Manchurian Incident” of 1931, which marked the start of full-scale hostilities between the Chinese and Japanese. However, this fact was soon picked up by the Chinese and international media. Parallels were quickly drawn between the behavior of the Japanese invaders of the 1930s and the contemporary Japanese tourists, and the choice of date was presented as a deliberate attempt to humiliate the Chinese. It also happened that the date of the trial in December 2003 coincided with the anniversary of the Japanese entry to Nanjing in 1937. This also was quickly picked up by the media, allowing additional parallels to be drawn with the Japanese invasion.

Just to make matters even more complex, this was only one of a number of issues which affected Sino-Japanese relationships during the summer of 2003. Others included the location of an oil pipeline from Russia, the discovery of deposits of mustard gas left over from WWII, and disturbances between Japanese and Chinese students at Northwest University, Xian, China. Taken together, these various incidents provoked a sense of crisis in Sino-Japanese relations, reflecting not only Chinese hostility towards Japan, but also increasing nationalism in China. But what is clear is that the availability of the Internet exacerbated the crisis, through helping to popularize Zhuhai as a sex tourism destination, making the news of the scandal widely available, and allowing the Chinese public to coordinate their protests to the administration.

Generally since the early 1990s, however, several factors have produced an increasing outcry against sex tourism, and have led national governments to increase their efforts to try and exert greater control (Hall, 1998; Seabrook, 2000).

The first factor which lay behind these changes was the HIV/AIDS pandemic which spread quickly from the early 1980s, and increasingly came to affect countries with large sex tourism industries. As Ryan and Hall note, the Thai Public Health Ministry started to campaign against prostitution and sex tourism in 1989, because of their realization that AIDS could pose a problem for tourism as a whole, and for the wider economy. The Asia Development bank calculated that the costs to the economy could rise to \$3.5 billion a year by the end of the century (Ryan & Hall, 2001; see also Beyrer & Stachowiak, 2003).

A second factor was an increasingly vocal campaign against human trafficking, and in particular the trafficking and sexual exploitation of women and children. This had long been an issue in Asia (Brown, 2000), but with the collapse of communism in Eastern Europe, the problem soon began to appear there as well. By 1993, it was reported that in Amsterdam, “Young women are being lured out of Eastern Europe by offers of jobs in the West. But there their passports are taken away and they find they have been sold as prostitutes” (Henley, 1993, *Guardian Features* section, p. 12). Trafficking in both the former Soviet Union and China soon became highly organized (for a comparison between the two countries, see Shelley 2005.) Indeed, increasing numbers of East European women began to appear in the bars and nightclubs of East Asia. These issues also were attracting increasing attention from the media, as discussed in the next section.

SEX TOURISM AND THE MEDIA

By the mid-1990s, it became clear that the Internet had opened up not only immense possibilities for collecting information, but also for talking about sex online and accessing pornography. As with earlier new technologies, calls soon grew strident for the policing, censoring and regulation of the

Table 1. References to sex tourism in major world publications, 1990-2005 (Source: LexisNexis Total Research, Major World Publications)

| Year | References | Year | References |
|------|------------|------|------------|
| 1990 | 8 | 1998 | 145 |
| 1991 | 17 | 1999 | 130 |
| 1992 | 22 | 2000 | 134 |
| 1993 | 29 | 2001 | 156 |
| 1994 | 38 | 2002 | 146 |
| 1995 | 156 | 2003 | 175 |
| 1996 | 255 | 2004 | 290 |
| 1997 | 141 | 2005 | 267 |

Internet, but the way it was designed (with decentralized structure and control), and the desire of the courts, particularly in the U.S., not to limit freedom of speech means that it remained largely unregulated, apart from some states such as Singapore, China, or the Islamic countries which have made heroic efforts to filter out information which they find unacceptable.

An important strand in the debate over regulation of the Web has been that concerning sex tourism and, by implication, pedophilia and child pornography. Indeed, so strong emphasis on pedophilia and pornography in discussions of sex tourism, that other forms of sex tourism noted above and involving consenting adults have often been largely ignored.

The development of these issues as a “moral panic,” taken up by the media, pressure groups and politicians, can be documented in the major online press databases, many of which date back to the period before the rise of the Internet³. As a simple measure of the importance of these issues, the number of hits in each time period can easily be verified. Here I have used major publications included in the LexisNexis Total Research database, because of the ease with which large quantities of information can be downloaded from it. Using “sex tourism” as a search keyword, the database produced the following numbers of hits for each year from 1990 onwards.

As can be seen, in the early 1990s, sex tourism was hardly mentioned by the world’s media as a concept at all, though clearly sex was already of major importance in the tourist industry, as Truong’s pioneering study of Southeast Asia shows (Truong, 1990). Interest continued at a low level, until 1995-1996 when there was a massive jump. After a dip for a few years, media interest in the subject picked up again in 2003, and remains high until the present (the results for the first six months of 2006 are similar to those for 2005).

The sequences of events explaining this pattern seems to be as follows. By 1990, there was increasing concern about sex tourism in a number of quarters. First, national governments which were increasingly concerned with the international images of their country, particularly Thailand. During the 1980s, sex tourism slowly started to emerge as an issue, particularly in Thailand, as the number of tourists escalated, from less than 100,000 in the 1960s to five million a year by the late 1980s. In 1987, the Thai government launched a “Visit Thailand” campaign to promote the country as a tourist destination. Two thirds of the resulting visitors were men, and it was estimated that around 223,000 were there for the purposes of sex (Poole, 1991).

Second, medical authorities were increasingly concerned with the spread of AIDS which was

starting to take an increasing toll in the country's sex industry. Reported cases from 100 in 1989 to 14,000 in May 1990, and there were estimates that 25 percent of the nation's sex workers were HIV positive. By 1993, Thailand was said to have one of the world's highest infection rates (Brangin 1993).

Third, there was pressure from NGOs and activists concerned with the welfare of women and children, many of them with links to the churches. The most important of these was ECPAT, whose Web site became one of the best sources of material on the issue, and which issued a series of influential country profiles and reports.⁴

Fourth, there was a growing concern about human trafficking and illegal immigration worldwide, exacerbated by the collapse of communism in Eastern Europe, as noted above. Countries like Hungary also were beginning to use the sex industry as a way to draw the tourists. "The sex ship sets sail early but the sex castle stays open late. If you miss both there are nightclubs with nude go-go dancers and erotic 'live' shows. This may look like Bangkok but it is Lake Balaton, once Hungary's most popular resort now touted as the new playground of European sex tourism" (Beck, 1990, Overseas News section). AIDS was starting to spread in Eastern Europe as well.

Finally the increasing visibility of pornography on the Internet became linked with these other issues in the media and the public imagination, and discourses of sex tourism took on the form which has predominated in the academic literature ever since. As a reaction to this, politicians were spurred to rapid action, given that this was an issue on which they found it easy to reach consensus across the political spectrum. Governments began to consider action (Seabrook, 2000): in 1990, Thailand, the Philippines, Taiwan and Sri Lanka were holding talks Britain, Germany, Switzerland, the United States, France and the Netherlands on joint action against pedophiles, and by the autumn of 1991, Germany was starting

to take the lead in taking action against its nationals abusing children on holiday abroad (Ingham, 1991). Soon, calls for similar action were being heard in Australia and elsewhere (Skeggs, 1992). By late 1993, even French MPs were calling for curbs on sex tourism.⁵

The contribution of the Internet to the debate was therefore threefold: (a) to make available material which people found offensive on a massive scale and therefore force public discussion of the issue; (b) to give a voice to the various pressure groups campaigning for greater controls and (c) to disseminate media reports of these issues, the measures being taken, and their policy implications. The new legislation were touted as giving police a powerful tool in pursuing pedophiles, reinforcing the idea in the public imagination that the possession of images was synonymous with actual pedophilia. The British Home Office claimed that international collaboration had led to success: "Operation Starburst in 1995" led to 20 prosecutions in the UK and over 100 worldwide, and "Operation Cathedral" in 1998, which involved collaboration between 15 countries and seizures of 750,000 images.⁶ In 2000, the British Home Office announced that it was setting up a new unit to deal with pedophiles within the National Criminal Intelligence Service, putting it in the same league as sabotage, terrorism, and international money-laundering. Despite all this publicity, however, it is doubtful how effective these measures have actually been in deterring these kinds of activities, given that the number of prosecutions has been modest compared with the supposed numbers of sex tourists. Also, the people prosecuted have included a number of high-profile individuals whose activities only came to light accident. This is most obvious in the case of Paul Gadd, well known in the 1970s as rock star Gary Glitter, which received enormous publicity in the United Kingdom (e.g., Aglionby & Barnett, 2005; Bainbridge & Aglionby, 2005; Drummond, 2002, 2003; Drummond & Fresco 2005; England & Barnes, 2006; Mackay 2006).

In 1999, Gadd took his computer to the local branch of PC World for repair. The technician noticed that there were a large number of pornographic images on the hard drive, many of them of children, and reported the matter to the police. Gadd was charged with downloading child pornography and jailed for four months, though he was cleared of charges of actual sex with children. The case received immense publicity. On his release, Gadd flew to Cuba, but soon attracted attention there and was expelled. Cuba was increasingly being identified by the Western media as a haven for sex tourism, and apparently also wanted to clean up its act.⁷ Gadd then moved on to Phnom Penh in Cambodia in the late summer of 2001.

Unfortunately, he arrived at a time when both the British and Cambodian governments were attempting to take a hard line with alleged pedophiles and sex tourists. One Briton had already been jailed in Cambodia for sex offences, while another had been jailed in Britain for having sex with a 13-year old girl while in Cambodia. Early in 2002, the Cambodian Minister of Women's Affairs demanded Gadd's deportation from the country. Gadd spent the next two years moving between Cambodia, Thailand and Vietnam, with a series of court battles to resist attempts to remove him. By the summer of 2005, he had moved to Vietnam, but was arrested in November of that year on charges of having sex with a 12-year old girl in Vung Tau, a resort town popular with foreign oil workers, where prostitution was presumably not unknown. However, Gadd was difficult to ignore because of the media attention that followed him in his travels. Eventually, after charges of rape were dropped after payment of compensation, he was sentenced to three years in jail in March, 2005. In an interview with the BBC, he denied that he had slept knowingly with girls below the age of consent, and suggested that he might return to the UK after his release. As a reaction to this and similar cases, the British government put forward proposals to place overseas travel restrictions on registered sex offenders in future.⁸

Gadd's misfortunes were clearly made worse by his former fame and the tenacity with which the tabloid press followed the twists and turns of the story. He was not a sex tourist in the conventional sense, nor had he been convicted of actual pedophilia in his original trial. Before the new legislation of the mid-1990s, he might not have been convicted of any offence at all. However, the media coverage of his case persistently linked the issues of pedophilia, pornography and sex tourism, and articles in the popular press on sex tourism often referred to the Gadd case, just as accounts of the Japanese in Zhuhai tended to end with references to Nanjing.

COUPLES AND SEX TOURISM: SWINGING, DOGGING, AND ADULT RESORTS

As the history of the 19th and 20th century often shows, new communications technologies are often adapted to the sex industry with considerable speed. Earlier studies have shown that sex lay behind much of the popularity of the Minitel system in France during the 1980s (Castells, 1996), even though it was designed for more mundane uses such as looking up telephone numbers and paying bills.

Once the Internet itself was in place in the early 1990s, sex-related usage escalated. As with Minitel, sex became the most popular area of discussion in many of the bulletin boards and chat rooms that proliferated on the Internet, and dating and matchmaking sites took over from the agony columns of the magazines and newspapers (Merkle & Richardson, 2000). Dating sites had the added advantage that they could reach a much wider region, would be read by many more people, and provided facilities like e-mail and the instant exchange of photographs through ICT, the first of a new generation of instant messaging facilities. The matchmaking engines often had room for

information on sex, age group, sexual preferences, appearance, location, and personal statements, as well as email addresses that could be used for more general purposes. Clearly many people using these sites are hiding behind adopted personae and Internet pseudonyms, but much of the information is probably genuine, as shown by the large number of unflattering self-descriptions and the number of participants in older age groups to be found on these sites. Some commentators have seen the emergence of a new culture of “encounter” arising as a result (Holden & Tsuruki 2003).

What these chat sites and matchmaking services also allowed was the proliferation of groups with similar unorthodox sexual preferences. Perhaps the largest of these were the swingers, couples and singles meeting together either to exchange partners or for group sex. “The lifestyle” as it is often known became popular in the 1970s as part of the counter culture in America, and among the sexually more adventurous in Europe. It continued to spread, despite the onset of AIDS, thanks to the almost universal use of condoms. It tends to be found most often among middle class highly educated couples, including many who are middle aged, many of them churchgoers (Bergstrand & Blevins, 2000). It has even spawned its own associations (such as the International Lifestyle Association, NASCA International for the U.S., or the Sexual Freedom Coalition for the UK) and its own genre of guidebooks (e.g., Bellemeade, 2002; Thomas, 1997). The Internet has provided swingers with three important forms of information: the location and personal details of other singles and couples and their various interests, the location of clubs and other meeting places, and chat rooms and notice boards where people can interact online or post their fantasies, experiences, photographs and videos.⁹ The number of people using these sites appears to be enormous. At the time of writing, Swinging Heaven in the UK claimed to have over half a million members, with nearly a quarter of a million singles or couples including photos or

videos in their advertisements. There is at least one case in which a couple turned a Web site documenting their sex lives into a multi-million dollar business.

Many Web sites cater to gay men and women as well, though they also have their own specialized sites. As the popularity of the Internet spread, a variety of sexual subcultures soon appeared online as participants were able to describe themselves and their preferences to each other.¹⁰ The Web sites also began to provide information on travel to tourist centers with active sex service industries and sub cultures such as San Francisco, Berlin and Amsterdam (Brants, 1998; Wonders & Michalowski, 2001), and the kinds of attractions and activities available there.¹¹ This was part of a realization of the significance of the gay tourist market and the potential for businesses in catering to it (Clift, Luongo, & Callister, 2002). An online cruising culture is not confined to the West, but also has developed in Japan as well (McClelland, 2003). As with heterosexual couples, contacting partners online offers participants several advantages. It allows discretion, especially in countries where homosexuality is still either criminalized or discriminated against. Messages reach a much wider audience than they otherwise would, and potential partners are able to exchange photographs and discuss sexual preferences before actually meeting.

Making contact with potential partners does not necessarily overlap with tourism, but it often does. Many Web sites have information on a wide variety of “erotic vacations,” adults-only resorts (many of them “clothing optional,” and sex clubs located there which cater either the straight or the gay market.¹² There is probably a continuum between clubs which cater mainly for the local or regional crowd, as in the cities of northern England which are not major tourist centers, to those which cater almost entirely for tourists, such as those in the major tourist resorts aimed at a swinging clientele. The physical layout of

the clubs, whether straight or gay, appears fairly uniform. There is usually an area for meeting and preliminary socializing, often centered around a bar. There also is a shower area, communal “play” areas featuring around large beds or mattresses, and sometimes private rooms to which couples and groups that require more intimate surroundings can move. Other common features include rooms with mirrors, rooms with bondage equipment and/or swings, glory holes, saunas, steam rooms, hot tubs, pools or Jacuzzi, and TV screens showing pornographic movies. One club in the UK has even imported a camper van and gravel into one of its playrooms, to recreate the outdoor dogging experience without the risks (for dogging see below). The Web sites often have space for visitor’s comments, which can range from the enthusiastic to the highly critical.¹³ One of the main issues in straight clubs is whether or not to allow entry to single men. It seems to be a universal problem for the swinger community that there are more men wishing to participate than women. Opinions are divided about letting in single men. Some argue that more men are needed to keep the party going, given that they tire and give up more quickly than women. Others argue that too many single men get in the way, and spoil the fun. The result is a paradoxical fee structure in which often single men pay more than couples and women are often admitted free. Some times of the week in many establishments are restricted to couples and single women only, with themed gay, bisexual, fetish-wear, S-M, or “greedy girl” evenings.

Demographic and locational imbalance creates a market demand for more informal venues for the voyeur community, and another developing niche in the market for amateur sexual services is provided by isolated spots where singles or couples meet informally for sex, often in the evening or at night. In the UK, this is now known as “dogging” though its antecedents, such as gay men frequenting public toilets for sex (Humphreys,

1975) or casual exhibition and open-air sex on nude beaches (Douglas, 1977), have been around for a long time. The new element in dogging is that exhibitionism and group sex tend to take place in car parks or other places which are accessible to vehicles, and that information on sites and activities is mainly spread by the Internet. This is an ideal medium for listing such locations, given that there are frequent changes of venue in response to police surveillance. The police can find out where the action is as easily as the doggers, simply by surfing the net.

However, generally these activities are taking place in an increasingly liberal atmosphere in most countries in the West. Most of the EU countries have now adopted the liberal and relaxed attitudes to sex which have long been the norm in France, Holland and Scandinavia. Pornography (other than child pornography) is readily available, sex clubs are increasingly popular, and expressions of open sexuality, including gay sexuality are increasingly recognized. Clothing optional and gay-friendly resorts and hotels are multiplying, and couples post their experiences, fantasies, photographs and action videos on the Internet, as sources of information for each other, and free entertainment for other surfers.

CONCLUSION

As can be seen from the discussion above, the relationship between the Internet and sex, including sex tourism, has been extremely complex over the last decade. First, the relationship is not entirely one way: to judge from the preponderance of sex-related material in lists of the most popular Web sites, it was access to potential partners and the forbidden fruit of pornography that helped the Internet take off in the first place. In the late 1990s, the top sites on the Internet were nearly all concerned with sex or pornography. Now, the most popular sites are the search engines Google and Yahoo, technical sites such as Microsoft, or

news sites such as the BBC. The sex sites only start much lower down the list. Now that the Internet has been with us for a number of years, it is becoming possible to assess the impact of this relationship on the wider society, and here the three terms which feature in the subtitle of this chapter, information, amplification and moral panics, may be useful headings under which to summarize my findings.

Sex has historically always been an important motivation for tourism, and the sex industry has grown up alongside the travel industry from ancient times. However, "sex tourism" as an issue in the media and the popular consciousness is comparatively recent. The data from the online press databases suggests that there were very few references to it at all before 1995-96, when it first became the subject of widespread media attention and debate. This happened to coincide with the takeoff of the Internet, and the merging images of pornography, child abuse, prostitution in the popular imagination meant that sex tourism began to appear more regularly as an issue.

It is undeniable that, for better or worse, sites dealing with sex-related materials are incredibly popular, and presumably many people are using them as portals to free entertainment rather than active participation. However, the dating sites show hundreds of thousands of people registering their profiles and participating in email, and presumably a significant number of these are doing so in order to meet real people. The popularity of these activities is shown by the proliferation of adult vacations, erotic tourism, clothing optional resorts, and guidebooks catering to the people who use them. This is a niche market, but the Internet is significant because it can make available information on so many of them in a single search. It has taken over the role of the small personal ad in the newspapers or the contact magazines which started up in the 1970s, but performs it infinitely more efficiently. Meanwhile, of course, the drop in the cost of transport over the years has meant

that the possibility of actually meeting potential partners also has greatly increased.

It is difficult to know how many people are involved in alternative lifestyle options, but what evidence there is suggests that it is significant, particularly in the wealthier and more highly educated sectors of society. The AIDS epidemic precipitated a crisis in the 1980s, but the swinging fraternity has long since embraced the condom, and in any case there are plenty of other things to do which don't involve the exchange of bodily fluids. Meanwhile, governments in the West seem to have come to terms with the situation: the legal regime is increasingly liberal, policing is increasingly relaxed, and the impossibility of controlling and regulating what consenting adults choose to do with each other is recognized. When things get out of hand, there is discrete regulation. The amount of sex and exhibitionism behind the main beach in Cap d'Agde a few years back worried the authorities because many families used the beach. The solution was typically Gallic and pragmatic. During the holiday season, the area to the back of the beach was declared a "nature reserve," and the public was kept out by mounted police patrols. Daytime swingers moved elsewhere instead. Once the kids were back in school, controls were relaxed, the swingers returned to the beach, the police disappeared, and the *status quo ante* was restored.

If the Internet can inform, it also can amplify. It would be interesting to research the pattern of spread of information and associated activities, not only for sex, but for many other activities as well. As the popularity of a subject takes off, the increase in information on the Internet is exponential at first, reaching a plateau as virtually everyone who is interested is accessing information online. Interest might fall off later as new fads appear, though in the case of sex this has yet to happen. The power of the Internet may therefore mean that social trends are amplified and accelerated, reaching a plateau more rapidly than they otherwise might have done.

However, the Internet also can amplify indignation, dissent and protest, creating moral panics that led, in the case of sex tourism, to regulation with breathtaking speed. As images of child prostitution, pornography and sex tourism merged in the media and on the net, governments and politicians felt impelled to act, as being soft on sin was simply not an option for them. No matter that the legislation was badly framed, that it seemed to some to perpetuate images of colonial paternalism (Noh, 1997), or that it actually led to the arrest of very few individuals (Fraley, 2005), including some like Gadd whose activities were discovered more or less by accident.

As more dispassionate observers have noted, sex tourism involving prostitution is likely to continue for good economic reasons, the poverty of the families concerned, and the differential cost of sex between countries. The way forward, they argue, is improving the conditions of sex workers, given that policing and regulation are virtually impossible. The implication is not to try and stamp out sex tourism, or to keep it off the Internet, but to use the Internet to empower and educate the sex workers themselves (Law, 2000), on the assumption that an increasing number of them will gain access as costs continue to fall, for example through the merging of mobile phone and Internet technologies in the years to come.

REFERENCES

- Aglionby, J. & Barnett, A. (2005, November 20). Gary Glitter could face a firing squad. *Observer*, New pages, p. 1.
- Bainbridge, B. & Aglionby, J. (2005, November 26). Sex tourism Accusations against Gary Glitter throw spotlight on Vietnam: Tracking down child abusers: Police forces unite to fight world problem. *The Guardian*, London, final ed., p. 7.
- Beck, E. (1990, August 14). Hungarian resort launches love boat. *The Times*.
- Bellemeades, K. (2003). *Swinging for beginners: An introduction to the lifestyle*. New Tradition Books.
- Bergstrand, C. & Blevins, J. (2000, Oct. 10). Today's alternative marriage styles: The case of swingers. *Electronic Journal of Human Sexuality*, 3. Retrieved from www.ejhs.org
- Beyrer, C. & Stachowiak, J. (2003). Health consequences of trafficking of women and girls in South-east Asia. *Brown Journal of World Affairs*, 10(1).
- Birmingham Post. (2003, April 16). New ban to stop perverts going abroad for child sex. *Birmingham Post*, p. 9.
- Bishop, R. & Robinson, L. S. (1998). *Nightmarket: Sexual cultures and the Thai economic miracle*. New York: Routledge.
- Bornoff, N. (1991). *Pink samurai: Love, marriage & sex in contemporary Japan*. New York: Pocket Books.
- Branigin, W. (1993, December 2). Asia Faced With AIDS Catastrophe. *The Washington Post*.
- Brants, C. 1998. The fine art of regulated tolerance: Prostitution in Amsterdam. *Journal of Law and Society*, 25, 621-35.
- Brennan, D. (2004a). Women work, men sponge, and everyone gossips: Macho men and stigmatized/ing women in a sex tourist town. *Anthropological Quarterly*, 77(4), 705-33.
- Brennan, E. (2004b). *What's love got to do with it? Transnational desires and sex tourism in the Dominican Republic*. Durham, NC: Duke University Press.
- Brown, L. (2000). *Sex slaves: The trafficking of women in Asia*. London: Virago.
- Castells, M. (1996). *The rise of the network society*. Oxford: Blackwell.
- Cater, N. (1995, October 23). Crackdown on child sex. *Herald Sun*.

- Claire, R. & Cottingham, J. (1982). Migration and tourism: An overview. In *Women in development: A resource guide for organisation and action* (pp. 122-138). Geneva: ISIS Women's International and Communication Service.
- Clift, S., Luongo, M., & Callister, C. (Eds.). (2002). *Gay tourism: Culture, identity and sex*. London: Continuum.
- Constantine, P. (1993). *Japan's sex trade*. Tokyo: Tuttle.
- Douglas, J. (1977). *Nude beach*. Thousand Oaks CA: Sage.
- Drummond, A & Fresco, A. (2005, November 22). Gary Glitter could face a firing squad. *The Times* (London), p. 17.
- Drummond, A. (2002, April 28). Glitter faces deportation in crackdown on sex tourism. *Scotland on Sunday*, p. 13.
- Drummond, A. (2003, January 8). Pervert thrown out of Far East hiding place; Glitter in Jail again. *The Express*, p. 10.
- Eldredge, R. (1997). The 1996 Okinawa Referendum on U.S. base reductions: One question, several answers. *Asian Survey*, 37(10), 879-904.
- England, V. & Barnes, A. (2006, March 5). Glitter to be deported to Britain after his release in November. *Independent on Sunday* (London), p. 47.
- English Media Service. (2003, September 29). Sex scandal prompts anti-Japanese sentiments in China. ANSA English Media Service.
- The Express. (2000, January 5). Police go online to net cybergangs. *The Express*.
- Express on Sunday (2000, January 9). Police target Internet merchants of porn. *Express on Sunday*.
- Flemming, R. (1999). *Quae corpore quaestum facit: The sexual economy of female prostitution in the Roman Empire*. *The Journal of Roman Studies*, 89, 38-61.
- Fraley, A. (2005). Child sex tourism legislation under the Protect Act: Does it really protect? *St John's Law Review*, 79(2), 445-483.
- Garcia Dizon, J. (2004). *Philippine migrants in Japan: Networks, strategies, narratives and the negotiation of identity*. Unpublished MA dissertation, Ritsumeikan Asia Pacific University, Beppu, Japan.
- Garcia Dizon, J. (2006). Revisiting the OPA phenomenon: What's next for Filipino migrant workers to Japan?" *Ritsumeikan Journal of Asia Pacific Studies*, 20, 69-84.
- Gould, T. (2000). *The lifestyle: A look at the erotic rites of swingers*. Firefly Publishers.
- The Guardian (1993, December 11). French MPs back sex tourism curb. *The Guardian*.
- The Guardian (2003, September 29). Japanese "orgy" claim sparks outrage in China. *The Guardian*, Final ed.
- Hall, C. M. (1992). Tourism in South-East Asia. In D. Harrison (Ed.), *Tourism and the less developed nations* (pp. 64-74). London: Belhaven Press.
- Hall, C. M. (1998). The legal and political dimensions of sex tourism: The case of Australia's child sex tourism legislation. In M. Oppermann (Ed.), *Sex tourism and prostitution: Aspects of leisure, recreation and work* (pp. 87-96). New York: Cognizant Communication.
- Henley, J. (1993, September 10). Stolen bodies. *The Guardian* (London).
- Hershatter, G. (1997). *Dangerous pleasures: Prostitution and modernity in twentieth-century Shanghai*. Berkeley, CA: University of California Press.
- Hicks, G. (1997). *The comfort women*. New York: Norton.

- Holden, T. & Tsuruki, T. (2003). *Deai-kei*: Japan's new culture of encounter. In N. Gottlieb & M. McLelland (Eds.), *Japanese cybercultures* (pp. 39-49). London: Routledge.
- Humphreys, L. (1975). *Tearoom trade*. Chicago IL: Aldine.
- Independent, The. (2003, December 13). Trial of 14 Chinese over huge orgy fuels anti-Japanese sentiment. *The Independent* (London, UK), Foreign ed, p. 15.
- Ingham, R. (1991, September 7). Germany acts on sex tourism. *The Independent*.
- Jackson, P. A. (1997). Kathoey <Gay> <Man>: The historical emergence of gay male identity in Thailand. In L. Manderson & M. Jolly (Eds.), *Sites of desire, economies of pleasure: Sexualities in Asia and the Pacific* (pp. 166-190). Chicago: University of Chicago Press.
- Jackson, P. A. (2003). Gay capitals in global gay history: Cities, local markets, and the origins of Bangkok's same-sex cultures. In R. Bishop, J. Phillips & W. Yeo, (Eds.), *Post-colonial urbanism: Southeast Asian cities and global processes* (pp. 151-163). New York: Routledge.
- Jeffreys, E. (2004). *China, sex and prostitution*. London: Routledge.
- Kempadoo, K. (2002). Introduction: Globalizing sex workers' rights. In K. Kempadoo & J. Doezema (Eds.), *Global sex workers: Rights, resistance, and redefinition* (pp. 1-28). New York: Routledge.
- Law, L. (1997). A matter of "choice": Discourses on prostitution in the Philippines. In L. Manderson & M. Jolly (Eds.), *Sites of desire, economies of pleasure: Sexualities in Asia and the Pacific* (pp. 232-261). Chicago IL: University of Chicago Press.
- Law, L. (2000). *Sex work in Southeast Asia: The place of desire in a time of AIDS*. London: Routledge.
- Lerner, G. (1986). The origin of prostitution in ancient Mesopotamia. *Signs*, 11(2), 236-254.
- Leupp, G. (1995). *Male colors: The construction of homosexuality in Tokugawa Japan*. Berkeley CA: University of California Press.
- Lewis, J. (2000). Controlling lap dancing: Law, morality, and sex work. In R. Weizer, (Ed.), *Sex for sale: Prostitution, pornography and the sex industry* (pp. 203-216). New York: Routledge.
- Lie, J. (1995). The transformation of sexual work in 20th-century Korea. *Gender and Society*, 9, 310-327.
- Liepe-Levinson, K. (1998). Striptease: Desire, mimetic jeopardy, and performing spectators. *The Drama Review*, 42(2), 9-37.
- Lintner, B. (2002). *Blood brothers: Crime, business, and politics in Asia*. Chiang Mai, Thailand: Silkworm Books.
- Longstreet, S. & Longstreet, E. (1970). *Yoshiwara: The pleasure quarters of old Tokyo*. Tokyo: Tuttle.
- Mackay, N. (2006, March 5). Leader of the gang: Gary Glitter's not the first western paedophile to prowl Southeast Asia. It's just that he got caught. *The Sunday Herald*, p. 37.
- Manderson, L. (1992). Public sex performances in Patpong and explorations of the edges of imagination. *Journal of Sex Research*, 29(4), 451-475.
- Manderson, L. (1997). "Parables of imperialism and fantasies of the exotic: Western representations of Thailand—place and sex. In L. Manderson & M. Jolly (Eds.), *Sites of desire, economies of pleasure: Sexualities in Asia and the Pacific* (pp. 123-144). Chicago IL: University of Chicago Press.
- Manderson, L. & Jolly, M. (Eds.) (1997). *Sites of desire, economies of pleasure: Sexualities in Asia and the Pacific*. Chicago IL: University of Chicago Press.

- Marsh, D. (2006, May 5). Vietnam wakes up to child-sex trade. *South China Morning Post*, p. 8.
- Matsui, Y. & Sharnoff, L. (1977). Sexual slavery in Korea. *Frontiers: A Journal of Women Studies*, 2(1), 22-30.
- McClelland, M. (2003). Private acts/public spaces: Cruising for gay sex on the Japanese Internet. In N. Gottlieb & M. McLelland (Eds.), *Japanese cybercultures* (pp. 141-155). London: Routledge.
- Merkle, E.R. & Richardson, R.A. (2000). Digital dating and virtual relating: Conceptualizing computer mediated romantic relationships. *Family Relations*, 49(2), 187-192.
- Moon, K. H. S. (1997). *Sex among allies: Military prostitution in U.S.-Korea relations*. New York: Columbia University Press.
- Moon, K.H.S. (1999). "South Korean movements against militarized sexual labor. *Asian Survey*, 29(2), 310-327.
- Moselina, L. (1979). Rest & recreation: The U.S. naval base at Subic Bay. *Tourism and Prostitution* (pp. 17-20). Geneva: ISIS (International Bulletin 13).
- Noh, E. (1997) "Amazing grace, come sit on my face," or Christian ecumenical representations of the Asian sex tour industry. *Positions*, 5(2).
- Philippine Women's Research Collective. (1985). *Filipinas for sale: An alternative Philippine report on women and tourism*. Quezon City: Philippine Women's Research Collective.
- Poole, T. (1991, October 15). Tourists who exploit women and children. *The Independent*, Living, p. 16.
- Rosner, B. W. (1998). Temple prostitution in 1 Corinthians 6:12-20. *Novum Testamentum*, 40(4), 336-351.
- Ryan, C. & Hall, C. M. (2001). *Sex tourism: Marginal people and liminalities*. London: Routledge.
- Sanders, D. (2002). "Some say Thailand is a gay paradise. In S. Clift, M. Luongo, & C. Callister (Eds.), *Gay tourism: Culture, identity and sex* (pp. 42-62). London: Continuum.
- Seabrook, J. (2000). *No hiding place: Child sex tourism and the role of extraterritorial legislation*. London: Zed Books.
- Seidensticker, E. (1983). *Low city, high city: Tokyo from Edo to the earthquake*. New York: Knopf.
- Seidensticker, E. (1990). *Tokyo rising: The city since the great earthquake*. New York: Knopf.
- Seigle, C. S. (1993). *Yoshiwara: The glittering world of the Japanese courtesan*. Honolulu: University of Hawaii Press.
- Shelley, L. (2005). "Russian and Chinese trafficking: A comparative perspective. In S. Stoecker & L. Shelley (Eds.), *Human traffic and transnational crime: Eurasian and American Perspectives*. Lanham, MD: Rowman & Littlefield.
- Skeggs, P. (1992, November 11). Call for law on tourist sex. *Herald Sun*.
- Soh, C. S. (1996). The Korean "comfort women" movement for redress. *Asian Survey*, 36(12), 1226-1240.
- Sunday Times. (2002, November 24). Pedophiles may lose passport. *Sunday Times* (London), p. 30.
- Thomas, P. (1997). *Recreational sex: An insider's look at the swinging lifestyle*. Peppermint Publishers.
- The Times. (1999, November 15). Havana is haven for sex tourists and paedophiles. *The Times* (London).
- Toorn, K. van der. (1989). Female prostitution in payment of vows in Ancient Israel. *Journal of Biblical Literature*, 108(2), 193-205.
- Truong, T.-D. (1990). *Sex, money and morality: Prostitution and tourism in Southeast Asia*. London: Zed Books.

Watanabe, K. (1995). Trafficking in women's bodies then and now: The issue of military "comfort women." *Peace and Change*, 20(4), 501-514.

Wonders, N. A. & Michalowski, R. (2001). Bodies, borders, and sex tourism in a globalized world: A tale of two cities—Amsterdam and Havana. *Social Problems*, 48(4), 545-71.

Yamazaki, T. (1999). *Sandakan Brothel No.8: An episode in the history of lower-class Japanese women*. Armonk, NY: M.A. Sharpe.

ENDNOTES

- ¹ ECPAT describes itself as "a global network dedicated to ending the commercial sexual exploitation of children." In 1996, its original name, "End Child Prostitution in Asian Tourism," was changed to "End Child Prostitution, Child Pornography, and Trafficking in Children for Sexual Purposes" (http://www.ecpat.net/eng/ecpat_inter/projects/sex_tourism/sex_tourism.asp, accessed 7/706).
- ² For a sample of press coverage at the time, see for example, "Sex scandal prompts anti-Japanese sentiments in China," ANSA English Media Service, Monday, September 29, 2003; "Trial of 14 Chinese over huge orgy fuels anti-Japanese sentiment," Independent (London, UK), foreign ed, p. 15, Saturday, December 13, 2003; "Japanese "orgy" claim sparks outrage in China," The Guardian - Final Edition, September 29, 2003.
- ³ Wikipedia defines "moral panic" as "a mass movement based on the false or exaggerated perception that some cultural behavior or group of people, frequently a minority group or a subculture, is dangerously deviant and poses a menace to society" (http://en.wikipedia.org/wiki/Moral_panic).

- ⁴ Many ECPAT publications can be accessed from the ECPAT site, <http://www.ecpat.net/eng/index.asp>.
- ⁵ "French MPs back sex tourism curb," *The Guardian*, December 11, 1993.
- ⁶ "Police go on-line to net cybergangs," *The Express*, January 5, 2000; "Police target Internet merchants of porn," *Express on Sunday*, January 9, 2000.
- ⁷ "Havana is haven for sex tourists and paedophiles," *The Times* (London), November 15, 1999.
- ⁸ "Paedophiles may lose passport," *Sunday Times* (London) November 24, 2002, p. 30; "New ban to stop perverts going abroad for child sex," *Birmingham Post*, April 16, 2003, p. 9.
- ⁹ For typical examples see http://www.intimateassociates.com/swingers/about_us.php (Intimate Associates), and <http://www.theila.org/publicpages/links.shtml> (International Lifestyle Association) for the U.S., or <http://www.swingingheaven.co.uk/> (Swinging Heaven) for the UK. Currently, the most popular adult sites in the U.S., ranking 31 (34 in the UK), is AdultFriendFinder.com.
- ¹⁰ These sites are too numerous to mention individually, but a selection can be accessed through portal sites such as Gay Crawler, <http://www.gaycrawler.com/>.
- ¹¹ Gay tourism already has its own Wikipedia site (http://en.wikipedia.org/wiki/Gay_tourism) which includes information on major tourist destinations and a selection of links, including the International Gay and Lesbian Tourist Association, <http://www.traveligla.com/>.
- ¹² See for example <http://www.4swinging.com/DEFAULT.htm>.
- ¹³ For typical comments for UK clubs, see <http://www.swingingheaven.co.uk/clubs/index.html>.

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper, pp. 260-284, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.5

Cultural Knowledge Management and Broadband Content in Development: Open Content Platforms, Copyright and Archives

David Rooney

University of Queensland, Australia

Elizabeth Ferrier

University of Queensland, Australia

Phil Graham

University of Queensland, Australia

Ashley Jones

University of Queensland, Australia

ABSTRACT

This chapter examines the possibility of creating online creative production archives with which to make locally and internationally sourced high quality video, audio, graphics, and other broadband content available to grassroots producers in developing economies. In particular, the possibility of Cultural Knowledge Management Systems and the use of innovative Creative Commons copyright licenses are explored. It is argued that in

a global knowledge economy, cultural production is a major driver of economic growth. The creativity and culture needed for cultural production are plentiful in developing countries indicating that if technical and institutional conditions are right there is significant potential for developing economies to compete in the global economy. It is, therefore, desirable for local groups to be able to acquire, store, and distribute locally and internationally sourced content to stimulate local-level cultural production.

INTRODUCTION

In this chapter the authors argue that the recognized potential for social, cultural, and economic benefits that accrue from widespread participation in the production of cultural materials, as it has been discussed in developed countries such as Australia and the United Kingdom (Cutler, 2003; DEST, 2002; National Broadband Taskforce, 2004), and in the academic literature (Florida, 2002; Rooney & Graham, 2004), is equally applicable in developing countries. Recent discussions about cultural industries in the developed world show a concern for digital cultural production modes in the context of the Internet and broadband infrastructure. This chapter, therefore, discusses key aspects of capacity building for developing economies to take advantage of these new conditions. The kinds of capacities discussed are concerned with infrastructure, industry, creative expression, and cultural maintenance and renewal capacities. Furthermore, working on the assumption that culture is an expression or mode of enacting knowledge (Holden, 2002; McCarthy, 1996; Rooney & Schneider, 2005), the authors argue that such capacity building will be conducive to the emergence of developing countries as knowledge societies and economies.

In particular, this chapter is concerned with how cultural knowledge management in a digital broadband environment, and innovative copyright developments from Creative Commons (Creative Commons, 2003) have assisted in the creation of an “open” cultural content commons. This commons can develop into a global network of Internet accessible digital archives that collect, hold, and diffuse materials for use in creative production (for commercial or noncommercial purposes) in ways that increase the capacity for independent cultural production in developing countries.

Why Cultural Production?

Beyond the purely economic, there are important though less tangible benefits related to widespread participation in cultural life. Mumford (1934) identifies a civilizing aim that should reside at the centre of all economic endeavours:

The essential task of all sound economic activity is to produce a state in which creation will be a common fact in all experience: in which no group will be denied, by reasons of toil or deficient education, their share in the cultural life of the community, up to the limits of their personal capacity. (p. 430)

There are very practical reasons for taking such a stance in respect of economic goals. These include the health of democratic participation through sophisticated media practices; the economic and cultural benefits that flow from a vibrant, active, and innovative culture of creativity; the proven net economic benefits of a knowledgeable, educated, and intellectually active population; the decentralization of media power; diversification of sources and forms of media content; the maintenance and promotion of local, regional, and national identities; and the widespread personal fulfilment that comes from active and visible participation in the life of a culture. In more general terms, cultural participation assists in resisting the worst aspects of the Western tendency to instrumentalism and technocracy that impoverish culture, make authentic expressions of grassroots culture invisible and devalued, and make it difficult for non-Western countries to compete in the global creative or cultural economy.

One simplistic explanation for the disparity in cultural economic power of the U.S. is that its media corporations hold a global “monopoly” on distribution channels and key production enabling resources, and forcefully impose unfair

protectionist trade barriers in the form of oppressive IP rights frameworks (Drahos & Braithwaite 2002). While other factors are always at play, such monopolies are strong and recognizable forces in the historical distribution of economic and cultural power.

Broadband distribution networks and new copyright innovations challenge the mass media patterns that emerged in the twentieth century and as such have the potential to create new opportunities for developing countries. This technological change brings historically low and diminishing costs for global distribution of cultural content (Rooney, 1997). Simultaneously, rapid developments in digital production technologies have led to lower costs of production, thereby making it possible for a much broader range of people than ever before to work as multimedia content developers at a commercially viable level. There is unprecedented demand for digital media content. This demand has stimulated media organizations, telcos, and governments to position themselves to capitalize on broadband technologies and media convergence, and compete to attract consumers to online services. Just as cultural forms and artifacts from non-Western countries have found global metropolitan markets (e.g., Japanese *anime* and *manga*, Chinese martial arts films, and post-colonial literatures), distinctive media content from developing countries has the potential to appeal to mass and niche audiences across the world. As a result of these trends, significant new opportunities are emerging. In short, the rise of widely accessible global distribution networks, greatly lowered costs of production technologies, heightens potential rates of involvement in production activities, and increased demand for digital media content (particularly distinctive content with appeal to multicultural metropolitan audiences). Furthermore, a policy willingness to embrace the potentials indicated by the above mentioned developments means that people who in the past have worked on the periphery of global cultural

production may gain socially, culturally, and economically in the emerging online environments. While there are barriers in achieving this success in the form of poor infrastructure, the dominance of the English language on the Internet, lack of skills and training, low levels of investment, and so forth, the potential for mobilizing grassroots creativity that has direct economic and cultural benefits, in contributing to notions of civility and citizenry, in fostering artistic dialogue across cultures, and in exploring the democratizing potentials that a diversified media environment offers cannot be ignored.

Looking more closely, it can be observed that the mass media industry structures that developed throughout the twentieth century are premised on high-capital costs (e.g., large television, recording, and film studios); highly specialised divisions of labor (specialised divisions of labor in audio, music, cinematography, animation, pre and post-production, etc); long and expensive development times for content; heavy reliance on advertising revenues; highly integrated distribution networks; and highly restricted access to those networks through electromagnetic spectrum licensing regimes. As recently as a decade ago, the cost of plant and equipment required to create high-quality audio and video productions was a prohibitive barrier to entry for the majority of people regardless of their talents. Capital outlays required to finance the global distribution of multimedia works were even more prohibitive. As few as six companies have dominated global mass media broadcast networks (Bagdikian, 1997; McChesney, 2000; Schiller, 1999).

Today, however, the tools to create high-quality multimedia productions are widely and inexpensively available (Graham, 2005). In some cases, high-quality multimedia production tools can be legally downloaded by users at no cost. As a means of distributing creative content, broadband networks are becoming more common and efficient, with over 100 million people now

subscribing to broadband services (De Argaez, 2004). Data transfer rates are increasing, the cost of broadband access is falling almost daily, and in some cases access is provided at no cost (National Selection Committee, 2004).

Combined with the above trends, and facilitated by new digital production tools, a blurring of roles and functions in creative labor processes has begun to replace the fairly rigid historical divisions of labor characteristic of mass media industries. Using basic consumer technologies, it is possible for a person to film, edit, compose music, produce, and globally distribute their multimedia productions. Moreover, collaborative content creation programs and tools enable teams and networks of people to participate in co-creation online, and pooling of resources and skills. An aspect of these emerging production arrangements are new content “customizing” practices, such as the modification, personalization, “remixing” and “repurposing” of existing content. An interesting result of these changes is that the participants now involved in content creation include fans and hobbyists who might not identify themselves as content producers. Such grassroots practices exemplify the blurring of boundaries between production and consumption that is characteristic of new media environments and which open up opportunities for developing countries.

Consequently, a new, much larger group of people is now engaged in the production and global distribution of high quality multimedia productions. This presents as a benefit in relation to the creative development of culture because it enables societies to renew their knowledge of themselves, to have new insights about their own condition, and to have new things to communicate about themselves. Thus, it is important that cultural innovation comes from the bottom up; in other words from the grassroots. With this constant cultural renewal there are social and economic benefits.

As suggested above, aesthetic innovation emerging from the grassroots has significant social and economic benefits. The new means and forms of production, distribution and exhibition available to grassroots content creators facilitate experimentation and innovation. As the independent sectors in the cultural industries have demonstrated, low-budget productions often afford a higher level of creative control to artists than they have when involved in large commercial productions. The finished product is more likely to be innovative and diverge from established formats and genres.

Further, there are local, national and global markets for grassroots stories, local knowledge and cultures, and hybrid content forms produced in developing countries. Independent film and television production sectors in a range of countries (such as Nigeria, Taiwan, and France) illustrate the way that low budget productions, made from the margins (independent of the major media companies), can hold wide appeal, representing cultures and subcultures to local and global audiences, different to those usually seen in mainstream cinema. Public television networks such as the UK’s Channel 4, or Australia’s SBS, have tapped into their respective independent production sectors (which Leadbeater and Oakley [1999] call “the missing middle” in the creative industries) to generate diverse, innovative, high-quality content that has succeeded in reaching national and international audiences (Ferrier & Lawe-Davies, 2002). If one makes a distinction between the independent and the grassroots sectors, the potential and diversity of the independent production sector in developed economies can be seen as indicative of the value of grassroots digital content production in developing countries (Ferrier, Bruns, Rooney & Graham, 2004; Ferrier & Lawe Davies, 2002). What is identified here as the “grassroots” content production sector—emergent, rapidly growing, informal and dispersed—can be thought of as “the missing grassroots” (Bruns, Ferrier, Graham &

Rooney, 2005), and it is even less visible to many policy makers, governments and media corporations than the independent sector, yet is arguably a richer and more sustainable source of diverse media content. As the enormous success of discussion lists, online chat, Web site development, blogs, and wikis demonstrates, online grassroots or amateur content creation and consumption are thriving, emergent phenomena. At the very least, these conditions demonstrate that amateur media content regularly reaches large global audiences through the Internet. At best, it can be argued that when appropriate infrastructure for cultural production is available commercial producers will be able to access larger markets. However, significant penetration of those markets is not automatic and as will be shown later gaining access requires attention to content (storage, retrieval, and diffusion) management and copyright.

The “Grassroots” and the Economic Future of Genre

There are four main reasons why this chapter emphasizes grassroots production efforts. First, most approaches to developing broadband content have so far depended on principles and assumptions developed in older media environments. The most fundamental policy and regulatory frameworks designed to guide the development of broadband services are often developed and managed by national broadcasting authorities, applying “old media” logic to radically different converged new media environments (Young, 2004). Consequently, in developed countries there have been enormous losses associated with broadband content initiatives, as exemplified by the largest quarterly loss in U.S. corporate history by AOL-Time Warner in January 2003 (Keegan, 2003). The “dotcom bubble” notwithstanding, the impetus for the AOL-Time Warner merger, as well as the unparalleled losses the merged entity sustained in 2003, were in large part a function

of Time Warner executives wrongly believing that transferring their print, movie, and music offerings to the broadband environment would automatically result in new markets and increased profits (Rushkoff, 2002). The faulty working assumptions underpinning the above failures are analogous to the assumptions underpinning the many failed early attempts to develop television by transferring the production principles, or “genres,” used in radio (Twitchell, 1999).

Content types from older media, usually defined as “genres” of one sort or another, have been the main focus of attention in developed countries attempting to define and stimulate the broadband content agenda in the domains of policy, research, and industry (e.g., DCITA, 2003a, b). However, by definition the term “genre” refers to well established, relatively stable, and predictable media forms (Graham, 2001). A focus on genre is a focus on what has been successful in older media environments. However, entirely new types of content will flourish in broadband environments. These new types of content are unlikely to develop within the multinational mass media institutions for the reasons stated above. It is among grassroots producers that real innovation is likely to be found, precisely because of their distance from the centralized institutions of mass media. This situation suggests that by virtue of their distance from the core global production institutions the potential for developing countries to find competitive advantages in this new media environment is excellent.

Second, there is a vast difference between the “push” principle of broadcast mass media and the “pull” principle of Internet media. The “push” principle works on the assumption that relatively few people will participate in the production of mainstream mass culture while the majority of people will passively “consume” what the few produce. The “pull” principle operates on the assumption that people will, if given the opportunity, participate in the production of culture as well

as actively seek attractive content to “consume.” A recent Pew Internet survey found that 44% of Internet users in the US “have created content for the online world” sharing ideas, Web sites, photographs, video, and music (Lenhart, Horrigan & Fallows, 2004). Extrapolating from that figure, and given that broadband subscriptions have recently exceeded the 100 million mark globally, there are presently 44 million people with access to broadband infrastructure who are actively creating and sharing content. Even if these numbers were halved, this represents an enormous amount of creative energy with significant economic and cultural potential. These trends indicate a potential inversion of the economic model that underpins mass media—rather than a relatively small number of people and organizations controlling production and distribution networks for cultural content, many millions of people now have a potential audience of many millions. Again, the potential for developing countries to gain a foothold in the global production arena is clear.

By way of cautioning against over-optimism and of the need for concerted political and strategic effort, this is not to suggest all the content produced by broadband users will be successful or even of high quality, but if access to suitable infrastructure is provided in developing countries it is almost a statistical certainty that a sustainable proportion of people will learn to produce material that realizes economic, social, and cultural benefits, whether directly or indirectly. This can be seen as a similar process to that which resulted from the advent of cheap printing (following Gutenberg’s innovations) and growing literacy rates, which combined to assist the emergence of a sustainable publishing industry.

Third, there are significant social, cultural, and economic benefits for regional, remote, and community-based initiatives (National Selection Committee, 2004). According to the National Selection Committee, broadband can bring economic revival to remote and regional communities by

continuing the practice of leveraging “the high level of grassroots activism” evident in these communities (ITU 2003 in National Selection Committee, 2004). Remote regions are rich in cultural tradition and “broadband offers new possibilities for maintaining or reviving traditional cultures and languages as well as new opportunities for innovative cultural expression” by weaving the local—whether rural, remote, or urban—into the global (National Selection Committee, 2004, p. 7). It also “provides new ways for cultural industries, visual and performing arts groups, museums, and other cultural institutions to reach their audiences” (p. 7). As the Time-Warner-AOL debacle demonstrated, the broadband environment is not amenable to being merely another conduit for mass media industries. Rather, it is a platform for the unique, the exotic, and the unusual. Cultural materials with these characteristics cannot be mass produced: they require grassroots participation at the local level. In turn, “distant” communities and cultural producers can reap the economic benefits of a global audience regardless of where they are. UNESCO’s Creative Content e-Platform (<http://creativecontent.unesco.org>) is an example of an Internet-based attempt by producers from the fringes to reach out to a wider audience. This multicultural repository contains “challenging” productions by independent producers from Africa, the Asia-Pacific region, and South and Central America. While not focussed on creative content, the United Nations Development Program’s Asia-Pacific Development Information Program (APDIP) (www.apdip.net) and Malaysia’s United Nations Institute for Training and Research (UNITAR) (www.unitar.org) use online knowledge management systems to provide “open” access to such things as linguistic, cultural, health, educational, and software resources in ways that are designed to be responsive to their core users needs.

Fourth and finally, as Mumford (1934) has already pointed out above, closely linked to the

potential for economic benefit and cultural preservation is an ethical imperative underpinning economic development more generally. While Mumford's words may be interpreted by the hardened cynic as a value-laden "motherhood" statement, there are very practical reasons for taking such a stance regarding economic goals. Indeed, central to the Declaration of Principles governing the WSIS are these very ideas (WSIS, 2003). To reiterate, these include: the health of democratic participation through sophisticated media practices; the economic and cultural benefits that flow from a vibrant, active, and innovative culture of creativity; the proven net economic benefits of a knowledgeable, educated, and intellectually active population; the maintenance and promotion of local, regional, and national identities; and the personal fulfilment that comes from active and visible participation in the life of a culture.

At this point it is worth investigating a little deeper the economic value of broadband content in the global economy. The following quote is typical of emerging attitudes in policy circles in developed countries but they could be applied to policy imperatives in developing countries as well:

Broadband take-up and availability of compelling content are inextricably linked. The level of broadband take-up is likely to remain relatively low unless there is sufficient compelling content available. Since the majority of content is generated overseas it is essential to promote local content that reflects Australians' values, identity, and character. It is also important that distribution channels work effectively with Australia's content industries. (Alston, 2003)

This set of policy imperatives can be read from the perspective of the "knowledge consumption services" sector, which derives from the applied social and creative disciplines (business, education, leisure and entertainment, media and com-

munications) and represents 25% of economic activity in OECD economies (OECD, 1998). In fact all modern economies are consumption driven (e.g., 62% of U.S. GDP) and the social technologies that manage consumption all derive from the social and creative disciplines.

Worldwide, the creative industries sector has been among the fastest growing of the global economy. Several analysts point to the crucial role they play in the new economy, with growth rates better than twice those of advanced economies as a whole (Cunningham, 2005; Howkins, 2001; Jeffcutt, 2005). Creative production has become the model for new economy business practice (highly outsourced; producer model; project management within just-in-time teams, etc.). Rifkin (2000) claims that cultural production will ascend to the first tier of economic life, with information and services moving to the second tier, manufacturing to the third tier and agriculture to the fourth tier. This is a global economic structural change that developing countries should seek to participate in and benefit from.

DIGITAL PRODUCTION TECHNOLOGIES

The authors would like to discuss here, how digital production and postproduction technologies are able to change cultural production dynamics in favour of grassroots producers. Specifically, this section outlines the cultural knowledge management technologies that are central to being able to take advantage of recent changes and that will assist in reducing barriers to production of local content and the broadcast of cultural expression, the diffusion of knowledge, and assist in maintaining the cultural and epistemic integrity of content produced in, by, and for developing countries.

To understand how broadband can best be harnessed to increase economic, social, and cultural

benefit requires an appreciation of enabling infrastructures such as new and emerging production processes; archival technologies and multimedia databases; metadata practices for distributed production processes; and education and literacy strategies for new media environments. These environments are characterized by digital re-use and re-mixing of cultural expression, using cut and paste, and file sharing practices in a distributed, collaborative production processes. Therefore, the even more participatory and collectivist nature of grassroots production demands appropriate (enabling) knowledge management, technical, and organizational platforms. In particular, archival technologies and multimedia databases including middleware are essential. These include culturally dynamic metatagging systems, or metadata that can be relevant to members of multiple and diverse cultures; robust middleware initiatives that enable collaborative creation over different temporal and geographical spaces;¹ and, most importantly, flexible licensing and copyright regimes that simultaneously reflect creative design practices, national and international laws, and encourage openness while protecting ownership rights. Initiatives such as Creative Commons (Creative Commons, 2005) have helped create a legal environment that achieves these important criteria.

Open Source Content Licensing: A Legally Safe Open Sharing Environment

Perhaps the most critical aspect of open cultural production environments is the provision of intellectual property licensing arrangements designed specifically to stimulate creativity by accommodating open collaboration in a global “creative commons” (Creative Commons, 2005). This is a particular concern for open online repositories that mediate in the collection and diffusion of creative content, a process that is outside the value

system of multinational media businesses. Furthermore, because of the development concerns of this chapter, such open copyright arrangements should not only be open but must also be flexible enough to account for differences between Western and non-Western or indigenous cultural intellectual property. Therefore, the focus in this part of the discussion is on Creative Commons copyright licenses that are designed specifically to provide this kind of flexibility. To this end, it is important to note that Creative Commons licenses have been adapted in many different countries including Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Croatia, Finland, France, Germany, Ireland, Israel, Italy, Japan, Jordan, Mexico, Netherlands, Philippines, Poland, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, England and Wales, and Scotland.

In developed countries like Australia that have indigenous communities suffering significant inequalities, it has already been argued that creatively oriented broadband infrastructure is a way to bring social, cultural, health, and economic benefits. *The Island Watch* and *Cape York Digital Network* infrastructure programs are examples of what is being done in this respect in Australia. The Australian experience also highlights how traditional Aboriginal laws, and cultural and spiritual practices are at odds with the inflexible all rights reserved structure of orthodox copyright. Australian Aboriginal experience highlights how copyright (and attitudes among creators to issues of ownership and rights that are ingrained through the dominant discourse on IP) struggle to deal with the products of cultural expression in ways other than as exclusive private property and economic commodities (Hunter, 2003; Johnson, 1996; Kleinert & Neal, 2000). Therefore, placing indigenous cultural intellectual property rights on a sound legal footing is not necessarily easy to do (Joseph & Ayres, 2005). Yet it is only the limits of imagination that prevent the develop-

ment of more flexible copyright licenses that will simultaneously respect indigenous cultural values and enable commercial activity on global markets. In respect of development, indigenous cultural production systems are key cultural innovation systems. In developing economies these innovation systems can be regarded as having particular importance for innovation and cultural policy. After all, indigenous systems of innovation are equal to Western systems of innovation even if they are different (Joseph & Ayres, 2005). Licenses already exist that acknowledge a range of rights (both economic and noneconomic); that go beyond the concept of exclusive private property and moral rights; that conceive of rights in ways that simultaneously enable the commercial and cultural handling of works of art while giving creators choices in how their works are accessed by different groups. Already at an advanced stage of responding to these issues, Gilberto Gil, Brazil's Minister of Culture and a practicing musician, has led a drive to provide freely available (online) locally produced cultural content using Creative Commons licenses (de Castro, 2004). However, before looking more closely at Creative Commons, it is possible to examine some larger questions related to copyright so as to frame Creative Commons licensing as a clear response to some important debates about the creative, social, cultural, and economic efficiency of copyright and IP law generally. Open content licensing is also an issue in education, software, health, linguistic and scientific archives, most notably in the UNITAR site.

Not only are there questions about the capacity of copyright to function effectively for economic reasons (Heller, 1998), there are persistent doubts about its effectiveness in facilitating what is often thought to be its central purpose: fostering creative and innovative work (Whale, 1971). As Bently and Sherman (2004) have observed:

Despite the prominent role that creative labour played in pre-modern intellectual property law, as the law took on its modern guise it shifted attention away from the labour that was embodied in the protected subject matter to concentrate more on the object in its own right. (p. 4)

Put another way, recognition of creativity as an activity or as a performance of value has been subverted to the extent that it is the economic value and communication of the finished work that modern copyright is primarily concerned with, while the activities, intentions, and values of the producer are now secondary considerations at best. The natural balance between equitably valuing the economic and social worth of creative work and creative workers has, therefore, been upset. Moreover, with this historical shift not only has there been a movement away from concern about protecting the rights and creative needs of the creative "laborer," there has been a shift in emphasis more towards protecting the financiers of creative work (Drahos & Braithwaite, 2002). This is a fundamental distortion of copyright, and one that is not helpful to creators—particularly those in developing countries. Most of the protected financiers controlling industrialized creative activities are organized into multinational media corporations. For this reason, the orthodox copyright framework favours developed countries rather than developing countries. Consequently, the copyright regimes of developed countries are a disincentive or barrier to cultural production, expression, and diffusion in developing countries. This is unhelpful because, while such cultures might be short of financial resources, two resources they have in plenty are culture and creativity. In other words, the raw materials for cultural development are present but the right institutional framework (particularly in terms of IP) may not be.

The open-source software licensing movement has shown that innovation can flourish outside

the traditional IP framework (Goldman & Gabriel, 2004), Linux is just one example of this. In particular, questions are now being asked about how efficacious overly restrictive (or strong) intellectual property regimes are as stimulants to the creative mind and worker (Drahos, 2005; Lessig, 2004; Mandeville, 1996). In this light, it is highly significant that Kretschmer (2005) found modern digital cultural production is now conducted in such a way that the reuse of copyright content in new productions is the norm. These work practices are an affront to the monopoly and exclusivity logic of orthodox copyright. Consequently, Kretschmer (2005) also notes that with those new practices (and attendant technologies), a more complex legal, work and business context has been created in which many independent producers either deliberately or through ignorance, routinely break the law or compromise the creative quality of their work. One of his conclusions, therefore, is that traditional copyright hinders rather than helps these producers.

As mentioned above, one attempt to modernize copyright and to give creative producers more flexibility and choice are the licenses devised by Creative Commons. Researchers at Stanford Law School's Creative Commons (CC) (Creative Commons 2003) have developed what they describe as "a spectrum of rights" that fall between the extremes of copyright and public domain (www.creativecommons.org). Creative Commons licenses are designed to promote the sharing of intellectual property and creative works to further stimulate creativity in the context of contemporary digital arts practices. In doing this the aim is to overcome the tendency of artists to "hoard" their work under an "all rights reserved" model, despite the advantages that a more open approach to sharing can bring to both the individual artist and the community as a whole. Creative Commons seeks to provide a flexible "some rights reserved" framework in which producers have more choices.

Importantly, the Creative Commons licenses are designed to accommodate both commercial and non-commercial uses of digital resources. They are based on the assumption that innovations and new ideas are fundamentally and necessarily extensions and elaborations of existing ones and that creative work should be possible in collaborative arrangements. This spectrum includes licenses in the form of:

- **By attribution:** a creator allows others to copy, distribute, display, and perform copyrighted work (and derivative works based on it) but only if they give the author credit.
- **Noncommercial:** creators allow others to copy, distribute, display, and perform their works (and derivative works based on it) but only for noncommercial purposes.
- **No derivative works:** creators allow others to copy, distribute, display, and perform only verbatim copies of their work and not derivatives based on it.
- **Share and share alike:** creators allow others to distribute derivative works only under a licence identical to the licence that governs the original work.

Once a licence has been assigned to a work by a creator it will take three forms: (1) a Commons Deed, written in plain language; (2) Legal Code, written in formal legal language that will be usable in court; and (3) Digital Code, written in machine readable form to help with archiving, searching and identifying creators' works. Authors are able to attach to their works the creative commons "some rights reserved" symbol (rather than the standard copyright symbol) (see Figure 1). The licenses can be used singly (e.g., By Attribution)

Figure 1. Creative Commons symbol



or combination (e.g., By Attribution and Noncommercial) and therefore offer an extremely flexible regime of copyright suited to modern digital broadband production environments.

As noted above, the licenses have been written according to local law in many countries and there is a need to write “purpose built” licenses for developing countries. It is not only the local differences in law that are significant here. The main point about Creative Commons is its potential flexibility for individual producers and groups. Choices could be made by different individual and groups of producers in response to, for example varying spiritual beliefs, cultural values related to individual and collective ownership, and assumptions about how to distribute wealth.

By providing a unique and diverse set of resources, and by encouraging derivative and open usage of those resources for the production of new creative works, open content repositories will help lay the foundations for new and alternative business and creative practices suited to broadband environments through which grassroots producers can benefit from. Equally important is that open content archives can be established to create a legally safe and culturally sensitive framework for individuals and organizations to work with multimedia resources in an open content environment.

Open Source Archive Model

Nigerian producer and director, Amaka Igwe, says; “Our dream is to sell Africa to the world. It’s going to be a display of our thoughts and an avenue to market ideas about Nigeria and products about Nigeria” (Balogun, 2005). She also points out that copyright, infrastructure, and distribution problems are holding the Nigerian industry back. The “open” provision of archives and their content, along with digital production and postproduction software will provide new opportunities to creative workers for whom such material would

be beyond usual budgetary constraints. In this environment, a country like Nigeria can begin to address issues such as those identified above. To begin addressing these constraints creative workers can “recycle” high-quality archival materials into new broadband content and commercial and noncommercial cultural materials using the kinds of technical infrastructures described earlier. This open framework will lower barriers to entry in the cultural production sector thereby providing incentives for employment and new business creation. Commercial cultural producers will no longer be geographically tied to the locations of major production houses.

The provision of relevant open resources has already begun. In particular, there is a growing collection of Internet accessible multimedia content and software resources, much of which is available under Creative Commons and similar licenses. For example, content is available from:

- **UNESCO Creative Content E-Platform:** <http://creativecontent.unesco.org> This is an online, multicultural catalogue of/for independent producers and broadcasters. It contains a variety of high quality recent video productions with a focus on Africa, the Asia-Pacific, and South America. This site uses standard copyright and is therefore restricted as a grassroots production resource.
- **ACRO:** www.acro.edu.au This is an archive of free content in the form of video, music, and photographs that use open source copyright licences.
- **Internet Archive:** www.archive.org This is a massive archive containing a historical record of the World Wide Web and other resources such as movies, music, computer games, cartoons, newsreels, and more.
- **Prelinger Archive:** www.archive.org/movies/prelinger.php This is an archive within the Internet Archive containing over 4,000

movies, TV ads, educational films, and other interesting moving images.

- **BBC Motion Gallery:** <http://www.bbc-motiongallery.com/customer/index.jsp> The BBC Motion Gallery contains lots of old BBC footage from news, sports, natural history, wildlife, news, locations, art, music, celebrities, politics, culture, and the performing arts. Materials come from the BBC and CBS news archives.
- **The Freesound Project:** <http://freesound.iaa.upf.edu/whatIsFreesound.php> This is a searchable archive for downloadable sound files.
- **Creative Commons:** www.creativecommons.org There are a range of resources here including links to open content resources of all types and software to assist in searching for such content on the Internet.

In addition open (post) production software tools available include:

- Avid DV; Free <http://www.avid.com/freedv/>
- Audacity audio editor; <http://audacity.sourceforge.net/>
- Gimp photo editing software; <http://gimp-win.sourceforge.net/>
- PhotoPlus; <http://www.freeserifsoftware.com/serif/ph/ph5/index.asp>
- Zwei-Stein video editor; <http://www.thug-satbay.com/tab?q=zweistein>
- STOIK Video Converter; <http://www.stoik.com/>
- AviSplit Classic video editor; <http://www.bobyte.com/>
- DubIt; <http://www.hitsquad.com/smm/programs/DubIt/>
- Soliton audio editor; <http://www.snapfiles.com/get/soliton.html>
- DeepBurner Free DVD burner; <http://www.deepburner.com/?r=download>

- Swarm DVD encoder/authoring tool; http://www.free-codecs.com/download/DVD_Swarm.htm

In addition, Google and Yahoo (see <http://creativecommons.org/find/>) search Internet engines are now able to conduct searches for Creative Commons licensed materials across the Internet.

To finish this chapter it is useful to discuss how the authors have attempted to provide an Internet-accessible creative production (rather than finished product) archive of mostly locally produced open content to provide ideas for others to consider. Australian Creative Resources Online (ACRO) is an online repository for a wide range of material and provides the opportunity to share content otherwise treated as waste or junk by mass media agencies. This “junk” is video footage and film; audio tracks and interviews; and still images. ACRO is designed to make this content available to producers with broadband access. ACRO, therefore, provides the capacity to support a new class of cultural producers who under the rigid framework of traditional commercial mass media and copyright structures would have only limited opportunities to produce content. Importantly, new producers can include teachers, students, and members of local communities. It is also important to note that there would be benefits in creating a network of such archives internationally. Each node would focus on developing local content for local and international producers.

A quick practical example of how production can be stimulated and efficiencies can be increased through open content infrastructure is when a documentary maker shoots 300 hours of nature footage to make eight one-hour documentaries for television. At the end of the series, the producer has precisely 292 hours of footage that will remain unused. Much of it will be of very high quality. Normally, this “waste” material would go into a personal archive, perhaps to be discarded unused years later. However, when the material

is digitised and made accessible on broadband networks, it can, for example, be used by teachers and students in multimedia courses, by budding documentary makers, by children learning how to make digital content in schools, or by cultural groups or communities to produce commercial and noncommercial works.

While much of ACRO is comprised of material originally intended for the traditional mass media, there is a new group of producers emerging. Producers who may come from outside the traditional commercial and educational structures can benefit from the provision of low cost, high quality content and production tools. Resource like ACRO will encourage a better understanding of the process of technology use and the role of ICT in economic and social development and in doing so will assist in building the skills necessary to develop new media production industries. In Brazil community telecenters using free software to enabling users to set up roaming accounts, and the use of wireless networking in Africa (APC, 2006) are examples of technological change in developing countries that can facilitate the construction of creative industries based around the benefits of digital multimedia technologies.

CONCLUSION

New work practices facilitated by new digital production tools and the blurring of roles and functions in creative labour processes have begun to replace the fairly rigid divisions of labour characteristic of traditional mass media industries. Using basic consumer technologies, a person or group of people can film, edit, compose music, produce, and globally distribute their multimedia productions. The new practices in interactive content production and consumption that have emerged in this environment challenge boundaries between production and consumption. Consequently a new, much larger group of people

can now be engaged in the production and global distribution of high quality multimedia works. Creative development of culture can enable societies to renew their knowledge of themselves, to remix or repurpose “received” content to suit their own needs, to have new insights about their own condition and to have new things to communicate about themselves. Cultural innovation in such networks must come from the bottom up; in other words from the grassroots. With this constant cultural renewal there are social and economic benefits for developing communities. Open content provisions should boost activities in cultural production that will lead to cultural and economic development. In the context of knowledge-based economies the importance of building this kind of capacity cannot be underestimated (Rooney, Hearn, et al., 2003; Rooney & Mandeville, 1998). If culture is knowledge (Holden, 2002; McCarthy, 1996), then, cultural production is an obvious way for developing countries to gain a foothold on a central pillar of the knowledge-based economy. It is important though that the combination of technology (archives and digital production tools), institutions (Creative Commons licenses) and creative workers (including their norms and work practices) are seen as a whole system in which none of the parts are neglected.

REFERENCES

- Alston, R. (2003). *Australia's broadband connectivity: The broadband advisory group's report to government*. Canberra: NOIE.
- Association for Progressive Communications (APC). (2006). *Announcements from APC*. Retrieved June 17, 2006, from <http://www.apc.org/english/index.shtml>
- Bagdikian, B. H. (1997). *The media monopoly*. Boston: Beacon Press.

- Balogun, S. (2005). *Nigerian movies make "Out-cast" stars*. Retrieved June 17, 2006, from The Sun News Online, <http://www.sunnewsonline.com/Webpages/features/showtime/2005/feb/18/showtime-18-02-2005-002.htm>
- Bently, L., & Sherman, B. (2004). *Intellectual property law*. New York: Oxford University Press.
- Bruns, A., Ferrier, E., Graham, P., & Rooney, D. (2003, October). *Mapping the missing grassroots: Online content creation and consumption*. Paper presented to Center for Social Research in Communication, University of Queensland.
- Creative Commons. (2003). *Licenses explained*. Retrieved June 17, 2006, from <http://creativecommons.org/learn/licenses>
- Cunningham, S. (2005). Knowledge and cultural capital. In D. Rooney, G. Hearn, & A. Ninan (Eds.), *Handbook on the knowledge economy* (pp. 93-101). Cheltenham: Edward Elgar.
- Cutler, T. (2003). *Research and innovation systems in the production of digital content and applications: Report for the National Office for the Information Economy*. Melbourne: Cutler & Co.
- DCITA. (2003a). *Australia's broadband connectivity: The broadband advisory group's report to government*. Canberra: NOIE.
- DCITA. (2003b). *Film and digital content*. Retrieved June 17, 2006, from http://www.dcita.gov.au/Collection/CollectionPage/0,,0_1-2_2-3_471,00.html
- De Argaez, J. (2004). *Broadband usage keeps growing*. Retrieved June 17, 2006, from Internet World Stats: Usage and Population Statistics, <http://www.Internetworldstats.com/articles/art030.htm>
- de Castro, H.C. (2004). It's Brazil's time. Retrieved June 17, 2006, from *Linux Magazine*, http://www.linux-magazine.com/issue/45/International_Open_Source_Forum_Brazil.pdf
- DEST. (2002). *Frontier technologies for building and transforming Australian industries: Stimulating the growth of world-class Australian industries using innovative technologies developed from cutting-edge research*. Canberra.
- Drahos, P. (2005). Intellectual property rights in the knowledge economy. In D. Rooney, G. Hearn, & A. Ninan (Eds.), *Handbook on the knowledge economy* (pp. 139-154). Cheltenham: Edward Elgar.
- Drahos, P., & Braithwaite, J. (2002). *Information feudalism: Who owns the knowledge economy?* London: Earthscan.
- Dspace. (2003). *Dspace: Durable digital repositories*. Cambridge: MIT. Retrieved June 17, 2006, from <http://www.dspace.org>
- Ferrier, E., & Lawe Davies, C. (2000, December). *In the shadow of Channel 4: SBS independent*. Paper presented at the Television: Past Present and Future Conference, University of Queensland.
- Florida, R. (2002). *The rise of the creative class: And how it's transforming work, leisure, community and everyday life*. New York: Basic Books.
- Goldman, R., & Gabriel, R.P. (2004). *Innovation happens elsewhere: Open source and business strategy*. San Francisco: Morgan Kaufmann.
- Graham, P. (2001). Space: Irrealis objects in technology policy and their role in the creation of a new political economy. *Discourse & Society*, 12(6), 761-788.
- Graham, P. (2005). Issues in political economy. In Albaran et al. (Eds.), *Handbook of media*
- Heller, M.A. (1998). The tragedy of the anticommons: Property in the transition from Marx to markets. *Harvard Law Review*, 111(3), 621-668.
- Holden, N.J. (2002). *Cross-cultural management: A knowledge management perspective*. Harlow: Ft Prentice Hall.

- Howkins, J. (2001). *The creative economy: How people make money from ideas*. London: Penguin.
- Internet2. (2003). *Shibboleth project*. Michigan: Author.
- Jeffcutt, P. (2005). The organization of creativity in knowledge economies: Exploring strategic issues. In D. Rooney, G. Hearn, & A. Ninan (Eds.), *Handbook on the knowledge economy* (pp. 102-117). Cheltenham: Edward Elgar.
- Johnson, V. (1996). *Copyrites: Aboriginal art in the age of reproductive technologies*. Sydney: National Indigenous Arts Advocacy Association and Macquarie University.
- Joseph, S., & Ayres, A. (2005). Current indigenous arts law issues. *Media International Australia*, 114, 54-60.
- Kalantzis, M., & Cope, B. (2001). Multiliteracies as a framework for action. In M. Kalantzis & B. Cope (Eds.), *Transformations in language and learning: Perspectives on multiliteracies* (pp. 19-32). Australia: Common Ground.
- Keegan, V. (2003). *United we fall*. Retrieved June 17, 2006, from The Guardian, <http://www.guardian.co.uk/economicdispatch/story/0,12498,875908,00.html>
- Kleinert, S., & Neal, M. (Eds.). (2000). *The Oxford companion to aboriginal art and culture*. Melbourne: Oxford University Press.
- Kress, G. (2001). Issues for a working agenda in literacy. In M. Kalantzis & B. Cope (Eds.), *Transformations in language and learning: Perspectives on multiliteracies* (pp. 33-52). Australia: Common Ground.
- Kretschmer, M. (2005). *Artists' earnings and copyright: A review of the British and German music industry data in the context of digital technologies*. First Monday, 10. Retrieved June 17, 2006, from http://www.firstmonday.org/issues/issue10_1/kretschmer/index.html
- Lankshear, C., & Knobel, M. (2003). *New literacies: Changing knowledge and classroom learning*. Buckingham: Open University Press.
- Leadbeater, C., & Oakley, K. (1999). *The independents: Britain's new cultural entrepreneurs*. London: Demos.
- Lenhart, A., Horrigan, J., & Fallows, D. (2004). *Content creation online*. Retrieved June 17, 2006, from Washington, DC: Pew Internet & American Life Project, <http://www.pewInternet.org>
- Lessig, L. (2004). *Free culture: How big media uses technology and the law to lock down culture and control creativity*. New York: Penguin.
- Mandeville, T. (1996). *Understanding novelty: Information, technological change and the patent system*. Norwood: Ablex Publishing.
- McCarthy, E.D. (1996). *Knowledge as culture: The new sociology of knowledge*. London: Routledge.
- McChesney, R.W. (2000). The political economy of communication and the future of the field. *Media, Culture & Society*, 22(1), 109-116.
- Mumford, L. (1934). *Technics and civilization*. New York: Harcourt Brace.
- National Broadband Taskforce. (2004). *The new national dream: Networking the nation for broadband*. Retrieved June 17, 2006, from <http://broadband.gc.ca/pub/program/NBTF/broadband.pdf>
- National Selection Committee. (2004). *Stronger communities for a stronger Canada: The promise of broadband*. Report of the National Selection Committee: Broadband for rural and northern development pilot program. Ottawa: Industry Canada.
- OECD. (1998). *Content as a new growth industry*. Paris: OECD.
- Pollack, M. (2003). *Internet2 releases privacy-preserving Web authorizing software*. Retrieved

June 17, 2006, from <http://archives.Internet2.edu/guest/archives/I2-NEWS/log200307/msg00000.html>

Rifkin, J. (2000). *The age of access*. London: Penguin.

Rooney, D. (1997). *Playing second fiddle: A history of technology and organization in the Australian music economy (1901-1990)*. Brisbane: Griffith University.

Rooney, D., & Graham, P. (2004). Creative content and sustainable community media organizations: Australian creative resources online. *Australian Studies in Journalism*, 13, 80-93.

Rooney, D., Hearn, G., Mandeville, T., & Joseph, R. (2003). *Public policy in knowledge-based economies: Foundations and frameworks*. Cheltenham: Edward Elgar.

Rooney, D., & Mandeville, T. (1998). The knowing nation: A framework for public policy in a knowledge economy. *Prometheus*, 16(4), 453-467.

Rooney, D., & Schneider, U. (2005). A model of the material, mental, historical and social character of knowledge. In D. Rooney, G. Hearn, & A. Ninan (Eds.), *Handbook on the knowledge economy* (pp. 19-36). Cheltenham: Edward Elgar.

Rushkoff, D. (2002). *Signs of the times*. Retrieved June 17, 2006, from The Guardian, <http://media.guardian.co.uk/newmedia/comment/0,7496,763023,00.html>

Schiller, D. (1999). *Digital capitalism*. Cambridge, MA: MIT Press.

The Semantic Grid. (2003). *The semantic grid community portal*. Southampton: University of Southampton.

Spedding, V. (2003). *Data preservation: Great data, but will it last?* Retrieved June 17, 2006, from Cambridge Research Information, <http://www.researchinformation.info/rising03data.html>

Twitchell, J. (1999). Media and the message. Retrieved June 17, 2006, from *Advertising Age*, <http://Web.nwe.ufl.edu/~jgoodwin/f00/enc/twit.html>

Warschauer, M. (2003). *Technology and social inclusion: Rethinking the digital divide*. Cambridge: MIT Press.

Wenger, E. (1999). *Communities of practice: Learning, meaning and identity*. Cambridge: Cambridge University Press.

Wenger, E. (2000). *Communities of practice and social learning systems*. *Organization*, 7(2), 225-246.

Whale, R.F. (1971). *Copyright: Evolution, theory and practice*. London: Longman.

WSIS. (2003). *Declaration of principles*. Geneva: WSIS.

Young, S. (2004). *An evaluation of the regulation of online services in Australia*. Doctoral thesis, University of Queensland.

ENDNOTE

- ¹ An example of an open source project addressing these technical issues is MIT's DSpace (DSpace, 2003; Internet2, 2003; The Semantic Grid, 2003).

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 148-165, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.6

The Right of Interpretation: Who Decides the Success of Picture Mail?

Michael Björn

Ericsson Consumer & Enterprise Lab, Sweden

ABSTRACT

This chapter is an empirical research report describing the diffusion of mobile camera phones and picture mail services in Japan between the years 1997 and 2005, based on annual consumer surveys conducted by Ericsson Consumer & Enterprise Lab. A general framework based on sociocultural values and attitudes to telecom for describing the telecom market from a consumer perspective is presented. This framework is then used to put different consumer life stage segments in relation to each other in respect to product diffusion. The change over time of attitudes and behavior is described, and the conclusion is drawn that the product terminology spontaneously created by consumers themselves in order to relate to the product is an important step for mass market diffusion. Furthermore, the group of people who develop this terminology becomes a crucial catalyst for diffusion—and in the Japanese case presented here consists of female students.

THE IPOD'S LIKE A CAN OF COCA-COLA...

Apple Computer has been very successful in the increasingly crowded MP3-player market. There are technical differences, the iPod can play AAC (also known as MPEG-2 Part 7; it was designed as an improved-performance codec relative to MP3) format songs and is tightly integrated with the iTunes store, but our studies at Ericsson's Consumer & Enterprise Lab (here referred to as ConsumerLab) indicate that very few people are even aware of technical differences, and that purchasing songs over iTunes is a minority activity. Instead softer issues come into play, such as design, image, and values connected to the product.

“At this point, the iPod's like a can of Coca-Cola—it's a given” says Beastie Boy Diamond in a *Wired* magazine interview (Steuer, 2004, p.187) and he is not alone in having made such statements. Instrumental in catapulting the iPod

into the ranks of the ultimate of “cool” seems to be the fact that musicians and other users themselves were early in taking a liking to the product; and, most importantly, were quite vocal in advocating its superiority. The fact that Apple had no control over this spontaneous endorsement campaign made a big difference. There is even an example of a full-featured but totally unendorsed ad film that in a matter of days had been watched 37,000 times (Kahney, 2004).

One might venture to say that although Apple undoubtedly designed and marketed the iPod, it was actually the consumers themselves who decided what was important with it. This is exactly what “right of interpretation” in this chapter’s heading is referring to.

In the current media landscape, it may well be that the meaning or significance of the product as perceived by the consumer is increasingly likely to have been imparted on it by other consumers. In other words, Apple still owns the iPod product—but the market (i.e., the sum total of potential buyers of the product) has decided what its benefits are.

To explore this point, this chapter presents a case study from Japan, based on research carried out by ConsumerLab in the years 1997-2005. The focus will be on mobile phones equipped with cameras and the picture mail service (sending pictures via mobile phones), and on how the meaning of this service was indeed decided by the market itself.

METHODOLOGY AND THE MARKETREALITY™ MONITOR

The basis of the research at ConsumerLab is annual quantitative studies (1000-2000 respondents per study, adding up to around 12,000 respondents globally per survey round) in a culturally heterogeneous sample of countries: Brazil, USA, France, Germany, Italy, UK, Sweden, Malaysia, China, and Japan. All studies are based on na-

tional representative samples in the age groups 15-69 years, except in China and Brazil, where we make urban samples because of large economic and social differences.

For Japan, specifically, the research is carried out as a mail-out questionnaire administered in late spring of each year by a well-known research institute with long-term operations in Japan.

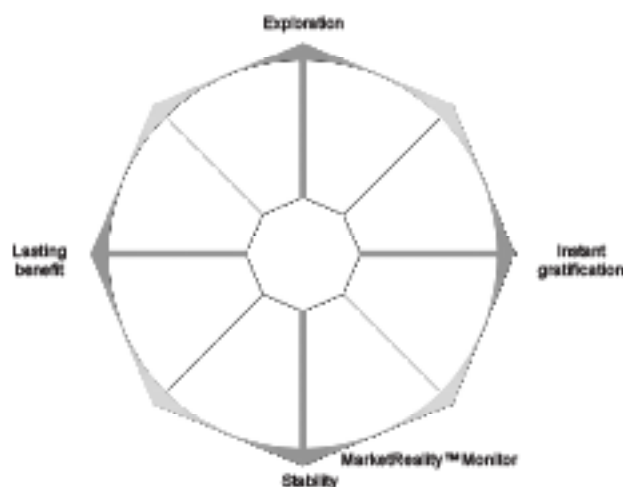
The studies contain approximately 400 questions that are asked in the same way and same order across all countries. This questionnaire has been built up gradually since 1995 and tries to encompass a broad scope of technology-mediated information and communication, including radio, TV, computers, the Internet, and (fixed and mobile) phones (with more space given in the questionnaire to telephony). Approximately half of the questions are phrased as attitudes to telecom, from the general to the specific. The attitudes are measured using questions with seven-point Lichert scales (very important—not important; I agree completely—I do not agree at all; etc.)

The MarketReality™ Monitor

ConsumerLab has developed a conceptual MarketReality™ Monitor (hereafter referred to simply as the Monitor) based on consumers’ sociocultural values and attitudes to telecom. The Monitor is built in three steps: Identification of two-dimensional regional value maps, identification of a global two-dimensional telecom attitude map, and finally, a merging of the value and attitude dimensions based on standardized axes values with a 50/50 impact. Respondents are distributed in the model based on individual factor scores. This way we have been able to create a space where each individual is plotted and where it is also possible to plot different segments, behaviours, attitudes, and so forth—while still always describing the telecom market from a consumer perspective.

The Monitor consists of two dimensions: “Exploration ↔ Stability” and “Lasting Benefits ↔ Instant Gratification,” shown in Figure 1.

Figure 1. The monitor (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)



Dimensions in the MarketReality™ Monitor

The first dimension, “Exploration ↔ Stability,” is the most important as it differentiates best between consumers on overall interest in telecom technology as well as on telecom product and service penetration. It also gives an indication as to the pace at which people need and require changes in their lives.

The higher a respondent is towards the *exploration* side, the higher her interest is in telecom technology and the more she is likely to have a large number of telecom products and services. On the *stability* side, we instead find a conservative attitude to telecom technology, and a low willingness to try telecom products or services that have not yet been tried and tested by others, and that have not received a social “seal of approval.”

Whereas the first dimension is usually present in some form in many models with a sociocultural heritage, we believe that the second dimension, “Lasting Benefits « Instant gratification” is unique to our own research. This dimension has to do with the relationship between oneself and others, but also with the reasons for using technology.

By lasting benefits we mean a tendency to take a more long-term view of the need for and

use of telecom technology. This indicates a more rational approach to the choice of telecom products and services, although it may well be that these explanations are made up “after the fact” and do not constitute truly rational behaviour.

By instant gratification, on the other hand, we mean a tendency to be more oriented towards satisfying one’s feelings and needs of the moment when considering telecom technologies. This indicates a shorter attention span when evaluating new telecom products and services, and less patience when expecting benefits from them.

A more in-depth description of the Monitor is given in the book *Situation Analysis* (Sekizawa, Washida, & Bjorn, 2002).

DIFFUSION OF PICTURE MAIL IN JAPAN 1997-2005: WHO DECIDES THE SUCCESS OF PICTURE MAIL?

Triggers for Diffusion of Services

If we apply our accumulated knowledge of triggers at ConsumerLab (i.e., something that makes people go from just showing an interest in a product or service to *act* on that interest) to diffusion (Rogers, 1995) of mobile services, we see

a pattern of differences in the Monitor.

At the explorative top of the Monitor, we find the earliest adopters (often referred to as *innovators* in marketing literature), who are triggered to use new mobile services because they are new and exciting.

In the first stage of diffusion, the explorative people towards the lasting benefits side are triggered by efficiency and the time saving they would get by using the new mobile services, whereas the explorative people at the instant gratification side are more triggered by the fun, speed, and spontaneity they get by using new mobile services. We might call this first diffusion stage early diffusion.

The second stage of diffusion is where the differences between those products (or services) that remain consigned to a niche market and those that go on to reach a broader market tend to appear—Moore (1991) coined the term *chasm* for this stage and it is used here in this sense. In our experience, the set of triggers in the chasm depend on which segment (i.e., which location in the Monitor) it is that adopts the service.

The segments towards the lasting benefits side are triggered by the convenience of the service. This convenience trigger is rationally oriented in the sense that it gets a task done in a dependable way, that is, the service fulfills an already existing need in a better way.

On the instant gratification side, triggers relate to the social enrichment offered by the new mobile service, that is, the need fulfillment is put in a social context rather than in a task-oriented context. Since the social context can change without active participation from the specific individual, chances are greater here that the need also arises implicitly in conjunction with the diffusion of the service.

Less explorative segments towards the instant gratification side are looking more for visual or (sub)cultural statements as an important ingredient to the identity they are building in relation to

their surroundings—the needs in this segment are more related to confirmation and status.

Provided that the new service does not flounder in the chasm stage, diffusion continues and reaches the mass-market diffusion stage. Here, the more stability-oriented people in the Monitor that are often the late adopters are mainly triggered by social communication and safety. It is however hard to trigger this group and many will only follow when the rest of the market is mature and everybody else is using the particular new service, which means that they have to use it in order not to be left out. Thus, we get the flow or diffusion pattern indicated in Figure 2.

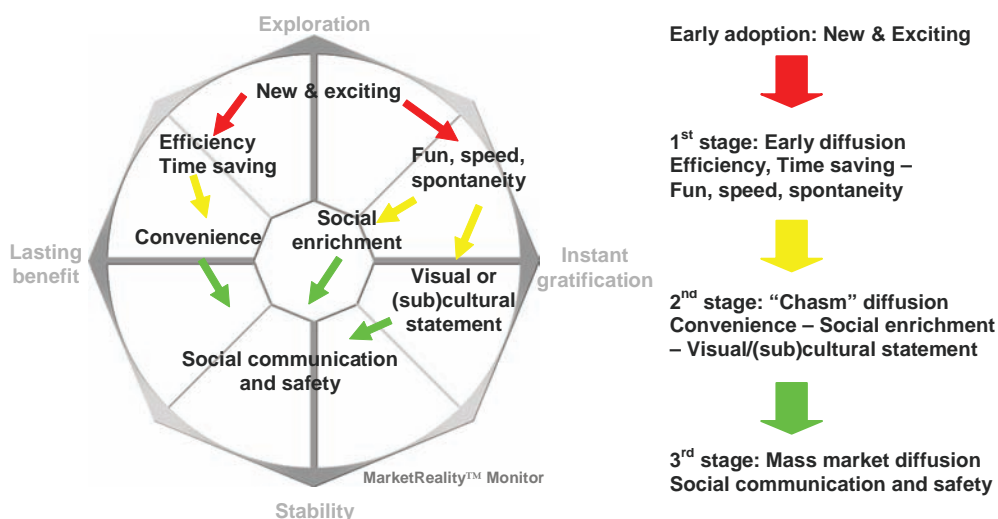
We do not see this diffusion pattern in itself as anything controversial, and it could most likely be supported by evidence from adherents of linear schools of diffusion as well as by adherents of convergence diffusion models (although the naming of the various stages would certainly vary). Instead, the controversy lies in what process is needed to take place for any given product or service to move through the different stages. In order to explore this process, we will look at ConsumerLab survey data from Japan from the years 1997-2005 and follow the actual diffusion process of picture mail on the Japanese market. Interestingly, as you will see, the story is less of a diffusion story and rather more a story of how end users build a mass market!

At ConsumerLab we did our first quantitative survey in Japan in 1997 and the survey has continued on an annual basis since 1999, comprising in total over 10,000 respondents. For the sake of brevity, we only present data from the odd years (i.e., 1997, 1999, 2001, 2003, and 2005) here, but inclusion of the even years (i.e., 2000, 2002, and 2004) does not change the results in any way.

In order to look at the data, let us first establish what life stages (McDonald & Dunbar, 2004) are relevant for the different stages of diffusion, by plotting them in the Monitor.

The Right of Interpretation

Figure 2. Diffusion pattern in the monitor (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)



Life Stages (Gravity Centres¹)

Figure 3 shows a plot in the Monitor of life stages in Japan 2001, the middle year in our series (the positions of the life stages vary very little over time). The major difference in comparison to life stages in our global (i.e., 10 countries) sample is that the group *men married no kids* is in the upper left side of the model (whereas it is in the upper right side of the model in the global sample).

Now let us look at the data year by year. Roll back your clock; imagine that you are back in year 1997 and visiting Japan.

Graphic Communication: Japan, 1997

Back in 1997, mobile phones were used for talking. Yes, it does seem like the Stone Age, but in fact it was not such a long time ago. New things were already happening that would change the way we view mobile phones for ever; SMS or

text messaging was already popular and the idea that the phone would become a multimedia communications device no longer seemed like science fiction. Specifically at Ericsson, we believed that inclusion of other media types in the communication process would provide powerful means to enrich phone conversations. Although there were no camera phones in the market, 1997 was the year when we started doing market surveys to understand the interest for camera phones (and Ericsson later became a driving force in the global standardization of picture messaging, MMS).

Figure 4 describes the starting point for diffusion of graphic communication services in the mobile phone in Japan. All the data for the years 1997, 1999, 2001, 2003, and 2005 will be presented in this manner. Indexes presented in the graphics are calculated so that the average for all twelve life stage groups is 100 (where, for example an index of 160 means 60% above the average). The picture shows the upper half of the Monitor and is focusing on two extreme life stage segments; the *men family university* group (i.e., men who

Figure 3. Life stage in the Monitor (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)

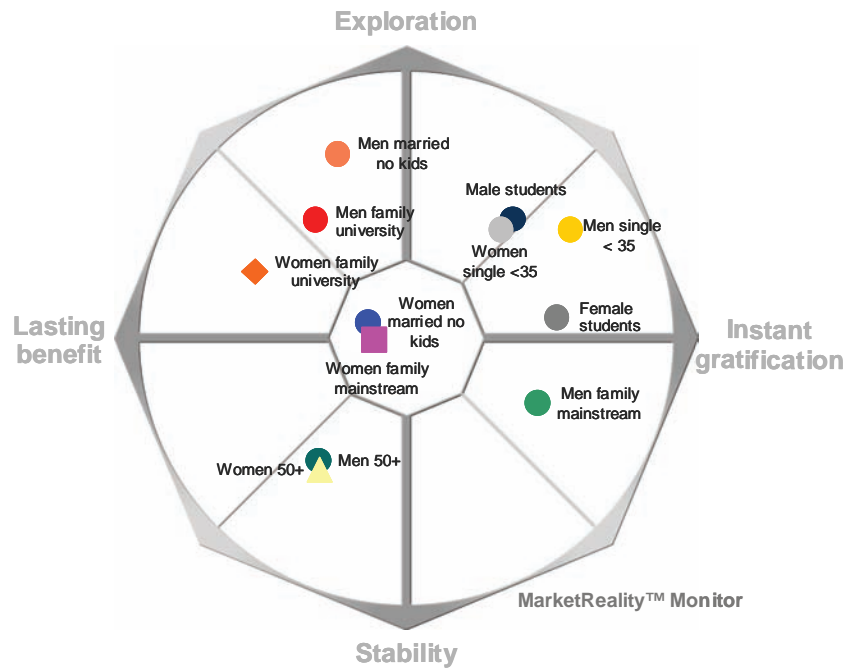
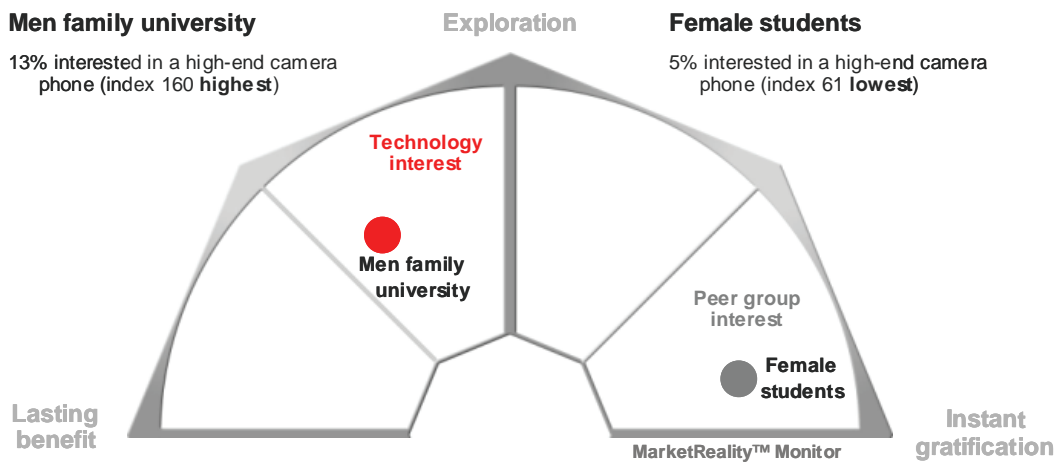


Figure 4. Starting point (1997) for diffusion of graphic communication services in Japanese mobile phone (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)



The Right of Interpretation

have a university degree and also have a family) and the *female students* group. The left half of the graphic contains information pertaining to the *men family university* group and, correspondingly, the right half of the graphic contains information pertaining to the *female students* group (unless otherwise stated). We have selected these two life stage segments for a number of reasons:

- They are present in the early stages of the diffusion flow and are thus key segments for initial product uptake.
- They are the most consistently different segments and turn out to play unique roles in the diffusion process.
- They correspond reasonably well to the popular Japanese ideas of otaku² (for *men family university*) and kogal³ (for female students); whereas the *men family university* group are driven by an interest for technology (at least for the type of product/service category we are investigating), the *female students* group are driven more by an interest in what their friends are doing (their peer group).
- They are of sufficient size for statistical analysis.
- They are stable in comparison to the same groups in other countries (as is opposed to the *men married no kids* group that moves to the upper right side of the Monitor in other countries).

In 1997 the *men family university* group showed the strongest interest of all 12 life stages for a high-end camera phone (at a price level of around 375 euro) with picture mail capacity (i.e., the possibility to include photos or pictures in a message). On the other hand, the *female students* group had the lowest interest of all 12 groups.

Our interpretation of this is that the *men family university* group saw a range of possibilities with this type of a product and were also excited by the new digital photo technology as such. The *female*

students group on the other hand saw no relation between this product and their daily needs.

Graphic Communication: Japan, 1999

In 1999 we can see that it is not the camera phone that has been introduced on the market, but instead the digital camera. The *men family university* group have clearly followed up on their early interest in digital photo technology and are the early adopters as well as usage leaders of this product. However, they still see quality as an issue and are probably already upgrading to second-generation digital cameras. Having already been “burnt” by e-mail in the phone turning into nothing more than paging (or simple text messaging), they do not see the need anymore for having the digital camera integrated into the phone.

The female students, however, have a totally different approach to digital photos. Thanks to the interest shown by early adopters (i.e., the *men family university* group—possibly their fathers) already back in 1997, they have gotten used to the idea of digital photos, and they already find the quality good enough. They are in fact already using digital photos in the form of Print-Club pictures. Print-Club is a photo machine reminiscent of passport and identity card photo machines found in train stations and so forth in many countries—with the big difference that the photographs are in colour, can be decorated with frames, and are printed as stickers. At this point in time, Print-Club pictures were shared among friends and many youngsters carried around albums with pictures of all their friends to show other friends when meeting them.

As you can see in Figure 5, the female students were the group most interested in viewing Print-Club pictures (*photo-seals*). Although female students are also most satisfied with digital picture quality, it is important to point out that Print-Club pictures paradoxically at this point in time were of downright awful quality (when understood as pixel density and colour range); instead their

quality judgment was probably influenced by the usefulness of the pictures, namely in sharing with friends, where they also score higher than any of the other life stage segments. The indication is that for them, it would be almost as natural to move the Print-Club into the mobile phone, as it was to move the pager into the phone. This was also the gist of the message that ConsumerLab was giving our Japanese customers in this time frame.

The bottom line, however, is that digital photography in the form of a personal device, was not yet spreading from the early adopters, as the digital camera was not a device that the female students—or other groups with average or lower interest in technology—could fully relate to.

Graphic Communication: Japan, 2001

In 2001 we can see the gap widening between the two groups, indicated in Figure 6: The *men family university* group are more and more concentrating on the digital camera, and this product is becoming relatively harder to find a need for among the female students. The digital camera starts diffusing into the mass market, but as a direct replacement to the analogue camera with film (as we can see from analysis of other questions in the survey not presented here). The female students play no active role in this diffusion.

On the other hand, female students score highest on all counts relating to digital photography in the mobile phone. Their interest for Print-Club pictures is starting to migrate to an easier-to-use and more convenient platform, although the actual application is not changing and neither is their peer group interest: taking pictures of themselves together with friends in various situations and showing them to other friends in other situations. The platform they are moving to is Sha-Mail, a picture mail application that was introduced in the year 2000 by the Japanese mobile phone operator J-Phone (now Vodafone Japan K.K.). The other Japanese operators would eventually follow suit

and introduce similar picture mail platforms, but since this is not a description of the development of the competitive market situation in Japan, we will simply refer to Sha-Mail and the other competing applications as picture mail in this presentation. (However, it might be interesting to point out that the Print-Club machine vendors also responded to the new threat by starting to put their machines online—however, ultimately without great success.)

Graphic Communication: Japan, 2003

In 2003, shown in Figure 7, the definition of picture mail as a form of social communication has become firmly established on the market by the female students, and although they remain the most avid proponents for this type of usage, the service is now in the mass market (i.e., roughly 50% of mobile phone owners have camera phone and/or picture mail). However, usage rates are extremely much higher in the *female students* group than in other segments, with almost half of the group sending picture mail at least once a week.

The *men family university* group is reacting negatively to the apparent success of picture mail among youngsters in the market, and turns in the lowest score of the 10 life stage segments below age 50 measured on the interest in sending pictures directly with their mobile phones. One might say that their reaction is one of outright rejection of picture mail as an interesting technology.

Graphic Communication: Japan, 2005

In 2005, shown in Figure 8, the hype around picture mail is gone, but usage in the *female students* group remains reasonably high—the levels we see this year probably reflect lifestyle usage on a practical level and may be the type of usage we

The Right of Interpretation

Figure 5. Diffusion in 1999 (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)

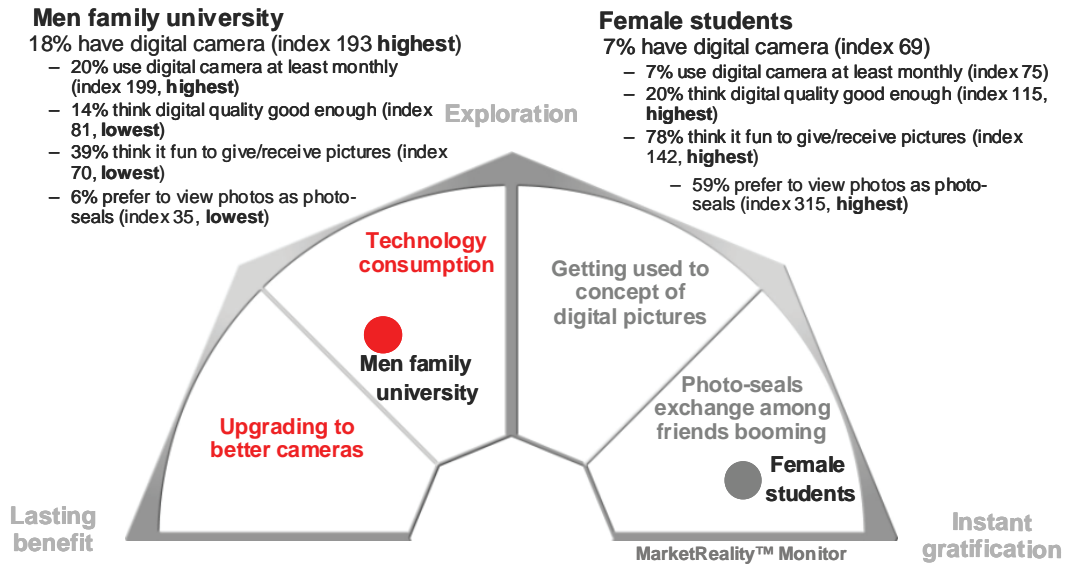


Figure 6. Diffusion in 2001 (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)

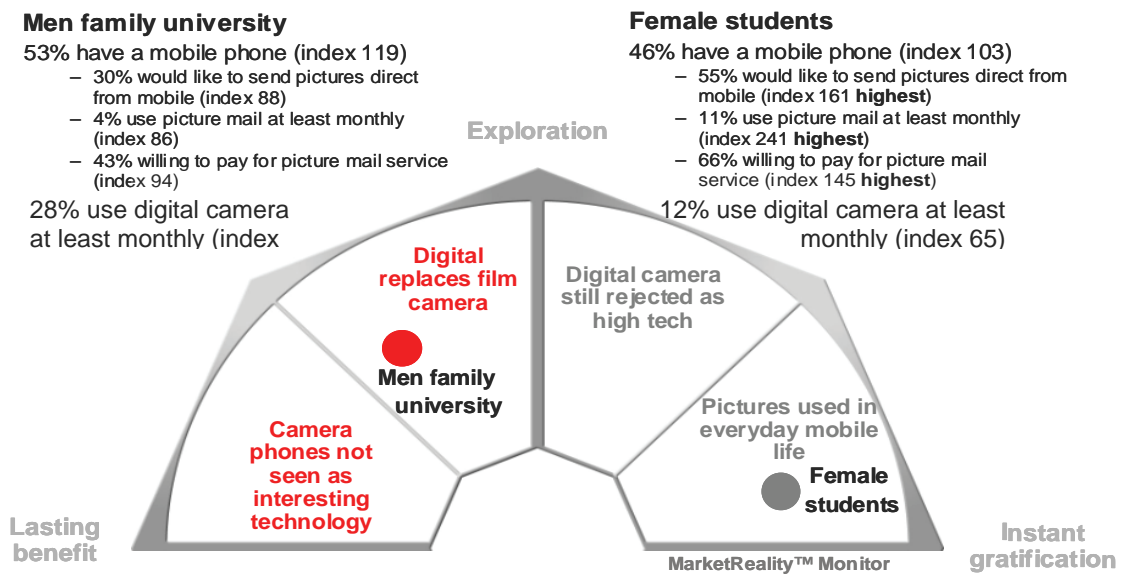


Figure 7. Diffusion in 2003 (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)

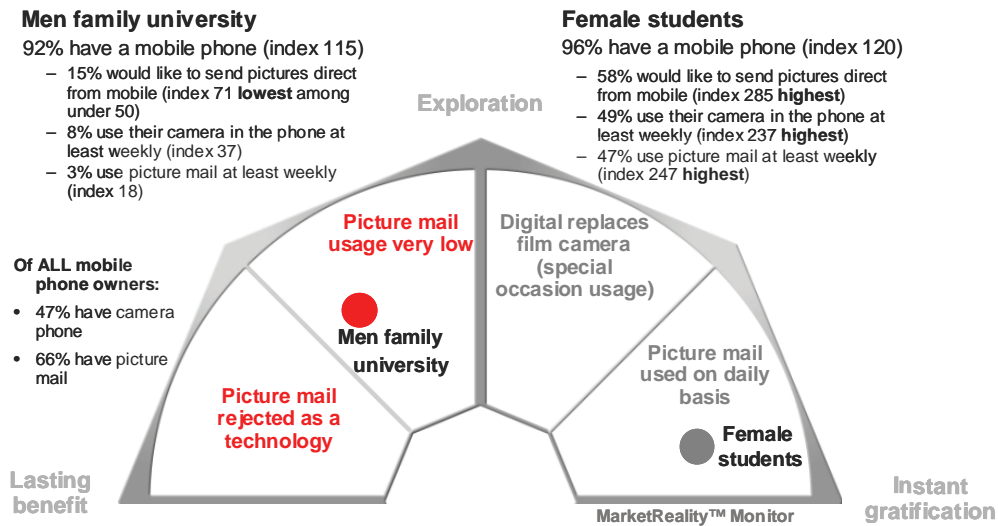
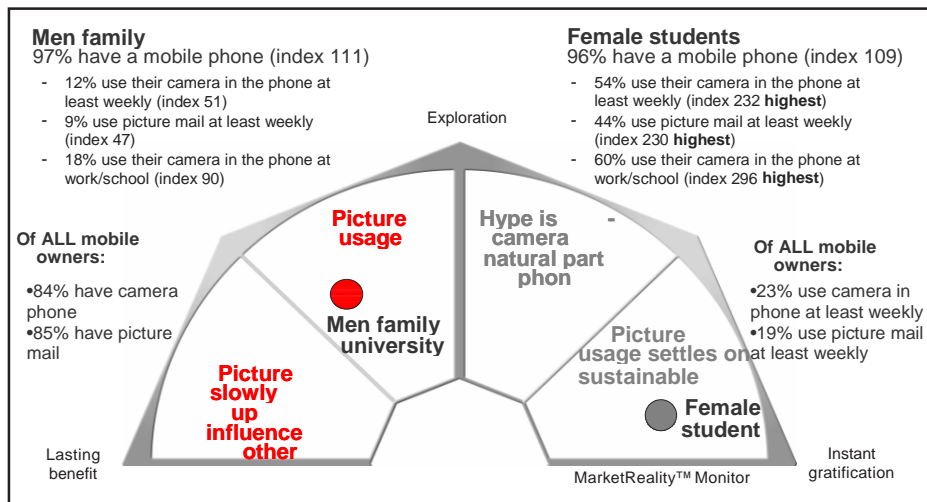


Figure 8. Diffusion in 2005 (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)



can expect in the long run from this group now that the camera has become a naturally integrated part of the mobile phone.

Totally on the market a critical mass of users (i.e., roughly 30% of mobile phone owners use camera phone and/or picture mail at least weekly) has evolved, leading us to believe that picture mail will remain a mass market service in the 2006-2010 time frame.

Interestingly, the *men family university* group is still lagging far behind the general market uptake, both when it comes to using the camera in the phone and for sending picture mail. While they have rejected camera phones on the basis that stand-alone digital cameras represent better technology, they are still influenced by usage uptake in society surrounding them—their gradually increasing usage likely represents a need to communicate in a manner suitable to the receiver of the message rather than a need to express themselves in a richer way.

Who Decides That Picture Mail Will Become Successful?

What we have seen here is a total reversal of initial interest and actual behaviour. Although the *men family university* group showed the strongest initial interest in a mobile phone with built-in camera—and would have been the obvious recommended target group by market researchers (with a high-end phone model)—they end up nearly at the bottom of the ladder with very low usage rates even eight years later. Conversely, the *female students* group go from showing the lowest interest to being the group that drives usage and thus general adoption.

While this may seem paradoxical, the answer lies in the triggers for behaviour that we discussed earlier. The difference in triggers between these two life stage groups in the Japanese context—and the inherent opposition between them—has been observed by others, such as Fujimoto (2005), who

would most likely define the diffusion pattern described here as a third-stage (socializing) paradigm of adoption. And although we had labelled the different triggers with words, it turns out that the process behind that label is the crucial part.

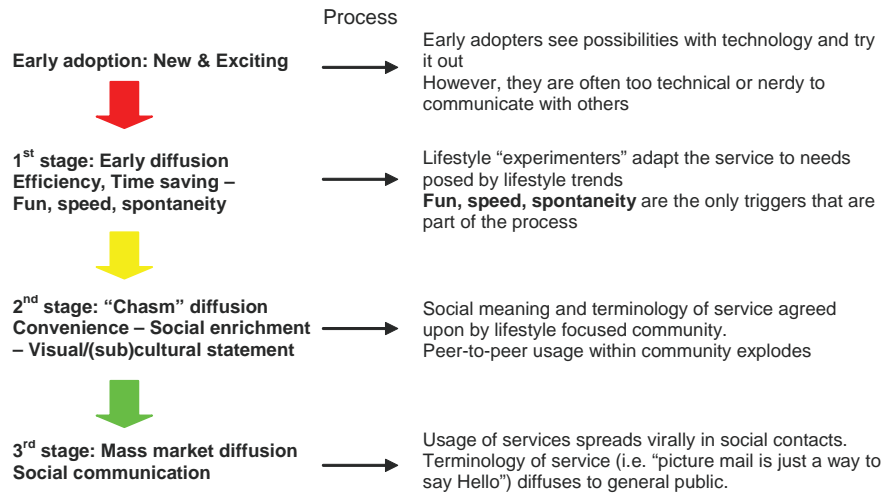
Early adopters in the top of the Monitor in Figure 9 are triggered to use new mobile services because they are new and exciting. They see the possibilities with the specific technology behind the service (product) and try it out. However, this group is often too technical or “nerdy” to communicate their vision or the benefits they see with the product to others. Others may call upon them as experts when problems arise, but this happens at a later stage when they already have started using the service for other reasons.

In the first stage of diffusion, the explorative people towards the instant gratification side are more triggered by the fun, speed, and spontaneity they get by using new mobile services. This group of people can be seen as lifestyle experimenters, in the sense that they are on the cutting edge of lifestyle-related trends such as fashion, food, music, and social behaviour. While not being interested in technology per se, this group takes high tech for granted and is thus willing to try out the service in order to see if it can be adapted to the lifestyles they are currently exploring.

In the second stage, the chasm diffusion stage, a process of redefinition of the need for and the social meaning of the specific service takes place. The social meaning of the service and terminology used to describe it is agreed upon inside of the lifestyle-focused community. By *social meaning* we here refer to the meaning of the service as it is actually interpreted by the users, it is social in the sense that the meaning is derived through interaction and exchange of opinions with others, and essentially a *conjuncture* as described by Hebdige (1979).

In other words, it does not have to be the same meaning as the provider of the service intends the service to have—but it still needs to have a

Figure 9. Diffusion process (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)



meaning, lest it will slip off the radar and be forgotten. The importance of meaning for retention is well documented by cognitive psychologists (Anderson, 1990).

Similarly, the terminology used to describe the service may be different in the user group from that used by the service provider. For branded services both users and service providers will probably use the brand name, albeit with different connotations. In this case, Sha-Mail would be used by end users to denote something pragmatic and useful like a “graphic hello”⁴ whereas, the service provider probably had a somewhat more technical association for the name.

Furthermore, usage within the community explodes. It seems that the explosion of usage is necessary in order to turn the service into a focus for behaviour in the peer-group community. There is a strong sense of a “we” in the peer group which stands in (implicit) opposition to a “them.” So the service becomes almost like a secret link between the members of the group, where a cultural behaviour basically unknown to the rest of society is developed. The Japanese term for this type of sudden and drastic increase in usage would be *my boom*⁵—and explosions

are indeed the cause of booms. This leads to the service becoming perceived both as some form of social enrichment and as a direct visual or otherwise (sub)cultural statement. The difference in perception depends on which market segment the observer belongs to.

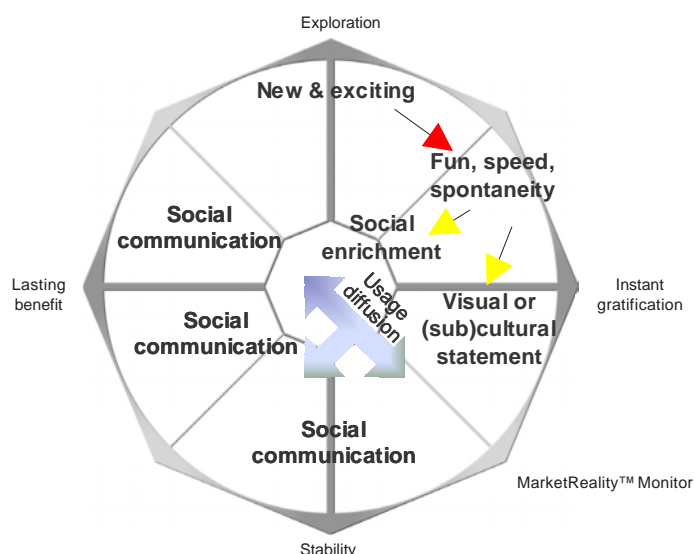
Provided that the social meaning of the service and the terminology used to describe it as defined in the *chasm* diffusion stage is relevant and makes sense to a broader part of the market, diffusion continues and reaches the mass-market diffusion stage. In the case of picture mail, the terminology comes from ordinary greetings: “picture mail is just a better way to say Hello,” the need of which is relevant to and easily understood by most people.

The later adopters of the service are mainly triggered by social communication. As diffusion progresses, it becomes increasingly harder to trigger users and they will only follow when the rest of the market is mature and everybody else is using the new service, which means that they have to use it in order not to be left out.

Putting back the triggers into the Monitor, we actually get a much simpler picture, shown in Figure 10, than what we started out with. The

The Right of Interpretation

Figure 10. Diffusion process in the Monitor (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)



complexity lies not in the triggers but in the processes that actually make these triggers go off.

IMPLICATIONS FOR OTHER MARKETS AND/OR OTHER SERVICES

A relatively common point of view is that Japan is a very different country (in various senses, depending on whom you ask)—and that, consequently, results from the Japanese market are not applicable to any other market. When combining the different perspectives of politics, technology, value chains, marketing, and so forth, this may or may not be true. However, from a strictly individual-oriented perspective, our experience is rather the opposite. There are large differences between many countries in the world, but Japanese people are not more “different” than people in many other countries. This view is also corroborated for example in the Inglehart Values Map,⁶ which puts Japan very close to Protestant Europe,

especially on the Secular-Rational dimension, but also on the Self-Expression dimension. At ConsumerLab, we have also done measurements on the cultural effect of globalization on consumers, and the indication is that Japanese people to a quite high degree are affected by globalization (more so than Americans, for example).

The important insight is that the results presented here just may be the norm rather than the exception. In order to open the table for discussion, we will look at diffusion data for two other services, SMS (or text messaging) over the mobile phone and music download over the Internet. The first example points to a mechanism very similar to the picture mail case, but on a global scale; the second example is inconclusive.

Diffusion of SMS Over the Mobile Phone

It is safe to say that SMS (or text messaging) was the first successful nonvoice application for the mobile phone. However, since the industry probably was not aware of the large impact that SMS ultimately would have, it is difficult to find good

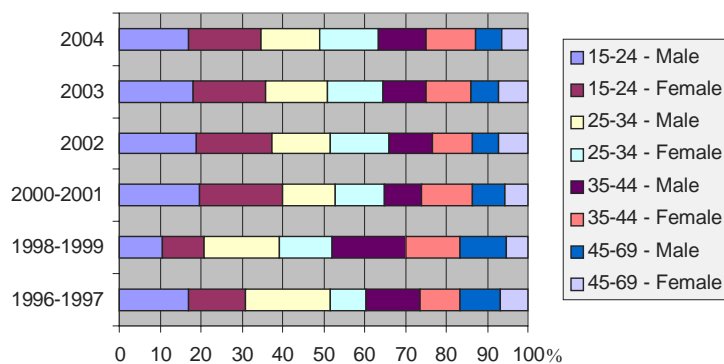
data from the early years of SMS usage. While not going back that far, we will here in Figure 11 look at SMS data for basically the same time period as we did for picture mail. In this case, then, the focus is consumers who send and/or receive SMS in the mobile phone at least once a week, but now covering all countries in the ConsumerLab survey sample.

First, however, some methodological points must be made: The countries in this sample are at various points of sociotechnological maturity and any interpretation of the results must bear this in mind. An age-gender division has been used instead of life stages for the reason of presentation brevity (8 groups instead of 12) and because of larger variation between countries in sizes of life stage groups. The usage levels have been indexed on a age-gender group per country and year basis, so that the usage level in a specific age-gender group in a certain country and year has been divided by the average usage level for that country in the same year—in effect giving us the relative importance of a specific age-gender group for SMS in that specific country and year. After that, all individual age-gender groups have been added for all countries in a specific year

and finally normalized so that all countries have equal weight—in effect giving us the relative global importance of any age-gender group for SMS in that specific year. Furthermore, the years 1996-1997, 1998-1999, and 2000-2001 have been combined, since ConsumerLab’s survey program was not fully annualized for all countries until the year 2002.

As shown in Figure 11, although the relative importance of the youth market is clearly seen, the result of the analysis also shows three distinct phases: The first phase is represented by 1996-1997, where there is a clear male dominance—with relatively higher incomes and a tech orientation similar to the *male family university group* mentioned elsewhere in this chapter. Usage levels of SMS are typically in the 15% range on a weekly basis. The second phase is represented by 1998-1999, where there is high growth but still some exclusivity in the user base. SMS usage levels are now typically in the 30% range on a weekly basis. In this phase we seem to be in the chasm and the overall equalling out of the age-gender groups; here it may be indicative of a reevaluation of the social meaning of SMS. Initially many possible meanings are present, including meanings related

Figure 11. Diffusion of SMS usage (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)



The Right of Interpretation

to efficiency and time saving, but by the beginning of the third phase one meaning has taken hold over the other—and that is the real-time oriented conversational (or chat-like) meaning that is also dominant today. It is interesting to see that the 15-24 female age group is the largest group for the first time in 2000-2001, indicating a new phase, and that it remains as large as the 15-24 male age group for the rest of the data series. The third phase is then the mass-market diffusion scenario with weekly usage levels of up to 90% in the most recent data. For this reason the relative market importance of the 15-24 female (and male) age groups diminish over time as the behaviour and use pattern initiated by this group spreads to other segments in the market.

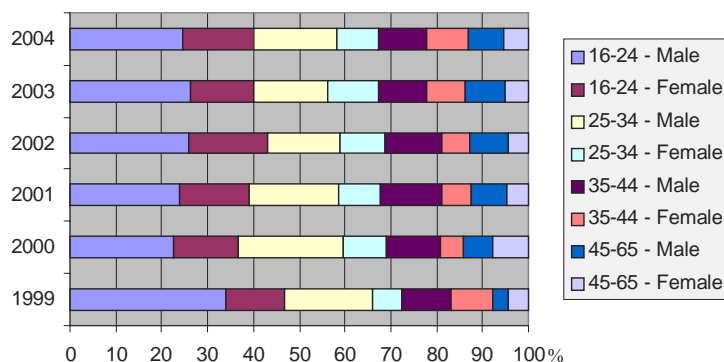
Diffusion of Music Download Over the Internet

Our second multi-country diffusion pattern example deals with downloading of music from the Internet (legally or illegally). The data set presented in Figure 12 is taken from our syndicated survey partner NOP World, as ConsumerLab's

own historical data are not as consistent in asking about specific services on the Internet, and for this reason the time period is slightly different. However the countries are the same as in ConsumerLab's own scope—except for the fact that Sweden has been omitted—and sample sizes are similar with around 1,000 respondents per country and year. Apart from this, the calculation methodology used is exactly the same as for the SMS over the previous mobile phone example.

In the data set in Figure 12, the male dominance throughout the whole series is the most striking feature—especially the 15-24 male age group. Moreover, there is no indication whatsoever that more than one diffusion phase is present in the series, even though there is a big downward movement in relative market importance for the 15-24 male age group from 1999-2000. Considering that music download music levels in 1999 were typically only in the 10% range of the population surveyed, the explanation rather seems to be a movement from the very earliest adopters to a larger but still early adopter-oriented type of user base. In the year 2000 typical usage levels are approaching the 20% range although there are still big variations between countries. From that

Figure 12. Diffusion of music download over the Internet (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)



point usage levels gradually move up to the 30% range without any major movements in the market composition. This example has been added to show that cases that do not fit the Japanese picture mail pattern are readily available, although this is not the place to go further in analysing music download over the Internet. However, it should be pointed out that this example may well show influence of anti-downloading activities from the music industry—portraying music downloaders as “leeches” (Ebare 2004) and possibly forcing a peer-group-generated social meaning of music downloading back into the underground again.

Support for this idea also comes from the comparison of downloading of music from the Internet to downloading of music over the mobile phone using only 2004 data from the same data set indicated in Figure 13.

Although it is in the early days of downloading music over mobile phones, with typical usage levels in the 5% range and extreme youth orientation, it is interesting to see that the male domination is much weaker on the mobile phone than on the Internet. Because of earlier involvement from the music industry on mobile phone downloads, there is very little illegal downloading happening in this market, and it seems obvious that the music download market for mobile phones is poised to

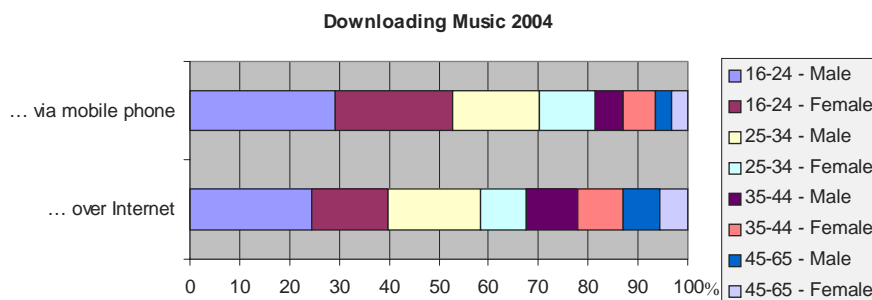
take a different route from music downloading on the Internet.

Another obvious interpretation is that the diffusion mechanism for services over the mobile phone follows one pattern and that services on the Internet follow one or several different patterns. In other words, the Japanese picture mail example may be highly relevant for other mobile-phone-based services (in other countries) such as SMS and music download—but provide less insight on diffusion patterns on the Internet.

SUMMARY AND DISCUSSION

The point of this chapter is by now hopefully very clear to the reader: The Japanese female students were not the earliest adopters of the picture mail service, but they were the crucial group to capture in order to make the service successful on the mass market. This is true to the point where it actually becomes irrelevant who the early adopters were. For the picture mail service—or, we believe, for any service based on new technology—it is relatively easy to find a small group of explorative people who are willing to try the service out, but it is more difficult to find a group who can translate the ramifications of the inherently new

Figure 13. Music downloading in 2004: Comparing via mobile phone and over the Internet (Copyright Ericsson Consumer & Enterprise Lab. Used with permission)



The Right of Interpretation

technology that the service implies into something meaningful for the mass market.

As shown in Figure 14, the life stage group *men family university* is the group originally interested in picture mail—but since the cameras in the mobile phones as well as the technical limitations in the messaging service do not live up to their expectations, they totally lose interest.

Female students start using digital images because they are delivered faster (e.g., in Print-Club machines) and fit better in a spontaneous lifestyle. Gradually they then focus this behaviour on picture mail in the mobile phone, creating a mass market in the process.

The answer to the question posed in the title of this chapter then becomes: The female students are the decision makers. It was they who decided that picture mail was bound for success; not the product managers, not the marketing people, and not even the early adopters. Obviously, they did not make a joint conscious decision at any point in time—instead many relatively unimportant individual decisions proved to have synergetic effect.

Compared to the *men family university* group (i.e., the early adopters in this case) they have lower social status, less individual power, and certainly lower income. But at least in the case of the picture mail service, it seems that their peer group networking nevertheless is a powerful vehicle for influence over other groups in society.

Moreover, the influence of the female students on other groups in society is at least twofold, since their adoption of picture mail has the effect of deciding the social meaning of picture mail (e.g., the usage style and code of conduct) and the terminology used to refer to the usage of picture mail (e.g., “a graphic hello”). The diffusion of social meaning of the service as defined by the female students, as well as the diffusion of their terminology was in essence what paved the way for the diffusion of the actual service itself.

This chapter has dealt mainly with communication services (and primarily with the Japanese picture mail service)—services that to some extent are all exposed to a network effect, as formulated with respect to individuals in Metcalfe’s Law⁷ (“the value of a network equals approximately the square of the number of users of the system”). As an idea for possible further exploration, it is interesting to note that when the terminology for picture mail fuses with ordinary language, a network effect is created in the sense that the more people that use this terminology the more natural it seems to become (and the greater its social value). In the same way, we may even attempt to describe the failure of the *men family university* group to have any impact on this market as a network externality effect (Liebowitz & Margolis, 1995)—since their terminology may be too difficult for others to internalize (i.e., adopt as part of their natural vocabulary).

The relevance of this story for other services in other markets could be argued, but from the data for other countries presented here, we have reason to believe that it may be quite relevant for mobile phone services such as SMS and music download—although it may provide less insight on diffusion patterns on the Internet. But even if the details of the diffusion patterns as such differ, the evidence is that it will be increasingly difficult to ignore the effects of how individual users themselves interpret product and service offerings and pass the word on to others. “At this point, the iPod’s like a can of Coca-Cola—it’s a given.” Indeed.

REFERENCES

Anderson, J. R. (1990). *Cognitive psychology and its implications* (3rd ed.). New York: W. H. Freeman and Company.

Ebare, S. (2004). Digital music and subculture: Sharing files, sharing styles. *First Monday*, 9-2. Retrieved from http://www.firstmonday.org/issues/issue9_2/ebare/

Fujimoto, K. (2005). The third-stage paradigm: Territory machines from the girls' pager revolution to mobile aesthetics. In M. D. Okabe & M. Matsuda (Eds.), *Personal, portable, pedestrian: Mobile phones in Japanese life* (pp. 77-101). Cambridge, MA: MIT Press.

Hebdige, D. (1979). *Subculture: The meaning of style*. New York: Routledge.

Kahney, L. (2004, December 13). Home-brew iPod ad opens eyes. *Wired News*. Retrieved from <http://www.wired.com/news/mac/0,2125,66001,00.html>

Liebowitz, S., & Margolis, S. (1995). Are network externalities a new source of market failure? *Research In Law And Economics*, 17, 1-22.

McDonald, M., & Dunbar, I. (2004). *Market segmentation: How to do it, how to profit from it*. Oxford: Butterworth-Heinemann.

Moore, G. (1991). *Crossing the chasm*. New York: Harper Business Collins.

Rogers, E. (1995). *Diffusion of innovations* (4th ed.). New York: Free Press.

Sekizawa, H., Washida, Y., & Björn, M. (2002). *Situation marketing*. Tokyo: Kanki Publishing.

Steuer, E. (2004). The remix masters. *Wired Magazine*, 12(11), 184-187.

nally based on Ericsson's Take 5 consumer segmentation model. More specifically, only Take 5 segments that are over represented (index over 120) in a life stage have been used to represent the place of that life stage in the Monitor. As an example, there are some respondents in the *men family university* group who are classified in the Take 5 segment Achievers—but since the segment Achievers is underrepresented in that life stage, they have been excluded when plotting *men family university* in the Monitor.

² The online encyclopedia Wikipedia describes otaku as “an enthusiastic fan of any one particular theme, topic, or hobby” (<http://en.wikipedia.org/wiki/Otaku>). If you speak Japanese you can also take a test and become a certified otaku. Retrieved from <http://www.otaken.jp/image/OTAK01.pdf>

³ The online encyclopedia Wikipedia describes kogal as “a subculture of girls and young women in urban Japan” and continues “They are characterized by conspicuously displaying their disposable incomes through unique tastes in fashion, music, and social activity.” Retrieved from <http://en.wikipedia.org/wiki/Kogal>

⁴ See http://dailysoy.blogspot.com/2004_12_01_dailysoy_archive.html for a typical usage example, in this case of people watching Christmas displays on town: “Few linger to bask in the festive goodness; just take a quick pic, possibly sha-mail it to a friend, and move on.”

⁵ Japanglish, Paperlantern Web site describes *my boom* as “something you are really into, absorbed in, a craze.” <http://www.paperlantern.net/culture/japanglish/>

ENDNOTES

¹ The meaning of *gravity centres* here is related to the fact that this analysis was origi-

The Right of Interpretation

⁶ Inglehart Values Map, <http://www.world-valuesurvey.org/library/index.html>

⁷ Metcalfe, R., http://en.wikipedia.org/wiki/Metcalfe's_law

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 36-58, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.7

The Role of Information and Communication Technology in Competitive Intelligence

Dirk Vriens

University of Nijmegen, The Netherlands

ABSTRACT

This chapter discusses the role of ICT for competitive intelligence activities. To this end, it starts with an introduction to competitive intelligence. Next, it discusses possible uses of ICT for intelligence activities. In this discussion attention is paid to the use of the Internet, to general purpose ICT tools, to ICT tools tailored to one or more of the intelligence stages, and to business intelligence tools (data warehouses and tools to retrieve and present data in them). Finally, the chapter describes how organizations may select ICT applications to support their intelligence activities.

INTRODUCTION

Competitive Intelligence (CI) can be described as producing and processing information about the environment of an organization for strategic purposes (cf., Kahaner, 1997). To (re-) formulate their strategy, organizations need to collect and process information about their environment—about, for instance, competitors, customers, suppliers, governments, technological trends or ecological developments. Collecting and processing environmental information for strategic purposes is by no means something new. It has always been important. Without knowing what is going on in

the environment, keeping the organization viable would be impossible. In fact, as Beer (1979) asserts, the “intelligence function” (scanning the environment in order to maintain the adaptability of a system) is a necessary function of *any* viable system. However, the issue of *explicitly* building and maintaining an intelligence function in an organization has only gained importance since the last few decades (cf., Hannon, 1997; Fleisher, 2001a). Due to the increasing complexity and dynamics of the environment the need to produce relevant “actionable” intelligence is increasing as well. Because of, for instance, increased global competition, (speed and impact of) political changes, and rapid technological developments (e.g., Kahaner, 1997; Cook & Cook, 2000; Fleisher & Blenkhorn, 2001) the need for information about the environment is more pressing than ever. As McDermott (in Hannon, 1997, p. 411) puts it, “Perhaps [CI] was inevitable, given the heightened competition that prevails now [...]” Or, putting it more directly: “If you are in business, you need competitor intelligence” (Fuld, 1995, p. 1). At the same time, organizations are facing a huge amount of available data about the environment. The Internet, although a very useful source of environmental data, is growing so large that finding relevant information is hard. As many authors point out (e.g., Cook & Cook, 2000; Chen et al., 2002), this leads to the problem of information overload.

Organizations are thus faced with an increased pressure to produce relevant information about the environment and, at the same time, with an extremely large, ever-increasing amount of data about the environment. To deal with this problem, many organizations are explicitly structuring their intelligence activities. Many have, for instance, implemented so-called “competitive intelligence units” (see Prescott & Fleisher, 1991; Kahaner, 1997; Fuld, 2002; or Gilad, 1996, for examples). To structure the process of competitive intelligence, several authors (cf., Kahaner, 1997; Gilad

& Gilad, 1988; Herring, 1991; Bernhardt, 1994; Fuld et al., 2002) propose an “intelligence cycle,” consisting of four stages:

1. **Direction.** In this stage the organization determines its “strategic information requirements.” It determines about what aspects in the environment data should be collected.
2. **Collection.** Here, it is determined what sources can be used for data collection and the data are actually collected.
3. **Analysis.** In the analysis stage collected data are analyzed to assess whether they are useful for strategic purposes. In this stage, the actual “production” of intelligence (data relevant for strategy) takes place.
4. **Dissemination.** The intelligence (produced in stage 3) is forwarded to the strategic decision-makers and used to formulate their strategic plans.

To make sure that these activities can be carried out properly, an organization should implement a so-called “intelligence infrastructure” (Vriens & Philips, 1999). This infrastructure consists of three parts: (1) a technological part, comprising the ICT applications and ICT infrastructure that can be used to support the (stages in the) intelligence cycle, (2) a structural part, referring to the definition and allocation of CI tasks and responsibilities (e.g., should CI activities be centralized or decentralized? Should CI-activities be carried out by CI professionals or can others be involved?), and (3) a human resources part, which has to do with selecting, training and motivating personnel that should perform the intelligence activities. The challenge for organizations is to find a balanced “mix” of technological, structural and human resource measures to build and maintain the infrastructure (cf., Fuld, 1995; Kahaner, 1997; Gilad & Gilad, 1988; Hannon, 1997).

In this book we focus on the technological part of the infrastructure. In particular, we focus on

the Information and Communication Technology (ICT) applications supporting the intelligence activities (see for instance Cook & Cook, 2000 for an overview). Examples of such ICT tools are the systematic use of the Internet for direction or collection activities (cf., McGonagle & Vella, 1999; McClurg, 2001), groupware applications for uncovering information requirements, specific applications for supporting the analysis of information (e.g., System Dynamics software), the use of an intranet for disseminating intelligence (cf., Cunningham, 2001; Teo & Choo, 2002), and data warehouses or data mining tools (cf., Zanasi, 1998; Cook & Cook, 2000; or Ringdahl, 2001).

Although many ICT tools to support intelligence activities are available, organizations face difficulties in using them. One particular difficulty is that there tends to be an overemphasis on the role of technology in obtaining intelligence. As a result, some organizations rely too much on the use of their ICT applications for intelligence. For instance, ICT for competitive intelligence often means ‘implementing’ a data warehouse with tools for (quantitative) analysis. The software industry even seems to equate the term “business intelligence” (a “former” synonym of competitive intelligence) with data warehouses and associated tools. In other cases, organizations implemented a “CI unit,” consisting of one person monitoring the results of an online database. In these cases, the technology is viewed as the only or most important means to produce intelligence. This can be problematic for several reasons. First, the data from data warehouses (or from ERP applications) mostly have an internal focus (cf., Fuld, 2002; Li, 1999) while competitive intelligence is about environmental data. Second, the use of ICT as the main source for intelligence may lead to an “unjustified sense of control” or even overconfidence in ICT for obtaining CI. This sense of control may emerge because of the vast amount of (electronic) sources one hopes to have at one’s disposal—e.g., by means of an online database, by means of clever search engines or

by means of a large data warehouse. However, the sense of control is unjustified, because one important source of intelligence—human intelligence (cf., Kahaner, 1997; Fleisher, 2001a; Fuld et al., 2002)—is not directly accessible via ICT [although the Internet may be used as a tool for tracking down and contacting primary sources (see Kassler, 1998)]. The sense of control is also unjustified because the number of electronic sources (e.g., websites) attached to the Internet is so large that no search engine covers all of them (see Chen et al., 2002). Moreover, their content is also (continuously) changing. Overconfidence in ICT for producing intelligence may also emerge because of the belief that intelligence activities can be automated. This is not true (yet) (see Fuld et al., 2002; Cook & Cook, 2000). As Cook and Cook (2000) remark: What you get from ICT-applications is data that still have to be put in a proper context to obtain intelligence. Direction and analysis remain the work of humans.

Another difficulty with using ICT in intelligence activities is that it can increase the information overload. If the collection stage is not properly directed, the Internet becomes “the intelligence-highway to hell”: without a clear focus one can go on searching and mining forever.

A last problem with employing ICT in intelligence activities we want to mention here is that ICT is sometimes implemented without paying attention to the human resource and structural parts of the infrastructure. For example, a persistent problem with the use of an intranet for intelligence gathering and dissemination is that some “refuse” to use it. The reasons are various: ranging from “lack of time,” “no part of my job-description,” to “I don’t see the point in using this system.” In such cases, the importance of additional human resource measures to motivate personnel to use the intranet application is not recognized (see e.g., Bukowitz & Williams, 1999, for a treatment of this motivation issue). A way to deal with such problems is to treat ICT as a part of the whole infrastructure.

Despite such problems, however, ICT is a valuable part of the intelligence infrastructure. ICT offers many opportunities to support (and sometimes carry out parts of) intelligence activities. However, to avoid problems, organizations should be careful in selecting and implementing ICT applications for CI purposes. They should know the possibilities of ICT to deliver internal and external data and its capacity for supporting (and carrying out) CI activities, and they should treat ICT as a part of the whole infrastructure. In short, to support organizations in using ICT properly for their intelligence activities, an understanding of the role of ICT in intelligence activities is needed—both in terms of the (im)possibilities of ICT for intelligence activities and of its being a part of the whole intelligence infrastructure. This chapter intends to address this need. Its main goals are (1) to give an overview of the use of ICT for the intelligence activities, and (2) to present criteria for selecting proper ICT applications. To reach this goal, the plan for the chapter is as follows. In the next section we discuss competitive intelligence more closely. Next, we present an overview of ICT applications for CI. And finally we discuss the issue of selecting ICT for CI.

WHAT IS COMPETITIVE INTELLIGENCE?

To determine the role of ICT in competitive intelligence, it is first necessary to define CI. Many authors use the term, but their definitions differ. Consider, for instance, the following two definitions:

1. “CI is the process of ethically collecting, analyzing and disseminating accurate, relevant, specific, timely, foresighted and actionable intelligence regarding the implications of the business environment, competitors and the organization itself” (Society of Competitive Intelligence).

2. “CI is the process of obtaining vital information on your markets and competitors, analyzing the data and using this knowledge to formulate strategies to gain competitive advantage” (Yuan & Huang, 2001).

At a first glance, these definitions seem to refer to the same thing. Both refer to a process of obtaining information, analyzing it and using (or disseminating) it. Some differences may also be noted. One definition speaks of intelligence, while the other refers to information, data and knowledge. The second definition explicitly states the goal of CI—while the first leaves it more implicit.

In this section, we examine competitive intelligence by means of the following four aspects:

1. the contribution of competitive intelligence
2. competitive intelligence as a product
3. competitive intelligence as a process
4. the nature of the obtained competitive intelligence

This enables us to define CI and, at the same time, understand the differences and similarities of different definitions in the literature.

The Contribution of Competitive Intelligence

Authors mostly refer to two reasons for obtaining competitive intelligence. The first reason is that it contributes to an “overall organizational goal” such as improving its competitiveness or maintaining the viability of the organization. The second reason refers to the contribution of CI to the organizational activities needed to reach the overall goal (e.g., decision-making or strategy formulation). For instance, the second of the above definitions of CI refers to both kinds of contributions. It states: “CI is (...) to formulate

strategies [second kind of contribution] to gain competitive advantage [first kind of contribution].” The first definition does not state either of the contributions. To our knowledge, most authors seem to agree about the overall contribution of CI. Some disagreement exists, however, about the organizational activities in which CI is used to reach this overall goal. Some hold the view that CI is used in decision-making at any level in the organization [e.g., the more ICT-oriented CI definitions (cf., Dresner, 1989)] while others maintain that it is mainly used in strategic decision-making (most authors seem to fall in this category: e.g., Fuld, 1995; Kahaner, 1996; Cook & Cook, 2000; Hannon, 1997). In defining CI, we will follow these authors and state that CI is tied to strategic decision-making.

Competitive Intelligence as a Product

In the literature, it is customary to make a distinction between (competitive) intelligence as a product and as a process (e.g., Gilad & Gilad, 1988; Fuld, 1995; Kahaner, 1996; Fleisher, 2001a). In treating intelligence as a product, authors refer to the “information” or “knowledge” obtained and used for strategic purposes. The process view stresses the process by means of which this information or knowledge is obtained and used. Both the above definitions stress the process aspect. The first definition also highlights intelligence as a product.

If competitive intelligence is seen as a product, it is usually compared with data, information and knowledge (cf., Fuld, 1995; Kahaner, 1997; Vriens & Philips, 1999). To define intelligence as a product (and to compare it with data, information and knowledge) we use a framework provided by Achterbergh and Vriens (2002) (see Figure 1).

For the survival of any individual, two processes are imperative: observation and the performance of actions. In the process of observation,

three steps can be distinguished. First, individuals perceive signals from the environment. These signals are referred to as data. The second step is that individuals make sense of these perceived data by putting them into a context or “frame of reference.” Once perceived and interpreted, individuals may evaluate whether the signal is informative (contains something new—i.e., something the individual did not know already) and whether action is required. Information is now defined as “perceived and interpreted data, containing something new to the observer.” Given this description, knowledge can be seen as the background for observation (cf., Achterbergh & Vriens, 2002). The process of performing actions consists of four steps: (1) selecting a desired effect (what does the individual want to achieve by acting?), (2) formulating options for obtaining the desired effect, (3) selecting an option, and (4) implementing the option. Figure 1 depicts these steps. Regarding the performance of actions, knowledge can be defined as that which serves as a background for these four steps.

In this view, knowledge has two main functions. It serves as a background for observing (or as Achterbergh & Vriens put it, the “assessment of signals”) and for “performing actions.” Note that knowledge is defined functionally. No attempt is made to sum up the content-elements of knowledge (see e.g., Davenport & Prusak, 1998). The reason for this is that the function of knowledge is easily pinned down, while its exact content is (still) “the subject of psychological research and philosophical debate” (Achterbergh & Vriens, 2002, p. 226).

Against the background of the definitions of data, information and knowledge, we can now define intelligence (see also Figure 2).

To do so, we transfer the above concepts from the realm of individual observing and acting to the organizational realm of strategic observing and acting. That is, we can define strategic observation as (1) “perceiving data from the environment,”

Figure 1. Individual observation and action—a model to clarify the distinction between data, information and knowledge

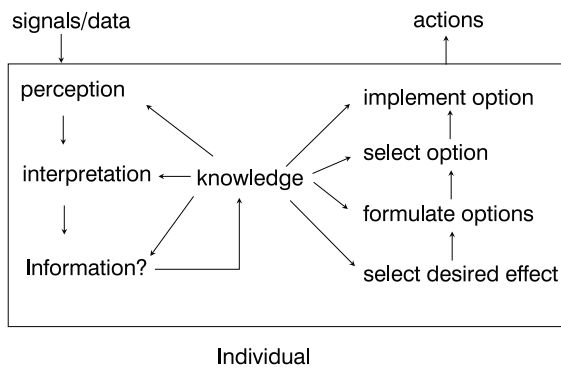


Figure 2. Organizational observation and action—a model to clarify the distinction between data, intelligence and knowledge

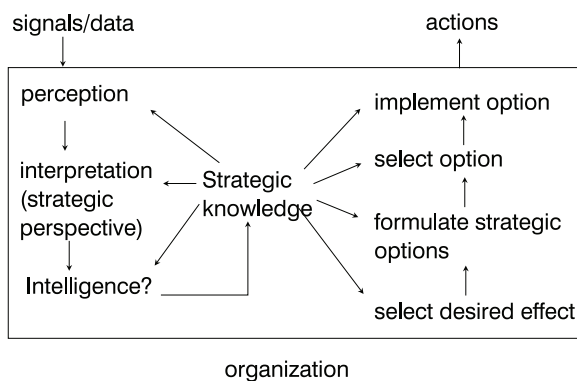
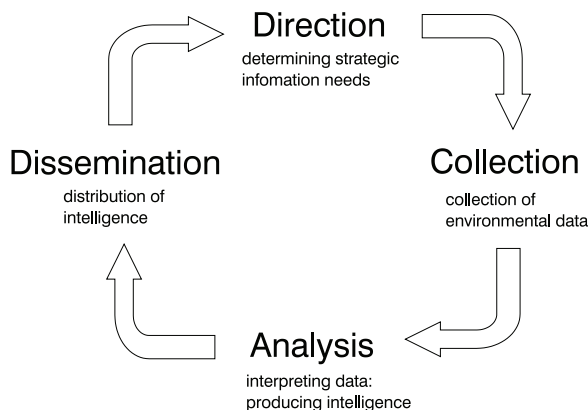


Figure 3. The four stages of the intelligence cycle



(2) making sense of these data—i.e., putting them in a strategic perspective, and (3) determining whether the data contain something of strategic importance (something new and relevant for strategic purposes) and assessing whether strategic action is needed. In this process of “strategic observation,” intelligence can be defined as the “strategic” counterpart of information. That is, if perceived and interpreted data contain something of strategic significance, and one did not already know this, the perceived and interpreted data can be defined as “intelligence.” Intelligence, in turn, is evaluated in order to decide whether strategic action is needed. The four processes of (individual) action, as described above, can also be translated to strategic action. Knowledge may then refer to the background against which these strategic observations and actions occur—the “strategic knowledge” in the organization.

This view on intelligence and knowledge also makes apparent that what counts as intelligence in an organization depends on the existing strategic knowledge in the organization. This seems self-evident—but as Gilad (1996) points out, it is anything but: Incomplete or incorrect strategic knowledge often leads to the phenomenon of business blind spots.

Competitive Intelligence as a Process

Next to defining “intelligence as a product” it can also be seen as a process delivering this product. As we already stated in the introduction, authors often divide the process of competitive intelligence into four stages: (1) direction, (2) collection, (3) analysis, and (4) dissemination. The whole process (comprising these four steps) is usually called the intelligence cycle (see Figure 3).

Below, we discuss these stages and illustrate them with findings from a study conducted by Lammers and Siegmund (2001). The object of this study was to give an overview of current CI practices in (large) organizations in The Neth-

erlands. Although we are aware of the fact that these findings only represent the “Dutch” situation, we are somewhat confident in generalizing them, because many participating organizations are large multinationals (e.g., Shell, Akzo-Nobel, or Philips).

In the direction stage, the “strategic information requirements” are stated. In this stage, one determines about what aspects of the environment data should be gathered in order to produce intelligence. A distinction can be made between a “rough” data profile (indicating certain data classes, e.g., “We need to know something about the logistic capacity of competitor X and Y”) and an exact data profile (indicating the exact data within a certain data class, e.g., “We need to know the amount of trucks and their capacity”). These topics (both in their exact or rough version) are also known as Competitive Intelligence Needs (Fleisher, 2001), Key Intelligence Topics (Kahaner, 1996) or Essential Information Elements (Sammon, 1984).

A particularly difficult aspect is determining the relevance of certain data classes before actual data about them are collected and before they can be interpreted, i.e., before intelligence can be produced. To accomplish this, some kind of model about the “organization in its environment” is needed. The challenge in the direction stage is to build and maintain such a model and to use it to define the strategically relevant data (classes) about the environment. In the literature, one often refers to the critical success factor method (or one of its variants; see for instance Sammon, 1986; Kahaner, 1997; Herring, 1999; or Cook & Cook, 2000) to build such a model and to derive environmental information needs from it.

In the second stage of the intelligence cycle, the required data are collected. To this end, two main activities are needed: (1) determining what sources are available and (2) accessing these sources and retrieving data from them. Many authors distinguish between several types of sources. For instance:

- open versus closed sources (open sources are accessible by everyone, closed sources are not);
- internal versus external sources (this distinction refers to the location where sources with data about the environment can be found: inside the organization (e.g., sales-representatives) or outside the organization);
- primary versus secondary sources [Primary sources are sources that hold the data in their original, unaltered form directly from the source from which the original data stems. Secondary sources offer altered data (cf., Kahaner, 1997)];
- sources that differ in data carrier—i.e., paper, electronic and human sources.

To collect data that may contain strategic relevant information, many possible sources can be identified. Several authors sum up lists of possible sources. Among these are: the Internet, online databases, trade shows, consultants, customers, universities, embassies, suppliers, journals, labor unions, etc. (see for instance Cook & Cook, 2000; Vriens & Philips, 1999; or Kahaner, 1997 for a more comprehensive overview). Most organizations tend to use more than one source. In a recent study, Lammers and Siegmund (2001) asked organizations in The Netherlands what data sources they employed in their intelligence gathering. Figure 4 presents the results. As can be seen in the figure, trade journals, the Internet and online databases were found to be the three most used sources.

Gilad and Gilad (1988) stress the importance of an “intelligence collection network”—a network of people involved in collection activities. Members of this network may be dispersed throughout the organization and have all kinds of functions (e.g., service, R&D, purchase, or marketing and sales). The idea behind such a network is that individuals may collect information about the part of the environment they are closely related to. To give an impression of the nature of such networks,

Figure 4. Sources used by large organizations in the netherlands for collection activities (scores range from 0 (never) to 5 (always); multiple answers are possible) (Source: Lammers & Siegmund, 2001)

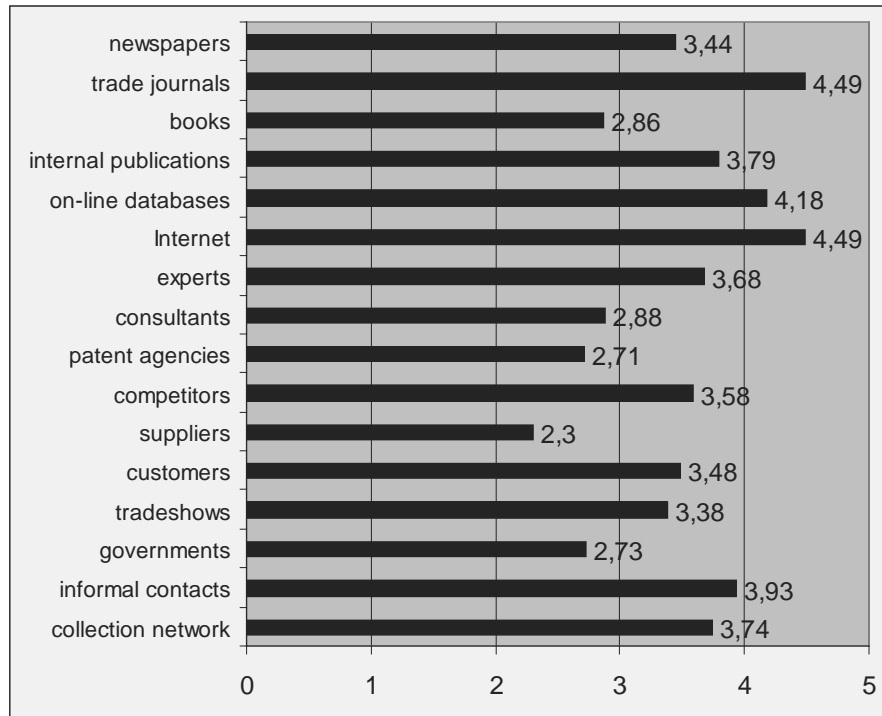


Table 1 summarizes the findings of Lammers and Siegmund regarding their composition in large organizations in The Netherlands. As can be seen, the study reveals a high involvement of marketing and sales, R&D and management in the collection network

To collect certain data, knowledge about the available sources should be gathered and used. This entails knowing (1) what sources may contain the requested data, (2) whether these sources can be approached and accessed adequately (measured, for instance, by means of general criteria like timeliness, costs, relevance, accuracy, whether the data is up-to-date, accessibility, etc. (cf., Gilad & Gilad, 1988), and (3) who will be involved in

gathering data about the sources and in the actual collection activities. Managing the CI collection stage means ensuring that this knowledge is generated, stored and applied.

In the third stage of the intelligence cycle, the data is analyzed. In terms of the model we presented earlier (see Figure 1), the third stage focuses on interpreting the data from a “strategic point of view” to determine their strategic relevance (i.e., to determine whether the data contain intelligence). For this analysis, as with the direction stage, a model of what is relevant for the organization should be available. Many authors present both general and specific models for this purpose. Among the general models are

Table 1. Composition of the intelligence network members of organizations in the Lammers and Siegmund study (The percentage refers to the percentage of organizations indicating that their collection network consisted of a specific member.)

| Members of the collection network | Percentage |
|-----------------------------------|------------|
| Marketing and Sales | 79 |
| Service | 14 |
| Purchase | 29 |
| R&D | 50 |
| Finance | 14 |
| Human resources dept. | 7 |
| Lawyers | 14 |
| Production | 7 |
| Management | 57 |
| Other | 36 |

SWOT analysis; the growth-share matrix of the Boston Consultancy Group; scenario-analysis; war-gaming; and competitor profiling (see Kahaner, 1997; Fuld, 1995; Powell & Allgaier, 1998; or Cook & Cook, 2000 for overviews of these models, and Fleisher, 2001b for a reflection on the analysis stage). More specific models are models about patent behavior (Kahaner, 1997; Poynder, 1998) or models tied to specific products. The goal of these models is to provide a context for interpreting data. For instance, an increase in R&D budget of a competitor may mean several things. A SWOT analysis may be used to put this “piece of data” in its proper context. If its R&D was analyzed to be a competitor weakness, the threat of a budget increase may be viewed as less serious than in the case where R&D was analyzed as state of the art.

In the same study we mentioned earlier, Lammers and Siegmund asked several Dutch organizations what models they used in the analysis stage. Table 2 presents the results. These results

Table 2. Models used in the analysis stage (Lammers & Siegmund, 2001) (The percentage refers to the percentage of organizations indicating that they used a certain model for analysis.)

| Models used in the analysis stage | Percentage |
|-----------------------------------|------------|
| Simulation | 35 |
| War gaming | 15 |
| Scenario analysis | 40 |
| BCG-matrix | 45 |
| SWOT analysis | 80 |
| Financial analysis | 65 |
| Competitor profiles | 90 |
| Other | 40 |

confirm the popularity of the SWOT analysis. It also turned out that organizations used models they made themselves (in the “other” category).

In the last stage of the intelligence cycle, the intelligence should be made available for strategic decision-making. That is, the intelligence should be presented clearly and distributed to relevant decision makers, using it to evaluate current strategic options and to generate, compare, select and implement new ones. Relevant in this stage is to make sure that the intelligence is actually used in strategic decision-making. All kinds of measures may be helpful in accomplishing this. For instance:

- paying attention to the format and clarity of the presentation of intelligence to strategic decision-makers (e.g., Fuld et al., 2002);
- using electronic means to store and distribute the intelligence to the right people;
- designing CI tasks and responsibilities in such a way that strategic management is

involved in the intelligence activities (cf., Gilad & Gilad, 1988).

The Nature of the Obtained Competitive Intelligence

Some confusion exists about the difference between competitive intelligence and terms closely related or associated with competitive intelligence, e.g., competitor intelligence, market(ing) research or corporate espionage. One existing confusion is the difference between competitive intelligence and other kinds of intelligence. Data about many environmental aspects may be of strategic significance, e.g., data about competitors, about technological changes, about governments, about suppliers, etc. If the subject about which data is collected is not specified (if the scope is broad), one tends to speak about *competitive* intelligence. In this chapter, we will also refer to competitive intelligence in this broad sense. The common factor in data about these subjects is that they can all contain information of strategic importance. If, however, intelligence is produced and processed about a specific (environmental) subject, authors often use terms indicating this subject: e.g., *competitor* intelligence, *technological* intelligence, or *marketing* intelligence. Some authors even seem to equate competitive intelligence with competitor intelligence (e.g., Fuld, 1995). Of special interest is the term “business intelligence.” This term was previously used to refer to the same issues as competitive intelligence (cf., Gilad & Gilad, 1988; Pawar & Sharda, 1997 who use the term business intelligence instead of competitive intelligence). However, lately, the software industry took over the term “business intelligence” to refer to a specific constellation of ICT tools used for organizational decision-making in general (cf., Cook & Cook, 2000; Fuld et al., 2002). We will adhere to this development and refer to BI as a specific set of ICT tools.

In defining CI, authors (cf., Gilad & Gilad, 1988; Cook & Cook, 2000) also stress the difference between CI and marketing research. This difference is partly a matter of scope. As Gilad and Gilad (1988, p. 8) put it: “Although the information produced by a market research department is intelligence, it is only a small part of the total intelligence required for decision making.” Hannon, (1997, p. 411) states that marketing research is different because “it is usually undertaken within the marketing function and, obviously, is more limited in scope than the overall competitive intelligence process.” Gilad and Gilad (1988) also emphasize that CI tends to be a more continuous activity than marketing research.

A last related term is corporate espionage. Although one may obtain intelligence by means of corporate espionage, the difference is that corporate espionage includes collection activities that are usually viewed as illegal and/or unethical: such as “dumpster diving,” stealing information or illegal access to an intranet, to name a few. CI only employs legal activities to produce intelligence (cf., Hannon, 1997; Gilad & Gilad, 1988; Kahaner, 1997; Cook & Cook, 2000; Fleisher, 2001a).

Defining CI: A Summary

In our effort to define CI, we can now make the following statements about CI:

- As a product, CI is “environmental information relevant for strategic purposes.”
- As a process, CI can be described by the intelligence cycle consisting of four stages: direction, collection, analysis and dissemination.
- The CI process aims to deliver CI as a product for strategic decision-making.
- CI differs from corporate espionage, business intelligence and other kinds of intelligence and from market(ing) research.

With this understanding of the concept of CI we can now look at the role of ICT for CI in the next section.

ICT FOR COMPETITIVE INTELLIGENCE

In this section, we discuss ICT tools for CI, i.e., ICT tools for supporting the activities in the intelligence cycle. To this end, we first try to position ICT tools for CI in the traditional classification of ICT applications. Next, we discuss four classes of ICT tools for CI.

Traditionally, ICT applications for management in organizations are classified along two well-known dimensions: the type of structure of the organizational task or decision the application is supposed to support (divided in structured, semi-structured and unstructured tasks or decisions) and the organizational (management) level at which these tasks or decisions reside (usually the operational, tactical and strategic management level) (see for instance Laudon & Laudon, 2000). Typically, transaction processing systems (TPS) are operational level systems supporting structured tasks; management information systems (MIS) support tactical (middle level) management by summarizing and reporting output of all kinds of TPS's—still supporting structured tasks. Decision support systems (DSS) typically add analytical tools to MIS for performing “what-if analysis.” This analysis is said to be semi-structured. Executive support systems (EIS) refer to tools supporting high level management in their rather unstructured task of strategy making.

We acknowledge that this list of applications is incomplete and that it does not do justice to the research attempting to order ICT applications. The reason for the inclusion of this classification is to see where ICT for CI can be placed. ICT for CI aims at supporting strategic decision-making and thus supports—in the end—an unstructured

organizational task. However, CI activities differ in structure: some CI tasks are highly structured (e.g., find experts on subject X); while others are not (e.g., “define the strategic information needs” or “analyze what it means that competitor X closes plant Y”). Moreover, CI tools may be employed at all levels in the organization: at the operational level (e.g., aiding sales representatives in asking questions to customers and storing the answers), at the tactical level (e.g., in supporting the management of CI professionals or supporting the analysis of environmental information) and at the strategic level (e.g., in presenting overviews of trends and their effects on the current or projected strategy). Therefore, ICT for CI (or Competitive Intelligence Systems—CIS) seem to defy an exact classification according to these dimensions. Instead, the dimensions can be used to state that CIS is best seen as a collection of electronic tools (see also Rouibah & Ould-ali, 2002):

- ultimately meant to support strategic decision-making;
- dispersed over different management levels; and
- supporting structured and unstructured intelligence activities.

In this section we will elaborate on the nature of these electronic tools. For this elaboration, we classify them according to (1) their contribution to one or more stages of the intelligence cycle and (2) the specificity of the tool. The latter “dimension” has two positions: a tool can be a general ICT tool used for intelligence activities (like groupware, used for direction activities or the Internet, used for collection or dissemination activities) or a tool specifically tailored to one or more intelligence activities. We will use this classification in our discussion of the tools below. We first discuss the Internet as a “general” ICT tool for all CI activities. Next, we pay attention to other ICT tools—both general and specific.

And, finally, we discuss business intelligence applications as a specific set of ICT applications useful for CI activities.

The Internet as a Tool for CI

CI practitioners rely heavily on the use of the Internet for their intelligence activities. The Internet is sometimes seen as the most important information resource for competitive intelligence and, to our knowledge, the Internet as CI tool has received the most attention in the literature (e.g., Cronin et al., 1994; Graef, 1997; Teo & Choo, 2001; Chen et al., 2002; Cook & Cook, 2000; McCurgle, 2001). Chen et al. (2002, p. 1) state that a 1997 Futures group report identifies the Internet as one of the top five sources. Lammers and Sigmund (2001) found that, in organizations they approached, the Internet was the most preferred source for acquiring information.

The Internet can be used in numerous ways to produce intelligence. Examples are: searching certain information by using search engines (Graef, 1997; Chen et al., 2002; Cook & Cook, 2000); obtaining knowledge about costumers through interactive websites and agents (Teo & Choo, 2001); receiving feedback from costumers about competitors or one's own products and services (Teo & Choo, 2001); monitoring discussion groups on competitors (Cronin et al., 1994; Graef, 1997); conducting patent search (Poynder, 1998); improving stock decisions by monitoring online stock data available from retailers (Yuan & Huang, 2001); accessing the latest news through a wire service (Cook & Cook, 2000); learning about competitors and partners by visiting their websites (Cronin et al., 1994; Graef, 1997; Chen et al., 2002; Cook & Cook, 2000), searching and contacting experts (Kassler, 1998); accessing governmental files (Kahaner, 1997; Cook & Cook, 2000); monitoring the "e-behavior" of visitors to your website (Tan & Kumar, 2002); gaining easy access to expertise through discus-

sion groups (Teo & Choo, 2001; Cook & Cook); or "outsourcing" collection activities by using commercial online databases (Cronin et al., 1994; Graef, 1997; Gieskes, 2000; Cook & Cook, 2000; Kahaner, 1997).

To discuss the use of the Internet for one or more stages in the intelligence cycle, Teo and Choo (2001) propose to make a distinction between its internal use (Intranet), its external use (Extranet) and its use for "primary and secondary research." However, this seems to confuse two distinctions: one regarding a division of the Internet (into Intranet, Extranet and "beyond") and one regarding the stages in the intelligence cycle (of which Teo and Choo highlight the collection stage). To avoid this confusion, we would like to propose to use both distinctions. Below, we first discuss Internet tools for direction, analysis and dissemination and next devote a section to Internet tools for the collection stage.

Internet for Direction, Analysis and Dissemination

Few studies mention the use of the Internet for the direction, analysis and dissemination stages. To support the direction stage, an Intranet application may enhance communication of and collaboration regarding results of this stage [e.g., an internal discussion site may be used to define and monitor intelligence needs (see Vriens & Hendriks, 2000)]. The same sort of Internet applications may be used to support the analysis stage. Teo and Choo (2001) discuss the relevance of the Internet (Intranet and Extranet) for all CI activities: they hold the view that it (especially e-mail, Intranets, Extranets and databases) enhances internal and external collaboration in CI activities (e.g., multi-departmental analysis of intelligence and the exchange of intelligence between departments as well as the exchange of CI data with suppliers, external consultants and customers). The Internet can also be used to en-

hance internal and external dissemination of CI data (Teo & Choo, 2001, p. 70, 73; Graef, 1996; Cunningham, 2001). Furthermore, Teo and Choo expect an increase in external collaboration and dissemination (i.e., with relevant stakeholders for mutual benefit) through Extranets.

The Use of the Internet for Collection Activities

The Internet is mainly used for collection purposes and many different tools and uses are reported. A difference can be made between using the Internet for searching and accessing electronic data available on the Internet versus searching and accessing other sources by means of the Internet (like people, trade shows, conferences, etc.—cf., Cook & Cook, 2000; Kassler, 1997). In the first case, the Internet contains the requested data, while in the second case, the Internet is viewed as a means for referring to other sources (like a knowledge map—cf., Davenport & Prusak, 1998). To this end, Kassler (1997) explains that the Internet is invaluable as a means for locating people and contacting them. Cook and Cook (2000) give several sites where information about other sources (experts, trade shows, conferences, etc.) can be found and state their usefulness for CI.

Most attention, though, seems to be on searching and accessing directly available data. However, due to the extremely large number of sites, (and hence) the amount of information and due to the changes in this information, finding the right data is not easy. Chen et al. (2002) state that to deal with a possible information overload a number of tools are available that “analyze, categorize and visualize large collections of Web pages” and “assist in searching, monitoring and analyzing information on the Internet” (Chen et al., p. 3). Below, we discuss some of these tools.

Search Engines

Many CI authors discuss the usefulness of Web search engines for collecting data on the Internet. Typically, they refer to the difference between “common” search engines that can approach websites with some user defined information based on their own indexes (examples are Altavista.com or Yahoo.com) and “meta” search engines, using other (“common”) search engines to conduct the search and integrate the results (cf., Chen et al., 2002). Among the search engines a difference is made between general and specific engines (cf., Chen et al., 2002; Cook & Cook, 2000). The specific engines cover a part of the Internet (qua content) e.g., governmental information or patents. Chen et al. (2002) also distinguish between (commercial) engines available through a browser and engines residing on user machines.

Tools for “Outsourcing” Collection Activities

A part of the collection activities can be outsourced to some (automated) service or tool offered via the Web. One way of “outsourcing” collection activities is making use of commercial online databases such as Lexis-Nexis, Dow Jones or Dialog (see Gieskes, 2000; Kahaner, 1997; Cook & Cook, 2000). As Chen et al. (2002) assert and Lammers and Siegmund (2001) found, these online databases are among the main sources for CI professionals. Another way of “outsourcing” collection activities is to employ “Web robots or agents.” As Tan and Kumar (2002, p. 9) put it, “Web robots are software programs that automatically traverse the hyperlink structure of the WWW to locate and retrieve information.” Cook and Cook (2000, p. 112) add, that “there are many valuable types of bots that can speed up the information gathering process including stock bots, spider bots, shopping bots, news bots [...]”

Tools for Text-Analysis

To support the collection of valuable data in (large) text files, Chen et al. (2002) mention tools for text-analysis—i.e., “automatic indexing algorithms to extract key concepts from textual data.” Because of the time spent on reading textual material, these tools may greatly enhance the collection of relevant textual data.

Tools for Monitoring Changes on the Web

Another useful set of tools for collecting relevant data on the Internet are tools that help in monitoring changes in particular parts of the Internet. Among the tools monitoring the Internet are “alerting services” (see Kassler), an online service that alerts you whenever a change to a given topic in a relevant part of the Internet [like a collection of Web pages, bulletin boards, or mailing lists (cf., Kassler, 1997; Vriens & Hendriks, 2000; Chen et al., 2002)] occurs. The previously mentioned Web robots can be used for these alerting functions.

Tools for Collecting Data about the “Electronic” Behavior of Internet Users

One particular use of the Internet for analysis purposes also receiving little attention in the CI literature is monitoring the (electronic) behavior of users of the Internet [e.g., by identifying their navigational patterns or clickstreams (cf., Tan & Kumar, 2002)]. Of course, software is available to keep track of several statistics of visitors to websites, but tools to further analyze this behavior for CI purposes seem to be less available. Reid (in this volume) presents an example of such a tool.

Internet Tools for Collaboration in Search Activities

As has been put forward, the network of intelligence collectors plays an important role in collection activities (Gilad & Gilad, 1988). Internet applications can be used to facilitate the (self) management of and collaboration in these networks. As an example, one may consider an Intranet application through which a “competitor profile” is available to the members of the network, so that each member can fill in his or her part of that profile. Such applications enable monitoring the collection behavior of the members of the network and discussing and “correcting” each other’s contribution (see Chapter X, for such an application).

Moving Beyond the Internet: General and Specific ICT tools for CI

Above, we discussed how the Internet (or tools exploring or mining the Internet) can be used for CI activities. We thus discussed how a general set of Internet-oriented tools can be made available for CI purposes. In this section we discuss (1) other general ICT tools that can be used for supporting CI activities and (2) specific ICT applications designed for one or more CI activities (among them are “CI-software” packages as Fuld et al. (2002) call them, and CI applications developed in-house). ICT tools from both classes may or may not use specific Internet applications as discussed above.

General ICT Tools for CI

General tools for the direction stage should aid in formulating strategic information requirements and in storing and disseminating (sub) results of this process. Among these are tools:

- supporting specific methods for identifying, storing and disseminating strategic information needs; for instance, tools that visualize the variables and their causal relations relevant for specifying the information needs. Examples are software supporting system dynamics (e.g., Vensim or Powersim—see Vennix, 1996), or software supporting, identifying or visualizing CSF's or Key Intelligence Topics (e.g., Mindmap).
- supporting the process of identifying strategic information needs—such as different types of groupware (cf., Coleman, 1997) or software supporting group model building (e.g., Vennix, 1996). An example of a suitable groupware application is GroupSystems (Nunamaker et al., 1991). This application enables different users to anonymously discuss, brainstorm about, categorize, and vote on relevant intelligence topics. Rouwette and Vennix (this volume) discuss groupware for direction purposes.

General tools for the analysis stage are comparable to those in the direction stage. They should:

- support specific methods used in analysis—e.g., SD software that enables CI professionals to run “simulations” with certain data and thus helps to establish their relevance. Other examples are applications supporting war-gaming or scenario analysis.
- support (management of and collaboration in) the process of analysis. Again, specific groupware applications may serve this purpose. In this category one may also include applications supporting the storage and dissemination of the analysis results (for use during analysis). Many general databases with Intranet access can be used. Specific Intranet applications for dissemination and collaboration were discussed in the previous section.

For disseminating intelligence, one may identify all kinds of applications that support (1) the presentation of the intelligence in a suitable format and/or (2) transmitting reports throughout the organization. Many applications are available, including standard drawing packages or Microsoft Office, for sending and receiving documents.

Specific ICT Applications for CI

Fuld et al. (2002) produced several “intelligence software reports.” In these reports they analyzed a number of software packages said to be designed specifically for (supporting) one or more CI activities. For each stage in the intelligence cycle (Fuld et al. identify five stages: they split up collection into collection of primary and of secondary sources) they derived criteria to score the applications. For the most part, these criteria link up with what has been said in this chapter. For instance, for the direction stage, Fuld et al. (2002, pp. 12-13) state that the fulfillment of the following functions acts as criteria in judging CI applications:

- Providing a framework to input Key Intelligence Topics and Key Intelligence Questions
- Receiving CI requests
- Managing a CI work process and project flow that allows collaboration among members of the CI team as well as with the rest of the company

Criteria for other stages refer to the:

- Ability to search effectively and efficiently internal or external sources
- Ability to deal with qualitative information
- Ability to support ordering, visualizing and mining information
- Ability to support several methods for analyzing data
- Ability to report and deliver reports

(For the exact criteria, the reader is referred to Fuld et al., 2002.)

Based on their analysis, Fuld et al. (2002) arrive at several conclusions. Among these are:

1. The “CI-software cannot drive the CI-process” (p. 2), but it can help in collecting data, in reporting and communicating intelligence and in supporting the workflow and collaboration.
2. No application can deal with all the intelligence stages adequately.
3. No application can “truly conduct qualitative analysis” (p. 10)—but some tools seem promising in assisting CI analysts to see novel linkages (p. 2). This conclusion seems to fit comments of other authors about the possibility of ICT applications in replacing human intelligence activities. As Cook and Cook (2000) point out: “innovative applications for analyzing competitive factors and forecasting the outcomes of strategic decisions may seem like the unrealistic dreams of CEOs and CIOs alike” (p. 165). However, they expect changes in the future. It is our conjecture that CI activities remain the work of humans. ICT can facilitate them—but it can never replace them.

Fuld et al. (2002) analyzed commercially available CI applications and concluded that there exists no “one-size-fits-all” solution. They add that the technology needs of organizations differ depending on their specific CI requirements. This may be the reason for organizations to build and maintain CI applications themselves.

Business Intelligence Applications

For some time, the terms competitive intelligence and business intelligence have been used as synonyms (e.g., Gilad & Gilad, 1988; Vriens & Philips, 1999; Pawar & Sharda, to name a few authors). However, the software industry has taken over the term business intelligence (BI) to indicate a

specific set of ICT tools. These BI tools refer to ICT tools enabling (top) management to produce overviews of and analyze relevant organizational data needed for their (strategic) decision-making. As a BI vendor defines it: “Business intelligence (BI) takes the volume of data your organization collects and stores, and turns it into meaningful information that people can easily use. With this information in accessible reports, people can make better and timelier business decisions in their everyday activities” (www.cognos.com). As early as 1989 the Gartner group specified the nature of BI tools: “Today’s [BI] technology categories include EISs, DSSs, query and reporting tools and online analytical processing (OLAP).” These categories currently include data warehouses (cf., Mahony, 1998) and new tools for analysis (e.g., data mining, cf., Zanasi, 1998) and reporting.

Data warehouses seem to have gained a central position in BI. Moreover, most vendors seem to equate BI with the use of data warehouse and tools for access and analysis of the data in it. Inmon (1993) defines a data warehouse as “a subject oriented, integrated, nonvolatile, and time variant collection of data in support of management’s decisions.” In an organization, possible relevant data for strategic decision-making is scattered in many databases (e.g., transactional databases, financial databases, personnel databases, etc.). Long and Long (2002, p. 425) point out that such data, which are not integrated and may contain redundancies, are hard to access. To cope with these problems, these data are collected and copied to a data warehouse and ‘reorganized into a format that gives decision-makers ready access to valuable, time-sensitive information’ (ibid). To keep the data in the data warehouse up to date, data from the source databases should be copied to it on a regular (weekly or sometimes daily) basis.

To gain access to a data warehouse and analyze its data, three types of tools are usually identified: queries, OLAP and data mining. For queries, query languages (like SQL) can be used.

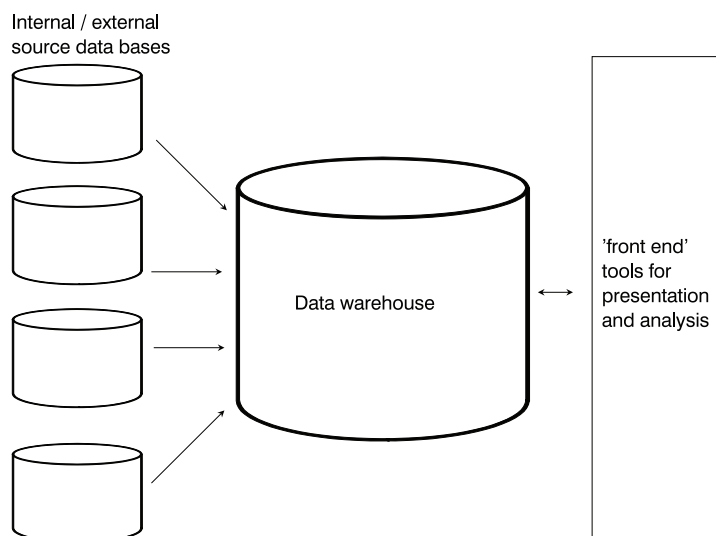
However, most of these are cumbersome for easy end-user access and not really suited for analysis. Online analytical processing (OLAP) is a tool for online analysis and manipulation of data. A user does not specify a query, but specifies so-called “dimensions” (like customer, product, region, time) and is able to relate these dimensions to each other in a very user-friendly way. The results can be shown directly in several formats (graphs, tables, numbers) and manipulated.

Data mining refers to a set of (statistical or artificial intelligence) tools to detect (new) relations in data (cf., Zanasi, 1998). Through data mining, for instance, elusive patterns in customer behavior may be detected. For example, a large retailer in The Netherlands discovered that buying a certain brand of diapers was positively correlated to buying a certain brand of beer. Such discoveries may be used for all kinds of purposes—ranging from identifying cross-selling opportunities or specifying marketing campaigns to improving shop layouts (cf., Long & Long, 2000). The basic architecture of a data warehouse (and tools for its use) is given in Figure 5.

The figure makes apparent that the source databases can be internal (transactional databases, financial databases, CRM data, or data from ERP systems, etc.) and external (e.g., databases from business partners, (commercially available) databases containing economic statistics, patent information, etc., or even online databases). However, most data warehouses only cover internal data—i.e., data generated in the transactions of the organization. As Fuld et al. (2002) put it: “BI software [...] typically deals with data warehouses and quantitative analysis, almost exclusively of a company’s internal data” (p. 7). This, of course, is a major drawback when treating BI tools as CI tools. However, we feel that once data warehouses are used for storing (and updating) relevant *external* data, they may become valuable CI tools as well.

Next to their internal focus, other drawbacks with BI software can be mentioned. In the previous quotation of Fuld, a second problem arises: BI software primarily deals with quantitative analysis, while CI relies heavily on qualitative data. Other problems have to do with costs and

Figure 5. Basic architecture of a data warehouse



implementation: data warehouses require large budgets and much implementation time and effort. Cook and Cook (2000, Chapter IX) also refer to the “high expectations” organizations have regarding BI software. In particular, one cannot expect BI software to produce intelligence. In their view, the results from analyzing data in a warehouse produce data that should “be analyzed and directly applied to a specific problem” to become intelligence. Therefore, “human intervention” is still needed.

HOW TO SELECT ICT FOR CI?

Now that an overview of ICT tools for CI has been presented, the question can be raised of what ICT tools are appropriate, given specific organizational CI needs. In this section we discuss three classes of criteria organizations can use to select ICT tools for CI. These classes are: (1) criteria regarding the contribution of ICT applications to one or more stages of the intelligence cycle, (2) criteria regarding the CI infrastructure and (3) criteria pertaining to costs. These three classes correspond roughly to the criteria used in the selection of ICT applications in general according to the information economics approach (cf., Parker, Benson & Trainor, 1988).

Criteria Regarding the Contribution to One or More Stages of the Intelligence Cycle

An (candidate) ICT application should contribute to one or more stages of the intelligence cycle. Criteria to judge the contribution of a particular ICT application to a certain stage (or to several stages) may refer to its appropriateness to deliver the desired *products* for the stage and to whether it fits the *process* leading to these products. For example, collection applications should be evaluated regarding their appropriateness to collect

the desired data (e.g., patent data). Applications should also match process aspects—for example, a particular application should support the particular methods (to be) used in the intelligence activities—e.g., a SWOT analysis or a system dynamics analysis. For more examples of such criteria, we refer to the criteria used by Fuld et al. (2002) to judge CI applications.

Criteria Regarding the Relation with the CI Infrastructure

The (CI) infrastructure may be decomposed into three sub-infrastructures: the ICT-infrastructure (this consists of the ‘technological infrastructure’ (ICT hardware, software and telecommunications technology) and the applications running on the technological infrastructure (cf., Earl, 1989), the human resources infrastructure and the organizational infrastructure; i.e., the structure of the organization qua CI-tasks and responsibilities. For each of these sub-infrastructures, specific sets of criteria can be given.

The criteria regarding the ICT infrastructure focus on the question of whether the application fits the current ICT infrastructure. This fit depends, among other things, on the current set of ICT tools used to support the CI activities. Does the application fit into this set? Does it deliver more functionalities than this set? Is an easy link between the applications in this set (if desirable) possible? Other questions for judging the fit to the ICT infrastructure have to do with the “technological” fit (does the current hard- and software permit the implementation of the application—or does it require large changes? Is the application reliable? Maintainable?). Yet another question for judging the fit to the ICT infrastructure has to do with the contribution of an application to the improvement of the infrastructure—e.g., through a particular application obsolete applications are replaced (or may be replaced more easily), or, through a particular application other state of the art applica-

tions can be implemented and used more easily. A data warehouse, for instance, can be seen as a contribution to the current infrastructure, because it enables all kinds of tools for visualizing and analyzing (internal) data.

The second set of criteria reflects the fit of the application to the human resources infrastructure—i.e., whether it fits existing skills, knowledge and attitudes of those who are carrying out CI activities. Important questions are, for instance, whether the required knowledge and skills (if any) are acquired easily, or whether the CI staff is motivated to integrate the ICT application into their routines. Criteria regarding the human infrastructure relate to the concept of “social acceptability” of an application [cf., Hendriks & Davis (this volume); Nielsen, 1999; Hartwick & Barki, 1994; Venkatesh & Speier, 1999]. This refers to standards or to the existence or absence of pressure to use an application. Authors on the subject of knowledge management have formulated criteria to diagnose and design solutions regarding problems with motivational aspects regarding the use of ICT for supporting knowledge processes (see e.g., Bukowitz & Williams, 1999).

The third set of infrastructural criteria reflects the fit of the application to the current definition and allocation of CI tasks and responsibilities (see Gilad & Gilad, 1988 for several ways of defining and allocating them). It does not make sense to install groupware for the direction stage if direction is not seen as a group process. The same holds for using ICT tools structuring collection and analysis activities if the whole CI process has a highly informal nature. In some cases, a task structure may be designed poorly and ICT for CI may act as a leverage to change the current task structure. An ICT tool can be valued because of its contribution to the improvement of the task infrastructure. A common example of a non-CI application said to improve the task-structure is workflow management systems (cf., Laudon & Laudon, 2000). In a similar vein, a groupware

application may be valued for contributing to implementing the direction stage as a group process. Philips (this volume) discusses an example of an organization using the implementation of a competitive intelligence system to analyze and change its whole CI infrastructure (including its human resources; technological and organizational structure).

Criteria Pertaining to Costs

These criteria refer to the costs of the application itself, its implementation (e.g., project costs, training, etc.) and its maintenance. These costs may be calculated by different methods (cf., Parker et al.).

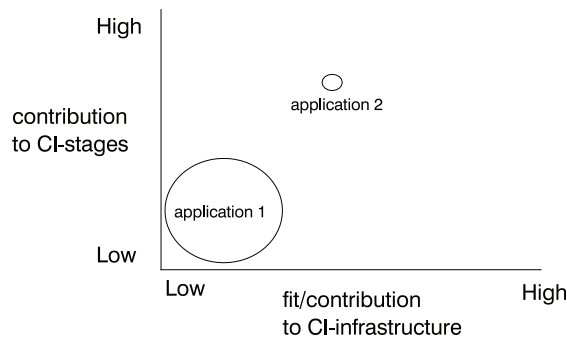
Selecting ICT for CI Using the Three Types of Criteria

To judge the appropriateness of an application for CI in a particular organization, the application should be “scored” regarding all three classes of criteria. To this end, the individual criteria in a class should all be identified, valued, and integrated into an overall score for the class. We will not treat all these sub-steps in this section—rather, we show how these overall scores can be used to select ICT for CI.

The overall scores of each class express (1) the contribution of a particular application to one or more of the intelligence stages, (2) the fit of the contribution to the CI infrastructure, and (3) the costs related to an application. These scores can be plotted in a graph (see Figure 6) — the size of the circle indicates the costs of an application.

In this figure, the scores of several applications are depicted (the size of the circles reflects the costs related to the application). For instance, application 1 may be a data warehouse (with an internal focus). This application is very expensive and contributes only partly to the intelligence stages (it contributes to the collection stage, but

Figure 6. Classification of ICT Applications for CI Using Three Dimensions (See text)



due to its internal focus its contribution to the CI stages is low). The data warehouse may contribute to the general infrastructure, but, in our view, contributes only partly to the CI infrastructure. By contrast, a data warehouse with explicit external linkages would still be very expensive, but may score higher on both other dimensions. Application 2 may be a groupware application. These applications are moderately expensive, may contribute to the direction stage and fit the infrastructure in several ways.

An organization may treat several ICT tools for the support of its CI activities in this way and eventually select some of them.

CONCLUSION

To select and use proper ICT tools for supporting the CI process, organizations should know (1) what the CI process is, (2) what the role of ICT (tools) in this process can be, and (3) judge the role of ICT (tools) for their own CI process. In this chapter, we discussed these three aspects. We defined CI both as a product and as a process. We then discussed the role of ICT tools in the CI process. Here, we presented four types of ICT tools relevant for supporting (and sometimes even replacing) CI activities: the Internet, general applications to be used in CI activities, specific CI applications

and business intelligence applications. In the last part of this chapter we discussed three classes of criteria organizations can use in evaluating and selecting ICT tools for their CI process.

Although the definition of CI and the criteria for selecting ICT tools for CI seem to have stabilized, the possibilities of using ICT for CI increase rapidly. Some of the trends that may be acknowledged are:

- A convergence of BI and CI applications (e.g., data warehouses and associated software also tied to external and qualitative data) (cf., Li, 1999)
- Using ICT for qualitative data may increase (e.g., Chen et al., 2002)
- Using the Internet for more than just collection activities (e.g., for collaboration and dissemination purposes) (cf., Teo & Choo, 2001; Cunningham, 2001)
- Improvement of Internet applications for collection (more efficient and effective collection applications will continue to emerge)
- Implementing CI applications can be seen as a process by means of which the CI process and infrastructure can be re-analyzed
- Improvement of analysis applications (cf., Fuld et al., 2002)

Despite all the possibilities of ICT for CI, we would like to end this chapter with remarking that producing intelligence still remains the work of humans who are the only “machines” able to put the data from the applications in their proper strategic perspective. ICT tools, however, are invaluable in supporting this task.

REFERENCES

Achterbergh, J.M.I.M. & Vriens, D. (2002). Managing viable knowledge. *Systems Research and Behavioral Science*, 19, 223-241.

- Bernhardt, D.C. (1994). 'I want it fast, factual, actionable'—Tailoring competitive intelligence to executive needs. *Long Range Planning*, 27(1), 12-24.
- Bukowitz, W.R. & Williams, R.L. (1999). *The Knowledge Management Fieldbook*. Edinburgh: Pearson.
- Chen, H., Chau, M., & Zeng, D. (2002). CI-spider: A tool for competitive intelligence on the Web. *Decision Support Systems*, 34, 1-17.
- Coleman, D.D. (1997). *Groupware: Collaborative Strategies for Corporate LANs and Intranets*. Upper Saddle River, NJ: Prentice Hall.
- Cook, M. & Cook, C. (2000). *Competitive Intelligence*. London: Kogan Page.
- Cronin, B., Overfelt, K., Fouchereaux, K., Manzanzvike, T., Cha, M., & Sona, E. (1994). The Internet and competitive intelligence: a survey of current practice. *International Journal of Information Management*, 14(3), 204-222.
- Cunningham, R. (2001). A toolbox for communicating competitive intelligence via the Internet. In C.G. Fleisher & D.L. Blenkhorn (Eds.), *Managing Frontiers in Competitive Intelligence* (pp. 90-99). Westport: Quorum.
- Davenport, T.H. & Prusak, L. (1998). *Working Knowledge*. Boston, MA: Harvard Business School Press.
- Dresner, H. (1993). *Business Intelligence: Competing Against Time*. Twelfth Annual Office Information Systems Conference, Gartner Group.
- Earl, M.J. (1989). *Management Strategies for Information Technology*. Englewood Cliffs: Prentice Hall.
- Fleisher, C.G. (2001a). An introduction to the management and practice of competitive intelligence (CI). In C.G. Fleisher & D.L. Blenkhorn (Eds.), *Managing Frontiers in Competitive Intelligence* (pp. 3-18). Westport: Quorum.
- Fleisher, C.G. (2001b). Analysis in competitive intelligence: Process, progress and pitfalls. In C.G. Fleisher & D.L. Blenkhorn (Eds.), *Managing Frontiers in Competitive Intelligence* (pp. 77-89). Westport: Quorum.
- Fleisher, C.G. & Blenkhorn, D.L. (2001). *Managing Frontiers in Competitive Intelligence*. Westport: Quorum.
- Fuld, L.M. (1995). *The New Competitor Intelligence*. Chichester, UK: Wiley.
- Fuld & Company. (2002). *Intelligence Software Report 2002*. Found at: <http://www.fuld.com>.
- Gieskes, H. (2000). Competitive Intelligence at Lexis-Nexis. *Competitive Intelligence Review*, 11(2), 4-11.
- Gilad, B. (1996) *Business Blindspots*. Calne (GB): Infonortics.
- Gilad, B. & Gilad, T. (1988). *The Business Intelligence System*. New York: Amacom.
- Graef, J.L. (1996). Sharing business intelligence on the world wide web. *Competitive Intelligence Review*, 7(1), 52-61.
- Graef, J.L. (1997). Using the Internet for competitive intelligence: a survey report. *Competitive Intelligence Review*, 8(4), 41-47.
- Hannon, J.M. (1997). Leveraging HRM to enrich competitive intelligence. *Human Resource Management*, 36(4), 409-422.
- Hartwick, J. & Barki. (1994). Explaining the role of user participation in information system use. *Management Science*, 40(4), 440-465.
- Herring, J.P. (1999). Key intelligence topics, a process to identify and define intelligence needs. *Competitive Intelligence Review*, 10(2), 4-14.
- Inmon, W.H. (1993). *Building the Data Warehouse*. Chichester, UK: Wiley.

- Kahaner, L. (1997). *Competitive Intelligence*. New York: Touchstone.
- Kassler, H.S. (1997). Mining the Internet for competitive intelligence. How to track and sift for golden nuggets. *Online: The Magazine for Online Information Systems*, 12(5), 34-45.
- Lammers, A. & Siegmund, J. (2001). *Business Intelligence in Nederland* [Business Intelligence in The Netherlands]. Master's thesis, University of Nijmegen (in Dutch).
- Laudon, K.C. & Laudon, J.P. (2000). *Management Information Systems*. Upper Saddle River, NJ: Prentice Hall.
- Li, C. (1999). ERP packages: What's next? *Information Systems Management*, (Summer), 31-35.
- Long, L.E. & Long, N. (2002). *Computers: Information Technology in Perspective* (9th ed.). Upper Saddle River, NJ: Prentice Hall.
- Mahony, T.M. (1998). Data warehousing and CI: An evaluation. *Competitive Intelligence Review*, 9(1), 38-43.
- McClurg, R. (2001). Using the Internet for gathering competitive intelligence. In C.G. Fleisher & D.L. Blenkhorn (Eds.), *Managing Frontiers in Competitive Intelligence* (pp. 61-76). Westport: Quorum.
- McGonagle, J.J. & Vella, C.M. (1999). *The Internet Age of Competitive Intelligence*. Westport: Quorum.
- Nielsen, J. (1999). *Designing Web Usability*. Indianapolis: New Riders.
- Nunamaker, J.F., Dennis, A.R., Valacich, J.S., Vogel, D.R., & George, J.F. (1991). Electronic meetings to support group work. *Communications of the ACM*, 34(7), 40-61.
- Parker, M.M., Benson, R.J., & Trainor, H.E. (1988). *Information Economics: Linking Business Performance to Information Technology*. Englewood Cliffs: Prentice Hall.
- Pawar, B.S. & Sharda, R. (1997). Obtaining business intelligence on the Internet. *Long Range Planning*, 30(1), 110-121.
- Philips, E.A. & Vriens, D. (1999). *Business Intelligence*. Deventer: Kluwer.
- Powell, T. & Allgaier, C. (1998). Enhancing sales and marketing effectiveness through competitive intelligence. *Competitive Intelligence Review*, 9(4), 29-41.
- Poynder, R. (1998). Patent information on the Internet. *Business Information Review*, 15(1), 58-67.
- Prescott, J.E. & Fleisher, C.S. (1991). SCIP: Who we are, what we do. *Competitive Intelligence Review*, 2(11), 22-26.
- Ringdahl, B. (2001). The need for business intelligence tools to provide business intelligence solutions. In C.G. Fleisher & D.L. Blenkhorn (Eds.), *Managing Frontiers in Competitive Intelligence* (pp. 173-184). Westport: Quorum.
- Rouibah, K. & Ould-ali, S. (2002). PUZZLE: A concept and prototype for linking business intelligence to business strategy. *The Journal of Strategic Information Systems*, 11(2), 133-152.
- Sammon, W.L. (1986). Assessing the competition: Business intelligence for strategic management. In J.R. Gardner, R. Rachlin, & H.W. Sweeney (Eds.), *Handbook of Strategic Planning*. New York: Wiley.
- Society of Competitive Intelligence Professionals. Found in: <http://www.scip.org>
- Tan, P. & Kumar, V. (2002). Discovery of web robot sessions based on their navigational patterns. *Data Mining and Knowledge Discovery*, 6, 9-35.

- Teo, T.S.H. & Choo, W.Y. (2001). Assessing the impact of using the Internet for competitive intelligence. *Information & Management*, 39, 67-83.
- Venkatesh, V. & Speier, C. (1999). Computer technology training in the workplace: A longitudinal investigation of the effect of mood. *Organizational Behavior and Human Decision Processes*, 79(1), 1-28.
- Vennix, J.A.M. (1996). *Group Model Building*. Chichester, UK: John Wiley & Sons.
- Vriens, D. & Hendriks, P.H.J. (2000). Viability through Web-enabled technologies. In M. Khosrowpour (Ed.), *Managing Web-Enabled Technologies in Organizations: A Global Perspective* (pp. 122-145). Hershey, PA: Idea Group Publishing.
- Vriens, D. & Philips, E.A. (1999). Business intelligence als informatievoorziening voor de strategievorming. In E.A. Philips & D. Vriens (Eds.), *Business Intelligence*. Deventer: Kluwer.
- Yuan, S. & Huang, M. (2001). A study on time series pattern extraction and processing for competitive intelligence support. *Expert Systems with Applications*, 21, 37-51.
- Zanasi, A. (1998). Competitive intelligence through data mining public sources. *Competitive Intelligence Review*, 9(2), 44-54.

This work was previously published in Information and Communication Technology for Competitive Intelligence, edited by D. Vriens, pp. 1-33, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.8

Information and Communication Technology Tools for Competitive Intelligence

Dirk Vriens

Radboud University of Nijmegen, The Netherlands

INTRODUCTION

Competitive intelligence (CI) can be described as collecting and processing information about the environment for strategic purposes (cf. Kahaner, 1997). To formulate a strategy, an organization needs to collect and process information about its environment—about, for instance, competitors, customers, suppliers, governments, technological trends, or ecological developments. Collecting and processing environmental information has, of course, always been important. However, because of the increasing complexity and dynamics of the environment, the pressure to produce relevant, timely, “actionable” intelligence increases as well. At the same time, the amount of available data about the environment also increases.

To deal with this problem, it is necessary to structure intelligence activities, and many organizations use information and communications technology (ICT) to this end. They use, for

instance, different types of Internet or intranet applications, so-called data warehouses, groupware applications, or applications specifically tailored to the organizations’ intelligence needs. The number of possible ICT tools for CI is large, and an important question for organizations is which tools they should select and implement for their CI activities. Organizations face difficulties in selecting, implementing, and using these tools. Many ICT tools, for instance, lead to an information overload—to large collections of irrelevant data—or are expensive applications that only marginally contribute to the production of intelligence.

To select proper ICT tools for CI, an organization needs to understand the role of ICT for CI. This paper intends to address this understanding. In particular, it will present a short overview of the available tools and it will discuss a procedure for selecting appropriate ICT tools.

BACKGROUND

To understand the role of ICT for CI and to select proper ICT tools, the CI process needs to be clarified. To describe this process, several authors (cf. Fuld & Company, 2002; Gilad & Gilad, 1988; Herring, 1999; Kahaner, 1997) propose to use the intelligence cycle, consisting of four stages.

- 1. Direction.** In this stage organizations determine their strategic information requirements; that is, they determine about what environmental aspects data should be collected. These aspects are also known as competitive intelligence needs (Fleisher, 2001) or key intelligence topics (Kahaner, 1997).
- 2. Collection.** In this stage, the required data are collected. To this end, one needs to (a) determine what sources are available, and (b) access these sources and retrieve data from them.
- 3. Analysis.** This stage focuses on interpreting data from a strategic point of view to determine their strategic relevance (if a piece of data is strategically relevant, the term intelligence is used; cf. Kahaner, 1997; Vriens, 2004). For this analysis, a model of what is relevant for the organization should be available. Often, tools such as Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis, scenario analysis, war gaming, or competitor profiling are used to arrive at such a model (cf. Cook & Cook, 2000).
- 4. Dissemination.** Here, the intelligence is made available for strategic decision making. That is, the intelligence should be presented clearly and distributed to relevant decision makers who use it to evaluate current strategic options and to generate, compare, select, and implement new ones.

Using this cycle as a background, many authors acknowledge the possible and actual use of ICT applications for CI activities (see, for instance, Chen, Chau, & Zeng, 2002; Cook & Cook, 2000; Fleisher & Blenkhorn, 2001; Fuld & Company, 2002). It is also a background for discussing the shortcomings of ICT applications for CI (e.g., Cook & Cook; Fuld & Company). In line with these authors, we will use this cycle of intelligence activities as a framework for reviewing, classifying, and selecting ICT applications, as will become apparent in the next sections.

A CLASSIFICATION OF ICT TOOLS FOR CI

ICT tools for CI can be classified according to two “dimensions”: (a) their contribution to one or more stages of the intelligence cycle and (b) the specificity of the tool—that is, a tool can be either a general ICT tool used for intelligence activities (like a groupware application, used for direction activities) or a tool specifically tailored to one or more intelligence activities. Below, we first discuss the Internet as a “general” ICT tool for all CI activities. Next, we pay attention to other ICT tools, both general and specific. Finally, we discuss so-called business intelligence applications as a specific set of ICT applications.

The Internet as a Tool for CI

CI practitioners rely heavily on the use of the Internet for their intelligence activities. Some authors report the use of the Internet for supporting the direction, analysis, and dissemination stages, for example, Web Enabled Technology (WET) applications enhancing communication and collaboration regarding results of this stages (e.g., Teo & Choo, 2001). However, most attention has been paid to the use of the Internet for collection activities. Among the reported uses of

Internet applications for collection activities are the following.

- **Search engines**
The CI literature discusses many types of search engines and their application for CI (cf. Chen et al., 2002; Cook & Cook, 2000).
- **Tools for outsourcing collection activities**
A part of the collection activities can be outsourced to some (automated) service or tool offered via the Web. Particularly popular is the use of commercial online databases (Kahaner, 1997; Chen et al., 2002). Another example is the use of Web robots or agents that “automatically traverse the hyperlink structure of the WWW [World Wide Web] to locate and retrieve information” (Tan & Kumar, 2002, p. 9).
- **Tools for text analysis**
Tools supporting the collection of data in (large) Internet-based text files are used.
- **Tools for monitoring changes on the Web**
- **Tools for collecting data about the electronic behavior of Internet users.** These tools work, for instance, by identifying users’ navigational patterns (cf. Tan & Kumar, 2002).
- **Internet tools for collaboration in collection activities.** Internet applications can be used to facilitate the collaboration in collection networks (networks of people performing collection activities).

General and Specific ICT Tools for CI

Besides using general Internet applications for CI purposes, other general ICT applications can be used as well. Examples are tools supporting the following.

- **Supporting the process of identifying strategic information needs** such as different types of groupware or software supporting group model building (e.g., Vennix, 1996).
- **Supporting specific methods used in analysis**, for instance, system-dynamics software enabling CI professionals to run simulations with certain data, and thus helps to establish their relevance.
- **Supporting (management of and collaboration in) the process of analysis.** Specific groupware applications may serve this purpose.
- **Supporting the dissemination of intelligence**—for example, applications supporting (a) the presentation of the intelligence in a suitable format and/or (b) the transmission of reports throughout the organization

There is also a class of ICT applications specifically designed for one or more CI activities. Fuld & Company (2002) analyzed and evaluated a number of such dedicated CI software packages. They concluded with the following.

1. The “CI software cannot drive the CI process” (p. 2), but it can help in collecting data, in reporting and communicating intelligence, and in supporting the work flow and collaboration.
2. No application can deal with all the intelligence stages adequately.
3. No application can “truly conduct qualitative analysis” (p. 10), but some tools seem promising in assisting CI analysts to see novel linkages.

Business Intelligence Applications

For some time, the terms competitive intelligence and business intelligence (BI) were used as synonyms. Nowadays, however, the term business intelligence is often used to indicate a specific

set of ICT tools. These BI tools refer to ICT tools enabling (top) management to produce overviews of and analyze relevant organizational data needed for their (strategic) decision making. BI tools typically include data warehouses and tools for extracting and presenting information from them (cf. Cook & Cook, 2000; Zanasi, 1998). In essence, a data warehouse is a large database in which data from many different databases (e.g., transactional, financial, or personnel databases) are copied and stored in such a way that they are readily accessible. To access, view, and analyze these data, specific tools are developed (e.g., data-mining tools for finding relations between classes of data). Using data warehouses and their associated tools to produce intelligence is not unproblematic. Examples of reported problems are the following (cf. Cook & Cook; Fuld & Company, 2002).

1. Most data warehouses only cover internal data (generated in the transactions of the organization; Fuld & Company, 2002). This is a major drawback when treating BI tools as CI tools. However, once data warehouses incorporate relevant *external* data, they may become valuable CI tools as well.
2. The focus of BI software is primarily on quantitative analysis while CI relies heavily on qualitative data.
3. Data warehouses cause cost and implementation issues: They require large budgets and much implementation time and effort.
4. Cook and Cook (2000) assert that one cannot expect BI software to produce intelligence. Data resulting from analyzing data in a warehouse should still “be analyzed and directly applied to a specific problem to become intelligence” (p.165).

HOW TO SELECT ICT FOR CI

To select appropriate ICT tools for CI, given specific organizational CI needs, organizations can use three classes of criteria: (a) criteria regarding the contribution of ICT applications to one or more stages of the intelligence cycle, (b) criteria regarding the CI infrastructure, and (c) criteria pertaining to costs. These three classes correspond to the criteria used in the selection of ICT applications in general (cf. Parker, Benson, & Trainor, 1988).

Criteria Regarding the Contribution to One or More Stages of the Intelligence Cycle

A (candidate) ICT application should contribute to one or more stages of the intelligence cycle. Criteria to evaluate the contribution of an ICT application for one or more stages may refer to its appropriateness to deliver the desired products for the stage, and to whether it fits the process leading to these products (cf. Fuld & Company, 2002). For example, collection applications should be evaluated regarding their appropriateness to collect the desired data (e.g., patent data). Applications should also match process aspects. For example, if particular methods are used to analyze data, such as a SWOT analysis, candidate applications can be evaluated regarding their appropriateness in supporting these particular methods.

Criteria Regarding the Relation with the CI Infrastructure

The CI infrastructure consists of three parts: (a) the technology supporting the CI activities (ICT hardware, software, and telecommunications technology), (b) the human resources needed to carry out the CI activities, and (c) the organizational structure of these activities, that is, how CI tasks and responsibilities are divided and

allocated. Each possible ICT application should match all three parts—from these three parts, specific criteria can be derived.

The criteria regarding the technology part of the infrastructure focus on the question of whether the candidate application fits the current technology. This fit depends on the current set of ICT applications used to support the CI activities. Does the application fit into this set? Does it deliver more functionalities than this set? Is an easy link between the applications in this set (if desirable) possible? Other questions for judging the fit to the technology have to do with the implementation and maintenance of the application: Does the current hard- and software permit the implementation of the application, or does it require large changes? Is the application reliable? Yet another question for judging the fit to the technology has to do with the contribution of an application to the improvement of the infrastructure; for example, through a particular application, obsolete applications are replaced (or may be replaced more easily), or through a particular application, other state-of-the-art applications can be implemented and used more easily. A data warehouse, for instance, can be seen as a contribution to the current infrastructure because it enables all kinds of tools for visualizing and analyzing (internal) data.

The second set of criteria reflects the fit of the application to the human resources, that is, whether it fits the existing skills, knowledge, and attitudes of those who are carrying out CI activities. Important questions are, for instance, whether the required knowledge and skills are acquired easily, or whether the CI staff is motivated to integrate the ICT application into their daily routines.

The third set of infrastructural criteria reflects the fit of the application to the current definition and allocation of CI tasks and responsibilities (see Gilad & Gilad, 1988, for several ways of defining and allocating them). It does not make sense to

install groupware for the direction stage if direction is not seen as a group process. The same holds for using ICT tools structuring the collection and analysis activities if the whole CI process has a highly informal nature. In some cases, the CI task structure may be designed poorly and ICT can act as a leverage to change it. An ICT tool can be valued because of its contribution to the improvement of the task structure. For instance, a groupware application may be valued for its contribution to structure the direction stage as a group process.

Criteria Pertaining to Costs

These criteria refer to the costs of the application itself, its implementation (e.g., project costs, training, etc.), and its maintenance. These costs may be calculated by different methods (cf. Parker et al., 1988).

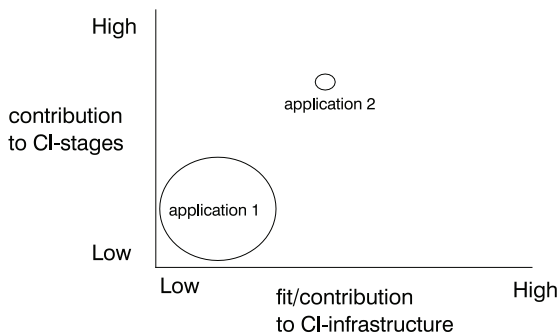
Selecting ICT for CI Using the Three Types of Criteria

To evaluate the appropriateness of an application for CI in a particular organization, the application should be “scored” regarding all three classes of criteria. To this end, the individual criterion in a class should each be identified, valued, and integrated into an overall score for the class. We will not treat all these substeps in this section; rather, we will indicate how these overall scores can be used to select of ICT for CI.

The overall scores of each class express (a) the contribution of a particular application to one or more of the intelligence stages, (b) the fit of the contribution to the CI infrastructure, and (c) the costs related to an application. These scores can be plotted in a graph (see Figure 1).

In this figure, the scores of several applications are depicted (the size of the circles reflects the costs related to the application). For instance, Application 1 may be a data warehouse (with an

Figure 1. Classification of ICT applications for CI using three dimensions (see text)



internal focus). This application may be very expensive, contributes only partly to the intelligence stages (it contributes to the collection stage, but due to its internal focus, its contribution to the CI stages is low). The data warehouse may contribute to the general infrastructure, but, in our view, contributes only partly to the CI infrastructure. In contrast, a data warehouse with explicit external linkages would still be very expensive, but may score higher on both other dimensions. Application 2 may be a groupware application. These applications are moderately expensive, may contribute to the direction stage, and fit the infrastructure in several ways.

An organization may treat several ICT tools to support their CI activities in this way and eventually select some.

FUTURE TRENDS

Many organizations recognize the importance of supporting CI activities by means of ICT. Although many ICT applications are already available, the possibilities of using ICT for CI will increase rapidly. Some of the trends that may be acknowledged are the following.

- A convergence of BI and CI applications (e.g., data warehouses and associated software

also tied to external and qualitative data; cf. Li, 1999)

- Using ICT for qualitative data may increase (e.g., Chen et al. 2002)
- Using the Internet for more than just collection activities (e.g., for collaboration and dissemination purposes; cf. Teo & Choo, 2001)
- Improvement of Internet applications for collection (More efficient and effective collection applications will continue to emerge.)
- Implementing CI applications can be seen as a process by means of which the CI process and infrastructure can be reanalyzed.
- Improvement of analysis applications (cf. Fuld & Company, 2002)

CONCLUSION

To select and use proper ICT tools for supporting the CI process, organizations should know (a) what the CI process is, (b) what the role of ICT (tools) in this process can be, and (c) how to evaluate the role of ICT (tools) for their own CI process. In this chapter, we discussed the role of ICT tools in the CI process. We classified several types of ICT tools relevant for supporting CI activities: the Internet, general and specific applications for supporting CI activities, and business intelligence applications. In the last part of this chapter, we discussed three classes of criteria organizations can use in evaluating and selecting ICT tools for their CI processes.

The possibilities of ICT to support CI activities will probably only increase. To make full use of its potential and to avoid many of the pitfalls associated with using ICT for CI, organizations should be careful in selecting and implementing ICT applications for CI purposes. They should know the possibilities of ICT to deliver internal and external data and its capacity for supporting

CI activities, and they should treat ICT as a part of the whole infrastructure.

REFERENCES

- Chen, H., Chau, M., & Zeng, D. (2002). CI-spider: A tool for competitive intelligence on the Web. *Decision Support Systems, 34*, 1-17.
- Cook, M., & Cook, C. (2000). *Competitive intelligence*. London: Kogan Page.
- Fleisher, C. G. (2001). An introduction to the management and practice of competitive intelligence (CI). In C. G. Fleisher & D. L. Blenkhorn (Eds.), *Managing frontiers in competitive intelligence* (pp. 3-18). Westport, CT: Quorum.
- Fleisher, C. G., & Blenkhorn, D. L. (Eds.). (2001). *Managing frontiers in competitive intelligence*. Westport, CT: Quorum.
- Fuld & Company. (2002). *Intelligence software report 2002*. Retrieved March 2003 from <http://www.fuld.com>
- Gilad, B., & Gilad, T. (1988). *The business intelligence system*. New York: Amacon.
- Herring, J. P. (1999). Key intelligence topics: A process to identify and define intelligence needs. *Competitive Intelligence Review, 10*(2), 4-14.
- Kahaner, L. (1997). *Competitive intelligence*. New York: Touchstone.
- Li, C. (1999, Summer). ERP packages: What's next? *Information Systems Management, 16* (3), 31-35.
- Mahony, T. M. (1998). Data warehousing and CI: An evaluation. *Competitive Intelligence Review, 9*(1), 38-43.
- Parker, M. M., Benson, R. J., & Trainor, H. E. (1988). *Information economics: Linking business performance to information technology*. Englewood Cliffs, NJ: Prentice Hall.
- Tan, P., & Kumar, V. (2002). Discovery of Web robot sessions based on their navigational patterns. *Data Mining and Knowledge Discovery, 6*, 9-35.
- Teo, T. S. H., & Choo, W. Y. (2001). Assessing the impact of using the Internet for competitive intelligence. *Information & Management, 39*, 67-83.
- Vennix, J. A. M. (1996). *Group model building*. Chichester, England: Wiley.
- Vriens, D. (Ed.). (2004). *Information and communication technology for competitive intelligence*. Hershey, PA: IRM Press.
- Vriens, D., & Philips, E. A. (1999). Business intelligence als informatievoorziening voor de strategievorming. In E. A. Philips & D. Vriens (Eds.), *Business intelligence*, (pp.11-44). Deventer, Netherlands: Kluwer.
- Zanasi, A. (1998). Competitive intelligence through data mining public sources. *Competitive Intelligence Review, 9*(2), 44-54.

KEY TERMS

Business Intelligence:The term business intelligence is used in two ways: (a) as a synonym for competitive intelligence and (b) to indicate a specific set of ICT tools to support managerial decision making. This set of tools often consists of a data warehouse and the tools to store, retrieve, and present the information it contains (e.g., data-mining software).

Competitive Intelligence: In the literature, two definitions are used: a product definition and a process definition. In the product definition, competitive intelligence is defined as information about the environment, relevant for strategic purposes. The process definition highlights

producing and processing this environmental information. Process definitions often refer to the intelligence cycle.

ICT (Information and communication technology): Can be used to indicate the organization's technological infrastructure (comprising of all hardware, software, and telecommunications technology) and to indicate one or more specific collections of hardware, software, and telecommunications technology (i.e., one or more ICT applications).

ICT Selection: The process of selecting proper parts of the technological infrastructure and/or specific applications. In the context of CI, specific criteria are used: criteria regarding costs, appropriateness in supporting intelligence activities, and their fit or contribution to the CI infrastructure.

Intelligence Cycle: This is a cycle of four stages (collections of intelligence activities). The stages are direction (determining the strategic [external] information requirements), collection (determining, locating, accessing, and retrieving sources to obtain data about the environment), analysis (determining the strategic significance of the environmental data), and dissemination (of the intelligence to strategic decision makers).

Intelligence Infrastructure (CI Infrastructure): The intelligence infrastructure comprises all technological, human-resources, and organizational means needed to manage, support, and perform the intelligence activities. It consists of three subinfrastructures: the technological, the human-resources infrastructure, and the organizational infrastructure.

This work was previously published in Encyclopedia of Information Science and Technology, edited by M. Khosrow-Pour, pp. 1458-1463, copyright 2005 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.9

It's All in the Game: How to Use Simulation–Games for Competitive Intelligence and How to Support Them by ICT

Jan Achterbergh

University of Nijmegen, The Netherlands

Dirk Vriens

University of Nijmegen, The Netherlands

ABSTRACT

In this chapter, we explore the role of simulation games for intelligence activities. Although games have been used in intelligence activities, the contribution of building and using simulation games to Competitive Intelligence has, to our knowledge, not been examined thoroughly. In this chapter we fill this gap by explaining the building and using stages of simulation gaming and by discussing the contribution of these stages to directing, collecting, analyzing and disseminating Competitive Intelligence. Moreover, we discuss the role of ICT to enhance the contribution of simulation games to competitive intelligence.

INTRODUCTION

As many authors on competitive intelligence point out, organizations need to collect and process information about the environment to (re)formulate their strategy. Moreover, the pressure to produce timely, accurate, actionable and strategically relevant information is growing because the complexity and dynamics of the environment is increasing rapidly (cf., Kahaner, 1997; Fuld, 1995; Cook & Cook, 2000 for similar arguments). Hence, organizations are trying to structure their competitive intelligence process—the process by means of which strategically relevant information about the environment is delivered.

In the literature on Competitive Intelligence (CI), this process is usually broken up into four stages: direction, collection, analysis, and dissemination (cf. Sammon, 1986; Bernhardt, 1994; Fuld et al., 2002; Kahaner, 1997; Vriens & Philips, 1999). In the direction stage, CI professionals establish what data are relevant for the purpose of strategic decision-making. In the collection stage, relevant data sources are determined and data are collected from them. In the analysis stage, collected data are transformed into competitive intelligence that can be used by strategic decision-makers. In the dissemination stage, the competitive intelligence resulting from analysis is disseminated over strategic decision-makers so that they can incorporate it in the process of (re)formulating their strategies (for a more thorough treatment of the process of competitive intelligence, see Chapter I of this book).

If CI is to deliver its contribution to the process of strategy formulation, a pro-active mode of intelligence gathering seems most appropriate (cf., Ellis, 1993; Hannon, 1997; Tessun, 1997). In a pro-active mode, intelligence practitioners try to anticipate environmental developments that may have a strategic impact and assess their consequences. Pro-active intelligence requires, in our view, a deep insight into the “organization in its environment.” For instance, directing the search for information requires an insight into strategic problems the organization in focus has to cope with and environmental factors having an impact on these problems. To direct the search for data, CI professionals need to construct models of these strategic problems and environmental factors. Analyzing collected information and transforming it into intelligence builds on these constructed models and requires an insight into possible effects of a multitude of states of affairs and events in the environment of the organization, on both parties relevant to and the organization in focus itself.

Not only do CI practitioners need a model of the “organization in its environment,” it is also important that this model is shared among the different parties involved in the intelligence process. The model should be shared among CI professionals so that they have a common orientation towards performing their CI activities. Moreover, it should be shared among CI professionals and strategic decision-makers for several reasons. Among these are: (1) improving the understanding of CI professionals of strategic problems, (2) grounding the model in the strategic orientation of the organization, (3) facilitating the dissemination of the intelligence, (4) ensuring commitment of strategic decision makers to using the intelligence, and (5) improving the process of monitoring and maintaining the model itself.

Sharing the model among the relevant parties in the organization requires high quality communication (both regarding content and process) between these parties. In this chapter, we examine the potential of (ICT-enabled) simulation games to support this communication process. As Geurts et al. (2000) assert, simulation games may be a valuable tool contributing to improving the quality of the communication. The element of simulation requires participants to interactively model the organization in its environment, systematically analyzing relevant variables, parties, processes and their relations. The element of gaming allows participants to interactively experiment with the model in a relatively safe environment. Together, the simulation and the gaming elements can improve both the content and the process of communication required for pro-active competitive intelligence. Although the use of games in supporting intelligence activities has been reported (e.g., Allgaier & Powell, 1998; Clark, 1998; Fuld, 1998), the link between the different stages of simulation games to CI has not been treated thoroughly. In this chapter, we will examine this link.

To deliver its contribution to the intelligence process, simulation games may be supported by ICT in various ways (e.g., by groupware of various Web-based applications). The role of ICT to enable simulation games is also discussed in this chapter.

To explore the contribution of simulation games to improving the quality of the communication required for the CI process and the possibilities for enabling this contribution by ICT, we first discuss the process of competitive intelligence and its required communication. Simulation games at issue are then discussed. In particular, we define simulation games as practicing tools for improving communications about complex problems (e.g., problems related to competitive intelligence as a process). Moreover, we discuss the stages of building and using simulation games and list the particular functional contribution of these phases to the improvement of communication about complex problems. This is followed by linking previous chapter discussions and specifying a model describing the possible contribution of simulation games to improving the quality of communications required for the CI process. We then highlight the possible contribution of ICT to simulation games improving the quality of communications needed to carry out CI processes. Finally, we conclude the chapter with a summary of the findings.

COMPETITIVE INTELLIGENCE

By competitive intelligence as a product, we understand it to mean information about the environment of organizations required for strategic decision-making (see also Chapter I of this book for a full treatment of CI as a product). Competitive Intelligence is produced in a process consisting of four stages: directing, collecting, analysis, and dissemination. To be able to assess the possible contribution of simulation games to support the

required communication in the CI stages, we discuss these stages and their communicative requirements in this section.

In the direction stage, the environmental information needed for strategic decisions has to be identified. In other words, the strategic information requirements have to be specified. The result of this stage is a list of relevant data (classes) about which information has to be gathered to monitor and/or (re)formulate the strategy of the organization. A crucial issue in the direction stage is to determine the relevance of these data (classes). In order to determine this relevance, directing officers need to be aware of, have knowledge about, and insight into the decisions and underlying problems strategic decision-makers have to deal with. They have to build and maintain a model of the organization in its environment to be able to create the required awareness, knowledge and insight. Moreover, they should use this model to define which environmental factors have an impact on the organization and are, therefore, worth monitoring. Building and using these models places high demands on the communication and cooperation between CI direction officers and strategic decision-makers in the direction phase. During the direction stage, ideally, CI professionals (and strategic decision-makers) are engaged in a continuous process of communication in which they build and maintain a model of the organization in its environment and in which they use this model to derive relevant data classes about which environmental information should be gathered. This communication requires that CI directing officers and decision-makers have a shared language to conceptualize strategic problems and environmental factors relevant to make decisions dealing with these problems.

During the collection stage, sources are identified and data is retrieved from these sources. To this end, one needs to be aware of the availability of sources and of the suitability of the available sources for the efficient retrieval of

Table 1. CI-stages and required knowledge

| | Description | Required knowledge |
|--|---|--|
| Directing | Determine strategic information requirements | Model of organization in its environment; |
| How to use the model to derive required information; | | |
| Collecting | Identify sources and retrieve data from them | How to select sources; |
| How to approach sources; | | |
| Analysis | Transform data into intelligence | Model of organization in its environment; |
| How to use the model to assess the impact of specific constellations of environmental variables; | | |
| Dissemination | Forward intelligence to strategic decision-makers | Selection of presentation format and content of intelligence |

data. Although a part of data collecting activities may be automated (e.g., by alerting services or online databases), knowledge about what the most appropriate sources are for a particular data class and how to approach them requires experience and the exchange of this experience. Hence, communication among those involved in search activities is important.

During analysis, CI professionals need to determine whether the collected data are significant for strategic purposes. In the analysis stage, the collected data are transformed into intelligence usable by strategic decision-makers. This presupposes that—just like in the directing phase—CI analysts are knowledgeable of the problems strategic decision-makers have to deal with. To this purpose, CI analysts need an underlying model of the organization in its environment—preferably the same model they produced during the direction stage. Moreover, they need continuous feedback about the intelligence they produce in the analysis stage.

In the dissemination stage, the intelligence produced in the analysis stage is forwarded to strategic decision-makers. This entails the selection of (content and format) of the way the intelligence

is presented and the actual communication of the intelligence. During this stage of intelligence, practitioners may also receive feedback on the presented intelligence. To disseminate the products of the analysis process, CI officers and strategic decision-makers, again, need a shared language to speak about the developments in the organization's environment in relation to the strategic decision-making process. Moreover, CI officers need to be aware of the formats of the intelligence that are convenient for the strategic decision-makers. If CI officers and strategic decision-makers are both involved in developing and using the model of the organization in its environment, they may have already created a shared language in which they can express strategic problems and the impact of certain environmental trends on the organization. Jointly building and maintaining such models, then, greatly enhances the understanding (and hence) dissemination of intelligence. Table 1 provides an overview of the four CI stages and their required knowledge.

In our view, the creation of the required knowledge in the stages is dependent on a high quality communication process involving CI professionals and strategic decision-makers. In

this communication process feedback is given about the required knowledge in the stages (e.g., about the quality of the model of the organization in its environment) and about the products of the stages (e.g., the information requirements in the first stage). For this communication process to succeed, all participants need to have a shared language to be able to articulate the specific requirements, problems and issues of a stage (e.g., a shared language to build and maintain a model of the organization in its environment, or a shared language to use this model for the assessment of the impact of environmental events).

SIMULATION GAMES

To define what a simulation game entails we turn to the work of Geurts, de Caluwé, and Stoppelenburg (2000). From an overview of the existing literature, these authors derive three perspectives relevant for defining a simulation game.

The first perspective is the *essence* of gaming that, according to Geurts et al. (2000, p. 27) consists of “people in models.” By this somewhat cryptic description they understand that simulation games involve: (1) models, i.e., representations to provide insight into complex wholes enabling the analysis of relationships between structure and behavior, and (2) people who from their own perspective interactively participate in and contribute to the simulation that is an organizational prototype.

The second perspective is the *function* of simulation games. This function consists of “practicing communication.” By means of simulation games participants learn from each other and from the model that provides a hybrid language for the complex problems the simulation game is about. Moreover, the game/simulation functions as an exercise providing a safe environment for communicating about problems by experimenting with and analyzing different interventions under varying circumstances.

The third perspective is the *form* of the simulation game that is described as “orchestrated complexity.” Simulation games are organized procedures consisting of particular building blocks (see Duke, 1974, for the “complete” set of 12 building blocks) allowing for the differentiation between the game package and its use, and the repeated, controlled, and documented application of the game.

Using these three perspectives, we define a simulation game as an organized procedure involving particular building blocks allowing participants to improve communication about complex problems by providing a safe and controlled environment to experiment with different interventions under varying circumstances by means of models representing these complex problems.

For the purpose of this chapter, it is relevant to distinguish between the *building* and *usage* stage of simulation games, for each of these phases may in its own way contribute to improving communication in the CI process.

Building a Simulation Game

Building a simulation game involves three interdependent stages, (1) building the model, (2) transforming the model into a simulation game, and (3) specifying relevant simulation game scenarios.

Model-Building

During the *model-building* stage, the simulation game constructors construct a simulation model of the problem they want to incorporate in the game. To this purpose, they start by defining the central problem they want to tackle by means of the simulation-game. This problem constitutes the core of the goal of the simulation game. For instance, the central problem the game should address is the improvement of communication

between CI officers and strategic decision-makers about CI required for selecting the organization's product market technology (PMT) portfolio. Given the definition of the central problem of the game, the game constructors translate this problem in terms of a simulation model.

To this purpose, they should proceed by identifying "real" systems, parties or actors involved in the problem that can become either players or exogenous forces influencing the course of the game (e.g., the organization in focus, its competitors, legislators, etc.).

Moreover, they should define variables relevant for modeling the problem in focus. Some of these variables count as "essential game variables." These are the variables used to establish game results (e.g., profit margin, market share). Other variables count as "playing variables" (e.g., number and type of products in the PMT portfolio). These variables both influence the essential game variables and may be influenced by the operations of the players of the game.

In addition to the variables, the game constructors should select "driving" parameters influencing the behavior of the selected essential game variables or playing variables. The values of these driving parameters influence the behavior of the selected parameters and the players of the game cannot influence them. Examples of such parameters are macro-economic parameters such as investment climate, inflation, or national spending on consumer goods.

Given the selection of the variables and parameters, the game constructors should define operations (interventions) admitted in the game. Operations change the value of playing variables. Given the change of the value of a playing variable and the values of the driving parameters, the value of other playing or essential game variables may also change. To be able to specify how an operation changes the value of essential game variables given the value of the driving parameters, the game constructors should define the relations between

operations on playing variables, the values of the parameters, and the value of the variables in terms of transformation tables or functions.

Finally, the model should be tested for consistency and realism. The result of model building is a tested simulation model of the problem the simulation game is about.

Transformation

In the transformation phase, the constructors *transform* the simulation model into a game/simulation. To transform the simulation model into a simulation game, the constructors should start by defining the goal of the simulation game in terms of objectives. It is useful to make a distinction here between out-game and in-game objectives. Out-game objectives are objectives the constructors want to realize by means of the game (for instance, improving communication about a particular complex problem). In-game objectives are objectives the players should realize while playing the game. These in-game objectives are measured in terms of the essential game variables (for instance, market share for a particular product).

Given the definition of the out- and in-game objectives, the game actors and their roles should be defined by selecting as actors "real" systems involved in the problem. Moreover, the in-game objectives should be defined in terms of "open" or "closed" targets for these actors. For instance, realize a larger market share for a particular product than your competitors is an example of an "open" target. Realize a market share of 80% is an example of a "closed" target. To make the game actors into real actors influencing the course of the play admitted operations should be allocated to them. If more than one individual player plays a game actor (e.g., four people play an organization that is an actor in the play), then individual playing roles should be defined.

Once game actors and roles are defined, the game constructors should define the game steps, specifying the sequence of operations in consecutive game turns. Moreover, rules and procedures for implementing these operations should be laid down. In addition, constructors should specify the physical appearance and paraphernalia (e.g., gaming documentation forms, meeting rooms, playing cards, etc.) of the game and the conditions for playing the game.

The result of the transformation stage is the untested simulation game. During the transformation stage, the constructors may be required to go back to the model building stage, for instance, because it may turn out that given the simulation model, the actual game becomes too complicated to play.

Scenario Building

To construct a playable game, the constructors should finally define scenarios for the simulation game. To this purpose, they should start by further specifying the out- and in-game objectives; for instance, improving communication about CI required for composing the PMT portfolio under different economic circumstances (growing or slacking economy) or improving communication about CI required for rolling out a relatively small PMT portfolio or rolling in a relatively large PMT portfolio.

Given this further specification, the constructors can define the “possible worlds” fitting these objectives by specifying the initial values of both the variables and the parameters and by defining “game events” (i.e., “unexpected” autonomous changes in values of either variables or parameters). For instance, in the scenario of rolling out a relatively small PMT portfolio, the essential game variables “number of product in the portfolio” and “market share per product” get a relatively small initial value. In the scenario of a growing economy, macro-economic parameters such as

“inflation” and “consumer spending” get values to simulate the growing economy.

Once the scenarios have been built according to the out- and in-game objectives, the game simulation can be tested for realism and playability. The result of the scenario-building stage is a set of tested relevant playable scenarios.

Using the Simulation Game

The use of a simulation game involves four stages: (1) preparation, (2) introduction, (3) gaming, and (4) analysis and feedback.

Preparation

To prepare playing the simulation game, the facilitators should start by specifying the out-game objectives of the simulation game session. Given these objectives, they can select the relevant scenario, the relevant participants/teams involved in the simulation game, the roles of these participants, and the physical requirements for playing the simulation game.

Introduction

In the introduction stage, the facilitator introduces the participants to the learning objectives, the goals, scenarios, roles, rules and setting of the simulation game session. The facilitator also takes actions to ensure the involvement and commitment of participants (anticipating uncertainty of the participants, difference in learning styles and possible resistance).

Gaming

During this stage, the actual game/simulation is played. Participants play their roles and try to reach the goals of the game/simulation according to the rules of the game. While playing the game, participants are taking actions that influence the

values of the relevant variables, given a certain scenario.

In addition, while participants are playing, the facilitator may intervene to increase the pressure, give feedback or motivate the participants to alter their behavior to improve the game.

Analysis and Feedback

Analysis and feedback can focus on several aspects of the game/simulation. First it may be directed at the results of the game—i.e., at the effect of (playing within) a certain scenario on the relevant variables. This analysis aims at the learning objectives of the game. Second, the analysis may be directed at the suitability of the game itself—i.e., whether it is properly built and used.

The analyses from simulation games may feed back into building them. In this way, building instructs simulation game usage, and simulation game usage instructs building. For instance, analysis of a simulation game may hint at problems with the model underpinning the simulation element of the game, may bring to light shortcomings in the gaming element of the simulation, or suggest additional scenarios for the simulation game. In this way, a simulation game can become an ongoing process of improving the simulation game and thereby improving the quality of the communication about the complex problem the simulation game is about.

Both the building and the usage phases of simulation games can contribute to improving communication about complex problems. To discuss this possible contribution in a more differentiated way, it is useful to identify the (desired) effects practicing communication by simulation game can serve and to analyze how building and using a simulation game may contribute to realizing these effects.

On the basis of their analysis of the existing literature, Geurts et al. (2000, p. 29ff) mention five organizationally relevant desired effects or

functions, as they call them, of simulation game: increasing awareness and motivation, training skills, improving knowledge and insight, improving communication and cooperation, and integration of learning experiences. Each of these desired effects, in its own way, contributes to improving the content and/or the process of communication about complex problems.

By increasing awareness and motivation, Geurts et al. mean that a simulation/game can help to gain a preliminary understanding of a problem, its consequences and the effects of particular ways of dealing with it. This understanding may also motivate participants to think about the problem and about particular ways to solve it.

A simulation game invokes certain new skills for dealing with a problem. As Geurts et al. put it: “participants are stimulated to find new lines of behavior and put these into practice” (p. 30).

By means of a simulation/game, participants can actively examine the specific consequences of certain lines of action regarding a certain problematic situation. It thus improves knowledge and insight into a certain problem and into the effects of certain ways of dealing with it.

In a simulation/game, participants work together on problematic situations—i.e., they need to communicate and cooperate to explore possible courses of actions. A simulation/game can therefore be seen as a means to diagnose and improve the communication and cooperation regarding dealing with complex problems.

A simulation/game can be used to integrate learning experiences of the participants regarding the complex problem at hand. A simulation/game provides a dynamic background against which knowledge and insights may be ordered.

In Table 2 we list possible contributions of simulation games to improving communication about complex problems.

Table 2. Contributions of gaming to improving the quality of communication

| | | Increasing awareness and motivation | Training skills | Increasing knowledge and insight | Improving communication and cooperation | Integration of learning experiences |
|-------------------------------------|-------------------------------------|--|---|--|---|--|
| Building the simulation-game | Model-building | Model-building may increase awareness of the importance of knowledge and communication | Training in structuring complex problems in terms of simulations | Increasing knowledge about the problem under consideration (what is the problem, why is it a problem) | If participative methods for model-building, transformation, and scenario definition are used, chances are created to improve communication and co-operation between parties dealing with the simulated problem | Participative building allows for pooling knowledge and creating a shared language, improving discussions between parties dealing with the simulated problem |
| | Transforming model into game | Motivating dealing with the problem | Training in making understandable complex models and making them transferable to other people | Increasing knowledge about relevant variables, parameters, events, and relations related to the problem | | |
| | Scenario definition | | | | | |
| Using the simulation game | Preparation | Awareness of differences between points of departure, differences between events; | Quickly picking up relevant aspects of a complex problem situation | Knowledge and insight into (constellations of related) variables causing certain effects given certain starting conditions, events and interventions | Teams of players playing against or with each other need to co-operate and communicate and get feedback on communication, cooperation and the results | Shared understanding and awareness of the dynamics of the complex problem given different conditions, events and interactions |
| | Introduction | Differences between 'lines' of interventions and their effects | Operationally dealing with complex problems in different circumstances | Focus is on analysis and explicit knowledge | Improvements can be monitored by playing the game more than once | |
| | Playing the simulation-game | Motivation providing a sense of control and security needed to deal with problems | Dealing with unexpected events and interventions | | | |
| | Analysis and feedback | Focus is on habituation and tacit knowledge | | | | |

SIMULATION GAMES FOR COMPETITIVE INTELLIGENCE

To explore how simulation games can contribute to improving communication about the required knowledge related to stages in the CI process, we are now in a position to bring together the results from earlier sections. We had listed the required knowledge for the different stages of the CI process and we derived an overview of the particular contribution of building and using

simulation games to improving the quality of communication about complex problems.

In the present section, we first present an example of a simulation/game useful in the context of CI. Next to illustrating a CI game, the example also provides a background to explore how the contributions of building and using simulation games can contribute to improving communication about the required knowledge related to the stages of the CI process.

A Strategic/CI Simulation Game: The Product-Market-Technology Portfolio

Important strategic decisions focus on the composition of the “product market technology (PMT) portfolio” for a certain period. This portfolio consists of all the products (for certain markets, produced using a certain technology) of an organization at a given point in time. Strategic decision-makers should deal with questions regarding its composition in the future. Key questions are: do we need to change the current portfolio and if so—what is the nature of these changes? This decision-making requires strategic knowledge and information about the environment—particularly about the moves of competitors and environmental trends and developments. To focus the required intelligence activities, a game may be designed and used in which this process of decision-making regarding the PMT portfolio of an organization is in focus and a competitor is simulated.

The goal of such a game would be to formulate an adequate PMT portfolio for a certain period of time. Variables to determine the adequacy of this portfolio may be the impact of the portfolio (in terms of profitability, market share, brand-impact, etc.) and feasibility of the PMTs (in terms of costs and the effort to make them fit into the current organization, means of production, culture, etc.). These variables are the essential game variables.

Another set of variables consists of the parameters influencing the game. Among these may be internal parameters like available budget, available capacity (staff, competencies, machines, ICT, etc.), and the mission of the organization. External parameters may be the macro-economic circumstances, labor market, capital market, technological developments, moves of competitors, customer trends, etc. During the game, the players cannot change the value of these parameters. However, the game may be designed in such a way that developments in the external parameters may alter the

value of the internal parameters—and influence the course of the game. Such developments may be modeled by autonomous external events.

The game may simulate the discussion of two groups of strategic decision-makers: one group deciding about the PMT portfolio of the own organization and another group working on a PMT portfolio of the most important competitor. Both groups may consist of participants playing different roles in the discussion: marketing managers, production managers, financial experts, etc. During the game the groups may perform one or more of the following operations: (1) add a new item to the PMT portfolio, (2) remove an item from the portfolio, (3) acquire a piece of information about the environment and (4) share a piece of information with the environment.

The game may be designed in such a way that both groups may acquire environmental information by only “one piece of information” per time-unit (e.g., a statement about an environmental parameter) and that the total number of information elements that can be acquired is limited. In this way, the information-gathering behavior can be monitored.

The game can also provide one or more occasions where players from different groups meet each other (e.g., on a trade show, or on a golf-court). The goal of these occasions is to try to find out about the portfolio of the competitor—and, at the same time, hold back essential information as much as possible. Many more features may be added to the game—but a complete description is beyond the scope of this chapter.

Contribution of Simulation/Games to the CI stages

Simulation/games may contribute to the knowledge required in the intelligence stages. In general, building and using a simulation game may lead to an insight into (1) the definition of information requirements, (2) the definition and

use of information sources, (3) the analysis and use of information to strategic decision-making (for instance, in how it leads to a PMT portfolio), and (4) in the dissemination of the information and intelligence, given the different values of the parameters. In this section, we elaborate on these contributions.

Contribution of Gaming to the Direction Stage

During the building stage, a model of the organization in its environment in terms of relevant parties, variables, parameters, and variables relevant for strategic decision-making is built and tested. Such a model is relevant for the direction stage because it can guide identifying relevant environmental data classes. If, for example, CI professionals and game constructors work together to build a realistic game for generating a PMT portfolio, they should decide on the essential game variables, the playing variables and on the environmental parameters that may affect these variables. They should also decide on the initial values of these variables and parameters. A realistic choice (e.g., a relevant technological or customer trend, a relevant mission statement, relevant macro-economic circumstances) is impossible without a valid model of the organization in its environment. Building a game may be a trigger to improve current models for identifying relevant environmental (values of) variables and parameters.

In the building stage, a number of different scenarios (the specific initial values of the variables and parameters) are defined, each of which is the starting point of playing a game. During the game (for each scenario), knowledge is created about the impact of certain (initial) values of these variables and parameters in the context of making certain strategic decisions (e.g., formulating a PMT portfolio). For instance, it may turn out that certain initial parameter values have

a high impact on organizational or competitor behavior. This knowledge may again be used in directing the intelligence activities—specific environmental parameters or variables may be monitored closely because some of their values may have a high impact on the organization. Playing a certain scenario can also reveal that some data classes gain in importance to make a certain strategic decision, while others cease to be of value. This knowledge can also be used to direct intelligence activities when a certain scenario comes into being.

Contribution of Gaming to Collection

During the building stage of a game for competitive intelligence, the model of the organization in its environment should be consulted to identify possible sources for collecting information about the environment. These sources could be made available to the players during a game. While a game is played, participants may create knowledge about the usefulness of these specific sources. In particular, it may turn out that the use and perceived relevance of specific sources depends on the different scenarios.

Contribution of Gaming to Analysis

The building stage results in a tested model of the organization in its environment in terms of relevant parties, variables, parameters and their relations. It thus provides a model for analyzing collected information about the environment as well. If the model is a realistic one, it may serve as a background for interpreting changes in value of the variables and parameters in the “real world.” The value of this model increases when different scenarios are tested during playing the game. During a simulation game, one may find out that specific constellations of parameter values have a certain effect on the organization. This knowledge should be used to interpret the values of the actual parameters.

Contribution of Gaming to Dissemination

One of the purposes of simulation games is to provide an insight into and support for communication and cooperation practices. Communication and cooperation are important issues for disseminating and using the intelligence in strategic decision-making. It is often claimed that adequate communication and cooperation between intelligence professionals and strategic decision-makers is the key to ensure that intelligence is distributed correctly and used. Building a simulation game may provide several possible settings for the communication about intelligence and cooperation between CI professionals and strategic decision-makers (ranging from a “passive” mode, in which intelligence professionals give an update on their output once in a while, to a “collaborative” mode, in which both groups cooperate intensely and produce the intelligence together). During the building stage, one may thus gain insight into the different forms of communication and cooperation. While using the simulation game (in different scenarios) knowledge may be created about the adequacy of these settings (under different scenarios). This may help in designing an adequate setting for communication and cooperation.

Moreover, when both CI professionals and strategic decision-makers participate in (building or playing) the game, building or playing the game itself realizes cooperation and communication about relevant knowledge for competitive intelligence purposes (e.g., the models, possible scenarios, etc.). It helps to create a shared language to facilitate (current and future) intelligence matters.

Table 3 summarizes the different contributions of a simulation/game to the intelligence stages. Dependent on the design of the specific game, it may also lead to specific intelligence. The specific game of the previous section may, for instance, give valuable insights in how an organization sees the strengths and weaknesses of a relevant competitor (given different scenarios).

Simulation/gaming can be regarded as a means to support generating relevant knowledge for intelligence activities. In the next section, we discuss how ICT may support the building and using stages of gaming in order to create, store, share and apply required knowledge for the competitive intelligence stages.

Table 3. Simulation games contributing to the acquisition of knowledge for the CI stages

| | Directing | Collecting | Analysis | Dissemination |
|-------------------------------------|--|--|---|---|
| Building the simulation-game | Building a model of the environment of the organization in focus in terms of parties, variables, and variables relevant for strategic decision-making that can guide identifying relevant knowledge domains and data classes | Identifying possible sources for collecting information about the environment | Providing a model for analyzing information about the environment. The model used in the direction stage can be used for analysis purposes as well. | Providing different settings for distributing environmental information and its use in strategic decisions |
| Using the simulation game | Identifying knowledge domains and data classes for making particular strategic decisions in different scenarios | Gaining knowledge about the usefulness of specific sources in different scenarios. | Gaining knowledge of the adequacy of the model for analysis purposes in different scenarios | Gaining knowledge about the adequacy of different settings for the distribution of the intelligence and its use (in different scenarios). |

ENABLING SIMULATION GAMES FOR CI BY ICT

The role of ICT to support simulation games for competitive intelligence falls into two broad categories: (1) ICT for supporting building and using a simulation/game and (2) ICT for making the results of the game available for the 'real' intelligence activities.

In the building stage, ICT (e.g., the Internet) can be used to collect intelligence to construct a realistic game. In fact, the same ICT tools normally employed in intelligence activities may be used. Moreover, ICT can greatly enhance the communication and cooperation needed to construct and test a realistic model of the organization in its environment. For instance, Intranet applications and GroupWare can aid in online construction and testing of the model. ICT applications can also support the choice of parameters and relevant values of the parameters for the specific scenarios used in the game. For instance, system-dynamic software can help in building a model of the causal relations between the essential game variables and the parameters. It can also help in determining specific effects of parameter values on essential game variables.

ICT can support the stage of using the game as well. ICT can help the participants to monitor the environment, to store the results of the game and to support the communication and cooperation needed during the game. To store the results of the game, a "scenario database" can be made and updated. In this database, all the relevant outcomes of playing the game in different scenarios should be stored. This information is relevant for the participants playing the game as it provides a log of the results of the current scenario. An insight into the results of playing the different scenarios is also relevant for the "real" intelligence activities (see below). ICT can also serve to generate a virtual game setting—i.e., simulate a part of the environment participants use to play the game (e.g., a virtual stock market, or a virtual

trade show). In a similar vein, ICT can be used to generate autonomous environmental events and forward information about it to the participants. Another way of using ICT during the game is to provide a 'decision support system' participants may apply to calculate the consequences of their decisions.

Table 4 lists possible uses of ICT to support creating, sharing and storing knowledge for the CI stages.

The second function of ICT regarding simulation games for competitive intelligence is to store the resulting knowledge from the simulation game and make this knowledge available to intelligence professionals. To this end, the model that was built and tested and resulted in several playable scenarios should be stored and used in the intelligence activities. A model of the organization in its environment is the essential model for directing and analyzing activities. During the game it can be tested in a "safe environment"—and this may lead to valuable information about its use in real intelligence activities. Therefore, it is essential to store the model and provide easy access to it (and to the arguments leading to the choice of certain essential game variables, parameters and their initial values). Likewise, the information resulting from playing different scenarios should be stored (see the scenario database mentioned earlier) and made available for intelligence purposes.

CONCLUSION

The purpose of this chapter was to explore the relevance of simulation/gaming for competitive intelligence and to examine the role of ICT to support simulation/gaming for competitive intelligence. Simulation/gaming can be a valuable tool for arriving at knowledge required in intelligence activities. Its main contribution is to build and test different scenarios regarding the impact of the environment on the organization. During building and testing these scenarios, awareness, knowledge

and insight may be gained about the underlying model of the organization in its environment and about the impact of different values of environmental parameters on relevant organizational variables. Moreover, building and testing different scenarios may also enhance the communication and cooperation needed for intelligence activities. ICT can support delivering the contributions of simulation/games to competitive intelligence in various ways. In this chapter, we discussed some possibilities to support the building and using stages and to facilitate the dissemination and use of the knowledge resulting from the game to intelligence activities.

In our view, simulation/games can be an important tool to support intelligence activities. However, one should be aware of the effort it takes to build and use a simulation/game. At the same time, if a simulation/game is properly designed, the knowledge gained from it may well be *the* knowledge used in the direction stage (and for a great part in the analysis stage). In addition, if properly enhanced by ICT—simulation games may well be one of the most important tools to direct intelligence activities.

REFERENCES

- Allgaier, C. & Powell, T. (1998). Enhancing sales and marketing effectiveness through competitive intelligence. *Competitive Intelligence Review*, 9(2), 29-41.
- Bernhardt, D.C. (1994). 'I want it fast, factual, actionable'—Tailoring competitive intelligence to executive needs. *Long Range Planning*, 27(1), 12-24.
- Clark, B. (1998). Managing competitive interactions. *Marketing Management*, 7(4), 9-20.
- Cook, M. & Cook, C. (2000). *Competitive Intelligence*. London: Kogan Page.
- Duke, R.D. (1974). *Gaming, the Future's Language*. Beverly Hills, CA: Sage Publications.
- Ellis, R.J. (1993). Proactive competitive intelligence: Using competitor scenarios to exploit new opportunities. *Competitive Intelligence Review*, 4, 13-24.
- Fuld & Company. (2002). *Intelligence Software Report 2002*. Retrieved at: <http://www.fuld.com>.
- Fuld, L.M. (1995). *The New Competitor Intelligence*. Chichester, UK: John Wiley & Sons.
- Fuld, L.M. (1998). *The Fuld War Room: The Ultimate in Competitive Intelligence*. Cambridge, MA: Fuld & Company.
- Geurts, J., Caluwé, L. de, & Stoppelenburg, A. (2000). *Changing the Organization with Gaming/Simulations*. Den Haag: Elsevier.
- Hannon, J.M. (1997). Leveraging HRM to enrich competitive intelligence. *Human Resource Management*, 36(4), 409-422.
- Kahaner, L. (1997). *Competitive Intelligence*. New York: Touchstone.
- Sammon, W.L. (1986). Assessing the competition: Business intelligence for strategic management. In J.R. Gardner, R. Rachlin, & H.W. Sweeney (Eds.), *Handbook of Strategic Planning*. New York: John Wiley & Sons.
- Tessun, F. (1997). Scenario analysis and early warning systems at Daimler-Benz aerospace. *Competitive Intelligence Review*, 8(4), 30-40.
- Vriens, D. & Philips, E.A. (1999). Business intelligence als informatievoorziening voor de strategievorming. In E.A. Philips & D. Vriens (Eds.), *Business Intelligence*. Deventer.

This work was previously published in Information and Communication Technology for Competitive Intelligence, edited by D. Vriens, pp. 248-268, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.10

Assessing Online Discussion Forum Participation

Matthew Shaul

Kennesaw State University, USA

ABSTRACT

As a socially constructive learning tool, discussion forums remain central to online education. They have continued to evolve in functionality, acquiring ever-increasing usability features. However, development has lagged in providing instructors the means to assess student work in forums. The author submits an overview of his software program that provides instructors with the means to evaluate forum work quickly, easily, and repeatedly. The software accomplishes this by accessing the forums' underlying database, searching for manifest and latent data, and calculating data associated with an array of metrics. This is a Web-based tool built on Open Source and standards-based languages, providing opportunities to port the program to numerous Learning Management Systems. It is the intention of this author to provide this tool, when completed, for such use as a free, Open Source tool. Interested parties may e-mail the author for progress updates. Currently, however, further work on the project must await the completion of another project, the author's dissertation.

INTRODUCTION

Learning Management Systems (LMS) continue receiving expanded toolsets and quickly assimilating new Web-technologies to provide users an increasingly interactive, richer experience. Chat, streaming media, "blogs," "video-casting," and "podcasting" found their way into online educational settings soon after being generally accepted on the Internet. Yet, discussion forums, an old (in Internet time) technology, seemingly remain the core from which many instructors build online classes. These technological descendants from long-ago bulletin boards and listservs, one of the earliest tools integrated into online education, remain central to the design and success of many distance education courses.

More so than the newer technologies, discussion forums approximate a replacement for the give-and-take of the brick-and-mortar experience, mimicking many-to-many discussions found in traditional classrooms. In addition, the recognizable conversational structure reflected visually in the tree-like output, simplicity and flexibility of the tool likely contribute to its continued success and

acceptance, granting users an immediate sense of familiarity. The importance of such comforting effects cannot be discounted, especially in a field still relatively new.

Discussion Questions

However, despite the history and wide, though not full, acceptance of the importance and use of forums, lack of awareness on how best to use them persists. Note that this unawareness does not pertain to the implementation of forums, or designing them to encourage adoption. In fact, Markel (2001) notes that forums have developed beyond simple, plain text message boxes, incorporating emoticons, HTML formatting, images, and hyperlinks to provide a more enticing tool to draw students into their use. Yet, while these features encourage participation, there is no clear way for instructors trying to devise effective forum evaluation schemes.

This article, therefore, examines forum technology assessment. Given the importance of assessment in learning, it is apparent that such a widely used distance leaning tool must provide instructors with sound options for evaluating student work. Moreover, effective assessment options, with associated feedback, provide the added benefit of encouraging an increase in student postings, thus adding to the forums' potency. Yeh (2005) notes that student participation increases as instructors place an importance on posting by assigning grades to forum use. This is unsurprising, as one would expect graded assignments to garner more attention from students than non-graded activities. Swan (2001) finds this true as students calculate reward versus effort when determining whether to participate in forums. Forums with a larger percentage of influence on grades receive more use. However, while most LMS do provide instructors some means of forum assessment, current tools remain either overly limited or too time consuming to use.

Forum Types

Note, different forum types exist, and not all contain posts needing assessment. The first might be termed "social" forums. These forums furnish students with an informal area to discuss class- or non-class-related matters. Often, instructors state they will not view these forums' contents, thus creating a space in which students are free to speak openly, criticizing or praising the instructor, course, curriculum, or school without concern the comments will influence grading. Instructors often refer to these forums as "water coolers" or "student lounges." While these forums may provide students social benefit, instructors almost never assess them (Nelson et al., 2005).

A second type of forum might be labeled "general discussion." Like the social forums, these tend toward a free flowing, less structured style. However, unlike the social forums, these pertain to the course material and are less informal. Instructors may select broad topics or simply ask students to post any course related questions or material. Whereas social forums resemble hallway discussions among students, general discussion forums mimic an open question discussion in the classroom. Like their classroom counterparts, online general discussion students might receive grades based upon participation, insight, argument, initiative, and other factors.

The last forum type considered here is the "topic driven" forum. These forums are the most structured in terms of content and correspond to classroom assignments in which the instructor picks topics and expects students to come prepared to debate and defend stances. Similar to general discussion forums, instructors may wish to assess topic driven forums as they would in the classroom—on participation, style, scholarship, argument, insight, and other subjective and objective factors.

Quantitative and Objective Forum Assessment

As stated previously, forums currently do possess methods to assess student work. The LMS and the instructor provide quantitative and objective means of evaluation. The concern, however, is whether these methods offer instructors the tools needed to accurately and meaningfully measure student work.

One of the most basic methods, in fact, exists in most LMS's, and is simply a count of each students' postings, allowing the instructor to assess based upon predetermined levels matched to grades. For instance, a minimum of five posts per week may warrant an "A," four a "B," and so on. The advantages of this method appear plentiful. For one, students easily understand the measurement and are clear on expectations, which Dennen (2005) notes may promote participation. In addition, assessing is easy for instructors, as the LMS likely provides reports listing a count total for each student. Instructors need do no more than run weekly reports and award grades accordingly.

Disadvantages, however, exist as well. Forum threads often contain a number of insignificant posts consisting of little more than "me too" or "well said." Since the LMS in this case only considers counts, these posts weigh equally with well-written, researched posts, a situation many students and instructors would find unfair.

Additionally, relying solely on counts encourages post submissions, but not necessarily forum participation, if the expectation is that students will also read their classmates' offerings. As a result, the forum may devolve into a writing exercise with each student posting detached, unrelated essays rather than interrelated posts, building an interconnected discourse (Dennen, 2005). Consequently, the forum in this case remains underused as an interactive, communicative learning tool (Dunlap, 2005) and becomes little more than a channel to submit electronic topical papers.

Instructors often address this shortcoming with a seemingly sensible solution: requiring students to comment or respond to a few of their peers' posts each week, in addition to submitting original posts. The requirements remain simple for the students to follow and easy for instructors tally. The new rule's intent, of course, is to forge threads from the posts, and subsequently, discussions from the threads, by mandating a level of interactivity. Although the idea seems reasonable and does produce at the least the instructor-assigned degree of interaction, the threads may consist of little more than this minimum. Students post to expectations (Dennen, 2005) and without more guidance than simple quantitative requirements will post the minimum type of reply necessary. Moreover, the response or comment posts can lack a depth matching the original post, and a repetitive pattern quickly ensues in which responders follow up initial posts with inconsequential replies, adding little to the aggregate knowledge (Ivankova & Stick, 2005). Thus, the forums attain some interaction, but the requirement change may not bring about the desired higher-level discourse or debate.

The next step, then, is to raise the degree of discussion while maintaining an easy means to measure student work. Some instructors attempt this by requiring all posts, including the response postings, to have citations from peer-reviewed publications. This seeks to infuse a degree of scholarship, thus raising the discussion level. At minimum, the hope is that the new rule forces students to research and form their responses around that research.

This remains a simple quantitative and objective measure. Instructors may alter the number of citations needed, or the sources allowed, but the measure remains merely a type of count. There is the beginning of significant change, however. Note, though in essence simple, such a measure is beyond the abilities of typical LMS because they lack the capability to differentiate a citation from

any other string of text. Thus, they cannot count or note citations, and the burden of tallying this assessment, then, moves for the first time from the LMS to the instructor.

Qualitative and Subjective Forum Assessment

Part of the allure of quantitative and objective assessment of forum work is the simplicity for the students and the instructors. For the instructors, this translates into speed and timesaving, as quickly accessed reports reveal each student's standing; grading is very straightforward. Yet, perhaps depending upon the student's age and grade level, relying solely upon quantitative measures may not offer the clearest evaluation of performance. In the case of tallying postings, the measure is ultimately an electronic attendance sheet, tracking whether students checked in and "participated." However, at the undergraduate level and higher, instructors likely prefer grading on criteria that are more substantial. Absent in most pure counting methods, subjective measures such as writing style, initiative, strength of argument, and originality offer a more robust grading rubric.

In fact, many such rubrics exist. For example, Edelstein and Edwards (2002) devised a forum assessment rubric called "Assessing Effectiveness of Student Participation in Online Discussions." This rubric consists of five categories: Promptness and Initiative; Delivery of Post; Relevance of Post; Expression within the Post; and Contribution to the Learning Community. The instructor is to consider each student's work as a whole, evaluating each post on a scale of one to four, with one the lowest, in each of these categories. Edelstein and Edwards provide explanations for each rating of each category to aid the assessor. For instance, a one rating in the "Relevance of Post" category translates to "Posts topics that do not relate to the discussion content; makes short or irrelevant remarks."

Such qualitative and subjective measures afford the instructor far more leeway in assessment than mere counts. Whereas a "me too" post is awarded standard points in a count assessment, such a post would draw the lowest score in the just mentioned Edelstein and Edwards category. These subjective ratings also provide the instructors the means to use their judgment, allowing them to weigh factors differently, perhaps for instance, heavily rewarding creativity in thinking or writing style, while affording less weight to the inclusion of citations.

Additionally, by moving to richer assessment rubrics, instructors lead students to submit richer messages, which elicit richer peer responses and lay the foundation of scholarly discussion. These subjective assessments attempt to measure higher-level learning, including analysis, synthesis, and evaluation and direct students to post accordingly. Bhagyavati, Kurkovsky, and Whitehead (2005) note that students adjust their posts to meet these expectations, and the forums' quality wholly moves upward. As stated earlier, students adjust their work to meet expectations.

Unfortunately, the instructor time expended is a considerable drawback of detailed rubric scoring and subjective qualitative assessment. Consider the time needed to work through a five-category rubric in a class of 20 students in which postings could easily total between 500 and 1000. Unsurprisingly, instructor fatigue becomes a concern as forum management evolves into a significant time- and effort-intensive activity (Dunlap, 2005).

Another drawback, often overlooked, is the return to manual effort for the assessor such rubrics require. This is unfortunate considering most LMS's run atop powerful computers very capable of intense calculations. Moreover, relational databases contain the actual forum data, availing a trove of information to SQL querying. Forgoing such computational resources is inefficient and counterintuitive considering online

courses exist only through the use of such advanced technologies.

Proposed Solution

The need for a forum assessment aid seems clear. The requirements are also apparent—develop a tool to assist instructors in assessing forums using measurements beyond the simple quantitative counts. The tool should incorporate some degree of qualitative or subjective measure and should utilize the power of the host computer. Certainly, the tool should provide a simple, usable interface to encourage adoption.

Current Packages

Ideally, forum software would offer an integrated tool to assist in assessing forum messages; unfortunately, this is presently not well advanced. However, Wu and Chen (2005) have developed software that attempts automating assessment of student forum work. Their software is similar to Qualrus, mentioned by Gilbert (2005), in that it parses written submissions and grades them based on the instructor's preprogrammed criteria. Whereas Qualrus and other similar essay-grading software purportedly evaluate style, grammar, structure, quality, and argument, Wu and Chen's software appears to measure fewer writing criteria. Instead, the software algorithmically determines knowledge density, or message quality, using instructor-specified keywords. The software then accesses the forum's database, and using the message field's length and participant-sorted message counts, assigns values for student effort and participation.

Wu and Chen's method attempts less to assess message content than essay grading software such as Qualrus, and examines the database for supplemental information; this may be preferable for forum evaluation. If the instructor uses forums for socially constructive learning, for instance,

much of the "construction" exists not individually in each message, but in the forum structure, in the interfaces between and among messages, captured latently in the database. Any assessment must consider the forum as a whole, messages inter-related in a web (Schellens & Valcke, 2004). To appraise each message separately and solely limits the instructor to an assessment of independent "mini essays," each presumably unaffected by others' postings.

Developing a Solution

Although Wu and Chen (2005) propose gleaning modest amounts of data from among the tables, this author believes the tables and the relations between the tables hold enormous amounts of valuable information. As an example, Dringus and Ellis (2005) believe mining the database has significant potential to reveal information hidden, for instance, in timestamps and sequence numbers. These numbers, referred to here as "manifest" information, lie in fields readily available to SQL queries. However, properly manipulating this manifest information potentially reveals additional "latent" information that is also useful in assessing the forums' contents.

For instance, message timestamps reveal relative temporal information that may show evidence of student initiative by indicating first postings or responses. Additionally, a post with many responses, evidenced by subsequent sequence numbers and parent-child pointers found in the database, may show a post's effectiveness. Certainly, for instance, it is arguable in a socially constructive environment that a student post, eliciting numerous responses and thus acting as the impetus for peer involvement, warrants a positive assessment to some degree. Yet, a methodology focused wholly on the individual message, and not tuned to consider the message "tree," misses this information entirely.

The solution, therefore, appears to require first the formation of meaningful measures, followed by a search of the database fields and relationships for latent and manifest data supporting the measures, and finally the development of the algorithm and SQL to pull the data from the database. The author has proceeded through these steps, designed such a program, and has developed a simple Web-based interface, allowing instructors to quickly and repeatedly use the tool. The hope is that the simplicity will compel instructors to use the tool often to provide students frequent feedback on forum performance.

Following is an overview of the measures used by this author, some insight as to the reason each is included, and a brief explanation of how the program attains the data:

- **Initiative:** Being first to provide an opinion is not easy, so the system rewards students in two situations: one if the student starts a thread, and two, if the student is the first to respond to an instructor post. The system captures this in the posts timestamps.
- **Effectiveness-Depth:** In a socially constructive environment, one measure of effectiveness is the amount of involvement elicited. Thus, the system calculates the number of responses and sub-forums spawned. Students are rewarded for being able to draw others into a discussion.
- **Effectiveness-Breadth:** This is similar to the previous measure in that it rewards students for educating classmate responses. However, a “deep” thread (many responses) may involve only two or three students, perhaps still valuable but less of an indication of the enthusiasm for thread than the number of responses indicate. On the other hand, this measure calculates and rewards effectiveness by tallying unique responders, thus revealing the scope of the enthusiasm.
- **Value:** In the current system, students can anonymously rate each other’s posts on a one-to-five scale representing “Not Valuable” to “Very Valuable.” The system then measures value by averaging the peer rating a student’s posts receive. This is a very important measure since each student defines value for each post differently. What may seem to many students a simple, low-value posting may clarify a point and offer high value to other students. This metric accounts for the possible variances.
- **Timeliness:** This measure is best used when the instructor does not impose a posting deadline on threads. Rather, students continue threads for as long as there is interest. In this way, students may revisit older threads as they learn more, or as they come upon new information. However, differences exist between legitimate, interesting late posts and messages submitted well after a thread is exhausted. The system recognizes this by calculating timeliness as the standard deviation of a thread’s posting time, and assumes interesting late posts will draw responses and move the standard deviation toward itself. Merely late posts will not alter the standard deviation and will not receive credit.
- **Participation:** Post count is not a good measure of participation. For instance, one student may log in and post several times a week over the extent of a course. Conversely, a peer may log in at the last minute and post an equal number of messages. Clearly, they participated at different levels. To reward consistent participation, this system determines whether each student’s Average Time Between Posts (ATBP) is within the standard deviation of the class’s ATBP. Students whose ATBP is outside do not receive credit.

Assessing Online Discussion Forum Participation

- **Scholarship:** Instructors may expect posts to contain certain keywords, phrases, or names. Additionally, they may require citations. The system searches each post for words from an instructor-determined list and scans for citations. Posts receive credit for containing either keywords or citations. The citation search is not flawless, as the system uses regular expression patterns to match what are likely citations.
- **Style:** Perhaps misnamed, the system does not examine the prose for writing style in this metric, but instead performs a word count. Students receive points for posts above a specified count but below another count. The attempt is not to reward short, unsubstantial posts, or long, rambling posts. Therefore, more precisely, the metric attempts to encourage succinct, concise writing.
- **Instructor Points:** While the previous metrics seek to cull needed data directly from the database, certainly some subjective measures cannot be calculated from the tables' fields. Thus, the system provides the instructor an opportunity to add or subtract points from each student's assessment. Therefore, for instance, the instructor may reward a student who has consistently put forth original arguments, or who has carried discussions to a higher level. Likewise, an instructor may subtract points from a student who has done well, but has consistently used poor grammar or spelling.

These metrics are varied enough to provide a flexible array of point opportunities to students. Some students may be comfortable, or in a fortunate position to attain points from the Initiative measure. Others may be better at writing concisely or with a style the instructor appreciates, and positioned to acquire Style points. Still others may have the time to post frequently and receive points for Participation. All can pursue Value or Scholarship points.

The author's system seeks to add further flexibility for the instructor as well. Rather than considering each measure equally, the tool allows instructors to weight each metric to their preference. For example, one instructor may find the Effectiveness-Breadth measure most compelling in assessing forum work. Therefore, the instructor may weight this as 40% of the overall assessment calculation. On the other hand, another instructor may weight this at 10%, and weight Instructor Points much higher. By allowing varying weights, the system incorporates another degree of instructor subjectivity into the assessment.

An instructor configures the desired weights on a simple Web page that lists each measurement with an accompanying explanation for the measure. Each is followed by a dropdown box listing numbers from zero to 100, and the instructor weights each measure so the total of all selected weights, added together, equals 100. This screen also has a textbox input for keywords, used in text searches, in the event the scholarship measure is chosen. Naturally, instructors weight measures they feel important for assessment highly and those they consider less important lower or zero.

If the instructor selects Instructor Points as a measure, the next screen displays a class roster with a dropdown box with numbers from negative 100 to positive 100 associated with each student name. Here, the instructor assigns positive or negative points to each student. Note, these are the actual points; the weight of these Instructor Points was configured on the first screen.

The final screen, whether or not Instructor Points is used, displays each student's calculated rating. It is important to note the system scores students as a percentile rank of all points awarded and not from a finite allotment of points. Thus, first the system determines total points awarded for everyone, and then ranks each student based upon the student's earned points. In this way, students are not aiming to amass a specific number of points for associated grades (i.e., 100 points

for a C, 200 for a B, 300 for an A), but instead realize they must maintain pace with classmates through participation by accumulating as many points as possible. As classmates participate, the pool of awarded points grows, compelling students to continue to post, less their awarded allotment shrinks as a percentage.

CONCLUSION

Assessing student work in discussion forums remains difficult for busy instructors, especially if one wishes to use measures beyond simple tallies. However, the author's software solution offers some hope by providing an easy to use, flexible solution. The tool is Web-based, written in Open Source and standards-based languages that should provide the basis for easy portability. Interested parties can e-mail the author for progress updates. Unfortunately, for the moment other project requirements demand a—hopefully brief—respite from the project. When finished, though, it will be freely available as Open Source.

Because of use of the LMS's underlying hardware and software, the tool performs its calculations quickly. Additionally, because of the simple interface, the tool encourages instructors to run assessment reports often, thus enabling the instructor to provide continual feedback to students. Consequently, the forums rise to higher levels of discussion and debate and become true socially constructive learning environments as students learn to post, read, and respond accordingly.

REFERENCES

Bhagyavati, Kurkovsky, S., & Whitehead, C. C. (2005). Using asynchronous discussions to enhance student participation in CS courses. In *Proceedings of the 36th SIGCSE Technical*

Symposium on Computer Science Education (pp. 111-115). Retrieved December 22, 2005, from the ACM database.

Dennen, V. P. (2005). From message posting to learning dialogues: Factors affecting learner participation in asynchronous discussion. *Distance Education, 26*(1). Retrieved December 23, 2005, from the ProQuest database.

Dringus, L., & Ellis, T. (2005). Using data mining as a strategy for assessing asynchronous discussion forums. *Computers & Education, 45*(1), 141-160. Retrieved December 8, 2005, from the Science Direct database.

Dunlap, J. C. (2005). Workload reduction in online course: Getting some shuteye. *Performance Improvement, 44*(5). Retrieved December 8, 2005, from the ProQuest database.

Edelstein, S., & Edwards, J. (2002). If you build it they will come: Building learning communities through threaded discussions. *ELearn, 2002*(4). Retrieved December 12, 2005, from the ACM database.

Gilbert, A. (2005). *Teachers leave grading up to the computer*. CNET News.com. Retrieved December 30, 2005, from http://news.com.com/Teachers+leave+grading+up+to+the+computer/2100-1032_3-5659366.html?part=rss&tag=5659366&subj=news

Ivankova, N. V., & Stick, S. L. (2005). Collegiality and community: Building as a means for sustaining persistence in the computer-mediated asynchronous learning environment. *Online Journal of Distance Learning Administration, 8*(3). Retrieved December 15, 2005, from <http://www.westga.edu/%7Edistance/ojdl/fall83/ivankova83.htm>

Markel, S. L. (2001). Technology and education online discussion forums: It's in the response. *Online Journal of Distance Learning Adminis-*

Assessing Online Discussion Forum Participation

tration, 4(2). Retrieved February 23, 2006, from <http://www.westga.edu/~distance/ojdla/summer2001/markel42.pdf>

Nelson, M., Bhagyavati, Miles, G., Settle, A., Shaffer, D., Watts, J., et al. (2005). Online teaching practices (both best and worst). Panel discussion. *Journal of Computing Sciences in Colleges*, 21(2). Retrieved December 14, 2005, from the ACM database.

Schellens, T., & Valcke, M. (2004). Fostering knowledge construction in university students through asynchronous discussion groups. *Computers & Education*, 46(4). Retrieved June 20, 2006, from the ScienceDirect database.

Swan, K. (2001). Virtual interaction: Design factors affecting student satisfaction and perceived learning in asynchronous online courses. *Distance Education*, 22(2), 306-331. Retrieved February 18, 2006, from the ProQuest database.

Wu, Y. B., & Chen, X. (2005). E-learning assessment through textual analysis of class discussions. In *Proceedings of the Fifth IEEE International Conference on Advanced Learning Technologies* (pp. 388-390). Retrieved January 8, 2006, from the IEEE database.

Yeh, H. (2005). The use of instructor's feedback and grading in enhancing students' participation in asynchronous online discussion. In *Proceedings of the Fifth IEEE International Conference on Advanced Learning Technologies*. Retrieved December 14, 2005, from the IEEE database.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 3, edited by L.A. Tomei, pp. 39-46, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.11

E–News: Community Interaction through Journalism

Matthew Simpson

University of Queensland, Australia

Jay Burmeister

University of Queensland, Australia

Michael Docherty

University of Queensland, Australia

ABSTRACT

This chapter describes the development of the E-News project which examined an interactive journalism approach in Rockhampton, Australia. This project provided an opportunity to examine how the introduction of this new technology into regional media and communication brings into question the traditional roles of the journalist, the editor, the graphic designer and the audience in the production and ‘consumption’ of written material. Such an approach provided the opportunity for grass-roots journalism to be examined for its capacity to provide a clearer insight into the nature of a community journalism-based approach such as the E-News system. It also allowed the examination of the resultant interaction that occurs between users and community. The experiences resulting from the E-News project

provide a framework for discussion regarding the potential of approaches such as E-News for community informatics in regional areas resulting from online news environment.

INTRODUCTION

Online development in the area of media and communication has taken many forms in the last decade. Information Communication Technologies (ICT) has enabled many areas which were traditionally physically orientated to emerge and explore a new dimension of online interaction. This chapter looks at the impact of community informatics on regional communities through exploration of collaborative issues in an educational context.

The nature of interaction between ICT and journalism is examined in the context of the issues that arose during the E-News project, and its implication for regional media and communication. This interaction occurred through collaboration between IT students at the University of Queensland's Ipswich campus and journalism students at the Central Queensland University's Rockhampton campus. It investigates the development and implementation of a real-life online journalism scenario.

The E-News project provided an opportunity to examine how the introduction of new technology into regional media and communication brings into question the traditional roles of the journalist, editor, graphic designer and audience in the production and 'consumption' of written material. The aims of the project were two-fold. First, it examined the development of an online environment for reliable information delivery for regional community-based journalism. The underlying assumption in this approach was that by enabling online collaboration, it is possible for a range of participants from varying backgrounds with non-technical levels of computer literacy to meaningfully interact in a news-based environment. The second aim was to examine how education could assist in addressing multi-disciplinary issues between all parties involved and the end consumers of the service: the community. The application of an educational framework to analyse a digital news perspective can reveal valuable lessons for community informatics.

The changing role of the traditional journalist because of ICT has been a rapid one. Despite this, the traditional definition of journalism has not changed, but has evolved along with the technology. Journalism still involves the collation and production of news and news articles for public consumption. What have changed are the process and the people able to conduct the preparation and publishing of news. Because of the increasing ability to post stories remotely or work online using ICT, community members

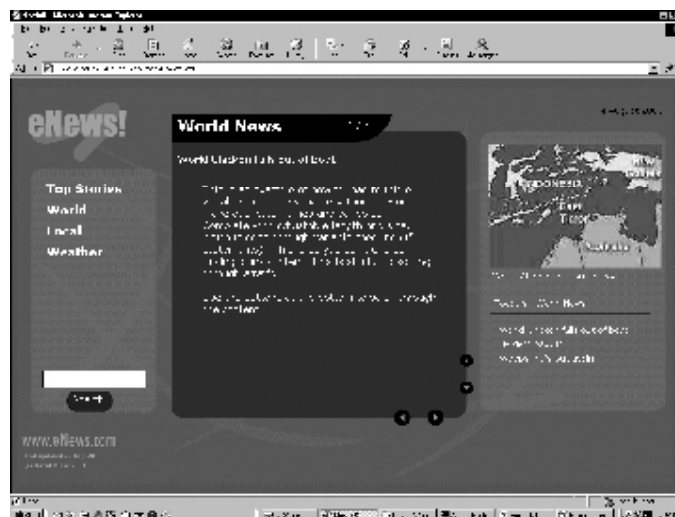
can now share concerns, and provide opinions and information into the news delivery systems. This has been termed 'grass-roots journalism'. In this chapter, the use of the word 'journalist' will include a non-professional, 'grass-roots' approach, describing an individual wishing to publish community information on a topic or event. This allows discussion regarding community involvement in topics of interest to consider professionals in the same sense as those who have a view on the topic in question. By adopting such an approach, the broader issues of community informatics in regional areas can be discussed, addressing all participants on equal terms.

The following section outlines the nature of the project and the participants. It explores project aims and the mechanisms by which the project was conducted and reviewed. Studio pedagogy and its role in providing a structural framework for project development is explored while examining the impact of the technology in this process. The chapter then moves to exploring a series of broader issues, particularly the interaction between users, which arose during the project. This approach lays the framework for discussion on the potential of E-News for community informatics.

BACKGROUND — THE E-NEWS PROJECT

The overall aim of the E-News project was to develop a Web site for the creation and modification of online news stories. The site was required to be highly usable and easily updateable. The nature of the project was collaborative, involving students from Information Environments (IE) at the Ipswich campus of the University of Queensland (UQ) and E-Journalism students at the Rockhampton campus of the Central Queensland University (CQU), and conducted in the second half of the year 2000. The IE students were required to function as a team of Web designers in order to develop a fully functioning database-

Figure 1. An Example of a Completed E-News Database Web Site



driven Web site for an external client (shown in Figure 1). The E-Journalism students acted as the client for this purpose, providing the requirements and the content for the site.

Communication between the Web designers and the clients occurred through many forms of the technology. Initial communication between the two parties occurred through video conferencing, followed by e-mail.

Another aspect of the project was to explore the impact that interactive technology can have on the presentation of news information that has traditionally been displayed in printed form. Throughout the course of the project, the nature of work practice in the creation, modification and utilisation of the system was observed through ethnographical approaches in order to gauge the comparative success of techniques applied by different groups. This was to be achieved through the re-representation of a real-life design environment in a Studio-teaching model. By teaching in such a manner, students were able to engage the client and gain experience in the nature of the design world. The nature of this pedagogy is effective not only in aiding the instruction and learning of students, but also in creating a realistic

environment for the testing of new methods and approaches in industry.

Pedagogy

The pedagogy underlying the Studio approach has its theoretical origins in social constructivism and is influenced by the work of Lebow (1993), Jonassen, Mayes and McAleese (1993) and Jonassen and Reeves (1996). The Studio approach places the learner at the core of the teaching and learning experience, and, like Simon (1960), emphasises the importance of learner activity and interaction as viable mechanisms to support learning. According to the Studio approach, 'what the student does is actually more important in determining what is learned than what the teacher does' (Shuell, 1986). In a break from the transmissive mode of delivery, characteristic of many lecturing situations and increasingly evident in the design of many content-driven online courses (Brown, 1997), the Studio approach creates both a learning environment in which students are actively engaged in the learning process, and a more fluid and responsive learning environment.

The project-based approach of the Studio provides an environment for learners to:

- Plan and develop their own learning projects,
- Apply the skills and knowledge learned in concurrent subjects to the specific real-life scenarios provided by the projects,
- Work collaboratively with other learners to develop knowledge and understanding,
- Work with mentors and coaches,
- Work as mentors and coaches.

Studio projects provide realistic and relevant contexts, which encourage ownership and a voice in the learning process. They also provide an opportunity for authentic assessment by assessing the learner's ability to use and apply the knowledge acquired in the learning process in the types of settings and situations where it is ultimately destined to be used. This is contrasted with approaches that use the number of facts or concepts that are memorised and reproduced under examination conditions. Transfer and application are also important outcomes of learning in the Studio-teaching approach.

The Role of Technology in the Pedagogy

Technology is used in the Studio approach, not to deliver content, but to move the classroom focus from the teacher to the learner, and to create a more active and engaging climate for the learners. Oliver (1998) argues that such a shift will encourage learners to develop their understanding and their capacity to think and act critically. Students are encouraged to use hardware and software to create new Information Environments, and the World Wide Web is used to support communicative, collaborative and cooperative activities among students and teachers.

The Studio approach aims to foster creativity, reflection, articulation and reasoning. All of these aspects are important lifelong learning skills and

valuable graduate attributes. The purposeful use of technology and of group work is central to these aims. This approach to Studio-teaching and real-life projects can be applied so that both the students and the client benefit from a rich, industry-orientated format. The nature of these outcomes is explained in the following section.

Final Product

In accordance with the nature of the Studio pedagogy, the IE students were initially briefed about the nature of the project, technical attributes and the context of the material to be displayed. Over the eight-week duration of the project, the clients informed the development process for the design of the project, the creation of the initial concept designs and the selection of several preferred designs, which were short-listed through an online presentation. From this point the IE students were formed into Web design production teams. The structure of these teams was similar to professional Web design production teams, consisting of graphic designers, project managers, interface designers, programmers, and other relevant members of the team (DiNucci, Giudice, & Stiles, 1998).

Communication with the clients was initially through video conferencing. This allowed personal initial introductions between students at the separate campuses, a more personal formation of conceptual ideas and increased project understanding between both parties. This level of discussion and the establishment of understanding were comparable to that which could be achieved through a physical meeting. By 'breaking the ice' through video feed, a familiarity between the clients and designers began to develop and continued through other less 'physically constraining' forms of communication. From this point, most communication and discussion occurred through e-mail and bulletin board discussion. During the group development process the client group reviewed the designs online through their Web sites. The

clients provided feedback to the individual Web site production teams through use of e-mail.

The evaluation of the process by the clients allowed prevalent issues about electronic news systems to be revealed. These were used to further the potential of the specific E-News project discussed here.

Application of the Product: Online newspapers allow much easier archiving than traditional printed newspapers. They also provide increased potential for forward chronological linking through post-hoc modification. In a traditional newspaper, cross-referencing between stories can occur, but unless the reader has direct edition access to the previous linked stories the link is of minimal practical benefit. However, digital linking provides the potential for easy back referencing which allows the context to be further understood by the reader. Electronically enabled news also allows for easier forward chronological linking as well; that is, to provide links to relevant articles written after the one being currently read. This process requires post-hoc editing, an issue that is addressed in further detail later in this chapter.

Multiple Layering: Multiple layering of digital information is a further advantage of E-News systems. Traditional news is subtly framed by story construction conventions deployed by mainstream journalists (Fuller, 1997). International news agency style, which was developed to send stories by telegraph, can be identified in newspapers, radio and television broadcasts across the world. This style usually demands a lead sentence, which summarises the key points followed by a second sentence, which provides context and a third, which consists of a direct quote (Cappon, 1982). Television reporting adds another dimension by layering on the perceived need for colourful moving pictures.

News agency style explicitly shapes story construction while implicitly ordering and informing content selection. This process is recognised by public relations practitioners who create events which serve these stylistic demands and are there-

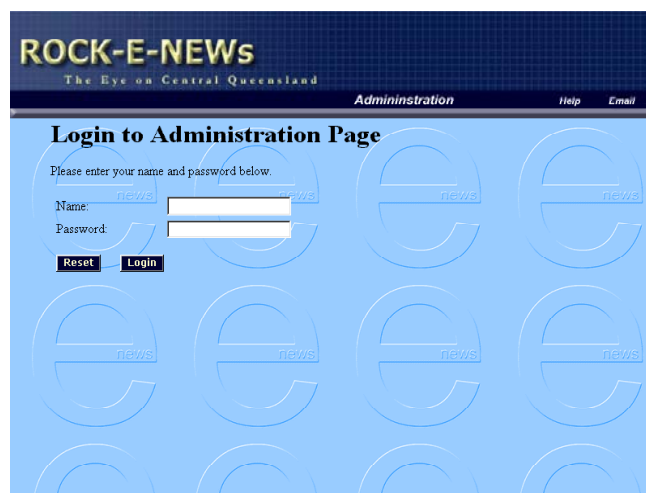
fore advantaged in the news making process. For example, news releases are usually constructed in news style, so that they can be more easily integrated into material offered as news by journalists. According to Knight and Nakano (1998), events can be staged to satisfy news values linked to news style.

The Internet allows stories to be multi-layered. For instance, a story delivered on the Internet can include hyperlinks to other sites which provide background information. News stories presented in this way can carry colour photographs, audio grabs and short QuickTime movies. Since all of these additional layers can be created, edited and lodged on the Web from a laptop in the field, gatekeepers who might misinterpret or even seek to censor the material can be excluded from the process (Stevens, 2002). This enables a trade-off between the levels of physical discontinuity and increased digital continuity which not only can achieve actions and events, but also report on current actions or situations from remote locations.

Another important issue raised by an electronic news system is article ownership. In an ICT environment, initial ownership comes down to those who posted the article. However, a further issue of ownership revolves around the point about who should be able to edit the articles—the contributor only, or other associated parties. In an ICT-enabled process these issues relate to overall site management which can have an overall editor or have contributors as editors. Thus, the impacts of digital news delivery results in not only challenging the roles of journalism, but also in causing changes in the basic relationship between traditional news providers and the larger community.

Such discussion begins to expose the potential of E-News for collaboration, community-based discussion and issue awareness in regional areas. The specific approach taken in this project builds upon these initial concepts of usability and informance and examines the potential of expanding them to achieve greater community awareness.

Figure 2. Administration Login Page



Community Journalism in Action

The Web sites constructed by using the Studio approach went live at the end of eight weeks of consultative development. The end result was an online design presentation to the client groups which involved the client groups conducting user testing on the sites. The journalism students involved in the testing of the Web sites used them in a manner to reflect real life work. They achieved this by working in groups to upload an assortment of news stories which included images, video footage and sound files.

This level of analysis of usability allowed further understanding of not only existing capacity but also potential applications for the E-News Web site to be explored. With such prototyping, inherent in the nature of ICT, it was possible to examine the constraints of these Internet applications, in terms of social control, collaboration and technical approaches. This experimentation revealed the potential of E-News systems to act as tools for improving community informatics in regional settings. The final site structures developed in this manner clearly demonstrated the potential of E-News as a collaborative community tool.

The final sites developed through the processes outlined above consisted of two major sections: the public Web site that displayed the articles, and the administration section that enabled the uploading of articles and associated files by journalists. The administration section required a login access which provided some level of control (see Figure 2).

This administration section enabled the journalists to be able to upload, edit and delete their stories with relative ease, through an easily used Web-based system (as shown in Figure 3). Journalists only needed to enter a title and summary and cut-and-paste the story into the text field. Adding the local file name and location on the computer through a series of simple online operations uploaded all associated files. In some sites, the ability to choose the location of a file-based image was also provided.

When a story was uploaded, journalists were able to view the layout of the article and remove it if it was considered that the layout was unsuitable for public viewing. This provided a very useable means for editorial control. An extensive help section was created to guide less experienced users through the process of uploading stories.

Online collaborative communities are not a new concept. Particular issue Web sites, such as Rugby Online (www.rugbyonline.com.au), have been focusing and drawing together like-minded people interested in particular topics. There are also many Web sites such as Yahoo groups (groups.yahoo.com) dedicated to allowing individuals to start their own groups for discussion, and where people can moderate and manage their own lists. Using the Internet for connecting people who reside in the same spatial area or who have similar geo- and socio-economic circumstances is not yet quite as common as the more well-known global approaches. This style of Web site connects people of a spatial location and allows them to communicate about a range of issues that affect them as members of that community. Whilst some online newspapers such as the Sydney Morning Herald (www.smh.com.au) do provide a level of regional information, they do not provide the ability for readers to act as a content provider.

As an example of the type of Web site approach now making its appearance in communities all over the world, a recent initiative by a local government in Victoria, Australia, has begun to see online regional community collaboration increase in particular areas. For example, the Moreland Com-

munity Council trialled an E-Discussion forum and electronic newsletter for local residents. This E-Discussion forum worked through an e-mail list system to share information rather than a Web site which was viewable by the whole community (www.moreland.vic.gov.au/news/mr190802.htm). The E-News system has the ability to provide not only a supplementary online news service but also an asynchronous collaborative medium for sharing local content news in regional communities.

Advantages and Potential of E-News

The E-News system has a number of very clear advantages. It allows for not only increased flexibility, but also for greater media utilisation through processes easily accessible to regional communities. The major attributes which make the system beneficial as both a journalistic tool and a collaborative community medium are described below.

INFORMATION TECHNOLOGY

The key underlying aim of developing and examining this system was to enable users who only have

Figure 3. Adding News Articles

The screenshot shows a web form titled "ROCK-E-NEWS" with the subtitle "The Eye on Central Queensland". The page is for "Administration" and includes links for "Help" and "Email". The main heading is "Add News Article Page". The form fields are:

- Title: [Text input field]
- Author: [Text input field]
- Date: [Text input field containing "20 September 2000"]
- Category: [Dropdown menu showing "Main News"]
- Text: [Large text area for the article content]
- Media File: [Text input field]
- Summary: [Text input field]

 At the bottom of the form are "Reset" and "Submit" buttons. The background of the page features a repeating pattern of the "ROCK-E-NEWS" logo.

basic computer skills to be able to competently use the Web site, by providing usable layout, well-structured pages, simple upload mechanisms and clear instructions. As home adoption of Internet technology increases in developing and developed countries alike, the basic computer literacy is increasing. The system developed here only requires basic Web searching capacity.

Another aspect of access for E-News is access to basic computer equipment inside the regional community. Effective community use of an E-News facility does not require all community members to have Internet access. Rather, it requires that some of the key players (community figures, such as head of schools, mayors, community leaders and so on) have access, with others in the community being able to access the Internet. Whether this occurs through public or private resources is not relevant, just as long as large sections of the community can be involved in E-News with limited effort. It is in this sense that the community can be and is actually involved, which ultimately drives the usability of the E-News system.

Synchronous news delivery is made possible by such a system, by enabling users to contribute online and in real-time. A synergy is formed through this level of collaboration with the ICT facilitating the community interaction. Future directions for this E-News system are considered later in this chapter in terms of community interaction and involvement while considering the technical attributes and constraints.

The system employs a considerable level of flexibility involving such attributes as multiple file types and cut-and-paste which reduce the need for a content editor through real-time synchronicity. Further explanation of the role of editors continues in the discussion related to community below. As with normal practice of e-lists, E-News systems can be moderated or un-moderated. Moderated lists obviously require more effort from employed or voluntary resources. This can be in the form

of formal editors or subject specialist voluntary moderators.

The system described above may be seen to blur the lines between bulletin boards¹ and online newspapers. The expiry date of news articles for E-News is relatively short in the traditional sense.

The E-News online equivalent to 'letters-to-the-editor' may be implemented as a bulletin board. Essentially, readers may post comments related to articles that in turn may be replied to by other readers. Such an interactive discussion is called a 'thread'.² Through adding aspects of bulletin boards and online newspapers, a richer online environment for E-News can be created by merging these two systems. Such an approach allows the E-News service to not just disseminate news but to also encourage community involvement.

Community

E-News aims to bring journalism to the community. However, by developing such an online environment to aid journalism delivery, it may also contribute to bringing community to journalism. The system described above has added to existing mechanisms of traditional journalism, and in so doing, has expanded the scope of journalism to include informative members of the community. This has enabled the E-News service to adapt the potential nature of interaction between community members with traditional news services.

Such community involvement provides challenges to the traditional roles of journalists and editors. An initial step could involve the selection of community members that have trusted status to publish online. These community members would have the ability to write their own articles on local situations, events or public comments. Essentially this allows a set of 'grass roots' journalists to bring the mass media back to the community level. This is an extension of public journalism, which not only displays topical information but also

engages the community through readers' opinions and values. 'The public journalists newspaper is doing what the conscientious citizen would do given the time and resources to do it' (Rosen & Merritt, 1994). It opens an opportunity to engage in the user's stories through community discourse, which enforces a reader's sense of involvement and their perceptions of worthiness to state an opinion. This community interaction provides a potential catalyst for regional areas to regain a holistic feeling of belonging.

Interactivity: Traditional journalism has a distinct hierarchy of structure in its nature, with editorial control being applied across all stories and their headlines. The traditional role of the journalist is challenged by empowering untrained community members to make contributions of newsworthy items in a public place of mass dissemination. This challenges the traditional role of the editor in as much as the editorial role is thus devolved to the individual contributors. This can result in the contributors growing to be part of a trusted community who self-publish on a credible site which has regional community ownership in the same sense as a daily print newspaper. It is worth noting that this approach varies with the ability of contributors to post discussion and editorial comment adding to existing stories rather than the simple posting of articles. Figure 4 depicts the overlap in the roles of community, writers and key community members.

It is possible for a system to be structured in such a way that the approach of traditional journalism is encompassed in the new system. From a journalistic approach, this requires the editor to moderate stories, and from an ICT approach, a Web master to manage the structure of the site. However, these roles can be encapsulated into one, essentially combining the editor and the typesetter (i.e., Webmaster). For a community, this results in the hierarchy of information providers being diminished, allowing open discussion to occur, and encouraging greater community awareness.

Real-time synchronicity: Real-time synchron-

icity allows contributors to engage with E-News systems at several levels. This occurs directly, by encouraging interaction through discussion on community issues, but also indirectly by fostering community awareness. This occurs because users can interact (chat) in real-time, thus encouraging an approach that through its very nature, is community-orientated. In such a site, even with contributor moderation, a greater sense of local ownership can occur, and may lead to encouraging the community as a whole to interact and participate in the 'local' online newspaper.

Ownership: The issues of ownership essentially arise from adding and editing articles post-hoc completion. From an ICT perspective, the implications of ownership are almost non-existent. The ICT can be structured to deliver any ownership situation that is desired. The issue resides with the sense of ownership from a community viewpoint. If community control is achieved, as discussed in areas above, post-hoc altering can encourage:

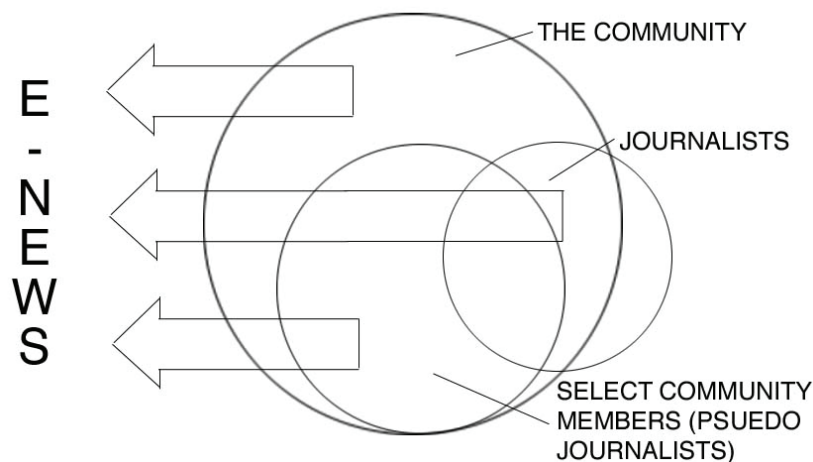
- Forward chronological editing to articles,
- Additional information added to a story, thus enriching the reader's experience, and
- Information updates to correct errors.

Essentially, this approach adds to the community's body of knowledge.

So if the approach outlined here can be so beneficial to community journalism, there is the question of what can work against its implementation. Major issues are article ownership and authenticity. In cases where people are free to update, correct and change the article content, who owns the article and is it credible information? Thus, the potential to free journalism from the traditional constraints which restrain and centralise control of public knowledge through online collaboration raises questions about comment ownership and all of its legal implications, authenticity and community demand.

However, we suggest that like most other products of technology, community based E-

Figure 4. The Nature of Connections with E-News



Journalism should be seen as an adjunct rather than a substitute for traditional journalism offered online. Web sites such as the Sydney Morning Herald Online (<http://www.smh.com.au>) or the Washington Post Online (<http://www.washingtonpost.com>) continue to attract significant hits in part because they offer badged information, which is presented in recognisable and therefore more easily assessable packages. These packages are framed by the publishers' familiar political, cultural and social assumptions (news values) and contain stories created within journalistic conventions including notions of accuracy, fairness and writing styles. In light of this complimentary approach, the creators of local newspapers, which in the case of smaller circulations are run by those who have a community interest rather than just those who are professionally trained, can benefit. Developing a resource which encourages and allows the sharing of news, views and information in a continuous format, rather than on a weekly or fortnightly basis as is traditional in print formats increases community awareness and knowledge of local events and happenings.

While stories made available through this means can be seen as subjectively selected and assembled arguments, there is a qualitative

difference between journalism, which should contain identifiable reference points (quotes and undoctored photos), and unsubstantiated rumour or intentional misinformation. It follows that consumers might more easily judge a *Washington Post* report of President Bush's latest news conference than a Matt Drudge (Drudge, 1998) essay based on anonymous tip-offs from the Web.

While all community members who wish to contribute to the online formats outlined here should be considered equal, the information they produce should and could not be considered equally informed. One only has to log into any one of hundreds of Web sites, such as Yahoo's Washington Politics Arena, to see ignorance, arrogance, national chauvinism and unbridled racism paraded as the free exchange of ideas. In this sense, journalism's hierarchical gate-keepers (editors) can be seen to be responsibly serving communities by excluding vilification, defamation and intentional rumour mongering.

Freedom of speech demands responsible contributors as well as a discerning public, if it is to underpin democratic decision-making³. The Internet provides the public with greater choices but it does not necessarily validate the information it makes available.

The legality surrounding the publication of electronic material is an evolving area of law. As a rule of thumb, the common legislation of publishing printed material tends to apply in the virtual realm as well. This encompasses such issues such as defamation of character, slander, mis-representation, privacy, and intellectual property. While this is not an area of expertise for the authors of this chapter, there are still several general issues that require addressing in this discourse. From a legal standpoint, all users should be required to register before they can upload information to an E-News type of Web site. This essentially makes each user accountable for the material they upload, and also associates a user's name with an entry which results in an informal community moderation process. From an ICT perspective, the Web site administrator (responsible for technical issues) could potentially double as a secondary moderator. It is also possible with the use of smart coding to have the system scan all articles upon upload. The kind of technology is currently used on forum (chat) Web sites to either remove or replace offensive language with emoticons (icons, to imply the desired expression). Ultimately, by making users responsible for their own content and producing automatic safeguards on derogatory language, constructive community discussion can occur online. Further, it is possible to require individual computer registration before access is granted.

The potential of E-News as a tool for collaborative interaction at the regional community level is apparent. The ability of any community member to deliver information in a near synchronous format, to a wider audience, encourages a level of interactivity and a sense of belonging not limited by physical constraints. With such a system which enables grass-roots journalists to express views on events, E-News can work as a stimulant in community informatics for encouraging community practice (development, service and action) in regional areas.

Future Trends

The full potential of the E-News system has not yet been realised. The system described in this development shows the potential for online community journalism which at the same time could be applied to issues of issue-based collaboration inside a community. From an ICT perspective, E-News is flexible, interactive and adaptable, and can build upon the base of the traditional newspaper. From the community viewpoint, E-News can potentially be of great value by bringing journalism to the community, the community to journalism, increasing community awareness of local issues, providing new opportunities for community involvement in news, providing a basis for community action and increasing the sense of place which has been thus far threatened by all forms of new technology. However, issues of authenticity and the legal issues surrounding this are still problematical areas. This project has demonstrated the 'do-ability' of such an approach; however, there is great scope for research into application issues.

The future of such an approach described here lies in the ability to not only draw the community together, but for the system to be used as a vehicle for providing community standpoints to an external audience. The result is a potentially well-formed discussion catalyst and entity to encourage community cohesion.

Information Technology

From an information technology viewpoint the E-News approach has very few constraints. The real benefit of E-News lies in the flexibility of the system, providing information upon demand by the readers combined with delivery on demand by the contributors. The two exciting areas in which ICT enabled regional news can be further explored are in 'threads' and 'moderation'.

The concept of threads can be taken one step further than the majority of current use. Using threads, stories can be linked to other articles that contain relevant information, expanding the body

of supporting knowledge that both a contributor can rely upon and a reader can obtain. Viewing these ‘threads’ and previous discussions provides a further understanding and contextualisation of other articles posted.

Moving to more editorial control can deliver an ability to connect threads between discussions and link them to related articles. Through maintenance of editorial control, contributors need only have average computer skills — in particular the need for skills in linking articles or discussion through hypertext. This inverse relationship between level of moderation and skill level required can be shown in Figure 5.

Through the expansion of technological aspects, the usability of E-News is in turn increased. With the increasing access and uptake of Internet technologies, the nature of Web-based news systems such as that briefly described here, will result in increased possibilities for many communities in both developing and developed situations.

COMMUNITY

From a community viewpoint, the potential of the E-News approach needs to be dynamic and informative. The future trends need to incorporate the formation of virtual communities to support

the physically distinct locations, whilst enabling these groups to interact both as groups and as individuals with the greater virtual world.

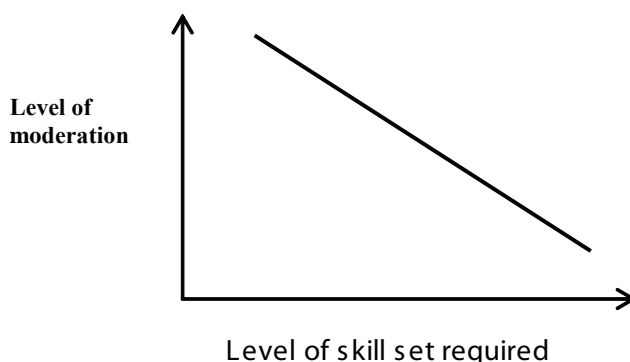
The current E-News approach incorporates substantial community involvement through grass-roots journalism and an increased feeling of belonging as mentioned above. Because of its ability to be a catalyst for extending community interactivity and awareness, the future potential for E-News approaches are numerous. Some of the more easily achievable extensions are outlined below:

Forum: A relatively synchronous, two-way interactivity. This application will allow more direct discussion beyond the scope of merely posting comments to articles, thus encouraging continuous communication.

Interactive Newsletter: Such a newsletter could focus on a lower level of involvement through one-way asynchronous interactivity, thus encouraging engagement with people who are interested and want to be aware but who are passive consumers.

Empowerment: The technology and its applications briefly outlined above allow people to choose their own level of involvement. The relatively low threshold, both journalistically and technically, empowers people to become involved at whichever level they desire.

Figure 5. The Trade-Off of Skills to Centralised Editorial Control



Community Journalists: Community journalists can push information into the system, whilst allowing news consumers to discriminate what they draw from the E-News site. Future trends are towards an increasing percentage of the community having computer access, which allows an increase in push technology. The involvement of community journalists is shown in the following diagram (Figure 6).

The various levels of synergy between intra- and inter-community interaction are shown in Figure 6. The involvement of community journalists is depicted in Figure 6 and shows that the E-News system can be a catalyst for intra-community interaction. In a larger setting, the ability for communities to interact with each other as a whole can be motivated to a level of a co-ordinated local public approach. The holistic virtual community can also act to enable substantial interaction, through a critical mass, with society.

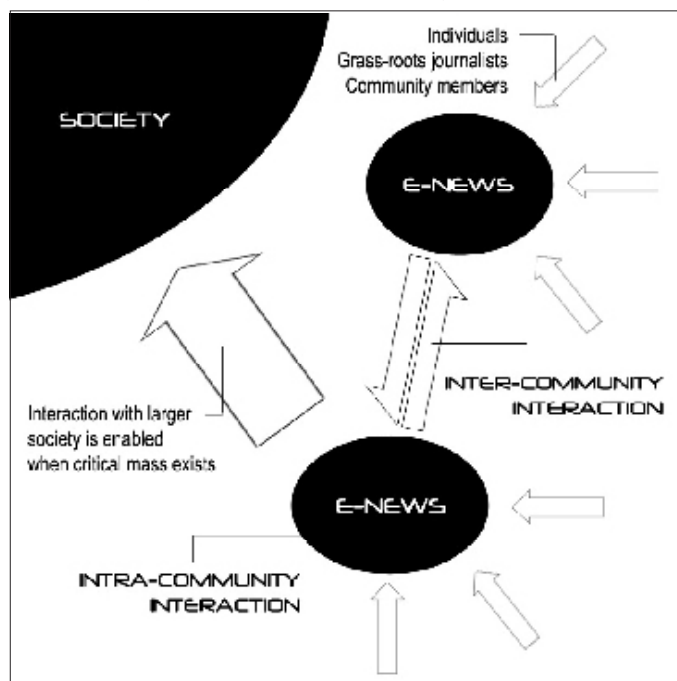
In this way individual members of particular communities can be engaged in discussion at

a societal level. This empowerment mediated through an E-News approach increases the value of community discourse at an intra-, inter- and societal level.

CONCLUSIONS

The experience described here, when coupled with similar experiences all around the world, demonstrates that the limiting factors of the E-News systems are in the bounds of community values and traditional organisational restraint, rather than in technology. By challenging the traditional roles of journalism through approaches similar to E-News, there is large potential for regional communities to make better use of Internet technologies in a social context through the resultant interaction that these approaches can deliver. This provides a framework to consider how regional community-based journalism may be reconceptualised.

Figure 6. The Levels of Community Interaction Surrounding E-News



This chapter has also demonstrated that there is value in using studio pedagogy to develop and test real life projects without affecting future success prospects through adverse experiences in undertaking pilot projects.

ENDNOTES

- ¹ A system that enables users to send or read electronic messages, files, and other data that is of general interest and addressed to no particular person.
- ² A thread is a set of posts on a newsgroup, composed of an initial post about a topic and all responses to it.
- ³ First Amendment, US Bill of Rights.

REFERENCES

Brown, A. (1997). Designing for learning: What are the essential features of an effective online course? *Australian Journal of Educational Technology*, 13(2) 115-126.

Cappon, R. (1991). *Associated press guide to news writing: A handbook for writers from America's leading news service*. New York: Macmillan.

De Fleur, M. (1997). *Computer assisted investigative reporting*. NJ: Erlbaum Associates.

Di Nucci, D., Giudice, M., & Stiles, L. (1998). *Elements of web design*. Berkeley, CA: Peachpit Press.

Drudge, M. (1998). Anyone with a modem can report on the world. *National Press Club Address*. Retrieved November 4, 2002 from: <http://216.247.220.66/archives/drudge/drudge.htm>.

Fuller, J. (1997). *News values: Ideas for an information age*. Chicago, IL: University of Chicago Press.

Jonassen, D. & Reeves, T. (1996). Learning with technology: Using computers as cognitive tools. In Jonassen, D. (Ed.), *Handbook of Research on Educational Communications and Technology* (pp. 693-719). New York: Macmillan.

Jonassen, D., Mayes, T., & McAleese, R. (1993). A manifesto for a constructivist approach to uses of technology in higher education. In Duffy, T., Lowyck, J., & Jonassen, D. (Eds.), *Designing Environments for Constructivist Learning* (pp. 231-247). Berlin: Springer-Verlag.

Knight, A. & Nakano, Y. (1998). *Reporting Hong Kong*. London: Curzon.

Lebow, D. (1993). Constructivist values for instructional systems design: Five principles toward a new mindset. *Educational Technology Research and Development*, 41(3), 4-16.

Oliver, R. (1998). *Teaching and learning on the World Wide Web: A guide for teachers*. Perth, Australia: Edith Cowan University.

Rosen, J. & Merrit, D. (1994). *Public journalism: Theory and practice*. Dayton, OH: Kettering Foundation.

Shuell, T. (1986). Cognitive conceptions of learning. *Review of Educational Research*, 56, 411-436.

Simon, H.A. (1960). *The new science of management decision*. New York: Harper & Row.

Stevens, J. (2002) Backpack journalism is here to stay. *Online Journalism Review*. Retrieved November 4, 2002 from: <http://www.ojr.org/ojr/workplace/1017771575.php>.

Chapter 3.12

Role of ICT in Establishing E-Government System for Disadvantaged Communities

Hakikur Rahman

Sustainable Development Networking Programme, Bangladesh

INTRODUCTION

Information and communications technologies (ICTs) are playing an increasingly vital role in the daily lives of all communities by revolutionizing their working procedures and rules of governance. ICTs offer a unique opportunity for governing elite to overcome the crisis of representative democracy, as ICT and the Internet empower civil society to play its role more effectively and facilitate the performance of governments' main function-serving the people who elect them (Misnikov, 2003). In the realm of government, ICT applications are promising to enhance the delivery of public goods and services to common people not only by improving the process and management of government, but also by redefining the age-old traditional concepts.

Community networking groups and local government authorities are well placed to campaign for greater inclusion for all members of the community in the information society. Possible

areas to target include the provision of technology at low or no cost to groups through community technology centres or out of hours school access. There are many possibilities and local government must take a significant role in these activities (Young, 2000).

Information society is based on the effective use and easy access of information and knowledge, while ICT for development (or ICTD) is not restricted to technology itself but focusing on manifold development and diverse manifestations for the people to improve their well-being. ICTD has deep roots in governance, is part of governance and has effects on governance patterns and practices at both central and local level.

By recognizing these facts, UNDP focuses on technologies to end poverty at WSIS Cyber Summit 2003, and emphasizes on ways that new technologies can help lift more than one billion people out of extreme poverty (UNDP, 2003). Apart from the four Asian IT giants (Korea, Rep., Hong Kong, China, Taiwan, China, and

Japan), most of the Asian countries have fallen under the “low access” category of the Digital Access Index. This has also been referred in the WSIS Cyber Summit 2003, until now, limited infrastructure has often been regarded as the main barrier to bridging the digital divide (ITU, 2003). Among the countries with ICT spending as share of their GDP, Sweden, UK, The Netherlands, Denmark, and France (8.63, 7.97, 7.39, 7.19, and 6.57% respectively during 1992-2001) remain at the top (Daveri, 2002, p. 9), while countries like Bangladesh, Greece, Mexico, Niger, and many more remain at the bottom (EC, 2001; ITU, 2003b; Miller, 2001; Piatkowski, 2002). In a similar research it has been found that in terms of average share of ICT spending GDP, New Zealand, Sweden, Australia, USA, and UK (9.3, 8.4, 8.1, 8.1, and 7.8% respectively during 1992-1999) were among the highest (Pohjola, 2002, p. 7), though most of the countries in the Asian and African regions remain below the average of 5%. The disadvantaged communities in the countries staying below average in ICT spending seem to be lagging in forming appropriate information-based economy and eventually fall behind in achieving proper e-government system.

The e-government system in those countries need to enhance access to and delivery of government services to benefit people, help strengthen government’s drive toward effective governance and increased transparency, and better management of the country’s social and economic resources for development. The key to e-government is the establishment of a long-term dynamic strategy to fulfill the citizen needs by transforming internal operations. E-government should result in the efficiency and swift delivery and services to citizens, business, government employees and agencies. For citizens and businesses, e-government seems the simplification of procedures and streamlining of different approval processes, while for government employees and agencies, it means the facilitation of cross-agency coordina-

tion and collaboration to ensure appropriate and timely decision-making.

Thus, e-government demands transformation of government procedures and redefining the process of working with people and activities relating to people. The outcome would be a societal, organizational, and technological change for the government and to its people, with IT as an enabling factor. E-government should concentrate on more efficient delivery of public services, better management of financial, human and public resources and goods at all levels of government, in particular at local level, under conditions of sustainability, participation, interoperability, increased effectiveness and transparency (EU, 2002).

ICT brings pertinent sides more closely by prioritizing partnerships between the state, business and civil society. A few East European countries have become economically liberal with the high level of foreign direct investment per capita and at the same time became ICT-advanced regional leaders in terms of economic reform. These countries also present the region’s most vivid examples of partnerships and collaboration. They have clearly manifested the importance of the public-private partnerships, transparent bottom-up strategies, involvement of all stakeholders, total governmental support, capturing economic opportunities, and enabling electronic mediated businesses, responding to the challenges of globalization.

BACKGROUND

Electronic government refers to public sector use of the Internet and other digital devices to deliver services and information. As the e-government industry expands worldwide, the complexity and specificity of online services continues to develop. Many nations have sites devoted specifically to e-government, on which they present new initiatives as well as offer listings of services available

online. For example, Taiwan, Singapore, and the United States have highly developed portals, which serve as gateways to a plethora of government services as well as directories to other specific government sites (West, 2004).

Definitions of e-government range from “the use of IT to free movement of information to overcome the physical bounds of traditional and physical-based systems” to “use of technology to enhance the access to and delivery of government services to benefit citizens, business partners and employees.” The common theme behind these definitions is that e-government involves the automation or computerization of existing paper-based procedures that will prompt new styles of leadership, new ways of debating and deciding strategies, new ways of transacting business, new ways of listening to citizens and communities, and new ways of organizing and delivering information (Pascual, 2003). E-government is a sub-set of the broader phenomenon of e-governance, and can be understood as the application of information technology’s tools and techniques to the workings of government for the benefit of its “customers”—citizens and businesses—as well as for itself (Scacco, 2003).

With the proliferation of easy-to-use Internet and Web technology, many federal, state and local governments now provide the necessary instructions and forms for specific services. This facilitates citizens with direct interaction with the desired government service. However, this first phase of digital government efforts has resulted in a fragmented conglomeration of services and information sources (Chun, Atluri, & Adam 2002).

In ways, governance systems are not always neutral to ICTs; they may sometime support or sometime obstruct the application of ICTs for development. The era of the global information society, as brought about by the technological advancement and globalization in trade and

economy may create challenges to the society, restrict the development of grass-roots communities; contests the business accomplishment and create barrier to the professional development if congenial policies have not been adopted by the government.

Governance, participation, and inclusion stand to benefit from the networking opportunities and access to relevant knowledge across distances. ICT can finally bridge local, regional and central governments, although it is difficult to separate the work of central government from overall governance practices. If a common platform of e-governance may be initiated, it does not matter much whether the central government provides nation-wide services or a grass-roots telecenter in a remote area services local villagers.

However, the central government need to review regularly its citizen services, retaining only those that are a clear public good, while outsourcing (whether fully or partially) to the civil society and private sector those that are too expensive or difficult for the government to administer or that would simply be better and faster delivered by non-governmental organizations.

Aims of E-Government

The aim of the e-government policy is to set the enabling framework for the government administration to effectively and efficiently utilize ICT opportunities and to guide the forward move in the right ICT direction along an accelerated path in contributing towards the economic and social upliftment of the nation. It will enable the citizen to be a beneficiary in the global information economy and would create the framework for an e-society to support their economic, learning, and personal needs (e-Sri Lanka, 2003).

E-government may be set to accomplish the following goals that move beyond mere efficiency of government processes to that of overall reform and development:

- Better business environment
 - Technology is a proven catalyst in increasing productivity and economic growth, especially in rural and under-served communities (Konrad, 2002) (remote and disadvantaged). The use of ICT in government and the establishment of e-government infrastructure assist to create a business-friendly environment at the grass root level. These can be achieved by streamlining the interactions and improving the interfaces between government and business focusing SMEs. By eliminating redundancies in procedures and emphasizing immediate and efficient delivery of services, e-government creates the atmosphere to attract the investors/investment
- Strengthened governance
 - Promoting transparency and accountability in government through the proliferation of ICT in management and operations opens opportunities for better mobilization of resources, efficient decision making and good governance
- Enhanced public participation
 - E-government facilitates swift delivery of information. Mass dissemination of information assists empowerment of citizens and facilitates informed decision-making. Eventually, citizens are made to be more actively involved in the policy and decision making processes of the government
- Improved productivity and efficiency of government agencies
 - Re-engineered management processes and procedures, efficient delivery of services, increased productivity of the bureaucracy, and increased savings are the inherent benefits of e-government system

With its emphasis on the use of information technology in the delivery of services, e-government presents a government agency with the opportunity to re-think how it delivers services. Specifically, e-government offers the agency the opportunity to: examine its current operations and procedures, identify business processes and practices that can be streamlined, implement those streamlined business processes, and implement new technologies that enhance those improvements. In the processes of streamlining business operations, a properly implemented e-government solution provides the agency with the opportunity to focus its resources on service delivery efforts that are most efficiently provided through direct contact versus other means (Pascual, 2003).

The success of efforts in achieving e-government lies in the way that technology is utilized and managed by the public sector. ICT as the enabling tool and with effective deployment it could facilitate the desired results in the long run. Systems, processes and procedures constitute the framework for the usage of ICT. However, the critical factor for the delivery of the desired results is the willingness of the public sector and the citizen to use and adapt to new technology-based environments (e-Sri Lanka, 2003). The government agencies should find innovative ways of working in fulfilling the needs of the people within the information society.

METHODOLOGY

Stripped down to its bare essentials, e-government is concerned with leveraging and distributing knowledge more effectively government to citizen (G2C), government to business (G2B), and inter-departmentally within government (G2G) (Smith, 2004), including government-to-employee (G2E) relationships.

A country needs to focus on the following areas from the unified perspective of national

governments, the telecom industry, and economic perspectives by:

- Making a connectivity breakthrough by expanding networks outside the urban areas
- Developing Web-based online services for the general public
- Providing large-scale Internet and capacity development training for the general public
- Identifying information and content needs and generating local content for social groups, entrepreneurs, farmers and communities
- Encouraging the development of need-based and bottom-up ICT strategies within a defined framework
- Making telecom sector a national priority
- Reforming telecommunications' legal and regulatory frameworks to facilitate nationwide network expansion, lower tariffs, affordable Internet access, higher teledensity, faster application of advanced technologies (broadband and wireless), increased openness and competitiveness in the markets
- Creating a regulatory environment in the telecom industry

The government should have clear concept on the formation of an information society with positive impact on the national economy. The transitional information society need to include the following strategies:

- Modernization of public administration and services
- Improvement in quality of life through the implementation of information technologies in the areas of education, health, environment and communication
- Development of an information technology sector and form a National Task Force to intensify congenial atmosphere for establishment of an information society

- Modify the educational system by including digital content (E-government Strategy, 2002)

E-government services focus on four aspects: citizens, the business community, government employees, and government agencies. E-government aims to make interaction with citizens, businesses, government employees, government agencies in more convenient, user friendly, transparent, inexpensive and effective way.

In e-government system individuals can request for a particular government service and then receive that service through the Internet or some computerized mechanism. The government service can be delivered through one government office, instead of many (as one-stop-service), a government transaction can be completed without direct in-person contact with the government employee.

The following sub-sections would like to constitute the main thrust of this chapter, describing a few parameters that may assist to enhance the e-government system in disadvantaged communities.

Improved Collaboration

Governments will have to explore new relationships among government agencies as well as partnerships with the private sector and NGOs to ensure quality and accessibility of e-government. Agencies may have to overcome traditional reluctance to work with each other to maximize benefits of scale in e-government projects. Collaboration among government entities, private enterprises and NGOs can assist policy-makers in crafting meaningful reforms and can expedite the implementation of e-government. Private sector experts, who deeply understand topics such as e-commerce, information technology, marketing and management, can advise government policy makers (Sakowicz, 2003).

In this context, four dimensions of e-government may be broadly categorized:

- **E-Services:** Electronic form of delivery for government information, programs, strategies, and services.
- **E-Management:** Information systems supporting the management and administrative functions of public institutions, including data and information management, electronic records maintenance and intra departmental information flow.
- **E-Democracy:** Assist to set agendas, establish priorities, make important policies and participate in their implementation in more deliberate ways (such as e-consultation or e-voting).
- **E-Commerce:** This concept is linked to the business side of government interaction (e-procurement—exchange of money for governmental goods and services conducted over the Internet/Intranet).

Extensive Participation of Common People

E-government is the use of ICT to transform government by making it more accessible, more effective and more accountable to the common people. By this definition e-government does not mean putting more computers on the desks of government officials. Rather, it concerns the relationship between government officials and people. The reformation may include:

- Providing greater access to government information by making laws, regulations, forms, data collected by the government to be made accessible online; promoting civic engagement by enabling the public to interact more conveniently and interactively with government officials
- Increasing government accountability by making its operations more transparent,

thereby reducing the delay in decision making and also reducing opportunities for corruption infiltration; supporting development goals by lessening the time and expense of small business entrepreneurs in their dealings with government, and by providing rural and disadvantaged communities with information and communications capabilities

- E-government is not any more a phenomenon limited only to the richer countries. Some of the most innovative uses of the Internet in governance are emerging from the developing world, as ICTs are increasingly being used to streamline government and connect it more closely with the people en masse it is intended to serve

Increased Economic and Societal Participation at the Grass Roots

Introducing e-government is a necessity in the contemporary economy. Its advantages are known, recognized, and incontestable. For this reason, the question is not if, but how, to implement and promote e-government in transitional economies by taking into account the significant discrepancies between the capacities of developing countries and those of more developed countries. These include both economic and social factors, not least of which is the relative absence of necessary specific habits and skills for the successful advance of technology.

The effectiveness of e-government solutions differs according to the stakeholders they address, whether common people of the community, business entrepreneurs or legal entities. The distinct challenge applies to reaching people in general. There are common thoughts of favoring business-oriented e-government applications over people-oriented ones.

However, implementation of an integrated e-government requires resolution of a few practical issues, like, breaking of monopoly on the fixed

telephone market; the capacity development for the Internet service providers; raising of computer illiteracy for the government staffs; easy availability of modern payment instruments in electronic form; and the application of electronic signature law.

In developing countries, access to information infrastructure remains always inadequate, and progress on telecommunications policy reforms are lagging behind. Yet there is an opportunity for leapfrogging the new technology can provide better, cheaper links to the grass root stakeholders, while competing global operators can provide low-cost long distance communications. Adopting new technologies, developing countries can deploy telecommunications at lower costs per capita than the industrial world and rapidify poverty alleviation processes (Rahman, 2003).

Enhanced Transformation

E-government is about transforming the way government interacts with the governed (government, business, people). The process can neither be easily accelerated nor simply can be manifested. It requires a coherent strategy, beginning with a thorough review of the nation's current regulatory environment and the ability of the population to make use of the planned technologies.

The primary motivation for e-government reforms should not be targeted to merely save money or reduce staff. While this can be a valuable output, the savings incurred from e-government initiatives should be the benefit the businesses and people utilizing the improved system are enjoying, rather than the government agencies have invested initially. In order to realize the long-term benefits of the transformation, governments should develop a citizen-centric model involving key stakeholders outside of government- businesses, trade associations, researchers, professionals, academics, CSOs, CBOs, and NGOs.

The success of e-government transformation is not just about the automation of existing pro-

cesses and inefficiencies. It is the creation of new processes and new relationships between governed and governor. The use of ICT should not be treated as just a cost- or labor-saving tool and simply allotting government officials with computers or automating manual records. E-government is a solution that can revolutionize the process of government within itself. Therefore, government leaders planning e-government projects should first examine the function or operations which they want to apply through ICT.

E-government requires strong political leadership within the government. In order to achieve successful e-government transformation, there must be officials at all levels of government who understand the technology and the associated policy goals with proper motivation to carry out reforms. Strong leadership can ensure the long-term commitment of resources and expertise as well as the cooperation of discrete factions within the system.

CASE STUDIES

A few case studies have been described in this section to illustrate cases in countries that have successfully adopted policies in their national ICT policies or taken approaches to implement the policies, focusing disadvantaged communities.

Bangladesh, being one of the developing country has integrated the societal participation at the grass root level. Relevant article from Bangladesh ICT Policy is added next for reference (ICT Policy, 2002):

- **3.10: Social Welfare.**
- **3.10.1:** Nation-wide ICT systems will be implemented for rural development activities, agricultural, horticulture, fisheries and livestock extinction for youth, technology guidance for rural enterprise, micro level planning, and so forth. Communicates and user groups or beneficiaries would be ac-

tively encouraged to participate in all such activities.

- **3.10.3:** Non-government organizations will be encouraged to establish centers at the village level for providing hardware/software or other support services. At the sometime the Government will use both the formal and nonformula channels to disseminate information about the application, advantages to communities of the use of ICT.

e-Sri Lanka takes a comprehensive approach to using ICT for overall development by promoting the growth of this promising sector, and more importantly by using ICT as an enabler for all the key sectors in the economy and society (World Bank, 2004a). The vision of e-Sri Lanka came about in response to the observed impact in India of the use of technology in development, and in transforming government. It is a concerted effort by the Sri Lankan government to design and implement a comprehensive, nationwide strategy to harness the potential of ICT for the achievement of broader socio-economic goals (Development Gateway, 2004).

Objective of the e-Sri Lanka Development Project is to promote: (i) use of ICT to enhance growth, employment, and equity through affordable access to means of information and communication; (ii) access to and use of public information and services on-line by citizens and businesses; and (iii) competitiveness of private sector, particularly of knowledge industries and Small & Medium Enterprises (SMEs). (World Bank, 2004b)

The Indian experience in e-government can be seen to be evolved in three phases. The first from the late 60s, or early 70s to the late 90s; second from late 90s to 2000; and the third 2000 onwards. The very recent trend of e-government systems in India achieved tremendous success in forming a homogeneous community across the country.

In the first phase, efforts to develop e-government were concentrated on the use of IT for in-house government applications with a principal focus on central government requirements as defense, economic monitoring and planning, and certain data intensive related to elections, conducting of national census, and tax administration (GOI, 1985). In the second phase, the implementation of the national IT Task Force and State Government IT policies symbolized a paradigm shift in e-governance policies towards using IT for a wider range of sectoral applications reaching out to a large number of people in rural as well as urban areas (Madon, 2003). The third phase has seen the ultimate development of e-government systems in India, reflecting visionary implementation of India Vision 2020 and e-India. Another example for India can be the Government of Kerala's recent policy focus on establishing front-end computerization to trigger the administrative reform, even before the automation of departmental records.

A statement made by Abraham Sotelo, the coordinator general of the E-Government Programme of Mexico has been quoted here, "E-Government is intended to strengthen the framework of professionalism in public service as well as lower government costs. It will help create a more deregulated government and eliminate a lot of paperwork and bureaucracy. The main objective is to create a high quality government service that is also honest and transparent" (World Report, n.d.).

Among many other successful e-government approaches implemented or adopted globally, IT2000 of Singapore, Digital 21 of Hong Kong, Malaysia Vision 2020 of Malaysia, and Mauritius Vision 2020 of Mauritius are to name a few.

FUTURE PROSPECTS

E-government offers the potential to bring citizens closer to their government. From 2001 to 2004,

e-mail interactions through government Web sites have increased from 73% to 88%. In e-government rating, North America scored 39.2, while Asia has only 31.6 in 2004. Despite this progress, there are still a diverse issues that hinder their ability to reach their full potential in terms of accessibility and effectiveness, especially in many developing countries (West, 2004).

E-government is an expensive tool requiring strong and enduring political will. Without the active commitment of government leaders, states are not assured the allocation of financial resources, the adoption of an appropriate legislative framework or even the most basic human investment in planning and implementing e-government. One strong indicator of political will is the degree of involvement of high level decision-makers in e-government implementation (Misnikov, 2003).

While the myth prevails that all e-government/e-governance initiatives are always costly, this is not true. The implementation cost of e-governance projects may seem expensive, but the cumulative social and economic outcome is much extended. However, there must be efforts and investment plan on the government side to create an effective e-government for providing direct value-added e-services for citizens.

Utilizing ICT to develop e-government will ultimately need to re-engineer government processes and transform governance. It is not enough to deliver services efficiently and effectively by following steps to accomplish certain procedural requirements. It has to simplify government processes altogether, change the concept of governance, and thereby transform the overall relationship between government and people. Increased information access and transparency in government processes leads to greater accountability and credibility, as online or computerized processes remove discretion from government officials and provide monitoring facilities.

Designing security systems for a digital government's multidomain environment requires balancing between providing convenient access

and monitoring permissions (Joshi et al., 2001). Developing an evolutionary architecture to integrate large heterogeneous systems poses another challenge. Although these systems support vertical applications, exporting their services requires reengineering their technological services and administrative processes. The goal is to establish an architecture that coordinates information exchange among government information systems while maintaining each organization's autonomy (Mecella & Batini, 2001).

CONCLUSION

The integration of ICT into development processes and delivery mechanisms of public and private services necessitates social mobility learning, vigorous planning, local level initiation and the sharing of local and international experience on best practice as pre-requisites. Effective monitoring and evaluation is also a must. It is a proven truth that no blueprint plan will sustain for long with the dynamic changes in ICTs and the degree of adaptation and innovation needed to exploit these technologies.

The strategies, standards, and guidelines on e-government schemes should form part and parcel of the policy and serve as the detailed blue print for the strategy development. The updated policy together with the set strategy is expected to increase productivity, competitiveness, cooperation, and foster innovation in the public sector to leapfrog in the knowledge economy. Successful implementation of the policy would assist the government to be more responsive and accountable to the citizen and achieve greater transparency by providing benefits of increased efficiency and fostering the trust of the citizen for greater cooperation towards the development efforts.

Good governance (including fighting against corruption and for greater transparency) has been identified as a "missing link" both in poverty alleviation efforts and equitable and inclusive eco-

conomic growth. Its basis lies in good governance: strengthening the diminishing the growing disparities among its members (Misnikov, 2003).

Developing countries cannot expect positive outcomes by following the strategies and building the institutions that served the developed countries in the industrial era. The development challenge in the 21st century will be entirely different to the development challenges of the past century. Indeed, all countries, whether developed or developing, will need to recognize the scale of changes currently underway and design new strategies for these realities (Clarke, 2003). Disparities in rural-urban infrastructure and in hierarchies of economic development are acute in most developing countries and tend to broaden with ICT development, due to high costs of ICT infrastructure deployment in rural areas and also due to limited profit potential of rural markets (Proenza, 2002).

Despite occasional setbacks, digital government projects now appear firmly on the road to fulfilling their promise of making civil and political processes more accessible than ever (Elmagarmid, & McIver 2001). However, it is estimated approximately 35% of e-government projects in developing countries are total failures and approximately 50% are partial failures (FairfaxDigital, 2004).

Ideally, the ICT tools offer an unprecedented opportunity for community to access information over any geographical distances and across any sovereign state borders. Opportunities for networking and knowledge sharing are also unlimited, regardless of its perseverance. Furthermore, ICTs position in governance systems and practices are becoming widely participatory and inclusive, with endless economic opportunities. Time has come to look backward, take a good view, breath a while, and re-think on strategies, policies, and planning on the developing countries acting locally, regionally and globally along this hopeful road to success and prosperity.

REFERENCES

- Clarke, M. (2003). *e-development? Development and the new economy*. Policy Brief No. 7, United Nations University, WIDER.
- Chun, S. A., Atluri, V., & Adam, N. R. (2002, May). Dynamic composition of workflows for customized e-government service deliver. In *Proceedings of the 2nd National Conference on Digital Government* (dg.o 2002), LA, California.
- Daveri, F. (2002). The new economy in Europe, 1992-2001. WIDER Discussion Paper No. 2002/70, Page 7.
- Development Gateway. (2004). *e-Sri Lanka: Transforming government, business, and society*. Retrieved September 9, 2004, from <http://topics.developmentgateway.org/edevelopment/>
- E-Government Strategy. (2002, February 27). *E-Government Strategy, Simplified Delivery of Services to Citizens*. Implementing the President's Management Agenda for E-Government, U.S.
- Elmagarmid, A. K., & McIver, W. J. (2001). Guest editors' introduction: The ongoing march towards digital government. *IEEE Computer*, 34(2), 32-38.
- e-Sri Lanka. (2003, May 9). *Innovative e-Government for empowered citizen*. Policy on E-Government, Preliminary Draft, Government of Sri Lanka, Sri Lanka.
- EC. (2001). *European Competitiveness Report 2001*. Luxembourg: The European Commission.
- EU. (2002, December 9). *EU Contribution to Prepcom II*. World Summit of Information Society, Geneva.
- FairfaxDigital. (2004). Most Third World e-govt projects fail: World Bank. *The Sydney Morning Herald*. Retrieved November 10, 2004, from <http://www.smh.com.au/>

- GOI. (1985). *Seventh Five Year Plan 1985-1999*. New Delhi: Government of India, Planning Commission.
- ICT Policy. (2002, October). *ICT Policy of Bangladesh*, The Government of the People's Republic of Bangladesh, Dhaka.
- ITU. (2003a, December 11). *ITU Digital Access Index: World's First Global ICT Ranking*, International Telecommunication Union, Geneva.
- ITU. (2003b). *World Telecommunications Development Report 2003: Access Indicators for the Information Society*, ITU, Geneva.
- Joshi, J. B. D., Ghafoor, A., Aref, W., & Spafford, E. H. (2001). Digital government security infrastructure design challenges. *IEEE Computer*, 34(2), 66-72.
- Konrad, R. (2002, February 11). *Battling Bush's digital divide*. C/NEN News.com.
- Madon, S. (2003). *Evaluating the development impact of e-governance initiatives: An exploratory framework*. Working paper series No. 124. Department of Information Systems. London School of Economics and Political Science, UK.
- Mecella, M., & Batini, C. (2001). Enabling Italian e-government through a cooperative architecture. *IEEE Computer*, 34(2), 40-45.
- Miller, H. N. (2001, May 11). The digital planet: A snapshot for the World of IT. A special presentation for the *Asociacion Mexicana de la Industria de Tecnologias de Informacion (AMITT)*.
- Misnikov, Y. (2003, Winter). How ICTs can serve good governance, How good governance can serve e-government and how regional cooperation can serve Information Society. *LGI Journal*, 17-23. Budapest.
- Pascual, P. J. (2003, May). *E-government, e-primers for the information economy, society and polity*. e-ASEAN Task Force, UNDP-APDIP, Bangkok. Retrieved from <http://www.apdip.net/projects/e-primers/>
- Piatkowski, M. (2002, August 21). *The "New Economy" and economic growth in transition economies*. WIDER Seminar, Finland. Retrieved from <http://www.wider.unu.edu/publications/dps/dps2002/dp2002-62.pdf>
- Pohjola, M. (2002). The new economy: Facts, impacts, and *Information Economics and Policy* 14(2), 137.
- Proenza, F. J. (2002). E-for all: A poverty reduction for the information age. Retrieved May 3, 2005, from http://communication.utexas.edu/college/digital_divide_symposium/papers/index.html
- Rahman, H. (2003, December 12-14). Information dynamics in developing countries. *Proceedings of ITIRA2003*, Central Queensland University, Australia. Retrieved from http://www.dec.uwi.edu/smarshall/itira/proceedings_online/2003/nonref_papers/rahman.pdf
- Sakowicz, M. (2003, Winter). Electronic promise for local and regional communities. *LGI Journal*, 24-28. Budapest.
- Scacco, A. (2003, Winter). Combating corruption digitally. *LGI Journal*, 28-29. Budapest.
- Smith, J. (2004, August 30). Asian governance and the "Knowledge Economy." *Public Sector Technology & Management* (PSTM online journal). Retrieved September 01, 2004, from <http://www.pstm.net/article/index.php?articleid=311>
- UNDP. (2003, December 9). *Newsfront*. UNDP, WSIS, Geneva. Retrieved January 15, 2006, from http://www.undp.org/rba/newsfront_2003.html
- West, D. M. (2004, September). *Global E-Government 2004*. A report from InsidePolitics. Retrieved from <http://www.OutsidePolitics.org>
- World Bank. (2004a). *E-Lanka development*. Retrieved September 29, 2004, from <http://web.worldbank.org/>

World Bank. (2004b). *e-Sri Lanka: Transforming lives through technology*. Retrieved September 29, 2004, from <http://web.worldbank.org/>

World Report. (n.d.). Retrieved March 5, 2004, from <http://www.worldreport-ind.com/mexico/egovernment.htm>

Young, K. (2000, October). New information and communication technology—Opportunities for local governance. *Web Words* (Online journal), Australia. Retrieved from <http://www.webwords.net/>

KEY TERMS

Community Networking: A form of network that brings together the practices of community development, community-based research, health, education, and insights from fields such as sociology, feminism, or library and information and management sciences.

Digital Divide: The digital divide is a social issue referring socio-economic gap between communities that have access to computers and the Internet and those who do not. The term also refers gaps that exist between groups regarding their ability to use ICT effectively, due to differing levels of literacy and technical skills, as well as the gap between those groups that have access to quality, useful digital content and those that do not.

E-Government: E-government refers to the use of information and communication technologies to improve the efficiency, effectiveness, transparency and accountability of government.

ICT: It is the convergence of information technology, telecommunications and data networking technologies into a single technology, and it is the electronic means of capturing, processing, storing and communicating information.

ICTD: It is a term for information and communications technologies for development, an initiative aimed at bridging the digital divide (the disparity between technological “have” and “have not” geographic locations or demographic groups) and aiding economic development by ensuring equitable access to up-to-date communications technologies.

Information Society: A society in which economic and cultural life is critically dependent on rapidly developed information and communications technologies and it is integrated by complex communication networks for exchange of information.

Information Systems: Also known as management information systems (MIS) is the formal study of the information systems within an organization, consisting of the network of all communication channels. An information system is comprised of all the components that collect, manipulate, and disseminate data or information.

This work was previously published in Encyclopedia of Digital Government, edited by A. Anttiroiko and M. Malkia, pp. 1436-1444, copyright 2007 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.13

The Role of Place: Tasmanian Insights on ICT and Regional Development

Dean Steer

University of Tasmania, Australia

Paul Turner

University of Tasmania, Australia

ABSTRACT

Despite continued rhetoric that information and communication technologies (ICTs) make ‘place’ irrelevant in a global networked economy, insights from regional areas suggest a different and more complex experience. This chapter examines the issues surrounding the concepts of place in regional areas and ICT-based regional development, as a vehicle to dispel some prevalent ICT-related themes that permeate discussions in this sphere. These issues open up a broader debate on what is meant by ICT-supported development in a regional context, how it can best be achieved and what insights have been developed from past experiences in Tasmania, Australia.

INTRODUCTION

“Since the early days of the Internet, the death of distance and the associated devaluation of geolocation have continued to be popular themes. However, as technologies, and our understandings of cyberspace have grown and matured, it is becoming evident that geography continues to exert its influence.” (Ramasubramanian, 2002)

“It is no accident that there are so many successful semiconductor (companies) in California. It is not just that all the managers in California were smarter than the managers everywhere else.” (James, 2002)

The prevalence of technological determinism¹ and economic rationalism within academic and

business discussions on the role of technology in regional development is witnessed by the recent emergence in the literature of the 'king's new clothes' insight that 'place' still matters. For those living and working in regional Australia the reduction in basic services and lack of adequate or affordable telecommunications infrastructure has for some time been very much a part of their everyday experience of the 'information economy'.

From a research perspective, while information and communication technologies (ICTs) open the global economy up to a region they also expose it to global competition and its associated socio-economic uncertainties (Barling & Castleman, 2000; Coulthard, 2001; Wilde, Swatman, & Castleman, 2000). Clearly, glib statements promising regions unequivocal benefits from conducting business 'anytime, anyplace, anywhere' mask the more difficult processes of how to meaningfully evaluate the impacts of ICT on regional development. More significantly, there has been considerable confusion in the literature over what is meant by regional development, how it is to be achieved and what role ICT can play in reviving and sustaining regional communities.

Until recently, research in this field has focused almost exclusively on the role of ICT in urban economic development or on its impact on farming enterprises. The impact of ICT on the social fabric of the community has been given little attention, with an implicit underlying assumption being — what is good for the economy is good for the community. More recently there has been recognition of the need to examine and assess the social, cultural, and psychological impact of ICT. However, despite the emergence of research on ICT in developing countries and to a lesser extent regional areas, the majority of this work continues to be centred on urban economic development. Given that ICT impact on all aspects of society, marginalising fundamental questions about the role of ICT in social and community develop-

ment is highly problematic, particularly in less economically affluent regions.

This chapter aims to examine some key issues surrounding the concept of place in regional areas of Australia as a vehicle to dispel some prevalent ICT-related themes that permeate discussions on regional development. This analysis opens up a broader debate on what is meant by ICT-supported development in a regional context, how it may best be achieved and what insights have been developed from the Tasmanian (Australia) experience.

Defining Place

One major difficulty in approaching issues surrounding ICT-related regional development is the issue of how best to define what (or more appropriately where) is being identified by the often interchangeably used terms 'Regional', 'Rural' and 'Remote'. The Australian Bureau of Statistics (ABS)² has already acknowledged that while numerous users of statistical data have requested a standard classification for place/location, this is problematic because of the conflicting meanings of the terms used by different users (ABS, 2001a). These issues are further compounded by some users adopting a flexible approach to definition; e.g., the Australian Department of Finance and Administration (DFA) usually defines regional Australia as non-metropolitan Australia but for specialised proposals broadens its definition to include all metropolitan areas excluding Melbourne and Sydney (DFA, 2001). While adopting a broad based definition may appear to be a simple solution to these definitional dilemmas (Curtin, 2001) we must remain sensitive to how the different assumptions implicit within these different definitions may have consequences for regional development. As the US experience illustrates, the multiple definitions at play in policy-making have resulted in disparate policy impacts for different rural areas³ (RUPRI, 2001).

Given these issues, it is perhaps not surprising that many writers often avoid explicitly defining the place or the region under discussion. There are many reports and papers that do not attempt definition; for example, the NOIE (2000) report into 'E-Commerce Across Australia' uses the term region(s) in a generic sense without definition, and also does not define terms such as Metropolitan and Non-Metropolitan. Other well-known authors in this field such as Coulthard (2001) and Coulthard, Castleman, and Hewett (2000) use the abbreviation R-3 to represent rural, regional, and remote areas without any distinction between the component areas or between R-3 and non-R-3 areas.

As with any conceptual definition, there are numerous ways that the term can be delineated (Luloff, 1999) and many suggested that trying to provide a generic definition of regional Australia is likely to create as many problems as it resolves (Beer, Maude, & Bolam, 1994; Elvidge, 1999; Foster, 2000; MacLeod, 2001). However, the Commonwealth Department of Health and Aged Care (2001, p. 3) suggests: "In order to systematically tailor services to meet the needs of Australians living in regional Australia, 'remoteness'... needs to be identified." Furthermore, in the current climate of competition for funding, particularly in Australia, there is a need to unambiguously identify and contextualize the area(s) under investigation, and at the very least, facilitate the comparison of 'like for like' (MacLeod, 2001).

While this chapter is not proffering a solution, the lack of an official, consistent definition of 'regional' compounds the problem of consistent analysis when investigating the impact of ICT in these areas. This is particularly so for Tasmania where the state population (473,300) is of a similar size to the region⁴ of Newcastle, NSW, Australia, (487,843), where Hobart (194,388), Tasmania's state capital city, is smaller than Wollongong, NSW, Australia, (266,666) and where a significant non-metropolitan area such as Launceston, TAS, Australia, (98,437) is less than two-thirds

the size of Geelong, NSW, Australia (159,764) (ABS, 2001b).

Although there is little doubt that accurate definitions for regional development policy are of importance, the impact and challenges of issues such as the global networked economy and the role of ICT generate their significance.

Regional Development and Technology

According to the Institute for Sustainable Regional Development (ISRD) (2000) the most pressing challenge facing non-metropolitan Australia is "how to build an economically productive, socially viable and ecologically sustainable future" during a period of major structural change. While linking economy, society and environment together is an important step, it takes us no closer to identifying mechanisms to achieve it. Indeed, it can be argued that it may even distract us from the task. As Castleman (1998) states, "Sustainability has become a comforting word, a concept describing a future vision rather than a means of reaching it." What is however evident, even to the Australian Prime Minister, is that regional Australia "has suffered through cuts to basic services" (NineMSN, 2002). Indeed it is clear that the gap between urban and regional Australia (however it is defined) is widening. In regional Australia the general trends of slower industrial growth, increased urban migration and the depletion in the quality and availability of basic services are tangible to even the casual observer.

Unsurprisingly this context has provided fertile ground for the promises and hype associated with the Internet and the Information economy. There has also been a considerable amount of literature supporting the view that the widespread introduction of ICT will revitalise regional Australia. Governments at Federal and State levels have also been very active in funding programmes and initiatives aimed at ensuring regional Australia

can capitalise on these ICT-related developments (Coulthard et al., 2000).

In this context, there is therefore no question that ICT will impact on regional development. However, unfortunately it remains unclear whether this impact will, in the final analysis, be positive (Wilde et al., 2000; Coulthard, 2001). More seriously, within the current conceptualisation of the issues, there is no way of meaningfully assessing whether the introduction of ICT will mitigate, exacerbate or simply replicate the pre-existing urban/regional divide.

As a contribution to re-framing these issues and to conducting a detailed examination of ICT-related regional development, the next three sections explore three prevalent ICT-related themes that cloud current debates.

THEME 1: PLACE NO LONGER MATTERS

The first prevalent ICT-related theme to be explored in the context of this chapter is that through the effective use of ICT the concept of place no longer matters. The argument is that by investing in ICT, regional areas will be able to participate in the global economy on an equal footing with the rest of the world.

The quote below from the National Office for the Information Economy (NOIE) typifies the mantra that has been prevalent since the earliest days of the 'Information revolution'; ICT equates to the 'death of distance':

Australia is a land of great distances. We are a long way from most of the world's markets. Participation in the information economy allows us to overcome the isolation of Australia in remote and rural areas and the disadvantages of national isolation from world markets... online services can build stronger and more viable regional communities, with enhanced investment, employment and skills, by providing better access for businesses

to markets and market information, and enabling more efficient marketing and distribution of products and services (NOIE, 1998).

While it is hard to deny that ICTs have been instrumental in connecting disparate regions to the 'rest of the world', the impacts of doing so have been far from uniform, and not always beneficial (Coulthard, 2001; Dutfield, 2002). There also remains the paradox, (particularly in Australia where most of its land mass is uninhabited or very sparsely populated), that the geographical 'imperative of putting physical networks (optical fibres, mobile antennas and the like) in trenches, conduits and emplacements to drive market access' still exists (Graham, 2001, p. 405). The lack of uniformity of benefits may be a reflection of the fact there is no uniformity in the areas that are endeavouring to participate in the global economy. Therefore, it may be that the impact of ICT reflects the existing local regulatory, economic, and social environments, re-emphasizing the role of places and people.

Furthermore, ICT are primarily tools for moving data around the globe, and "while the power of distance has been eroded, it should not be confused with the diminished meaning of place" (Wilson, Corey, Mickens, & Mickens, 2001). Wilson et al. (2001) also identify the paradoxical relationship of place and technologies; "As ICT become more ubiquitous and permeating ... the actual importance of locality and spatial organization emerges." This paradox can be seen in Tasmania, an Australian State that has been the recipient of substantial funding through programmes such as the Telstra T2 sale Social Bonus, of which \$150 million was allocated for ICT-related development, infrastructure and service delivery (Tasmanian Govt., 2001).

In 2001, 30 Software Developers in Tasmania (an industry for whom it might be reasonable to assume location and/or place was not significant) were surveyed by one of the chapter's authors. Of those developers surveyed, approximately 20%

of the respondents indicated that if they were to expand their businesses to include interstate markets, they would need to seriously consider relocating to the mainland. The two primary reasons given for this were:

- a. A perceived need for face-to-face meetings with prospective clients and the associated high cost of transportation, accommodation, and 'wasted' travel time.
- b. Perception that 'made in Tasmania' was not associated within these markets with high quality.

The second point was identified as an issue for two of the respondents who were trying to sell to the Tasmanian Government. When trying to compete with interstate developers, the inference was if you were any good you would be in Melbourne or Sydney.

This cannot easily be dismissed as being peculiar to Tasmania. As a report prepared for the Rural Industries Research and Development Corporation (RIRDC) notes, most of the Internet activity in North America still revolves around particular places. The implication being that those outside of these areas continue to struggle to participate in, and to receive the promised benefits from, the global marketplace.

“As the majority of Internet activity is currently based in North America, and in particular the United States, it is interesting to note that this activity is concentrated in relatively small areas, most famously, Silicon Valley and Seattle (Microsoft’s and Amazon.com’s headquarters). This centralisation of the economic growth and resultant benefits has been of equal concern to the US Government as it has been to our own. Many regions in North America are struggling to capture the benefits of the Internet in the same ways as we are in Australia” (Simpson, 2001).

It appears that, despite the promises, “the death of distance ... is too simplistic a claim because it misses so many of the nuances of the structure and character of electronic interaction” (Wilson et al., 2001). Not only does place still matter and wield a significant influence, but it also appears to have an even stronger influence in regional areas.

THEME 2: CLUSTERING LEADS TO COMPETITIVE ADVANTAGE

The second prevalent ICT-related theme to be explored in the context of this chapter is that through clustering, regions will automatically gain a competitive advantage. The argument is that ICT allow regions to organise existing and new business enterprises into clusters. It is then argued that synergies will automatically flow, which will then lead to exploitable competitive advantages.

The quote below from Senator Nick Minchin, Australia’s Minister for Finance and Administration, supports the accepted wisdom that clustering equates to an exploitable competitive advantage. “It is worth reinforcing that if Australian business is to compete successfully in the modern economy, it is critical to form and maintain networks and linkages to maximise our competitive advantage.” (SABV2010, 2000)

It is understandable that regions such as California’s Silicon Valley, which have experienced spectacular economic growth, have become attractive targets of emulation (DiGiovanna, 1996; MacLeod, 2001). However, MacLeod (2001, p. 809) offers a cautionary note by stating that “... policy prescriptions drafted for the purposes of renovating downbeat regions, but which are derived from theoretical investigations based on the selective experiences of ideal-typical hotspots, are misguided.”

Further, Enright and Roberts (2001, p. 72) make the observation that “very little research

has been published on industry clustering in Australia.” They also state, “Much of the investigation conducted to develop regional clusters in Australia has involved exploring and mapping the supply and distribution chains and networks of local industries and firms. Little research has been done to explore smart infrastructure and human capital requirements, core competencies, and marketing intelligence needed to support and sustain the development of local clusters” (Enright & Roberts, 2001, p. 73).

Despite the lack of research, governments around Australia, at national, state and local levels are attempting to use clustering (and ICT clustering in particular) to stimulate economic growth with varying degrees of success and failure. Indeed, the very nature of these attempts may be detrimental to the entire Australia economy, thereby actually reducing any potential competitive advantages that might be acquired. As Gartner senior vice-president Bob Hayward has stated, “I deal a lot with multinationals making investment decisions in the (Asia Pacific) region and they often tell me that their vision of Australia is of seven countries that compete against each other rather than a continent-country that gets its act together” (Janz, 2002). From a Tasmanian perspective this point resonates with the intra-state competition that exists between different regions within the state. Again, far from acquiring a competitive advantage all regions lose out due to their inability to plan strategically and act cooperatively.

In Tasmania, the City of Launceston is promoting itself as the “City of Learning and Innovation” and as an Information Precinct (iPrecinct) with many ICT-related programmes and activities occurring in parallel with each other (LCC, 2001). One such programme is the Launceston Digital Development Forum (LDDF), which was established by the Tasmanian Electronic Commerce Centre (TeCC) to bring together key players with the aim of helping the Launceston community seize the ‘new economy’ opportunities available to the Launceston region (TeCC, 2002).

However, simultaneously the City of Burnie, another regional city in Northern Tasmania, is also competing in the same space, recently declaring its Integrated Community Network (ICN) pilot programme (which saw the laying of fibre optic cable in the city), as “an exciting strategic initiative, which is in keeping with Burnie’s goal of becoming the information technology capital of Tasmania” (Arnold, 2001).

This raises the obvious question as to how much competitive advantage can be derived at inter- or intra- regional levels when ‘everybody’ employs the same strategy. Given that no two regions are identical, is it tenable that the same rules for acquiring a competitive advantage through clustering be applied in a generic manner? Porter says, “Many business people still don’t understand that a lot of their competitive position is based on their location . . . you must understand and use your local strengths. Location counts as much as ever” (James, 2002).

This emphasizes the point that any region is more than just the sum of its public infrastructure (sometimes referred to as hard infrastructure). Interaction and cooperation between the social, economic, and political (sometimes referred to as soft infrastructure) is what makes a region dynamic, and able to develop effective strategies. It is as much a product of the region’s capacity as any public infrastructure (MacLeod, 2001; Villeneuve & Gilbert, 1999). However, soft infrastructure is very difficult if not impossible to transfer or duplicate in different areas (MacLeod, 2001; Harris, 2002).

Of course, not everyone agrees with the current preoccupation with regional competitiveness. MacLeod (2001, p. 819) cites Krugman as saying that, “competitiveness can become a ‘dangerous obsession’: one that . . . conveniently safeguards us from considering a whole host of awkward questions relating to the uneven power networks that enframe the new regional world.” Indeed, for all the resources that have been expended in an effort to emulate places such as Silicon Valley,

it seems that we are no closer to understanding what makes a regional cluster succeed or fail (Garnsey, 1998).

There is considerable evidence to suggest that place still makes a difference to the success of regional clusters, and that blindly applying generic principles without calibrating for unique local issues may adversely impact on the success of any regional cluster development project.

If the benefits of clustering in regional development are not guaranteed, then perhaps there also needs to be a re-assessment of the promised benefits that have been made of ICT as being the catalyst of regional sustainability.

THEME 3: ICT CAN SUSTAIN REGIONAL AREAS

The last prevalent ICT-related theme to be explored in the context of this chapter is that the implementation of ICT in regional cities and towns can halt and even turn around economic decline. The argument is that through ICT regional areas can be seamlessly integrated into the global economy thus creating the required economic framework to ensure sustainability.

Again, the issue of definition emerges as a problem, because ‘sustainability’ has come to mean different things to different people (Carroll & Stanfield, 2001). Historically sustainability has been associated with environmental issues, but the term has been adapted widely and broadened to include many different issues including economic, social and business. However, Carroll and Stanfield (2001, p. 470) also highlight that the “regional development literature has generally ignored the issue” of sustainability. A working definition of sustainability in the context of development used by Robertson cited in Carroll and Stanfield (2001, p. 470) is: “Sustainable development is loosely defined as economic enhancement that meets the needs of the present generation without

compromising the ability of future generations to meet their needs.”

Clearly however, regional sustainability needs to move beyond purely economic growth to involve the unification of economic and social imperatives to produce an improvement in the quality of life for those of the region (Carroll & Stanfield, 2001; Rossi, Salieri, & Sartori, 2002; Villeneuve & Gilbert, 1999). Unfortunately, while the impact of ICT on regional sustainability is as complex as it is paradoxical, it has remained buried in largely unquestioned dichotomies, which makes its assessment, at best, problematical (Castells, 2001; Wilde et al., 2000). The technology that facilitates almost instant worldwide communication and helps to give the perception of a ‘shrinking global neighbourhood’ is the same technology that some see as creating a divide within the local neighbourhood (Symonds, 1999).

Despite regional sustainability exhibiting a complex nature (Gómez, Hunt, & Lamoureux, 1999), or perhaps because of it, the popular press, ICT advocates, politicians and much of the academic research has focused almost exclusively on economic indicators. Within this framework, given the widening regional divide, it would seem that ICT-related developments, with a few exceptions, are not fulfilling their promises. The use or misuse of a single measure to evaluate the impact of ICT can be observed in Telstra chief executive officer Dr. Ziggy Switkowski’s address to the World Congress on IT in Adelaide in 2002 when referring to a slower than anticipated uptake of ADSL in Launceston:

“... while you can build the field of dreams, will they come? Our experience from the Launceston project ... is that the availability of broadband, even when priced below cost, is absolutely no indication of people’s willingness to use it at this time.” (Switkowski, 2002)

Alternatively, if we broaden our conceptualisation of ICT-related development to incorporate

social, community and environment, a more complex and 'interesting' exercise can be revealed. From this perspective the success or failure of the ICT-related programmes in centres such as Launceston would be assessed in far broader terms than just economics. Even for the most optimistic, it would be hard to argue that the concentration of ICT funding in Launceston has elevated the city to a position of economic global significance. However, the focus on assessing economics indicators alone misconceptualises the problems and does a disservice to the analysis of complex positive and negative impacts arising from the introduction of ICT on regional communities, businesses and environments (Lovering, 1999). Luloff (1999, p. 314) supports this view, stating, "Rural community development is far too complex to be adequately captured by the use of only one variable or measure and/or by one method of gathering data." Further, Mansell, Steinmuller and When (1999) see similar problems when trying to compare the performances of different regions: "Current indicators or benchmarks for assessing how information society characteristics in local areas or regions compare with other regions are insufficient. ... Policy makers are often left in the dark about how their region is performing over time."

Fortunately some understanding of these types of issues is emerging in economic and political circles where aggregated indicators are gaining a measure of acceptance as alternatives to measuring progress using accounting measures alone, such as Gross Domestic Product (GDP). For example, the United Nations Development Programme's Human Development Index (HDI), and the Genuine Progress Indicator (GPI), are just two of the emerging measurement processes that recognise that economics alone does not accurately evaluate progress (ABS, 2002). Similarly, the regional development profession needs to develop empirically reliable methodologies and

tools that assess the overall impact of ICT on sustainable regional development. It is essential that these methodologies and tools recognise the inter-relational nature of economic, social and environmental policy, so that regional progress can be reliably and accurately demonstrated (Gómez et al., 1999; Houghton, 1998). More practically, it is obvious that the mere existence and availability of the technology to enhance regional development does not in and of itself guarantee use, nor does it assure the realization of the desired outcome (Gibbons, 2002; Hamelink, 1999; Mansell et al., 1999).

Therefore, employing economic measures in isolation cannot assess the full impact of ICT on regional areas. Successful measurement must include ICT's ability to enhance social integration, provide resilience to fluctuating global forces, develop the environment, strengthen the sense of community, improve lifestyle, and to provide easy and equitable access to services. Only then, when added to the economic measurements, can a complete assessment be made of the impact of ICT on regional areas.

CONCLUSIONS

Regional development is a complex process, perhaps more of an art than science. It has been seen from the above discussion that much has been promised of ICT for regional areas. The promises have included economic sustainability, competitive advantage and the opportunity for connection to the global community. However, difficulties with the measurement of ICT's impact and limited exploration of the problematical nature of the assumptions underlying these promises have clouded understanding and measurement of the experiences of regional Australia.

To ensure that the true worth of ICT for regional areas can be examined, this chapter has revealed

a need for a re-calibration from purely economic indicators to an aggregation of indicators including social, community, environment and economic. This exploratory chapter has examined issues surrounding the concept of place within discussions on ICT-related regional development. It has highlighted the prevalence of technological determinism in these discussions and contributed to a more meaningful conceptualisation of the role and impact of ICT-supported development in a regional context. Significantly, this chapter has promoted a more holistic view of ICT-related development that includes assessments specifically calibrated to capture the value of ICT.

ENDNOTES

- ¹ The term technological determinism is attributed to Marshall McLuhan, who suggested that, "We shape our tools and then our tools shape us" (Merkel, 2000).
- ² The ABS currently deploys two separate classifications of location/place: (i) Section of State (defining rural localities as populations 200-999, and rural balance areas as populations under 200); (ii) Accessibility/Remoteness Index of Australia (ARIA) measuring remoteness in terms of access along road networks to services centres defined as towns with more than 5000 population (ABS, 2001a).
- ³ "Public policies have different impacts across space. Rural and urban areas face different issues based on economic, demographic, and location issues, and therefore have different policy needs...The implications and ramifications of different definitions of rural areas on policy design, implementation, and impact must be taken into account to avoid unanticipated or unintended effects" (RUPRI, 2000).
- ⁴ ABS Statistical District boundaries

REFERENCES

- ABS. (2001a). *ABS views on remoteness*. Retrieved April 23, 2002 from: <http://www.abs.gov.au/ausstats/>.
- ABS. (2001b). *Australian demographic statistics*. Retrieved July 15, 2002 from: http://www.ausstats.abs.gov.au/ausstats/31010_dec+2001.pdf.
- ABS. (2002). *Measuring Australia's progress*. Retrieved July 7, 2002 from: http://www.ausstats.abs.gov.au/ausstats/1370-0_2002.pdf.
- Arnold, P. (2001). *World class communications coming to Burnie*. Retrieved April 23, 2002 from: <http://www.icn.net.au/files/7-12-01-press-release.pdf>.
- Barling, G.D. & Castleman, T. (2000). *Investigating the impacts of technologies on rural, regional and remote Australia*. Retrieved May 4, 2001 from Deakin University, School of Information Systems 2000 Working Papers Web site: http://www.deakin.edu.au/mis/research/Working_Papers_2000/2000_20_Barling.pdf.
- Beer, A. P., Maude, A., & Bolam, A. (1994). *Beyond the capitals: Urban growth in regional Australia*. Canberra: Australian Govt. Pub. Service.
- Carroll, M.C. & Stanfield, J.R. (2001). Sustainable regional development. *Journal of Economic Issues*, 35(2), 469-476.
- Castells, M. (2001). *The Internet galaxy: Reflections on the Internet, business, and society*. New York: Oxford University Press.
- Castleman, L.J.C. (1998). What is the relationship between the social and the economic in regional sustainability? In Falk, I. (Ed.), *Learning Communities, Regional Sustainability and the Learning Society: An International Symposium* (pp. 81-86). Centre for Research and Learning, University of Tasmania, Launceston.

The Role of Place

- Commonwealth Department of Health and Aged Care. (2001). *Measuring remoteness: Accessibility/remoteness index of Australia (ARIA)*. Retrieved August 3, 2001 from: <http://www.health.gov.au/pubs/hfsocc/ocpanew14.pdf>.
- Coulthard, D. (2001). *eCommerce and the region: Not necessarily an unequivocal good*. Retrieved May 3, 2001 from: http://www.deakin.edu.au/mis/research/Working_Papers_2001/2001_07_Coulthard.pdf.
- Coulthard, D., Castleman, T., & Hewett, B. (2000). *Riding on the Internet's back: Can rural communities use information technologies for economic development?* Retrieved May 3, 2001 from: http://www.deakin.edu.au/mis/research/Working_Papers_2000/2000_14_Coulthard.pdf.
- Curtin, J. (2001). *A digital divide in rural and regional Australia?* Retrieved April 30, 2002 from: <http://www.aph.gov.au/library/pubs/cib/2001-02/02cib01.htm>.
- DFA. (2001). *Definitions*. Retrieved April 22, 2002 from: http://www.finance.gov.au/ctc/toolkits/indevel/definitions_id.html.
- DiGiovanna, S. (1996). Industrial districts and regional economic development: A regional approach. *Regional Studies*, 30(4), 373-386.
- Dutfield, S. (2002). *Place and non-place*. Retrieved April 22, 2002 from: http://diac.cpsr.org/cgi-bin/diac02/pattern.cgi/public?pattern_id=179.
- Elvidge, N. (1999). *Efficiency and Equity Effects of Suburbanised Retailing Systems in Australian Regional Cities (Doctoral Thesis)*. Retrieved August 22, 2002 from University of Queensland, Department of Geographical Sciences and Planning Web site: <http://adt.library.uq.edu.au/public/adt-QU1999.0006/>.
- Enright, M.J. & Roberts, B.H. (2001). Regional clustering in Australia. *Australian Journal of Management*, 26, 65-86.
- Foster, K.A. (2000). "Being like a region": Framing issues for a roundtable on regions, regional identity, and regionalism in Greater Boston. Retrieved October 22, 2002 from: http://www.ksg.harvard.edu/rappaport/forums/Being_Like_a_Region.pdf.
- Garnsey, E. (1998). The genesis of the high technology milieu: A study in complexity. *International Journal of Urban and Regional Research*, 22(3), 361-377.
- Gibbons, P. (2002). *Using technology for social engagement of the aged*. Retrieved April 28, 2002 from: http://diac.cpsr.org/cgi-bin/diac02/pattern.cgi/public?pattern_id=39.
- Gómez, R., Hunt, P., & Lamoureux, E. (1999) *Focus on telecentres: How can they contribute to social development?* Canada: International Development Research Center (IDRC). Retrieved June 24, 2002 from: <http://www.idrc.ca/pan/chasqui.html>.
- Graham, S. (2001). Information technologies and reconfiguration of urban space. *International Journal of Urban and Regional Research*, 25(2), 405-410.
- Hamelink, C. (1999). ICTs and social development: The global policy context. *UNRISD Discussion Paper, 116*. Geneva: United Nations Research Institute for Social Development. Retrieved September 24, 2002 from: <http://www.acca21.org.cn/info21/link/bg/info/4/toc.htm>.
- Harris, R. (2002). Research partnerships to support rural communities in Malaysia with information and communication technologies. In Lazar, J. (Ed.), *Managing IT/Community Partnerships in the 21st Century*. Hershey, PA: Idea Group Publishing.
- Haughton, G. (1998). Principles and practice of community economic development. *Regional Studies*, 32(9), 872-877.

- ISRD. (2000). *Regional sustainability*. Retrieved April 16, 2002 from: <http://www.isrd.cqu.edu.au/isrd/regional/regional.htm>.
- James, D. (2002). How to kick global goals. *BRW*, 24(12), 50-55.
- Janz, C. (2002). Staterivalry hurts nation: Analyst. *Australian IT, Sydney*.
- LCC. (2001). *Launceston City Council - prospectus*. Retrieved February 10, 2002 from: <http://www.elaunceston.com/info/intro.html>.
- Lovering, J. (1999). Theory led by policy: The inadequacies of the 'new regionalism' (Illustrated from the case of Wales). *International Journal of Urban and Regional Research*, 23(2), 379-395.
- Luloff, A.E. (1999). The doing of rural community development research. *Rural Society*, 9(1), 313-328.
- MacLeod, G. (2001). New regionalism reconsidered: Globalization and the remaking of political economic space. *International Journal of Urban and Regional Research*, 25(4), 804-829.
- Mansell, R., Steinmuller, W.E., & When, U. (1999). Indicators of a sustainable society: Policy analysis and application. *The IPTS Report*, 32. Retrieved September 10, 2002 from: <http://www.jrc.es/pages/f-report.en.html>.
- NineMSN. (2002). *PM pledges to help country towns survive*. Retrieved May 9, 2002 from: http://news.ninemsn.com.au/National/story_28144.asp.
- NOIE. (1998). *A strategic framework for the information economy: Identifying priorities for action*. Retrieved March 12, 2002 from: www.noie.gov.au/projects/information_economy/strategic_framework/dec98_strategy.htm.
- NOIE. (2000). *e-Commerce across Australia*. Retrieved September 13, 2002 from: http://www.noie.gov.au/publications/NOIE/ecommerce_analysis/eCommerceAcrossAustralia.pdf.
- Ramasubramanian, L. (2002). *The power of "place": Framing IT's role in social capital formation*. Retrieved May 1, 2002 from: <http://www.ccnr.net/2002/abstracts/laxmi.htm>.
- Rossi, G.B., Salieri, P., & Sartori, S. (2002). Measurement growth in a total quality perspective. *Measurement*, 32, 117-123.
- RUPRI. (2000). *The importance of place in public policy*. Retrieved January 16, 2003 from <http://www.rupri.org/policyres/context/pub-policy.html>.
- RUPRI. (2001). *Defining rural: Definitions of rural areas in the U.S.* Retrieved April 22, 2002 from: <http://www.rupri.org/policyres/context/rural.html>.
- SABV2010. (2000). *Cluster community news, Number 5*. Retrieved January 20, 2002 from <http://www.clusters.com.au/Documents/July00.pdf>.
- Simpson, R. (2001). *The Internet and regional Australia: How rural communities can address the impact of the Internet*. Retrieved April 20, 2002 from <http://www.rirdc.gov.au/reports/HCC/01-087.pdf>.
- Switkowski, Z. (2002). *Next generation telecommunications: Unleashing the power*. Adelaide: World Congress on IT 2002. Retrieved July 12, 2002 from: <http://www.telstra.com.au/newsroom/speech.cfm?Speech=18821>.
- Symonds, J. (1999). Social and economic benefit in public regional Internet facilities. *Proceeding of the 10th Australasian Conference on Information Systems*, (pp. 919-930). Retrieved April 10, 2002 from: www.vuw.ac.nz/acis99/Papers/PaperSymonds-053.pdf.
- Tasmanian Govt. (2001). *Second Telstra sale social bonus package*. Retrieved April 28, 2002 from: http://www.go.tas.gov.au/telstra/tsbupdate_dec2001.htm.

The Role of Place

TeCC. (2002). Launceston digital development forum. Retrieved December 10, 2002 from: http://www.tecc.com.au/3News_and_Events/2Calendar_of_events/index.asp.

Villeneuve, P. & Gilbert, A. (1999). Social space, regional development, and the Infobahn. *Canadian Geographer*, 43(2), 114-117.

Wilde, W.D., Swatman, P.A., & Castleman, T. (2000). *Investigating the impact of IT&T on rural, regional and remote Australia*. Colorado: Proceedings of COLLECTeR (USA) 2000. Retrieved December 7, 2001 from: <http://www.collector.org/Wilde.pdf>.

Wilson, M.I., Corey, K.E., Mickens, C., & Mickens, H.P. (2001). *Death of distance/rise of place: The impact of the Internet on locality and spatial organization*. Stockholm, Sweden: INET 2001 Conference. Retrieved April 7, 2002 from: http://www.isoc.org/isoc/conferences/inet//01/CD_proceedings/U128/INET2001-U128.htm (Permission received to quote).

This work was previously published in Using Community Informatics to Transform Regions, edited by S. Marshall, W. Taylor & X. Yu, pp. 67-82, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.14

Radio for Social Development

Patrick Craddock

Multimedia and Distance Education, New Zealand

Peggy Duncan

Health and Social Research Consultant, New Zealand

INTRODUCTION

“*Tell me a story*” is an established educational technique. “*Tell me a story*” using radio is an application of this technique, but instead of having one or several listeners, it is possible to reach thousands or millions of people throughout both urban and rural areas. *The Archers*, was a British radio drama serial that started its life with educational objectives and has been broadcasting for decades to a large dedicated audience of millions (Gallagher, 1975). This article will describe how a radio drama education project expanded into small local communities, each with its own community radio station, and how the actors in the radio drama addressed specific health issues of a particular area through the use of live performances.

BACKGROUND

As far back as the 1970s, McAnany (1976) found in his Mexico study that in radio projects over two-

thirds of listeners preferred to listen to music and drama and that few tuned in to local educational programs or programs from the capital city.

Supporting radio drama for behavior change with other resources is a key part of any radio education project. In a presentation on behavior change, Brooke-White (1985) saw non-formal radio education for adults as being concerned with change. She said the role of the media educator is based on the principle of learning by choice, and that change came from within the individual listening to the programs. Her comments referred to writers, editors and producers who needed “skills in the communication of structured information geared to facilitate change” (p. 1).

Fossard (1996) has written extensively on the development of drama for radio, giving particular attention and emphasis on making the messages suitable and credible to the listening audience. With a particular focus on soap opera in bringing about social change, Nariman (1993) suggests that radio drama is very effective if it makes sense to the listener, and it addresses issues similar to those faced by the listening audience using characters

who are believable and who deal with the issues in a recognizable way.

In Africa, radio drama is regarded as being very effective in the education of rural people if it “encompasses cultural factors such as the oral tradition and social learning through performance” (Morrison, 2003, pp.1-4). Other factors that make drama an effective medium include the recognition that rural people tend to have lower literacy rates than urban people, they cannot be reached by other means of communication such as newspapers or television and that generally, there is homogeneity and social cohesion in small villages. The spoken word and traditional forms of drama incorporating cultural values and beliefs are the primary ways of educating the young and to sustaining cultural mores among adults in such situations.

An example that showed the impact of broadcasting radio drama programs took place in Tanzania during the period 1993 to 1997 (Ryerson, 2003). After four years of broadcasting, a Radio Tanzania drama serial had succeeded in attracting 58% of the population between the ages of 15-45 in the broadcast regions. Evaluation research of the radio drama conducted by The University of New Mexico and the Government of Tanzania showed that this radio serial stimulated behavioral changes. More than half of the population in the areas where the serial was transmitted identified themselves as listeners. HIV/AIDS is a huge problem in Africa and this story had, as one of the key characters, a truck driver with numerous girlfriends dotted along his truck journey route. He became HIV positive. Of the listeners surveyed, 82% said the program had caused them to change their own behavior to prevent HIV infection by using condoms and limiting their number of sexual partners. Independent data from the AIDS Control Program of the Tanzania government noted over a 150% increase in condom distribution in the broadcast areas during the first year of the soap opera.

Other data collected through Ministry of Health clinics indicated that the radio soap opera had influenced family planning methods in four out of ten new adopters. This included a quarter of the respondents who could cite the soap opera by name. Another 16% cited “something on the radio” and then identified the soap opera as their source when shown a list of programs being broadcast.

While radio serials obviously build up a regular listening audience and the potential for behavior change, it is also possible to use radio drama as a tool with campaign radio.

In Vanuatu, a small South Pacific nation, a radio drama project on health advice has strong links with the running of a local clinic. *Famili Blong Sarah (Sarah's Family)* is a weekly radio drama series aiming to increase knowledge of, and promote positive attitudes about, reproductive health issues. The soap opera also served as a teaching tool for nurses, teachers, and aid post workers. The first 20 episodes were dedicated to character development in the hope that the audience would bond with the radio characters before sensitive sexual health issues were introduced. Over 180 episodes have been produced to date. On their Web site, Wan Smol Bag notes “live performance and face-to-face training sessions are preferred, but radio drama can reach islanders nationwide on a consistent basis.”

LEPROSY EDUCATION USING LIVE RADIO BROADCASTS

An example of health education using a live radio broadcast performance at Alto Molocue, a town in the poorer part of the Zambezia province, Mozambique, took place at the beginning of 2003. A Danish NGO had funded a new FM community radio station in the town to broadcast items of interest and of educational and social value to the people of the area. Alto Molocue has the misfortune of having a high incidence of Leprosy, and

it was one of the few places where the Portuguese colonizers had built a treatment center. Although since Mozambique gained Independence, the center has had little maintenance. For 50 years, medical authorities have been doing their best to contain and cure the disease and have had some successes and some failures. Leprosy tends to be a “cunning” disease. Many young people who catch Leprosy do nothing about seeking medical help until the disease makes its first serious attack on their nervous system. A child will get a white mark on their skin. It does not itch or form an uncomfortable rash and often nothing is done. It is only when the disease has shown more serious manifestations that people will seek help and by that time it is too late to reverse the damage. Yet, leprosy can be cured if it is caught in its early stages.

In January 2003, a medical specialist in charge of Leprosy care in Alto Molocue obtained funds for the promotion of a small project “to celebrate fifty years of Leprosy care and treatment in this district.” He began preparing printed resource materials, coached a small theatre group to perform a play using traditional characters and showing how to detect the disease and to seek treatment, using methods and messages understood and familiar to the local people. He made contact with a radio drama coordinator who was producing a regular weekly radio drama series for rural people. Within a short time, the decision had been made to pool resources from the two projects. Thus, the small project began to expand into a larger multimedia educational event aimed at educating the people on early detection and treatment of leprosy, and making it possible to treat the disease before serious damage to the body occurred.

Using radio drama, entertainment, pre-recorded interviews, structured information and resource support from the radio education project, the local radio station manager suggested that the event take place over a whole weekend. Two experienced local radio announcers from Radio Mozambique (a six-hour drive away), who spoke

the local Elomwe language had visited the area to collect a number of interviews from Leprosy patients and medical staff. One producer made a point of collecting information from the local community. He said that “It was important to hear first men and then women make the same point. This way villagers and local people believe it. Always in our culture, you need different people repeating ideas—both sexes and people with respect in their lives, that is, the leaders” (Monteiro, 2003). Radio public service spots were prepared and the radio drama producer trained the theatre group to perform for a live audience and a simultaneous live radio broadcast. The Leprosy doctor talked with a local priest and organized the first ever live radio outdoor church service. The service was dedicated to the medical care of Leprosy. Extra copies of the printed resource material were prepared and printed.

To ensure non-stop live broadcasting, the professional Radio Mozambique broadcasters worked long hours over the weekend with the local radio staff who were inexperienced volunteers. People crowded into different venues in town to see the theatre group act, and they visited the radio station in large numbers. Competitions were held. Many adults and children won prizes. Around fifteen hundred people attended the special live broadcast of the church service. In terms of numbers and the apparent show of interest, the weekend was deemed a success.

While there was no formal research into the program impact, there was evidence that a large number of people had physically attended all the different events. Besides the live broadcasting, there were repeats of the pre-recorded interviews. After the event, the Radio Station Manager was approached and asked by various local groups to prepare and broadcast more radio programs on Leprosy and general health matters. She gave community groups airtime to develop their own radio programs on public health. Listeners and those people who attended the theatre performances and visited the radio station had been

made more aware of the help they could seek at medical clinics. This type of linkage is important. It shows community initiative and involvement that is independently stimulated by the programs. It also highlighted the strength of good communication between all the organizations working to produce the weekend event.

Within a very short space of time, other community radio stations wanted to be involved in educational community radio, thus reinforcing the view that local communities respond to educational messages involving drama. Various radio education campaign days were held throughout Zambezia in different towns. In each campaign, the actors who took part in the weekly radio dramas gave a live radio performance of a play. Within hours of their arrival at the town, word spread quickly that the radio actors were present. This knowledge acted like a magnet and people came to the performances because they “knew” the actors and they listened to the radio dramas. Local celebrities showed an interest in sharing in the campaign activities. Priests wanted to give church services, school teachers wanted to be interviewed, and the local council leaders offered to open the day’s activities with a formal speech and ceremony. The actors became instant heroes and heroines. One of the Radio Mozambique producers working with the campaigns said he had worked in media for several years, but he had never seen actors receive such popularity and accolades.

Why were the radio educational campaigns so successful and why did they attract such large local audiences? Part of the success can be attributed to the actors being known to their audiences through the regular broadcasts and to the characters having credibility with the listening audience. The characters face similar situations to those experienced by their listeners and they acted like people in real life with their own problems and their personal relationships. There was a measure of cultural acceptance by the audience, community involvement through

the involvement of local people and the pooling of material resources to maximize the impact of the campaign.

DISCUSSION

Van Zyl (2004) stresses that “Producers, writers and researchers in the field of development communication must sit down with funding providers and commissioners of programmes and convince them to move away from a blind faith in a single medium, the curse of media determinacy, to consider the entire social, economic, cultural and psychological context of the use of a medium in education and development programmes” (p. 2). Jallof (2003) has a similar point of view and notes that there are over 30 national languages in Mozambique that can be grouped into 14 different language groups. She says, “National solutions to Mozambique’s information and communication problems must take these factors into account...” (p. 116). Who can disagree? It is the old but so frequently forgotten point that you cannot teach effectively in a vacuum. You need to have an understanding of the culture and the ways in which people learn. Effective communication in radio requires people with skills, knowledge, cultural sensitivity and an intention to incorporate as many diverse elements into their programs as possible. Radio is only one medium. But with support from print, posters, community resources and support people from the community, communication begins and subsequent behavior change takes place over a period of time. Time for real change takes not months, but years of broadcasting. There is a need to increase the number of listeners and to then hold their attention week after week. Part of the task is scheduling programs at times suitable for your listening audience. Program credibility is essential and cultural values need to be present in all the radio programs. Care is required with the language level, amount of content presented and presentation styles.

A study of 14 radio serials around the world by The Communication Initiative (2004, p.18) identified a number of replicable features including:

- a. Having an integral and ongoing audience research component;
- b. Incorporating audience feedback at every stage by reading letters on the air, adapting storylines in response to research, running competitions and so forth, will help to keep and increase audience;
- c. Paying constant attention to entertainment quality, realism and production values will keep audience, radio stations and donor funders happy;
- d. Giving strong attention to initial and in-service staff training is something that is sometimes overlooked, but pays off in the end;
- e. Collaborating closely with existing social/health/agriculture services is vital if the media intervention is advocating the use of specific services/technologies, and can be extremely damaging to the project, if overlooked;
- f. Paying strong attention to back-up materials in print and in person, and/or to accompanying factual/documentary/Q&A programs;
- g. Addressing both the supply and the demand side, that is, providing education and support for suppliers of health services as well as encouraging demand for health services from the general public;
- h. Promoting the show by running on-air spots/trailers and/or by advertisements in the local press seems to increase the audience; and
- i. Paying constant attention to the broadcast channel to be sure the show is on the air at or as near to prime time as possible.

A sustained time frame of broadcasting is a key ingredient of the media education package. In Mexico, Miguel Sabido developed five family planning soap operas: *Vamos Juntos* (“We

Go Together”), *Caminemos* (“Let’s Walk”), *Nosotros las Mujeres* (“We the Women”), *Por Amor* (“For Love”), and *Los Hijos de Nadie* (“Nobody’s Children”) that were broadcast from 1977 to 1986. During the time, these programs were transmitted there was a 34% decline in the population growth rate. In 1986, Mexico received the United Nations Population Prize for its role as the leader for the population success story in the world (Ryerson, 2003).

The University of Northumbria in Britain evaluated the impact of a two and half year radio education project in Zambia (Collins, 2002). This was the project that was also involved in the radio campaigns. The project designed a weekly educational radio drama and radio magazine for rural listeners. It was broadcast in two different local languages and repeated at times when there were a maximum number of listeners to the radio, for example, early morning and in the evening. After the program had been transmitting for one year, the university research team found that around half the population (53%) had become regular listeners to the radio drama serials. In one district, 47% of the listening audience said they had implemented something they had heard about in the programs. The same evaluation team also reported on the radio magazine program, which was transmitted in a similar time slot, with repeat broadcasts and with similar content messages to the radio drama. It had approximately half the number of regular radio listeners compared to the radio drama serial. In their comments on the radio magazine, listeners did not mention any details of the content. Yet, in the same district over 80% of the radio listeners correctly identified the names of the radio drama characters.

Why should there be a difference between the two programs, the radio drama and the radio magazine? Both programs were in similar languages, covered similar content, broadcast at similar times and were designed for the same audience by the same project team. Much of the material in the weekly magazine programs con-

sisted of interviews with experts and narration by the radio announcer. It must be assumed that it was the format of the programs, the language used and style of presentation that made the difference. A drama with an exciting story is more attractive than experts expounding on their field of expertise and sometimes talking in a voice that lacks the passion of a trained actor. Hence radio drama is a powerful tool.

In a final independent survey of the radio education project conducted in May 2003, it was noted that the message content needed refining. "The tone of some of the results from this survey also suggest that it may be time in some areas to increase the level of detail in the messages that go out through subject specific broadcasting" (Collins, 2003, p.7).

What can be implied from this observation is that the radio drama broadcasts have already built up a regular listening audience who find the programs credible and interesting and that they have absorbed some of the social messages. A report (Compton, Oliveira, & Spence, 2002, p. 20) on the same project came to the conclusion that "the 'radio soap' has just begun to gather a wide following, and its effectiveness will increase over time with increased listenership and increased experience of the local producers."

If the programs were continuously broadcast over several years, positive behavior change could be expected to take place. The same message echoes again and again through the research of radio drama for education. A radio serial creates awareness in listeners, transmits information effectively, but it needs ongoing human and material resource support and a long-term broadcasting commitment if the embedded social messages are to be absorbed and turned into positive behavior.

REFERENCES

Brooke-White, V. (1985). *CONTED philosophy and role*. Radio New Zealand Internal document, Wellington, New Zealand.

Collins, A. (2002). *Radio Listening Survey of a radio project in Zambezia, Mozambique*. Northumbria University, Newcastle-upon-Tyne, UK.

Collins, A. (2003). *Radio Listening Survey of a project in Zambezia Province, Mozambique*. Northumbria University, Newcastle-upon-Tyne, UK.

The Communication Initiative. (2004). *Replicable features: Institutional review of educational radio dramas*. Retrieved from <http://www.comminit.com/pdsradio drama/sld-9379.html>

Compton, J., Oliveira, E., & Spence, D. (2002). *Zambezia Agricultural Development Project Phase II (ZADP II) Mid Term review*. Department for International Development, British Government, UK.

Famili Blong Sarah. Wan Smolbag Theatre, Port Vila, Vanuatu. A Radio Drama Serial on Health. Retrieved from <http://www.comminit.com/pdscc2001/sld-2917.html> and <http://www.wan-smolbag-theatre.org>

Fossard, E. (1996). *How to write radio serial drama for social development*. Population Communication Services, The John Hopkins University School of Public Health.

Gallagher, J. (1975). *Twenty "five years of the Archers"*. BBC. London.

Jallov, B. (2003). (B. Girard, Ed.) *The one to watch creating and sustaining ICT projects in Mozambique*. FAO.

McAnany, E.G. (1976). *Radio's role in development: Five strategies of use*. Washington, USA: Clearinghouse on Development Communication.

Monteiro, Q. (2003). *An interview with the author*. Quelimane, Mozambique.

Morrison, J. (2003). AIDS education in Africa: The uses of traditional performance. Paper presented at *Journalism Conference*, Stellenbosch University, September. Retrieved from the Communication Initiative Web site, www.comminit.com/st2003

Nariman, H.N. (1993). *Soap operas for social change*. Westport, CT: Praeger.

Ryerson, W.N. (2003). *The effectiveness of entertainment mass media in changing behavior*. Population Media Center. Retrieved from <http://www.populationmedia.org/archives.html>

Van Zyl, J. (2004). *Radio in context is everything - Two dangerous fixes to avoid*. Retrieved from <http://www.abculwazi.org.za> and <http://www.comminit.com/trends.html>

KEY TERMS

Drama Serial: An ongoing story told in dramatic form incorporating sound effects, music, dialogue and/or narration. It may be broadcast

once, twice, or several times in a week, and it is usually from 15 to 30 minutes in duration. Sometimes, it is referred to as a “soap opera”.

Drama Series: A story also told in dramatic form with a fixed number of episodes.

Radio Campaign: A project focused on a district or town with a radio station. It seeks to involve the whole community through, for example, radio, singing, dancing, competitions, displays, use of local officials, experts, schools and organizations. Its duration is variable.

Social Messages: These are created to both entertain and educate so that a listener will increase their knowledge on educational issues, develop favorable attitudes to the messages and change their behavior.

ENDNOTE

- ¹ Wan Smol Bag is a theatre group dedicated to addressing social issues through drama education.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, X. Yu, pp. 598-602, copyright 2005 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.15

Digital Bridges: Extending ICT to Rural Communities Using Space Technologies

Phillip Olla

Madonna University, Michigan

ABSTRACT

Space technology has advanced rapidly in recent years. Nevertheless, a number of countries still lack the human, technical, and financial resources required to conduct even the most basic space-related activities, such as meteorology, communications natural-resource management, and education. The need to make the benefits of space technology available to all countries has thus grown more urgent with each passing year. This chapter proposes a two-phased approach for using space technology to deliver information communication technologies (ICT) to underserved areas. The first phase involves the definition and implementation of the satellite global infrastructure to provide connectivity to underserved regions. The second phase introduces the concept of a coalition of space Internet providers (COSIP) model. The aim of this model is to encourage the diffusion of space technology delivered by the GBBS infrastructure to the grassroots level. The model defines how Internet capabilities should

be introduced to rural underprivileged societies to provide health and educational services in a sustainable manner. This model is a reincarnation of the local information utility (LIU) model that was successfully implemented over a decade ago to aid the diffusion of the Internet to rural American communities. This chapter explains the technology at the foundation of the COSIP model and describes the actors required along with their roles and responsibilities.

INTRODUCTION

Information communication technologies (ICT) are considered the driving force for economic, social, and technical development. In effect, high speed Internet delivers numerous imperative fundamental services such as education, health, telecommuting, electronic commerce, and e-government services, at unparalleled cost and performance conditions (Toumi, 2004).

There has been phenomenal growth in the increase in ICT over the globe; however, the digital divide still exists, posing major challenges to many of the developing countries, which are still grappling with a severe shortage of telephone lines, lack of electricity, and high levels of illiteracy. Although it is important to acknowledge the digital divide, it is more important to focus on the progress that has been made and dispel the myth about the digital divide. The most important document that highlighted the digital divide is the 20-year-old Maitland report. Some of statements that were accurate 20 years ago are now deeply established as global myth. Re-education will be needed to change opinions due to the constant e-mail chains and false reporting from journalists and researchers. An example is “There are more telephones in Tokyo or New York than in the whole of Africa.” As of the start of 2004, there were approximately 25 million fixed lines and more than 50 million mobile phones in Africa, which is several times more than the total population of Tokyo and New York. Another urban myth that you may recognize is “half of the world’s population have never made a telephone call.” Although considerable segments of the world’s population do not have access to a telephone, and probably could not afford to make a phone call if a phone was available, the international telecommunication union (ITU) estimates suggest the number is close to one-fifth of the world’s population that have no telephone access. Another myth relating to the availability of the Internet is that “there are more Internet users in Iceland than in Africa.” This statement originated in the 1999 report *Internet for Development*, and became obsolete in 2004. The Internet has become pervasive in society; however, rural and low-income urban areas are underserved in developing nations, and will probably remain so for the foreseeable future, for economic and structural reasons similar to those that limited expansion of Internet services in rural America over a decade ago (Clement, Holbrook, & Staman, 1996). The important

thing to note from these statements is that the rate of adoption of ICT technologies around the globe is accelerating and there is a need for new models, technologies, and networks to introduce new services and applications to those living in underserved areas around the globe.

In recent years the requirements for connectivity and information services has expanded throughout the developing world. However, connectivity is hampered by the time-consuming and costly process of building traditional fixed (i.e., wired) infrastructure. For example, only 3.6 % of the population of Africa has online access (Internet-World-Stats, 2006). The situation in Africa is indicative of the entire developing world: there is a substantial unmet demand for connectivity in developing countries. Further, humanitarian services such as telelearning and telemedicine could effectively and broadly be provided if connectivity costs were lower.

Satellite technology has great potential to reach people living in remote and underdeveloped parts of the globe, and in many instances, it is the only form of technology that can provide connectivity to remote or difficult-to-access regions. Satellite systems play an important role in enhancing the ICT landscape, extending necessary services to the hard-to-reach and bridging the digital divide. It is apparent that satellites, from their vantage points in low, medium, or geosynchronous orbit, dedicate a synoptic view and global coverage for either resources management or for global connectivity. Space technology, through communication and remote sensing satellites, contributes to both the conduit and the contents for the evolving Internet infrastructure. Communication satellites provide necessary interconnection to information sources, thus enabling access to “information services” themselves.

This chapter is structured as follows. The first section provides an overview of the digital divide; the next section discusses the vision of a world without a divide by the creation of a global broadband satellite system (GBSS). The following

section explores how a new wireless technology called WiMax can be converged with satellite technology to address the *digital divide*. Prior to the conclusion, this chapter explores the concept of a local partnership approach for digital inclusion called the COSIP model.

MEASURING THE DIGITAL DIVIDE

The use of the term “digital divide” became popular in the 1990s to portray the apparent emerging gap between those who have access to ICT technologies and skills and those who do not. The divide exists due to socio-economic or geographical reasons, and results in limited or no access to services such as the Internet, computers, and communication capabilities. There is a concern that ICT would exacerbate existing inequalities and allow people to be disadvantaged based on their country, geographic location, age, gender, culture, or economic status.

The view that restriction to information access closed doors to economic and social development opportunities is not new. In 1984, the *Missing Link Report* (Kelly, 2005) highlighted that the lack of telecommunication infrastructure in developing countries impeded economic growth. The *Missing Link Report's* scope was limited to access to telephones rather than the current ICT concept. In 1996, the ITU initiated a United Nations project *Right to Communicate*, that was aimed at providing access to basic ICTs for all, with the motivation to reduce information poverty for developing countries. This is a goal of many NGOs, and is also at the heart of plans of the world summit on the information society (WSIS).

Most reports looking at their evolution of ICT over the past decade in developed and developing countries express a view that an overall trend of growing ICT disparities exists between countries. Looking closer at the statistics as published by the different official bodies, such as ITU or the world bank, it is clear that the gap in ICT access

between developed and developing countries does exist and is still quite important. It is difficult to comment on the size of the gap, as recent measurement indicators are dependent on specific parameters such as:

- Internet host
- Internet users
- Fixed telephones
- Network speeds
- Costs

Despite these varied parameters that can be considered, one thing that is not in contention is that the availability and the quality of a robust telecommunication infrastructure is the key to a quick and reliable development of ICT in the developing countries.

Although the term digital divide was originally created to differentiate between those who have access to digital information technologies (computers and software) from those that do not, more recently, the meaning has changed to mean access to broadband Internet connections or ICT services. The important term is *connection*. In spite of the rapid evolution of telecommunications, there are still regions of the world that are isolated from major population centres and Internet connections. Over the next decade, the digital divide is expected to grow smaller due to innovative solutions that utilize satellite and wireless technology. To understand the extent of the digital divide, it is useful to identify services and hardware that focus on reducing the digital divide among the four key ICT (Kelly, 2005) domains listed below.

1. **Fixed line telephone networks:** These form the main telecommunication infrastructure. The digital gap fell from 14 times to 5 times greater, in the decade between 1992 and 2003, as economies such as China and Vietnam greatly expanded their fixed-line networks.

2. **Mobile telephones:** The reduction is even more dramatic here. Mobile phones took around 20 years to reach their first billion users; however, it only required 4 years (2002-2005) to surpass the two billion subscriber mark. During the decade, the digital gap was reduced from 30 times to 5 times. Since 2002, mobile phones have outnumbered fixed-lines.
3. **Personal Computers (PC):** Unfortunately, this area is not narrowing as quickly as the communications categories. Although the level of penetration in developing countries has risen from one PC for every 243 inhabitants in 1992 to one for every 29 in 2003, this is still a long way behind the rate of one PC for every 2.2 inhabitants in developed economies. The digital divide is wider in PC ownership than any of the other indicators tracked here. One reason for this is the high cost of acquisition and of ownership (e.g., upgrading memory, software, etc.) of a personal computer. The advent of low-cost computers such as the \$100 laptops, together with the widespread adoption of free and open-source software, may help to reduce the digital divide for PCs.
4. **Internet:** The Internet has had the most dramatic reduction in narrowing the digital divide. Between 1992 and 2003, the gap between developed and developing countries narrowed from 41 times more to 9 times more. Although there are fewer estimated Internet users than PCs in developed countries (44.8 and 44.9 per 100 inhabitants, respectively), in developing countries there are more Internet users than PCs (5.1 and 3.4 per 100 inhabitants). This suggests the significance of Internet access from cyber cafes, post-offices, schools, universities, and other public internet access centres (PIACs) in the developing world.

The evidence is clear that for the four ICT domains identified, the digital divide is narrowing as diffusion spreads, and in most cases at an accelerated pace. The concept of a narrowing digital divide is an oxymoron, as the technological changes are also accelerating, and ICT innovations are constantly being invented and deployed. This will lead to the impression that the digital divide is actually expanding faster. As more bandwidth becomes available, the Internet applications to use the bandwidth follow, and is eventually diffused to developing nations, and each succeeding ICT innovation starts the diffusion.

The Importance of Connectivity

The Internet and the World Wide Web symbolize the convergence of media infrastructure and services. Unlike any other medium, it has empowered the average user to become an originator of content and services, in addition to being a consumer. Used primarily in the early days for e-mail, file transfer, and remote login applications, the Internet has graduated to many innovative applications in areas as diverse as distance education, telemedicine, e-commerce, banking, and corporate communication, to name only a few. The browser programs that help the users access the Internet have sophisticated features, such as audio and video streaming and other multimedia applications. At present, the bandwidth constraints are the prime limitation which, once resolved, will allow more innovative, interactive broadband applications (UNESCAP-Report, 2002).

The Internet has had a profound impact on educational pedagogy, and innovative e-learning techniques are being implemented round the globe. However, the digital divide has a profound effect on how these techniques are implemented outside the Western world. Private individuals' homes in developed nations have more bandwidth than most African universities. Further, the type of access American and European households can receive for \$100 per month would cost African universi-

ties \$10,000 for the same time period (Partnership, 2002) African universities are significantly handicapped in their ability to provide modern educational opportunities to their students.

Bandwidth is central to the operation of university life, therefore improving access to a greater number and cheaper bandwidths. Managing it efficiently, and using it appropriately for teaching, learning, and research, has become a critical issue for African universities (Partnership, 2002)

In Africa, most institutions use dial-up, leased lines for connectivity and their average bandwidth is often significantly slower than residential service in the United States. The lines are generally used at 100% capacity, 60% of the time, and the average bandwidth cost is US\$5.46/kbps/month (Steiner, Tirivaya, Jensen, & Gakio, 2004). To compound the issues, universities often do not receive the bandwidth promised by their local service provider. Shared lines and lack of monitoring equipment mean African universities pay more for less.

Many end-user service providers already exist in most developing nations, and the major commercial ones, in particular, are expanding in both customer numbers and service offerings. However, rural and low-income markets are underserved and likely to remain so for the foreseeable future. The

reasons are similar to those that for a long time limited telephone access to rural and low-income communities in developed nations. Customers are scattered, it is expensive to reach, and often high-priced services are not affordable. Rural, isolated geographical areas offer slim pickings to large commercial service providers.

The challenge is to create models that begin by building on existing local resources, and can be scaled to expand as local markets grow. The community of regional and local service providers needs to come up with imaginative approaches to encourage this expansion. The groups most realistically able to step up to provide these services are the ones with experience in these markets. Local institutions who know their own communities with backing from local private investments are ideal. This approach is supported by the Organization for Economic Cooperation and Development (OECD). An OECD report concluded official donor assistance has *abandoned support* for communications infrastructure in developing countries (OECD, 2005). Focus has shifted to social investments to reduce poverty. The OECD states that assistance from private sector organizations is required to help cover the shortfall by building, delivering, and operating communications services. The approach discussed

Table 1. Bandwidth in African universities (Source: Bandwidth Task Force)

| Current bandwidth utilization in selected universities | |
|--|---|
| Institution | Bandwidth Utilization: Kbps up/Kbps down |
| University of Dar es Salaam (Tanzania) | 256/512 |
| Makerere University (Uganda) | 1,280/2,500 |
| Eduardo Mondlane University (Mozambique) | 384/1,000 |
| Bayero University (Nigeria) | 64/128 |
| Obafemi Awolowo University (Nigeria) | 128/256 |
| University of Ibadan (Nigeria) | 56/200 |
| University of Jos (Nigeria) | 64/128 |
| University of Ghana | 512/1,024 |

in the next section to create a global broadband satellite system is poised to lead the way in this type of initiative by building a communications infrastructure and ensuring a strong partnering between the humanitarian and learning organizations in the local community.

VISION OF A WORLD WITHOUT A DIVIDE: GLOBAL BROADBAND SATELLITE SYSTEM (GBSS)

In comparison to fixed cable solutions, satellite technology provides the advantage of universal coverage, point-to-multipoint transmission capabilities, seamless transmission, independence from terrestrial infrastructure, and rapid deployment. Satellite technology can deliver broadband Internet services to developing countries and to rural and remote areas in developed countries where terrestrial infrastructure is practically nonexistent or its rollout is prohibitive in an affordable and timely basis (ITSO, 2002).

Satellites are considered to be one of the keys to reducing the digital divide, especially in the more isolated areas, in much the same way as they brought telephone services. In fact, as far as Internet access is concerned, there are geographical areas where there is just no alternative to satellites. (EADS-Space, 2005). The ITU has a vision to address the communication infrastructure imbalance affecting underdeveloped countries by implementing a global, connected information and communication society. The initiative would be through an innovative public-private sector partnership that would lead to the establishment of a global broadband satellite system considering the deployment benefits over other communication support infrastructures. Cost permitting, a robust and affordable universal broadband infrastructure could be implemented within a reasonable timeframe. This initiative would lead to the development of a new market

for broadband equipment and services through the adoption of a universal technical standard for user terminals, effective access to the geostationary orbital and frequency spectrum resources, and a minimal procompetitive regulatory environment. The idea of GBSS can be traced back to a United Nations Resolution below:

Resolution 1721 (XVI) of the United Nations General Assembly sets forth the principle of the availability of satellite telecommunications to the nations of the world on a global and non-discriminatory basis.

In the 1960s, while trying to fulfil this resolution, the international community created the International Telecommunications Satellite Organization. The objective of this group was to operate a single global commercial telecommunications satellite system to provide expanded basic telecommunications services to all regions of the world on a nondiscriminatory basis. In theory, their task was to ensure that developed and developing countries would benefit equally from emerging satellite technologies. The same political will was behind the establishment of other government-operated international and regional systems, such as Intersputnik, Inmarsat, Eutelsat, and Arabsat, subsequently joined by dozens of successful private satellite systems.

When you consider the fact that there are over 200 commercial satellites in geostationary orbit that cover the entire planet, there should not be a digital divide, as there is no region on the planet without reasonable coverage. There are 69 countries, accounting for more than 60% of the world population, currently relying on satellites for their domestic and international telecommunication services. An investigation by the ITU into the reasons behind the mismatch of existing global satellite capacity and the need for communication and Internet services revealed the following (Toumi, 2004).

- a. User terminals are expensive and cumbersome. Traditionally based on proprietary standards, satellite systems are not interoperable. This is an obstacle to the economies of scale required for mass production of low-cost equipment.
- b. The technical and operational bases guiding allocation of frequency spectrum and geostationary orbital slots for fixed satellite services (FSS) are not optimized for use by inexpensive terminals accessing broadband services. In effect, these allocations were determined based on a small number of sufficiently large terminals (earth stations) coexisting with the terrestrial stations and taking up almost all frequency bands.
- c. The *passband* transmission capacity is costly. Satellite operators face tough administrative, technical, and regulatory hurdles to gain access to domestic markets. Restrictions on user terminals, including utilization taxes and fees, complex and costly type approval procedures, reluctance to use the so-called network, and *head-end* or *gateway* stations located outside the national territory, to mention just a few, are governed by agreements satisfactory to governments, operators, equipment manufacturers, and service providers.

Barriers to the Broadband ICT's Access Deployment

Broadband ICT access has been primarily deployed in developed countries in urban areas due to the economics and limitation of existing technologies. In the initial phases of the concept development stage, the service providers and the operators are always inclined to serve the most highly populated regions, which normally translate to rich suburbs and cities, where most of the potential customers reside.

There are two factors that affect the diffusion of ICT. These are called the demand and cost

factors. The first aspect driving adoption of ICT in developed countries and urban areas is the hunger for more bandwidth to support multimedia applications. Rural areas in developing countries prefer voice communication technologies and applications with a sluggish progression toward ICTs. Developed countries own telecommunication infrastructure and have the means to pool financial resources to invest and pay for new services, while developing countries lack any form of basic infrastructures such as telecommunication, electricity supply, and roads. The developing nations also experience great difficulty mobilizing the required financial resources. This concept can be described as the *demand factor*.

The next key factor driving ICT adoption is the available technologies. Existing wired or wireless technologies have intrinsic limitations either in performances or in capacity, for example, the 6 km maximum distance from the exchange for ADSL or the line of site (LOS) customer premise equipment (CPE) location from the base station for wireless access. If and when these limitations become eliminated using other complementary backbones or equipment such as WiMax, the additional expense for this new equipment, along with their deployment and operation, directly impacts the business model. This factor is referred to as the *cost factor*. To achieve a cost effective deployment of ICT in developing nations, both the demand and cost factors need to be addressed, as they are major barriers to broadband access. One approach used to address this problem is using an international partnership model.

An International Partnership Approach for Resolving the Global Digital Divide

The ITU recently released a statement that indicated the use of partnership as the key to connecting communities. The initiative is called *connect the world*. It is a global multistakeholder effort established and working within the remit

of the WSIS to encourage partnerships to bridge the digital divide. The main objective of this initiative is to provide ICT to people worldwide, of whom making a simple telephone call remains impossible.

Currently, the main driver behind the concept of a GBSS is the WSIS. This initiative definitely has political clout. It was attended by 50 heads of state/government and vice-presidents, 82 ministers, and 26 vice-ministers from 175 countries, as well as high-level representatives from international organizations, the private sector, and civil society who attended the Geneva Phase of WSIS and gave political support to the Geneva Declaration of Principles and Geneva Plan of Action (ITU, 2005) that were adopted on December 12, 2003. More than 11,000 participants from 175 countries attended the summit and related events. These types of initiatives are required because research suggests that over 800,000 villages, or 30% of all villages worldwide, do not have any form of connection. Research also reveals that 942 million people living in the developed nations have five times better access to fixed and mobile services, nine times better access to Internet services, and own 13 times more PCs than 85% of the world's population living in low and lower-middle income countries (Cayla, Cohen, & Guigon, 2005).

The trend for telecommunications' markets has been liberalization and privatization of the telecommunications market to free themselves of their public service obligations. This trend makes it almost impossible to visualize a global broadband service infrastructure owned and financed by the public sector or a solitary operator. Unfortunately, this means that any project aimed at providing universal broadband services must depend on global market forces and the voluntary participation of network and device operators.

Formation of the GBSS Association

The most sensible approach to attain a global broadband service infrastructure is to develop a

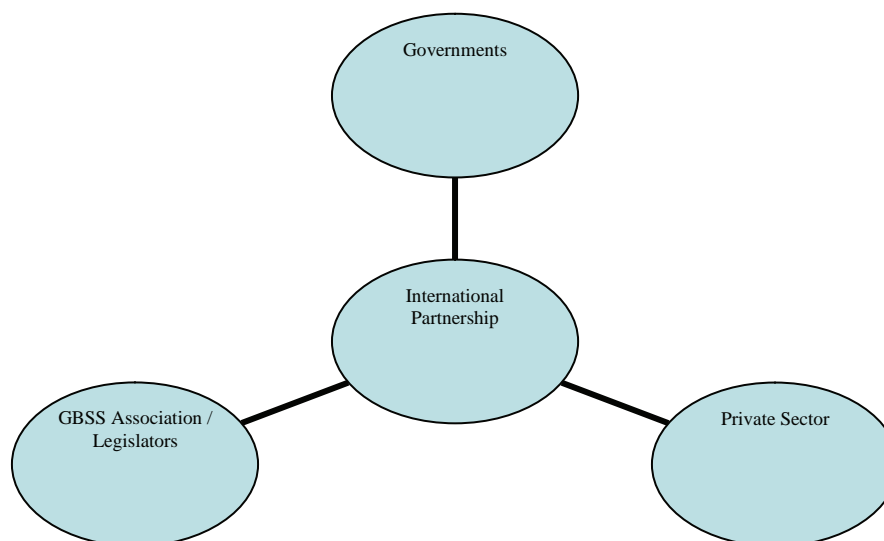
model similar to the digital mobile system GSM system. There are more than 1.7 billion people who use GSM networks and services. This equates to one quarter of the world's population. GSM is one of the greatest technological success stories of our age, on a par with the Internet. In fact, there are more people with GSM mobile phones than have Internet access. GSM networks are represented by the GSM Association (GSMA). This global trade association represents more than 690 GSM mobile phone operators across 213 territories and countries of the world. In addition, more than 160 manufacturers and suppliers support the association's initiatives as associate members. The primary goals of the GSMA are to ensure that mobile phones and wireless services work globally and are easily accessible, enhancing their value to individual customers and national economies, while creating new business opportunities for operators and their suppliers.

Role of the International Governments

Using the principles of the GSMA as a guiding model, there are fundamental issues that need to be addressed before we can even consider providing satellite high-speed Internet services through individual or community low-cost, small-dish platforms. This is a very elaborate project, and governments and private organizations, along with international bodies will have to develop an attractive technical and regulatory framework. Some of the components that fall under the responsibility of the governments would include:

- Identifying internationally harmonized radio-frequency bands and orbital locations that can assure global coverage, suitable for the provision of high-speed Internet services.
- In the likely situation that harmonized frequencies cannot be identified globally in "unplanned" bands, the allotment plans for the direct broadcasting satellite services

Figure 1. Actors for creation of global broadband satellite system



- The GBSS body would need to request that governments for member countries should make available part of their national allocation, without compromising their rights under the Plans.¹

One of the most important roles governments will also be responsible for is establishing a harmonized and minimal satellite telecommunications regulatory framework that promotes competition and broadband services. The regulatory framework would include the following four responsibilities:

1. Granting *landing rights* to all satellite operators participating in this initiative to provide high-speed Internet services
2. Licensing at least two service providers in each country to provide high-speed Internet services

3. Ensuring the principle of interoperability among all satellite systems providing high-speed services
4. Ensuring competition among operators providing high-speed services
5. Ensuring financial support where market conditions are such as to hinder access to high-speed Internet services

The Role of the Private Sector: Building Infrastructure and Markets

The primary role of the private sector is to develop innovative technical infrastructures and build strong markets for the products and services. The commitment from governments to create a global market for satellite broadband services will introduce new business opportunities for the private sector. It is imperative that the telecommunications industry, especially the satellite operators and device manufactures, should be actively involved in the design and development of a global infrastructure.

To ensure the creation of a harmonized global market, it will be important that GBSS operators have access to prime frequency bands and ideal orbital locations. This will allow them to deliver high-speed services via small-dish and low-cost user terminals. The role that needs to be undertaken by the private sector is described below:

- Harmonize universal technical standards for user terminals to access high-speed Internet service; the aim of this is to promote mass production of simple, low-cost terminals.
- Develop interoperability standards between broadband satellite networks to facilitate easy content exchange; the standards should also take account of ITU Resolution 101 on the development of the Internet protocol (IP) for public telecommunications networks.
- Use the orbital locations and RF spectrum resources identified for the global broadband satellite infrastructure, exclusively to provide broadband services in conformity with the universal technical standard specifications.

This initiative is more than just a system to resolve the digital divide. It also represents opportunities for the expansion of the telecommunications industry, an industry which is constantly investigating new prospects to ensure its survival and progress. Today's satellite telecommunication technologies are capable of providing universal access to high-speed Internet services within a reasonable timeframe at high cost. The GBSS approach will improve the access, provide more innovative features and content and become more affordable. This objective can only be attained by forging a new type of partnership between the public and private sectors. It is important to understand that providing a GBSS is merely providing the backbone network infrastructure. Ground networks will still be required to connect communities. One emerging technology that could be used to distribute the broadband signal over

a large area is called world interoperability for microwave access (WiMax).

CONVERGENCE OF SATELLITE-WIMAX TECHNOLOGY FOR ADDRESSING THE DIVIDE

WiMax is a standards-based wireless technology that provides high-throughput broadband connections over long distances. IEEE 802.16 provides Internet connectivity up to 50 km (31 miles) of linear service area range and allows connectivity between users without a direct line of sight. It is also anticipated that WiMax will allow interpenetration of broadband services such as VoIP, video, and Internet access, simultaneously.

The technology industry as a whole is committed to addressing the global digital divide, and there are numerous organizations and initiatives, such as WIMAX Forum, ITU, Intel, Microsoft, and GSMA, that are committed to reducing the technology disparity. The WiMax forum (Cayla et al., 2005) in particular is committed to delivering an innovative wireless technology standard to address the new millennium development goals aiming at a *global partnership for development* (Goal 8), and more specifically through Target 18:

In cooperation with the private sector, make available the benefits of new technologies, especially Information and Communications. And the objective that: everyone can create, access, utilize and share the information and knowledge, enabling individuals, communities and people to achieve their full potential and improve their quality of life in a sustainable manner.

The new WiMax wireless technology will adequately address the following WSIS goals for 2015:

- **Target 1:** To connect villages with ICT and establish Community Access Points, knowing that it is estimated that 1.5 million villages in developing nations remain unconnected to telephone networks
- **Target 10:** To ensure that more than half the world's inhabitants have access to ICT, knowing that the total number of estimated Internet users in 2002 was around 600 million, or just under 10% of the world's population

In areas without preexisting physical cable or telephone networks, WiMax could allow access between anyone within range of each other. Home units the size of a paperback that can provide both phone and network connection points are already available and easy to install. Intel is already working on creating processors that support WiMax. PanAmSat, the satellite communications company recently called satellite-delivered WiMax “the future for handheld devices.” At the WiMax Forum Plenary in Vancouver 2006, PanAmSat used WiMax to deliver the first-ever live video sent by satellite to a handheld device. PanAmSat anticipates that mobile phone, PDA, and laptop users will begin to access the Internet over satellite-based WiMax connections, and also foresees the technology as a way to deliver IP-TV throughout.

WiMax is considered to be a cost-effective solution for remote deployment; however, it is definitely not limited to such applications, and may also be an answer to expensive urban deployments. Due to the lack of wired infrastructure in most developing countries, the costs to install a WiMax station in conjunction with an satellite hub will be minuscule in comparison to developing a wired solution. The wide, flat expanses, rugged terrain, and low population density is ideal for WiMax deployment, and its current diametrical range of 30 miles. For countries that have skipped wired infrastructure because of inhibitive costs and unsympathetic geography, WiMax can en-

hance wireless infrastructure in an inexpensive, decentralized, deployment-friendly, and effective manner (Cayla et al., 2005).

Satellite broadband converged with WiMax technology provides a very strong technological offering, with the potential to cover the globe. Unfortunately, having good technology does not ensure that the people who need it the most can afford the technology or understand the full potential. It is important to have viable and sustainable access models. The model proposed in the next section involves the formation of an alliance called coalition of space internet providers (COSIP) and is based on a proven methodology.

LOCAL PARTNERSHIP APPROACH FOR DIGITAL INCLUSION: OVERVIEW OF COSIP MODEL

This section proposes the concept of using local initiatives to increase demand for new ICT services. The solution proposed involves the formation of an alliance called coalition of space internet providers (COSIP). This model exploits ideas developed over a decade ago to successfully aid the diffusion of Internet connectivity to communities in rural North America. The solution involves identifying a local institution and creating infrastructures that build on existing local resources and expertise. This model can be scaled so as to expand as local markets needs expansion. The COSIP model is based on the Local information utility (LIU) proposed in 1994 (Clement et al., 1996). The idea of a LIU was created by CICNet Rural. The LIU was built around one or more local organizations, such as a school district, a community college, or a public library.

The coalition will provide a means to access health and educational resources to a rural community using one of the described space technology configurations. The technological configuration will be dependant on the technical requirement,

size of community, and the purpose of the connection (education, telemedicine, community engagement, etc.). There will also be the opportunity for Internet connectivity to be extended to other groups in the community or to a telecenter which could serve the ICT needs of the local community. The resulting system must provide access to local and community information resources. As experience in localities grows, project stakeholders will need to broaden their information holdings and come to integrate educational, business, cultural, and governmental purposes and information within their structures.

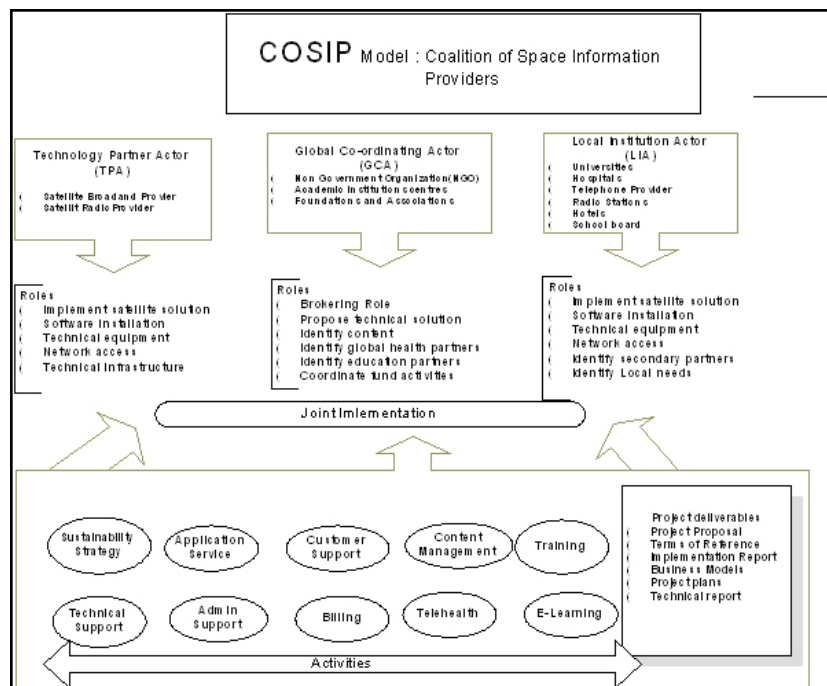
All initiatives similar to COSIP, which aim to implement ICT services to bridge the digital divide, must aim to address the following issues (Gurstein, 2000):

- Provide support for a multiplicity of usage roles involving the creation, dissemination, and retrieval of information

- Address the full range of possible users and the diversity of their life situations
- Recognize the interplay of social and technical dimensions in infrastructure development
- Encompass both conventional and new media
- Highlight *access gaps* and social forces likely to be left out by market forces
- Help to identify essential services

The growth of the Internet as a means of providing communication, education, or health services offers an opportunity for new, agile groups of people to come together and work from widely dispersed geographical locations around the globe. Education is a very important aspect. The perceived potential of computer-based networking to transform primary, secondary, and basic health education will eventually lead to widespread networking for schools. Higher

Figure 2. Coalition of Space Information Providers (COSIP) model



educational institutions are realizing opportunities to extend their campuses by using radio, computer networking, and video technologies to impart educational content, in effect moving the universities closer to the community for the purpose of continuing lifelong education.

Successful implementation of the COSIP Model will certainly contribute to the achievements in the field of ICT, as well as in other priority areas, such as poverty alleviation, managing globalization, and addressing emerging social issues. Using the COSIP model, each interested local community will have to find their own motivations for investing in community networking. The opportunity to improve the economic prospects of many localities, coupled with educational institutions' drive to improve educational services and the ability of local health care providers to form telemedical partnerships with international health care organizations, can serve as overall motivating forces.

This type of initiative will require the creation of a partnership consisting of three focal actors; technology partner actor (TPA), local institutional actor (LIA), and global coordinating actors (GCA). These roles will be explained in more detail in the next section.

COSIP Actors' Roles and Components

To successfully implement the COSIP model, there are three important groups of actors. The local institutional actor, the satellite technology partner, and the global coordinating actor.

Local Institutional Actor (LIA)

The LIA are normally the primary actor. The primary actor is the focal point of the relationship. The primary actor can be any local institution or group, such as a school district, university, community college, public library, business group, community coalition, or even a local communica-

tion service provider such as a telephone, radio station, or television company. The plan should be implemented so as to adapt to local conditions and growth patterns.

Satellite Technology Partner Actor (STP)

The STP will use its considerable technical assets and knowledge to build in the air what does not exist on the ground in developing countries. Satellite and broadband wireless technologies will be blended to provide low cost, secure, and easy to use connectivity to locations not readily accessible by wired, land-based systems.

Traditionally, satellites are used to link a facility in a developed country to a particular location in a developing country. From that location, a wired network is built to provide connectivity to computer users. Often, connectivity is limited to a single location such as a university, hospital, or cyber café. The solution being proposed by the COSIP model builds on this concept to extend the coverage to sites in the vicinity of that community. The coverage can be extended depending on the requirements of the COSIP group members. Satellite and wireless technologies can be combined to provide fast, reliable, and secure connectivity by establishing "hotspots" that are independent of location and wired networks. See Figures 3 and 4 for example configurations.

Global Coordinating Actors (GCA)

The GCA takes on the role of a broker, responsible for validating the LIA's claim for resources and matching it with the capabilities of one of the STPs. They will also be responsible for coordinating the local organizations along with regional service providers providing guidance and advice. Any applications for funds will be via this group, and initial payments to the TPA for equipment, training, and support will be handled by the GCA. To achieve the goal and support

Figure 3. Primary location=university secondary location=school (nonprofit making)

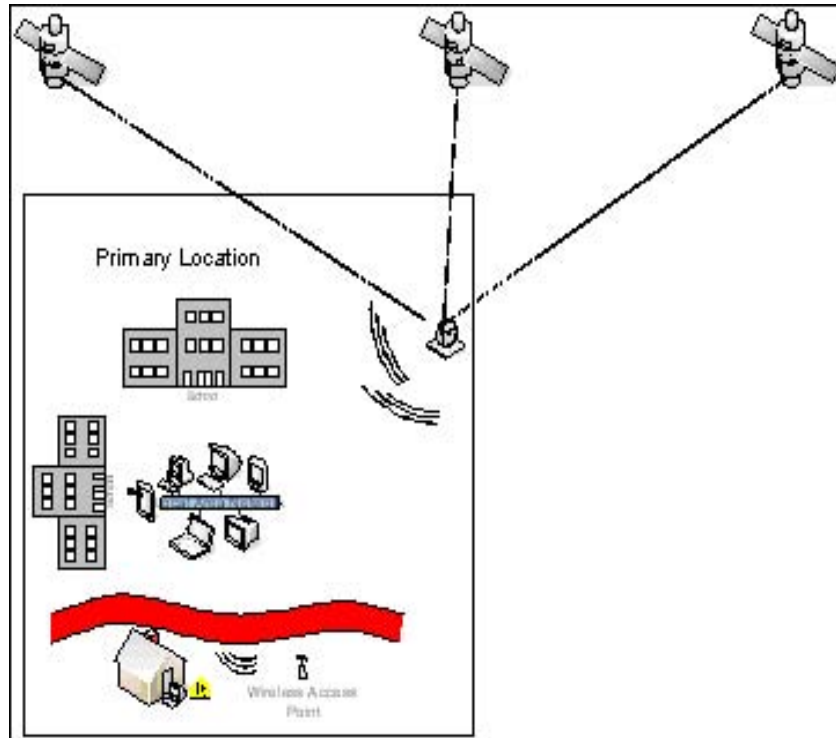
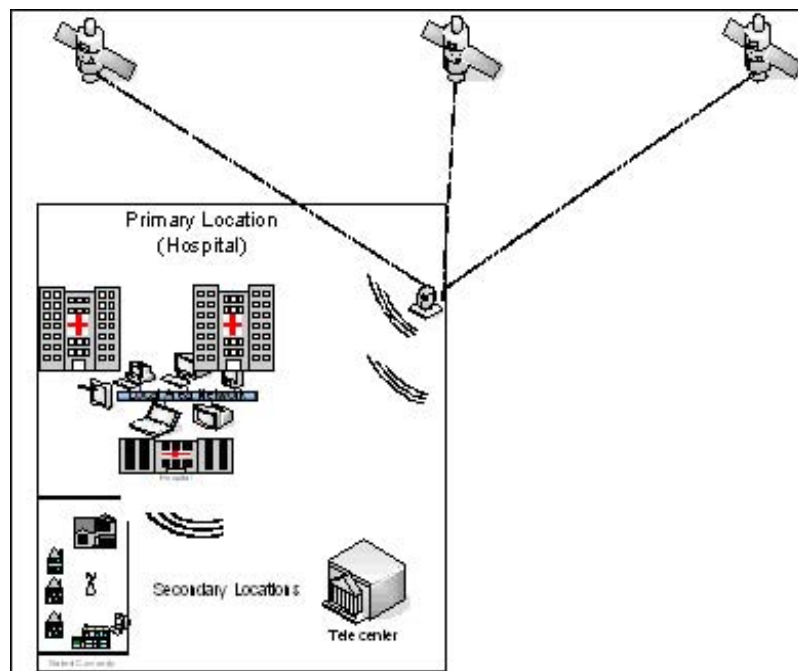


Figure 4. Primary location=university secondary location=school (nonprofit making)



the alliance objectives, the GCA, in conjunction with service providers, needs to play a brokering role, developing technical, human, and capital resources to help local groups plan and implement realistically.

Components of COSIP

The local institutional actor LIAs may, if they so choose, resell services to other users or user groups in the community. This approach is encouraged to aid sustainability of the project. The LIA also has the potential to create private information exchanges (PIX), purpose-driven connections between local groups to support more efficient means of local resource access. Providing the connectivity is not enough. The core components that must be considered include customer support, user training, the right mix of services, the proper information infrastructure, and content.

Support and Training

Support is critical to the success of the project in the community, and the agreement between regional service providers and local customers should place special emphasis on the customer's likely needs to provide a robust service package. The models implemented must define locally appropriate user training, both entry-level and advanced. Regional service providers should work with the LIA to identify training sources for local trainers or broker referrals to knowledgeable resources, often at postsecondary educational institutions in the region. The LIA should also define a help desk capability to answer service questions from users, and should provide a centralized referral capability for networking consultants, trainers, and other experts.

Application Services

The range of services an LIA will provide can include electronic mail, news, Web and Gopher

servers, internetrelay chat (IRC), video conferencing, voice over IP (VoIP), mailing list management, and caching applications for Web client and server response speedup. Other services can be provided on the basis of an appropriate bandwidth infrastructure (i.e., higher bandwidth may permit video applications).

Technical Infrastructure

The TPA will need to supply the LIA with a basic package of middleware and services, and should be responsible for their coordination and for conducting ongoing, standards-based research and development. The capabilities should include:

- Authentication services (i.e., verification that a given user is allowed access)
- Authorization services (i.e., verification that a user can invoke a given application)
- Call detail and settlement services (for access from remote LIAs)
- Domain name service
- Accounting and financial support services

If the components above are considered, the chances of success are increased. It is important to consider models such as the COSIP model due to the fact that these initiatives are being implemented in developing nations with limited resources, knowledge, and technical competencies. It is also likely that government and local official are corrupt, which would mandate that the concept of a GCA is utilized to avoid fund mismanagement.

CONCLUSION

The availability of ICT services and applications are considered to be the driving force for economic, social, and technical development. The convenience of a good infrastructure facilitates the delivery of high speed Internet, which transports

important services such as education, communication, health, telecommuting, electronic commerce, and e-government services. The development of ICT applications promises a ray of hope to the developing countries; however, the prospect of accelerated growth still seems to be far away. It is imperative to facilitate the emergence of a global broadband satellite system capable of providing high speed Internet access on a global and nondiscriminatory basis, in accordance with the provisions of United Nations General Assembly Resolution 1721 (XVI), as well as the International Telecommunication Union Resolution 64, which mandates nondiscriminatory access to modern telecommunications facilities and services. Once a global system is in place, the next challenge would be to encourage deployment in the local vicinities using models such as the coalition of space Internet providers. This type of approach is necessary to ensure that a sustainable model is implemented at the grass root facilitating the use of appropriate equipment, devices, services, and business models.

REFERENCES

- Cayla, G., Cohen, S., & Guigon, D. (2005). *WiMax: An efficient tool to bridge the digital divide*. Retrieved February 22, 2007, from www.wimaxforum.org
- Clement, J., Holbrook, P., & Staman, M. (Eds.). (1996, June 25-28). Extending Internet access to rural areas and small communities in the upper Midwestern United States. In *Proceedings of the INET'96 International Conference*. Montreal, Canada, http://www.isoc.org/inet96/proceedings/e5/e5_4.htm
- EADS-Space. (2005). *Orbiting Internet satellites to bridge the digital divide*. Retrieved February 22, 2007, from <http://www.space.eads.net/press-center/editorial-features/428-en>
- Gurstein, M. (2000). Community informatics: Enabling community uses of information and communications technology. In M. Gurstein (Ed.), *Community informatics: Enabling community uses of information and communications technology* (pp. 1-30). Hershey, PA: Idea Group Publishing.
- Internet Usage Statistics for Africa. (2006). *Africa Internet usage and population stats*. Retrieved November 2006, from <http://www.internetworldstats.com/stats1.htm>
- ITSO. (2002). *Global broadband satellite infrastructure initiative*. Retrieved February 22, 2007, from http://www.itso.int/php_docs/BroadbandInitiative-FINAL-english-17Dec02.htm
- ITU. (2005). *WSIS outcome document*. Retrieved February 22, 2007, from <http://www.itu.int/wsisis/outcome/booklet.pdf>
- Kelly, T. (2005). *Twenty years of measuring the missing link*. International Telecommunication Union. Retrieved February 22, 2007, from <http://www.itu.int/osg/spu/sfo/missinglink/index.html>
- OECD. (2005). *Financing ICTs for development efforts of DAC members*. Organization for Economic Cooperation and Development, Development Assistance Committee. Retrieved February 22, 2007, from www.oecd.org/dataoecd/41/45/34410597.pdf
- Partnership. (2002). *Securing the Linchpin ICT for teaching, learning and research*. The Partnership for Higher Education in Africa. Retrieved February 22, 2007, from <http://www.foundation-partnership.org/linchpin/index.php>
- Steiner, R., Tirivaya, N., Jensen, M., & Gakio, K. (2004). *Connectivity in African tertiary institutions*. Retrieved February 22, 2007, from [http://www.ifc.org/ifcext/bsn.nsf/AttachmentsByTitle/ATICS_2004_Report/\\$FILE/ATICS+2004+Report.pdf](http://www.ifc.org/ifcext/bsn.nsf/AttachmentsByTitle/ATICS_2004_Report/$FILE/ATICS+2004+Report.pdf)

Digital Bridges

Toumi, A. (2004). *A global broadband satellite system to serve development*. International Telecommunication Union. Retrieved February 22, 2007, 2006, from <http://www.itu.int/newsarchive/wrc03/documents/broadband.html>

UNESCAP—Report. (2002). *Towards a policy framework for integrating space technology*

applications for sustainable development on the information superhighway. Retrieved November 2006, from <http://unescap.org/icstd/SPACE/documents/InfoHighway/4.asp>

ENDNOTE

¹ UNESCAP—Report. (2002).

This work was previously published in Commerce in Space: Infrastructures, Technologies, and Applications, edited by P. Olla, pp. 169-185, copyright 2008 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.16

Voice Over IP for Rural Telecommunication Provision

Thomas Wilsdon

University of South Australia, Australia

Jill Slay

University of South Australia, Australia

INTRODUCTION

With the continual convergence of analogue technologies with those either simulated or implemented in digital based equivalents, future benefits usually involve better reliability and lower costs. As current technical limitations are removed, the literature does not show any large scale assessment of the legal and security implications of the removal of cables in this digital world or the effect of a move toward wireless transmission in this context. Neither Voice Over Internet Protocol (VoIP) nor IEEE 802.11b is new technology, but the combination of these services to provide a primary telephone network for small regional centres is an innovative solution to rural telecommunication problems.

There are many companies, especially in the context in rural Australia, currently developing satellite communication networks for regional communities to access broadband equivalent

internet access, generally where this type of bandwidth is usually unavailable. Reasons for insufficient access primarily are due to lack of infrastructure and this can be directly attributed to either the remoteness, or to the effect of a low level of population some areas which generally equates to the lack of potential return on investment for telecommunication companies wishing to establish infrastructure out to these regions.

The cost of implementing a traditional wired infrastructure to reach these lowly populated regions offers no great reward to the companies providing the service and therefore they usually discount such an expansion or explore other means to provide the minimum service required by the Australian legislation to every household.

Australia's primary telecommunications company, Telstra, who has a majority owner in the Australian government, is required to meet service supply standards to all Australian households—no matter the geographical location. Service levels

to regional and remote regions of Australia are similar in quality to that of highly populated metropolitan areas but traditionally limited in the services they are required to provide. While current telephone coverage is of an acceptable level, the growth of internet access, among other forecasted future technologies requiring data like infrastructure (IP), has caused great bottlenecks within current solutions and network providers such as Telstra are exploring ways to overcome this. Simply stated, the infrastructure available was implemented with limited foresight and will not scale to accommodate these new and emerging services.

Satellite usage, among other networking technologies, is now being tested and implemented to allow for the delivery of large volumes of IP traffic to regions which are not covered within the major telecommunications network infrastructure. Most of these technologies being explored take the form of wireless. Included benefits of wireless such as the substantial cost reduction achieved with the avoidance of installing long distances of cable and infrastructure. Satellite, particularly with the use of KA band services, allows for clients to connect in a bidirectional fashion with very small aperture terminals (VSAT), transmitting via satellite hub locations to apertures in similar trip times to that of wired infrastructure.

The principle of satellite, and other technologies, is packet switched based usually on the underlying infrastructure of digital transfer as compared to analogue transfer used within the current circuit switched networks. While this provides significant increases in the amount and types of traffic which can be transferred simultaneously, it requires the translation of current analogue technologies, such as telephone and fax, to digital equivalence and back again to analogue to simulate current models. As with most of the services proposed to be offered, and in VoIP in particular, the timing and delivery model are of the utmost importance to ensure the quality of

service for all users. Substantial fluctuations in the time for the delivery of digital packets can confuse the protocols and participants, making the phone call seem unnatural in comparison to current phone usage.

VoIP, as a standard, attempts to simulate the current analogue telephone call but utilises the advantages of digital networks with its ability to generate, route and receive phone calls. Of major concern is the efficiency of the network, along with quality of service (QoS), integration with plain old telephone systems (POTS) and last mile connections. Small companies hope to address some of these issues by offering clients access to metropolitan like services in regional Australia using the benefits of wireless communications not only for the major distance (satellite) but also at the last mile with wireless local loops in the form of 802.11b to connect to this service.

WHAT IS VoIP (VOICE OVER INTERNET PROTOCOL)?

This suggests traditional telephony, which is a circuit-switched technology, can be adapted or interact with an IP network (Marjalaakso, 2003). One may pose the question of why the traditional phone systems must be updated or complemented while it appears to be satisfying current requirements?

BENEFITS OF VoIP

Not only are the merging of voice and data traffic down an individual stream financially beneficial to users, but possible services provided are greatly increased with the ability for scalable updates over time, a characteristic not associated with the traditional analogue telephone network.

Financial Benefit

McPherson reports the financial benefits alone are not enough to entice a large scale of take up of VoIP (McPherson, 2003). Although it is known the cost of a packet switched network for VoIP is approximately half the cost than that of a circuit switched network, an end user will not be aware of these costs other than the monthly subscriber bill. Thus, the financial benefit will be the greatest selling point of the technology to customers and it must be highlighted and marketed openly.

How these vast financial benefits are achieved is due to the architecture of IP networks, and the ability for intelligent navigation (routing) to occur. This gives the appearance that the VoIP solution determines the cheapest method to place the call, when in fact it is predetermined by routing tables within the network. The private network is intelligent and directs the phone call to enter the PSTN where a local call charge will be incurred rather than that of a long distance call. The financial benefit is appealing but IP networks are not always reliable—particularly with time sensitive information.

Other benefits can include no external bills generated by internal calls, even if geographically separated. If a phone call is routed the entire distance via the IP network and never enters the PSTN, no third party bill will charge for that call, as compared to a leased line solution. An example of this is a company with many offices interconnected via broadband links into the internet using VPN connections to secure communications.

Service Benefit

The integration of two networks into one provides maintenance benefits, but is the convergence of voice and data a good relationship? Marjalaakso (2003) predicts the VoIP will compliment the already existing Internet based services such as

web, email and newer technologies like net meeting and instant messaging.

SECURITY VULNERABILITIES OF VoIP

As with all technologies it is essential to examine whether customers confidentiality, integrity and availability to their conversations, data and service are preserved. Marjalaakso (2003) discusses the inbuilt security of standards such as SIP, but summarises that these are not valid as they are flawed and knowledge is widespread about such vulnerabilities. While this is true and valid, the level of encryption and secrecy on telephone services for domestic users and the current level of secrecy on circuit based networks must be determined.

Other risks associated with VoIP implementations are categorised below, using the traditional security goals of confidentiality, integrity and availability.

Confidentiality

Confidentiality concerns one's ability to remain anonymous to outsiders while being able to disclose information for authorisation and billing. Issues in confidentiality include eaves dropping and tapped. The Australian Telecommunications Act allows for a call entering a public network to be "tapped". In 2001-2002, 2,500 authorised phone tapping warrants were issued to authorities, with prosecutions from the information gathered from authorised tapping rising 48% proving this to be a valuable weapon for law enforcement. Thus it is an essential requirement for VoIP to be able to provide a similar or better attribute than current networks.

While current telephone networks offer no encryption on transport it is an attribute that is required for VoIP as it merges into accessible networks and makes the task of unauthorised access

much easier with the use of freely available tools such as traffic sniffers etc (Marjalaakso, 2003).

Integrity

Integrity is essential in a communication technology and by its very nature it is difficult to actually modify traffic in real time with VoIP as delay will cease the call. The integrity of the telephone call is rarely ever jeopardised when operating in real time. The public will need reassurance of this, along with their other fears of VoIP, when it comes VoIP is implemented in rural communities.

Authentication is important for receiving correct calls but also for network protection. It must be determined whether existing authentication techniques are going to be adopted for network access or if VoIP-specific means are to be implemented. Typically authentication within an internal network is not applied, but for gateway passthrough this generally requires an authentication of some type. Other issues of authentication relate back to the Telecommunications Act and its requirements in regards to call logging, tracing and tapping. By using strong authentication techniques, identification of unique persons is available during the authorisation stage.

Billing is one of the core features in a public network and must be reliable, accurate and non repudiable to ensure financial recovery of cost. Analogue telephony has suffered from phreaking and avoiding tolls to make calls and billing procedures disputable; VoIP must address these as high priorities when working in an external network. Different methods of billing can be implemented by service providers and authentication servers such as RADIUS or IAS (Microsoft's RADIUS equivalent product) can be used with appropriate software to enforce these plans.

With the experience from traditional telephony the practice of removing all service commands out of the user's accessible band can minimise the threat of phreaking. Traditionally the practice of playing various tones through a handset can

override the accounting and billing mechanisms (Mitnick & Simon, 2001).

Call logging is a requirement of the Australian Telecommunication Act. While this is not so important within internal networks, it is a feature usually undertaken by VoIP hardware such as gateways. The Australian Telecommunication Act requires the ability to back track a call from destination to origin, this is established when connecting initial handshake between the two nodes with and is addressed in H.323 Annex D (Nichols & Lekkas, 2002).

Availability

Availability refers to the ability to access and use the service being provided. In this context this means to either make or receive phone calls. Current telephone networks offer a high rate of availability and stability—this sets the benchmark for any technology which may supersede the current network.

The costs for a non functional phone can be not only in terms of the company's reputation but a phone service has now become an expected service which at its worst can be life threatening.

Availability may be enhanced through redundancy. Traditional VoIP implementations have a gateway to interconnect two or more IP networks. In the case of this network becoming inefficient or ineffective there must be some form of an alternative; this may be in the form of many gateways performing some load balancing function. An alternative could be the PSTN gateway located at every branch, allowing not only for redundancy but also the routing of phone calls from other geographical locations to be charged at local call access fees. Companies using a VoIP solution could then be more resilient to a Denial Of Service (DOS) attack which attempts to remove the functionality of the IP network but with intelligent devices this can be overcome to route through an available resource such as an alternative gateway.

Availability is also increased by use of peering networks—the concept of networks providing connection to each other. Generally this is done to improve performance, reduce costs and create better market dominance. Peering is not merging of companies but rather a merge of networks owned by companies. The benefits are matched with some of the following less beneficial properties such as attack from one to the other by diversion, spoofing, DOS, overload etc.

A trust relationship must be established between companies to allocate resources to the other's connected network which satisfy requirements to carry the traffic and generally will not be static. As load increases when demand is greater, it can be assumed the load would be higher during business hours in local time when compared to the middle of the night—therefore it is required that either a well researched usage plan is provided or a real time analysis and network control tool be implemented.

VoIP Orientated Denial of Service (DOS) Attacks

Convergence of voice onto data networks has merged the vulnerability of traditional data network attack methods to affect VoIP as a system. One such attack method is DOS and essentially is the abundance of traffic aimed overwhelmingly a single network device, interface or service. The vulnerabilities of computer networks are well publicised and continually exploited and one must question its ability to provide the infrastructure to voice networks. However VoIP DOS are not prevalent to this date.

Environmentally Orientated VoIP Attacks

Attacks on the environment where VoIP is existent are a greater concern. DOS attacks and even peak traffic can serious degradation of network QoS and may render VoIP not available. Network manage-

ment tools exist for both security and performance but this is a consequence from merging the two services on to the one network.

Many concerns have been highlighted with the convergence of data and voice traffic into one sole network. These fundamentally relate to the theory of “placing all your eggs in one basket” which ensures greater loss if the network becomes unavailable.

Counter argument is also valid in terms of the cost reduction in the form of less development, construction, maintenance and management of separate networks. Generally voice has a greater priority during network transmission and this may have adverse results if not configured correctly for both data and voice—generally, with the correct management tools, if sufficient resources are available then the relationship can work gracefully.

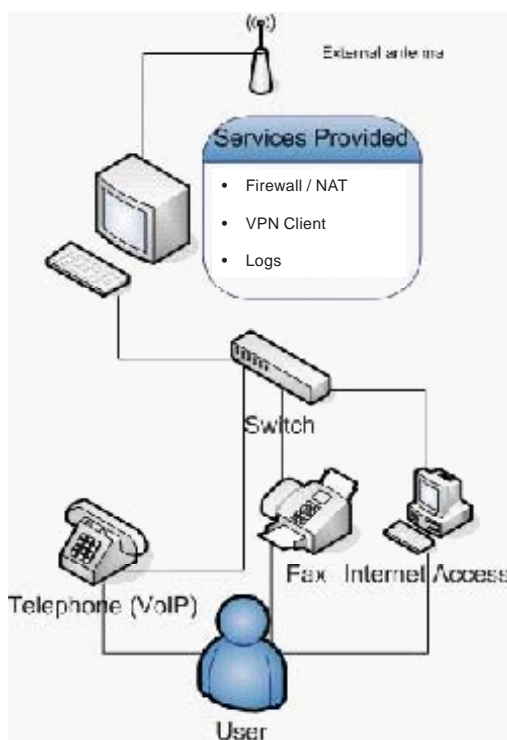
EXAMPLE OF VoIP IMPLEMENTATION

Our research examined the marriage of two independent technologies to provide a last mile solution to users. Utilising the 802.11b architecture to form a network of connected clients to allow for VoIP to be accessible in remote communities where cable infrastructure is either non existent or not capable of scaling to new technologies such as broadband equivalent internet access. The primary purpose of the project was to build a conceptual model and determine whether this would work at a carrier grade equivalent. The project aimed at remote centres, i.e. less than 20 dwellings, and therefore focused on clients in a determined radius from one central access point.

Network Model

The model this system proposes is described as Bridged Mode between wireless points. This allows for static connections to exist with little

Figure 1. Proposed client structure



network management requirement for the connection, and securing of connections, in a dynamic period. As phone calls are bi-directional it requires that a connection is not only in the pull model (client generated), but if a call is to be received and the SIP model is used it requires the device to be active on the network to have a call routed to it.

Protocol Usage

The protocol to be used is SIP, since it has been seen to be a better performing solution in the wireless solution that H.323—as this solution only documents within the set bounds the interface to the WAN may transform into another protocol with the appropriate gateway. No security or authentication services will be provided from the SIP implementation; rather these will be developed on the network infrastructure. In case of a WAN outage it is expected a PSTN connection

will exist with multiple connection lines to act as a form of redundancy.

Security

Encryption must be applied to this service as the ability to eavesdrop and gain unauthorized access in 802.11b is well documented. The security model chosen is that of a Virtual Private Network (VPN) with the server residing at the remote centre, this may be located at another location if an implementer wishes to secure the entire transit for inter-network transmissions, but this would increase round trip time upon establishment of connection.

The network model discussed above documents that the clients exist in a static position with a connection via antennas and bridged devices. For this reason it is proposed that the VPN client exist within this device to allow for encryption between the connection point for the client and the central access point. By making the VPN client exist in this device it allows for unencrypted traffic flow within the client's local area network meaning management is less intense. Other benefits include security by abstraction, the VPN service cannot be shutdown as it is part of the boot up and connection to the network and the user would not know of its existence.

Concurrent Connections

The number of simultaneous connections is dependant on the access point, the network performance, and WAN interface among other elements such as codec used. A standard access point can support up to 50 connections, realistically the load bear can handle 25 at reasonable quality. This is based on our research using an Asus WL-300b using an omni external antenna with 31 clients, after this the service degraded substantially. This research did not include any security measures and therefore would suggest fewer connections due to overheads.

It is hard to determine the exact number of connections as is based upon many factors and variables. Realistically for high quality of service if offering both VoIP and internet access (256kbps/64kbps equivalent) using the security measures listed above no more than 20 connections should be made.

As this solution is based on remote town, less than 25 dwellings, and therefore one access point should service this if industrial hardware is utilised. The Asus WL-300b is a mid range access point aimed at small business with the external antenna connections.

DISCUSSION AND CONCLUSION

While 802.11b and Voice over IP may be utilised in the situation described, this is an unreliable and not a true carrier grade solution. The provision of VoIP over the wireless network does pose some issues in terms of performance and quality, but generally these can be rectified with the usage of proprietary solutions. The greatest threat is that of the infrastructure which 802.11b provides.

Placing this system in a remote centre would require constant monitoring which is not available. Cable infrastructure has a higher reliability, but this study has not assessed other wireless mediums. Some of the greatest shortcomings of utilising 802.11b are the use of unlicensed spectrum which allows other devices to readily use this same frequency and degrade service. Moving into a licensed spectrum increases the network capacity, performance, reliability and cost but may be a solution that will be reviewed with technologies such as GSM, 3G, and GPRS.

It is also noted that such a network may not be viable with the progression of satellite technology. Optus, in Australia, has revealed plans to deploy two new satellites and the possibility of using these to service individual households is not unrealistic with the low cost of hardware, smaller dishes and increasing bandwidth.

However VoIP is continuing to blossom and the marriage with 802.11 infrastructure is continuing. Dominant usage of the two technologies together are for office environments, but we predict within two years mobile phones with 802.11 access will exist within current handsets (GSM, 3G) which determine the cheapest method of call when 802.11 networks are available.

REFERENCES

- Bussiere, D. (2003). *Voice over IP and security*. Network Computing Asia.
- Marjalaakso, M. (2003). *Security requirements and constraints of VoIP*. Helsinki University of Technology.
- McPherson, S. (2003, February 18). Talk is cheap. *The Australian*.
- Mitnick, K, & Simon, L. (2001). *The art of deception: Controlling the human element of security*. London: John Wiley & Sons.
- Nichols, R.K., & Lekkas, P.C. (2002). *Wireless security: Models, threats, and solutions*. New York: McGraw-Hill.

KEY TERMS

Call Logging: A requirement of the Australian Telecommunication Act in regards to the ability to generate call lists made to or from a particular node on a network with public access.

Eavesdropping: The ability for one to access a call and either in real time or after reconstruct the conversation.

IEEE 802.11b: An established protocol or standard for wireless networking.

Phreaking: The ability to use a phone service without being billed.

Voice Over IP for Rural Telecommunication Provision

Quality of Service (QoS): An indicator of availability and specifies the transmission rates, error rates, and other network performance metrics which can be measured, improved, and, to some extent, guaranteed in advance.

Voice Over Internet Protocol (VoIP): The use of IP networks rather than circuit-switched ones for the transmission of phone calls.

*This work was previously published in *Encyclopedia of Developing Regional Communities with Information and Communication Technology*, edited by S. Marshall, W. Taylor, X. Yu, pp. 723-728, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).*

Chapter 3.17

ICTs as Tools for Poverty Reduction: The Tanzanian Experience

Zaipuna O. Yonah

Tanzania Telecommunications Company Ltd., Tanzania

Baanda A. Salim

Sokoine University of Agriculture, Tanzania

ABSTRACT

This chapter attempts to enhance the understanding and knowledge of Information and Communication Technologies (ICTs) in relation to the Tanzania National ICT Policy as a case study. The authors extensively explore these pervading technologies as they impact on the education, commerce, social, cultural, and economic life of the poor Tanzanian people. The chapter looks at how Tanzania is coping with the issue of poverty eradication as one of the eight UN Millennium Development Goals (MDGs). It addresses the issue of digital divide and the role that ICTs can play in poverty reduction. Tanzania's efforts in embracing ICTs and the challenges facing the country in its efforts are also addressed. Overall, the chapter demonstrates that ICTs are a set of tools for knowledge sharing, which is a powerful means for poverty reduction. Furthermore, it is

advisable to focus on information literacy rather than just focusing on computer literacy.

INTRODUCTION

In this chapter, an attempt has been made to enhance the understanding and knowledge of Information and Communication Technologies (ICTs) in relation to the Tanzania National ICT Policy as a case study. The authors extensively explore the evolving frontiers of these pervading technologies as they impact on education, commerce, social, cultural and economic life of the poor Tanzanian people. The chapter also attempts to show case examples of ICT national projects in Tanzania to demonstrate how the government of Tanzania, entrepreneurs, and some of the rural communities are appropriating ICTs to fit into their needs. The chapter reflects on perspectives,

trends, and potential of using ICTs to develop innovative approaches and methods for poverty reduction in Tanzania.

The chapter is organized into six sections. The Background section looks at the general issues, putting Tanzania into perspective and how it is coping with the issue of poverty eradication as one of the eight U.N. Millennium Development Goals (MDGs). Targets for achieving poverty eradication are articulated in the National Poverty Eradication Strategy. The Development Vision 2025 aims at guiding Tanzania to achieve five goals by year 2025, namely, (1) high quality livelihood, (2) peace, stability, and unity, (3) good governance, (4) a well educated and learning society, and (5) a strong and competitive economy. This section further puts into perspective Tanzania's position on the role of ICTs in meeting the goals of the Vision 2025 as well as the MDGs. The framework for appropriating these ICTs for national development and poverty reduction is articulated in the National ICT Policy.

The second section attempts to answer the question: what is poverty and what causes it? It is noted that ICTs are now acknowledged to be a set of powerful tools for building the capacity for knowledge management and hence for building the capacity for poverty reduction. It also addresses the issue of digital divide. The third section addresses the role that ICTs can play in poverty reduction. It outlines the desirable characteristics and attributes of the modern ICTs useful for poverty reduction. This section further addresses issues of connectivity, affordability, and capability. The fourth section details efforts that Tanzania has made in embracing ICTs. It narrates on various projects being undertaken in Tanzania such as projects on increasing capacities and opportunities; projects on reducing vulnerabilities; projects on enhancing government capacity, efficiency, and accountability; and projects on participation, empowerment, and the strengthening of civil society.

The fifth section looks at the challenges fac-

ing the country in its efforts to embrace ICTs. It also looks at the prospects and try to project the trend of adoption of ICTs in the country in the next five or so years. In the last section of the chapter, some recommendations are drawn on "an entry point" into dissemination of ICTs to the rural areas of Tanzania. In this section, the authors try to lay out priority areas in harnessing the power of ICTs in bringing about development to the rural people of Tanzania.

BACKGROUND

Tanzania is one of the 191 United Nations member states that have pledged to meet the eight UN Millennium Development Goals (MDGs) by year 2015 (URT, n.d.). These goals are: (a) Eradicate extreme poverty and hunger, (b) achieve universal primary education, (c) promote gender equality and empower women, (d) reduce child mortality, (e) improve maternal health, (f) combat HIV/AIDS, malaria and other diseases, (g) ensure environmental sustainability and (h) develop a global partnership for development. In response to this pledge, Tanzania restated the UN-MDGs and came out with its own nine (9) development goals, herein to be referred to as TZ-MDGs, namely (URT, n.d.):

- a. **Extreme poverty:** Halve the proportion of people living below the national poverty line by 2015.
- b. **HIV/AIDS:** Halt and reverse the spread by 2015.
- c. **Hunger:** Halve the proportion of underweight, under five year olds by 2015.
- d. **Basic amenities:** Halve the proportion of people without access to safe drinking water by 2015.
- e. **Primary education:** Achieve universal primary education by 2015.
- f. **Gender equity:** Achieve equal access for boys and girls to primary and secondary schooling by 2015.

- g. **Reproductive health:** Reduce maternal mortality ratio by three-quarters by 2015.
- h. **Under-five mortality:** Reduce under five mortality by two-thirds by 2015.
- i. **Environmental sustainability:** Reverse loss of environmental resources by 2015.

The focus of this chapter is on the first TZ-MDG, which is on eradication of extreme poverty. As is in many developing countries, poverty in Tanzania is characterized by low income and expenditure, high mortality and morbidity, poor nutritional status, low educational attainment, vulnerability to external shocks like natural disasters (e.g. drought, pests, diseases and floods), and exclusion from economic, social and political processes. Generally, poverty is particularly widespread in the rural areas, but is not insignificant in urban areas. There are also important regional and district differences in the levels and specific dimensions of poverty. Those most at risk of being trapped to live under poverty are young children and youths, the elderly, women, those in large households and those involved in subsistence agriculture, livestock production and small-scale fishing.

The primary targets for achieving the first TZ-MDG on poverty eradication are articulated in the National Poverty Eradication Strategy (NPES) (URT, 1997). The set timeline for this TZ-MDG, which is more ambitious than the international one (2015), is to halve extreme poverty (measured by income and expenditure) by 2010 and eradicate it by 2025, which corresponds to the articulation of the goals of the Tanzania Development Vision 2025 (URT, n.d.). The Development Vision 2025 aims at guiding Tanzania to achieve five goals by year 2025, namely: (1) high quality livelihood, (2) peace, stability and unity, (3) good governance, (4) a well-educated and learning society, and (5) a strong and competitive economy capable of producing sustainable growth and shared benefits. Overall, the Vision foresees that by the year 2025:

Tanzania should have created a strong, diversified, resilient and competitive economy, which can effectively cope with the challenges of development and, which can also easily and confidently adapt to the changing market and technological conditions in the regional and global economy.

The challenge is, therefore, to mobilize massive resources towards the realization of the Vision 2025 goals.

It is worth noting that the Government of Tanzania has already acknowledged that ICTs can be harnessed to meet the goals of the Vision 2025, as well as that of the TZ-MDG on poverty reduction. In broad terms, ICTs refer to any technique or knowledge used to create, store, manage, and disseminate information. They include simple information centres with notice boards, books, brochures, posters, and newspapers, simple content systems running on cheap (safely disposable) hardware, for example, audio and video cassettes, disconnected mailing systems, to locally browse-able content accessible through a range of electronic technologies such as telephone, fax, television, and radio. Modern ICTs include the Internet, e-mail, computers, mobile phones, digital cameras, online databases and portals.

In a sense, ICTs enable communication, a process that links individuals and communities, governments and citizens, in participation and shared decision making. This is done through use of a variety of ICTs to engage, motivate, and educate citizens of opportunities for development and poverty reduction, in this way promoting changes in peoples attitudes and behaviours and thus increasing their participation in the development or poverty reduction processes (Gillman, 2003).

The framework for appropriating these ICTs for national development and poverty reduction is articulated in the National ICT Policy (United Republic of Tanzania, 2003). In the policy framework, it is clearly shown that ICTs are crosscutting in nature, an attribute well shared with poverty. As

such, therefore, ICTs can indeed be appropriated as tools for realizing effective communication processes to achieve, among others, distribution and sharing of knowledge and information for supporting poverty reduction initiatives.

In this chapter, an attempt is made to enhance the understanding and knowledge of ICTs and the evolving frontiers of these pervading technologies are explored as they impact on education, commerce, social, cultural and economic life of the poor Tanzanian people. It also attempts to show case examples of ICT national projects that demonstrate how the government of Tanzania, entrepreneurs, and some of the rural communities are appropriating ICTs as tools to fit into their needs and empower themselves to fight poverty. Further, an attempt is made to stimulate debate to reflect on perspectives, trends, and potential of using ICTs to develop innovative approaches and methods for poverty reduction.

WHAT IS POVERTY AND WHAT REALLY CAUSES IT?

Widespread and persistent poverty in Tanzania is the main development challenge since the 1990s. Currently, about 40% of the population lives below the basic needs national poverty line (World Bank, 2004), that is, a population surviving on less than US\$2 per day. A debatable issue arises here: *what does poverty really entail?* Poverty is often viewed from an income-based perspective as lack of income and measured in terms of income and expenditure. In recent years, however, the concept has been enlarged. Poverty is now seen as a multidimensional concept that is the opposite of well-being, which includes more than income. Therefore, apart from the inability of poor people to meet basic needs (such as nutrition, clothing, and shelter), poverty also refers to disadvantages in access to land, credit, and services (e.g., health and education), vulnerability to violence, external economic shocks, natural disasters, powerless-

ness, and social exclusion (Shaffer, 2001; Williams, Sawyer & Hutchinson, 1999).

According to the Government Poverty Reduction Strategy Paper (PSRP) (URT, 2000) and the Poverty Monitoring Master Plan (PMMP) (URT, 2001), people living in poverty in our society are reidentified to include: illiterate people; unskilled labourers; self-employed micro-entrepreneurs; subsistence farmers; women; children; and population living in remote (rural) areas. Those in the group that are extremely vulnerable include children, persons with disabilities, youths, elderly, people living with HIV/AIDS, women, drug addicts, and alcoholics.

Poverty, the simplest indicator of alienation (Allen, 2002), causes a citizen to feel devalued, resentful, frustrated, and angry. Despite the vast advances that are being made in the spheres of science and technology, medicine, capital mobility, and so forth, income disparities are ever widening, both within countries and between nations. This imbalance in equity is characteristic of alienation—alienation between developed and developing nations; alienation between civilizations or cultures; alienations within our nation (regions, districts, etc.) and even alienation within families. Therefore, overcoming poverty, a consequence of alienation, will require the full participation of every member of the Tanzanian society. It is worthwhile to note that ICTs are now acknowledged to be a set of powerful tools for building our capacity to care, knowledge management, and hence for building the capacity for poverty reduction. In the literature, alienation based on modern ICTs is also popularly known as the digital divide (Weigel & Waldburger, 2004).

POVERTY REDUCTION

The poverty reduction challenge is about how to empower the poor with knowledge and skills, thus availing to them new opportunities to improve their livelihood (Weigel & Waldburger, 2004).

In terms of income and expenditure this would mean an increase in income, and hence capacity to afford food, health services, and other basic needs.

The strategic approach is to use ICTs in a creative manner to level the playing field in economic, social, cultural, and political terms by reducing the rapidly growing gap caused by a very asymmetric architecture of opportunities between the rich and the poor. As a matter of emphasis, the role of ICTs in poverty reduction is not limited to reducing income poverty, but also includes non-economic dimensions, in particular, empowerment (Gerster & Zimmerman, 2003). This can be accomplished through a variety of strategies ranging from the *sustainable livelihoods approach*—by putting people first; *production-oriented growth strategy*—which focuses on pro-poor corrective measures; a *distribution-oriented strategy*—which emphasizes the redistribution of wealth within the nation; and a *rights and empowerment strategy*—which promotes knowledge about basic rights and empowerment (Gerster & Zimmerman, 2003; Weigel & Waldburger, 2004).

It was stated earlier that modern ICTs facilitate the creation, storage, management, and dissemination of information by electronic means much more easily, efficiently, and conveniently. Some of the desirable characteristics and attributes of these modern ICTs useful for poverty reduction include:

- a. **Interactivity:** ICTs are effective two-way communication technologies, which have drastically changed the way individuals, organizations, and enterprises interact. This is made possible by the fact that modern ICTs embody broad communication and processes of economics, social, political activity, and organization to empower citizens. At the same time ICTs increases transparency within and among societies, fostering empowerment and accountability (Sharma, n.d.; Spence, 2003).
- b. **Permanent availability:** The new ICTs are available 24 hours a day, seven days a week. For this reason they can be mainstreamed into our daily activities.
- c. **Global reach:** When ICTs are embraced in any socioeconomic activity, geographic distances hardly matter anymore. This has changed the shape of the socioeconomic activities. One of the impacts is in conditioning and changing the structure of markets, hence pushing the world towards globalization. This is true for the case of the Internet, which enables individuals in any country to participate in markets or activities beyond the immigration constraints determined by geographic locations (Sharma, n.d.).
- d. **Reduced per unit transaction costs:** Relative costs of communication have shrunk to a fraction of previous values and this effect has impacted on the cost of business transactions. Transaction costs have tended to rise with time, distance, and correlated variables, especially as the global economy has expanded and become more integrated. With modern ICTs, time and distance essentially do not matter. Therefore, the reduction in transaction costs can be larger in absolute and percentage terms than the rising trend. A good example is on long distance or international telephone calls vis voice over IP (VoIP) calls.
- e. **Creates increased productivity and wealth or value:** ICTs are value adders and amplifiers in products and services. In addition to lowering transaction costs, modern ICTs can be very liberating by enabling wholly new possibilities of creating wealth/value. For example, by making services previously difficult to trade or non-traded at all to become easily tradable—within countries and internationally. ICTs also are capable of untrapping the value of human resources or human capital (e.g., with local skills) by

marketing such capital globally than just locally, for example, in the case of outsourced jobs and offshore opportunities (Proenza, n.d.; Yonah, 1999).

- f. **Multiple sources of information and knowledge:** Modern ICTs embody a lot of knowledge, particularly if such ICTs include electronic networks. These embody and convey knowledge and in this sense provide important intermediate products and services and content in education, human, and social capital formation activities. In this context, it is a fact that the creation of knowledge and access to information is the basis of new prosperity. Access by the poor to high-tech opportunities empowers them with valuable knowledge and equips them with productivity skills, which is essential in any poverty reduction process. In this respect, poor people do not have a simpler set of living needs and aspirations, as may be assumed (Gates, 1999; Kao, 1996).

Despite these powerful attributes of ICTs, access to information using ICTs is determined by (a) *connectivity*—are the services available? (b) *affordability*—can the targeted poor users afford the access, and (c) *capability*—do the targeted users have skills required to support and utilise profitably the access? The user's skills relate to technical abilities, language, and literacy. Therefore, for ICTs for poverty reduction to succeed they need to be integrated and mainstreamed in the national development priorities and projects.

SHOWCASE EXPERIENCES

It is worthwhile to note that ICTs are impacting on all dimensions of life: education, health, quality of family, culture, leisure and arts, scientific and technological world. The way people do business globally is changing beyond imagination. ICTs are helping economies expand at an unprec-

edented rate and competitiveness has become the motto of the way. However, for ICTs, as tools of empowerment, to contribute to the poverty reduction initiatives, certain conditions have to be met. These relate to ownership, local content, language, culture and appropriate technology enabled by adequate functional basic amenities and connectedness, e.g. roads, electrical power, telephone, water, etc. Access becomes important only once these conditions have been met. Due to this requirement of connectedness most of the ICTs have an urban bias and discriminate against rural areas.

Since the 1990s, years of economic liberalization in Tanzania, there has been a large wave of investment in ICTs for development and some significant part of this has been aimed at poor people—both in terms of bringing ICT access to poor communities, and in using ICTs in many other ways which support poverty reduction. These investments have produced *many* documented successes, lessons learned, and experiences. Most of the documented materials on ICT projects are mostly sector and application specific covering multipurpose community access; access technologies amenable to poverty reduction; gender equality; education and human resource development; science, high-tech, and ICT-sector growth; business and livelihoods development and support; public sector, services, and poverty management; environmental and natural resource management; and transparency, accountability, and empowerment.

The many experiences that are discussed in the subsequent sections offer a lot of insight and value, though it is difficult to consistently maintain focus on poverty, and separate poverty reduction from broader economic development insights. However, it has to be noted that growth and development are necessary but not sufficient for poverty reduction; and also that pro-poor strategies and investments are as important for ICTs and knowledge-economy strategy as for other connected areas of social and economic development. This section uses some

of the material from publicly available websites carrying content about Tanzania.

Projects on Increasing Capacities and Opportunities

One of the many deprivations that compound the misery of the poor and prevent them from rising out of poverty is their lack of access to adequate education, training, skills development, broader information, and knowledge resources that could help them improve their lives and livelihoods. One of the show case projects on information sharing is the *Sharing with Other People Network* (SWOPNet) managed by the Tanzania Commission for Science and Technology (COSTECH). It may be found at www.swopnet.or.tz. The SWOPNet portal electronically brings together all owners of ICTs projects under one roof. The site is essentially very useful for publishing outputs from different research and development projects in the field of ICTs conducted within Tanzania.

It has been envisioned that education and knowledge helps the poor to improve their current livelihoods, address impediments and vulnerabilities that prevent them from seeking opportunities to improve their lives, and participate in new sectors of the economy that require advanced skills and, therefore, offer higher incomes. ICTs can help make educational institutions more efficient and responsive, both by improving communication flows within them and between them and their various constituencies; and by increasing their access to global knowledge and good practice in education. One of the most promising areas where ICTs can help improve education quality and outcomes is in teacher training. The Tanzania educational system is, in general, plagued by inadequate resources for teacher training and curriculum development leading to low quality of education. Creative combinations of the Internet (for content access and interactivity) and digitally stored training materials (including CD-ROMs) can dramatically increase both the *reach* and

the *yield* per unit cost of teacher training efforts. The government of Tanzania is making efforts to build strategy to integrate ICTs in the Tanzanian secondary schools (Menda, 2005b). There is also a showcase ICT project owned by the Ministry of Education and Vocational Training (MEVT) geared at integrating ICTs in Secondary Education and Teachers Training colleges (TTCs). These are the preferred entry points for integrating ICTs into the secondary education in Tanzania (more at www.pambazuka.org/index.php?id=26807).

Projects on Reducing Vulnerabilities

Poverty and illness go hand in hand and feed upon each other. Poor people are particularly prone to disease and illness.

There are several ways that ICTs can help to address the health challenges facing developing countries. First, the capacity to monitor, respond to, and thus hopefully control disease outbreaks and address their causes, can be significantly enhanced by improving communication flows and the information-management capabilities of health care professionals at community, district, regional, and national levels. In many cases, time is of the essence in responding to disease outbreaks, and faster communication and information gathering can often make a dramatic difference in how well an outbreak is contained. More generally, the ability of health care providers to assemble and share timely information about health trends and needs enables a country's health care system to adapt more quickly and allocate resources more effectively.

The government of Tanzania is ready to adopt ICTs in the provision of health services (International Institute for Communication and Development, 2004; Menda, 2005a), a commitment made recently by the Permanent Secretary in the Ministry of Health and Social Welfare, Hilda Gondwe, when officiating at a national roundtable workshop on the application of ICTs in the country's health sector. The workshop was organized by Chris-

tian Social Services Commission (CSSC) and financed by the Catholic Organization for Relief and Development (CORDAID) and International Institute for Communication and Development (IICD) (The Guardian, 2006).

Several show case projects that show how ICTs are being appropriated to realise health information system, to collect health data at village levels, and on child vaccination programs are reported at http://www.swopnet.or.tz/ws_projs.html.

Projects on Enhancing Government Capacity, Efficiency and Accountability

Government officials, and the institutions in which they work, are hampered in many ways by poor information and knowledge flows. They often have weak access to even basic current data about the issues and trends in the country. Information flows poorly within most government departments because of a combination of weak communications infrastructure, hierarchical structures, and rigid bureaucratic cultures.

In addition, government officials have limited information on global good practice, and few opportunities for consultation and collaborative problem solving with colleagues elsewhere. At the same time, citizens, entrepreneurs, and particularly the poor, often have limited information about their rights and the services available to them, about the structure and functioning of government agencies, and about procedures for requesting services.

ICTs can help in a variety of ways to address these problems. ICTs can be used to reorganize and speed up administrative procedures, to increase the volume and speed of information both within government institutions and between them and the larger society, to train government officials in global best practices, and to allow greater collaboration and sharing of experience among government officials both within a country and across borders. The government of Tanzania is

exemplarily active in appropriating ICTs to improve its e-readiness and the delivery of public services. The official online gateway of the United Republic of Tanzania is accessible at <http://www.tanzania.go.tz>. Information accessible from this site includes fully analysed population census data, and most of the government policies and presidential speeches are hosted at this site.

There are several other information gateway projects in the country, for example, the Tanzania Online Information Gateway at www.tzonline.org and the Tanzania Country Gateway project at www.tanzaniagateway.org. Collectively these Internet-based gateways give Tanzania a global presence. The gateways provide links to ideas and good practice, information about development activities and industry trends, funding and commercial opportunities. These portals provide and promote exchange and dissemination of information on development matters.

Another project is the Tanzania National Assembly (Parliament or “Bunge”) portal at www.parliament.go.tz. Acts, bills, and useful Bunge documents are readily available from this site through its Parliamentary Online Information System (POLIS). This Internet-based global presence clearly demonstrates that the Tanzania Parliament is appropriating modern ICTs to transform the Bunge from an old-fashioned institution to a new, modern, paperless electronic parliament. Furthermore, the Tanzania Investment Center website at www.tic.co.tz acts as the official investor’s guide to Tanzania.

ICTs can also play an important role in combating corruption and making government institutions more transparent, by reducing the opportunities and incentives for, and increasing the costs of, corruption. The most obvious role for ICTs is to “disintermediate” between the citizen and the services, procedures, and documents by automating and making widely accessible, many of the simpler procedures which have traditionally depended on the involvement of a local government officer. If a citizen can directly access a

needed form, acquire required documents, permits and certifications, or register a new small business, using automated procedures, the opportunities for corruption are reduced. ICTs can also empower individual citizens and groups to hold government officials publicly accountable. These efforts are evident from the TIC Web site www.tic.co.tz especially links to the Business Registration and Licensing Agency (BRELA); www.necta.go.tz for the National Examination Council of Tanzania; and www.isd.co.tz for the insurance supervisory department.

Projects on Participation, Empowerment, and the Strengthening of Civil Society

ICTs can play an important role in informing and empowering citizens and strengthening the capacities of a wide range of civil society organizations and institutions. This is important not only in increasing the demand for good governance and strengthening the voice of citizens in government policy, but also for promoting both the stability and responsiveness of the political system and for the economy and society as a whole.

By facilitating new forms of many-to-many communication, collaboration, and information-sharing, both within a given country and among groups with similar interests and concerns across borders, ICTs can add to the vibrancy of civil society institutions and networks as a check on government. They can also act as a source of ideas and innovations, and an outlet for the interests, concerns, and desires for solidarity on the part of individuals and groups. This will reduce the alienation of the poor from feeling isolated, powerless, and neglected. A contrast can be found between a physical rally meeting to the famous eThinkTank user group at www.eThinkTank.org focused on issues concerning ICTs. Another portal is at www.hakikazi.org, a civil society meeting place for sharing ideas promoting the rights of all people to fully participate on social, technical,

economic, environmental, and political (STEEP) issues. The portal carries a cartoon-based guide to popularize the PRSP (URT, 2000).

By definition, however, the poor have scarce resources, and the burdens of their daily lives often leave them little discretionary time to engage in activities designed to protect their interests and articulate their needs. Their limited education, and in many cases illiteracy, puts them at a disadvantage when faced with sophisticated ICTs that are not adapted to their most pressing needs, their modes of communication (including a frequent preference for oral communication), their cultural norms, and the social contexts in which they typically interact and pursue joint action. In such cases, community radio and video conferencing facilities (like that at the Tanzania Global Development Learning Center (TGDLC—www.tgdlc.go.tz) become very appropriate.

Projects/Challenges on Appropriating ICTs for Income Generation

Economic programs implemented by the Tanzania Government have been based on the philosophy that Tanzania is committed to a market economy whereby the private sector will take the lead in creating incomes, employment, and growth. On the other hand, the State will be a producer of public goods, play a regulatory role to level the playing field, and create conducive environment for the private sector to take the lead in driving economic growth. The private sector has started playing an ever increasing role in creating incomes and employment. Small and Medium Enterprises (SMEs) account for a large share of the enterprises active in Tanzania. In fact, SMEs are the emerging private sector and do form the base for private sector led growth (Hakikazi Catalyst, 2001; URT, 2002, 2003a).

According to Drucker, there are eight key areas that constitute any business (Drucker, 2001), namely: *marketing, innovation, human*

resources, financial resources, physical resources, productivity, social responsibility, and profit requirements. Let us recall Gandhi's test for technology appropriateness: to "*find out how the last man would be affected by it*" (Gates, 1999). The authors, therefore, propose to apply Gandhi's test for the effectiveness of ICTs in each selected income generating activity by examining the impact of mainstreaming ICTs into the eight key business areas.

THE ULTIMATE CHALLENGE: TO FOCUS ON INFORMATION LITERACY AND NOT ONLY ON COMPUTER LITERACY?

The Tanzania Vision 2025 (URT, n.d.) would like to see Tanzania be a well educated and a learning society. What does this mean in relation to ICTs as tools for poverty reduction? It has been said earlier that ICTs are embedded in networks and services that affect the local and global accumulation and flows of public and private knowledge.

The authors hold the view that the government of Tanzania needs to focus more on information literacy rather than mere computer literacy. Information literacy is the ability to access, evaluate, and use information from multiple formats—books, newspapers, videos, CD-ROMs, or the Web. Information literacy is a set of competencies, skills that will grow with the people as the society evolves towards a knowledge society, even when current computer operating systems, search engines, or computing platforms and devices are obsolete.

To date, however, it has been observed that, in promoting the information society agenda, citizens and the government are still focused on technology. However, they must focus on increasing awareness of the potential applications; on improving the availability of and access to modern digital communications; and on encouraging people and organizations to use technology more

efficiently and effectively. It also has to advocate for policies that encourage and allocate funding towards the development of skills to use technology and improve computer literacy. This focus has been, and is still, invaluable. To really move into the information age and get benefit from the potential of a knowledge based society, it needs a new focus, that is, on the content that flows through the ICTs, a focus on information and knowledge, and focus on how to create it, manage it, and use it. To do this a new focus on information literacy is needed. An information literate person is one who (American Library Association, 2000):

1. Recognizes the need for information and determines the extent of the information needed;
2. Identifies potential sources of information, accesses the needed information effectively and efficiently from sources of information including computer-based and other technologies;
3. Evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system;
4. Recognizes that accurate and complete information is the basis for intelligent decision making, develops successful search strategies, then organizes information for practical applications and uses information effectively in critical thinking to accomplish a specific purpose;
5. Identifies potential sources of information and understands the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally.

Therefore, there is a challenge: how to ensure that the Tanzanian society becomes information-literate? It is the ultimate challenge to the government, public sector, private sector, development partners, and the whole Tanzanian community

though all of the society, that especially the poor people are flooded with information options on day-to-day basis.

CONCLUSION

Tanzania, like other developing countries, is confronted with the challenge of eradicating extreme poverty and hunger. It is acknowledged that the new opportunities which ICTs are opening up can be harnessed in Tanzania's efforts to eradicate poverty. The framework for appropriating ICTs for national development and poverty reduction is articulated in the National ICT Policy.

This chapter has attempted to enhance the understanding and knowledge of ICTs in relation to the National ICT Policy and has extensively explored the evolving frontiers of this pervading technology as it impacts on education, commerce, social, cultural, and economic life of the poor Tanzanian people. The chapter has also presented several show case examples of projects in Tanzania that demonstrate how the government of Tanzania, entrepreneurs, and some of the rural communities are appropriating ICT tools to fit into their needs. Some challenges have been identified and presented with the aim of stimulating debate to reflect on perspectives, trends, and potential of using ICTs to develop innovative approaches and methods for poverty reduction. It is emphasised that, since these ICTs are not solutions to social problems by themselves, they must be carefully chosen and implemented for each appropriate purpose. Overall, the chapter demonstrates that ICTs are a set of tools for knowledge sharing, which is a powerful means for poverty reduction. Further, it is shown that ICTs could only be tools of empowerment for those who have access to them. And that "I" (Information) and the "C" (Communication) are far more important than the various technologies which are just means to an end. Therefore, ICTs cannot turn bad development into good development; they can make good

development better. It all has to do with focusing on information literacy as opposed to just focusing on computer literacy.

REFERENCES

- Allen, I.G. (2002). *Can we eradicate poverty while tolerating alienation?* Retrieved June 29, 2006, from the Christian Mission for the United Nations Community, <http://www.Christianmission-un.com>
- American Library Association. (2000). *American Library Association Presidential Committee on Information Literacy*. Retrieved June 29, 2006, from <http://www.ala.org/acrl/nili/ilit1st.html>
- Drucker, P.F. (2001). *The essential Drucker*. Harvard Business School.
- Gates, B. (1999). *Business @ the speed of thought: Using a digital nervous system*. Warner Books.
- Gerster, R., & Zimmermann, S. (2003). *ICTs for poverty reduction: Lessons for donors*. Retrieved June 29, 2006, from <http://www.comint.com/strategicthinking/st2003/thinking-187.html>
- Gillman, H. (2003). *Fighting rural poverty—The role of ICTs*. Paper presented at IFAD side event at the WSIS-Geneva. Retrieved June 29, 2006, from <http://www.ifad.org/events/wsisis/synthesis/index.htm>
- Gunawardene, N. (n.d.). *ICT for poverty reduction: Think big, act boldly*. Retrieved June 29, 2006, from <http://www.teriin.org/terragreen/issue71/essay.html>
- Hakikazi Catalyst. (2001). *Tanzania without poverty—A plain language guide to Tanzania's poverty reduction strategy paper*. Retrieved June 29, 2006, from <http://www.hakikazi.org/eng/>
- Hakikazi Catalyst. (2003). *Millennium development goals—No more broken promises*. Retrieved June 29, 2006, from <http://www.srds.co.uk/mdg/nmbp-draft-04.pdf>

- IICD. (2004). *Telemedicine hampered by infrastructure and awareness—says Tanzanian health expert during seminar by SWOPNet*. Retrieved June 29, 2006, from International Institute for Communication and Development (IICD), <http://www.iicd.org/articles/iicdnews.2004-09-02.7493425067>
- Kao, J. (1996). *Jamming: The art and discipline of corporate creativity*. Harper Business Publishers.
- Mandela, N. (2005, February 3). *Make poverty history* (Speech during The Global Campaign for Action Against Poverty). London's Trafalgar Square.
- Menda, A. (2005a). *ICT experts probe methods in Tanzania to train medics outside hospitals*. Retrieved June 29, 2006, from International Institute for Communication and Development (IICD), <http://www.iicd.org/articles/iicdnews.2005-07-15.2614286290>
- Menda, A. (2005b). *Stakeholders build strategy to integrate ICT in the Tanzanian secondary school*. Retrieved June 29, 2006, from International Institute for Communication and Development (IICD), <http://www.iicd.org/articles/iicdnews.2005-07-15.3965031729>
- Proenza, F.J. (n.d.). *e-ForALL: A poverty reduction strategy for the information age*. Retrieved June 29, 2006, from [http://communication.utexas.edu/college/digital divide symposium/papers/index.html](http://communication.utexas.edu/college/digital%20divide%20symposium/papers/index.html)
- Shaffer, P. (2001). *New thinking on poverty dynamics, implications for policy*. Retrieved June 29, 2006, from http://www.un.org/esa/socdev/poverty/paper_shaffer.pdf
- Sharma, M. (n.d.) *Information technology for poverty reduction* (Proposal to Asian Development Bank, Manila, Philippines). Retrieved June 29, 2006, from <http://topics.developmentgateway.org/ict>
- Spence, R. (2003). *ICTs, the Internet, development and poverty reduction—Background paper for discussion, research and collaboration*. Retrieved June 29, 2006, from <http://www.mimap.org/>
- The Guardian, (3rd February, 2006). *Govt ready to adopt ICTs in health services*. By Gardian Reporter. Retrieved from <http://www.ipp.co.tz/ipp/guardian/2006/02/03/59218.html>
- United Republic of Tanzania (URT). (2000). *Poverty reduction strategy paper (PRSP)*. Dar es Salaam: Government Printer. Retrieved June 29, 2006, from <http://www.tanzania.go.tz>
- United Republic of Tanzania (URT). (n.d.). *IDT/MDG progress—The United Nations and the International/Millennium Declaration development goals (MDG)—on United Republic of Tanzania*. Retrieved June 29, 2006, from <http://www.undp.org/mdg/Tanzania.pdf>
- URT. (1997). *National poverty eradication strategy*. Dar es Salaam: Government Printer.
- URT. (2001). *Poverty monitoring master plan*. Dar es Salaam: Government Printer.
- URT. (2002). *Small and medium enterprise development policy*. Dar es Salaam: Government Printers.
- URT. (2003). *National information communication technologies policy*. Dar es Salaam: Government Printer.
- URT. (2003a). *The Cooperative Societies Act—No. 20 of 2003*. Dar es Salaam: Government Printers. Retrieved June 29, 2006, from <http://www.parliament.go.tz>
- URT. (n.d.a). *The Tanzania development vision 2025*. Retrieved June 29, 2006, from <http://www.tanzania.go.tz>
- Weigel, G., & Waldburger, D. (Eds.). (2004). *ICT4D—Connecting people for a better world—Lessons, innovations and perspectives of information and communication technologies in*

development. Swiss Agency for Development and Corporation (SDC) and the Global Knowledge Partnership (GKP).

Williams, B.K., Sawyer, S.C., & Hutchinson, S.E. (1999). *Using information technology—A practical introduction to computers & communications* (3rd ed.). Irwin McGraw-Hill.

World Bank. (2004). *2004 world development indicators*. Retrieved June 29, 2006, from <http://www.worldbank.org/data/wdi2004/pdfs/table2-5.pdf>

Yonah, Z.O. (1999). Orienting engineers in exploiting applied engineering and information technology in Tanzania: Challenges, opportunities and practical solutions. In *Proceedings of the ERB Press Seminar on Engineers as a Resource for Sustainable National Development* (pp. 64-76). Arusha, Tanzania.

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 305-319, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.18

Information Technology Standards in China

Michelle Rowe

Edith Cowan University, Australia

INTRODUCTION

“If you want to access my market, you have to use my standards.” This seems to be the approach adopted by some in China and certainly is the line promoted by the Director of the Ministry of Information Industry’s research institute, Chen Yuping (Chen, 2004, p. B.1). Standards have been seen to be the cards available to China in its negotiations, given the desire of many multinationals to locate or outsource their businesses and operations in the Chinese market.

BACKGROUND

Many multinational firms have located in developing countries such as China to develop their overseas and industrial markets and to take advantage of low cost environments. Multinationals find it profitable to contract IT software and services in developing countries and many have done so in China.

China’s reform and opening up in the late 1970s gave the impetus to rapid economic growth. This reflects such outsourcing as well as its source of cheap labour, highly skilled workers, and modern factories. Increasingly domestic demand and the size of the Chinese market provide a growth mechanism for the economy and outsourcing enables access to this growing world market.

China’s entry into the World Trade Organisation no doubt will have an impact on accessibility of investors into the market and demonstrates the realisation of the globalisation of markets. This is especially the case in terms of IT, which has been a major player underpinning rapid growth occurring in the Chinese economy.

The Chinese computer industry has been a main player in the growth of electronic and IT industries in China. From January to October 2003 the Chinese computer sector achieved sales of 453.7 billion yuan (U.S. \$54.6 billion) (Info-Prod Research, 2003, p.1). This represented an increase of 64.7% and can be equated to a contribution by IT of 15% to a 34.6% growth in industrial sales in

the country for that period (Info-Prod Research, 2003, p. 1).

Gartner, Inc. anticipates Chinese demand for IT services to be an estimated U.S. \$25 billion and U.S. \$30 billion by the year 2007, a growth of eight times the present level of demand (Jen Lin-Liu & Singh, 2004, p. 26). No doubt the Beijing 2008 Olympics also will contribute to this growth and will lead to a greater presence of multinationals and increased investment in IT in the country (Xie Jia, 2004).

Advocates of globalisation focus on removing barriers to trade. However, where their interests potentially could be affected by global competition, they often seek to protect their interests. Nationalism takes over from globalism (Datt, 2004, p. 1). This seems to be the case in terms of IT standards in China.

STANDARDS

One of the ways China is striving to shift their position from assemblers to innovative firms that are able to compete internationally is to use its market size to create competing standards rather than allowing multinationals to create the technology, set the standards and control industry.

One such example of this is the attempts by Government and industry to establish critical technology standards regarding 3G wireless standards called TD-SCDMA, rather than adopting worldwide CDMA2000 or WCDMA standards.

This strategy sought to solidify China in the telecom-equipment industry. TD-SCDMA was hoped to guarantee Chinese manufacturers some role in the Chinese market as foreign corporations such as Nortel Networks Ltd, Royal Philips Electronics N.V. and Siemens AG were willing to form partnerships with Chinese firms-Datang Mobile and Huawei Technologies Co. Ltd.-to manufacture TD-SCDMA equipment.

However, China recently agreed to put on hold its wireless encryption standard that differed

from IEEE802.11 standard adopted world wide. This encryption technology was to be provided free to 11 Chinese national firms ranging from large players such as Huawei to smaller emerging players. What this meant was that after June 1, 2004 companies selling Wi-Fi equipment to China would have had to licence technology from one of these national firms and incorporate it into their equipment.

Why is multiple standards a problem? Technical standards ensure that, say, a CD bought in one country can be played on a CD player made in another. Standards typically are set by groups of manufacturers or, increasingly, by international organisations. If China enforces its own standards, companies would need to make special versions of products to sell in the Chinese market, adding cost and complexity (Chen, 2004, p. B.1). Compliance with multiple standards would have been onerous, hence the reaction from other players in the market.

China, in promoting its interests and in endeavouring to reduce reliance on foreign technology and multinationals, has attempted to “shake up the global standards game” (Chen, 2004, p. B.1). In setting its own standards China was seeking to strengthen its position in negotiating royalties or technology transfers which it has had to pay to use components and software developed by others (Chen, 2004, p. B1).

China, in attempting to enforce its own standard, was striving to use its “clout” as the factory floor of the world and as an emerging market, potentially being one of the largest wireless markets. It assumed that this encryption standard would be supported. The shelving of this standard was in the face of growing pressure from other players, including Intel Corp. and the U.S. Government.

Some observers see the need for the Chinese to emerge as leaders in setting standards through “inducement” rather than dictating terms (see Stevenson-Yang in Chen, 2004, p. B1). Failure to do so could lead to being “cut-off from export markets, international customers and collabora-

tion in technology” (see Stevenson-Yang in Chen, 2004, p. B.1). Some in the Chinese bureaucracy are taking a more flexible approach to the standards issue, underscoring the need to work in partnership with the international community.

China’s domestic market and its role as a major player in IT manufacturing has lead it to consider setting other standards, especially those that are compatible with standards already established. Examples of this are in the areas of RFID and video-compression technology. Partnerships with foreign companies to set standards potentially could benefit China to enable it to access new markets, and vice versa. It is understood Nokia is working with Chinese manufacturers to develop a standards for the next-generation Internet (Chen, 2004, p. B1).

Despite this decision it is likely that China will continue to promote its wireless encryption standards. Further work is being undertaken to draft additional standards regarding routers and other Internet hardware and software that deal with security issues (Chen, 2004, p. B1).

Nevertheless the issue remains one of “why should we follow established standards when we could design our own?”

REFERENCES

Chen, K. (2004, April 23). China will keep pursuing digital standards. *Wall Street Journal (Eastern Edition)*, B.1.

Datt, R. (2004, March 10). Outsourcing, nationalism and globalisation. *Businessline, Chennai*, 1.

Info-Prod Research. (2003, December 10). Computer Industry plays leading role in promoting IT sector in China, Info-Prod Research (Middle East). *Ramat-Gan*, 1.

Lin-Liu, J. & Singh, S. (2004, January). Indian IT firms connect with Chinese counterparts. *IEEE Spectrum*, 41(1), 26.

Xie, J. (2004, May 27). Olympics to lift firm’s fortunes. *China Daily (North American edition)*, 9.

KEY TERMS

3G: Third generation technologies. 3G is the generic term used for advanced multimedia wireless communication.

IT Standards: International standards that ensure compatibility of technologies produced throughout the world.

Multinational Corporations: A company that owns or controls production or service facilities in more than one country and so conducts business globally.

RFID: Radio Frequency Identification is a technology used to uniquely identify objects, often in transit.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, X. Yu, pp. 456-457, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.19

ICT and Distance Learning for Agricultural Extension in Low Income Countries

Colin R. Latchem

Open Learning Consultant, Australia

Ajit Maru

Agricultural Informatics Consultant, India

INTRODUCTION

About 2 billion people in low-income countries are dependent upon smallholding farming for their livelihoods. These are among the world's poorest people. Most of them lack land tenure and farm in regions with limited land and water resources. Many must cope with drought, desertification, and environmental damage caused by failed land reforms, large-scale monocropping, overgrazing, logging, destroyed watersheds, and the encroachment of new pests and diseases. They use only the most primitive of tools and they lack the knowledge and skills to improve their farming methods, value-add their produce, and compete in national and global markets. Many of these smallholder communities have been devastated by HIV/AIDS. In some regions of sub-Saharan Africa, food production has dropped by 40%, and

it is estimated that over the next 20 years, 26% of the agricultural labour force will be lost to this pandemic. And demographic and economic changes in the low-income nations are increasingly leaving farming in the hands of women, who lack the knowledge and resources to farm efficiently.

The Food and Agricultural Organization of the United Nations (FAO, 2000) stresses the importance of information and knowledge in achieving a food-secure world for present and future generations. There is a massive need for agricultural extension to maintain the natural resource base, for example, to help smallholders increase cropping intensities, diversify into higher-value commodities, and adopt new methods of natural resource management and integrated pest management (Swanson, Bentz, & Sofranko, 2003).

In its traditional forms, agricultural extension has aimed at transferring research findings to farmers through face-to-face training and farm visits. It has been top-down, limited in scope, and slow to change ideas and practices. The more recent approaches to extension are farmer-demand-driven (Lightfoot, 2001). They empower the smallholders to form themselves into learning communities, identify needs, trial proposed methods, and adopt, modify, or discard practices according to their findings. They do not depend solely upon information, ideas, and practices provided by agricultural researchers and extension workers. The farming communities are encouraged to share their knowledge and experience.

The major challenge lies in finding how to fast-track such extension programmes more widely and equitably. Because of their locations or other personal circumstances, many smallholders cannot currently access extension programmes. To make matters worse, many extension services are now being downsized, decentralized, privatized, or only made available on a fee-for-service basis, which puts them even further out of reach of the smallholders. There is, therefore, enormous need and potential for ICT and distance learning to be applied to expanding and strengthening agricultural extension in low-income countries.

TECHNOLOGIES AND METHODOLOGIES

ICT and distance learning allow training and information to be delivered far beyond the traditional catchments of the providers. They allow for interaction, negotiation and exchange as well as the transmission of content. By allowing rural communities to be contributors and communicators and not merely passive consumers, they have the power to really help to change hearts and minds (Richardson & Paisley, 1999; Mundy & Sultan, 2001).

A number of agricultural research and extension agencies are now adopting these newer approaches. Some focus on using technology to overcome the physical and communications barriers between researchers and extension workers, while others are concerned with developing the tools to provide the smallholders with access to databases, decision support tools, online discussion groups, advice, news items, etc.

It should not be assumed that computer, Internet, and satellite technologies invariably provide all the answers for this work. Connectivity, cost, and a lack of technical know-how and support are still major constraints within many farming communities. This is why the CTA (2001, 2003) concluded that what is needed is a mix of new and conventional technologies adapted to the specific needs, skills, and resources of the local communities.

Table 1 summarizes the nature, strengths, and weaknesses of the various technologies and applications that can be used in extension, and gives examples of their use.

FUTURE TRENDS

Combining the technologies and methodologies described above with demand-driven, participative, community-focused distance learning offers an exciting new paradigm for agricultural extension. Networks, programmes, and services can be developed to provide farmers with just-in-time education, information, and advice from multiple sources, regardless of where the providers or end users are located.

The overriding challenge is to achieve strong commitment and partnership by governments and public and private donors and service providers and ensure that their actions match the rate of technological change. If this can be achieved, there never need be any lack of access to training in farming and agribusiness, or too many communities to serve.

Table 1. Technologies, applications, and their strengths and weaknesses in extension

| Technology or Application | Strengths | Barriers to Adoption | Outcomes |
|--------------------------------|--|---|--|
| Private ruralists | Can play an important role in extension. Computer-mediated or telephone-based learning can offer the most cost-effective services. | Rural literacy is the main problem. May be slow, difficult and costly to deliver to remote communities. Lack of ready-made, may not be able to assess and assess processes. Can be slow and costly to customise to local needs and languages. | Radio, posters, pamphlets and brochures are used in many extension programs, sometimes in conjunction with other media. |
| Radio | Commonly available, relatively low cost technology with some advantages in low-income nations. The cost of a community radio station may not be high – Radio Espiritu Santo (radio participativa) in Brazil has a Community of Learning Media Empowerment (COMEM) initiative in Uganda (http://www.colong.co.uk/docs/2002/10/10.html), broadcast from a radio station that is the main airwave, radio is a good way to reach rural areas and is available in many parts of the world, such as in Africa, Latin America and the Caribbean, and South America. | The distribution of access to radio stations has led to commercial prices being charged for listeners which may be beyond the means of the extension providers. Power supply and other business costs may be problems for some funding committees. Radio reception may be problematic in some rural and/or regions. | Agricultural radio programmes are used to support extension in, e.g., Nigeria, Uganda, Fiji, and Trinidad and Tobago. Other examples include Sierra Leone (http://www.cde.gov.sl/radio/extension.htm), the Philippines (http://www.papayan.gov.ph/127.asp), and the Tamil Nadu Agricultural University extension programme (http://www.a.u.arsu.co.uk/). It has a wide range of radio broadcasting, audio cassette, print, Computerized, and on-air computer programmes. |
| Farm Forums | "Phone-in" and "door-to-door" radio programmes are available to help groups and work with the business and extension workers in identifying issues, collecting data, and solving and analyzing problems, and also providing advice. | Promotion costs can be high. A number of Farm Forums have ceased as a consequence of the privatization of state radio and subsequent increase in cost of air time. | The Papua New Guinea Extension Development Centre (EDC) has been using radio to provide a platform for local extension workers to participate in a series of daily "open-air" programs and to provide a platform for local extension workers to discuss and solve their problems (http://www.edc.org.pg/). Farm Forums have also been used in Africa, India and elsewhere. |
| Radio and the Internet | Combines the benefits of a "reach" advantage of radio with the "reach" and "interaction" capabilities of the computer in the Internet. | Lack of infrastructure, technology, technical support and computer skills. Promotion costs. | In the Internet Community Radio Internet Project (http://www.crip.org.uk) in Sri Lanka, daily programmes are broadcast which provide advice to the farmer. In the response to farmer messages, apply the information received, and enable local communities to develop websites that are their focus or the nation's server. |
| Teledrama | Highly motivational. Promotes active and moving pictures to assess and participate. Effective in low-literate communities. | High costs of production. Limited penetration in some regions. | India's cable-TV-based program, drama, in which trained agricultural journalists are used to develop programmes for local extension in the film Pradesh. Gujarat Agricultural University and other Pradesh University in India have departments and numerical television (http://www.cau.ernet.org/). Other examples include the "Grameen TV" in India. |
| Distance and videoconferencing | May be seen to communities unable to make radio or satellite broadcasts. May also be seen to exchange information and practice between communities and other groups. | Dispatch may be slow and expensive. | Used in a number of other programmes as an alternative or a supplement to broadcasts. |

Table 1. (continued)

| Technology | Target | Challenges | Features |
|----------------------------------|--|--|--|
| Telephony | Telephony, especially cellular telephony, has a great potential in accessible GHS and WAP-enabled cell phones enable the sharing of lessons and experiences between agriculturalists, researchers and extension workers. | Many governments lack the means or the political will to improve poor and costly telecommunication. WAP-enabled telephony infrastructure, research is possible in the way of Internet-based knowledge sharing, information services, etc. Connectivity could only be available however, technical assistance such as routing and receiving calls to the Internet can reduce the cost of long distance and international calls. | Distance Telephony (Using a Phone Program) is being launched (http://www.gprn.gov.in) to make parallel by the rural farmers from the service to rural and remote areas. Distance link to local entrepreneurs who are too poor to usually for formal loan activities. These allow village women to set up a network to connect their telephone points to a local dialing centre linked to access vital number and business information, generate income, and establish local entrepreneur. Much of the success is obtained, in Senegal, in a WAP platform that forms a link farmers to research and extension areas. By making it impossible for traders to inflate prices, by allowing negotiation areas, and by reducing the range of profitable goods, etc., the poorest enables farmers to increase their revenues by twenty percent after reducing the cost of communication. |
| Distance learning | Helps experts and communities to be related and learn from each other. Distance learning via computers and the Internet also enables rural extension workers to exchange e-mail messages, Web pages, and exchange text messages. Web pages to enable sharing communities with low literacy levels. | Communications are asynchronous, so where personal telephone and e-mailing and discussion must be used centres at an area with only be accessible for them. | Nil |
| Videoconferencing | Allows researchers, extension workers and community groups to see as well as hear each other and exchange digital photographs and video clips. | Capital and equipment costs are high for meeting with a developed web-based systems. Communications are asynchronous, so the timing and location of the conference may be inconvenient for farmers. | The National Institute of Agricultural Extension Management (NIEM) (http://www.niem.gov.in) is India provides the means the cost of videoconferencing needed between research and extension affairs involving a teleconferencing services. |
| Video and digital cameras | Enable digital photographs and video clips of crops, livestock, diseases, pests, etc., to be shared by e-mail or Internet. | Cost and lack of technical expertise. | The Commonwealth of Learning (COL) project is providing a videoconferencing (VCE) project in the agricultural and agribusiness programmes in Africa and the Caribbean. This enables local content to be generated and broadcast or distributed on courses in videoconferencing that is much appreciated by the farmers, and extension workers to disseminate materials and policies through e-mail more conveniently. |
| World Wide Web | Provides access to content local and global knowledge and information in the form of text, graphics, photographs, animation, audio and video. Allows users to be exchanged between researchers, extension staff and rural farmers who access e-mails. | Cost, lack of infrastructure, access, technical support and computer skills. Small holders not being capable of managing their own learning and electrification between reliable and available services. Developers not being capable of using the various available tools or a secondary material to be made available to be sharing e-mail by providing for large and even global audiences. | The Rice Knowledge Bank (http://www.kb-ri.cgiar.org) is among. The World Agribusiness Centre (http://www.col.org/colcom/centres/), The Virtual University of the Semi-Arid Tropics (http://www.vu.org). The Commonwealth of Learning, FAO and CGIAR (http://www.col.org/colcom/centres/), The Virtual University of the Semi-Arid Tropics (http://www.vu.org/), The Virtual Extension and Research Communication Network (VERCON) (http://www.vu.org/colcom/centres/vercon/) |
| E-mail and Computer conferencing | Differs in that it is with the right infrastructure, inexpensive. The technology is relatively easy to master. Exchanges and synchronous and asynchronous in time. | Lack of infrastructure, access, technical support and computer skills. Cost which increase both for the providers and the consumers at the same, frequency and number of interactions increase. | The Development of Sustainable Agriculture in the Pacific (DSAP) project that the low levels of connectivity between the Pacific Islands areas mean that ICT-based communication is currently limited to e-mail. |

Table 1. (continued)

| Initiative | Design | Implementation | Features |
|---|---|--|--|
| Smallholder and the Internet | Can help regions with low reliability access materials, courses, large-volume audio, and global knowledge networks. | Lack of infrastructure, access, technical support, training and computer skills. | The Africa Learning Initiative has used CD-ROM projects to provide digital content to farmers in a network of community development and extension workers. Includes a digital development kit and a WebSpace Foundation. The project used audio on CD-ROM to provide audio technology to provide Web-based materials and a budget for rural communities lacking telephone access in Africa, Asia and Latin America. |
| CD-ROM and DVD | Easy to use, low cost, analog, digital and video in documents to support learning. Inexpensive to produce and distribute without Internet access. | Lack of infrastructure, access, technical support, and computer skills. Cost. Smallholder not being able to manage their own learning. | The Inter-American Institute for Cooperation Caribbean (IICA) has produced a CD-ROM Learning Center for agricultural extension workers in rural areas. In partnership with Caruapin, the IICA, Caribbean Centre, and Services, Barbados, have the Internet and CD-ROM to advance extension through the region. |
| Mobile computing | Smart laptops and notebooks can be used anywhere in the field. | Cost. Lack of technology, computer skills and technical support. | FAO has been that several workers use hand-held computers containing CD-ROMs to support programmes to guide farmers in using soil tests, epidemic planting, and other services, etc. The use of hand-held computers in extension is possible in other areas, agricultural, laptops, possible printers and cell phones to enable access to information. They have provided information in the field, immediately, a cost that information and a number of other programmes to farmers. The use of laptops will be useful to replace a number of the other services for farmers without Internet access to extension services. |
| Telephones, Internet, mobile, ICT-support, etc. | Help to bridge the digital divide by providing communities with ICT training, facilities, and services. | Poorly thought through business plans. Poor business and service delivery. Lack of community support and necessary critical mass of users. | Operational only because of the urgency and cost of the ICT-based information. However, the ICT-based extension is difficult to implement, especially in rural areas. The ICT-based extension is not a sustainable project. |

CONCLUSION

The CTA (2003) concludes that to date, despite all the rhetoric, there have been few revelatory, paradigm-shifting approaches to extension. International and national agencies are beginning to explore the possibilities of extension through ICT and distance learning, but these initiatives rarely receive high priority, and few of the providers have the funds, infrastructure, knowledge, or capacity to tackle this task on the scale required. Most of the initiatives have been short-term pilot or donor-supported provider-driven information programmes rather than demand-driven distance-learning programmes. Some have been

successful and are replicable. Others have not been sustainable or, for whatever reason, have not been mainstreamed or institutionalized. Unfortunately too, there has been little evaluation of the take-up, usage, applicability, outcomes, and cost benefits of these initiatives.

There is a need to move beyond this piecemeal approach. The Neuchâtel Group (1999) urges international development agencies, governments, nongovernmental organizations (NGOs), private and public service providers, agricultural and educational organizations, and the private sector to form partnerships and networks to advance agricultural extension in low-income countries. All of those agencies involved in this major and challenging task need to be willing and able to change their roles and mandates and develop new

competencies (Lightfoot, 2001). Experts in agriculture need to adopt learner-centred approaches. Experts in ICT need to understand the particular requirements of extension. Rural organizations need to help find ICT-based solutions (CTA, 2003). Regional and local service providers need to help in translating programmes, materials, and support services into local languages, cultures, and agro-ecological zones. And, systems are needed to ensure that the education and information provided is timely, user-friendly, relevant, and available at the click of a button to farming communities, local radio stations, newspapers, NGOs, etc.

Some of these services will need government or donor funding. Others may have to be paid for by the communities themselves. The circumstances will determine the means (van der Stichele & Bie, 1997).

Like the CTA, the FAO (1997) cautions against depending upon the Internet as the panacea for development. The CTA (2003) stresses that the technical tools and solutions must be country- and location-specific, and Maru (2003) observes that technology-based approaches can only succeed where there is appropriate and localizable content and interaction and indigenous capacity to generate them.

Perraton (2000) observes that distance learning has met with failure as well as success in the developing world, and McLean et al. (2002) stress that no single model of distance learning is appropriate for all target groups. A distance-learning provision must therefore be carefully adapted to the social, cultural, economic, and political circumstances of the communities and their environments. Far more is needed than merely placing lecture notes, handouts, research findings, or PowerPoint presentations in English and using technical jargon on the Web or CD-ROM. The programmes need instructional design. They need to be:

- Developed in conjunction with, and disseminated to, multiple stakeholders (farm-

ing communities, extension workers, rural businesses, NGOs, schools, etc.)

- Interactive, multimodal, and multimedia
- Collaborative, with extension workers or local facilitators helping the smallholders to become motivated, master the technology and new learning, and apply and test the new or improved methods in the field
- Up-to-date, authoritative, and appropriate to the circumstances, expectations, culture, language, prior learning, literacy, and comprehension levels of the smallholders
- Designed for self-paced individual and group learning
- Dialogic, offering the smallholders opportunities to collaborate and share ideas and experiences with others who understand their circumstances and whose views they respect
- Simple to understand, easy to work through, and practically oriented
- Based upon both local indigenous and global knowledge and practice
- Appropriate to the technology, budgets, and time available to the providers and users
- Faster, cheaper, better, and more equitable than any of the alternatives

REFERENCES

CTA. (2001). *Information for agricultural and rural development in ACP countries: New stakeholders, new media and priority themes*. Synthesis of the CTA Seminar, Paris, June 2000. Wageningen, The Netherlands: Technical Centre for Agricultural and Rural Cooperation (CTA).

CTA. (2003). ICTs—Transforming agricultural extension? In *Proceedings of CTA Observatory*, September 24-25, 2003. Wageningen, The Netherlands: WICC/CTA. Available online <http://www.cta.int/observatory2003/index.htm>

FAO. (1997). Development communication and

the Internet: Introduction. Available online <http://www.fao.org/sd/cddirect/cddo/Intro.htm>

FAO. (2000). Information and communication technologies for rural development and food security: Lessons from field experiences in developing countries. Available online <http://www.fao.org/sd/cddirect/cdre0055b.htm>

Lightfoot, C. (2001). Transforming conventional extension to farmer driven extension: Actions and operational guidelines for extension reform managers. Available online http://www.isglink.org/LIGHTFOOT_PRACTICAL_GUIDE.pdf; <http://www.eldis.org/static/DOC12963.htm>

Maru, A. (2003). ICT use in agricultural extension in India, in CTA, (2003), ICTs—Transforming agricultural extension? *Proceedings of CTA Observatory*, September 24-25, 2003. Wageningen, The Netherlands: WICC/CTA. Available online <http://www.cta.int/observatory2003/index.htm>

McLean, S., Gasperini, L., & Rudgard, S. (2002). Distance learning for food security and rural development: A perspective from the United Nations Food and Agricultural Organization. *International Review of Research in Open and Distance Learning*, 3(1), April. Available online <http://www.irrodl.org/content/v3.1/mclean.pdf>

Mundy, P., & Sultan J. (2001). Information revolutions: How information and communication management is changing the lives of rural people. Wageningen, The Netherlands: Technical Centre for Agricultural and Rural Cooperation (CTA). Available online http://www.cta.int/pubs/inforev/english/InfoRev_English_1.pdf

Neuchâtel Group. (1999). A common framework for agricultural extension. Available online http://www.inter-reseaux.org/publications/enlignes/PDF/segou_en.pdf

Richardson, D., & Paisley, L. (Eds.) (1999). The first mile of connectivity. Available online <http://www.fao.org/WAICENT/FAOINFO/SUST-DEV/CDdirect/CDre0025.htm>; <http://www.fao.org/sd/cddirect/cdre0026.htm>

Swanson, B.E., Bentz, R.P., & Sofranko, A.J. (Eds.) (2003). Improving agricultural extension: A reference manual. Available online <http://www.fao.org/docrep/W5830E/W5830E00.htm>

van der Stichele, P., & Bie, S.W. (1997). The last mile: How can farmers take advantage of new media? Available online <http://www.fao.org/sd/cddirect/cdan0006.htm>

KEY TERMS

Global Positioning System (GPS): World-wide radio-navigation system formed from a constellation of 24 satellites and their ground stations that provide reference points to calculate positions accurate to a matter of metres, and with advanced forms, to less than a centimeter. GPS receivers are so miniaturized that they are becoming accessible to virtually everyone. Used in cars, boats, aircraft, construction equipment, farm machinery, and even laptop computers, they are predicted to become almost as basic as the telephone.

SMS (Short Message Service): Facility that allows short text messages to be sent to GSM (Global Systems for Mobile Communications) mobile phones.

Wireless Application Protocol (WAP): Advanced intelligent messaging service for digital mobile phones and other mobile terminals that allows Internet content to be viewed in text format on special WAP-enabled GSM mobile phones.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, X. Yu, pp. 885-890, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.20

ICT for Knowledge and Intellectual Capital Management in Organizations

Jacques Bulchand

University of Las Palmas de Gran Canaria, Spain

Jorge Rodríguez

University of Las Palmas de Gran Canaria, Spain

ABSTRACT

This chapter describes which information and communication technologies (ICT) can help in the process of managing knowledge and intellectual capital in organizations. We start the chapter examining the risks we face when we use technologies for knowledge management (KM) and for intellectual capital management (ICM). Once we have done this, we review the literature to see which technologies different authors mention; choosing then the most frequently cited ones. We classify these technologies in base technologies and technological applications, getting to a final number of 17. Each of them is then summarily described and its possibilities in helping KM and ICM are stated. The chapter ends by classifying all of them according to their utility in helping

in KM and ICM and in which of the processes needed in organizations for managing knowledge and intellectual capital they can be used.

INTRODUCTION

Since the 1960s, information and communication technologies (ICT) have been present in organizations. After some years in which organizations just used ICT to automate repetitive processes, an era begun in which ICT started to be used to process data in order to get information out of it: organizations that were able to carry out this process obtained a sustained competitive advantage over their competitors. But, obviously, and as it usually happens, after some time, all companies in one sector where obtaining the same kind of information using the same data as input and the

same ICT as tools, arriving to a state in which good use of ICT stopped providing a competitive advantage.

But in the last few years, a new opportunity has arisen in this area: the use of ICT to process knowledge and intellectual capital. This is a huge challenge for organizations. In fact, organizations that get to use ICT for these mentioned processes will once again obtain sustained competitive advantage over their competitors. In this chapter we examine which of all the technologies that belong to the vast amount named under ICT can be used for knowledge and intellectual capital management and in which of the processes needed to process these two items in organizations they can be used.

BACKGROUND

We start the chapter describing and analyzing technologies that serve as KM facilitators. In this section we review the literature on those technologies.

The first contribution that we cite is that of Bollinger & Smith (2001), who classify the tools that they believe facilitate KM processes into four types: hardware, software, collaborative work and intelligent tools, as shown in Table 1.

We can see that one of the groups, intelligent tools, comprises the tools that permit user needs to be anticipated and new knowledge to be extracted from existing knowledge. Therefore, the tools in this group are more interesting for KM although, as we shall see later, they unfortunately have the problem of a low present level of development, which is the reason why their diffusion is still in its infancy.

Table 1. Computer information technology tools for knowledge management

| Tool category | Tool |
|------------------------------|---|
| Hardware | <ul style="list-style-type: none"> • Investment in IT • Networks • Intranet |
| Software and data-base tools | <ul style="list-style-type: none"> • Knowledge-based systems (KBS) • Collaborative hypermedia for documentation of discussions • Learned lessons databases • Data warehouses • Databases for classification, codification, and categorization of information • Storage of e-mail threads to create a repository of best practices • Corporate memory databases, also known as knowledge archives • Corporate yellow pages • Employee home pages on an Intranet |
| Collaboration tools | <ul style="list-style-type: none"> • Electronic meeting systems • Video-conferencing • GroupWare • Electronic bulletin boards |
| Intelligent tools | <ul style="list-style-type: none"> • Decision support tools using neural networks • Virtual reality • Genetic algorithms • Intelligent agents • Internet search engines • Knowledge mapping |

Source: Bollinger and Smith (2001, p. 12)

Ruggles (1998) cites four technologies as being the most used in KM nowadays: Intranets and Extranets, knowledge repositories, tools to support decision making-and workgroup tools to support collaborative work

Wen Chong, Holden, Wilhemij, and Schmidt (2000) indicate that the most frequently used technologies are Intranets, knowledge repositories, search engines, workflow management tools, data warehouses, workgroup tools, document management systems and decision support systems.

Another author who cites ICT for knowledge management is Binney (2001), who defines a KM spectrum and classifies the applications and technologies according to their usefulness to the

management of each type of knowledge. That spectrum is shown in Table 2.

As we can see in Table 2, Binney (2001) believes that there are six types of KM, ranging from transactional KM to KM in the areas of innovation and creation of knowledge, via analytical KM, knowledge resource management, KM of the processes and development of an organization's knowledge capabilities. The order in *Table 2* is relevant since, from left to right, the theories move from the most technological theories to the most organizational, and the knowledge moves from explicit to tacit.

Junnarkar and Brown (1997) also examine the use of technologies for KM and, in the spiral that describes the knowledge management process

Table 2. Enabling technologies mapped to the KM spectrum

| | Transactional | Analytical | Asset Management |
|--|--|---|---|
| Definition | The use of knowledge is embedded in the application of technology. | Interpretations of, or creates new knowledge from, vast amounts or disparate sources of material. | Management of explicit knowledge and intellectual property assets |
| KM Applications | <ul style="list-style-type: none"> • Case-Based Reasoning (CBR) Applications • Customer Service Applications • Order Entry Applications • Service Agent Support Applications | <ul style="list-style-type: none"> • Data warehouse • Data mining • Business Intelligence Management Information Systems • Decision Support Systems • Customer Relationship Management (CRM) • Competitive Intelligence | <ul style="list-style-type: none"> • Intellectual Property • Document Management • Knowledge Valuation • Knowledge Repositories • Content Management |
| Enabling Technologies | <ul style="list-style-type: none"> • Expert Systems • Cognitive Technologies • Semantic Networks • Rule-Based Expert Systems • Probability Networks • Rule Induction, Decision Trees • Geospatial Information Systems | <ul style="list-style-type: none"> • Intelligent Agents • Web Crawlers • Relations Object DBMS • Neural Computing • Push Technologies • Data Analysis and Reporting Tools | <ul style="list-style-type: none"> • Document Management Tools • Search Engines • Knowledge Maps • Library Systems |
| Portals, Intranet, Extranet and Internet | | | |

Table 2. continued

| | Process | Developmental | Innovation and Creation |
|--|--|--|--|
| Definition | Codification and improvement of process | Increase the competencies or capabilities of an organization's knowledge workers. | Provide an environment in which knowledge workers can come together in teams to collaborate |
| KM Applications | <ul style="list-style-type: none"> • TQM • Benchmarking • Best Practices • Quality Management • Business Process (Re)Engineering • Process Improvement • Process Automation • Lessons Learned • Methodology | <ul style="list-style-type: none"> • Skills Development • Staff Competencies • Learning • Teaching • Training | <ul style="list-style-type: none"> • Communities • Collaboration • Discussion Forums • Networking • Virtual teams • Research and Development • Multi-disciplined Teams |
| Enabling Technologies | <ul style="list-style-type: none"> • Workflow management • Process Modelling Tools | <ul style="list-style-type: none"> • Computer-based Training • Online Training | <ul style="list-style-type: none"> • Groupware • E-mail • Chat Rooms • Video Conferencing • Search Engines • Voice Mail • Bulletin Boards • Push Technologies • Simulation Technologies |
| Portals, Intranet, Extranet and Internet | | | |

Source: Binney (2001, p. 38)

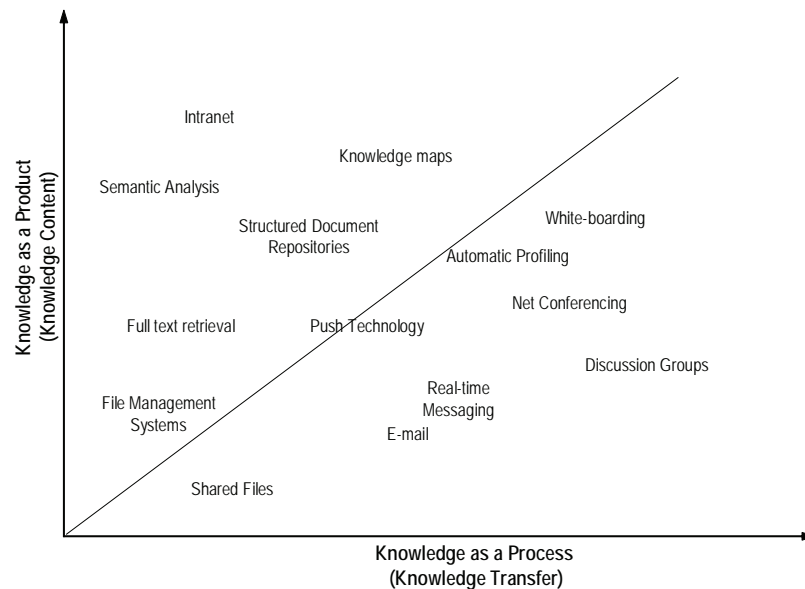
in organizations (Nonaka, 1994), they identify a series of enabling technologies in each type of interaction. In *socialization*, they identify videoconferences and virtual and asynchronous conference systems; in *externalization*, electronic mail and distribution lists. In the case of *combination*, they name workgroup tools, IS, distribution of documents in electronic formats, Intranets and push technologies. Finally, in *internalization*, they identify data mining tools based on neuronal networks, simulations and visualization technology based applications, such as geographical information systems.

Another interesting point of view is that of Mentzas, Apostolou, Young, and Abecker (2001), who classify KM software according to whether the knowledge is considered a process

or a product (Figure 1). In the first case, KM is considered to be a social communication process, since the knowledge is possessed by the person that generates it and is shared through the interaction. Therefore, the ICT are used to transfer the knowledge and not to store it. In the second case, greater attention is paid to the documents containing the knowledge, and to the creation, storage and reuse of the knowledge.

Other authors who explicitly use the term knowledge technologies in their mention of technologies for KM are Meso and Smith (2000), who identify technologies frequently used in those systems and group them according to their function in KM. Thus, for the use of knowledge they cite workgroup tools, messenger tools, videoconference, push technologies, and technologies

Figure 1. The process-centered and product-centered approaches in KM software



Source: Mentzas et al. (2001, p. 96)

Table 3. Technologies and technological applications for KM

| Technologies | Technological Applications |
|---|----------------------------|
| Web Technologies | Data warehouses |
| Databases, repositories and data mining | Help desk tools |
| Real world imitation technologies | Decision support systems |
| Computer-based learning | Discussion forums |
| Work and document flow management | Intranets and Extranets |
| Geographical information systems | Yellow pages |
| Knowledge maps | Knowledge portals |
| Workgroup tools | Case-based reasoning |
| | Document repositories |

to support group decision-making. In the case of searching for knowledge, they cite navigators and Web technologies, data mining tools, search and locate technologies and intelligent agents. For knowledge creation, they only consider intelligent agents suitable and, finally, in the case of packaging knowledge, they identify document management systems and intelligent agents. Of

all those technologies, the authors themselves consider that workgroup and Web navigators are the most prominent nowadays.

That ends our review of the principal works citing technologies for KM, in which it is clear that certain technologies are repeated on various occasions. The next two sections give more detailed descriptions of which of those technolo-

gies we consider the most important for KM, and classify them into two blocks: base technologies and technological applications (Table 3). The first group includes those technologies that are available in the market for any type of use and that can be employed in KM processes, although they were not conceived solely for that purpose. The other group comprises those packets formed by the combination of a group of basic technologies and those specifically configured for KM, although they may also have uses in other organizational areas.

Apart from the technologies and technological applications shown in Table 3, we have seen that the literature mentions many others that are not habitually used in KM, although we should not discount the possibility of their future applicability. Among those, we can refer to data analysis and report tools, trees of deduction and induction by rules, process modeling, probability networks, semantic networks, library systems, simulation technologies and cognitive technologies.

Dangers and Potential Problems when Using ICT for KM and ICM

We dedicate this section to analyze the dangers and potential problems that can arise from the use of technologies in knowledge and intellectual capital management. First of all, we examine some of the dangers cited by various authors. For example, from their experience in two practical cases, Swan, Newell, Scarbrough, and Hislop (1999) draw the conclusion that focusing the KM project on technical and infrastructural elements blinds those in charge to the social and cultural aspects. These authors state that these last two aspects are necessary to change the management of organizations in order to enable the development of a true and complete network of shared knowledge.

Chase (1997) agrees with that approach when he indicates that, in spite of the investments that organizations make in ICT and in training em-

ployees in its use, the best knowledge existing in the organization is not normally available in the right place, time or format.

Junnarkar and Brown (1997) consider that, although ICT constitute a key enabler of knowledge creation, they are insufficient by themselves to increase an organization's collective intellectual capital. In other words, ICT are necessary but insufficient for KM and therefore, Baker, Baker, Thorne, and Dutnell (1997) and Tiwana and Bush (2001) indicate that, for ICT to function as facilitators of communication among an organization's members, they require a structured framework that permits that communication to take place efficiently.

Sveiby (2001) indicates that a climate of internal competitiveness should not be created since, in this case, the knowledge to be shared is only that which adds no value, while Junnarkar and Brown (1997) consider that there are three key elements that would facilitate the use of ICT for KM. Firstly, standards of hardware, software and communications should be developed for the entire organization in order to facilitate the sharing of information and knowledge. Secondly, investments in ICT must be made according to the organization's overall KM strategy. Thirdly, multidiscipline workgroups of the organization's experts in the areas of organizational design, organizational development and technologies should be formed with the aim of developing a joint strategy.

Finally, we should cite Lueg (2000) and Lang (2001), who state that the area of application of ICT for information management, and especially for KM, is very limited since, if information is considered to be the result of man's interpretation of the data, the complexity of getting computers to perform that task can easily be appreciated. They also indicate that the problems lie in the present ICT and believe it necessary to redefine them and create new languages, categories and metaphors. For their part, Baker et al. (1997) consider that the technologies are especially valid to access explicit

knowledge since, for technology to permit access to tacit knowledge; it must be capable of solving problems related to the non-structure of this type of knowledge, to the impossibility of writing it and to the numerous interactions between the individuals involved.

Our opinion is in line with those contributions. We agree that the limitations of current ICT for KM may be overcome, on the one hand, by improving their capability to work with tacit knowledge, and attempting to improve significantly both the way in which they are used and the corporate approach to them, and, on the other, by selecting those ICT that really are relevant to the area and creating a bundle labeled knowledge technologies and applying them selectively.

BASE TECHNOLOGIES FOR KNOWLEDGE AND INTELLECTUAL CAPITAL MANAGEMENT

In this section we give a detailed description of the previously outlined technologies that are especially significant to KM. We first describe each of them and then define their specific contribution to KM.

Web Technologies

There are numerous technologies created around Web services and based on the use of HTML, its extensions and XML. Web technologies serve to access knowledge resources available on Internet or Intranets by using a Web navigator (Meso & Smith, 2000). These technologies are widespread for a variety of reasons, from which we can highlight their allowing simple development of KM systems, their flexibility in scalability terms, their simple use and their imitation of the way humans interrelate, by making the knowledge of others available irrespective of hierarchies, formal barriers and other aspects. We can include

the following technologies in this group of Web technologies:

- **Intelligent Agents.** Laudon and Laudon (2000) define these as programs that perform specific, repetitive and predictable tasks for a particular user for a business process or a software application. They are programmed to seek and find information relevant to the user based on his/her preferences. Some examples of these tasks are the deletion of junk mail, making appointments or searching for the cheapest travel tickets of interest to the user. The agents are not endowed with great intelligence but they do hold a significant amount of information about their owner. Search Engines. Search engines comprise a series of programs that permit the location of documents that meet certain of a wide range of criteria. The searches can vary from the very simple to the highly complex.
- **Push technology.** This technology consists of providing the user with the information required, thus avoiding the need to search for it on the Web. The user indicates the type of information required (sports, weather, etc.) and the software warns the user when it locates something interesting that is available to the user (Laudon & Laudon, 2000). In that respect, the syndication technologies and reception of feeds in RSS format are currently enjoying great success. To be specific, that is a shift from a proactive user to a system of proactive sources that provides the user with the requested information. In the case of KM, the main use of *push* technologies is in their ability to make a selective diffusion of knowledge.

Databases, Data Warehouses and Mining Tools

A *database* is a set of data organized to service a series of applications efficiently by centralizing

the data and minimizing their redundancy. When databases contain a large amount of static data, in other words, data that is not frequently modified, for example, historical data, they are called *data warehouses*. *Mining tools* serve to analyze a great quantity of data normally contained in a database, searching for patterns that can be used to guide decision-making and to predict future behaviors (Laudon & Laudon, 2000). The three described elements are initially thought of for data management but may also be used in information and knowledge management, providing that the latter is explicit. That is why some authors speak of *knowledge repositories* instead of using the term data warehouses.

From the point of view of KM, databases and knowledge repositories capture the explicit codified knowledge present in different organizational levels. In other words, they are used to store and make available what we know of the organization. That task is supported by mining tools, which are able to collaborate in the knowledge generation process (Bhatt, 2001).

The main problem of those repositories is that they usually lack contextualization, meaning that the users have to make a significant interpretation; in other words, the repository contains information and not knowledge (Bhatt, 2001). Some repositories aim to integrate the maximum possible content when information is captured, thus permitting the storage of resources complementary to text, such as images, audio and video. In any case, it is clear that there is the limitation of their only being able to capture and represent a fraction of the knowledge and intellectual capital, namely, the explicit knowledge (Quintas, Lefrere, & Jones, 1997). In spite of those problems, repositories facilitate the maintenance of the organization's shared intelligence and historical memory (Ruggles, 1998).

These technologies have a highly promising future in KM processes since they will participate in the vast majority of associated processes, namely, the creation, codification, application, validation, protection and distribution of knowledge.

REAL WORLD IMITATION TECHNOLOGIES

In recent times we have witnessed the appearance of a series of technologies whose objective is the development of systems that simulate the behavior of entities in the real world, be they human humans, cell groups or social systems. In this section we examine some of them.

Expert Systems. Expert systems are systems dedicated to the capture and codification of the knowledge and wisdom of a human expert in specific domains (Laudon & Laudon, 2000). They belong to the area of artificial intelligence and their functioning comprises three distinct phases. In the first phase, they convert the experts' tacit knowledge into explicit knowledge in the form of IF...THEN... rules until a rule base is created. In the second, faced with a determined situation, they are able to arrive at a valid result by using a minimum number of context-relevant questions for the user to answer, thus advancing in the search for the result. In the final phase, they are able to explain how they arrived at a solution, thus enabling new, apprentice experts to absorb that tacit knowledge by transforming it into tacit knowledge.

Their area of application is limited to situations where we have one or several experts to help us in the creation of the expert systems. However, those experts are not sufficient in number to be present wherever and whenever decisions are made. The expert system helps users who are not experts but who have a certain basic knowledge of the issue to be resolved. According to Hornik and Ruf (1997) expert systems allow training costs to be reduced, albeit in exchange for high initial investment in their development. Those authors also show that knowledge is transferred to a greater extent with expert systems than without the aid of this type of tool. In any case, the ideal way of using this type of system is in combination with analogue techniques (principally contrasts and reflection)

so that, on the basis of the problem posed by the expert system itself, it is the learner who thinks and not always the expert system that answers the questions.

Two areas where they have been successfully applied are health and finance. In the health area, their use is based on codifying the diagnoses of diseases and their treatments in a system that is later used by a doctor to aid him/her in relations with the patient. In the financial field, the most common application has been as an aid in granting loans and in conducting audits (Hornik & Ruf, 1997).

Genetic Algorithms. Genetic algorithms, also called adaptive computing, refer to a set of techniques that use the conceptual model of the adaptation of living beings to their environment as a method of survival (Laudon & Laudon, 2000). One of the principal advantages of these algorithms is that they are able to solve problems in which individuals are unable of understanding its structure (Holland, 1975).

Genetic algorithms are particularly indicated for product optimization and the design and monitoring of industrial systems. For example, in business environments the need for optimization (minimization of costs, maximization of profits, efficient allocation and use of resources, etc.) is usual in complex and turbulent environments (Laudon & Laudon, 2000), which is precisely where they are seen to be more useful.

Since this is such an incipient technology and is in a phase that we could call embryonic, its use in KM is still rare, although it is foreseeable that, in the not too distant future, genetic algorithms will become increasingly important in the same areas as expert systems and even in some areas where the latter display little utility.

Neuronal Networks. A neuronal network is a set of software and hardware that attempts to imitate the process patterns of the human brain. These networks have been attracting great at-

tention recently since, as Laudon and Laudon (2000) indicate, we are witnessing a resurgence of interest in approximations of artificial intelligence that are based on an approach in which machines are designed to imitate the biological process of thought.

The neuronal network approach differs from that of expert systems in that neuronal networks are able to understand, but not to explain, how they came to a specific conclusion while the expert systems, being based on rules, are always able to explain their method of working.

Their use is centered on the resolution of problems related to the classification of patterns, predictions, financial analyses, control and optimization, all of which are applications in which the importance of the knowledge is very high. Normally, their aim is to help a human, not to replace him/her.

Computer-Based Learning

Learning is fundamental to an organization's ability to execute KM processes. As we have seen in the previous sections, the two concepts are intrinsically linked since, to be able to manage knowledge, it is essential to have suitable conditions for learning to take place (Mellander, 2001).

Computer-based learning is that set of technologies designed for the worker to access organizational knowledge about ways of doing things from his/her computer whenever he/she wishes or needs, instead of attending training courses planned by the organization itself or by the organization charged with providing the information.

There are two principal advantages to using this type of system (Trodsen & Vickery, 1998). On the one hand, concepts are retained better when they are applied directly and immediately. On the other, it improves knowledge transfer since it has been shown that students learn faster in a risk-free environment, with no fear of being seen to make

mistakes or of teachers or colleagues discovering their ignorance.

Work and Document Flow Management

Work and document flow management consists of analyzing the sequence of tasks and documents involved in executing a business process and creating the necessary mechanisms for the transfer of documents and information to take place in the most automated way possible under some procedural norms (Laudon & Laudon, 2000). Sometimes, workflow management is also called document flow management.

When these systems are used to automate the transfer of documents, with pre-established rules and no value to the firm, between administrative assistants, their contribution to KM is quite limited. However, when the analysis achieves the definition of the set of business rules, and even permits its management, we are performing tasks of knowledge codification, validation, creation and distribution. As in most of the described KM cases, for this process to be executed correctly, there must be a series of standards and classifications referring to the basic concepts of the business (Sveiby, 2001).

Geographical Information Systems

Geographical information systems (GIS) are tools designed to analyze and display data on maps of a geographical or other nature (Laudon & Laudon, 2000). Their capabilities include those of combining, storing, manipulating and representing information with geographical references (georeferenced information).

From the KM perspective, the main use of geographical information systems is the creation of knowledge by locating patterns of behavior in the data by spatially visualizing it. Just as data mining tools look for patterns by means of numerical analysis of data, these tools enable humans

to be the ones that look for patterns by means of spatial analysis.

The future development of this technology will be to create geographical data mining tools that are able to contextualize the data geographically and then look for significant patterns in those data. However, we believe that the development of this type of tool will take quite a time: that is, until numerical data mining reaches a point of maturity that permits its application in other contexts.

Knowledge Maps

A knowledge map is a diagram that shows the knowledge available in an organization. It allows fast and efficient location of information relevant to decision-making and problem-solving. Moreover, it is a directory that describes a series of categories of specialized information and indicates where it can be found, and its state, value and utility.

According to Ruggles (1998), it is evident that a great part of organizational knowledge can not be codified; it remains in the minds of experts. Therefore, it is important to be able to locate those experts through these maps and to know what knowledge they possess. Ruggles states that there are several reasons for the complexity of constructing the maps. On the one hand, someone must determine who in the organization knows the most about a topic. That task is complicated; not only in terms of locating the subject who meets that requirement, but also because of the possible problems among other workers who may feel undervalued. On the other hand, true experts are not normally interested in being easily located by anyone in the organization, especially if there is not a system that rewards them for the additional workload involved.

We find the use of these maps in the distribution and creation phases of KM. They permit concepts to interrelate, thus easily defining a common language by observing the different maps and checking the meanings of a particular term in each of them.

Workgroup Tools

Workgroup software, or groupware, refers to software that includes functions and services that facilitate the collaborative activities of geographically disperse workgroups by permitting the users to interact and share structured and non-structured information (Shani, Sena, & Stebbins, 2000), thus facilitating the creation of systems to aid decision-making (Meso & Smith, 2000).

Many workgroup software options are available on the market. These packages usually include a series of applications aimed at managing the following aspects:

- *Meetings of physically disperse groups* (Bollinger & Smith, 2001), either through visual systems such as videoconference, or through textual tools such as chat.
- *Information sharing*, which is achieved through the exchange of electronic messages between members of a group, with the messages stored by topic, making it possible for every member to access everything that has been said about any topic. Similarly, it is possible for several group members to work on a document because it enables all members to access the document and make modifications that are clearly displayed.
- *Electronic agenda* of group members and the resources they have available. Those resources include the management of common resources such as meeting rooms or equipment, while also permitting meetings between group members to be arranged according to their availability.
- *Electronic mail*, a tool that has previously been described, the only difference being that, in this case, the application is included in an overall system.

As in the case of Web technologies, and since workgroup technologies are available to every organization, we cannot consider them to be pro-

viders of strategic resources although they could become so depending on the use made of them and the contents inserted into them.

TECHNOLOGICAL APPLICATIONS FOR KNOWLEDGE AND INTELLECTUAL CAPITAL MANAGEMENT

Having analyzed the principal technologies used in KM, either as direct contributors to the processes, or simply as supports in their development, we now describe the most common KM technological applications that use the technologies described in the previous section.

Data Warehouses

The term data warehouse is used to refer to the combination of a database management system, a series of mining tools and a set of current and historical data of potential interest to an organization's managers (Laudon & Laudon, 2000). Those data are standardized and consolidated for the firm as a whole so that the joint analysis of the data of the different areas is possible. The data are available to everyone with access to the warehouse, with no modification to the data permitted.

The main utility of these data warehouses lies in their enabling quality information for decision-making to be obtained (Boar, 2001) by facilitating the extraction of knowledge from operational level databases by manipulating them until what was being sought is found. That extraction is conducted with data mining tools.

From the point of view of KM, data warehouses are also interesting because, to a great extent, they facilitate the distribution of knowledge, permitting all the organization's components to have access to the strategic data that they need for their work.

Help Desk Tools

Help desk services are those which users of a product or service can contact (normally by telephone) when they have a query regarding the installation, set up, use or functioning (e.g., technical assistance in ICT related issues). The objective is to combine a series of resources in such a way that incidents are resolved by optimizing the resources, and customer satisfaction is achieved (Wen Chong et al., 2000). The term help desk can be used both for services provided internally in organizations and for services provided to external customers.

Since these are services whose objective is to assist and satisfy the customer, in many cases they include such diverse concepts as business resource management, customer relationship management (CRM), call centers, sales force automation (SFA) and front and back office solutions.

The knowledge used in those applications is complex since it has to be vast and at the same time deep in order to meet all requests. Therefore, the use of KM in technical assistance services leads to a series of advantages (Davenport & Klahr, 1998), such as higher quality solutions given to customers, consistency in the responses, a higher proportion of problems resolved on the first call without having to escalate the problem to a higher level, lower cost per call, fewer calls to the support service and lower total costs, the possibility of having less technical, more user-oriented, staff, speedier learning and improved staff satisfaction.

Decision Support Systems

The term *decision support systems* (DSS) was first coined by Peter G. W. Keen and his collaborators at Massachusetts Institute of Technology in the mid-1970s. According to Keen and Scott-Morton (1978), DSS are based on four basic characteristics:

- The point of attention is not the operational level, but the resolution of the managers' specific problems, whether in their repetitive tasks or one-off tasks.
- The objective of the system is to support decision-making and not to replace the decider.
- The system comprises the person responsible for management and the technological mechanisms that permit a conversational interactive functioning.
- It is a support system that must be conceptualized more as a service that grows and evolves as the user learns and adapts, than as a finished product.

In practice, DSS are the result of the combination of ICT with operational research and business science, giving rise to generalized or specifically designed interactive models that are frequently of the "what if" type and intended to support decisions that are not completely structured in any level of the organization.

DSS are very useful in organizations wishing to improve their workers' capacity to make decisions, by making available the wealth of knowledge existing in the organization. Wisdom is collected from those who know about different subjects, transformed into rules and guides and made available, usually by means of ICT, to the organization as a whole (Ruggles, 1998). The possibility of making better decisions is one of the main reasons behind setting KM projects in motion (Wen Chong et al., 2000).

Discussion Forums

The term discussion forum is used generically to refer to any type of system of online bulletins where it is possible to post questions or messages in general, and find answers from others who read the forum. They usually include the option of accessing the forum with the sole purpose of reading the contents without actively participating.

Various organizations have attempted to implement the approach of creating a space for these forums on the firm's Intranet, with the idea that the workers use them as a place to exchange their ideas and experiences and to resolve their most common queries. Unfortunately, that type of approach is not usually successful (Shani et al., 2000), since the workers are normally reluctant to air their queries in public and in writing, on the one hand, and to answer their colleagues' queries, on the other.

Intranets and Extranets

An intranet is a private network in which Web technologies are used for communication between members of an organization, and which is protected from outside access by the use of passwords and firewalls (Laudon & Laudon, 2000). An Extranet is an Intranet to which access is granted to a limited group of external users and organizations, such as partners, customers, suppliers and collaborators in the distribution channel (Cothrel & Williams, 1999). In what follows, we only use the concept of Intranet although all the statements could equally be applied to extranets.

Not every intranet project should be thought of as a KM project; however intranets are frequently used to permit access to knowledge and to exchange it within the organization (Ruggles, 1998). Despite the apparent evidence about the utility of an Intranet, the reality seems to be quite different. Thus, authors like Cornellá (2001) indicate that it is common to find organizations shocked by the little use made of their Intranet and the low impact of Intranet on the generation of outcomes despite the significant investment that it represents. That situation is especially serious if it is considered that the objective of the intranet is precisely the exchange of knowledge between members of the firm.

According to that author, the answer lies in the fact that every *digital space* (a set of information and technological exchange tools) invariably needs

a *social space* (a series of motivation, incentive and recognition mechanisms that stimulate people to make use of the digital space) and that this need has a multiplicative format, so that, if either of the two is absent, the result is zero, irrespective of the strength of the other.

Yellow Pages

Corporate yellow pages are databases on experts: a place in which the specialty areas of all the organization's members figure. One of its simplest applications is to locate experts in a determined field. The function mechanism of yellow pages is very simple: the management defines the areas of interest to the organization's functioning and the relevant workers declare themselves experts in the different areas.

As in the case of previously mentioned technologies, it is necessary to have reward systems linked to the use of this tool otherwise workers will not register as experts in any aspect because it would entail an additional workload. From the point of view of KM, the main interest in yellow pages is their contribution to the application and distribution of knowledge in organizations.

Knowledge Portals

A knowledge portal is a Web page containing a series of intelligent agents necessary to locate on the Internet information that is important to us.

Knowledge portals were conceived with the idea of them becoming the brain of the organization and providing its workers with the vital information needed for success in the hypercompetitive markets (Kotorov & Hsu, 2001), thus guaranteeing the survival of the organization.

Those authors believe that one of the problems is that, with the cost of publication practically nil, there has been an avalanche of content that has caused the cost of finding valid information for decision-making to soar. Knowledge portals

represent a possible solution to that problem since they locate on the Web what the user needs.

However, for information to be valuable, it must not only be relevant, it must also be timely, exact, verified and suitably presented. We have already seen that intelligent agents are ideal for locating timely and relevant information but they are unable to participate in its verification and presentation. The problem of verifying information is especially serious when the source is Internet, where any rumor can become reality in a very short time, regardless of whether it is true or not.

In short, knowledge portals are applications of special interest in KM, since they permit access to knowledge in a simple, automated way, even when faced with high levels of uncertainty and an avalanche of information. However, they do have their limitations, one of the most significant being their inability to verify the information.

CASE-BASED REASONING

Expert systems capture and codify the knowledge of expert individuals, but organizations also possess collective knowledge that has been accumulated over the years. *Case-based reasoning* (CBR) systems are useful to capture and store that type of knowledge.

Their working mechanism is based on storing descriptions of the experiences of human specialists in the form of cases in databases, to be retrieved when a situation that is identical or similar to a stored experience occurs. Once the most similar case is located, new parameters are applied and, if possible, the solution to the old case is adapted to the new case. If the outcome is successful, the new case is also stored in the repository (Laudon & Laudon, 2000). In other words, adapting the solutions of previous problems solves new problems.

While the functioning of expert systems is based on a set of IF-THEN, IF NOT-THEN rules, case-based reasoning represents knowledge as a

constantly expanding combination of cases. These systems comprise four elements: a dictionary of resources used, a cases base, the resources to find similarities, and the resources to adapt the solutions (Richter, 1995). As previously mentioned, their contribution to KM is based on their capturing and applying organizational knowledge. Therefore, we can say that they participate in the codification and application phases.

DOCUMENT REPOSITORIES

The objective of document repositories is to capture knowledge and pass it to documents that the entire organization can use later (Davenport & Völpe, 2001). According to those authors, repositories are the most common type of KM and usually contain different types of knowledge: about the best practices carried out, sales management, lessons learnt during the development of projects or products, putting IS into motion, intelligence for the strategic and planning functions, and so forth.

Repositories may be official (edited, vetted and approved by management) or not. A portal is usually created to permit simultaneous access to several repositories. Many of them contain pointers to the experts in each document, thus creating yellow pages of knowledge at the same time.

Davenport and Klahr (1998) point out that one area in which repositories are normally used is technical assistance for users. However, they also state that, although the knowledge is stored on electronic documents, performing a search in all of them is not a valid option because it takes too long while the user is on the other end of the line. In seeking a solution to that problem, Tiwana and Bush (2001) propose a system of star-rating the documents according to the perceived usefulness of each of them, so that the most useful documents appear in the search results before those that are less useful.

CLASSIFICATIONS

After the review of the principal technologies and technological applications currently used in KM, this section classifies them according to their utility and the KM processes in which they play a part.

Utility

In Figure 2, we show the relationship between the current utility of the mentioned technologies for KM and the actual use that organizations are making of them. It should be borne in mind that the use being made of them is measured as a whole and not only for their use in KM.

Dividing that figure into four quadrants, we examine each quadrant in turn, starting at the top-right and moving in an anti-clockwise direction. The first group contains the high-utility, high-use technologies comprising Web technologies, work-

group tools, databases, repositories and mining tools, and work and document flow management tools. These are the elements available to organizations wishing to conduct KM processes. The only aspect that needs developing in this group is a more intensive application of the technologies in KM, especially in the cases of databases and workflow management tools, which are currently used in the resolution of operational and routine tasks that do not really contribute much to KM.

The second group contains the lower-utility, high-use technologies; comprising computer-based learning and geographical information systems. Given the lower utility of the technologies in this group, the actions to be taken should be on the lines of discovering whether it is possible to use these technologies to a greater extent for KM. The third group, the low-utility, low-use technologies, is empty because no elements meeting those two conditions were included in the technologies under consideration.

Figure 2. Utility and current use of the different technologies in KM

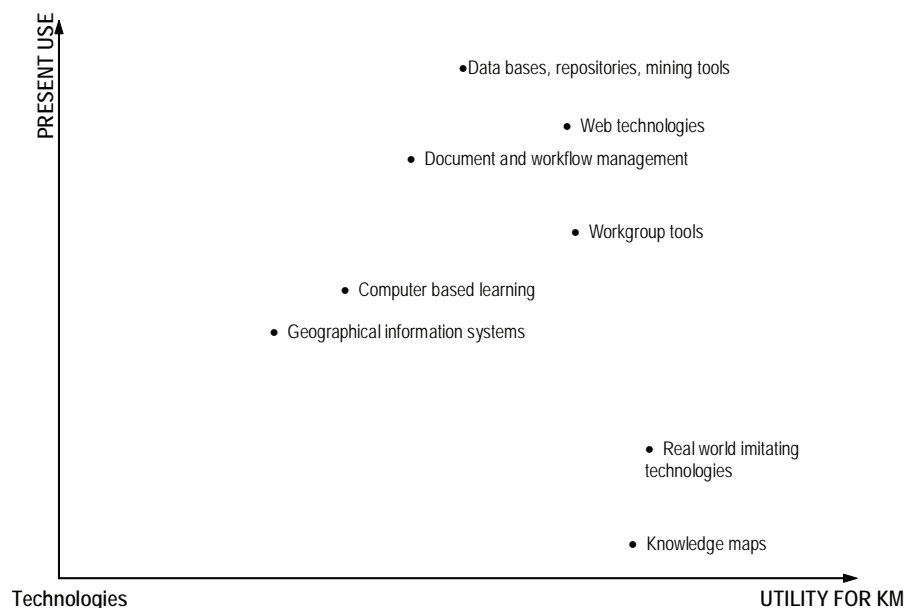
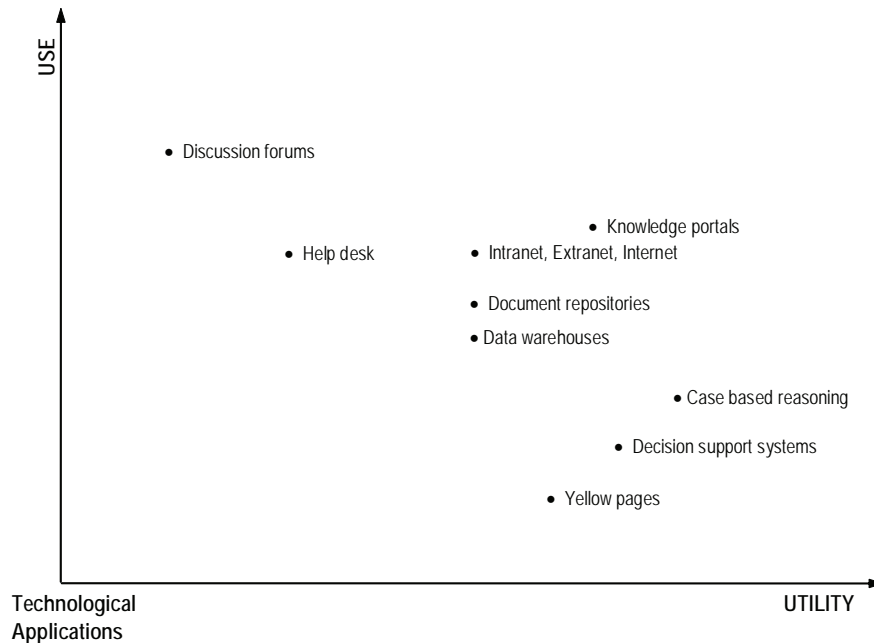


Figure 3. Utility and use of the different technological applications in KM



Finally, we come to the group with the highest potential for development: the high-utility, low-use technologies. This group comprises the real-world imitation technologies and knowledge maps. It has been confirmed that experiences of these technologies in the field of KM have been positive; therefore, we consider it advisable to intensify research into these areas, both in the technologies themselves and in their applicability to KM.

Figure 3 is similar to the previous one, but for the technological applications. Once again, we analyze the quadrants in an anti-clockwise direction. The first quadrant contains a series of high-utility, high-use applications comprising data warehouses, document repositories, Intranets and Extranets and knowledge portals.

The second quadrant refers to low-utility, high-use applications, in which we include discussion forums and help desk systems. The former have been in use since the early days of Internet in

the 1970s, although rarely for KM-related tasks. The latter are generally proposed with the aim of managing knowledge, although that has been accomplished on only a few occasions. Their diffusion is relatively widespread, but we believe that by themselves they can not properly support KM processes, and that applications such as case-based reasoning are required.

As in Figure 2, the third quadrant, high-utility, low-use, is empty. The fourth quadrant contains the group of applications with the greatest potential: those that we consider to have high-utility for KM processes, but whose actual use in those processes is low, either because they are still in the development phase, or because the results of tests that have been conducted were not as positive as expected. These applications are case-based reasoning, decision support systems and yellow pages. Therefore, we propose that future research focus on those three applications and the two previously mentioned technologies,

namely, real-world imitation technologies and knowledge maps.

Knowledge Management Processes

We also consider it interesting to classify the contribution of the different technologies and technological applications to the various basic processes related to the knowledge existing within an organization. To that end, we use a chart containing seven processes: creation, codification, validation, distribution, protection, updating and application.

Table 4 shows that the technologies contribute most in the codification and distribution processes, which was logical to predict, since they are the two areas where technologies display significant advantages over other means. However, they also have the ability to collaborate in each of the other five processes, albeit to a lesser extent.

In the previous section, we also indicated the contribution of each technological application to the seven processes necessary for KM. We use that information to produce Table 5.

The results shown in Table 5 are similar to those in Table 4, but with differences in the support given by technological applications to the knowledge application processes, on the one hand, and the near absence of applications that aid the creation and updating phases. That situation is normal since it is precisely those two processes that depend most on the human component.

FUTURE TRENDS

It is logical that the study proposed here should be, and is, in a state of constant evolution. Since what is being proposed is the possibility of defining a group of knowledge technologies, the evolution

Table 4. Classification of technologies for KM according to the process in which they play a part

| Technologies | Creation | Codification | Application | Validation | Protection | Updating | Distribution |
|--|----------|--------------|-------------|------------|------------|----------|--------------|
| Web technologies | | | ☒ | | | ☒ | ☒ |
| Databases, repositories and mining tools | ☒ | ☒ | ☒ | ☒ | ☒ | | ☒ |
| Real-world imitation technologies | | ☒ | ☒ | | ☒ | | |
| Computer-based learning | | ☒ | | | ☒ | ☒ | |
| Workflow management | ☒ | ☒ | | ☒ | | | ☒ |
| Geographical information systems | | | | | | ☒ | |
| Knowledge maps | ☒ | ☒ | | ☒ | | | ☒ |
| Workgroup | | ☒ | | | | | ☒ |

Table 5. Classification of the technological applications for KM according to the process in which they play a part

| Data applications | Creation | Codification | Application | Validation | Protection | Updating | Distribution |
|--------------------------|----------|--------------|-------------|------------|------------|----------|--------------|
| Data warehouses | ☒ | ☒ | | ☒ | ☒ | | ☒ |
| Help desk tools | | ☒ | ☒ | ☒ | | | ☒ |
| Decision support systems | | ☒ | ☒ | | | | ☒ |
| Discussion forums | | | | ☒ | ☒ | | |
| Intranets & Extranets | | ☒ | ☒ | ☒ | | | ☒ |
| Yellow pages | | | ☒ | | | | ☒ |
| Knowledge portals | | ☒ | ☒ | | | | |
| Case-based reasoning | ☒ | | ☒ | ☒ | | ☒ | |
| Document repositories | | ☒ | ☒ | ☒ | ☒ | | ☒ |

of participation of these and other technologies in KM and ICM in organizations will have to be seen.

CONCLUSION

The principal conclusion that we can draw from this work is that the participation of ICT in the KM and ICM processes can be significant, especially in the management of explicit knowledge and under determined organizational circumstances. We should not fall into the error of thinking that two components of the organization as complex as its knowledge and intellectual capital can be properly managed with ICT alone. However, we can be sure that, with ICT, those processes can be facilitated and greatly improved. Moreover, it is foreseeable

that, in the near future, other technologies based on those mentioned in this work will appear, and they will be technologies that enable further development of this applicability since they will be conceived more specifically for that purpose.

REFERENCES

- Applehans, W., Globe, A., & Laugero, G. (Eds.). (1999). *Managing knowledge: A practical Web-based approach*. Reading, MA: Addison-Wesley Longman.
- Baker, M., Baker, M., Thorne, J., & Dutnell, M. (1997). Leveraging human capital. *Journal of Knowledge Management*, 1(1), 63-74.
- Bhatt, G.D. (2001). Knowledge management in organizations: Examining the interaction between

- technologies, techniques and people. *Journal of Knowledge Management*, 5(1), 68-75.
- Binney, D. (2001). The knowledge management spectrum - Understanding the KM landscape. *Journal of Knowledge Management*, 5(1), 33-42.
- Boar, B. (Ed.). (2001). *The art of strategic planning for information technology*. New York: John Wiley & Sons.
- Bollinger, A.S., & Smith, R.D. (2001). Managing organizational knowledge as a strategic asset. *Journal of Knowledge Management*, 5(1), 8-18.
- Chase, R.L. (1997). The knowledge-based organization: An international survey. *Journal of Knowledge Management*, 1(1), 38-49.
- Cornellá, A. (2001). *Sin espacio social no funciona el espacio digital*. Retrieved December 20, 2001, from <http://www.infonomia.com/extranet>
- Cothrel, J., & Williams, R.L. (1999). On-line communities: helping them form and grow. *Journal of Knowledge Management*, 3(1), 54-60.
- Davenport, T.H., & Klahr, P. (1998). Managing customer support knowledge. *California Management Review*, 40(3), 195-208.
- Davenport, T.H., & Vöpel, S.C. (2001). The rise of knowledge towards attention management. *Journal of Knowledge Management*, 5(3), 212-221.
- Holland, J.H. (Ed.). (1975). *Adaptation in natural and artificial systems*. Ann Arbor: University of Michigan Press.
- Hornik, S., & Ruf, B.M. (1997). Expert systems usage and knowledge acquisition: An empirical assessment of analogical reasoning in the evaluation of internal controls. *Journal of Information Systems*, 11(2), 57-74.
- Huber, G.P. (1991). Organizational learning: The contributing process and the literatures. *Organization Science*, 2(1), 88-115.
- Junnarkar, B., & Brown C.V. (1997). Re-assessing the enabling role of information technology in KM. *Journal of Knowledge Management*, 1(2), 142-148.
- Keen, P.G.W., & Scott-Morton, M.S. (Eds.). (1978). *Decision support systems: An organizational perspective*. Reading, MA: Addison-Wesley.
- Kotorov, R., & Hsu, E. (2001). A model for enterprise portal management. *Journal of Knowledge Management*, 5(1), 86-93.
- Lang, J.Ch. (2001). Managerial concerns in knowledge management. *Journal of Knowledge Management*, 5(1), 43-57.
- Laudon, K.C., & Laudon, J.P. (Ed.). (2000). *Management information systems. Organization and technology in the networked enterprise*. NJ: Prentice Hall International Editions.
- Lueg, Ch. (2000). Information, knowledge, and networked minds. *Journal of Knowledge Management*, 4(1), 151-159.
- Mellander, K. (2001). Engaging the human spirit: A knowledge evolution demands the right conditions for learning. *Journal of Intellectual Capital*, 2(2), 166-171.
- Mentzas, G., Apostolou, D., Young, R., & Abecker, A. (2001). Knowledge networking: A holistic solution for leveraging corporate knowledge. *Journal of Knowledge Management*, 5(1), 94-106.
- Meso, P., & Smith R. (2000). A resource-based view of organizational knowledge management systems. *Journal of Knowledge Management*, 4(3), 224-234.
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14-37.
- Quintas, P., Lefrere, P., & Jones, G. (1997). Knowledge management: A strategic agenda. *Long Range Planning*, 30(3), 385-391.

Ruggles, R. (1998). The state of the notion: Knowledge management in practice. *California Management Review*, 40(3), 80-89.

Shani, A.B., Sena, J.A., & Stebbins, M.W. (2000). Knowledge work teams and groupware technology: Learning from Seagate's experience. *Journal of Knowledge Management*, 4(2), 111-124.

Sveiby, K.E. (2001). A knowledge-based theory of the firm to guide in strategy formulation. *Journal of Intellectual Capital*, 2(4), 344-358.

Swan, J., Newell, S., Scarbrough, H., & Hislop, D. (1999). Knowledge management and innovation:

Networks and networking. *Journal of Knowledge Management*, 3(4), 262-275.

Tiwana, A., & Bush, A. (2001). A social exchange architecture for distributed Web communities. *Journal of Knowledge Management*, 5(3), 242-248.

Trondsen, E., & Vickery, K. (1998). Learning on demand. *Journal of Knowledge Management*, 1(3), 169-180.

Wen Chong, Ch., Holden, T., Wilhemij, P., & Schmidt, R.A. (2000). Where does knowledge management add value? *Journal of Intellectual Capital*, 1(4), 366-380.

This work was previously published in Strategies for Information Technology and Intellectual Capital: Challenges and Opportunities, edited by L. Joia, pp. 168-187, copyright 2007 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.21

Digital Business Portfolios: Categories, Content, and Production

Eleanor J. Flanigan

Montclair State University, USA

Susan Amirian

East Stroudsburg University, USA

ABSTRACT

Developing an innovative and original professional digital business portfolio and keeping it updated is one of the most effective tools that can be used either by the business professional or by the student emerging into the business world. It constitutes a lasting comprehensive experience for both groups. Continual reflection upon their work arms students and business people alike with more confidence in their own competence and worth as they embark on their professional careers or justify their desires for advancement. This article will confine itself to the types of portfolios used most frequently in the business world or in preparation for entering a career, showing that content in each can be cumulative or separate. It will describe ideas for the types of artifacts to compile along with how to format them effectively and digitize them creatively. It will give answers to why to create a portfolio,

who should have one, what should be in it, and how portfolios are created.

INTRODUCTION

Many people are oblivious to the structured paths that lead them from one level of knowledge or one career path to another. Unless they are unusually reflective and deliberately trace their intellectual growth, most people move along and go with the flow of daily living and daily work needs. Whereas professionals keep pace with new requirements placed upon them, students move ahead according to a required college curriculum, taking the prescribed courses as directed. Both groups, however, accumulate valuable experiences along their paths.

Students find that as graduation approaches, preparing comprehensive resumes requires them to sum up their achievements and experiences.

This is usually an onerous task. Rather than waiting until the end of the program, it may increase the students' abilities to comprehend the path of learning if they have to collect and preserve their work in a creative accumulative project, reflecting and assessing during the process.

Business people are certainly aware of keeping their resumes up to date, although they may not do this until some employment crisis forces them to reflect and to report on their accomplishments. Annual job assessment reviews often prompt scrambling through papers or memories of the prior year to compile a report for the desired salary raise or promotion.

Developing a creative portfolio also can help to guide writing a creative resume. Overall, declarations in resumes are strengthened by providing concrete examples of competencies and skills attained. Statements on the resume can be linked to the portfolio artifacts to show specific examples of projects or supporting documents for claims made by the interviewee. This is "show and tell" brought to life by the creator of a digital portfolio who not only proclaims that he or she knows about technological advances but can put them into practice, using them for creative enhancement of the traditionally static resume.

PORTFOLIO OVERVIEW

Although comparatively innovative in business settings, structured portfolios are not new to many other disciplines. Their uses vary, depending on their purposes and their intended audiences. Whereas self-reflective portfolios serve as journals or organizers of activities and experiences, academic portfolios show student learning and progress or the development of skills. Professional portfolios are used in career determination or assessment of accomplishments as well as serving as demonstrations to validate claims of professional development.

Some portfolios consist of one's own work, while others, such as teachers' portfolios, incorporate the tasks they developed for their students along with evaluations, exemplary projects, or external and internal assessments.

Another definition of portfolios is common in the financial world. There, a portfolio is a collection of monetary assets reflected in stocks, bonds, real estate, and personal possessions. Reallocating and shifting these assets for optimal return is the task of financial analysis. Borrowing from this description of an asset portfolio, another way of summing up one's assets is by evaluating a collection of one's personal achievements. These assets are perhaps more precious than mere monetary accumulations. It takes a lifetime of work to acquire educational, professional, and personal assets. Enhancing this theme of portfolios as a collection of assets, Poore (2001) considers a person's business career as a portfolio of well-chosen investments.

DIGITAL PORTFOLIOS

Digital business portfolios basically are collections of artifacts used to validate claims made by the creator. These artifacts are in a creative variety of formats: text documents, Web pages, presentations, research papers, assessment instruments, original projects, academic or external teamwork, internships, performance videos, certificates of achievement, spreadsheets, databases, digital images, and multimedia demonstrations. These digital portfolios serve the business student population as well as business professionals, encouraging them to look critically at their work and to analyze it objectively. Using concrete examples of their achievements and growth, portfolio developers create technologically creative resumes with the portfolio artifacts to support statements of proficiency in their chosen fields.

In short, a portfolio is a demonstration of skills and abilities containing evidence of growth and competence. Portfolios can be learning tools, job search tools, and career growth tools. The purpose of the portfolio to some degree dictates the artifacts collected as well as the format of the design.

TYPES OF DIGITAL PORTFOLIOS FOR ASSESSMENT, JOB SEARCHES, AND INTERVIEWS

Learning and Assessment Portfolio

Students create portfolios as part of classwork for assessment or for tracking their growth during their academic careers. While collecting the artifacts of learning, students realize that they have concrete evidence to support their perceptions of their own development. Their belief in their own growth is given support by looking objectively at the increasing complexity of their projects. Their self-assessment is substantiated by recognizing how their knowledge base changed, comparing the artifacts from the beginning of their studies with the more sophisticated projects done toward the end of their academic years.

This reflection on one's work prompts another important area: developing the ability to be objective when assessing both the quality and/or quantity of materials used in the portfolio. Nicholson (2004) considers self-reflection as "the first step in knowledge construction" (p. 322). With encouragement from a teacher/mentor, the students have a chance to reflect upon their progress, do remedial work, and plan their paths for continued growth.

Students also find portfolios invaluable when pursuing internships or employment at the conclusion of their program. Learning portfolios preserve artifacts that later can become part of career portfolios. Thus, the initial portfolio is done as a student provides a base or example for any future

portfolio development. At many points in a work career, the employee frequently pursues further skills or education in a full degree program, a certification, or even a workshop. It is important that these achievements be documented to demonstrate growth or achievement to the employer. So, the portfolio is the constant base ready to receive and preserve new artifacts.

Initial Job Inquiry Portfolio

In advertisements for employment, the candidate is often directed to send documents such as resumes or supporting material electronically. If the initial inquiry is made online, a small portfolio of work examples could be submitted, along with an electronic resume as an e-mail attachment. The content of the portfolio would consist primarily of text documents including a resume and several work examples or a few highly compressed images. The portfolio creator must be aware that sending this type of portfolio has restrictions in that there are a variety of e-mail systems on the receiving end. Any portfolio sent electronically should be in the neighborhood of one megabyte of memory.

An alternative to actually sending the resume, text documents, or supporting images would be to compose a resume and cover letter with internal hyperlinks directing the reader to a Web-based portfolio. This type of portfolio also can take the form of an expanded Web resume or be an extensive multimedia Web-based presentation. This different strategy means that the original portfolio does not need to be restricted in size. In these cases, the portfolio is Web-based and simply linked from the job application materials.

The introductory portfolio differs in structure from a comprehensive portfolio in the amount of material available. The introductory portfolio also might be an electronic document tailored for each job application or initial inquiry, showing just the type of experience, skill, or education that best pertains to each company or position being

sought. Thus, the creator would pick and choose among the various artifacts in order to focus on the needs expressed by the employer or interviewer. This more personal, focused approach would show depth of preparation as well as forcing the prospective employee to focus on addressing the specific requirements of the job proposed.

Interview Presentation Portfolio

This portfolio also should be tailored to the particular needs of the company or the position sought, perhaps using the mission statement of the specific company as the base for comparison with the job seeker's competencies. Since the purpose of this portfolio is to add to the smaller introductory portfolio, it should include more materials, since size is not as great a limitation. Graphically, this portfolio should follow the rules of good visual communication for presentations, being aware of appropriate colors or formatting. This type of portfolio lends itself to including slide presentations or multimedia projects.

This portfolio should fit on a CD with several copies available. When taken to a job interview, the applicant can present the portfolio during the interview session. A copy then can be left with the interviewer to accompany the application materials following the interview.

Career Growth Portfolio

Once hired, the employee should continue to collect artifacts and include them into portfolios to demonstrate the work performed and growth achieved in skills and responsibilities. This type of portfolio is very helpful in yearly performance reviews and for applications for promotion. As Williams et al. (2004) state, "The portfolio should be designed to transition" with the employee (p. 2). Quality artifacts should increase as years on the job increase.

As an example of this concept of transition during one's career, the field of teacher educa-

tion has been in the forefront for the past decade, encouraging portfolio development. Wilcox and Tomei (1999) address developing portfolios to fit three growth phases of a professional career in education: teacher as learner, teacher as expert, and teacher as scholar. These phases are direct reflections of the portfolios of many professional educators.

This type of portfolio could fit on a CD or, if it includes video or other multimedia, could be distributed on a DVD. If there is a yearly review, the parameters of the review should dictate the main content of this type of portfolio. The employee would choose artifacts focusing on more recent achievements and would not include irrelevant material.

PORTFOLIO ARTIFACTS

A simple rule of thumb is to save everything that relates to work, professional growth, and achievement. It is vital to organize storage methods and to digitize artifacts as soon as possible. Artifacts may be digitized by scanning or photographing them with a digital camera. Once the materials are digitized, it becomes less important to store artifacts in paper form. It is important to create at least one backup of the original digital materials.

The purpose of the portfolio will determine which of the artifacts is placed into the digital document when it is time to create the digital portfolio. For example, a career portfolio would contain the documentation found in Table 1.

Students may find the documentation presented in Table 2 helpful in preparing their portfolios for the interview presentation portfolio.

The sample of careers presented in Table 3 may find the suggested portfolio content topics helpful when preparing for new job interviews, annual reviews, or promotion requests.

Table 1.

| | |
|----------------------------|--|
| Personal Information | Evidence of personal interests, mentors, role models, personality inventory, assessments |
| Educational Credentials | Evidence of education history, thesis or other major papers or research, examples of coursework products |
| Career Achievements | Evidence of work history, career plan, references, inventory of career accomplishments |
| Communication Competencies | Evidence of communication skills, technical skills, certifications, speaking, diversity skills, teamwork |
| Professional Activities | Examples of publication, presentations |
| Recognition | Evidence of academic honors, workplace achievement or recognition, promotions |

Table 2.

| | |
|---------------------------|---|
| Statement of Career Goals | Statement of how their skills and competencies will enhance the mission of the company |
| Academic Achievements | Transcripts, relevant courses taken, honors, awards, internships |
| Evidence of Competencies | Skill-based projects, reports, papers, relevant team activities, original computer-based cases |
| Exterior Assessment | References, academic commendations, club or group affiliations, leadership roles, community service, volunteer work |

PORTFOLIO PRODUCTION TIPS

Digitizing documents and objects for archiving is different than scanning or photographing for presentation. For archiving, the largest file possible should be created. It should be the highest resolution in RGB color mode at the largest scale that the hard drive, digital camera, or scanner can handle.

If the original document becomes lost or disintegrates through aging, this technique of using the maximum settings creates the best possible digital representation of the document. Using the highest settings allows for creating additional smaller files, optimized for portfolio presentation.

Creative Digitizing

Digital documents that are originals should be copied and stored at least twice. Full-size original digital files should be kept on CDs or DVDs. When it is time to prepare them for a portfolio, the original files should be copied from the discs. The archivist should be alert to several situations relating to present and future technologies. Digital files should be in standard formats. Proprietary or native application formats may not stand the test of time. These also should be saved in a standard format such as TIFF for images or RTF for text documents with formatting. This does not mean resizing or compressing the files. The original

Table 3.

| | |
|-------------------------------|--|
| Graphic Artists | Professional graphics, artwork, commercial projects, freelance work, gallery showing, private commissions |
| Sales and Marketing Personnel | Presentations, reports on client success, service awards, promotion paths, recognitions |
| Office Personnel | Creative documents, relevant projects, recommendations, management reviews |
| Information Systems Workers | Multimedia or sophisticated technical projects, proof of certifications, images of systems projects, commendations |
| Help Desk Personnel | Commendations from clients, technical manuals, performance reviews |

files are best saved uncompressed. Once the files are sized and prepared for a portfolio, then they can be compressed.

Dimensional objects also should be saved. Good, high-resolution digital pictures of the objects should be taken and at least two copies of these images on CD or DVD should be stored. It is worth the time and cost to get a professional to create quality images as artifacts. If a non-professional chooses to take digital pictures, the photos should be shot in a large format with the highest resolution the camera allows. Natural or bright artificial lighting is necessary to illuminate the object in order to separate it from the background. Tools such as tripods help to steady the camera for crisp, sharply focused images.

Tape or digital audio and video media may be used in portfolios. Since analog tape media degrades in the duplication process, the tape that is closest to the original edit should be kept and backed up digitally to CD or DVD discs. When preparing files for a portfolio, the file size may be reduced or compressed, but the best quality digital copy of the original serves as a backup to which to return.

Digital Portfolio Formats

Portfolios can be constructed using a variety of media, including popular office application programs as well as portfolio software and Web-based platforms.

Text-Based Portfolio Formats

Microsoft Word, PowerPoint, and Adobe Acrobat provide a ready source for text-based digital portfolios. These popular software programs are very efficient to use, especially for the novice creating a portfolio.

Adobe Acrobat, for example, requires a free plug-in but is rarely a limitation since Acrobat Reader is a business standard and can be installed virtually on all computers. This program particularly makes the collection of creative artifacts possible, as it allows for a combination of text, graphics, video, Web projects, and interactive displays to be integrated into an easily accessible electronic format. Since portable document files (PDF) are transportable across all platforms, they are readable by both sender and receiver.

Another key criterion for software selection, according to Barrett (2002), should be its capability to allow hypertext links between stated goals and outcomes as related to the artifacts. Each of these programs has sophisticated hypertext features that provide flexibility in portfolio design while still maintaining coherence when relating one section to another.

Portfolio Software

There are several software programs that specialize in areas crucial to portfolio creation. Among these are Extensis Portfolio, Cumulus Canto, and Epsilon Portfolios. The underlying goal of each of these programs is digital asset management (DAM), which is the underpinning of portfolios. DAM is an enabling technology and solution to creating, archiving, managing, and finally using the collected artifacts or assets.

There are several benefits to using professionally created programs. They provide the structure needed to create portfolios efficiently. They catalog the digitized assets or artifacts using metadata, which is data about the data describing the artifact. This description standardizes the naming and filing of each artifact, thus enabling the portfolio creator to find appropriate material when creating different portfolios needed during various levels of a professional career.

Web-Based Portfolio Formats

The three software programs — Extensis Portfolio, Cumulus Canto, and Epsilon Portfolios — are also Web-based. Their features vary, but secure server storage is common to all three. Along with storage, the most desirable features in Web-based software should include the structure needed to create and archive artifacts, create personal Web pages, provide suggestions for Web design, and offer well-designed templates. Helpful features also should guide the user through the steps needed for distribution of the portfolio, burning

to CDs or DVDs, creating QuickTime movies, developing slide shows, and e-mailing.

Another Web-based portfolio collection and storage area is available through a feature in Blackboard, a widely used educational course management system. The Blackboard Content System includes the ability not only to store artifacts but also to manage the portfolio by allowing the creator to control its availability to external users and to check that the links to items within the portfolio maintain their validity.

Successfully constructing and implementing Web-based portfolios involves more than just collecting artifacts and distributing an attractive and useful portfolio for career purposes. Academic use during a student's development may aid in greater reflection on the student's scholastic path. Counselors can enhance their interaction with students by tapping into students' portfolios for advisement. Coursework and assignments can be checked and commented on by instructors with further suggestions for improvement. Due to the ability to store securely on institutional servers, students and teachers could develop a more collaborative association.

A Webfolio, according to Gathercoal, Love, Bryde, and McKean (2002), is more than simply digitizing a traditional portfolio. Since the portfolio could be made available to external viewers, it could be made an integral part of a curriculum. Serving several purposes, it could be used by students as a "working portfolio generating artifacts only they can view, a developmental portfolio they share with faculty, and a showcase portfolio they share with the world" (p. 31).

Using the Web as a storage medium and then manipulating artifacts to fit appropriately into a variety of portfolios, as the need arises, permits portfolio creators to be more adaptive and flexible. The base portfolio, perhaps created during student years and stored on the Web, could become a lifelong touchstone for professional and career advancement.

Multimedia Use — Pros and Cons

Some career documentation is most effectively delivered via multimedia or motion media, such as audio, video, or animation. This type of documentation is usually not appropriate for inclusion in an e-mail attachment, as the file size likely will exceed the one-megabyte recommendation.

Multimedia can be effective when delivered on CD or sometimes through a hyperlink to the Web. Whatever delivery method is chosen, the important consideration is the software or plug-ins that are required on the user's computer in order to view the multimedia files in the sender's portfolio. If the end-user computer lacks the programs needed, then the multimedia portfolio files cannot be viewed. If users get an error, they may stop viewing the portfolio altogether. Therefore, including multimedia can be risky.

To avoid problems, preview the portfolio on the broadest possible range of computers, operating systems, and installations. Multimedia is safest used in presentations made directly from a laptop or computer during an interview, guaranteeing that there will be no problems with plug-ins or missing software.

CONCLUSION

Compiling a digital portfolio is a strong asset to the student's learning path as well as means of collecting and preserving valuable projects for the business professional. It serves not only as an archive for precious material that otherwise may be lost over the years but also as an organizing principle, according to Campbell (2004). Learning theory reminds us that people remember what they do and what they produce instead of what others have done for them. So, portfolios provide a memory jog with a record of quantitative and qualitative growth over time. Portfolios capture a moment in time when students were acquiring the skills and competencies needed for their careers.

However, having had the experience of creating a portfolio, the student-turned-professional can build upon it and add to it during their business careers.

The reflections made when collecting and archiving projects allow students to make cohesive connections between concepts learned in various courses. Business personnel also capture significant documents, projects, images, reports, recommendations, and programs. Prior to developing a formal portfolio, these artifacts often are misplaced physically as well as forgotten at just the time when the employee needs all of the support possible to shore up a request for a promotion or to keep a job.

The portfolio provides concrete evidence of learning, improvement, and successes. It serves as a snapshot of knowledge growth and experiences attained. Overall, it serves as a proof to claims of skills and competencies for potential employers and provides students with concrete evidence of some of their achievements.

REFERENCES

- Barrett, H. (2004). *Standards-based electronic portfolio handbook for assessment and evaluation*. Kent, WA: electronicportfolios.com.
- Campbell, D., Cignetti, P., Melenyer, B., Nettles, D., & Wyman, R. (2004). *How to develop a professional portfolio*. Boston: Pearson Education.
- Gathercoal, P., Love, D., Bryde, B., & McKean, G. (2002). On implementing Web-based electronic portfolios. *Educause Quarterly*, 25(2), 29-37.
- Nicholson, B. (2004). Course portfolio. In M. Galbraith (Ed.), *Adult learning methods: A guide for effective instruction* (pp. 321-340). Malabar, FL: Krieger Publishing.
- Poore, C. (2001). *Building your career portfolio*. Clifton Park, NY: Thomson Delmar Learning.

Digital Business Portfolios

Wilcox, B., & Tomei, L. (1999). *Professional portfolios for teachers*. Norwood, MA: Christopher-Gordon Publishers.

Williams, A., & Hall, K. (2004). *Creating your career portfolio: At a glance guide*. Upper Saddle River, NJ: Prentice Hall.

ADDITIONAL RESOURCES

Cumulus Canto. Retrieved October 2, 2005, from <http://www.canto.com>

Epsilen Portfolios. Retrieved October 2, 2005, from <http://www.epsilen.com>

Extensis Portfolio. Retrieved October 2, 2005, from <http://www.extensis.com>

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 2, Issue 2, edited by L. A. Tomei, pp. 71-80, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.22

A Socio–Technical Analysis of Factors Affecting the Integration of ICT in Primary and Secondary Education

Charoula Angeli

University of Cyprus, Cyprus

Nicos Valanides

University of Cyprus, Cyprus

ABSTRACT

We live in a world that is constantly impacted by information and communication technology (ICT). ICT is considered an important catalyst and tool for inducing educational reforms and progressively extending and modifying the concept of literacy. With the extensive use of ICT in schools and everyday life, the term computer literate has already been established. Schools are open systems that interact with their environment, and the effective use and integration of technology is directly associated with the role of various socio-technical factors that may impact the integration of ICT in schools. In this chapter, we report on an exploratory study undertaken in Cyprus schools to examine the status of using ICT from the perspective of socio-technical systems. Specifically,

teachers' knowledge of ICT, frequency of using ICT for personal purposes, frequency of using ICT for instructional purposes in different subject matters, attitudes toward ICT, self-confidence in using ICT in teaching and learning, and school climate were examined. The findings provide useful guidance to policymakers for planning, implementing, managing, and evaluating the integration of ICT in schools. Implications for the concept of computer literacy are discussed.

INTRODUCTION

Due to rapid technological advancements, we live in a world that is constantly impacted by information and communication technologies (UNESCO, 1999). Some key-markers that charac-

terize differences between 19th-century societies (i.e., industrial-age societies) and 20th-century¹ societies (i.e., information age societies) are: (a) standardization vs. customization, (b) bureaucratic organizations vs. team-based organizations, (c) adversarial relationships vs. cooperative relationships, (d) parts oriented vs. process oriented, (e) compliance vs. initiative, and (f) conformity vs. diversity (Reigeluth & Garfinkle, 1994). By virtue of these differences, we are obliged to evaluate once more the worth of our existing educational systems. Are our current educational systems, with their emphasis on content coverage and teacher-centered classroom practices, conducive to preparing students to survive in a changing world that is steadily shaped by developments in information technologies? How do we prepare our future citizens to become computer or technology literate? Do new computer technologies herald the beginning of an era of broader literacy, and if we are educating children to be active citizens in an information society, what forms of literacy are required? What does it mean to be literate, an active reader, a writer, and a communicator of meaning in the information society?

Countries in North America, South America, Europe, Asia, and Africa have all identified a significant role for information and communication technology (ICT²) in improving education and reforming curricula for the purpose of preparing future citizens to be productive and actively involved in an information society (Kozma & Anderson, 2002; Pelgrum, 2001). ICT is considered by many not only to be the “backbone of the Information Society, but also to be an important catalyst and tool for inducing educational reforms that change our students into productive knowledge workers” (Pelgrum, 2001, p. 165). For these reasons, schools have made major investments and continue to invest heavily in increasing the number of computers in schools and the networking of classrooms.

ICT is thus steadily becoming part of classroom life, and it progressively changes the concept of

literacy (Brindley, 2000; Watt, 1980). The traditional concept of literacy as the ability to read and write (Crystal, 1987x) is changing, and ICT opens up a further definition of literacy—one that goes beyond the acquisition of basic skills. Brindley (2000) argues that “schooled literacy, which traditionally sees the acquisition of the ability to construct and interpret text as largely an individual activity, bounded by the concept of text as linear and fixed, is no longer adequate” (p. 13). With the enduring introduction of computers in schools and the extensive use of ICT in our everyday life, the term computer literate has been established and flourished.

For many, being computer literate simply means acquiring technical expertise to be able to competently use computer software and hardware. In this chapter, we consider a much more complex and exciting concept of computer literacy—one that is directly associated with the affordances of ICT and the concept of visual literacy. “Visual literacy refers to the use of visuals for the purposes of communication, thinking, learning, constructing meaning, creative expression, [and] aesthetic enjoyment” (Baca, 1990, p. 65). Thus, the extensive use of multimedia in schools and everyday life opens up the way to an extended concept of literacy. For example, ICT reinvents the text and leads us to a new form of literacy, which encompasses a range of media by which students learn and communicate, such as graphics, video, and sound (Papert, 1993). Similarly, McFarlane (2000) argues that multimedia allow students to record and present their own meaning using multiple media. Thus, the technology of multimedia does not restrict reading and writing to the mere coding and decoding of text. Using a computer, children can represent their creativity with text, graphics, speech, video, animation, and more. Technology offers us new forms of representation and expression that extend the traditional and limited concept of literacy. In the information society one has to be able to “read the text and the image and the moving image and the

ability to secure understanding through reading the pictures as well as text in a rich and organic way” (Kempster, 2000, p. 25). For these reasons, Papert (1993) argues for an emerging model of literacy, which encompasses a range of media by which students learn to express themselves and communicate. In the emerging model of literacy, the ability to read and write are enhanced and sometimes replaced by images, graphics, and sound. These new forms of expression and communication can be used by students to construct meaning and represent their understandings after selecting the most appropriate form from multiple alternatives.

McFarlane (1997) also argues that with computers, literacy extends beyond simple manual encoding and decoding of text. “It involves the habit of viewing writing as a way of developing and communicating a child’s thoughts. The use of word processors, for example, helps to present text as something to be experimented with, redrafted and developed as ideas develop, or the demands of purpose or audience change. It liberates the writer from the heavy burden of manual editing and presentation” (McFarlane, 1997, p. 119). Word processors are not only great productivity tools to write faster, or to make fewer mistakes, but also tools that fundamentally change the authoring process children are engaged in (Hep- pell, 2000).

Moreover, a literate person in the 21st century makes judgments about the quality and value of information. The Internet presents new challenges in the way text is presented, and requires a new set of reading skills that go beyond linear book print to screen print. The inclusion of graphics, hyperlinks, and bookmarks also requires an understanding of how text in a Web page is structured in a non-linear way. Thus, a computer-literate person should be able to access this non-linear text with speed and accuracy and construct understanding. Similarly, the National Grid for Learning in the United Kingdom (DfEE, 1998) refers to the new form of literacy as information

or network literacy that is defined as the capacity to use electronic networks to access resources, create resources, and communicate with others. The use of e-mail, for example, to electronically communicate with others dramatically extends and alters students’ written language in many ways. E-mail can rapidly expand the audience that children write for, and secondly, it can engage children in a different type of writing than the traditional one (Easingwood, 2000). It can also be used to support students’ collaborative work with other students in different schools. The notion of children working collaboratively using the new technologies enables them to develop skills that are needed in the workplace and modern society. Thus, it is clear that computers have the potential to make new things possible in new ways, creating new forms of literacy that are critical to our present and future society.

It therefore becomes important to examine whether schools offer the education needed so that students develop the new forms of literacy that are so important for surviving in the information age. Several researchers (Eraut & Hoyles, 1989; Snyder, 1994) argue that teachers need to be trained in order to utilize ICT appropriately in teaching and learning, and that computers by themselves cannot develop the new form of literacy. Pelgrum (2001) also suggests that ICT in education is an area that is in turmoil and in which many participants play a role. For example, forces operating in schools and in classrooms may be influential in bringing about changes or inhibiting them. Hence, it is important to regularly monitor the status of ICT in education in order to not only account for the financial investments, but also to inform policymakers regarding the content and direction of future policies.

Apple (1986) states that technology in the schools has usually been seen as an autonomous process. “It is set apart and viewed as if it had a life of its own, independent of social intentions, power, and privilege” (p. 105). Along the same line of reasoning, Street (1987) also argues that

computer literacy erroneously rests on the assumption that ICT is a neutral tool that can be detached from other specific and social contexts. According to Kling (2000), the integration of ICT in the school system should be examined within a socio-technical framework, where people need to sufficiently interact with the technological tools within the system for the change to be effective. The term “socio-technical systems” was coined in the 1950s (e.g., Trist & Bamforth, 1951; Trist, 1982) to capture the interdependencies between the social and technical aspects of a system. Put simply, a socio-technical system is a mixture of people and technology, hence the concept of “socio-technical system” was established to stress the reciprocal interrelationship between humans and machines. More importantly, the socio-technical systems approach provides us with a comprehensive and systemic methodology for holistically examining factors that may impact the integration of ICT in elementary and secondary education.

In this chapter, we present an exploratory study undertaken in Cyprus schools to examine the current status of using ICT in primary and secondary education, and discuss implications for the development of the new form of literacy given the current status of ICT in Cyprus schools.

THEORETICAL FRAMEWORK

Schools, like other organizations, are open systems that continuously interact with their environment (Getzels & Cuba, 1957; Hanna, 1997; Hoy & Miskel, 2001). The interaction of a system with its external environment is vitally important, because as a result of this interaction, the system receives feedback and appropriately adapts to new demands and circumstances. A system that does not adapt to the needs of its external environment will gradually become extinct (Hoy & Miskel, 2001).

Thus, the introduction of ICT in the school

system has created a need for extending the theory of social systems into a theory of socio-technical systems such that the interaction between teachers and technology can be examined and understood. Social informatics is an area of research, which systematically examines the design, uses, and consequences of technology, taking into consideration the context of the organization, the people who work within the organization, and the interactions between people and technology (Denning, 2001; Friedman, 1998; Kling, 2000). One key idea of social informatics is that ICT, in practice, is socially shaped and the uses of technology in an organization are contingent upon several social and technical dependencies. The concept of socio-technical networks or systems is used to describe the interdependencies between technology and people, and to explain that the culture of an organization and people’s beliefs, attitudes, and feelings play an important role in shaping the organization’s mood and determining the effectiveness of the integration of technology in the organization (Kling & Lamb, 2000; Kling, 2000; Markus & Benjamin, 1987). Thus, the effective use of technology in different organizational settings is directly associated with the intertwining of technical and social elements (Friedman, 1998; Heracleous & Barrett, 2001; Kling, 2000).

Trach and Woodman (1994) support that the socio-technical model constitutes a flexible model for successfully implementing systemic changes in an organization. Thus, technology should be viewed as a catalyst for pursuing systemic as opposed to piecemeal changes across the different subsystems of an educational system (Angeli, 2003; Valanides & Angeli, 2002). Teachers, for example, constitute an important subsystem of every educational system. According to Fullan (1991), every reform effort should take into consideration the knowledge, skills, beliefs, and attitudes of the people who will implement the changes. In general, a precondition for a successful implementation of any change effort is adaptation,

which includes all adjustments an organization makes in order to realize the changes (Hoy & Ferguson, 1985). Adaptation is a broad term and may include multiple criteria. In this chapter, six areas of adaptation are examined: (1) teachers' knowledge of ICT, (2) teachers' frequency of using ICT for personal purposes, (3) teachers' frequency of using ICT for instructional purposes in different subject matters, (4) teachers' attitudes toward ICT, (5) teachers' self-confidence in using ICT in teaching and learning, and (6) school climate.

According to Huberman and Miles (1984), many educational reform efforts died out because teachers were not supported in their change efforts and thus never accepted or understood the changes they had to implement. Therefore, the adoption of changes requires educating teachers to understand and accept the nature of the restructuring effort, and develop the knowledge, skills, and attitudes that are required for bringing about the change in their classrooms (Fullan, 1991; Louis & Miles, 1990). As Barth (1990) characteristically stated, nothing influences students more than their teachers' own professional and personal development. The process of integrating ICT in teaching and learning is demanding and requires teachers' continuous professional development (Picciano, 2002). In addition, Picciano (2002) believes that school principals and inspectors also need to participate in ICT training so that they understand how ICT integration affects the classroom (micro level) and the school (macro level). Fullan (1991) explains that educational change efforts often create feelings of uncertainty that are not only related to lack of knowledge and skills, but also confidence, as teachers often feel inadequate and uncertain about their new roles (Fullan & Hargreaves, 1992). For these reasons, teachers' ICT professional development is important not only for the development of ICT knowledge and skills, but also for the development of positive attitudes and confidence in using ICT in teaching and learning. Hoy and Miskel (2001) point out that the style of leadership in an organization is

also an important factor. For example, a principal who encourages the use of ICT in teaching and allows teachers to create collaborations within the school and between schools for the exchange of ideas will play an important role in successfully institutionalizing the change effort. Thus, as Hoy and Miskel (2001) state, what is needed is transformational leadership. Transformational leaders are those who foresee the need for change, create new visions for education, and encourage teachers to take responsibility for their professional and personal development in order to successfully fulfill their new obligations and roles.

METHODOLOGY

The Context of the Study

The public educational system in Cyprus consists of the primary and secondary levels, while just recently new attempts have been made to also include pre-primary (3-5½-year-old children) education. Grades 1 to 6 constitute the primary level, and grades 7 to 12 the secondary level. Education is free for all grade levels and mandatory until grade 9 or the age of 16, but an overwhelming 95% of students complete all grade levels. The majority of students attend public schools, and there are only a small number of private schools mainly at the secondary level. Fifty teachers were randomly selected from each one of the 12-grade levels in primary and secondary public education. During the spring semester of 2004, a questionnaire and a pre-stamped self-addressed envelope were delivered to each individual teacher with the help of research assistants. Each teacher was asked to individually complete the questionnaire and return it to the researchers. The majority of the teachers (520) returned their completed questionnaires within a week, and only 22 teachers did not return their questionnaires at all, even after a second reminder by telephone two weeks after the questionnaires were delivered to them. Thus,

the data from 578 questionnaires were used in the study.

Data Collection

The questionnaire consisted of seven parts. The first part collected demographic data related to teachers' age, number of computer labs in each school, number of computers in each lab and teachers' classrooms, teachers' ownership of a personal computer, and teachers' participation in an ICT professional development training program. The other six parts collected data related to: (1) teachers' knowledge of computer software, (2) teachers' frequency of software use for personal purposes, (3) teachers' attitudes towards integrating ICT in teaching and learning, (4) teachers' self-confidence in integrating ICT, (5) teachers' frequency of using ICT for instructional purposes in the classroom, and (6) school climate and support.

Specifically, the second part of the questionnaire used a Likert-type scale from 1 to 5 (I do not know how to use it, I somewhat know how to use it, I know how to use it satisfactorily, I know how to use it well, I know how to use it very well) to measure teachers' knowledge of various software, and the third part used a Likert-type scale from 1 to 5 (never, once or twice every three months, once or twice a month, once or twice a week, almost every day) to measure frequency of software use for personal purposes. Similarly, the fourth part measured teachers' attitudes with a Likert-type scale from 1 to 5 (absolutely disagree, disagree, neither disagree nor agree, agree, absolutely agree), and the fifth part used the same Likert-type scale that was used in the fourth part to measure teachers' self-confidence. For the sixth part, which measured teachers' frequency of using various computer programs in classroom practices, teachers had to write how many times a week they were using different software in their teaching. Finally, the seventh part of the questionnaire measured school

climate and support. A Likert-type scale from 1 to 5 (absolutely disagree, disagree, neither disagree nor agree, agree, absolutely agree) was also used. Thus, the questionnaire collected demographic data and data related to the six areas of adaptation from the perspective of the socio-technical systems perspective.

RESULTS

Demographic Data

Among the 578 teachers, 446 (77.14%) of them were females and 132 (22.86%) were males. The average age of the participating teachers was 31.98 ($SD=8.107$), but the average age was significantly smaller ($t = -5.501, p = .000$) for female teachers ($Mean = 30.94$ years) than for male teachers ($Mean = 35.24$ years). All teachers owned their own personal home computer ($Mean = 1.05, SD = 1.05$), and in some cases, there were teachers who owned two computers at home. Also, 67.5% of teachers recently participated in an ICT teacher professional training program where they learned how to use several computer programs, such as Word, Excel, PowerPoint, and the Internet. Teachers taught in schools where there was a computer lab with an average of 5.55 computers in each lab and at most one computer in each classroom. The computer-student ratio differed for each school, but in all schools computer access was not prolific.

These data signify the tremendous effort that has been undertaken for successfully integrating ICT in the teaching-learning environment, considering the fact that not too long ago there were no computers in the classrooms and no computer labs in most of the schools in Cyprus. It is however more important to investigate how and to what extent ICT is used in Cyprus schools in relation to teachers' ICT knowledge, frequency of software use for personal purposes, attitudes, self-confidence, frequency of using ICT for in-

Table 1. Descriptive statistics of teachers' knowledge of software

| Software | M | SD | n |
|--|-------------|-------------|------------|
| Word Processing (i.e., Word) | 4.17 | 1.11 | 577 |
| Databases (i.e., Access) | 2.01 | 1.16 | 569 |
| Spreadsheets (i.e., Excel) | 2.76 | 1.33 | 572 |
| Graphics (i.e., Paint) | 2.68 | 1.34 | 570 |
| Presentation (i.e., PowerPoint) | 3.34 | 1.43 | 575 |
| Authoring Software (i.e., Hyperstudio) | 2.17 | 1.35 | 576 |
| Internet | 3.28 | 1.53 | 570 |
| E-Mail | 3.19 | 1.60 | 575 |
| Knowledge of Software | 2.95 | 1.03 | 560 |

Table 2. Descriptive statistics of teachers' frequency of software use for personal purposes

| Software | M | SD | n |
|--|-------------|-------------|------------|
| Word Processing (i.e., Word) | 4.11 | 1.16 | 576 |
| Databases (i.e., Access) | 1.03 | .44 | 569 |
| Spreadsheets (i.e., Excel) | 1.92 | 1.08 | 576 |
| Graphics (i.e., Paint) | 2.07 | 1.06 | 576 |
| Presentation (i.e., PowerPoint) | 2.15 | 1.06 | 576 |
| Authoring Software (i.e., Hyperstudio) | 1.28 | .64 | 576 |
| Internet | 3.70 | 1.38 | 574 |
| E-Mail | 3.20 | 1.53 | 573 |
| Educational CD-ROMs | 2.55 | 1.24 | 572 |
| Frequency of PCU | 2.95 | 1.03 | 560 |

structional purposes in the classroom, and various factors pertaining to the socio-technical character of the school system.

Teachers' Knowledge of Computer Software and Frequency of Use for Personal Purposes

Descriptive statistics related to teachers' knowledge of computer software and teachers' frequency of using software for personal purposes are presented in Tables 1 and 2, respectively.

The results in Table 1 indicate that teachers' knowledge of software varied according to the type of software. Specifically, teachers appeared

to be more familiar with Word than with any of the other software such as PowerPoint, the Internet, e-mail, Excel, graphics, authoring software, and databases. More analytically, the results in Table 1 indicate that teachers knew how to use well only Word, while their knowledge about PowerPoint, the Internet, and e-mail was rated just above the level of satisfactory use. Teachers' knowledge regarding the rest of the software was rather poor and below the level of satisfactory use. It is also important to mention that these data refer to teachers' self-reported estimates of their knowledge and do not necessarily represent their actual knowledge.

The results in Table 2 indicate that teach-

ers used Word most frequently and rarely used databases. The Internet, e-mail, educational CD-ROMs, and PowerPoint were less frequently used than Word, but more frequently used than graphics, spreadsheets, authoring software, and databases. For example, teachers used Word once or twice a week, while they almost never used databases or authoring software. Thus, the collective results from Tables 1 and 2 clearly indicate that teachers' knowledge of computer software was dependent upon the type of software, and that their frequency of software use followed almost the same order, in terms of magnitude, as their knowledge of computer software. The means of the variables related to knowledge of software and frequency of software use were found to be highly and significantly correlated ($r = .905, p = .01$). Correlation, of course, does not mean a direct causal relation, and it cannot explain whether better knowledge of a computer program causes its frequent use, or whether the need to frequently use a computer program causes better knowledge of it. The only valid conclusion is that the participants reported better knowledge for some kinds of software and higher frequency of use for the same kinds of software.

Teachers' Attitudes

Dealing effectively with ICT relates not only to knowledge of ICT tools, but also to individuals' attitudes and perceptions regarding ICT tools. Attitudes and perceptions act as a filter through which all learning occurs (Marzano, 1992), and are considered as a constituent part of learners' "self-esteem" that oversees all other systems (Markus & Ruvulo, 1992). Thus, learners continually filter their behaviors through their self-belief system to the extent that they even attempt to modify the "outside world" and make it more consistent with the "inside world" (Glaser, 1981). The limited teachers' knowledge or skills about

the use of several software and computer applications seem to have an impact on their attitudes and concerns.

For these reasons, teachers' attitudes towards ICT were also examined in this study. Table 3 shows descriptive statistics related to the 19 items measuring teachers' attitudes towards the use of ICT in education. The results in Table 3 indicate that the majority of teachers expressed rather positive attitudes towards the use of ICT tools in education. Teachers felt rather comfortable in using ICT for instructional purposes, and expressed positive attitudes towards applying ICT in teaching and learning, because ICT could make learning easier, meaningful, and useful. However, there were a lot of teachers who expressed skepticism or even fear, because they felt incompetent to resolve potential technical problems with the computer. In general, teachers expressed a somewhat overall positive attitude towards the use of computers in education, although some of them also expressed concerns pertaining to technical problems that might hinder their work and students' learning. Of course, even though ICT-related attitudes seem to play an important role in how ICT is used in teaching and learning (Levine & Donitsa-Schmidt, 1998), research indicates that positive attitudes alone are not always good indicators of teachers' eventual use of ICT in the classroom (Wild, 1996). This is due to the fact that teachers often times have positive attitudes about ICT integration without realizing how difficult the task is, or how much effort they need to invest to successfully complete the task. Thus, despite teachers' rather positive disposition towards ICT integration, they may still find the task of integrating computers in the classroom difficult, once they realize what it really entails. This also seems to be a reasonable conclusion from the current results, taking into consideration that the participants of the present study had limited knowledge of the full range of affordances of

Table 3. Descriptive statistics of teachers' attitudes

| Item | M | SD | n |
|--|-------------|------------|------------|
| I feel comfortable with the computer as a tool in teaching and learning. | 3.78 | 1.07 | 577 |
| The use of computers makes me stressful. | 3.84 | 1.06 | 575 |
| If something goes wrong with the computer, I will not know what to do. | 2.63 | 1.12 | 576 |
| The use of computers in teaching and learning makes me skeptical. | 2.70 | 1.13 | 576 |
| The use of computers in teaching and learning makes me enthused. | 3.78 | .83 | 574 |
| The use of computers in teaching and learning interests me. | 3.99 | .93 | 575 |
| The use of computers in teaching and learning scares me. | 2.28 | 1.14 | 572 |
| I believe the computer is a useful tool for my profession. | 4.33 | .81 | 575 |
| The use of computers in teaching and learning will mean more work for me. | 3.61 | 1.00 | 574 |
| Computers will change the way I teach. | 3.77 | .83 | 575 |
| Computers will change the way my students learn. | 3.74 | .88 | 571 |
| Whatever the computer can do, I can do it equally well in another way. | 2.50 | .90 | 572 |
| Computers make learning harder because they are not easy in their use. | 2.16 | 1.71 | 575 |
| Computers make learning harder because often times there are technical problems associated with them that students cannot resolve. | 2.67 | 1.07 | 574 |
| The computer supports and enhances student learning. | 4.05 | .72 | 574 |
| The computer makes learning more meaningful. | 3.86 | .75 | 576 |
| The computer helps students represent their thinking better. | 3.85 | .74 | 577 |
| The computer is a meaningful tool for the teacher because it can help him/her teach a topic more effectively. | 3.92 | .79 | 575 |
| The computer hinders teaching because of the technical problems it may cause. | 3.62 | .92 | 576 |
| ICT Attitudes | 3.36 | .26 | 545 |

several ICT tools and their applications in the teaching-learning environment.

Teachers' Confidence

Table 4 shows descriptive statistics related to teachers' confidence. The results indicate that teachers felt somewhat confident in selecting appropriate software to be used in their teach-

ing, and felt about the same with designing and implementing classroom activities with ICT tools. Several factors seem to play an important role in affecting how individuals use ICT (Fullan, 1991). These factors include not only ICT knowledge and the amount and nature of prior ICT experience, but also ICT-related attitudes and learners' beliefs in their ability to work successfully with ICT tools (self-confidence or self-efficacy) (Levine & Donitsa-Schmidt, 1998; Liaw, 2002;

Table 4. Descriptive statistics of teachers' confidence

| Item | M | SD | n |
|--|-------------|-------------|------------|
| I feel confident in selecting appropriate software to use in my teaching. | 3.51 | 1.12 | 572 |
| I feel confident in preparing classroom activities with ICT for my students. | 3.30 | 1.20 | 569 |
| Confidence | 3.40 | 1.04 | 568 |

Table 5. Descriptive statistics of teachers' frequency of using ICT in the classroom

| Software | M | SD | n |
|---|--------------|-------------|------------|
| Internet | 1.233 | 2.46 | 578 |
| Word Processing (i.e., Word) | 1.606 | 2.78 | 578 |
| Spreadsheets (i.e., Excel) | .309 | .97 | 578 |
| Databases (i.e., Access) | .031 | .21 | 578 |
| Presentation (i.e., PowerPoint) | .711 | 1.45 | 578 |
| Educational CD-ROMs (e.g., drill and practice, tutorials, etc.) | 1.524 | 2.75 | 578 |
| Frequency of Instructional Use | 5.413 | 8.22 | 576 |

Murphy, Coover, & Owen, 1989). Attitudes and beliefs are considered as predictors of behaviors and behavioral intentions that are linked to self-confidence. Beliefs about an object usually lead to attitudes towards it, and in turn, attitudes lead to behavioral intentions regarding the object, which affect actual behaviors towards the object. Finally, there is a feedback loop where behavioral experience modifies preexisting beliefs about the object. In terms of ICT use, attitudes toward ICT affect users' intentions or desire to use ICT. Intentions in turn affect actual ICT usage or experience, which modifies beliefs and consequent behaviors or behavioral intentions (future desire), and self-confidence or self-efficacy in employing ICT in learning. Thus, teachers' actual ICT usage in the classroom is directly associated with their knowledge, attitudes, and self-confidence, although attitudes and confidence are directly dependent on knowledge and improve with success and frequent use. It seems that teachers' self-confidence was

delimited by teachers' knowledge of software and frequency of software use.

Teachers' Frequency of Using ICT in the Classroom for Instructional Uses

Table 5 shows descriptive statistics of teachers' frequency of using ICT for instructional purposes in the classroom. The results in Table 5 draw a rather pessimistic picture in terms of actual instructional use of ICT in the classroom. First, none of the teachers reported any use of electronic communication (i.e., E-mail), authoring software (i.e., Hyperstudio), or graphics (i.e., Paint) in their teaching. Second, computer applications such as spreadsheets, databases, and PowerPoint were minimally used, and teachers' reported mean frequencies of use for these software were .309, .031, and .711, respectively. Third, only the mean frequencies of use for the Internet, Word, and

educational CD-ROMs had values higher than one indicating that they were used infrequently and only by very few teachers. Finally, in comparison with the results in Table 2, teachers were using the same software much less frequently for instructional purposes than for personal purposes. This seems to suggest that teachers' knowledge, attitudes, and self-confidence had probably less impact on teachers' instructional use of the software or that there were some other reasons inhibiting the instructional uses of ICT in teaching and learning. For example, the existing socio-technical character of a school could substantially constitute a significant factor in supporting or inhibiting both use and frequency of use of certain software, despite teachers' technical expertise, attitudes, and self-confidence in employing ICT in teaching and learning.

Socio-Technical Environment

Table 6 shows descriptive statistics of various factors related to the socio-technical character of a school. Based on the results, there were

participants who felt that their superiors, the computer coordinator, and other colleagues tended to encourage them to use ICT in the classroom, but there were also other participants who did not share the same point of view. Also, teachers in general neither agreed nor disagreed about the availability of technical or instructional support in their school, or whether there was adequate computer equipment or software available. Lastly, teachers expressed mixed views on whether the subject of ICT integration was sufficiently discussed in faculty meetings. The only valid conclusion from the results in Table 6 is that at least teachers did not feel discouraged for their attempts to integrate ICT tools in their classrooms. They perceived a rather neutral socio-technical environment in their schools. It is also possible that teachers did not have a clear understanding of the situation in their school, and thus were unsure about it. Obviously, there was not a strong momentum, nor systematic plan of action for effectively integrating ICT in the participants' schools. Teachers' somewhat positive attitudes and perceived self-confidence were rather compatible with the existing socio-

Table 6. Descriptive statistics of socio-technical factors

| Item | M | SD | n |
|---|----------|-----------|----------|
| There are teachers in my school who help me integrate ICT in my teaching. | 3.12 | 1.120 | 564 |
| The computer coordinator encourages me to use ICT in my classroom. | 3.38 | 1.171 | 565 |
| The principal encourages me to use ICT in my classroom. | 3.15 | 1.083 | 566 |
| The inspector encourages me to use ICT in my classroom. | 3.43 | 1.087 | 565 |
| We often talk about ICT integration during our faculty meetings. | 2.92 | 1.109 | 567 |
| There are many software available in my school. | 3.04 | 1.072 | 566 |
| There is technical support readily available in my school. | 3.09 | 1.086 | 565 |
| There is ICT instructional support readily available in my school. | 2.89 | 1.080 | 566 |
| There is adequate computer equipment in my school. | 3.04 | 1.223 | 566 |

technical environment, which, as the results indicated, was not overwhelmingly supportive, but rather neutral.

Personal Computer Use and Instructional Computer Use

The fact that teachers reported rather infrequent instructional use or no instructional use for most of the software is contradictory to teachers' frequency of using computer software for personal purposes, as well as contradictory to their subjective self-confidence, attitudes, reported knowledge of several software, and the socio-technical environment.

In order to better examine the existing discrepancy between the frequency of ICT use for personal purposes and frequency of ICT use for instructional purposes, five composite variables were created, namely, teachers' knowledge (KNOW), frequency of personal computer use (PCU), attitudes (ATT), self-confidence (SCF), and frequency of instructional computer use (ICU). These five variables represented the mean value of the single items in Tables 1, 2, 3, and 4, respectively, with the exception of ICU, which represented the sum of the individual items in Table 5. Two regression analyses were consequently conducted with the frequencies of PCU and ICU as the dependent variables for the first and the second analyses, respectively. The independent variables for both analyses were the other three composite variables (KNOW, ATT, and SCF), teachers' age, participation in an ICT professional development training program, and the nine individual items shown in Table 6 measuring aspects of the socio-technical environment (STE₁ to STE₉). Other variables from the first part of the questionnaire were excluded from the analyses, because they were found not to be discriminating nor redundant, as they were highly and significantly correlated with other variables. For example, *years of teaching experience* was considered to be a redundant variable, because

it was highly and significantly correlated with age ($r = .960, p = .01$). *Ownership of a personal computer* was also not a discriminating variable, because all teachers owned a personal computer, with the exception of some of them who reported that they owned two personal computers. Table 7 shows the correlations between all possible variables (dependent and independent) that were used in the two regression analyses and some additional variables from the first part of the questionnaire.

Regarding the items in the first part of the questionnaire (demographic information), it was considered more appropriate to use them as individual variables, since they could not be considered dimensions of the same construct, as it was, for example, the case with teachers' self-confidence or attitudes. Regarding the items in the last part of the questionnaire, although they were measuring aspects of the socio-technical environment, we used them as individual variables, because we were interested in identifying which dimensions of the socio-technical environment seemed to play an important role in ICT integration. In most cases, the guiding principle for including or excluding a variable in the regression analyses was their overlapping meaning and high significant (positive or negative) correlation with other variables. Table 7 shows the correlations between all possible pairs of dependent and independent variables, as well as some additional variables that were considered important to further clarify and interpret the results of the regression analyses.

Table 8 displays the results of the first stepwise multiple regression analysis with the frequency of PCU as the dependent variable and the independent variables that were determined as significant predictors of the dependent variable. The independent variables that contributed significantly to the prediction of frequency of PCU were teachers' knowledge, self-confidence, and gender, and from the socio-technical factors those related to inspector support and computer equipment in the

Table 7. Correlations between all possible pairs of criterion, predictor, and selected demographic variables

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------------|---------|--------|--------|--------|--------|---------|--------|--------|
| Age (1) | 1.00 | | | | | | | |
| ICT Inservice (2) | -.190** | 1 | | | | | | |
| KNOW (3) | -.401** | -.075 | 1 | | | | | |
| PCU (4) | -.274** | .077 | .772** | 1 | | | | |
| ICU (5) | .046 | .087* | .283** | .354** | 1 | | | |
| SCF (6) | .201** | .134** | .597** | .592** | .303** | 1 | | |
| ATT (7) | -.185** | .056 | .537** | .527** | .309** | .592** | 1 | |
| STE ₁ (8) | -.015 | -.046 | .085* | .128** | .202** | .220** | .136** | 1 |
| STE ₂ (9) | -.003 | -.069 | .166* | .195** | .202** | .321** | .232** | .548** |
| STE ₃ (10) | -.019 | -.086* | .191* | .242** | .211** | .325** | .273** | .517** |
| STE ₄ (11) | .005 | .046 | .160* | .195** | .191** | .285** | .238** | .420** |
| STE ₅ (12) | .031 | .094* | .036 | .044 | .048 | .168** | .036 | .294** |
| STE ₆ (13) | -.079 | -.104* | .094* | .068 | .110** | .185** | .119* | .275** |
| STE ₇ (14) | .003 | -.061 | -.008 | -.023 | .074 | .149** | .052 | .273** |
| STE ₈ (15) | .016 | .104* | .042 | .050 | .211** | .188** | .059 | .343** |
| STE ₉ (16) | .069 | .111* | .077 | .035 | .057 | .173** | .108* | .236** |
| Gender (17) | .225** | -.034 | .132** | .207** | .118** | .082 | .171** | -.008 |
| TE (18) | .960** | .200** | .407** | .290** | .057 | -.217** | .205** | .020 |

| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|--------|--------|--------|--------|--------|--------|-------|-------|
| 1.00 | | | | | | | |
| .656** | 1 | | | | | | |
| .440** | .400** | 1 | | | | | |
| .361** | .267** | .302** | 1 | | | | |
| .267** | .252** | .278** | .438** | 1 | | | |
| .375** | .316** | .354** | .363** | .560** | 1 | | |
| .321** | .210** | .248** | .437** | .448** | .384** | 1 | |
| .044 | .039 | -.0119 | .003 | .003 | .044 | .102* | 1 |
| -.002 | .002 | .036 | -.078 | -.001 | .022 | .047 | .146* |

Note: SCF = teachers' self-confidence, KNOW = teachers' knowledge, ATT = teachers' attitudes, STE1 to STE9 = individual items of the socio-technical environment corresponding to the items in Table 6, TE = years of teaching experience, ICT inservice = participation in ICT professional training, Gender = 1 for females and 2 for males.

school. Teachers' knowledge was found to be the best predictor of teachers' frequency of PCU and alone explained 59% of the variance.

Teachers' self-confidence was found to be the second best predictor that contributed to a significant increment in R^2 , from .590 to .617.

There were three other variables, namely gender, inspector support, and computer equipment that also contributed significantly to the prediction of teachers' frequency of PCU, but the amount of variance in frequency of PCU attributable to each one of them was much smaller, namely,

A Socio-Technical Analysis of Factors Affecting the Integration of ICT

Table 8. Multiple regression analysis of factors predicting teachers' frequency of personal computer use

| Model | Variables | R | R ² | Adjusted R ² | Adjusted ΔR ² | F Change | Significance |
|-------|---------------------|------|----------------|-------------------------|--------------------------|----------|--------------|
| 1 | Knowledge . | .768 | .590 | .590 | .590 | 693.205 | .000 |
| 2 | Confidence . | .786 | .617 | .616 | .026 | 33.594 | .000 |
| 3 | Gender . | .792 | .628 | .625 | .009 | 13.349 | .000 |
| 4 | Inspector Support . | .795 | .632 | .629 | .004 | .568 | .019 |
| 5 | Computer Equipment | .799 | .635 | .635 | .006 | .361 | .002 |

Table 9. Multiple regression analysis of factors predicting teachers' frequency of instructional use

| Model | Variables | R | R ² | Adjusted R ² | ΔR ² | F Change | Significance |
|-------|----------------------------------|-------------|----------------|-------------------------|-----------------|--------------|--------------|
| 1 | Self-Confidence | .301 | .091 | .089 | .089 | 48.778 | .000 |
| 2 | Instructional Support | .342 | .111 | .113 | .024 | 14.358 | .000 |
| 3 | Attitudes . | .378 | .143 | .138 | .025 | 4.785 | .000 |
| 4 | Colleagues . | .391 | .152 | .146 | .008 | 5.448 | .020 |
| 5 | Knowledge | .404 | .163 | .154 | .008 | 6.125 | .014 |
| 6 | Self-Confidence (removed) | .400 | .160 | .153 | .003 | 1.761 | .185 |
| 7 | Age | .410 | .168 | .160 | .008 | .743 | .030 |

.9%, .4%, and .6%, respectively. Although the correlations between teachers' frequency of PCU and some other variables (i.e., age, ICT inservice, and the remaining socio-technical factors) were significant, these variables were not found to be significant predictors of PCU.

For the purpose of further clarifying and interpreting the results of the first regression analysis, a careful examination of the pair-wise relationships between teachers' age, gender, knowledge, and ICT inservice training in Table 7 indicates that these variables were highly and significantly correlated, but only teachers' knowledge and gender proved to be significant predictors of the frequency of PCU. This can be explained by the fact that the younger teachers tended to have more knowledge than the older ones ($r = -.274, p = .01$), female teachers were in general younger than male teachers ($r = .225, p = .01$), and younger teachers were more inclined

to participate in inservice ICT training ($r = -.190, p = .01$). Similarly, as shown in Table 7, all items corresponding to the socio-technical factors were highly and significantly correlated among each other, but not all of them were found to be significant predictors, as the unique contribution of many of them was not found to be significant. In multiple regression:

It is possible for a variable to appear unimportant in the solution when it actually is highly correlated with the dependent variable. If the area of that correlation is whittled away by other independent variables, the unique contribution of the independent variable is often very small despite a substantial correlation with the dependent variable. (Tabachnick & Fidell, 1989, p. 143)

Thus, from the list of the socio-technical factors, only inspector support and availability of

computer equipment in the school were found to be significant predictors of the frequency of PCU. Interestingly, computer equipment was found to be an important predictor of PCU, although there was not a significant positive correlation between the two variables. This outcome is really difficult to explain, because computer equipment in the schools does not seem to be directly related to teachers' frequency of PCU outside the classroom. One possible explanation is that teachers began to use computers for personal purposes after the introduction of computers in the schools, which possibly served as the impetus for teachers to learn how to use computers.

Table 9 displays the results of the second stepwise multiple regression analysis between frequency of ICU as the dependent variable and the significant independent variables. The independent variables that contributed significantly to the prediction of the frequency of ICU were teachers' self-confidence, instructional support in the school, teachers' attitudes, support from colleagues, and knowledge. Teachers' self-confidence was the best predictor of the frequency of ICU, but it could explain only 9.1% of the variance. The variables of instructional support, teachers' attitudes, support from other colleagues, and teachers' knowledge also contributed to a significant increment in R^2 . These variables could explain 2.4%, 2.5%, 0.8%, and 0.8% of the variance in the frequency of ICU, respectively. The total amount of variance attributable to these variables was only 16.8%.

Interestingly enough, the significant predictor of self-confidence was removed from the regression equation in step six, as its unique contribution was no longer significant. When, in step 7, age was introduced, there was a significant increase of ΔR^2 that made the total amount of variance, after partialling out the contribution of teachers' self-confidence, significantly higher. In stepwise regression, "independent variables are added one at a time if they meet statistical criteria, but they also may be deleted at any step where they

no longer contribute significantly to prediction" (Tabachnick & Fidell, 1989, p. 147). Thus, the total amount of variance attributable to instructional support, teachers' attitudes, and support from colleagues, knowledge, and age, was found to be 16.8%. Teachers' self-confidence that was initially found to be the best predictor of ICU was in the end excluded from the list of significant predictors for two reasons. First, teachers' self-confidence, after the inclusion of four other variables (instructional support, attitudes, support from colleagues, and knowledge), did not contribute significantly to the prediction of the frequency of ICU and could be excluded without any significant decrease in R^2 . Second, the combination of teachers' knowledge and age was a better predictor of the frequency of ICU than teachers' self-confidence.

DISCUSSION AND IMPLICATIONS

The socio-technical systems model provides us with a framework to systematically identify factors that could possibly affect the integration of ICT in education. From this perspective, a questionnaire was used in this study to collect demographic data and information related to teachers' knowledge of ICT, frequency of using ICT for personal and instructional purposes, attitudes toward ICT, self-confidence in using ICT in teaching and learning, and school climate. The findings tend to support that female teachers were more inclined to participate in ICT inservice training; had better knowledge, attitudes and self-confidence related to ICT; and used ICT tools more frequently both for personal and instructional uses than male teachers. Teachers' knowledge of computer software and frequency of use for personal and instructional purposes were dependent on the type of software. For example, teachers' knowledge and frequency of use for personal purposes was mainly restricted to word processing, and to a much smaller extent to the Internet, e-mail, and educational CD-ROMs, while other software were almost unknown

and rarely used. Teachers expressed somewhat positive attitudes towards the use of computers in education, but they also expressed concerns pertaining to technical computer problems that might hinder their work and students' learning. They also felt, to some extent, self-confident in selecting appropriate software to be used in their teaching, and somewhat confident in designing and implementing classroom activities with ICT tools. Teachers' attitudes and self-confidence seem to be delimited by their restricted knowledge of software and frequency of software use for personal and instructional purposes.

Teachers also reported infrequent instructional use or no instructional use even for software that they frequently used for personal purposes outside the classroom. This discrepancy seems to be attributable to the rather neutral socio-technical environment that existed in their schools, but also to other factors. Specifically, a stepwise regression analysis indicated that 63.5% of the variance in teachers' frequency of personal computer use could be predicted by teachers' knowledge, self-confidence, gender, inspector support, and computer equipment. However, according to a second stepwise regression analysis, only 16.8% of teachers' frequency of instructional computer use could be predicted by instructional support from officials, teachers' attitudes, support from the other teachers in the school, knowledge, and age.

The findings indicate that teachers in Cyprus are not illiterate in terms of having ICT skills and in terms of using ICT for personal purposes. What the findings clearly show is that teachers do not feel empowered to actively use ICT in authentic teaching and learning activities. Teachers need to develop confidence in their own professional activities and realize that what they are doing is right and important for their students' education. As Gable and Easingwood (2000) state, it will take time to train teachers to fully appreciate the power of ICT, but it is crucial to invest in such efforts, so that teachers fully appreciate the

philosophical aspects of what they are doing, rather than just learning how to use the computer. These results indicate that policymakers in Cyprus have to seriously consider the lack of learning opportunities for the development of new literacy in Cyprus schools, and make coordinated efforts for providing a different and better kind of training to teachers. This training should pay attention not only to teachers' technical expertise, but also their attitudes, self-confidence, and in-depth understanding of ICT's affordances and added value in teaching and learning targeting an extended concept of literacy. Teacher professional development about the instructional uses of ICT in the classroom and about computers as learning tools for providing us with new forms of media that can enrich learner communication and expression is absolutely in great need.

Along the same line of reasoning, teacher education departments must also consider the quality of their curricula and adapt them appropriately, so that they adequately prepare teachers to integrate ICT in teaching and learning. We argue that teacher preparation, inservice or preservice, should focus on new interactive computer-based technologies, such as electronic communication systems, visualization and dynamic systems modeling tools, simulations, and networked multimedia environments, for scaffolding and amplifying students' thinking (Bransford, Brown, & Cocking, 2001). These tools are known as cognitive tools or mindtools (Jonassen, 2000), because they engage learners in meaningful thinking to analyze, critically think about the content they are studying, and organize and represent what they know. Jonassen, Carr, and Yueh (1998) state that "learning with mindtools depends on the mindful engagement of learners in the tasks afforded by these tools and that there is the possibility of qualitatively upgrading the performance of the joint system of learner plus technology" (p. 40). Therefore, mindtools require learners to think harder about the content being studied, and engage them in thinking that would be impossible

without the tools. Finally, the tools we use and the way we use them shape our experiences and our thinking (Vygotsky, 1978) and impact our literacy. Thus, “if technology is to be viewed as an add-on in the learning environment that is pursued for the sake of technology alone, then it will not change education” (Valanides, 2003, p. 45), because technology, in and of itself, cannot influence learning, no matter how powerful it might be. On the other hand, if technology is utilized as a cognitive tool that has added value in certain instructional situations, then it will become a driving force for systemic educational change to help teachers and students to experience deep learning and acquire an extended concept of literacy that is compatible with the needs of our society.

The overall findings of the study indicate that ICT is not systematically integrated in Cyprus schools and is not an important part of everyday classroom practices. This seems to be related to several reasons, such as teachers’ limited knowledge of a variety of software, limited instructional support provided to teachers by the Ministry of Education, teachers’ somewhat positive attitudes, lack of a true community of practice in the schools where teachers help each other to integrate ICT in teaching and learning, and teachers’ age. It seems that a supportive school environment could play an important role in effectively and successfully integrating ICT in teaching and learning. Teacher support can be provided in each school by the more experienced teachers in the school or even by more experienced teachers in different schools, by inspectors who visit the school in order to assist teachers in their ICT integration efforts, or by an Instructional Support Service in the Ministry of Education that is responsible for providing instructional guidance to practicing teachers. Moreover, a supportive school environment can eliminate teachers’ feelings of isolation in the school, and can encourage effective communication and collaboration among teachers for achieving common goals and literacy in education.

In addition, when ICT is integrated into the classroom environment, the learning environment becomes more learner centered than before, and new assessment strategies are needed in order to capture the essence of learning that takes place in these environments. Traditionally, assessment has been used to sort out students, as well as distinguish the good students from the weak students and, as the end-point of instruction, to assess students’ understandings after the instruction ended (Graue, 1993). Hence, the focus of evaluating student learning has been on the products or outcomes of learning, such as facts and information, and not the processes of learning. In ICT-enhanced classrooms, learning objectives vary from achieving deep understanding of concepts to developing critical thinking, decision making, and problem-solving skills, to cultivating positive attitudes towards learning. Therefore, as Shepard argues (2000), the form and content of assessment must change to “capture important learning goals and processes and to more directly connect assessment to ongoing instruction” (p. 5). If the focus of assessment does not change and if new assessment strategies are not developed and accepted as valid methods for assessing student performance, then, as we strongly believe, teachers will hesitate to generously use ICT in their teaching.

Another factor that we consider important, even though it was not found to be a significant predictor in this study, is the lack of adequate computer access in Cyprus schools. For example, given the current situation in Cyprus schools, a teacher who wants to use ICT in a lesson must first make special arrangements to reserve the computer lab in the school in order to be allowed to use it. It seems, however, that because at this point teachers do not use ICT regularly in their classroom practices, they feel that the one computer lab in the school provides them with sufficient computer access. McFarlane (2000) also argues that computer access is a key factor in inhibiting teaching with ICT and states that “until children

come to school with a powerful portable computer of their own, access will remain a key brake on the use of digital media in school” (p. 22).

In conclusion, the schools in Cyprus do not seem to be adequately preparing students to develop the new forms of literacy skills that are needed in the information society, and have not been affected to a great extent by new modes of communication, new tools for expression, and new ways of the representation of knowledge. Given the current situation, it is hard to see how new forms of literacy can be satisfactorily developed in Cyprus schools. These findings have implications for Cyprus’ international competitiveness. If the educational system in Cyprus will not invest in learning with ICT, then the students in Cyprus will not develop the competencies and the literacy skills that are needed to fairly compete with the students of other countries, which have a better status of ICT in education. Technological illiteracy “could lead to becoming a member of an underclass with a similar status to those who, in previous generations, could not read and write” (Easingwood, 2000, p. 97).

The development of an extended concept of literacy is not an easy matter and many factors seem to affect its development. The implications of this study for the development of an extended concept of literacy are important and need to be seriously taken into consideration by policymakers. It seems that policymakers and government officials have to systemically approach the issue of ICT integration in primary and secondary education, so that ICT is infused in a system that is ready to accept the new educational change. The results imply that a systemic effort for the development of an extended concept of literacy should include a focus on creating a supportive school environment, and a revised focus on teaching and teacher training.

Another implication for the development of an extended concept of literacy is that plans of

action have to be developed to identify areas in the curriculum that can be enhanced with the use of ICT. Currently, the curriculum in Cyprus does not include a focus on ICT, and does not appear to have a direction and urgency in systematically integrating ICT. Specifically, the official curriculum in primary and secondary education does not currently include the use of ICT in the teaching of the subject domains despite the fact that ICT integration has been proclaimed as a top priority in the agenda of policymakers. Thus, in the present system, the teacher has to decide how and when to integrate ICT in teaching and learning. Curriculum restructuring efforts need to be undertaken so that teachers receive better guidance about how ICT can be integrated in different subject matters and how ICT can extend the traditional concept of literacy.

CONCLUSION

The purpose of this chapter was to examine factors that may affect teaching with ICT in primary and secondary education, and thus ultimately hinder or delay the development of new literacy skills that are important for citizens to survive in a rapidly changing world. Based on the findings of the study, the development of an extended concept of literacy is not easy and many factors seem to affect its growth, such as teachers’ knowledge of ICT, attitudes, self-confidence, age, and instructional support from colleagues and superiors. We argued in this chapter that policymakers need to carefully plan the development of the new forms of literacy in Cyprus schools by systemically integrating ICT in the schools so teachers and students together can develop an extended concept of literacy that is critical for surviving in the information society.

REFERENCES

- Angeli, C. (2003). A systemic model of technology integration. Paper presented at the *American Educational Research Association Conference*, Chicago.
- Apple, M.W. (1986). *Teachers and texts: A political economy of class and gender relations in Education*. London: Routledge and Kegan Paul.
- Baca, J.C. (1990). *Identification by consensus of the critical constructs of visual literacy: A Delphi study*. Unpublished doctoral dissertation, East Texas State University, USA.
- Barth, R. (1990). *Improving schools from within: Teachers, parents and principals can make the difference*. San Francisco: Jossey-Bass.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (2001). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.
- Brindly, S. (2000). ICT and literacy. In N. Gamble & N. Easingwood (Eds.), *ICT and literacy: Information and communications technology, media, reading and writing* (pp. 11-18). London: Continuum.
- Crystal, D. (1987). *The Cambridge encyclopedia of language*. Cambridge: Cambridge University Press.
- Denning, P. J. (2001). The IT schools movement. *CACM*, 44(8), 19-22.
- DfEE. (1998). *The national literacy strategy: Framework for teaching*. London: HMSO.
- Easingwood, N. (2000). Electronic communication in the twenty-first-century classroom. In N. Gamble & N. Easingwood (Eds.), *ICT and literacy: Information and communications technology, media, reading and writing* (pp. 45-57). London: Continuum.
- Eraut, M., & Hoyles, C. (1989). Group work with computers. *Journal of Computer Assisted Learning*, 5, 12-24.
- Friedman, B. (Ed.). (1998). *Human values and the design of computer technology*. Cambridge: Cambridge University Press.
- Fullan, M. (1991). *The new meaning of educational change*. New York: Teachers College Press.
- Fullan, M., & Hargreaves, A. (1992). *What's worth fighting for in your school?* Buckingham: Open University Press.
- Gamble, N., & Easingwood, N. (Eds.). (2000). *ICT and literacy: Information and communications technology, media, reading and writing*. London: Continuum.
- Getzels, J. W., & Cuba, E. G. (1957). Social behavior and the administrative process. *Social Review*, 65, 423-441.
- Glaser, W. (1981). *Stations of the mind*. New York: Harper & Row.
- Graue, M. E. (1993). Integrating theory and practice through instructional assessment. *Educational Assessment*, 1, 293-309.
- Hanna, D. (1997). The organization as an open system. In A. Harris, N. Bennett, & M. Preedy (Eds.), *Organizational effectiveness and improvement in education* (pp. 13-20). Philadelphia: Open University Press.
- Heppell, S. (2000). Foreword. In N. Gamble & N. Easingwood (Eds.), *ICT and literacy: Information and communications technology, media, reading and writing* (pp. xi-xv). London: Continuum.
- Heracleous, L., & Barrett, M. (2001). Organizational change as discourse: Communicative actions and deep structures in the context of informational technology implementation. *Academy of Management Journal*, 44(4), 755-778.

- Hoy, W. K., & Ferguson, J. (1985). A theoretical framework and exploration of organizational effectiveness in schools. *Educational Administration Quarterly*, 21, 117-134.
- Hoy, W. K., & Miskel, G. C. (2001). *Educational administration: Theory, research, and practice* (6th ed.). New York: McGraw Hill.
- Huberman, M., & Miles, M. B. (1984). *Innovation up close*. New York: Plenum.
- Kemster, G. (2000). Skills for life: New meanings and values for literacies. In N. Gamble & N. Easingwood (Eds.), *ICT and literacy: Information and communications technology, media, reading and writing* (pp. 25-30). London: Continuum.
- Jonassen, D. H. (2000). *Computers as mindtools for schools: Engaging critical thinking* (2nd ed.). Upper Saddle River, NJ: Prentice-Hall.
- Jonassen, D. H., Carr, C., & Yueh, H. -P. (1998). Computers as mindtools for engaging learners in critical thinking. *TechTrends*, 34(2), 24-32.
- Kling, R. (2000). Learning about information technologies and social change: The contribution of social informatics. *The Information Society*, 16(3), 217-232.
- Kling, R., & Lamb, R. (2000). IT and organizational change in digital economies: A socio-technical approach. In B. Kahin & E. Brynjolfsson (Eds.), *Understanding the digital economy: Data, tools, and research*. Boston: MIT Press.
- Kozma, R., & Anderson, R. E. (2002). Qualitative case studies of innovative pedagogical practices using ICT. *Journal of Computer Assisted Learning*, 18, 387-394.
- Lenine, T., & Donitsa-Schmidt, S. (1998). Computer use, confidence, attitudes, and knowledge: A causal analysis. *Computers in Human Behavior*, 14(1), 125-146.
- Liaw, S. -S. (2002). Understanding user perceptions of World Wide Web environments. *Journal of Computer Assisted Learning*, 18, 137-148.
- Louis, K. S., & Miles, M. M. (1991). *Improving the urban high school: What works and why*. London: Cassell.
- Markus, H., & Ruvulo, A. (1992). "Possible selves." Personalized representation of goals. In L. Pervin (Ed.), *Goal concepts in psychology*. Hillsdale, NJ: Lawrence Erlbaum.
- Markus, M. L., & Benjamin, R. I. (1987). The magic bullet theory in IT-enabled transformation. *Sloan Management Review*, 38(2), 55-68.
- Marzano, R. J. (1992). *A different kind of classroom: Teaching with dimensions of learning*. Alexandria, VA: ASCD.
- McFarlane, A. (2000). Communicating meaning—Reading and writing in a multimedia world. In N. Gamble & N. Easingwood (Eds.), *ICT and literacy: Information and communications technology, media, reading and writing* (pp. 19-24). London: Continuum.
- McFarlane, A. (Ed.). (1997). *Information technology and authentic learning: Realizing the potential of computers in the primary classroom*. London: Routledge.
- Murphy, C. A., Coover, D., & Owen, S. V. (1989). Development and validity of the computer self-efficacy scale. *Educational and Psychological Measurement*, 49, 893-899.
- Papert, S. (1993). *The children's machine: Rethinking school in the age of the computer*. New York: Basic Books.
- Pelgrum, W. (2001). Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computers and Education*, 37, 163-178.

- Picciano, A. G. (2002). *Educational leadership and planning for technology* (3rd ed.). Upper Saddle River, NJ: Prentice-Hall.
- Reigeluth, C. M., & Garfinkle, R. J. (Eds.). (1994). *Systemic change in education*. Englewood Cliffs, NJ: Educational Technology Publications.
- Salomon, G., Perkins, D. N., & Globerson, T. (1991). Partners in cognition: Extending human intelligence with intelligent technologies. *Educational Researcher*, 20(3), 2-9.
- Shepard, L. (2000). The role of assessment in a learning culture. *Educational Researcher*, 29(7), 1-14.
- Snyder, I. A. (1994). Writing with word processors: A research overview. *Journal of Curriculum Studies*, 26, 43-62.
- Street, B. V. (1987). Models of computer literacy. In R. Finnegan (Ed.), *Information technology social issues*. London: Sevenoaks, Hodder and Stoughton.
- Tabachnick, B. G., & Fidell, L. S. (1989). *Using multivariate statistics* (2nd ed.). New York: Harper & Row.
- Trach, L., & Woodman, R. (1994). Organizational change and information technology: Managing on the edge of cyberspace. *Organizational Dynamics*, 23, 30-46.
- Trist, E. L. (1982). The development of socio-technical systems as a conceptual framework and as an action research program. In A. H. Van de Ven & W. F. Joyce (Eds.), *Perspectives on organizational change and behavior* (pp. 19-75). New York: John Wiley & Sons.
- Trist, E. L., & Bamforth, K. W. (1951). Some social and psychological consequences of the Longwall method of goal setting. *Human Relations*, 4, 3-38.
- UNESCO. (1999). *The science agenda—Framework for action*. Paris: UNESCO.
- Valanides, N. (2003). Learning, computers, and science education. *Science Education International*, 14(1), 42-47.
- Valanides, N., & Angeli, C. (2002). Challenges in achieving scientific and technological literacy: Research directions for the future. *Science Education International*, 13(1), 2-7.
- Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.
- Watt, D. H. (1980). Computer literacy: What should schools be doing about it? *Classroom Computer News*, 1(2), 1-26.
- Wild, M. (1996). Technology refusal: Rationalizing the future of student and beginning teachers to use computers. *British Journal of Educational Technology*, 27(2), 134-143.

ENDNOTES

- ¹ We consider the last part of the 20th century to be the beginning of immense developments in information, communication, and network technologies.
- ² The term *ICT* is used in this study interchangeably with *computer applications*, and includes the Internet, the World Wide Web, and all types of computer software.

This work was previously published in Handbook of Research on Literacy in Technology at the K-12 Level, edited by L. Tan and R. Subramaniam, pp.604-625, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.23

Satellite Technology in Schools

Annalene Cosemans

Audiovisual Technologies, Informatics and Telecommunications, Belgium

INTRODUCTION

SchoolSat1 was an initiative to utilise advances in satellite technology to improve access to the Internet for Irish schools. It was partially funded by the European Space Agency under the ARTES 3 Multimedia Programme and ran from December 2001 until January 2003. The purpose of SchoolSat was to set up, manage and evaluate a pre-operational, satellite-based service for compulsory schools in Ireland. It had as a clear objective and expected outcome: the establishment of a business and deployment plan for a fully operational and sustainable service for the Irish compulsory school sector based on a strategic mix of uni-cast and multi-cast services.

BACKGROUND

In most countries, the Internet is seen as a central component of an educational ICT strategy. It is seen as important for a variety of reasons. In part, the Web can be seen as a vast library of resources, some of which can be used by both teachers and students to enrich teaching and learning. There is also an equality dimension to the resource view of

the Web, as the smallest and most isolated schools with no library can access exactly the same online material as the biggest urban schools.

The Internet may also be a conduit for a new generation of educational software. For decades specialist software aimed at schools has been produced however, despite the success of the educational software sector in the home and training markets, little of it is in use in schools. The use of software in schools may have been constrained by logistical difficulties including licensing, installing the software, etc. Many of these difficulties can be avoided if educational material is available online, providing an easier solution in school, one that students can continue at home, and teachers can explore in advance with ease.²

The need for Internet access in school also goes beyond the content of the World Wide Web. In part, “the medium is the message,” as it becomes important for learners to develop information literacy. Negroponte, in his seminal book *Being Digital*, describes a “post information age,” where individuals have much greater control of the information they receive and send, where they can communicate with agencies in a “place without space,” and where they can control more of the information they receive.³ This vision of a society

with empowered individuals finding information as they need it and managing their own learning and information needs is an attractive one, but it is dependent on learners having the skills to deal with the vast amounts of material available to them.

THE SCHOOLSAT PROJECT

The SchoolSat Pre-operational Pilot project used Internet via DVB (Digital Video Broadcasting) satellite technology with the KU band return channel for the establishment of the interactive channel. The aim of the trial was to investigate how far this technology could offer a solution to connect schools to the Internet, to build school networks and to transmit large files of information, be it data, video, audio, or graphics.

The planned service was based on the Digital Video Broadcasting (DVB) standard which is deployed Europe-wide (and is becoming accepted as a worldwide standard) for digital television. It allows the user to receive Internet services with a relatively small antenna (less than 1 metre diameter) and a PC (personal computer) equipped with a satellite modem anywhere within the footprint of the Eutelsat W3 satellite (used by the technology provider, Web-Sat4). This PC can be used as a gateway to connect multiple PCs to the Internet.

The 14-month project included the following phases:

- Phase 1: Set-up and orientation of end-users: December 2001-February 2002
- Phase 2: Pre-operational pilot phase: March 2002-December 2002
- Phase 3: Evaluation: March 2002-January 2003
- Phase 4: Business planning and deployment: September 2002-January 2003

The following schools took part:

- Gairmscoil Mhic Diarmada, a vocational school on the Irish speaking Arrain Mor island
- Gairm Scoil Chu Uladh, Bellanamore Secondary School
- Carrick Vocational School
- Loreto Community School, Milford
- Scoil Mhuire, Buncrana
- Abbey Vocational School, Donegal Town
- Loreto Secondary School, Letterkenny
- Carndonagh Community School
- Donegal Education Centre

SchoolSat was a direct response to the relatively poor level of connectivity to the Internet experienced by primary and secondary schools, despite the Irish Government's stated intention to provide every Irish classroom with a broadband connection to the Internet. Although it is true that throughout the developed world most schools have Internet access—(recent EU figures suggest that 90% of EU schools have Internet access, and this figure is growing all the time⁵), increasingly narrowband access is seen as insufficient for real educational use, and provision of broadband access is seen as a major objective for educational ICT policy. That is why in Northern Ireland, the current ICT strategy provided broadband access for all second-level schools. But although city schools are offered more and more choice according as ADSL services roll-out and competition drives costs down, the rural schools and schools in towns have too small populations to attract a competitive broadband offer. Despite the best efforts of all concerned, broadband access to the Internet in Irish schools remains considerably below European norms and there is a danger that Irish pupils will find themselves on the wrong side of a digital divide in terms of their access to and use of resources and opportunities afforded by fast access to the World Wide Web. Nolan Bowie notes, for example, that in the US there is

a geographical dimension to the digital divide, with rural families less likely to have access to the Internet than urban families.⁶

From the service provider point of view, SchoolSat proved that putting a service like Web-Sat in a school environment was viable and provided a great deal of evidence as to the service requirements of a schools community. On average, each school transferred about 1GB maximum of data each month with a usage ratio of approximately 1:20, where each school downloaded about 20 times more content than they transmitted. Technical problems were minimal and to a large extent such a service can be expected to run trouble-free with the minimum of maintenance. Problems, where they occurred, had far more to do with connectivity into the schools LAN and local maintenance issues that they had to do with any difficulty to do with the satellite service.

Having said that, it is clear that in order for a satellite supported service to be viable, it has to be to a community of school users and is not a service that can be offered on an individual basis. In rather simple economical terms, it is just not viable to offer a service such as SchoolSat to individual schools as installation, maintenance, and service provision all require specific levels of buy-in to make such a service sustainable. Significant economies of scale can be called upon in order to build a reasonable business case, but without these, satellite service providers will struggle to offer a reasonable and long-term solution for Irish schools regardless of brash marketing campaigns.

This requirement for some form of centralised service provision is not all bad news, however, and another significant outcome from SchoolSat was that given schools' tendency towards predictable and pre-defined content, they are in a good position to benefit from the added value of satellite multicasting services. During the 12-month pilot in Donegal, it was evident that a great deal of Internet traffic was to a small number of Web sites. School communities tend to be conservative and inclined to visit the same sites, where

quality, suitability of content and safety can be guaranteed. This means that a satellite-supported service that delivers a set of pre-described content to the local server is eminently suitable and one which can deliver significant economies of scale. To this end, Web-Sat and ATiT are now building a school multicasting offer within another ESA project which can offer end-to-end multicasting and caching services to schools aimed at maximising their use of the Internet and delivering safe and reliable content to the classroom using state-of-the-art technology. The objective behind the project, called SchoolCast7, is to plan, design, implement and bring to pilot utilisation a content delivery system, whereby a variety of multimedia files (Internet, video, audio, image) can be multicast to 10 or more Irish schools using a two-way satellite infrastructure, and cache the files at the school server for fast local access. The pilot will also validate the service on high bandwidth terrestrial multicast networks through the collaboration of HEAnet.

The intention is to pilot test SchoolCast in schools in Ireland with a view to its take-up as a sustainable commercial service. Through the pilot the business case for such a service will be refined and elaborated. Key target clients include satellite service providers, educational stakeholder communities including national and regional school portals, ministries of education and government agencies, schools and educational content providers.

FUTURE OF THE PROJECT

In June 2003 the final report⁸ was submitted to ESA, which includes the report on the pedagogical value of such a service as carried out by Dr. Aidan Mulkeen from the National University of Ireland, Maynooth. This report describes the main activities and outcomes from the project and broadly concludes that the service is of great benefit to schools, particularly those in rural communities

where opportunities for broadband access via means other than satellite are scarce. It also shows that putting in place a satellite service for schools is manageable and describes a service which ran relatively fault-free for more than one year. Although attempts were made to correlate the level of service with both size of school and pupil/PC ratio, it is apparent that the use of the Internet in schools is generally far more a function of teacher motivation, experience and expectation.

Meanwhile, SchoolSat has continued in Donegal despite the fact that the funding from ESA ended in February 2003. The service to the schools taking part continues due in part to the direct support of NCTE and more recently with the partial support of Údarás na Gaeltachta. This support has guaranteed the continuation of the Web-Sat service to the schools taking part until June 2004.

It is important to note, that since the end of the SchoolSat trial in Ireland in January 2003, the Irish Department of Education and Science has launched a significant initiative to provide over 4,000 schools in Ireland with a broadband connection. Given the advantages and feasibility of satellite technology as proven in SchoolSat to meet the connectivity needs of rural and remote schools, it is estimated that more than 60% of these schools will require satellite connectivity of a similar type to that provided during SchoolSat. Roll-out is planned to begin in January 2005.

CONCLUSION

One thing remains clear, given the geographical spread of Irish schools with more than half located in rural communities or towns of less than 10,000 people and that is that satellite services remain the only viable way to offer broadband access to the Internet in the foreseeable future for many schools. While not cheap, the only way such services can be offered at an affordable price is for them to be offered on a reasonably centralised

basis. Centralised purchasing and management has become increasingly popular with regard to ICT service for schools generally, hence the intention of the Irish Department of Education and Science to utilise HEAnet, the national Irish Higher education network provider to manage the forthcoming broadband schools service in Ireland¹⁰. Given the price of economic isolation and the need for balanced regional development, satellite technology offers a key opportunity to ensure that the schools' broadband service meets the needs of all Irish pupils and not just those in large cities.

REFERENCES

- Anonymous. (2003). EU data published online. Retrieved March 24, 2003, from http://europa.eu.int/comm/education/elearning/wn2002_03/what2.htm#2a, <http://www.schoolsat.net/>, <http://atit.ie.schoolcast/>
- Bowie, N. A. (2000). The digital divide: Making knowledge available in a global economy. In OECD (Ed.), *Learning to bridge the digital divide* (p. 40). Paris: OECD.
- Negroponte, N. (1995). *Being digital*. London: Hodder and Stoughton
- OECD. (Ed.). (2001). *Educational software and digital content. Learning to change: ICT in schools*. Paris: OECD.
- Reynolds, S. (2003). Final report SchoolSat. 13-14. Report to ESA.

KEY TERMS

Bandwidth: The amount of data per second that can be delivered to your computer. A 56K modem has a bandwidth of 56 kilobits/second. The term bandwidth is also used in conjunction with data rate when discussing video.

Broadband: Broadband is a new way of connecting to the Internet that will ensure rapid access, faster download times and a better overall performance such as high-resolution, graphics and CD-quality sound. Broadband connections are sometimes also called “fat pipes” due to the substantial amounts of data they can carry compared to more traditional “narrowband” connections, such as a modem which delivers variable service quality with slow download speeds. A broadband connection can be delivered in several different ways: Cable, DSL, Fixed wireless and satellite.

Caching: Using a buffer within your own computer’s fast memory to hold recently accessed data. It is designed to speed up access to the same data later.

Digital: Information represented as discrete numeric values, e.g., in binary format (zeros or ones), as opposed to information in continuous or analogue form. Binary digits (bits) are typically grouped into “words” of various lengths—8-bit words are called bytes.

DVB: DVB stands for Digital Video Broadcasting, the European standard for Digital TV. This standard provides a very high-speed, robust transmission chain capable of handling the many megabytes per second needed for hundreds of MPEG-2 digital TV channels.

LAN: Local Area Network.

Multicast: A one-to-many client/server connection in which multiple clients receive the same stream from a server. To receive a multicast, a client listens to a specific IP address on a multi-cast-enabled network, like tuning a television to

a specific channel. In contrast, a uni-cast is a one-to-one connection in which each client receives a separate stream from a server. Multicasting is a technique whereby information is transmitted to a well-defined and controlled group of users on your network.

ENDNOTES

- ¹ <http://www.schoolsat.net/>
- ² OECD (Ed.). (2001). Educational Software and Digital Content. Learning to Change: ICT in Schools (pp. 37-55). Paris: OECD.
- ³ Negroponte, N. (1995). Being Digital. 164-169. London: Hodder and Stoughton.
- ⁴ Web-Sat technology is owned and supplied by Web-Sat in Ireland, more information from www.web-sat.com
- ⁵ EU data published online retrieved March 24, 2003 from the World Wide Web at: http://europa.eu.int/comm/education/el-earning/wn2002_03/what2.htm#2a
- ⁶ Bowie, Nolan A. (2000). The Digital Divide: Making Knowledge available in a Global Economy. In OECD (ed.), Learning to Bridge the Digital Divide (p. 40). Paris:OECD.
- ⁷ <http://schoolcast.atit.ie/>
- ⁸ Reynolds, Sally. (2003). Final report School-Sat. 13-14. Report to ESA.
- ⁹ Schools Broadband Connectivity Study, published by Datnet, Ireland in July 2003 and available here http://www.education.ie/servlet/blobServlet/sbpp_schools_broadband.pdf
- ¹⁰ For more information about how this will be managed, see <http://www.heanet.ie/services/services.php?serID=122&subID=34>

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, X. Yu, pp. 624-627, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.24

The Use of Online Technology in the Teaching and Learning Process: WebCT — Communication Technology or Communication Turn Off?

Maggie Ferguson

University of Central Lancashire, UK

Adrian Ibbetson

University of Central Lancashire, UK

ABSTRACT

This paper provides an evaluation of the effectiveness of a year-one module delivered by a combination of traditional and online teaching methods to leisure and tourism undergraduates. The research further considers the value of the extemporized implementation of computer-mediated instructional settings that do not consider or refer to existing evaluative frameworks, in view of the fact that initiatives often are driven more by pragmatism and policy than pedagogy and theory. The findings show that there are negative and positive attributes to both methods of instruction, but overall, traditional methods are seen as preferable to new online developments.

The reasons for this preference are explored and include communication interaction and contact with a tutor. The main positive attributes of the online system are flexibility and accessibility. The issue of appropriateness of online instruction at differing higher educational levels is also considered.

INTRODUCTION

The current UK university sector is subject to a diverse range of environmental factors that have increasing influence on traditionally accepted practices. These environmental factors include increasing competition among institutions, a

dwindling resource base, and a more academically varied student population due to widening participation initiatives and increasing pressures to increase student numbers. The result of this has led to many universities having to revisit their services both in terms of the subjects they offer and in how they are delivered. There is an increase in pressure to sell their product to a much wider market both at home and abroad and, as a result, universities have had to consider alternative methods by which to deliver the curriculum, with by far the most prominent of these being the utilization of education technology. The use of distance education technology is increasingly perceived as the future of education (Leung & Ivy, 2003; McGinn, 2000; Sistek-Chandler, 2000; Webb, 2001), and it is anticipated that increasing utilization will lead to greater profitability for universities due to its ability to increase and widen provision with little or no significant increase to existing resource structures.

UK government initiatives suggest that post-compulsory education will be delivered increasingly by a range of integrated methodologies, including distance learning packages, traditional chalk and talk delivery, and online student support (Thompson, McGivern, Lewis, & Dierck-O'Brien, 2001). The dilemmas presented by such a scenario are multifarious, with perhaps the necessity to use online technology to teach larger numbers of students regardless of the appropriateness of this type of forum for learning being the most significant to course tutors.

The primary objective of this paper is to provide an evaluation of the effectiveness of a year-one module delivered by a combination of traditional and online teaching methods to leisure and tourism undergraduates. The research will consider further the value of the extemporized implementation of computer-mediated instructional settings that do not consider or refer to existing evaluative frameworks, in view of the fact that initiatives are often driven more by pragmatism and policy than pedagogy and theory.

THE FLEXIBLE FRIEND: ANYTIME, ANYPLACE, ANYWHERE

The expected influence of existing and developing learning technologies is an area that is subject to increasing debate, and authors such as Porter, (1996, cited in Segrest, Domke-Amonte, Miles & Anthony, 1998) contend that new technology will stimulate more change in the upcoming years than universities have seen in the last half of the 20th century. Further, writers such as Van Dusen (1997, cited in Evans & Haase, 2001) state that one of the reasons for the rise of online learning is that “the half-life of what a person learns is getting shorter and shorter” (p.248) and that with the rapid changes in technological and societal practices, the education process is becoming more and more of a lifelong journey. A major factor behind the growth of distance education programs is the opportunity to engage and to learn without being restricted by geographical or time boundaries. E-learning as a medium of delivery for education has many advocates (Leung & Ivy, 2003; Salmon, 1998, 2000; Webb, 2001), due to various possibilities such as the enhancement of access and a more flexible learning experience. Webb (2001) further contends that the Internet is a tremendous equalizer as a source of knowledge.

WebCT AND LEARNING

WebCT is one of several existing managed learning environments (e.g., Blackboard, Domino, and Top Class). Many UK institutions are choosing WebCT campus edition, and 38% of institutions worldwide have selected this system over others (e.learning age, 2003). This study concentrates on the use of WebCT as an online teaching medium, as this is the system that currently is utilized by the university in which the research was conducted. WebCT provides a secure environment in which course materials can be placed.

It has the capacity to facilitate the creation of sophisticated World Wide Web-based educational environments by non-technical users and can be utilized on the one hand to create complete online courses or, on the other hand, to publish supplementary materials (Morss, 1999). WebCT provides a number of learning tools, including course content, course calendar, electronic mail, navigational tools, discussion board, and student progress tracking. It is promoted as being easy to use (webct.com/company accessed November 30, 2003), and authors such as Wernet, Olliges, and Delicath (2000) concur with this. It is useful in providing additional information and services to students and is purported to facilitate improved communications among the tutor and the students. Lu, Yu, and Liv (2002) further suggest that WebCT supports development of problem solving and critical thinking, although they do recognize that there is not much existing research to support this view.

ATTRIBUTES AND LIMITATIONS OF ONLINE PROVISION

The Web is increasingly utilized in course instruction, and, according to Leung and Ivy (2003), is seen as a popular tool for enhancing the learning experience for students. Salmon (2001) contends that there would appear to be increased opportunities for student interaction, student centeredness, and collaboration. French, Hale, Johnson, and Farr (1999) note that computer-mediated communication (CMC) can promote more autonomous tutor/learner relationships than those possible in one-to-one contexts, and Burnett (2003) maintains “that reduced to an on screen presence the tutor is less able to adopt a dominant role in digital conversations” (p. 247). Palloff and Pratt (1999) uphold the view that fundamental to the learning processes are the interactions among students and the interactions among students and instructors.

A potentially useful feature of WebCT is the bulletin board, which provides a forum for students to post comments and debate issues and points that are relevant to the course. LaMaster and Morley (1999) recognized this facility as being both meaningful and enjoyable, while studies by Poole (2000) and Teague (1999) ascertained that students preferred discussion boards to online synchronous chat, since they could draft and consider responses to others’ ideas. It must be noted, however, that much of this existing research has concentrated mainly upon post-graduate users, and, indeed, the use of distance learning thus far has been predominantly within the sphere of post-graduate education (Gammie, Gammie, & Duncan, 2002). Morss (1999), however, surveyed undergraduate perspectives on the use of bulletin boards and reported mainly positive learning experiences, while Ibbetson (2000) found that students did not engage in the process to any meaningful degree.

Previous studies on student perceptions of course Web sites are limited and conflicting to a certain degree. Montelpare and Williams’ (2000) focus-group-based research found that students appreciated the fact that the Web-based activities were relevant, easily accessible, convenient, and self directed. Students also reported that they gained confidence from the hands-on experience and that the exercise encouraged interactive teamwork. However, Lomine (2002) contends that students’ opinions of online learning and teaching are varied, with an enthusiastic small number being interested and willing to work with computers as much as possible, while conversely, a reticent small number will be reluctant almost by principle. The research maintained that the majority usually fall somewhere in the middle.

The construction and implementation of complete WebCT courses by instructors/lecturers is arduous and time-consuming, which as yet has not been recognized or acknowledged fully by universities. Hartley (1999) and Witt (2003) recognize the large amount of time and

effort that must be invested by the instructor in compiling and inputting the information and concedes that there is usually little support or motivation to dedicate time to the development and maintenance of Web courses. According to McGorry (2003), many instructors find creating interactivity in an online course one of the greatest challenges in Internet-based education. A National Education Association (Reisman, Dear & Edge, 2000) survey of more than 400 distance learning instructors indicated that more than half of them spends more hours on distance learning courses than on traditional courses. The process also is undertaken in the belief that students will engage either fully or partially in the process and subsequently will benefit as learners as a result of this engagement.

Existing research by Rosen and Petty (1997) contends that this may not be the case for a number of reasons. For example, the use of links to related sites that are intended to provide supplementary information potentially can become the main area on which the students focus and can also direct or misdirect them to further linked sites that are of no relevance to the original course site. Hartley (1999) also argues that repetitive imagery leads to sensorial overload, which may hinder the understanding of the relevant concepts presented, and additional factors, such as previous Web experience and learning styles, are also cited as being influential in participation success, and, according to Roberts (2002), the connections between interaction and learning are not yet fully understood.

Salmon (2000) stresses that the importance of individual access and the existing abilities of participants to use online learning tools are essential prerequisites for successful participation in online learning. The importance of experience is emphasized by Lu et al. (2002), who maintain that access is easier for post-graduate students. These students could be considered to be more mentally mature and to have greater life experience and higher reading levels, which qualify them to

pursue more readily the more impersonal environment created by various online study tools. Thyer, Artelt, Markward, and Dozier (1998) and Siegal, Jennings, Conklin, and Napoletano Flynn (1998) describe additional barriers to learning and cite unreliable technology, lack of technical support, and cost as the most significant. Technical support is crucial in an online learning environment. If students are unable to access course material, their participation will be seriously hindered. McGorry (2003) maintains that initial frustration with technical problems in online courses can cause students to quickly abandon programs, creating long-term negative perceptions of these courses and preventing students from pursuing this type of education.

Basile and D'Aquila (2002) tried to determine whether there is a difference in attitudes among students exposed to computer-mediated instruction (WebCT) and students receiving only traditional instruction. They concluded that there was no difference in attitudes, but they do raise the question of the role of the instructor in implementing pedagogy. They note that the teaching style for one of the two tutors who was used in the research appeared to be more conducive to a traditional format. However, Carey and Gregory (2002) found that completely asynchronous Web-based distance learning was a "generally satisfying and educationally effective experience" (p. 429) and, by and large, perceived to be at least as good as traditional formats and in many regards superior to the existing methods. A later study by Gregory (2003), however, found a change in students' perceptions and attitudes, that illustrated a desire for a return to some form of instructor/tutor interaction, which concurs somewhat with Thyer et al. (1998), who maintain that students preferred lectures to transmitted coursework. Wernet et al.'s (2000) research states more categorically that "traditional students expect ongoing, weekly, personal interaction with an educator" (p. 501), and they believe that this is due mainly to existing preconceived notions of how learning occurs

within education, based on prior experiences and within existing learning environments and, as such, is considered the norm. Therefore, the aim of the study is to evaluate further the effectiveness of a module that was delivered by a combination of traditional delivery and WebCT technology.

METHODOLOGY

This project involved collaboration among lecturers teaching the same module across two geographically separated campuses. The physical construction of the WebCT course was undertaken by two tutors over a period of some months. Financial support was obtained by one of the tutors, which was utilized to provide some relief from teaching duties. In actuality, however, this support proved to be insufficient, as the process took much longer than originally anticipated.

The module in question was a first-year introductory leisure module that was part of the undergraduate syllabus and spanned a full academic year (two semesters). In the first instance, the first half of the module (first semester) was taught in a traditional manner: one-hour lecture plus one-hour seminar. In the second semester, a hybrid approach, as advocated by Gregory (2003), was adopted, where the weekly lecture content was converted into Web page format and used to construct a managed learning environment in WebCT; this included paths of lecture notes, links to useful Web sites, module mail, and discussion boards. This weekly content identified reading to be done in preparation for the seminar, which was conducted using a standard face-to-face format. The pages compiled did not consist of traditional presentation slides and were constructed specifically for WebCT in an effort to maximize the best components of the system. Two different instructors from the same department taught the module on the two campuses, but they did teach the whole module (i.e., in the first semester, they both used a chalk-and-talk approach, and in the

second semester, they both used WebCT to support the teaching/learning process). Thus, the project used the same staff to deliver different methods to the same students and provided an interesting comparison between the two potentially different styles of teaching/learning.

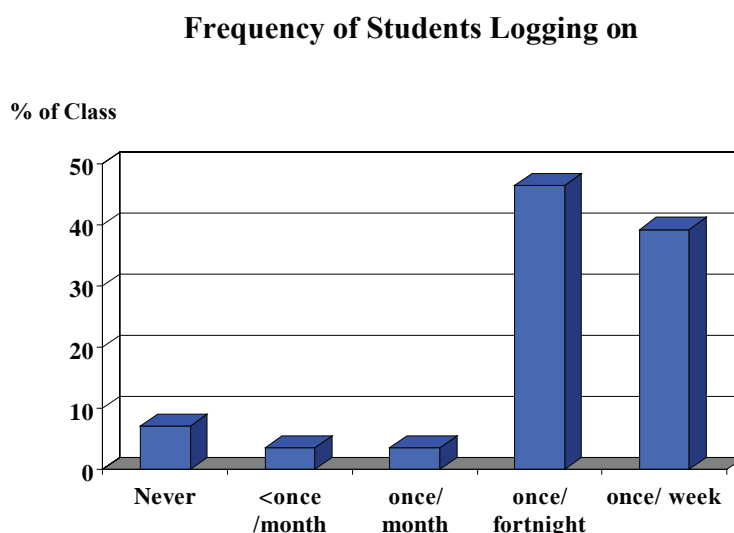
At the end of the module, the students (Campus 1 $n = 7$, Campus 2 $n = 52$) were asked to complete a brief questionnaire (using a Likert scale format) that asked them about their logging on habits, level of satisfaction, perception of the accessibility of the tutor, and perceived level of understanding. Qualitative comments were also sought regarding clarification of the quantitative scores and pertaining to the best features of WebCT, the worst features of WebCT, and potential future improvements to the module. Results are presented for the whole group as the small numbers in Campus 1 precludes comparison.

In addition to completing the questionnaire, students were asked to participate in focus group interviews as part of the module evaluation. The interview template was designed to embellish the issues raised in the questionnaire. These were conducted in seminar groups, one at Campus 1 and two at Campus 2. The focus groups were undertaken by a researcher that was external to the teaching and learning process. The discussions were tape-recorded, and the evidence has been used to form the evaluation.

RESULTS

From Figure 1 it is evident that the majority of students (46%) logged on once per fortnight. Thirty-nine percent of students logged on each week, and a small portion logged on much less frequently (3% once per month, 3% less than once per month, and 7% never). These findings were disappointing, as students were required to log on each week to read the paths of notes, follow the links, and complete the reading in order to inform the preparation for the seminar. From Table 1, it

Figure 1. Frequency of students logging on



is evident that, although 32.1% merely used the managed learning environment to provide them with a comprehensive set of printed notes, the majority of the students (60.8%) did use the site in an interactive manner, even if this varied in degree from limited use of intrinsic features to exploration of links and use of the bulletin board.

Students on the larger of the two campuses bemoaned the fact that they could not easily physically access computers on campus. Their preferred work area appeared to be the library. They reported that having to constantly queue for a machine was a major barrier to logging on regularly. The students reported that the busiest period was from late morning to early evening, and that unless you got up early and laid claim to a workstation, you were condemned to the queue. The students in question reported that on average they logged on twice per week to do general work, answer their e-mails, and surf the Internet. This

should have allowed them to also access WebCT. The picture on the smaller campus was very different. The new Library and Learning Resource Centre currently appears to match comfortably and to satisfy demand.

Table 2 demonstrates that the majority of the students (96.2%) found the package easy to use to varying degrees; this would negate students finding the package difficult to use as a reason for the disappointing logging on habits reported previously. The issue of reliability of the system elicited the following comments: “The Internet [the network/server] is not always reliable.” “It [WebCT/Server] is very slow when lots of people are logged on at the same time.” Physical access was a problem for some, as the following statements illustrate: “Finding available computers on campus is often difficult.” “I find it difficult to find time to go on the Internet — I can only access the Internet on campus and I have to wait around for a computer.”

Table 1. Demonstrating how students accessed WebCT

| Description of Use | Percentage |
|--|------------|
| Do not log on; use other people's notes and read books on reading list | 7.1 |
| Look over someone's shoulder while they log on | 0 |
| Just log on and print pages to minimize time using WebCT | 32.1 |
| Log on and read pages but do use other features | 17.9 |
| Read the pages and explore the links to other Web sites | 25.0 |
| Read the pages, explore the links, and occasionally use the bulletin board | 17.9 |
| Read the pages, explore the links, and regularly use the bulletin board | 0 |

Table 2. Demonstrating ease of use of WebCT

| Level of Difficulty/Ease | Percentage |
|--------------------------|------------|
| Very Difficult | 3.8 |
| Difficult | 0 |
| Relatively Difficult | 0 |
| Relatively Easy | 26.9 |
| Easy | 46.2 |
| Very Easy | 23.1 |

In terms of perceptions of student satisfaction, Figure 2 demonstrates that the majority of students were satisfied with the delivery of the module, but they were more satisfied with the traditional lecture/seminar method than the WebCT augmented approach.

These findings differ in part with the qualitative feedback stated as follows, relating to the flexibility of access and the permanency of the material that provided a reliable reference mechanism. The flexibility of WebCT was positively supported by the following three statements. "You can read it as many times as you want." "It's a great fallback if you have missed a week." "It's convenient, I can decide when to do the work; it allows me to be more flexible with my time." The structure and

permanency of the system were supported by the following quote:

The notes are more structured [in WebCT], rather than rushing down notes from a lecture which are difficult to understand afterwards.

Negative feedback referred to the reading involved the following: "One of the worst things was finding the time, being motivated enough to complete the reading" and to the cost involved in printing notes from the site.

From Figure 3, it is evident that the students favored the traditional lecture/seminar-type delivery over the online method in relation to their perceptions of the accessibility of the tutor.

Figure 2. Perceptions of student satisfaction by method of teaching

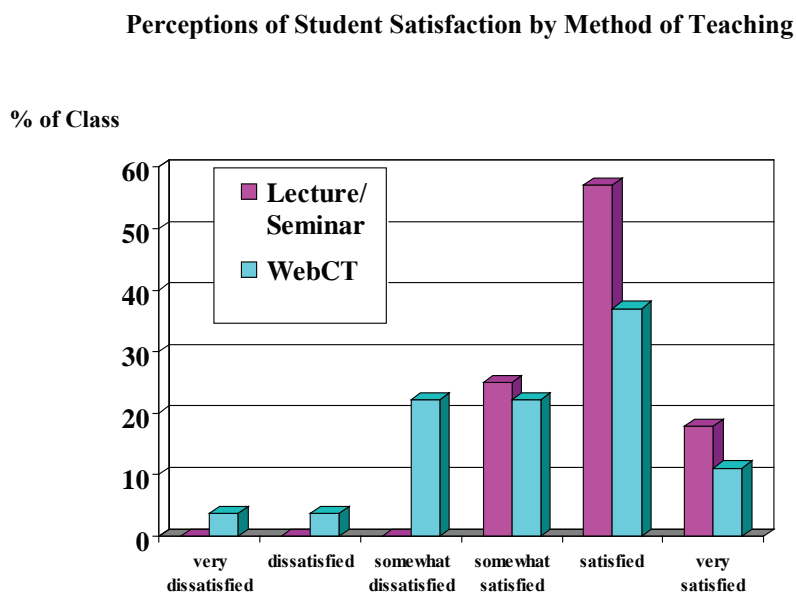


Figure 3. Student perceptions of tutor accessibility by method of teaching

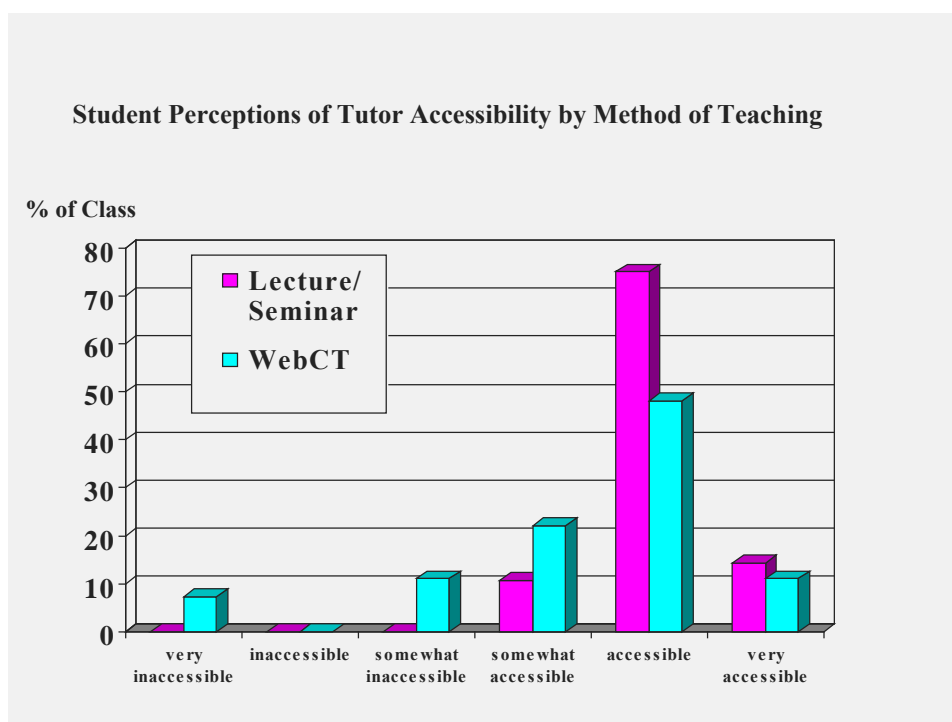
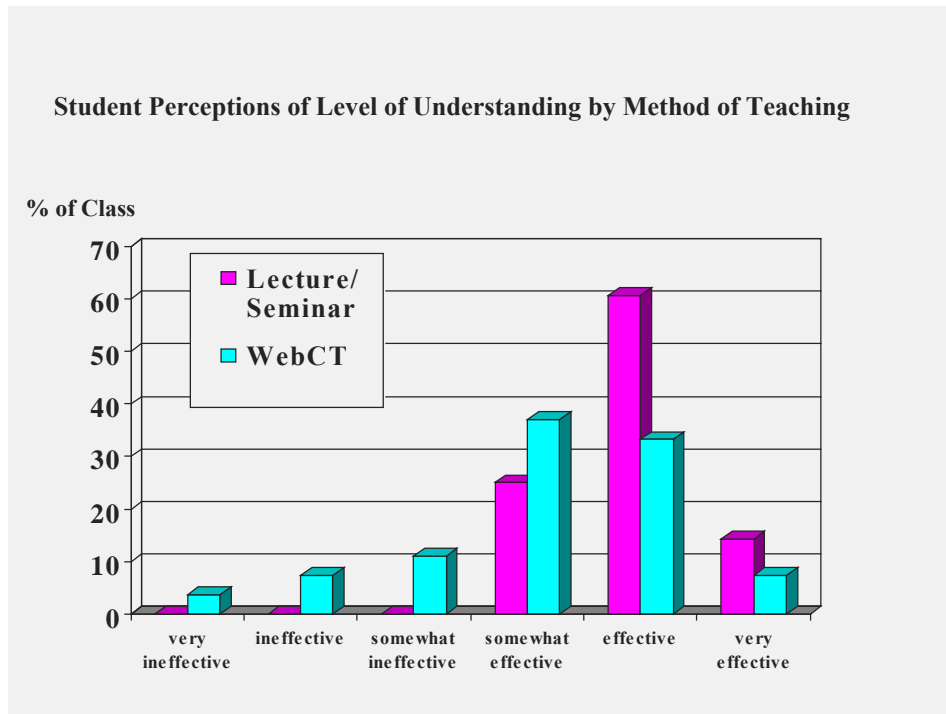


Figure 4. Student perceptions of level of understanding by method of teaching



The qualitative comments recorded demonstrate that the students' perceptions of accessibility appear to be connected to the question of clarification and explanation. Typical responses include comments such as, "Some things can't be expanded or discussed and questions can't be answered as they would be in a lecture" and "You don't get the interaction with the tutor to ask questions there and then."

In addition, some of the students' comments highlighted additional negatives with regard to the volume of WebCT material available; the following statements illustrate the problems encountered.

I find it easier to take things in, in the traditional lecture, when I am listening and writing rather than having to collect reams of writing off the Internet that I cannot be bothered to read, and when I do it does not sink in.

I tended to just print out the notes and skim over them instead of taking in and understanding the information.

Although the majority of students perceived the module as a whole to have developed a good level of understanding, the traditional lecture/seminar approach was reported to be more successful than the augmented online method (see Figure 4).

As stated previously, the following qualitative comments reported by the students give rise to an element of contradiction. The quote, "WebCT was a new and exciting way of learning instead of traditional lectures," shows that some students appear to have responded more readily to the new and exciting nature of the managed learning environment that WebCT enables. Additionally, statements such as, "WebCT provided more flexibility than the traditional approach ... extra links to further sites was an interesting

addition,” highlighted that the more dedicated students appreciated the additional links within the site, which facilitated more in-depth study and achieved a desired level of differentiation, as planned by the tutors.

DISCUSSION

The disappointing findings with regard to students initially logging on to the system and accessing the path of notes required for the following weeks’ seminar were attributed to a number of factors, including difficulties in getting access to computers, an unreliable server, and slow running capacity at busy times. This was frustrating for both the students and the tutors and emphasized one of the fundamental weaknesses of existing/current online teaching systems provided by universities. Since this research was conducted, the university has invested in a new server that is faster, which has helped alleviate some of the problems encountered. The importance of access as stressed by Salmon (2000), Thyer et al. (1998), and Siegal et al. (1998) was not fully realized in this instance, which raises the question of how future online courses should be developed in order to avoid these problems. It must also be questioned, if these initial difficulties contributed to some of the negative feedback that concurs with McGorry’s (2003) theory that initial technical problems can lead to students negative perceptions. The recognized and promoted anytime, anyplace, anywhere attributes of WebCT were not confirmed/supported by the majority of students within this study, as their logging on habits were consistently disappointing, and their interactions with other sites and the bulletin boards were minimal and underdeveloped.

Few students took advantage of the links provided by the instructors, and they did not use the Web site for feedback and questions. This finding implies that the Internet was used mostly as an information site. These findings are in contrast

to Montelpare and Williams’ (2000) findings that Web-based activities, including use of Web links, were well received by their students. Additionally, Rosen and Petty’s (1997) view that the student can become distracted by links is not evident in this study.

From the students’ perspectives, there was ambivalence toward the bulletin board, despite repeated attempts by the tutors to stimulate discussion. Interestingly, this lack of active engagement on the bulletin board is not a new phenomenon; it was a feature of a similar initiative undertaken at a previous institution by one of the authors (Ibbetson, 2000). One of the primary reasons for encouraging use of the bulletin board is that it provides an arena for virtual interaction, which is desired by tutors but is often suppressed in large group situations. In theory, as participation in online learning is individual in nature, it should follow that the reasons for not contributing in group situations are removed. In actuality, however, the contributions made to the bulletin board appear and remain in the public domain, and, therefore, reticence surrounding fear of failure and social embarrassment remains. When considered in comparison to the positive, meaningful, and enjoyable experiences of the post-graduate students in LaMaster and Morley’s study (1999), the question of level and experience of student would appear to be significant. This is supported somewhat by Lu, et al. (2002), who purport that undergraduate students may not have the mental maturity, greater life experience, or higher reading levels that would make them more able to pursue more readily the impersonal environment of the bulletin board.

The students favored the traditional lecture/seminar-type delivery over the online method in relation to their perceptions of the accessibility of the tutor. This differs from Basile and D’Aquila’s (2002) research that found that there was no difference in students’ attitudes between the two teaching methods. The main reasons stated for preference of traditional methods included

clarification of points and social and intellectual interaction with the tutor.

It appears that some students experienced difficulty in digesting the information in the textual, online format. However, this may reflect more generally individual learning abilities and preferences than the online format per se. For example, students are just as likely to skim over a book or any other printed material, and students have different learning requirements, preferences, and styles. However, it should perhaps be noted again that online learning and teaching strategies are relatively novel and, therefore, unfamiliar to students; thus, their frame of reference is limited. Therefore, the unfavorable comparison of the WebCT-augmented approach to the traditional lecture/seminar format may be a function of its novelty, due to the fact that this was the only module that the students experienced in this manner in their entire first year. This would also concur in part with Wernet, et al.'s (2000) assertion that students have existing preconceived notions of how learning occurs within education, based upon prior and existing experiences within learning environments. If online learning methods are to be utilized more fully in the future within higher education, then this assertion of preconception could be tested further within the bounds of this medium, as it becomes more culturally ingrained.

The majority of students stated that they were satisfied with the delivery of the module but that they were more satisfied with the traditional lecture/seminar method than the WebCT/seminar augmented approach. While this contradicts Carey and Gregory's (2002) study that perceived Web-based learning as being superior in many regards to existing traditional methods, it does concur with Gregory's (2003) most recent research that expressed a desire for a return to more student/tutor interaction and with Thyer et al. (1998), who maintained that students preferred lectures to transmitted course work.

The qualitative data contradicted somewhat the quantitative finding with regard to students' perceptions of understanding by method of teaching. Some students appear to have responded more readily to the new and exciting nature of the managed learning environment that WebCT enables. For instance, the ardent students especially appreciated the additional links within the site that facilitated more in-depth study and achieved the desired level of differentiation planned by the tutors. This concurs with Lomine (2002), who found that students' opinions of online learning and teaching were varied, with an enthusiastic small number being interested and willing to work with computers as much as possible, while, conversely, a reticent small number were reluctant almost by principle.

The impersonal nature of online learning was expressed in a number of statements given, which highlighted the importance to students of tutor contact and interaction. Since this module was delivered to first-year undergraduates who are still initiating and developing networks and learning the norms of university life, it was perhaps a case of too much too soon. The importance of experience, as advocated by Lu et al. (2002), supports the tutor's notion that online learning is best suited to those with more experience of life and university and know more readily what is expected of them. As previously stated, much existing work in this area has concentrated on postgraduate involvement with online learning, and, as such, little research considers effectiveness at differing undergraduate levels. The effectiveness of WebCT would appear to be related to the educational level at which it is undertaken, which poses this question: Can expectations be shaped or changed to account for this, and, if so, how can this be achieved?

It is evident that the role of the tutor is fundamental throughout the whole process of constructing and delivering online teaching/learning systems. Traditionally, a tutor constructs a course,

compiles lectures, and delivers them. For online learning, the construction of the course is only the start of the process; the material then has to be inputted onto the system, which is onerously time-consuming and demanding, and authors such as Hartley (1999) and Witt (2003) recognize this. It is assumed that it is relatively easy to convert and generate material for online consumption in a managed learning environment such as WebCT. However, to go beyond merely converting PowerPoint slides into a Web-page format and developing detailed, coherent material takes a great deal of planning and preparation. It is the contention of the authors that converting and developing material that would have previously been delivered as a one-hour lecture into a path of notes plus integrated Web links in WebCT takes approximately 10 hours. Therefore, to produce a managed learning site in WebCT that has rigor as well as appeal is not something that can be done overnight. While the authors did receive some support for the process, it was not nearly enough to complete the task to a satisfactory standard, and much work was conducted in addition to existing commitments.

CONCLUSION

It is evident that a more comprehensive evaluation of the effectiveness of online techniques is needed before they are implemented as a fundamental teaching tool in universities. The study reveals that students prefer traditional teaching methods and regard them to be more effective than emerging online teaching systems. It is clear that the role of tutors is considered to be important, and that students rely very much on continuous personal contact, communication, and interaction with them. The flexibility of the online course was seen as a positive attribute of the new system as was accessibility, though there were negative considerations regarding reliability of the system.

The previous experiences of the students would also appear to contribute to successful utilization of online systems and, as such, raise questions as to the validity of applying ad hoc standardized online packages at differing levels in higher education. The importance of previous experience is an area that will be investigated further in future research as will the influence of existing and prevailing educational cultures. Prevailing educational cultures cannot be discounted as being a significant factor with regard to student satisfaction and perceptions of effectiveness, which suggests that future utilization and integration of online educational material would lead eventually to similar cultural acceptance of these new systems by students.

REFERENCES

- Basile, A. & D'Aquila, J.M., (2002, January/February). An experimental analysis of computer-mediated instruction and student attitudes in a principles of financial accounting course. *Journal of Education for Business*.
- Burnett, C. (2003). Learning to chat: Tutor participation in synchronous online chat. *Teaching in Higher Education*, 8(2), 247-261.
- Carey, J.O. & Gregory, V.L. (2002). Students' perceptions of academic motivation, interactive participation and selected pedagogical and structural factors in Web-based distance learning. *The Journal of Education for Library and Information Science*, 43(1), 6-15.
- e.learning age. (2003). Retrieved on October 2003, from <http://search.epnet.com/direct.asp?an=11201174&db=buh>
- Evans, J.R. & Haase, I.M. (2001). Online business education in the twenty-first century: An analysis of potential target markets. *Electronic Networking Applications and Policy*, 11(3), 246-260.

- French, D., Hale, C., Johnson, C., & Farr, G. (1999). *Internet based learning: An introduction and framework for higher education and business*. London: Kogan Page.
- Gammie, E., Gammie, B., & Duncan, F. (2002). Operating a distance learning module within an undergraduate workplacement: Some reflections. *Education + Training, 44*(1), 11-22.
- Gregory, V.L. (2003). Student perceptions of the effectiveness of Web-based distance education. *New Library World, 104*(1193), 425-431.
- Hartley, K.W. (1999). Media overload in instructional Web pages and the impact on learning. *Educational Media International, 36*, 145-150.
- LaMaster, K.J. & Morley, L. (1999). Using WebCt bulletin board option to extend transitional classroom walls. *ERIC Document Reproduction*. Service no. ED 440922.
- Leung, Y.F. & Ivy, M.I. (2003). How useful are course Websites? A study of students perceptions. *Journal of Hospitality, Leisure, Sport & Tourism Education, 2*(2). Retrieved from <http://www.hlst.ltsn.ac.uk/johlste>
- Lomine, L.L. (2002). Online learning and teaching in hospitality, leisure, sport and tourism: Myths, opportunities and challenges. *Journal of Hospitality, Leisure, Sport & Tourism Education, 1*(1), Retrieved from <http://www.hlst.ltsn.ac.uk/johlste>
- Lu, J., Yu, C-S., & Liv, C. (2002, July). Learning style, learning patterns and learning performance in a WebCT based MIS course. *Information and Management, 40*(6).
- McGinn, D. (2000). College online. *Newsweek, 135*(17), 54-58.
- McGorry, S. (2003). Measuring quality in online programs. *The Internet and Higher Education, 6*(2), 159-177.
- Montelpare, W.J. & Williams, A. (2000, June). Web-based learning. Challenges in using the Internet in the undergraduate curriculum. *Education and Information Technologies, 5*(2), 85-101.
- Morss, D.A. (1999). A study of student perspectives on Web-based learning: WebCT in the classroom. *Internet Research: Electronic Networking Applications and Policy, 9*(5), 393-408.
- Paloff, R.M. & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom*. San Francisco: Jossey-Bass.
- Poole, D. (2000). Student participation in a discussion-oriented online course: A case study. *Journal of Research on Computing in Education*, (pp. 162-179).
- Reisman, S., Dear, R.G., & Edge, D. (2001). Evolution of Web-based distance learning strategies. *The International Journal of Educational Management, 15*(5).
- Roberts, B. (2002). Interaction, reflection and learning at a distance. *Open Learning, 17*(1).
- Rosen, E.F. & Petty, L.C. (1997). Using Internet resources in a research methods course. *Behaviour Research Methods, Instruments and Computers, 29*, 222-227.
- Salmon, G. (1998). Developing learning through effective online moderation. *Active Learning, 9*, 3-8.
- Salmon, G. (2000). *E-moderating: The key to teaching and learning online*. London: Kogan Page.
- Salmon, G. (2001). Creating the e-learning experience. Which way is forward? In *Proceedings of the Plenary Address to BEST Conference*, Windermere, April 1.
- Salmon, G. (2002). Pedagogical requirement of virtual learning environment (VLEs) pets and

planets. The 24 hour university: Stretching the limits. In *Proceedings of the UCISA TLIG-SDG User Support Conference*, Leeds, UK.

Segrest, S.L., Domke-Amonte, D.J., Miles, A.K., & Anthony, W.P. (1998). Following the crowd: Social influence and technology usage. *Journal of Organizational Change Management*, 11(5), 425-445.

Siegel, E., Jennings, J.G., Conklin, J., & Napoletano Flynn, S.A. (1998). Distance learning in social work education: Results and implications of a national survey. *Journal of Social Work Education*, 34, 71-80.

Sistek-Chandler, C. (2000). Webifying courses: Online education platforms. *Converge*, (pp. 34-38).

Teague, J. (1999). Computer communication in distance post-graduate teacher education. In *Proceedings of the BERA Conference*, Brighton.

Thompson, J., McGivern, J., Lewis, D., & Dierck-O'Brien, G. (2001). E-developments: An autobiographical narrative. *Quality Assurance in Education*, 9(3), 153-161.

Thyer, B. A., Artelt, T., Markward, M.K., & Dozier, C.D. (1998). Evaluating distance learning in social work education: A replication study. *Journal of Social Work Education*, 34, 291-295.

Webb, J.P. (2001). Technology: A tool for the learning environment. *Campus-Wide Information Systems*, 18(2), 73-78.

webct.com. (n.d.). Retrieved on November 30, 2003, from <http://www.webct.com/company>

Wernet, S.P., Olliges, R.H., & Delicath, T.A. (2000, July). Postcourse evaluations of WebCT classes by social work students. *Research on Social Work Practice*, 10(4).

Witt, P.L. (2003, June). Enhancing classroom courses with Internet technology: Are course Web sites worth the trouble. *Community College Journal of Research and Practice*, 27(5), 429-438.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 1, No. 4, edited by L. A. Tomei, pp. 25-38, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.25

The Didactical Potential of Robotics for Education with Digital Media

Andreas Wiesner-Steiner
University of Bremen, Germany

Heidi Schelhowe
University of Bremen, Germany

Heike Wiesner
University of Bremen, Germany

ABSTRACT

The project “Roberta—girls conquer robotics” was launched by the Fraunhofer Institute (AIS) with the aim to help promote girls’ interest in sciences, mathematics and technology. As a summary of this research program, this article presents substantial results from the scientific evaluation of Roberta and suggests a new pedagogical approach towards the use of robotics in education. We discuss how didactics and technology (LegoMindstorms) interact in Roberta courses and how the materiality of robotics itself plays an important role here; that is, it already comes along as gendered material. Due to that, we draw conclusions towards general educational concepts for digital media. If carefully used as a didactical actor, robotics not only suits boys’ and girls’ interest in technological messiness but enables them for a technological-mediated life instead of just feeling overwhelmed. Robotics,

therefore, can function as an appropriate medium for general education in the more comprehensive sense of developing personality and agency.

INTRODUCTION

“Roberta — girls conquer robotics,” a project funded by the German Federal Ministry of Education and Sciences (BMBF), was launched by the AIS with the aim to help promote girls’ interest in sciences, mathematics and technology, and especially to encourage girls’ curiosity for engineering and computer science (Müllerburg, Petersen, & Theidig, 2004)¹. Scientifically escorted by the University of Bremen, Digitale Media in Education (DiMeB) and the Institute for Didactics of Natural Sciences (IDN), Roberta addresses 10- to 16-year-old girls. The project’s basic assumption is that robot construction kits — offering possibili-

ties to develop more self-confidence in one's skills — provide an attractive access to technology for girls. This article presents substantial results from the qualitative evaluation of Roberta courses and suggests a new pedagogical approach towards the use of robotics in education.

Background: Evaluation of the Roberta Project

The robot construction kits (Lego Mindstorm) consist of complementary mechanical, dynamic and electronic parts that allow the construction and programming of different types of robots. Basic models can be equipped with different engines and sensors (contact sensors and optical sensors). The programming can be done in two programming languages (RIS and NQC), the first offering easy-to-combine graphical blocks, the second requiring more teaching and explanation. The programs are transmitted on to the RCX module, a programmable Legobrick with three input sockets for sensors and three for engines. To learn about informatics, the teaching of basic programming skills marks an important aim of the Roberta courses.

While informatics is treated in Roberta as a constructivist science, the educational sciences provide the necessary orientation for both shaping and evaluating digital learning environments. Our evaluation, thus, focused on the following questions:

- How can the interest in technology of girls and women be triggered by the use of robotics?
- How is curiosity for technology generated?
- How should learning environments be designed to satisfy both girls and boys?
- Which didactical concept is appropriate in connection with robotics?
- Are robotics and didactics suitable to influence the self-concept of the students?

Results of the quantitative evaluation show that the course experience in longer Roberta courses are noticeably stronger influenced by the focus of the teacher (didactics, informatics, gender, technology) than in shorter ones (Rethfeld & Schecker, 2005). The didactical focus stages as the most positive influence on the experiences of the participants – which is why the importance of the course-concept increases with the length of the courses. Although the self-concept of informatics and occupational orientation are only affected in medium-size and longer courses, all Roberta courses help to develop a more positive attitude towards informatics with the participants — both concerning the self-estimation of their own competence and their occupational orientation (Hartmann, Schecker, & Rethfeld, 2005). The following qualitative exploration allows for a deeper and more detailed insight into these issues. Methodically, material and video analysis, participative observation, as well as single and group interviews and expert interviews, were combined (Wiesner, 2004).²

De/Construction of Gendered Materials — “Now we add real Formula 1 decorations to it”

Not only does the importance of didactics increase with the length of a Roberta course, the materiality of robotics itself plays an important role. Right from the start the material speaks for itself, because the children handle something they already know. The programmable bricks, engines and sensors, however, provide an unknown means to make experiences, so that children of both sexes are usually confronted with something new, too. The Legomaterial in this sense is evocative; that is, it generates presumptions, experiences and actions by itself. Treated from a gender-sensitive perspective, it even appears to be “gendered material”. A practical example:

The use of a car-like basic model often leads to car-like robots. Triggered by the impulse car-

likeliness, boys — and often girls too — in no time construct vehicles. This phase of construction is often introduced by remarks such as: *“Now we add real Formula 1 decorations to it.”*

Were no (car-like) models given, girls and boys often construct models with strong analogies to humans and animals. If children are left to choose the models themselves, their constructions are observed to be less gender specific. Gender-specific behavior becomes more obvious if given materials, models and tasks that already contain and enforce gender-specific orientations. Although the (Lego) material evokes gender-specific behavior³, didactical interventions and gender-conscious tasks allow to successfully deconstruct the gendered material. This point is made very clear by robotics expert Deirdre Butler:

... a teacher ... noticed ... the fact that the boys' ideas were dominating and they all centered around wheels. They all had to be vehicles that moved fast. Rather than separate the groups - ... for the next project, ... they simply should not [have] made a wheeled robot. They could use wheels to make conveyor belts or create other moving parts ... And that began to change things in her classroom, because they began to make other types of things.

As a consequence, the task not to construct a wheeled vehicle can transform both internalized gender-specific behavior and the use of gendered materials. Combined with a gender-sensitive view on team interaction and help, this can lead to new learning effects.

The Staging of Gender in Robotics — “just stick to the construction manual ...”

Our observations could not support the assumption that girls tend to work in a more team-oriented fashion than boys. In small groups, both sexes

were able to develop social skills and preferred to work in groups. Though in some boys' and girls' teams, alternations between team work and a hierarchical task division can be observed, to us, these differences also had strongly to do with the learning arrangement: The more intense a gender-sensitive approach, the more the boys and girls can work as teams. This aspect became evident in the practice of themes, like moving the robot through a maze, a highly self-designable task where problem-solving strategies often got developed as a team. “Gender-neutral” themes thus helped to prevent particular mixed teams from falling into two gendered groups.

Gender differences and gender-specific behavior brought into the learning environment as a precondition have been, in our view, actively transformed and thus co-produced by both the gendered material and the didactical design of Roberta courses. The consequential “staging of gender” (Wiesner, 2002) thereby takes place, where material and discursive worlds interact in specific ways. Due to that, technical materiality and didactical intervention constitute a switching relation, co-producing each other's effects in learning environments.

In that process, a gender-conscious didactical approach to both the technology and the students becomes essential. This is important to avoid girls being robbed of their fame on a crucial social point, when they present their robot in front of all participants; and to avoid boys from failing if they are driven by a “self-concept of the winner” (Buschmann, 1994). Noticeably often, the boys disturbed the girls' presentations by letting their own robots drive into their presentations. This was amplified by a rather reserved behavior of the girls that displayed gender stereotypes (e.g., *“You go ahead starting, we can present our robot at the end”*). Nonetheless, the boys were also put under stronger pressure by the amount of teacher attention, as a row of unhappy presentations showed. In both cases, LegoMindstorms can work as an exclusive or inclusive technology.

As we know today, bringing technology into schools can be beneficial, but much depends on how the teachers mediate the new tools. No wonder, the necessity of a gender-sensitive training concept for teachers⁴ is an important conclusion from the results of the qualitative evaluation. In Roberta courses, such an approach particularly amplifies positive experiences with technology design by ensuring that girls and boys have equal access and starting points. What we think robotics in education offers new here is that technological interest, creativity and the discovery of new skills, as well as the gaining of knowledge — perceived as a reflexive mixing of didactics and technology — can make kids ready for an increasing sociality with technical objects and processes, which will accompany and transform their life constantly. It is through this very concrete relation and interaction between both the materiality and virtuality of building and programming robots and their didactical mediation that, for us, the specific potential of robotics can get to the kids. The following sections will illustrate how robotics can create diverse potentials to initiate new forms of learning that deal with both the concrete and the abstract world.

Robotic Material and Constructivist Learning

Merging abstract programming and concrete construction worlds, robotics bear a character of challenge. Instead of following instructions, there is not just one way to make a robot. Many possibilities are found to tie to one's imagination. According to Papert, they ought to be things one can think with and that open specific and appropriate possibilities for the individual way of learning (Papert, 1994; Ackermann, 1996). Through concrete handling, the Lego material supports access to abstract concepts and vice-versa: the transfer of abstract programming concepts into concrete motion. Meanwhile, it gives feedback on how successful a construction or programming

process is. Such proceedings offer appropriate conditions to promote girls' and boys' technical curiosity. Girls usually feel inferior with regard to technical constructions, and often fear embarrassment. Robotics technology — combined with a gender-sensitive constructivist learning approach — instead allows for a less biased access.

FUTURE TRENDS: RECOMMENDATIONS FOR EDUCATIONAL CONCEPTS

In this respect, the experience with robotics to promote girls' interest in technology allows conclusions towards general educational concepts for digital media. Robotics as a *relational actor* not only suits boys' and girls' interest in technologies' messiness, but enables them for a technological-mediated life instead of just feeling overwhelmed. It is, however, also an appropriate medium for general education in the more comprehensive sense of developing personality and agency.

The Didactical Agency of Robotics

This study addresses the question how information and communications technology (ICT) affects and transforms identity (Turkle, 1995), resembling one of the major discourses in science and technology studies, where technology is not understood as separate from the behavior and identity of human users, but as a productive (f)actor in hybrid socio-technical settings (Latour, 1998; Rammert, 2002), where it works as an agent and a translator of human practice and experience.

The Lego-Mindstorms technology both in its virtual and material appearance offers exactly that — regarding the design and the use of its inscribed, activity-engaging potential for new learning strategies. During the Roberta courses, students constantly receive system feedbacks (either from the screen or from the robot) that structure their actions together with the teach-

ers' didactical approach. Even if the technology does not act intentionally, different forms of the *attribution of agency* can be observed here, as Rammert and Schulz-Schaeffer (2002) put it. The system reports, or the robot does not work, if incorrect programming commands were entered or technical malfunctions appear. The system suggests new action without pointing to the "right" direction. From the kids' view, the technology at hand "acts" on two levels: They experience an immediate physical, material processing executed through semiotic processes (programming). For this reason alone, students experience a process of the merging of abstraction and experimental interaction, of their own and of technological actions. System feedbacks, thus, are fundamental, simultaneously didactically constructed *and* mediatable agency-pattern, simply because they initiate reactions. They are also gender-neutral, since they occur independent from whomever operates the computer and do not assess changes due to gender differences but on grounds of the given tasks. Many teachers agree that the system feedback particularly activated self-learning effects.

According to our case for gendered materials, however, gender-sensitive didactics is not realized automatically via system feedbacks. If you want to promote girls' interest in technology, LegoMindstorms only becomes a didactical actor through a sensitively designed learning environment. Learning effects, creativity and new actions, thus, not only evolve through successful mastering of technology but by the *translation* of human agency through technological agency. In other words, learning emerges from the collaboration of technological and didactical worlds, the allocation of their different forms of agency and their active transformation by students. The potential of robotics as a didactical actor then lies in this possibility to frame the gradual development, allocation and attribution of both human and technological agency within learning processes (see Wiesner-Steiner, Wiesner, & Schelhowe, 2005).

While sociologists of technology often point to an increasing mangling of technology and sociality (see Latour, 1998), our perspective on robotics as a didactical actor for learning processes is particularly driven by the idea to discover potentials that lie in a gradual development and allocation of *different* forms of agency:

Question: "I have noticed that the robots did not always drive through the maze independently with their light and motion sensors. How come?"

Answer 1: "What I learned – the robots don't like you. You can't always master the technology." (boy)

Answer 2: "The robot is a technical product and then it is our fault that we didn't understand this." (girl)

Answer 3: "I think it's got to do with both. Sometimes the robot didn't do something it was programmed to, but there were also program errors." (girl)

Answer 4: "We have not seen that the robot didn't do what we told him to at all. Sometimes he did something we thought to be wrong, but that was in fact somehow right." (girl)

Answer 5: "I think the most mistakes occurred because we didn't really know the programming language and so the robot did what he was programmed to do but not what we wanted him to." (girl)

Particularly in NQC-related programming and presentation phases of Roberta courses, different forms of the allocation of agency and creatorship by the students and teachers (what "does" the technology, what should students do to make the robots do something ...) can be observed that create a specific form of experimental interactivity with the Lego material: Acting emerges both from an impression of the relatedness of technical and human agency and a clear feeling of their distinctiveness. The allocation of human and/or technological agency by the students based on this ambivalence thus shows relatedness as

well as expresses boundaries (see Gieryn, 1995). Learning experiences are categorized and processed within a highly differentiating cognitive framework. The allocation and distribution of different forms of agency not only display where insecurities regarding causalities and connections in the learning process exist but what students think is special with digital media in comparison to other learning experiences.

Based on their former experiences, boys and girls were most convinced of their own agency in the phase of construction, while in the programming phase they attribute the strongest form of technological agency. Nevertheless, the programming phase marks the time when they are most active in confronting the technology. This becomes evident if a group is observed throughout a long course. A robot programmed by a boy and a girl via NQC in same shares would do something slightly different, often together with what they programmed him to. Altogether responsible for more than 60 tries in their programming phase (2 ½ days), the group would not have stayed on track without the attachment of their programming interest to the concrete object “robot,” nor without any didactical intervention.

In opposition to the programming, in the presentation phase students are particularly interested not only to connect but to perform their own and technical activities. Amplified by the test situation, this is why the allocations the students make in this phase are more goal- and control-oriented than in more experimental course phases. Here, the agency of the technology is perceived as failure or success in relation to the given task, while mastering tasks is seen as both a success of the team *and* the robot. But is this not the place where research points to gender-specific differences? Where boys rather allocate success to themselves, while girls tend to allocate failure to the circumstances? This clearness vanishes in the case of Roberta courses, because — particularly in long courses — it can be observed that boys, like girls, use *both* allocations. The importance

of these allocations regarding the technology and themselves is thereby influenced likewise by the gender-specific orientations and didactical conception of the course.

In consequence, an important didactical task is to help the students find their own initiative. It is not only important to tackle the given task by means of successful control of the technology, but also to provide insights into the connection of human means of action and learning processes with technological agency. A corresponding remark by a Roberta teacher:

In the first 2 days, the students already asked for more help. If this is interpreted, they only made limited use of their means of action. (teacher)

Knowledge of the allocation and gradual development of technical and human agency in learning processes that aim at both the shaping and use of technology can be very instructive for handling situations like this. Recommendations of activity for different learning phases can be given and the technology itself can be continually improved as a didactical actor. Hardware and software used in Roberta courses have a special, technically delegated potential to destructure and restructure established learning routines. Both assist or prolong not only learned behavior and application routines, but also enforce, through their inscribed agency, new and creative forms of appropriation, without the paths being outlined in detail. A gender-sensitive approach can amplify this process (or even initiate it for girls), by ensuring that students have equal opportunities to develop and design.

Following this, examples for possible changes of the self concept are presented next. Here we are less interested in whether the students develop sustainable profession-oriented interests in engineering and computer sciences but whether constructing and programming robots can emulate transferable knowledge that gives them a more active understanding of technology, which goes

beyond surface-level familiarity. To be productive with highly interactive, multi-modal, adaptive and autonomous future applications, students need to apply their knowledge in a wide range of situations.

POSSIBILITIES AND LIMITS OF THE CHANGE OF SELF CONCEPTS BY ROBERTA COURSES

Whether one's own activity in dealing with LegoMindstorms is perceived as strong or weak gives hints to the possibilities for changing the self concept. For this reason, we not only asked students what they learned, but let them reflect on their learning processes. While the students referred to a special form of "experimental interaction" (Rammert, 1999) with the robotics material, in courses of different lengths, it is mainly the programming technique that interacts in specific ways with the social environment:

- "I do think that this has something to do with learning. I wouldn't program just for fun at home." (boy)
- "I think that it is important to connect this to something game-like. Looking at this programming language, I would absolutely not want to have this written on the blackboard. I think it is important to try it playing." (girl)
- "There weren't really disciplinary problems, because the students were challenged by the computers." (short course, teacher 1)
- "After 4 days, social problems are of greater importance than in short courses. In short course, the robot as a medium is such a challenge, that there is hardly a chance for social problems to occur in a team." (Long course, teacher 2)

Question: "Would you wish to learn more in this way?"

- "I wouldn't only refer to it in Physics and Informatics, but to Natural Sciences in general. Chemistry is usually a subject that I really like, but we don't have such good experiments. And this is important: that I don't just get a formula, but that I can also see: it really is like this. To get this confirmation." (girl)
- "What I learned? To start small and proceed in small steps.." (boy)

Besides sequencing the tasks, two wishes are formulated here: the wish for more playful, experimental learning and the wish for transferable knowledge. The question of change of the self concept was finally addressed by the teachers themselves:

- "We actually learned to enter a few commands in NQC. That is what can be tested. Can you program a loop? But we should also make clear that school education is more than the pure transfer of knowledge. That one can learn from mistakes. The students don't even realize that it is also an aim of the course to help them to help themselves. Not experiencing the learning at junctions and parting of ways is what is valuable." (teacher 1)
- "This self-confidence that they gain in both technology and themselves cannot be taken away from them so easy again. This will keep them for a while and then in the higher grades, when a colleague takes this up in Natural Sciences in an appropriate way, it will stay like that. ... those are very subtle mechanisms. That they bear that in mind and may consider it in future decisions in the higher grades, for their hobbies and in leisure time. That they believe in their capability to handle technical questions. In that respect, some technology distance may have been taken away." (teacher 2)

CONCLUSION

Knowledge of the allocation and gradual evolution of technological and human agency in design-oriented learning processes can be instructive for pedagogical concepts dealing with digital media. Recommendations for action can be specified for different courses, settings and learning phases, and the technology as a didactical actor can be improved permanently. The material and virtual aspects of LegoMindstorms thus bear the potential to deconstruct and reconstruct learning routines. They do not only assist or prolong routines of action but, through their inscribed agency, enforce new creative ways of learning that are not determined. A gender-sensitive didactical approach (implemented in a corresponding learning environment) can start and amplify this process by ensuring that the students have equal experimental opportunities. According to the Roberta aim of promoting girls' interest in technology, the following recommendations for the creation of learning environments are given:

- Assist dynamic processes of team formation
- Promote open working environments
- Promote "gender-neutral" project themes and work
- Reflect help and attendance in a gender-conscious way
- Provide a flexible mix of open and structured learning
- Give opportunities for teamwork and promote teamwork
- Schedule for gender-sensitive interventions during the project and presentation phases
- Consider the materiality, resistance and agency of technology in didactical approaches
- De/construct gendered material
- Observe allocation and distribution of technical and human agency gender sensitively.

With such an environment, the techniques of programming and constructing robots with LegoMindstorms not only offer the potential to enhance the room for activity. Purposefully used as a "didactical actor," the interaction with the "social machines" of the Roberta technology even offers possibilities for the change of self concepts *before* (female) students make educational choices and withdraw from computer science, engineering or math courses.

REFERENCES

- Buschmann, M. (1994). Jungen und koedukation. Zur polarisierung der geschlechterrollen. *Die deutsche Schule*, 86(11.2), 192-213.
- Gieryn, T.F. (1995). Boundaries of science. In Jasanoff et. al. (Eds.), *Handbook of science and technology studies* (pp.393-444).
- Hartman, S. & Schecker, H. (2005). *Mädchen im umgang mit informatik, technik und naturwissenschaften – Externe evaluationsergebnisse zu dem Projekt Roberta*. Erscheint in: zeitschrift für didaktik der naturwissenschaften, ZfDN.
- Hartmann, S., Schecker, H., & Rethfeld, J. (2005). Mädchen und roboter – Ein weg zur physik? In A. Pitton, (Ed.), *Tagungsband der jahrestagung in Heidelberg 2004 der gesellschaft für didaktik der chemie und physik – Relevanz fachdidaktischer forschungsergebnisse für die lehrerbildung* (in press). Münster: Lit Verlag.
- Joerges, B. (1996). *Technik körper der gesellschaft*. Arbeiten zur Techniksoziologie, Suhrkamp, Frankfurt am Main.
- Latour, B. (1998). Über technische vermittlung. Philosophie, soziologie, genealogie. In W. Ramert (Ed.), *Technik und sozialtheorie* (pp. 29-83). Campus-Verlag.
- Müllerburg, M., Petersen, U., & Theidig, G. (2004). Mit robotern spielend lernen. In: VDI

(Ed.), *ROBOTIK 2004* (pp. 393-400). VDI Berichte Nr. 1841.

Rammert, W. (1999). Weder festes faktum noch kontingentes konstrukt: Natur als produkt experimenteller interaktivität. *Soziale Welt*, 50(3), 281-296.

Rammert, W. (2002). *Technik als verteilte aktion. Wie technisches wirken als agentur in hybriden aktionszusammenhängen gedeutet werden kann* (working paper, TUTS-WP-3-2002). Technical University Technology Studies.

Rammert, W., & Schulz-Schaeffer, I. (2002). Technik und handeln. Wenn soziales handeln sich auf menschliches verhalten und technische abläufe verteilt. In dies (Ed.), *Können maschinen handeln? Soziologische beiträge zum verhältnis von mensch und technik* (pp. 11-65). Campus Verlag.

Rethfeld, J., & Schecker, H. (2005, June 20-21). *Roberta – Mädchen erobern roboter*. Ergebnisse der quantitativen Begleitforschung. 3. Qualitätsmanagement-Workshop, Fraunhofer-Institut AIS, Birlinghoven.

Turkle, S. (1995). *Life on the screen: Identity in the age of the Internet*. London: Phoenix.

Wiesner, H. (2002). *Die inszenierung der geschlechter in den naturwissenschaften. Wissenschafts- und geschlechterforschung im dialog*. Campus-Verlag

Wiesner, H. (2004). Handlungsträgerschaft von robotern: Robotik zur förderung von chancengleichheit im schulischen bildungsbereich. *Historical Social Research, Zentrum für Historische Sozialforschung*, 29, 120-154.

Wiesner-Steiner, A., Wiesner, H., & Schelhowe, H. (2005). Technik als didaktischer akteur: Robotik zur förderung von technikinteresse. In C. Gransee (Ed.), *Hochschulinnovation. gender-initiativen in der technik. Reihe: Gender studies in den angewandten wissenschaften* (to be published). Hamburg: LIT-Verlag.

ENDNOTES

- 1 As of summer 2005, 153 courses have been conducted (1,880 students, of which 1,605 were girls. For more information about Roberta, visit <http://alex.ais.fraunhofer.de/zeno/web?action=content&journal=16413&rootid=15465>
- 2 The database contains qualitative interviews with a total of 11 tutors, six group discussions with students, two expert interviews and minutes, and photo and video analysis from six courses. All types of courses (short, medium, long) were analyzed.
- 3 The offered combinations of wheels and engines often leads to the exclusion of other functional lego bricks.
- 4 Gender sensitive didactics consist of:
 - Performance-related praise (particularly girls)
 - Gender-conscious reflection on the given attention and help
 - Gender-sensitive intervention during the project phases
 - “Gender-neutral“ tasks (e.g., circus instead of soccer scenarios)
 - Open learning scenarios
 - De-/construction of the “gendered material“
 - Use of designable technology.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 1, edited by L. Tomei, pp. 36-44, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.26

Students' Perceptions of the Laptop Program: What Factors Should be Considered Before Implementing the Program

Chuleporn Changchit

Texas A&M University, USA

Robert Cutshall

Texas A&M University, USA

Susan Elwood

Texas A&M University, USA

ABSTRACT

Due to a rapid increase in the usage of information technology, several companies are demanding that graduates have more than just the basic computer skills when they graduate. This has prompted many universities to initiate a campus laptop program in order to increase their students' computer experiences and skill sets. The success of a laptop program relies heavily on the extent to which the laptop environment is accepted and wholeheartedly implemented by students and faculty. Defining the conception factors necessary to successfully implement a laptop initiative becomes a critical issue to the success

of the program. This study examines university students' perceptions of a required laptop program to determine what factors that they think are crucial for the success of such a program. By understanding what factors encourage students to support a laptop initiative, such a program can be made more useful to students as well as more beneficial to universities.

INTRODUCTION

At an increasing number of universities, laptop computers have become a requirement for incoming students in preparation for their career success. The demand for technology-enhanced learning

environments no doubt will grow substantially over the next decade, as society, the academic community, and students continue to expect the educational process to employ technology comparable to that found in the real world (Hall & Elliott, 2003). On campuses where all students are expected to have and use computers, laptops appear to be the popular choice. The portability of laptops allows students to take them to classes, libraries, and on trips. It is also argued that their ubiquity makes computer-enhanced classroom instruction possible, decreases the need for labs, and consequently lowers the institution's computer budget (Badamas, 2001).

Laptop computers provide unsurpassed flexibility and convenience for students in the modern academic environment (Bazillion & Braun, 2001; Vaughan & Burnes, 2002). For higher education, providing experiences with computer tools tends to be one of the prerequisites to professional success, because employers value extensive experiences with information technology (Brown, Burg, & Dominich, 1998; Rola, 2002; Tomek & Muldner, 1999). Previous researchers have shown that laptop computers in the classroom can lead to positive educational outcomes (Finn & Inman, 2004; Fouts & Stuen, 1997; Gottfried & McFeely, 1998; Varvel & Thurston, 2002), which provides another incentive for universities to examine a laptop program.

Students' use of laptop computers is becoming more prevalent in today's universities. This more ubiquitous use of technology has forced several universities to discover and manage new perceptual issues in addition to the more familiar issues stemming from the primary use of university labs. Thus, defining the conception factors necessary to successfully implement a laptop initiative becomes a critical issue to the success of the program.

This research was centered on the needs and attitudes of students. Typically, students are still skeptical when it actually comes to requiring them to purchase and to use a laptop in higher

education. This study attempts to investigate what factors are important to students. It is important to understand what factors can influence students' decisions on the laptop program. By understanding what factors encourage students to support a laptop initiative, such a program can be made more useful to students as well as more beneficial to universities.

LITERATURE REVIEW

Laptop computers are used widely in many workplaces and schools and are currently the largest growth area within the personal computer market (Berkhout, Hendriksson-Larséna, & Bongers, 2004). The need to access information technology on a daily basis continues to grow, and the laptop computer's advantages of being portable, lightweight, and space-saving, enabling users to work anywhere and anytime, have increased its popularity among personal computer users.

The decision to require student ownership of computers is not unusual among higher education institutions. Several universities are initiating laptop programs in which all students are required to purchase laptop computers. These universities also offer their students computing and networking facilities that enable them to use many kinds of Web-based resources, from the library catalog to complete graduate degree programs. Within an astonishingly short time, higher education has achieved a ubiquitous electronic presence.

The laptop initiative not only has given students a better education but also has made them more competent in using technology. Several issues comprise a students' perceptual base regarding a laptop initiative. A study reported that key themes related to these issues include (1) academic and social use of laptops, (2) e-mail and instant messaging, (3) faculty utilization, (4) Web uses, (5) comparisons with desktops, (6) cost, (7) library use, (8) problems, (9) family utilization, (10) service and help, (11) convenience, (12) network

Students' Perceptions of the Laptop Program

access, (13) worry, and (14) hardware and software (Demb, Erickson, & Hawkins-Wilding, 2004).

However, since university laptop initiatives are still in their infancy, many people may choose not to support such initiatives (Finn & Inman, 2004). Unless it is imperative for the university that students are willing to support the program, it is quite risky to start requiring all students to purchase a laptop. Not everyone exposed to an innovation will adopt the new technology at the same rate. The speed at which technology diffuses throughout a social system, such as higher education, is believed to be heavily dependent on several factors. The success of the laptop program relies heavily on the extent to which the laptop environment is accepted and wholeheartedly implemented by students and faculty. As with any new technology adoption, the acceptance of a laptop initiative is likely to be quite uneven. Some students will accept it readily, whereas others will resist change actively.

This research was centered on the needs and attitudes of students. Typically, students are still skeptical when it actually comes to requiring them to purchase and to use a laptop in higher education. This study attempts to investigate what factors are important to students. It is important to understand what factors can influence students' decisions on the laptop program. By understanding what factors encourage students to support a laptop initiative, such a program can be made more useful to students as well as more beneficial to universities.

METHODOLOGY

A direct survey was used to collect data for this study. The survey questions were compiled from previous study questions pertaining to information technology innovation as well as suggestions from researchers and students (Demb et al., 2004; Luarn & Lin, 2005; Moore & Benbasat, 1991). These questions were designed to gather data on

students' perceptions on the prerequisite factors necessary to implement a laptop initiative as well as their demographics. To validate the clarity of these questions, three professors and three students were asked to read through the survey questions. Revisions to the survey were made based on the feedback received.

A total of 54 items were used as 5-point Likert-scaled questions with end points rating from "strongly disagree" to "strongly agree." Surveys were divided into three sections. The first section, survey items Q1 to Q28, collected demographic data. These demographic data were collected to find out if there were any specific characteristics of the subjects that might influence their decisions to support the laptop initiative. The second category, survey items Q29 to Q53, measured students' perceptions on the prerequisite factors necessary to implement a laptop initiative. These questions were asked to discover the most important factors that students perceived for the success of the laptop initiative. The third category, survey item Q54, measured students' willingness to support a laptop initiative.

Data Collection

Surveys were distributed to 402 students enrolled in a mid-sized, four-year university. The participants were given a 54-item survey and allowed class time to complete it. All participants were informed that participation in the study was voluntary and that all individual responses would be kept anonymous. The students were asked to rate each of the survey items on a Likert scale from 1 to 5, with 1 being "strongly disagree" and 5 being "strongly agree." Three hundred and eighty-two participants completed and returned the survey instruments.

Approximately 20.2% of the respondents agreed or strongly agreed with requiring all students to purchase a laptop computer for use in their education. Approximately 55.8% of the respondents disagreed or strongly disagreed with

Table 1. Demographic characteristics

| Age (in years) | | | | | | |
|----------------------------------|-----------|-------------|-------------|-----------------|-----------|-----------|
| Under 18 | 18-21 | 22-25 | 26-29 | 30-33 | 34-37 | Over 37 |
| 3 (0.7%) | 149 (39%) | 118 (30.9%) | 41 (10.8%) | 20 (5.2%) | 17 (4.4%) | 34 (8.9%) |
| Gender | | | | | | |
| Female | | Male | | | | |
| 219 (57.3%) | | 163 (42.7%) | | | | |
| Ethnicity | | | | | | |
| African American | Asian | Caucasian | Hispanic | Native American | | |
| 20 (5.2%) | 18 (4.7%) | 196 (51.3%) | 140 (36.7%) | 8 (2.1%) | | |
| First Generation College Student | | | | | | |
| Yes | | No | | | | |
| 171 (44.8%) | | 211 (55.2%) | | | | |
| Own a Computer | | | | | | |
| Desktop | | Laptop | | | | |
| 324 (84.8%) | | 161 (42.2%) | | | | |

a laptop computer initiative. The remaining 24% of the respondents were neutral on a laptop computer initiative. Table 1 summarizes additional demographic characteristics of the respondents.

ANALYSIS AND DISCUSSION

The research data showed an odd-even reliability score of 0.946, suggesting internal consistency of the data. In addition, a Cronbach's alpha score of 0.922 was calculated as a second measure of reliability. It should be noted that these high levels of reliability relate to the data resulting from the measurement, not the instrument itself.

Factors Perceived as Critical

To determine which factors were deemed critical to the successful implementation of a laptop computer initiative, the mean responses to each question were calculated and examined. The items with the five highest mean scores were identified. The threshold for these factors was at a relative consensus point of 85% agreement. These fac-

tors, perceived as more critical by students, are presented in Table 2.

Students believe that access to printers is the most important factor for the success of a laptop initiative. This factor had a mean score of 4.47 out of 5 with 89.4% agreeing or strongly agreeing with this factor. This finding is consistent with observed student behavior in physical computer labs. Many students complete their assignments on computers off campus and bring their work to the computer lab to print hard copies.

Following the trend that exists in industry, students believe that it is critical for the university to provide a wireless network in order for them to access information stored at various points on campus and to access the Internet. The mean response for this item was 4.46 out of 5 with 89.2% agreeing or strongly agreeing with this factor.

The notoriously power-hungry laptop computers drove the students to rate the need for sufficient power outlets in the classroom. Students rated the importance of this factor with the same mean score as the need for wireless network of 4.46 out of 5, implying that 89.2% agree or strongly agree with this factor.

Students' Perceptions of the Laptop Program

Table 2. Critical success factors

| Question: For the laptop initiative to be successful, the University must.... | Mean |
|---|------|
| provide students with access to printers. | 4.47 |
| provide a wireless network. | 4.46 |
| provide sufficient power outlets in the class. | 4.46 |
| provide onsite maintenance support. | 4.36 |
| provide updates for virus protection. | 4.29 |

Table 3. The not-so-critical success factors

| Question: For the laptop initiative to be successful, the university must | Mean |
|--|------|
| require all students to purchase a laptop. | 2.74 |
| require all students to exchange to a new laptop after two years. | 3.00 |
| require all students to purchase a backup battery. | 3.04 |
| provide physical storage space/locker for students to store a laptop. | 3.53 |
| encourage all professors to fully utilize a laptop in the class. | 3.67 |

Students also believe that it is critical for the university to provide onsite maintenance for laptop computers. This is evidenced by the high mean score of 4.36 out of 5. The majority of the students, 87.2%, agreed or strongly agreed with the necessity for onsite maintenance. If the students are expected to use their laptops as a learning tool, they must be able to have their laptop quickly serviced when needed.

Another factor rated as critical by students was the issue of providing updates for virus protection. The mean response for this item was 4.29 out of 5 with 85.8% agreeing or strongly agreeing with this factor.

Factors Perceived as Not-So-Critical

To determine which factors were deemed not so critical to the successful implementation of a laptop computer initiative, the mean responses to each question were calculated and examined. The five survey items with the lowest mean scores were labeled as the not so critical factors with a perceived limited impact to the success of a laptop initiative (see Table 3).

While students may see the benefits of using laptop computers in their education, they do not

believe that it should be a requirement. This factor had a mean score of 2.74 out of 5 with only 33.8% agreeing or strongly agreeing with this factor.

The majority of students also believe that it is not a critical factor to require a hardware update after two years. The mean score of this survey item was 3.0 out of 5. Only 35.5% agreed or strongly agreed with the requirement to exchange to a new laptop after two years.

Students believe that requiring all students to purchase a backup battery is not a critical issue. This factor had a mean score of 3.04 out of 5 with only 38.2% agreeing or strongly agreeing with this factor. This finding is consistent with the observed critical factor of providing sufficient power outlets in the classroom. With sufficient power outlets available, the need for a backup battery becomes a non-critical issue.

Students also perceived that the necessity of providing physical storage space for the laptop computer when not in use was a non-critical issue. This factor had a mean score of 3.53 with 53.1% agreeing or strongly agreeing with this factor. This finding is consistent with the portability concept of the laptop computer. Laptop and notebook computers are designed to be smaller and lighter, which makes them easy to carry around when not

in use. Hence, physical storage space on campus is not a necessity.

It does not seem to be of critical importance to students that professors should utilize a laptop computer in the classroom. This factor had a mean score of 3.67 with 59.9% agreeing or strongly agreeing with this factor. This finding is consistent with students' attitudes against requiring all students to purchase a laptop. It will be difficult for a professor to utilize a laptop computer in the classroom if not all students possess a laptop computer.

Differences Between Groups

To determine if there were significant differences, t-tests on the means were conducted on the critical factors between the group of students who support a laptop initiative and those students who do not support a laptop initiative. The responses from participants were divided into two groups based on their responses to survey item Q54. The two groups were the support group (those who responded with a 4 or a 5) and the reject group (those who responded with a 1 or a 2). The students who were uncertain on the laptop initiative (those

who responded with a 3) were excluded from the t-tests. Table 4 shows the factors exhibiting a significant difference between the two groups at a p-value < 0.05.

The results of the t-tests revealed a significant difference between the two groups on 11 factors: (1) exchange the laptop for a new one after two years; (2) purchase a backup battery; (3) require all students to purchase a laptop; (4) encourage professors to utilize the laptop in the classroom; (5) demonstrate the laptop's benefits to the students; (6) demonstrate how to fully utilize the laptop; (7) provide onsite maintenance support; (8) provide sufficient power outlets; (9) provide students with e-mail accounts; (10) provide all students with standardized software; and (11) provide access to printers.

It also is interesting to note that the support group rated all factors higher than the reject group. These results demonstrated that the support group tends to pay more attention to the details of program implementation. The findings suggest that the university may want to consider these factors before implementing the laptop program.

Table 4. Significance between group differences

| Factors | Support Group | Reject Group | p-value |
|---|----------------------|---------------------|----------------|
| Exchange the laptop after two years | 3.38 | 2.75 * | * |
| Purchase backup battery | 3.57 | 2.78 * | * |
| Require all students to purchase laptop | 3.57 | 2.32 * | * |
| Encourage professors to utilize laptop | 4.22 | 3.33 * | * |
| Demonstrate laptop benefits | 4.25 | 3.52 * | * |
| Demonstrate how to fully utilize laptop | 4.25 | 3.70 * | * |
| Onsite maintenance support | 4.53 | 4.29 * | |
| Provide power outlets | 4.62 | 4.41 * | |
| Provide e-mail account | 4.38 | 4.10 * | |
| Standardized software | 4.46 | 4.16 * | |
| Access to printer | 4.64 | 4.40 * | |

CONCLUSION

The initiative for the use of laptop computers in higher education is viewed as advantageous, as reported in many previous studies (Finn & Inman, 2004; Fouts & Stuen, 1997; Gottfried & McFeely, 1998; Varvel & Thurston, 2002). Due to the ever-increasing use of technology in primary education and the increasing demand by industry for more computer-savvy graduates, the use of technology in higher education will continue to grow. Nevertheless, in order to smooth the transition, the factors critical to a successful laptop program must be identified and addressed.

This study has provided an empirical glimpse into the minds of students as to what they perceive as critical factors in a laptop initiative. The findings revealed that students, both those who favor and those who do not support laptop initiatives, place a critical level of importance on the following factors: (1) having access to printers; (2) having a wireless network in place; (3) having sufficient power outlets available in the classroom; (4) providing onsite maintenance support; and (5) having continuous and up-to-date virus protection software. Both groups also perceived that the following five factors have a lower degree of importance in the success of a laptop program: (1) requiring all students to purchase a laptop; (2) requiring all students to exchange to a new laptop after two years; (3) requiring all students to purchase a backup battery; (4) providing physical storage space/locker in order for students to store a laptop when not in use; and (5) encourage all professors to fully utilize a laptop in the classroom.

The results also revealed that 11 factors were perceived differently between the groups who support and do not support the laptop program. These factors were: (1) exchange the laptop for a new one after two years; (2) purchase a backup battery; (3) require all students to purchase a laptop; (4) encourage professors to utilize the laptop in the classroom; (5) demonstrate the laptop's

benefits to the students; (6) demonstrate how to fully utilize the laptop; (7) provide onsite maintenance support; (8) provide sufficient power outlets; (9) provide students with e-mail accounts; (10) provide all students with standardized software; and (11) provide access to printers. These findings suggest that the university may want to carefully consider these factors before implementing the laptop program.

The results in this study reveal the factors that are perceived by students as important or not important, if the university were to implement a laptop initiative. Determining such factors may allow educational institutions a base-level awareness of students' perceptions. This awareness could provide insights into what needs to be done to implement an effective laptop program. These initial findings warrant further investigation. To achieve a better understanding of all of the critical factors in a laptop program, future research also should include the perceptions of faculty, administrators, and staff as well as those of students.

REFERENCES

- Badamas, M. A. (2001). Mobile computer systems — Security considerations. *Information Management & Computer Security*, 9(2/3), 134-136.
- Bazillion, R. J., & Braun, C. L. (2001). Classroom, library and campus culture in a networked environment. *Campus-Wide Information Systems*, 18(2), 61-67.
- Berkhout, A. L., Hendriksson-Larséna, K., & Bongers, P. (2004). The effect of using a laptop station compared to using a standard laptop PC on the cervical spine torque, perceived strain and productivity. *Applied Ergonomics*, 35(2), 147-152.
- Brown, D. G., Burg, J. J., & Dominick, J. L. (1998). A strategic plan for ubiquitous laptop computing. *Communications of the ACM*, 41(1), 26-35.

- Demb, A., Erickson, D., & Hawkins-Wilding, S. (2004). The laptop alternative: Student reactions and strategic implications. *Computers & Education, 43*(4), 383-401.
- Finn, S., & Inman, J. (2004). Digital unity and digital divide: Surveying alumni to study effects of a campus laptop initiative. *Journal of Research on Technology in Education, 36*(3), 297-317.
- Fouts, J., & Stuen, C. (1997). *Copernicus project: Learning with laptops: Year 1 evaluation report*. East Lansing, MI: National Center for Research on Teacher Learning. (ERIC Document Reproduction Service No. ED 416 847)
- Gottfried, J., & McFeely, M. (1998). Learning all over the place: Integrating laptop computers into the classroom. *Learning & Leading with Technology, 24*(4), 6-12.
- Hall, M., & Elliott, K. M. (2003). Diffusion of technology into the teaching process: Strategies to encourage faculty members to embrace the laptop environment. *Journal of Education for Business, 78*(6), 301.
- Luarn, P., & Lin, H. H. (2005). Toward an understanding of the behavioral intention to use mobile banking. *Computers in Human Behavior, 21*(6), 873-891.
- Moore, G. C., & Benbasat, I. (1991). Development of instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research, 2*(3), 192-222.
- Rola, M. (2002). Building IT into lesson plans. *Computing Canada, 28*(22), 28.
- Tomek, I., & Muldner, T. (1999). Acadia advantage — Evolution and experiences. *Interactive Learning Environments, 7*(2-3), 175-194.
- Varvel, V. E., Jr., & Thurston, C. (2002). Perceptions of a wireless network. *Journal of Research on Technology in Education, 34*(4), 487-501.
- Vaughan, J., & Burnes, B. (2002). Bringing them in and checking them out: Laptop use in the modern academic library. *Information Technology and Libraries, 21*(2), 52-62.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 2, Issue 2, edited by L. A. Tomei, pp. 53-61, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.27

Game Mods: Customizable Learning in a K16 Setting

Elizabeth Fanning
The University of Virginia, USA

ABSTRACT

A game mod describes a modification within an existing commercial computer-based game that has been created by a user. By game modding, a user can participate in the creative process by taking the setting of his or her favorite game and customizing it for entertainment purposes or to convey information. For years, commercial computer-based game developers committed considerable resources toward preventing users from hacking into or hijacking their games. Now several computer-based game developers provide editors with their products to encourage users to create content and to allow educators, for instance, to take advantage of the benefits and production quality of commercial computer games in order to create customized instruction. This article focuses on mainstream, accessible games with straightforward modding tools that easily can be integrated into a learning environment.

INTRODUCTION

What Do Computer Games Have to Do With Learning?

Anyone who thinks there is a difference between education and entertainment doesn't know the first thing about either. Marshall McLuhan, Communications Theorist

Learning theorists from Piaget to Jonassen contend that profound, lasting learning culminates from the participant exploring, discovering, and interacting with his or her environment and culture in order to assimilate and create new meaning within his or her personal schema (Donaldson, 1984; Jonassen, 1988; Satterly, 1987). For a computer-based, constructivist learning environment, the quality of the user's learning experience is vested in the extent to which the

computer responds in a way that is consistent with the learner's information processing needs (Jonassen, 1988). The level of the user's interactivity and consequent sense of empowerment and control over his or her learning experience will affect the extent to which surface or deep learning will occur (Jonassen, 1988). Studies using computer games in learning settings, particularly the classroom, indicate that while student test scores may not improve significantly from using games, students do learn on a more profound level and are able to describe, for instance, why an answer to a test question is correct or incorrect (Squire, 2002). While this outcome appears marginal at this point, it is worth exploring what computer games do afford a user empowerment, motivation, insight, and engagement (Gee, 2003; Prensky, 2001).

How might one harness and channel a game's learning opportunities into the classroom in a way that empowers self-directed learning and the development of conceptual tools? Recognizing that emerging and even current learners most likely have grown up with a mouse in hand or at least developed considerable schema shaped by interacting with computer-based technology, computer games have gone beyond satiating the game-playing public as a dalliance or source of entertainment and have evolved into a meaningful, socially expressive medium, a platform for discussion and reflection that continues after the game session is over and outside the context of the game. However, the resources needed to create a commercial computer-based game are formidable, in many cases requiring the expertise of game designers, computer artists, and programmers, not to mention robust marketing support. Many have endeavored to create educational games for the classroom and workplace, but most have neither the resources nor the expertise to match the production quality and comprehensiveness of content characterized by more mainstream, commercial, computer-based games.

Given these requirements and constraints, how might one harness and channel a game's learning opportunities into the classroom? Perhaps game mods could provide a means for educators to use the quality and basic format of commercial games to create customized instruction for enabling students to create meaning in their own learning. A game mod describes a modification within an existing commercial computer-based game that has been created by a user. To do this, a user works with the game's existing assets to alter a small segment of the game's graphics, text, audio, or interactivity. In effect, a user can participate in the creative process by taking the setting of his or her favorite game and customizing it for entertainment purposes or to convey information.

Mods: Rules of the Game and Terms of Engagement

For years, commercial computer-based game developers committed considerable resources toward preventing users from hacking into or hijacking their games (Holt, 2004); however, and perhaps in keeping with the spirit of gameplay, many game users considered these prohibitive efforts simply another challenge to master within the game environment (Holt, 2004). Now, several computer-based game developers are providing editors with their products to encourage users to create content (Marriott, 2003; Prensky, 2003). It is important to note that these editors do not reveal the entire code but only enough for the user to create several levels of modification (Holt, 2004; Marriott, 2003; Prensky, 2003).

Why do commercial game developers even offer this much? According to Chaptman (2004), Holt (2004), and Prensky (2003):

- Within the game cultures, cool game companies encourage modding; they are more respected for their responsiveness and their

Game Mods

show of confidence in their users' technical competencies.

- The game developers are ensured continued play and sales, especially as the user can make the game continue to expand to more levels.

In keeping with the gaming culture, a game's modding capability comes with several rules spelled out in the license that comes with the game's software:

- The modder cannot make money off of their mods.
- The modder needs to own the base games.
- The modder cannot combine mods from different games into one mod.

To what extent does modding serve the modder? According to Holt (2004) and Prensky (2003):

- The mods are free to make.
- Modding provides a way for gamers to make their own games ("I can do it better"). The modder creates a new free game and extends gameplay of a game that otherwise may satisfy for two to three weeks.
- The modder can upload their mod to a modder's forum to showcase their work and to participate in a large community of workers, fans, and game players.

Note, too, that modding can be done at different levels, from a simple change to the appearance of a character to a more complex creation of a completely new setting, complete with AI. For the purposes of classroom use, however, what follows is an examination of how to bring modding into the classroom as a creative learning exercise without the encumbrance of complicated prerequisite technical skills.

Tools for the Classroom

Two popular computer games—Civilization, created by Sid Meiers and published by Firaxis software; and Electronic Arts' The Sims, created by Will Wright—provide easy-to-use, easy-to-access tools for customizing gameplay. Civilization is considered the penultimate commercial educational game (Squire, 2004). Played alone or with several players, Civilization is a geographically oriented and world-history, fact-driven game. Its gameplay requires the user to use maps and resources to manage the development of a civilization, based on the limits and opportunities presented by topography, resources, cultural affectation, and interactions with surrounding cultures (Squire, 2001, 2002, 2004). By comparison, The Sims is another popular but less educational game that allows user customization as well, but its outcomes are shaped less by geographic and political landscape and more by social considerations (Squire, 2001, 2004). The Sims often is described as less of a game and more of a simulation (hence, its name) or a toy, in that it is not designed around a more concrete goal (Fortugno & Zimmerman, 2005). Others argue that the goal of The Sims is to succeed in keeping the Sims going (Wright, 2003). Regardless of the arguments, the game does suggest a potential for application beyond simply engaging the user in a digital dollhouse. The Sims already has been modded for use in language curricula (Squire, 2004). Instructors have gone into the code layer to change the prompting language from English to French, for instance, to encourage incidental language learning via the gameplay experience. Others have taken its modding capabilities even further and into exciting new directions by creating public service advertisements¹ and replications of music videos² with The Sims' video capture tools.

Building a Plantation

To see how game modding can be used in a classroom setting, we used the popular, more flexible game *The Sims*, created by Electronic Arts. The *Sims*' game engine also allows and encourages the user to create buildings as simple as a modest bungalow, for example, or as complex as a historical landmark, such as Thomas Jefferson's Monticello. We endeavored to create a virtual Monticello (Figure 1) to see how far we could go with *The Sims*' game engine to create a mod based on the structure and its social interaction and then to determine the extent to which the final product might foster motivation, game literacy, or media dialogue.

We spent 20 hours using *The Sims*' tools to create Monticello, based on research of the plantation's blueprints and house plans as well as the historic significance of the time in which it was built. While *The Sims* has an engine that allows for elaborate construction, it did present some limitations:

- Pop art and modern home furnishings that the user can access to decorate the structure, thus interfering with the historical integrity of the house.
- Timed programming variables that can be difficult to alter. At one point, a school bus drove by and took Patsy Jefferson with it. It was necessary to wait until another game-play session in order for Patsy to return (by bus).

To customize a mod further, a user can venture, as we did, into the online community proliferating around *The Sims* in order to find tools for importing furniture. Some of these tools are created by modders not affiliated with *The Sims* who often expanded on the existing *Sims* editor code to enable more elaborate modifications (Figure 2).

Similarly, to create more real-life, Monticello-based characters, *Sims Creator* (Start/Programs/Maxix/Sims/Sims Creator) was used to create a specific type of person, from personality attributes to physical appearance and gender (Figure 3).

Reactions: The Learner

To begin our study, we opened the mod to a group of four high school students. Two of them were regular *Sims* players. At first, they wanted to sit back and watch, hoping to observe a historical reenactment of what might have taken place in the plantation they all had visited in person at least once.

As is typical of female *Sims* players (Chu, Heeter, Egidio, & Mishra, 2004), the girls were more interested in what people in the house were doing and how they got along. Sally Hemmings worked on the first floor. Another cooked in the basement. A butler wandered between the entryway and Thomas Jefferson's bedroom, where Jefferson stood pensively. Eventually, the cook caught on fire, and the girls used their *Sims* skills to attempt to save the cook—despite their efforts, death intervened. In time, the focus group also explored the mischief that players typically get into by fooling the game and by directing characters to behave badly to see what would happen (perhaps this is the digital-age version of teasing the cat or a prank phone call). Mischief accomplished or not, the focus group collectively expressed interest in accessing the blueprints for the plantation's gardens so that they could recreate them within the mod. Hence, despite the shortcomings of our virtual Monticello, our focus group validated Gee (2003) and answered the call that beckoned from the computer game: to pursue self-directed learning by solving complex problems. Such self-directed exploration to go beyond the boundaries of one's current understanding to create and assimilate meaning is also, of course, rich in constructivist learning implications (Jonassen, 1992; Satterly, 1987).

Reactions: The Classroom Teacher

We then presented the Monticello mod to five middle school and high school teachers for whom we demonstrated the Monticello mod and then asked to explore it on their own. Afterwards, we discussed with them the extent to which they found such a tool feasible for classroom use and how they might use it for learning. All of the instructors in the group were familiar with The Sims, but none had previous experience with it.

The instructors' first responses to the virtual Monticello mod was that it looked like a digital replacement of the traditional, second-grade diorama in the shoebox assignment. Initial issues with the mod were that it does not quite accurately represent the plantation physically. One indicated that they would like the ability to:

- Import historically relevant artifacts into the framework.
- Change character attributes to accurately represent historic personalities.
- Change the rules so that characters could not earn creativity points based on artistic accomplishments but rather earn points based on something that would have been important for that character during a given time period, or remove the point option altogether. "History is not a game," as one ardent history teacher explained.
- Reshape the going-shopping metaphor in the game engine that allows users to spend Sims dollars to construct and furnish the house. We used cheats to access Sims dollars to create this mod, following a financing strategy similar to that which Jefferson sometimes used to construct and furnish his own Monticello.

The teachers also expressed concern that a student might be more engaged in the gameplay than in the learning. One suggested that in the classroom, the student would want to use a mod

Figure 1. Virtual Monticello

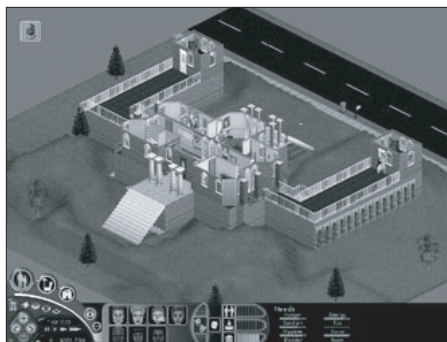


Figure 2. Jefferson's revolving bookstand

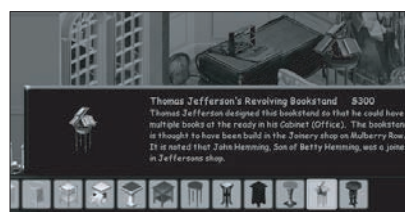


Figure 3. Peter Fosset description



like the virtual Monticello to emphasize its historical significance, toning down the novelty of its gameplay. Another expressed that that he was

“excited about the possibility of bringing the past to the present” with mods, citing their value as “an observation tool,” and liked the idea of being able to go in and move around, adding, “I can explore the past and explore interactions!” By doing so, he felt that his students could gain insight through exploration and inference by considering the period characteristic values and experiences of historical figures that might shape their choices and behaviors.

Even with programming limits of *The Sims*, most teachers felt that their students could use such mods to experience a “good approximation” of the past, one that would help them to construct their understanding of the time period and issues that shaped decisions. Given this utility, one instructor noted that historically contextual game mods could fortify the development of his students’ mental models, and that as a teacher, he would have better insight into his students’ historical reasoning, based on the decisions they made within the framework.

“I could present [a mod] as an alternative assessment, opposed to a test or paper,” he explained, adding, “That you can change things is very exciting for the study of history.”

Contextualizing the Mod in the Classroom

As teachers explored how they might use the virtual Monticello mod in a classroom setting, their ideas for implementation included:

- A class inquiry. The teacher could run the mod on the projector and discuss how to interact with it with the class. Later, the students could work in groups on their own mods to explore and create shared meanings. The instructor could alternate between using class and group mods to promote inquiry and discussion. As one teacher pointed out, “There’s a lot of value just in creating

the scenario and having the students do the research for that.”

- An examination of character. “I want to see Monticello and send in Nat Turner,” one explained, to see how a character programmed with Nat’s attributes would react in a plantation setting. One instructor suggested replacing Jefferson with Napoleon for the same reasons.
- A yearlong study. One teacher suggested that the creation of the scenario could be an ongoing project, divided across academic quarters, each dealing with a different part of its construction in a way that parallels the course content delivery.

Integrating any type of computer game into a curriculum shifts the culture of the classroom from one that is teacher-driven to one that is a more user-centered learning environment; the teacher becomes a facilitator rather than a proffer of knowledge (King 2003; Squire 2004). However, when computer games are introduced into the classroom, the teacher has an amplifying effect on the learning outcome. If the teacher is appropriately prepared to use a game in his or her curriculum, it augments the learning success. Unfortunately, the inverse is true if the teacher is less aware of how to facilitate learning using computer games (Squire 2004).

Perhaps we can begin managing this amplifying effect by focusing on what the teacher *can* do

Figure 4. Jefferson in his study



Game Mods

to prepare for bringing game-based learning into the classroom by:

- Identifying the equipment and entry behaviors required for the game.
- Determining the time required for the game to make an impact on learning. Typically, a student needs time to understand how to use a game before he or she can begin learning with it.
- Recognizing the types of learning that computer-based learning facilitates, which is more knowledge-based and, to an extent, subjective.
- Determining how computer-based learning can support the learning goals.
- Choosing an appropriate game or game editor for creating mods.
- Contextualizing the game into the curriculum in a way that encourages exploration, discovery, and the development of conceptual tools.
- Including appropriate scaffolding as well as off-line activities that encourage reflection, dialog, and shared meanings among the learners beyond the context of the game.

It is also worth exploring if an IT specialist should be familiar with the utility of game-based learning and how to use it in a classroom setting as well in order to support the classroom teachers in meeting their learning goals. This same person could be called upon to create simple learning mods or skeletons for the students to work with, as specified by an instructor, or based on a given curriculum's learning goals.

Finally, and perhaps most importantly, the instructor needs to be game-literate, recognizing and understanding that computer games are a means of expression and representation (Green, 2004) and that, like reading and writing, game literacy develops when the learner has the tools and ability to create his or her own games (Clark, Perrone, & Reppenning, 2005; King, 2003).

CONCLUSION

The purpose of this discussion is to examine how game mods might provide an affordable, comparable, and customizable alternative to wildly successful commercial games, an alternative that could be used in a classroom setting to facilitate a meaningful learning experience. However, the success of the use of game mods in the classroom will depend not only on the novelty of a good idea or on how comfortable the instructor and learner are with using computers and making simple changes to existing applications, but also on how well the modding activities are contextualized within the curriculum. Creating meaning still needs to be forged within an evocative and relevant context.

ACKNOWLEDGMENT

Rodney van Zyl, The University of Virginia, USA, for the artwork included in this article.

REFERENCES

- Boards. The creative edge in commercial production. (2005). Public Health Department, Belgium—Teenage Mum. Retrieved from <http://www.boardsmag.com/screeningroom/animation/1146/>
- Chaptman, D. (2004). Video-games in the classroom. *Wisconsin Technology Network*. Retrieved from <http://www.wistechnology.com/article.php?id=513>
- Chu, K., Heeter, C., Egidio, R., & Mishra, P. (2004). *Girls and games literature review*. Michigan State University Mind Games Collaboratory. Retrieved March 10, 2005, from http://spacepioneers.msu.edu/girls_and_games_lit_review.htm
- Clark, D., Perrone, C., & Reppenning, A. (2005). Webquest: Using WWW & interactive simulation

games in the classroom. *First Monday*. Retrieved from <http://www.firstmonday.dk/issues/issue5/perrone/>

Donaldson, M. (1984). *Children's minds*. London: Fontana.

Fortugno, N., & Zimmerman, E. (2005). Soapbox: Learning to play to learn—Lessons in educational game design. *Gamesutra*. Retrieved from http://www.gamasutra.com/features/20050405/zimmerman_01.shtml

Gee, J.P. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave Macmillan.

Gorilla Mask. (2005). "Trapped in the closet" performed by *The Sims (Part 1)*. Retrieved from <http://gorillamask.net/rksims1.shtml>

Green, H. (2004). *Researchers and teachers push for games in schools*. The Institute of Education, University of London. Retrieved March 10, 2005, from http://ioewebsserver.ioe.ac.uk/ioe/cms/get.asp?cid=1397&1397_1=10817

Holt, T. (2004). How mods are really built. *Serious Games Summit DC*. Retrieved March 10, 2005, from <http://www.cmpevents.com/GDe04/a.asp?option=C&V=11&SessID=3305&Mgt=0&RVid=0>

Jonassen, D. (Ed.). (1988). *Instructional designs for microcomputer courseware 101*. Hillsdale, NJ: Lawrence Erlbaum.

Kim, L.S. (1995). Creative games for the language class. *Forum*, 33(1), 35.

King, B. (2003). Educators turn to games for help. *Wired News*. Retrieved March 10, 2005, from <http://www.wired.com/news/games/0,2101,59855,00.html>

Marriott, M. (2003). Games made for remaking. *The New York Times*. Retrieved March 10, 2005, from <http://www.nytimes.com/2003/12/04/technology/circuits/04modd.html?ex=1135227600&n=0fc160f73ad53e42&ei=5070>

Prensky, M. (2001). *Digital game-based learning*. New York: McGraw Hill.

Prensky, M. (2003). "Modding"—The newest authoring tool. *www.marcprensky.com*. Retrieved from <http://www.marcprensky.com/writing/Prensky%20-%20Modding%20-%20The%20Newest%20Authoring%20Tool.pdf>

Satterly, D. (1987). Piaget and education. In R.L. Gregory (Ed.), *The Oxford companion to the mind*. Oxford: Oxford University Press.

Squire, K. (2001). Games to teach project. *Education Arcade*. Retrieved from <http://www.educationarcade.org/gtt/>

Squire, K. (2002a). Cultural framing of computer/video games. *Game Studies*, 2(3).

Squire, K. (2002b). *Replaying history: Learning world history through playing civilization III*. Retrieved from <http://website.education.wisc.edu/kdsquire>

Squire, K. (2004). What happens when games go into any classroom situation? *Serious Games Summit DC*. Retrieved March 10, 2005, from <http://www.cmpevents.com/GDe04/a.asp?option=C&V=11&SessID=3250>

ENDNOTES

¹ <http://www.boardsmag.com/screening-room/animation/1146/>

² <http://gorillamask.net/rksims1.shtml>

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 2, Issue 4, edited by L. Tomei, pp. 15-23, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.28

A Statewide Analysis of Student Web Portfolios in New York Colleges and Universities

John DiMarco
St. John's University, USA

ABSTRACT

This survey research project investigated the existence of Web portfolios on academic Web sites in New York State. The goal of this project was to promote Web portfolios and the main objective was to provide interpretation of the current level of student Web portfolio usage and activity within all New York colleges and universities. Major findings were that there is a low quantity of Web portfolios in relation to overall student enrollment, thus providing impetus to study a new phenomenon, lack of Web portfolios. The study yielded data providing a breakdown of where and how many Web portfolios were found. This study provides a basis for further research by scholars into Web portfolios within academic settings.

BACKGROUND

Understanding what a Web portfolio is and is not is sometimes not easy. Is a Web portfolio a course Web site? No, it is not. Is a Web portfolio a non-professional personal Web site used for posting

personal data related to social outcomes? No, it is not. A Web portfolio is a personal Web site that provides evidence of your skills and expertise in the form of artifacts (photos, professional documents, artwork, and multimedia content, including audio, video, and animation) from any discipline or field. The ideas behind the Web portfolio as a tool for assessment, lifelong learning, and skill building have not been proven nor have they been embraced by society or academia, at large. Those who exude confidence and passion for the notion of universal access to Web portfolios and Web portfolio skills cannot yet say that the Web portfolio has become an accepted, professional cyber identity. This paper yields conclusions that uncover some intriguing dialogue surrounding Web portfolios. There are not very many student Web portfolios found through college and university Web sites. The new phenomenon that has emerged from this research is the lack of Web portfolios.

Goldsby and Fazal (2001) note that student created portfolios are:

[Commonly] used in teacher preparation programs to demonstrate teaching skills and exper-

tise. This practice was introduced as test scores alone lack the comprehensive scope needed for effective assessment and evaluation, portfolios can be implemented to interpret/make decisions regarding learning of teaching competencies. (pp. 607-608)

The case for the student portfolio in any discipline can be made on the same basis; electronic portfolios provide a new level of assessment that cannot be measured by traditional methods, such as standardized tests, applications, and resumes. Electronic portfolios and Web portfolios provide assessment of competency within a discipline as well as a marketable tool for graduates. The Web portfolio has promise as a tool, platform, and impetus for worldwide learning and growth in technological skills. The objective of this research project is to provide an accurate interpretation of the level of Web portfolio usage within the colleges and universities of New York State.

As we move towards more fluent, ubiquitous platforms for Web media, such as Internet-ready phones, Web-based television, and wireless personal digital devices, the Web portfolio and its place as an assessment tool, a learning tool, and a vehicle for lifelong learning has been recently scrutinized by scholars. Scholarly definitions of the electronic portfolio (e-portfolio) vary from discipline to discipline. To define the Web portfolio, we must first define the e-portfolio. DiMarco (2005) put forth this definition:

The electronic portfolio is a collection of artifacts, project samples, cases, and focused content presenting the messages and professional and public appearance of an individual or a company through electronic media (Web, DVD, CD-ROM). The e-portfolio provides evidence of skills, experience, and learning. I define the Web portfolio as: an electronic portfolio that is an internet delivered, interactive, mass communication used to persuade users. (p. 13)

Greenberg (2004) writes:

Ideally, all work in an electronic portfolio not only is digital but also is available on the Internet. Yet even though materials may be visible on the Web, the ePortfolio is not simply a personal home page with links to examples of work. In addition, unlike a typical application program, such as word processing, an ePortfolio is a network application that provides the author with administrative functions for managing and organizing work (files) created with different applications and for controlling who can see the work and who can discuss the work (access). (pp. 28-29)

This definition presents several items for closer analysis. First, Greenberg (2004) makes a distinction that the e-portfolio is not only digital but also available on the Internet. Development of the e-portfolio and delivery are typically centered on using the Web. By using the Internet for delivery, e-portfolios become less effective and more prone to failure. Also, an e-portfolio is not just a home page. Any portfolio needs to be filled with work samples and evidence of growth and learning throughout a career, an amount of information that cannot be delivered effectively in only one page. An e-portfolio must be a narrative that gives perspective to the viewer. The perspective of the viewer is shaped by the content and structure of the Web portfolio. Greenberg also describes the e-portfolio as having a network function. The Web portfolio specifically is a content container that allows dynamic storage capabilities as well as obvious delivery features. Content management is the concept that is essential to bringing Web portfolios into use across jobs and disciplines. The creator of a Web portfolio will gain technical skills by acting as an administrator for his or her own Web site, which will be an e-portfolio. The e-portfolio allows a student to manage his or her work throughout an academic and a professional career.

Either creation of an e-portfolio is fostered within a learning environment, or the skills are gained through self learning. The e-portfolio provides opportunity for both. The e-portfolio is a tool for lifelong learning and will be part of learning and growing throughout a person's college and professional life. Gathering materials and creating Web pages provides a learning experience that will carry over into a professional skill set. As network computers and the Internet become standard in every aspect of our lives, the skills and abilities needed to present creative and intellectual capital will become paramount to success in a technological marketplace.

Greenberg (2004) says there are three types of e-portfolios. Each is defined by the author's assumed goals. This can be helpful in developing content a management structure in a simplified manner. The structure of each type of e-portfolio differs based on the point of origin of the work. Greenberg believes this results in three types of e-portfolios:

1. The *showcase ePortfolio*: organization occurs after the work has been created.
2. The *structured ePortfolio*: a predefined organization exists for work that is yet to be created.
3. The *learning ePortfolio*: organization of the work evolves as the work is created. (2004, p. 29)

Greenberg's (2004) three portfolio types are effective for establishing types of portfolios based on content. A more appropriate structure might focus on the audience for the e-portfolio because it is important that the e-portfolio is user- and audience-centered. Greenberg's e-portfolio types fit into an author-based definition of e-portfolio types, which is a broad approach to classifying e-portfolios. However, referring specifically to Web-based e-portfolios, three types can be defined:

1. The personal Web portfolio for students or individuals,
2. The teacher Web portfolio, and
3. The business Web portfolio.

Scholars, including Sanders (2000) and Moonen and Tulner (2003), have praised the virtues of Web portfolios. These scholars agree that there is a need to embrace the Web portfolio as a tool, regardless of the discipline. These scholars also agree that the Web portfolio is a tool and should be mastered by teachers and taught to students within the appropriate contexts of their disciplines. Specifically, one example would be that of an art portfolio. This type of portfolio has a structure and presentation style that will focus on the artwork and the skills of the artist. The same method can be adapted for a student in the discipline of English. In this case, the portfolio should focus on the writings and literature aptitude of the creator. In his personal case study on Web-based portfolios for technology education, Sanders (2000) states that:

The information age is not just a cliché—we're living it! Global networked information systems such as the World Wide Web are changing nearly every aspect of our lives. These technologies should be prominent within our curriculum. Often, they are not. Web-based portfolios offer a meaningful way for technology students to gain a thorough understanding of these critical new technologies beyond mere Web research. Web-based portfolios provide benefits that can never be realized with conventional portfolios. (p. 11)

The Web portfolio has grown well beyond the boundaries of the education and technology fields. It is finding its way outside of educational institutions and into human resources and other corporate directions. This idea is supported by Moonen and Tulner (2003) who reported:

*But also beyond regular education, interest in electronic **portfolio** is growing. EifEL [7] that commencing in May 2004, EifEL (European Institute for E-Learning) is going to provide all of its Members with an electronic **portfolio**, the most innovative and fastest growing technology in the field of education, training and human resource development. (p.1)*

Mainstream integration of the use of Web portfolios at colleges and universities is a noble and promising endeavor for scholars, administrators, and students. The case for Web portfolios is one that seems to be emerging slowly. With a growing body of evidence supporting Web portfolios, one might assume that searching for and finding Web portfolios on college Web sites would be an easy task. However, finding a multitude of Web portfolios and rhetoric about Web portfolios on the Web sites of New York State colleges and universities was not a fruitful endeavor. Ultimately, this research found small evidentiary pockets of Web portfolios on these Web sites. The data from this research helped identify a new phenomenon—the lack of Web portfolios.

PROJECT GOALS

The goal of this project was to promote Web portfolios, and the main objective was to provide interpretation of the current level of student Web portfolio usage and activity within colleges and universities. For the present study, I examined the number of Web portfolios posted to the Internet by students through a Web portal or academic Web site from each of the 294 private and public colleges and universities in New York State. These were located using the Web site <http://www.nymentor.edu>. This study is exploratory and will be used to enable subsequent action research into the development of a comprehensive statewide Web portfolio program in New York. This study also

provides a basis for further research into Web portfolios within academic settings.

RESEARCH QUESTION

A personal Web portfolio serves as a self-selected, self-developed multimedia presentation of work that offers multiple views of a person's learning and development (DiMarco, 2005). Driven by creative expression and college learning experiences, Web portfolios provide tangible evidence of growth and accomplishment. Web portfolios also allow students to present research papers, essays, and academic projects that incorporate text, images, audio, and video. The disciplines of computer science, art, and education have embraced Web portfolio development most frequently. However students in all disciplines need a Web portfolio when they leave college. Having tools to help illustrate one's skills and experience is critical to a college graduate. A resume is one such tool. However, Web portfolios go beyond the traditional resume in scope of content and presentation by providing a broader platform for visual and interactive communication. After college, the Web portfolio can become a personal hub for professional communication with potential employers and the public. It can serve as a platform for publishing career accomplishments and presenting skills and experiences through content.

There is evidence that the use of Web portfolios in society is surging. This notion is present when reviewing the scholarly literature on academic Web portfolios, as well as content analysis of Google-based searches on Web portfolio programs. For example, Web portfolio programs are campuswide at The Penn State University (DiMarco, 2005) and even statewide in Minnesota (<http://www.efoliominnesota.com>). Web portfolio programs are becoming an important component of academe and are helping build technical com-

munication and presentation skills within today's information society.

The primary research question guiding this study was:

What is the level of Web portfolio usage (as measured by the presence of a Web portfolio) and activity (as measured by content and artifact incorporation) by students within the 294 colleges and universities of New York State?

METHODOLOGY

This study is a basic survey of the Web sites of the 294 New York State colleges and universities, undertaken to determine the level of Web portfolio existence or nonexistence. Data gathering methods included recorded observations of college and university Web sites, combined with content analysis and rigorous note-taking during Web site observations. This data gathering method pointed to specific usage or nonusage of Web portfolios by the students of each institution.

Survey research methods provided this research project with nominal quantitative data from an unknown population of national and international Web portfolios. The study used a sample frame of Web sites (294 out of 294) from New York colleges and universities.

Web portfolio analysis of 294 cases (college Web sites) began with a list that was obtained from nymmentor.edu. This included the demographic and enrollment data on all known colleges and universities in New York State. The nymmentor.edu Web site is managed by the New York State (NYS) Department of Higher Education. The nymmentor.edu site was used for data gathering because it provides topical, credible NYS education data. The site has an edu domain extension, which means that it is an educational domain and provides current data on the colleges and universities of every NYS city and county. After studying initial cases of Web sites, the data revealed no Web

portfolios at college sites for nursing and medical degree programs. The process of data gathering consisted of the following steps:

Step 1: Went to the school Web site based on the Web site address published on nymmentor.edu.

Step 2: Used the site search feature (if it was available) to perform limited keyword searches using the following six terms “web portfolios”; “digital portfolios”; “student portfolios”; “electronic portfolios”; “student websites”; and “student web portfolios.”

Step 3: Performed searches looking for clues to Web portfolios on the school site. After a minimum of 10 minutes of exhaustive searching, the next case was studied. *Step 3: Observation Methods.* Specific Web site sections that were investigated: observed technology services menus, observed home pages, observed sitemaps, observed search features within sites, observed technology departments, observed education departments, observed graphic arts departments, observed computer science departments, observed career services departments.

Step 4: Entered observation notes into MS Excel using the insert comment function. Entered notes for Web sites that had Web portfolios or evidence of articles, press releases, or faculty papers that referred to the use of Web portfolios or the planning of future use of Web portfolios at the institution.

Step 5: Counted total number of Web portfolios for each college or university; entered the data into an Excel spreadsheet containing the listed NYS colleges and universities; and generated percentages of Web portfolios

against enrollments.

Step 6: Read the field notes, reviewed sites again, and generated open-coding content analysis about the Web sites of NYS colleges and universities.

LIMITATIONS

As a researcher with a high level of experience in Web portfolio research, I entered this study with a level of bias that initiated a loosely shaped hypothesis that very few Web portfolios actually existed. However, during data gathering, I remained objective and attempted to uncover Web portfolios, even when my intuition led me to think that there would be none at the particular case Web site.

FINDINGS AND CONCLUSIONS

As this study progressed, it was evident that there were a small percentage of Web portfolios in comparison to total enrollment. The cumulative enrollment total reported by nymmentor.edu for NYS colleges and universities is 1,155,042 students. The total number of Web portfolios found was 4,570, which represents 0.39% of the enrollment population. Nine of the 294 schools had active retrievable Web portfolios. This finding points to the very small percentage of Web portfolios compared to the student enrollment at NYS colleges and universities. The same level of involvement seemed to continue throughout the colleges and universities, where Web portfolios were found. Among the nine schools, where evidence of Web portfolios was found, the highest percentage of Web portfolios was found at Syracuse University where 4,439 alphabetically listed Web portfolios existed in a student enrollment of 16,753. Syracuse University had the highest Web portfolio usage found, with 26.49% of the

students having some form of a Web portfolio on the Internet and accessible through the Syracuse University Web site.

As Web portfolios were found, authorship, content, and context were recorded. The Figure 1 is a breakdown of region, setting, total enrollment, and percentages for Web portfolios together with enrollment data for the nine schools where Web portfolios were found.

The study focused on gaining insight into the existence or nonexistence of student Web portfolios available via the Web sites of NYS colleges and universities. As the Web portfolio situation unfolded during this study, the data revealed some interesting facts that might yield additional parameters for investigating Web portfolio activities within academia. Two facts seemed to evolve from this study. The first fact was few Web portfolios are readily available for viewing at the Web sites of NYS colleges and universities. Also, when Web portfolios were found, there were few in relationship to the total enrollments of the institutions. The largest Web portfolio stake is claimed by Syracuse University, which presents Web portfolios for more than 26% of the total enrolled student population.

The second fact found was that many academic Web sites posted documents regarding the virtues of and an involvement with Web portfolios, yet these institutional Web sites showed no tangible implementation of Web portfolios by students. To elaborate on this point, when searching colleges and university Web sites using the site search engines, much data was found on various case sites that discussed Web portfolio programs and technology grants received by institutions to create comprehensive or pilot Web portfolio programs. Although evidence of this literature was found in the form of faculty newsletters, academic memos, and research proposals, there were few or no Web portfolios found at the institution's Web site.

This was observed in more than a dozen case sites examined. At Adelphi University, for ex-

A Statewide Analysis of Student Web Portfolios in New York Colleges and Universities

Table 1. College and university Web portfolio totals

| CASE # | School name | Region | Setting | Total enrollment | Web portfolio link on homepage | Web space provided by school (~ accts) | Total # of working student Web sites/portfolios found | % of Web portfolios to enrollment |
|--|---|----------------|---------------|------------------|--------------------------------|--|---|-----------------------------------|
| 10 | Bard College | Mid-Hudson | Rural setting | 1,726 | no | yes | 15.00 | 0.86% |
| <p>Bard has a student server that allows students to voluntarily post personal Web pages and Web sites. Found 19 Web portfolio/personal Web sites listed, but only 15 with active content. There were also several blogs.</p> | | | | | | | | |
| 88 | Hobart and William Smith colleges | Genesee Valley | Small town | 1,847 | no | yes | 10.00 | 0.53% |
| <p>Ten Web pages from a computer graphics class were found. They did not fit the typical Web portfolio criteria; they were class projects only.</p> | | | | | | | | |
| 115 | LaGuardia Community College | New York City | Urban | 12,875 | no, but one link away | yes | 17.00 | 0.13% |
| <p>Notes: Found 17 Web portfolios posted; entire Web portfolio program; and found some scattered samples of other student portfolios.</p> <p>Summary: The college with the most prominent, pedagogically integrated e-portfolio (Web portfolio) program is LaGuardia Community College. The program is highly visible throughout the college Web site.</p> | | | | | | | | |

continued on following page

Table 1. continued

| | | | | | | | | |
|-----|---|-------------|------------|--------|----|-----|-------|-------|
| 122 | <u>Long Island University - C.W. Post</u> | Long Island | Suburban | 8,421 | no | yes | 4.00 | 0.04% |
| | There were four portfolios (doctoral students in information studies and personal URLs that were not on college-sponsored space). | | | | | | | |
| 224 | <u>State University College at Buffalo</u> | Western | Urban | 11,072 | no | yes | 1.00 | 0.01% |
| | There was one portfolio by an art student. | | | | | | | |
| 225 | <u>State University College at Cortland</u> | Central | Small town | 7,331 | no | yes | 47.00 | 0.64% |
| | There were 47 portfolios found (educational technology students as a class project). | | | | | | | |
| 252 | <u>SUNY College of Technology at Farmingdale</u> | Long Island | Small town | 6,250 | no | yes | 7.00 | 0.11% |

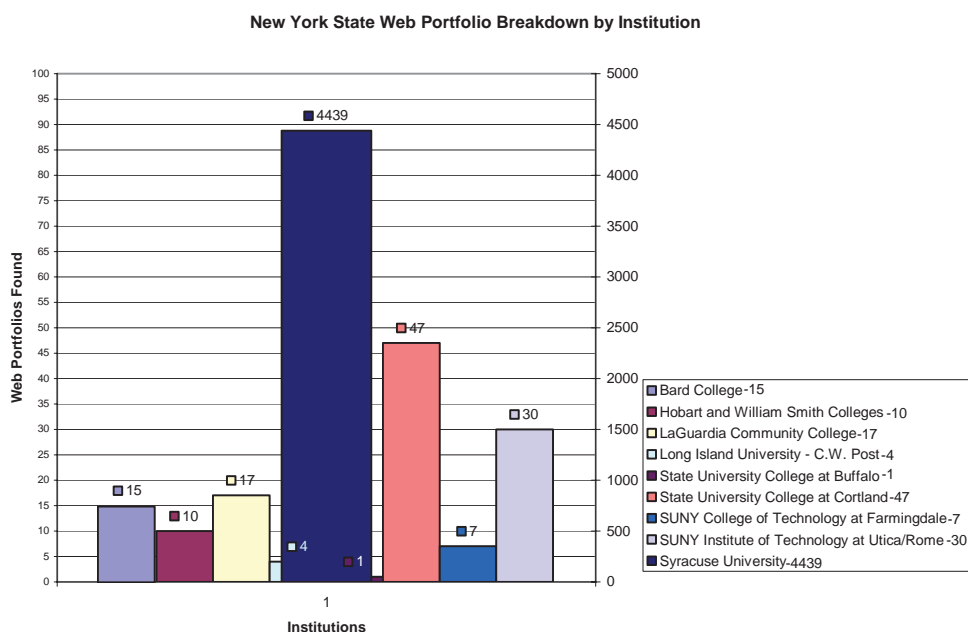
continued on following page

A Statewide Analysis of Student Web Portfolios in New York Colleges and Universities

Table 1. continued

| | | | | | | | | |
|--------|--|-----------|----------|-------------------|----|-----|-------------------------|--|
| | <u>Graphic design students had 7 portfolios.</u> | | | | | | | |
| 263 | <u>SUNY Institute of Technology at Utica/Rome</u> | Northeast | Suburban | 2,432 | no | yes | 30.00 | 1.23% |
| | <u>Notes: 30 found (technical communication students with well-done work).</u> | | | | | | | |
| | <u>Summary:</u> The Web portfolios that exhibited the highest quality work and design were located at SUNY Institute of Technology at Utica/Rome. The work was from bachelor's and associate degree students in technical communication. | | | | | | | |
| 267 | <u>Syracuse University</u> | Central | Urban | 16,753 | no | yes | 4,439.00 | 26.49% |
| | <u>Notes: 4,439 found; some were just used as space; some had home pages; "~" accounts on Syracuse University servers; and Unix editors or FTP.</u> | | | | | | | |
| | <u>Summary:</u> Syracuse University had the largest number of Web portfolios with 4,439. This institution had by far and away the most populated Web portfolio gallery. The space was an account off of the university's server. The Web portfolios are kept active by the university for 10 years after students graduate. Student Web addresses have "~" in the URL. | | | | | | | |
| Totals | | | | 68,707 enrollment | | | 4,570.00 Web portfolios | 6.60% of Web portfolios compared to enrollment |

Figure 1.



ample, a Web article, written by education faculty members, described the use of an information technology-based system for Web portfolios in use by the special education department. Despite the presence of the article, there was no evidence of Web portfolios. The point here is that there seems to be data pointing to Web portfolios at many institutions, but little or no action to implement a viable, usable, embraceable solution.

The most active Web portfolio program appeared to be at Syracuse University. This conclusion was based on the proportion of users to enrollment. In the case of Syracuse University, the institution provides Web space to all students for the creation and development of a Web portfolio. It also provides instructional technology resources, such as a dedicated system for Web space users, basic tutorials on uploading files, and frequently asked questions. The support and creative freedom provided by the institution might be part of the reason why so many students are taking advantage of the university's Web space.

The most pedagogically integrated Web portfolio program existed at LaGuardia Community College. Formal examples of Web portfolios are showcased along with digital tools and processes. These items are outlined in a dedicated Web portfolio section of the college's Web site that resides only one click away from the home page. Although organized and well funded, the LaGuardia e-portfolio project only showcases 17 Web portfolios, a mere .13% of enrollment. This is substantial because the college has initiated a strict policy of Web portfolio development within the curricula. However, few Web portfolios actually exist for viewing on the college's Web site.

Another area that further research might target is Web portfolio usage within technology- and nontechnology-related disciplines, and Web portfolio use by faculty members to see whether a relationship exists between the existence of teacher Web portfolios, disciplines, and the development of student Web portfolios. Are students more likely to create a Web portfolio if they have a professor facilitating or mentoring

the process? Several trends in this direction were observed when analyzing the data. Some sites showed student projects are a large part of the portfolio population within educational technology departments. SUNY Cortland had a student Web portfolio population from several concurrent sessions of a course in the use of educational technology.

A literature review has shown that the promise of Web portfolios is apparent and usage is growing among academic institutions throughout the world. The present analysis of Web portfolio activities at NYS colleges and universities has demonstrated small numbers of Web portfolios in relation to overall enrollment. I set out to answer the question: What is the level of Web portfolio usage (as measured by the presence of a Web portfolio) and activity (as measured by content and artifact incorporation) by students within the 294 colleges and universities of New York State? The answer is the level of usage is extremely low in relation to enrollments. This fact leads me to view the Web portfolio phenomenon as a research topic that might be studied using exploratory methods. Future research might help indicate why there is such a lack of Web portfolios available for viewing on the academic Web sites of colleges and universities in New York.

ACKNOWLEDGMENT

Professor DiMarco would like to thank Dr. Richard Smiraglia for his mentoring during this research project.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 2, edited by L. A. Tomei, pp. 15-25, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

REFERENCES

- DiMarco, J. (2005). *Web portfolio design and applications*. Hershey, PA: Idea Group.
- Goldsby, D., & Fazal, M. (2001). Now that your students have created Web-based digital portfolios, How do you evaluate them? *Journal of Technology and Teacher Education*, 9(4), 607-616. Retrieved from <http://proquest.umi.com>
- Greenberg, G. (2004). The digital convergence: Extending the portfolio mode [electronic version]. *Educase* 39(4), 28-37.
- Listing of colleges and universities managed by New York State Department of Higher Education*. Retrieved February 1, 2006, through April 2, 2006, from <http://www.nymmentor.edu>
- Moonen, J., & Tulner, H. (2003). *E-learning and electronic portfolio: Some new insights*. The Netherlands: Universiteit van Twente. Retrieved September 5, 2006, from <http://www.connict.nl/pdf/moonentulner-portfolio.pdf>
- State-wide portfolio project for the state of Minnesota*. Retrieved March 10, 2006, from <http://www.efoliominnesota.com>.
- Sanders, M. (2000). Web-based portfolios for technology education: A personal case study. *The Journal of Technology Studies*, 11. Retrieved September 5, 2006, from <http://scholar.lib.vt.edu/ejournals/JOTS/Winter-Spring-2000/pdf/sanders.pdf>

Chapter 3.29

Innovative Technologies for Education and Learning: Education and Knowledge-Oriented Applications of Blogs, Wikis, Podcasts, and More

Jeffrey Hsu

Fairleigh Dickinson University, USA

ABSTRACT

A number of new communications technologies have emerged in recent years that have been largely regarded and intended for personal and recreational use. However, these “conversational technologies” and “constructivist learning tools,” coupled with the power and reach of the Internet, have made them viable choices for both educational learning and knowledge-oriented applications. The technologies given attention in this article include instant messaging (IM), Weblogs (blogs), wikis, and podcasts. A discussion of the technologies and uses, underlying educational and cognitive psychology theories, and also applications for education and the management of knowledge, are examined in detail. The implications for education, as well as areas for future research are also explored.

INTRODUCTION

For many years, the mediums employed for education have remained fairly constant and traditional: tried and true methods such as the blackboard and chalk, whiteboards, flipcharts, and overhead projectors. The employment of computing technologies has resulted in the use of PowerPoint, e-mail, and Web-based course portals/enhancements such as Blackboard and WebCT.

There have been numerous studies done, and papers written, about the use of technology in the classroom, together with work on the related areas of e-learning, Web-based learning, and online learning. The usage of computing technologies in education has been examined in numerous studies, and there is a sizable body of work on Web and online learning, including the studies by Ahn, Han, and Han (2005), Liu and Chen

(2005), Beck, Kung, Park, and Yang (2004), and numerous others.

In particular, some of these technologies have been recognized as useful in the classroom, and have been engaged in innovative ways. The technologies of particular interest are those that are referred to as “conversational technologies,” which allow for the creation and sharing of information (KPMG, 2003; Wagner, 2004). Another term often used to describe these technologies is the concept of “constructivist learning tools,” which encourage, and are focused on, users creating, or constructing, their own content (Seitzinger, 2006).

The interest in employing these kinds of technologies stems not only from the unique pedagogical benefits gained, but also from the basic need to stay in tune with the focus and strengths of today’s students. Prensky (2001) suggests that the students being taught today are “no longer the people our educational system was designed to teach” and that while the students of today can be termed “digital natives,” many educators could be better termed “digital immigrants.” Yet another way to look at this is to view earlier educational approaches as “print-based,” while those of the current environment can be called “digitally-based, secondly-oral” (Ferris & Wilder, 2006).

The purpose of this article is to examine these technologies and explore both the evolution of their use from personal applications to that of educational tools, and also to examine the key educational applications for which these are being used. Relevant research and applications are examined and analyzed. The future of these technologies for educational and professional use, together with viable research areas, is examined as well.

CONVERSATIONAL TECHNOLOGIES AND CONSTRUCTIVIST LEARNING TOOLS

The notion of conversational technologies is not a new one, as it encompasses many types of systems that have been widely used for some time, including e-mail, video conferencing, and discussion forums.

The term “conversational technology” is derived from the work of Locke et al. (2000) relating to conversational exchanges and his Cluetrain Manifesto. One of the key concepts here is that “markets are conversations” and that knowledge is created and shared using question and answer dialog. Specific theses that relate to this form of “conversational knowledge management” suggest that aggregation and abstraction of information helps to create information. Other characteristics of conversational knowledge management include the fact that it is fast, stored in different locations, and does not require sophisticated technologies in order to be accomplished (Wagner, 2004).

Conversational technologies encompass a wide range of systems and software, many of which are familiar, including e-mail, instant messaging, Web pages, discussion forums, video and audio content/streaming, wikis, and Weblogs. While there are specific aspects that are of interest in terms of the more mature technologies, the ones that will be given attention in this article are the issues, impacts, and applications relating to IM, blogs, wikis, and podcasts. These are technologies that are newer, have a growing base of users, and are starting to become recognized as viable tools for education.

The term “constructivist learning tool” has also become associated with these, particularly blogs

and wikis, in that they have a key characteristic of allowing users to develop and maintain their own content. Some of the characteristics of constructivist learning include engagement, active learning, collaboration, real world based, and the usage of reflection as a part of the learning process (Seitzinger, 2006).

It should be noted that these technologies and tools are best suited to course structures where class collaboration and communication are encouraged, rather than those with an emphasis on lectures and a presentation of factual information. In addition, in courses where there is substantial group work, or projects where a collaborative document is created, the use of these would be especially helpful and useful. Both hybrid and full distance learning courses would be situations where these could also be used effectively.

TEACHING AND LEARNING: NEW TRENDS

Conversational and constructivist technologies are certainly here to stay, as evidenced by their extensive role in our society. It would therefore be useful to examine their applicability in the educational realm. While usage based on popularity or student preference seems to be one factor, there are also theoretical and conceptual bases for employing these kinds of technologies in the classroom.

Earlier paradigms of teaching emphasized print-based materials for instruction, which included printed textbooks, paper-based instructional materials, and written tutorials, all of which are grounded in the notion that the teacher, lecture, and instructional materials form not only the basis, but also the authority in the educational process. The transmission of material from the teacher (lecture) and/or textbook to the student (called the “print model”) is still the central basis of most teaching, even if they are supplemented with other methods including discussion and other

forms of student interaction/participation (Ferris & Wilder, 2006).

However, the advent of digital and conversational technologies has brought forth the new concept of secondary orality (Ong, 1982). This concept emphasizes that teaching and learning should go beyond printed materials toward a greater emphasis on group work, fostering student communities, and encouraging student participation. The concept encourages a greater sense of interaction with and “ownership” of knowledge, emphasizing self-awareness and expression, and effectively using electronic tools (Gronbeck, Farrell, & Soukup, 1991).

The use of conversational technologies can have a positive impact, because they attempt to not only improve upon the print approach, but also use secondary-oral techniques. In other words, while a student can still be presented with material (in different formats) using the print model, the introduction of secondary-oral methods can be used to improve the overall learning experience. Using the latter, there is the opportunity to work and learn collaboratively, explore, analyze, engage in discussion, and otherwise “learn” in new and innovative ways (Ferris & Wilder, 2006; Wallace, 2005).

INSTANT MESSAGING (IM)

It is unlikely that there would be many college students who are unfamiliar with the use of IM. Allowing for interactive and real-time synchronous communications with instant response, instant messenger is truly conversational in that it allows for “chat” and communications between both individuals and groups. The major instant messaging systems in use include AOL (AIM), MSN Messenger, Yahoo! Messenger, and ICQ.

IM is a means for users to “chat” and communicate in real-time. While originally the domain of personal users, over time the unique benefits and effectiveness of this medium were realized,

and IM started to become accepted as a form of communication in businesses (particularly high-tech firms), and now has been studied and tested as an educational tool (Kinzie, Whitaker, & Hofer, 2005).

The important features of IM include both its synchronous nature and its ability to support both chat and phone-like interaction. While real-time interaction allows for rapid communications to occur, there is also no need to enter an interaction “space” as with chat rooms. Instead, the main usage of IM is in one-on-one communications, which can be more formally termed as a dyadic “call” model, which more closely resembles phone call interaction. It should be noted that even though much of the communication is done between two individuals, there are some systems that support multiparty instant messaging.

Some of the salient features of IM include the ability for users to see user details as to current status (online, idle, away, out to lunch), and also on a user’s changes in status (active, logged out, etc.). Lists of users can be displayed on the screen, so that contact can be made when desired. If a “chat” is initiated, a special window comes up, and the interaction can commence, provided that both parties are online and willing to proceed.

The real-time nature of IM has resulted in the technology being used for reasons aside from personal “chat.” In business, IM has become in some industries an accepted form of communication. A number of studies have concluded that instant messaging is ideal for informal interaction. In particular, the use of IM has been shown to be helpful in cases where collaborative coordination and problem solving is involved. Social bonding and interaction, which is a component contributing to the success of more complex collaboration situations, is also enhanced by using instant messenger technology (Nardi & Bradner, 2000).

An important difference between IM and e-mail is the tendency for instant messenger interaction to be more casual and informal than e-mails, which helps to bring about a more “friendly”

communication atmosphere. This may in part be due to a reduction in the formalities that are typically involved when using e-mail or the phone. In particular, IM has been considered more suitable for such tasks as scheduling meetings, asking or answering quick questions, and for other kinds of tasks that are brief, require a prompt response, or are less formal. It is perceived to be far simpler to IM someone to ask a quick question, for example, or to confirm a meeting or lunch, rather than to e-mail or call (Nardi & Bradner, 2000).

It is also of interest that IM communications tend to be more flexible in terms of their uses (everything from task-related questions to a new joke), and can allow for greater expressiveness in terms of emotion, humor, and personality (Nardi & Bradner, 2000). Another interesting aspect is what Nardi and Bradner (2000) refer to as “outeraction,” which focuses on the processes associated with IM. These include conversational availability, communications zones, intermittent conversations, awareness, and conversational progress/media switching. IM is useful in certain communications situations, since it tends to be less disruptive and interrupting, while at the same time a user’s availability is more clearly known (scanning buddy list status, for example). It is also a convenient means for setting up more formal interactions, such as arranging a conference call (media switching). Intermittent, dispersed communications can be conducted over a longer period of time, which includes interruptions. Another benefit includes the knowledge that others are “there” and available, even if not currently in chat mode; however there is always the opportunity to make contact, whether through IM or a different form of communications.

While some educators may scoff at and even express criticism at the thought of instant messaging as a viable educational tool, others believe there is potential in the medium.

In terms of educational uses for IM, they are being explored and tested. Clearly, IM not only

Table 1.

| INSTANT MESSAGING | |
|----------------------------|---|
| Description | Real-time communications that allow for informal communications to be conducted easily and quickly |
| Advantages | Availability and acceptance by students Social presence (know the status of other users online) Real-time (synchronous) communications Encourages collaboration Reduces formality in communications |
| Disadvantages | Distracted attention, especially in a classroom setting “Time waster” that is not directed toward course content, but on personal discussions Expectations of 24-7 instructor access Can be time consuming for instructors Benefits are uncertain in classroom settings |
| Educational applications | Virtual office hours (instructor-student) Collaboration on group projects Real-time class discussions Mentoring |
| Course/subject suitability | Courses with group projects and assignments Distance learning support |
| Theoretical foundations | Active learning Dual (verbal and visual) processing |

allows students to collaborate more effectively on homework assignments and projects, but also helps to maintain a closer social network between students, which could have a positive impact on learning. In addition, if IM is carefully targeted and focused toward the material or lecture topic in hand, the use of IM may actually help and stimulate deeper and more active learning.

On the other hand, it has been hypothesized that the distraction of working on various other tasks in parallel with IM, known as “distracted attention,” may have a negative impact on learning (Hembrooke & Gay, 2003).

Active learning (Grabinger, 1996) and dual (verbal and visual) processing (Clark & Paivio, 1991) are at work here. It could be said that using IM to encourage greater discussion and reflection on the course contents would be likened to the use of discussion boards; however, since IM is a real-time technology, the interaction is conducted during the lecture or class, not afterward. Some studies have reported positive effects and student satisfaction from IM being used to discuss course subjects in real-time (Guernsey, 2003).

A study by Kinzie et al. (2005) examined the use of IM during classroom lectures and found

that while the general idea of using IM online discussions was positively received, the actual process and experience of using IM to conduct discussions during class lecture sessions was not found to be less than a positive experience by both teachers and students. It was suggested that the difficulties of multitasking and dividing one's attention between the lecture and instructor, doing the IM discussion, contributed to the lack of satisfaction with the process.

Burke (2004) used instant messaging as a medium for creating course diaries in three different mathematics courses. IM was chosen since it was thought to be popular, widely used by students, and considered more "fun," so there was some hope that this popularity would transfer over to greater and more enthusiastic usage by students. In fact, the choice was made to use IM over a seemingly more suitable choice, blogs. A bot was created that would retrieve IM diary entries from students and store them in a PostgreSQL database, and there was also a program set up to display diary entries from each student, viewable by both the student and the instructor. The main finding of the study was that the IM media was not ideally suited for all kinds of courses, especially those that involved creating longer portions of text, or involved diagramming. Error detection and recovery was also not that well developed, and also there was a need for better editing tools.

In summary, while instant messenger can be appropriate for various applications, in particular for information communications in a business setting, the results from educational studies appear to be mixed, with both positive and negative effects noted. While there seem to be advantages to real-time communications between students, between students and instructors, and also between groups working on a project, it appears that there are problems and limitations if the technology is used in a classroom setting. The challenges of focusing on a class lecture, together with maintaining a conversation online, seem to be a problem that has not yet been resolved. In ad-

dition, while instructors can often establish closer relationships with students using IM, there is also the problem of unreasonable student expectations of continuous teacher access, which may not be present if IM was not available as an option. In connection with this, using IM for student help can result in a greater time commitment, since sessions can become lengthy with many questions and responses being sent back and forth.

BLOGS (WEBLOGS)

Blogs started as a means for expressive individuals to post online diaries of themselves. Complete with text and photos, these logs were essentially an individual's online narrative or diary, with events, stories, and opinions. While its original use was for personal expression, recently its effectiveness as a tool for education has been discovered, including its use as an extension of "learning logs," which are created online (Barger, 1997). One of the earliest blogs, as we know and use them today, was Dave Winer's Scripting News, which was put online in 1997. While the use of Weblogs can be considered generally new, the concepts of keeping a "log" or "learning log" is not.

The concept of "learning logs" has been in use since before the advent of the Weblog. The concept of this is to enable someone to document his or her learning, and also to do some critical reflection (Fulwiler, 1987) and self-analysis. The use of a learning log or journal is related to action research learning strategies (Cherry, 1998) and attempts to link previous knowledge and new information learned. Blogs are a natural extension of learning logs/journals in that they are electronic and can be made available ("published") more easily (Armstrong, Berry, & Lamshed, 2004).

The use of electronic Weblogs as educational tools offers the benefits of increased information sharing, simplified publication of information, and improved instructor monitoring and review (Flatley, 2005; Wagner, 2003). The use of blogs has

been expanding, as Perseus Development reported that there were some 10 million blogs in 2004, and the number is ever increasing (Nussbaum, 2004). The growth in this area is expected to increase in the years to come.

Blogs can be defined more formally as being “frequently updated Web sites consisting of dated entries arranged in reverse chronological order” (Walker, 2005) and can take several forms, including the personal diary/journal, knowledge-based logs, and filter blogs. The first, an electronic, online diary of one’s life events and opinions, is probably the most common. The online diary/journal blog is one that, being on the Internet, is public, as opposed to the traditional (typically paper) diaries, which are generally kept private. It should come as no surprise that there are many different online diary/journal blogs that are currently online, where one can find out details, often much more than one might want to know, about someone’s life and thoughts. Personal blogs form the majority of the blogs that are currently online and available, which make up roughly 70% of all the blogs in existence (Herring et al., 2003).

The second type (knowledge-based) captures knowledge and places it online in various formats. The third type (filter) attempts to select, rate, or comment on information contained in other sites (Herring et al., 2004).

There are software packages that are designed to help users create blogs, including Blogger, Xanga, Blurty, and MovableType. While the basic features of most blog software emphasize the creation of blog pages, some of the more sophisticated ones offer the capability to track readership, see who followed what links, add photos, and set up more advanced structures. When online, blogs can range from being totally public (listed in the blog service directory), to being “unlisted” but still open to being highly restricted (password-protected).

Blogs are also interesting and unique in that they are not merely online versions of paper diaries and journals. Rather, as a communications

medium under the control of the main writer (author), it is reflective of the fact that an audience is “watching and listening.” What is put on a blog is not merely a one-sided set of thoughts and reporting of events; there can also be responses to feedback and reactions from the “viewing audience.” Therefore, blogging is considered a highly social activity, rather than a personal one. In fact, recent work has indicated that the momentum for creating, and also updating a blog, came about as a result of encouragement from friends and the viewing audience (Nardi et al., 2004). In addition, blogging can have negative repercussions when posted information is perceived to be confidential, proprietary, or improper. In some cases, employees posting what was considered by their employers as “confidential” information can cause problems.

Blogs do not, in general, exhibit a free-flow of information between the blogger and the outside audience. While feedback is often requested, received, and desired by the blogger, the level and quantity of feedback from readers is generally limited compared with the output from the blog writer. In addition, while blogs may have sections where hyperlinks are mentioned, the number of hyperlinks in blog pages is frequently not very large (Schiano, Nardi, Gumbrecht, & Swartz, 2004).

More formally, Weblogs can be considered to be objects motivating human behavior, which is related to activity theory. Activity theory states that there are objects that have motives that respond to a human need or desire, and that they manifest a person’s desire to accomplish that motive (Leontiev, 1978; Vygotsky, 1986). The objects that connect bloggers to their own social networks include letting people know what is happening in their lives, voicing opinions, asking for feedback, and “letting off steam” about certain challenges or difficulties currently being experienced, to name a few (Nardi et al., 2004).

Blogs have been categorized by Krisnamurthy (2002) as being categorized into four different

types, along the dimensions of individual versus community, and personal versus topical. A blog can therefore range from being very individual and personal, all the way to being open to the community, however very focused on a particular topic.

The acceptance of blogs for educational purposes is gaining interest, with one university, the University of Maryland, attempting to implement blogging software campus-wide (Higgins, Reeves, & Byrd, 2004).

In addition, the educational uses of blogs take advantage of their ability to encourage expression and the development of online relationships. Blogs allow for learning and interaction to be more knowledge-centered, especially if the assignments are structured in the format of encouraging feedback and input from the instructor and outside experts. Blogs also allow students to gain a better understanding of a subject's knowledge domain (Glogoff, 2005). As an example of this type of blog-enhanced class structure, students might be provided with a Weblog from which to complete certain course assignments. After researching the indicated subject, the student would present the new information by "publishing" it to the Weblog. The Weblog would constitute the student's assignment, which would then be subject to review and critique by not only the instructor, but also by other students in the class. Supplementing this could be discussion boards, where threads would be devoted to discussions on the Weblogs created by the students. This kind of assignment and interaction would be especially useful for both hybrid and fully online distance learning courses (Glogoff, 2005).

There are other benefits of Weblogs. These could be expressed using the learning theories and concepts of guided discovery, directive learning, receptive learning, and social/community-centered instruction.

Guided discovery allows for the exploration and study of a certain topic, which is then followed by assignments that emphasize the synthesis of

information. In effect, a student can be asked to research an area and "construct knowledge" using the Weblog as a medium. Part of the assignment goes beyond merely explaining or presenting the material, and asks for the application of the concept using a real-world situation. The ability for students to post and make comments about other students' blogs provides an atmosphere of interactivity and collaboration. One of the advantages of using blogs together with guided discovery is that it encourages the use of cognitive scaffolding, where students would approach learning (together with the use of blogs and interaction) by repeatedly seeking information, reflecting and thinking about what has been learned, and then going back and obtaining more information, so as to build upon and dig deeper into the subject area. This can result in a more active and productive form of learning (Betts & Glogoff, 2004; Glogoff, 2005).

Directive learning, where responses from students are followed by prompt feedback from instructors, can also be supported using blogs. In this case, students would not only use a blog to submit assignments, but also to review instructor feedback. In addition to feedback, there would be opportunities for the instructor to ask additional questions, in effect, to encourage further exploration and "drilling down" into the subject (Betts & Glogoff, 2004; Glogoff, 2005).

Receptive learning is where instructional modules are presented that focus on certain broader areas, from which certain sub-areas within these are highlighted for a student to research and report on. Generally, the areas are contained within a designated theoretical context (Betts & Glogoff, 2004; Glogoff, 2005).

Social/community-centered instruction is a logical component of educational work using blogs, and in particular the use of peer and social interaction as a part of the learning process. The use of blogs functions as an easily accessible medium for students to present their findings (and to be read by others) and also to integrate not only the information presented, but also related links

and references to other resources. This form of interaction helps to encourage further exploration by students. A blog-based discussion can then be continued by conducting peer reviews of other students' blogs, which may include commentary, critique, the posing of questions, and opening up the way for further inquiry. The ability to share and benefit from the findings of other students (and to explore further) is another important outcome. The theories of community practice (Snyder, 2002), social cognition (Vygotsky, 1978), and communities of inquiry (Lipman, 1991) provide support for the blog-related techniques mentioned previously.

Ducate and Lomicka (2005) discuss their experiences in using Weblogs to support foreign language classes. Weblogs help the foreign language student to learn during the process of reading, and then creating blog entries. Students can learn by reading blogs that are written in the new, target language, including learning new vocabulary, checking out links and further information on words, and learning associated cultural information. The reading and absorption of blogs on the culture associated with the target language, including literature and lifestyles, all would contribute to the learning process.

Another approach would be to have students maintain blogs written in their new, target language, and then the goal would be to seek commentary and critique on these blogs by others in the class. Yet another innovative method might be to share blogs with other classes studying the same language, and for students to read and comment on each other's postings. In the case where students travel to a country where the target language is spoken, the compilation of travel blogs would be a useful learning tool as well (Ducate & Lomicka, 2005).

Wang and Fang (2005) looked at whether the use of blogs encouraged or enhanced cooperative learning in an English rhetoric/writing class taught in Taiwan. The main premise was that blogs can encourage students to spend more time working

within a class "community" and can benefit from a greater sharing of contributions and inputs. In general, cooperative learning benefits can be divided into three different types: formal, informal, and base groups. Formal cooperative learning is where the instructor explicitly provides course materials and assignments to a group and then observes the students' learning processes. When the instructor provides information more generally (such as detailing how to use a blog for course assignments) and then lets the group work out their own methods for handling an assignment, that is known as informal cooperative learning. When a learning-oriented group is maintained for an extended period of time, such as throughout a semester, then this form of cooperative learning is known as a cooperative base group (Johnson & Johnson, 1998; Johnson, Johnson, & Holubec, 1991). The study, run over the course of a semester, found that the use of blogs contributed not only to cooperative learning in general, but also to autonomous learning. Autonomous learning is focused on how much students take responsibility for their own learning, and also develop self-confidence in the task or skill (Wenden, 1991). The use of blog technologies was also found to help improve information processing, learning self-evaluation, and effective time management (Wang & Fang, 2005).

Martindale and Wiley (2005) also used blogs in their courses and looked at two cases of the impact of this technology on teaching and learning. Martindale taught a doctoral-level course on instructional design and technology. In it, students were introduced to blogs and used them throughout the course, which overall tended to promote higher levels of quality in their course work. Blogs were used to post ideas and abstracts of their projects, and also to place links for relevant research papers and Web-based resources. The end result was a course "knowledge base" that represented the cumulative output of the students in the course. The blogs were also used for article critiques, which were an integral part of each weekly class.

Table 2.

| WEBLOGS (BLOGS) | |
|----------------------------|---|
| Description | A technology that allows a sequence of entries (online diary, journal) to be posted and published online |
| Advantages | Reflection and critical thinking are encouraged Authenticity through publication Social presence Development of a learning community Active learning encouraged Ability to receive and respond to feedback |
| Disadvantages | Controlled primarily by blog author Editing/modifications not open as in a wiki |
| Educational applications | Online learning journal Problem solving/manipulation space Online gallery space (writings, portfolio, other work) Peer review exercises |
| Course/subject suitability | Writing courses Foreign language courses Research seminars |
| Theoretical foundations | Activity theory Guided discovery Cognitive scaffolding Receptive learning Social cognition Community practice Communities of inquiry |

Students were given access to the blogs of other students and were able to offer feedback.

Wiley taught two different courses, one on online learning research, and the other on online interaction culture. Both included the use of blogs as a supporting technology, the first employing a general course blog where information about the course, student assignments, and class updates and student/instructor interaction exchanges were posted on an ongoing basis. In the second, blogs were used to discuss experiences using different online communications technologies, causing students to become highly engaged, resulting in passionate discussions and detailed commentaries

posted to the blogs, far exceeding the level and depth of feedback that was expected (Martindale & Wiley, 2005).

In summary, blogs can be useful for educational purposes, particularly where there is the need to encourage and stimulate critical thinking and reflection on a work, concept, or idea. The submission or publication of a document or text as a blog can then lead others in a class to review and comment, setting the stage for greater analysis and study. In particular, blogs are suited to writing courses, where a text can be analyzed and critiqued, or for a situation where a peer review is desired. The use of blogs is also ideal for the

situation where someone keeps an online journal of one's learning, or wants to display her or her work to an audience. The blog approach is also considered useful for group study of a certain focused problem or case, such as those used in graduate courses and seminars.

WIKIS

Yet another technology, known as the wiki, has emerged, which allows for improved collaboration compared with Weblogs. While the major emphasis of Weblogs is the creation of a set of pages and documents primarily by a single individual, the strength of a wiki is the ability for numerous interested readers and users to express ideas online, edit someone else's work, send and receive ideas, and post links to related resources and sites. As a result, wikis go a step further and allow for greater collaboration and interactivity (Chawner & Gorman, 2002). Wikis have been found to have value for educational purposes, and their use has begun to be integrated into a number of university courses, in particular (Kinzie, 2005).

The term "wiki" comes from the Hawaiian word "wikiwiki," which means "fast." The technology is computer-based and can be generally described as a knowledge sharing and creation system that has as its basis a set of Web pages, which can be created and updated on an iterative and collaborative basis, and is in many ways a form of groupware. A wiki is designed to run on the Internet and World Wide Web, uses the HTTP protocol, and resembles traditional Web sites in terms of its underlying structure. Some of the benefits of wikis include the ability to easily create pages (using a simplified form of HTML or basic HTML) and the ability for a document to be authored collaboratively and collectively. In particular, simplicity is the key to wikis, and wiki pages have been designed to be easy to create, (simpler than the process of creating standard Web pages). One of the better-known examples

of a wiki is www.wikipedia.org, which is an online encyclopedia with entries authored and edited by different persons worldwide, and in several different languages as well. In essence, it is an online information resource that is authored by interested and knowledgeable persons from around the world.

Wagner (2004) developed a set of design principles that relate to wikis. These are the principles of open, incremental, organic, mundane, universal, overt, unified, precise, tolerant, observable, and convergent wikis. *Open* means that anyone can edit a wiki, creating an "open source" environment for the sharing of knowledge. *Incremental* means that new pages can be added, even if they do not yet exist. *Organic* means that the information can be continuously evolving, as changes and edits are made. Wikis are *mundane* because they involve the use of a simplified set of essential commands. The design of wikis is also *universal*, meaning that writing and editing is a "combined" activity, formatting is related to input (*overt*), page names are not context specific (*unified*), and pages are generally named with some precision (*precise*). Wikis should be *tolerant* of error; activity should be *observable* by all, and duplications are undesirable and should be deleted (*convergent*).

There are a number of software programs that enable the effective creation of wiki pages, including TikiWiki, TWiki, and Pmwiki. These allow for the effective creation, modification/editing, and management of wikis, including creating pages, creating links, formatting, and feature modules (discussion forums, photo pages, download areas, etc.) (Chawner & Lewis, 2006)

Wikis are set up to allow for easy collaboration, and more specifically, editing. Rather than passively reading a passage of text or related information (which may include graphics, multimedia, hyperlinks, etc.), a reader of a wiki can also take on the role of a writer, making changes to the text (re-organizing, editing, re-writing, and marking up) at will. In essence, the document is

open to changes by a “collaborative community,” which allows for the secondary-oral model in education to be applied.

One reservation on the part of educators to embrace wikis is the fact that wikis are designed to allow for open and free access and editing by all members of a “community.” As a result, if improperly managed, a wiki’s content can become an unreliable, inaccurate, or biased source of information due to its largely unmonitored format. There is also the issue of having little or no “quality control,” resulting in a wiki not being trusted by its readers and users. An example of this was the controversy over the accuracy and reliability of Wikipedia, in the case of John Seigenthaler, in which the subject alleged that false and incorrect statements were posted in his biography (Seigenthaler, 2005). However, other studies have attempted to prove that Wikipedia was overall an accurate information source. One article reported that after analyzing a set of Wikipedia’s science articles, they were judged to be, by the British journal *Nature*, as reliable as the *Encyclopedia Britannica* (BBC News, 2005).

Wikis are useful for education in that they help to promote student participation and also a sense of group community and purpose in learning. Indeed, an important element of this is the relaxed sense of control over the content, allowing students to have a greater role in managing its focus and direction.

Wikis are not all the same, and there is significant diversity between various forms and implementations of wiki systems. In fact, it could be debated what features truly characterize a “true” wiki. The features inherent in most include the ability for users to both read and edit information, without the need for security or access restrictions. The emphasis is on simplicity, and the informal, “never finished” nature of wikis, which may constitute the contributions of multiple authors, is another key characteristic. While the emphasis of many wikis is on simplicity and a lack of access restrictions, that does not mean that

all wikis work this way. In reality, there can be a continuum of features from simple to complex. At the complex end of the scale can be capabilities for security/access restrictions, complex organizational structures, and for integrated with content management systems (Lamb, 2004).

Now that the strengths and weaknesses of wikis have been established, it would be useful to examine the educational applications of wikis. In general, the most suitable applications are those that take advantage of the wiki’s free, open structure. As such, the use of wikis as discussion/bulletin boards, brainstorming tools, and online sketchpads is appropriate. Meeting planning is another viable application area, in that the organizer can start with a preliminary agenda, from which the other participants can then add their own additions or make modifications or comments.

An important application area for wikis has been identified in knowledge management (KM). The use of wikis for knowledge management may allow for an improvement over existing systems and technologies. Currently, with existing KM systems, there does exist a number of bottlenecks relating to knowledge acquisition, namely acquisition latency, narrow bandwidths, knowledge inaccuracy, and “maintenance traps.” Basically, these knowledge acquisition bottlenecks result from a time lag between when the knowledge is created, and then distributed. In addition, there are the problems of limited channels of knowledge input, possibilities of erroneous information being received, and also the difficulties of maintaining the knowledge base as it grows larger (Land, 2002; Wagner, 2006; Waterman, 1986).

The use of wikis to elicit a “bazaar” approach to knowledge management, rather than a “cathedral” approach, is proposed as a better alternative. These terms are derived from software development, whether the “bazaar” allows for more continuous and open access to code (or information), as opposed to the “cathedral” approach where access is only provided on certain (release) dates to certain

persons. The difference between the “cathedral” (closed), sources of knowledge acquisition management and “bazaar” (open) could be illustrated by the difference between encyclopedias that are created by a single firm, such as Encarta or the Encyclopedia Britannica, and those that obtain information from readers and users, such as the well-known Wikipedia.

The emphasis therefore is on teamwork, continuous review and testing, and the development of conversational sharing (Wagner, 2006). Inherent in the workings of wikis is support for an open, collaborative environment, where many people can contribute to the development of knowledge instead of being limited to a set of “experts.” It appears that conversational knowledge acquisition and management are appropriate for wikis (Cheung, Lee, Ip, & Wagner, 2005). As for educational applications and KM, a study by Raman, Ryan, and Olfman (2005) examined the use of a wiki to help encourage and support collaborative activities in a knowledge management course. More specifically, using wikis in the course helped to encourage openness and better sharing and updating of knowledge bases. Many-to-many communication is supported, and the persistence of the created pages formed the basis of a knowledge repository. In short, the impact of easy page creation and improved updating and editing, together with effective maintenance of knowledge histories, were seen as positives (Raman et al., 2005; Bergin, 2002).

Activities in the KM course activities included group article review assignments, answering questions about sharing knowledge and uses of the wiki technology, and also creating a wiki-based knowledge management system. Students were asked to create, update, refine, and then maintain a class knowledge management system. In terms of these experiences, while the use of the wiki technology was generally viewed positively, feedback received indicated that, since the goals of using the wiki were not made clear, using one was perceived to be counter-productive. More specific

guidance on goals and objectives, a clearer system structure, and advanced training were suggested as ways to make the wiki a more effective educational tool. The availability of too many features made the task of doing the course activities more difficult, since much time was spent learning the various features rather than focusing on the task at hand. A simpler, less feature-rich version was therefore preferred (Raman et al., 2005).

Another popular application of wikis in the classroom is in supporting writing courses. The use of this technology can help to foster the impression that writing is “fun,” and that there can be a shared and collaborative side to writing, revising, and commenting on written work. In other words, the technology can benefit not only the writing and editing process, but also in bringing about an awareness that writing is being done for a specific audience.

An example of the use of wikis in English is the Romantic Audience Program at Bowdoin College, where students used a wiki to discuss and examine Romantic literature, focusing on poetry, poets, and related topics. The technology was used to elicit discussion and analyses by the group, encourage elaboration on areas where further study or insight was sought, and to seek out linkages to additional sources and commentary. Another project is Auburn University’s Wikifish, which was created by one school within the university, where questions are posed, and opinions and comments by all are encouraged.

Difficulties encountered in using wikis for education include the difficulty of tracking the new pages and contributions made by students, since modification can be made to another student’s text without specifically identifying the author or editor. As a result, it can be difficult to monitor, and properly attribute, what contributions were made by whom, on a particular page. A proposed solution to this was an instructor’s use of categories and topics, requiring that students link to and add, rather than simply modify, the contributions of other students. Another issue was how much

Table 3.

| WIKI | |
|----------------------------|--|
| Description | A technology that allows for material to be easily published online, and also allows open editing and inputs by a group |
| Advantages | Contributions and editing by a group Open access to all users Collaborative |
| Disadvantages | Lack of organization and structure may result in an unmanageable wiki Tracking of contributions and modifications can be difficult Quality control |
| Educational applications | Collaborative writing/authoring Group project management Brainstorming activities Knowledge base creation (knowledge management) |
| Course/subject suitability | Knowledge management Writing Group work in courses |
| Theoretical foundations | Conversational technology Constructivist learning tool |

of a balance in terms of the tradeoff between total freedom, and total control, was ideal. Since a clear benefit of a wiki is the emphasis on free expression and on spontaneous inputs, reducing this may have a negative effect on open interaction and student contributions (Lamb, 2004).

An interesting application of the use of wikis in the classroom was the work by Bruns and Humphreys (2005), where wikis were used in a New Media Technologies course to collaboratively develop entries for an online wiki encyclopedia called the *M/Cyclopedia of New Media*, an actual live wiki resource made available online. The effort to develop entries involved over 150 students spanning six classes in the program. Feedback indicated that while students had little difficulty with using the wiki system, obstacles came about more with the writing and format of the encyclopedia entries.

Another study examined the use of wiki technology in German-speaking communities

in Switzerland (Honegger, 2005), while Desilets, Paquet, and Vinson (2005) looked at how usable wikis are and found that the main problems encountered related to the management of hyperlinks. Wikis were also examined from the perspective of structure: how did the use of certain templates affect the appearance and layout of wiki pages? The results suggested that they are useful in certain circumstances and could be helpful overall to end users (Haake, Lukosch, & Schummer, 2005).

In summary, wikis are best suited to course and activities where there is a document, text, or other project to be worked on jointly by a class or group. In a sense, it is a tool for collaboration, and a form of groupware. The compilation of a class or group report or project, the creation of a knowledge base, or brainstorming sessions appear to be viable applications. The free and open structure, however, can fall prey to disorganization and degradation in quality, and so it is important

to have safeguards and procedures in place to ensure an effective result.

PODCASTS

While the terms “pod” and “podcast” at first mention might evoke visions of “Invasion of the Body Snatchers,” for most tech people in the know, the reference to Pod is almost certainly a reference to Apple’s popular and ubiquitous iPod.

However, podcasts are in actuality not what their name might imply them to be. A “podcast,” a combination of “iPod” and “broadcast,” neither refers to a technology specifically requiring an iPod, nor broadcasts information to users. Instead, podcasts are multimedia files (typically audio or video) that are downloaded to users on a subscription basis. Because of the potential confusion due to the use of the word “pod,” some have called for the letters to mean “personal option digital” or “personal on demand,” rather than iPod.

Podcasts can be played back on any device or system that can play digital audio (typically MP3) or video files, and are not broadcast to a large audience, in the way that television, radio, or spam e-mails are sent. Instead, they are sent to users who have specifically subscribed to a podcast service, and as such, files are automatically downloaded to the user’s computer when they are ready and available. In addition, podcast files are generally not streamed (as video is streamed), but rather are downloaded for later playback (Lim, 2005; Lum, 2006). Podcasts are delivered to subscribers through the use of RSS or RFD XML format media feeds, rather than more traditional forms of downloading (Descy, 2005).

Podcasts are considered to be a viable educational tool for several reasons. First, because of the popularity and wide use of devices such as the iPod and similar units, it would seem like a good medium from which to distribute educational materials. Secondly, the ease with which infor-

mation can be retrieved and accessed makes this a good choice for students, who are using these devices on a regular basis for music and should have few technical difficulties or learning curves (Lum, 2006).

There are multiple facets to podcasts. First, there is the consumption perspective, where someone downloads the podcast and then listens or views it. This involves subscribing to a service (or enrolling in a course), finding the relevant file, and then downloading and playing it. Alternately, someone can actually create podcasts; an instructor can produce lessons for students, or students can produce an assignment in the form of a podcast file (Lum, 2006).

Education is one area where the power of the podcast has been used in various ways. At Duke University, orientation material was distributed as podcasts, loaded onto iPod units, and given to students in its 2004 incoming freshman class. The units were provided not only for orientation purposes, but also for use in playing podcast lectures when the students take certain courses at the university. At Mansfield University, students were sent podcasts about various student life issues, and at Arizona State University, President Michael Crow used podcasts to deliver messages to the university community (Lum, 2006).

While there appear to be sound reasons for using podcasts, there is also a theoretical basis behind the use of podcasting. This is based on cultural-historical activity theory (Engestrom, 2002) and is based on the fact that podcasting can be considered a tool that can be used to help learners to better interact with or understand a task and its environment. Vygotsky (1978) argues that the effectiveness of podcasts rests in its linkage between social/cultural influences present in the environment and the cognitive development of the learner. Expressed another way, the concept is that since so many student have access to iPods and MP3 players, it would make sense to explore the viability of using such a device for learning and educational purposes.

Table 4.

| PODCASTS | |
|----------------------------|---|
| Description | The ability to create audio (and other media) based files to be distributed on a regular/subscription basis to users; these can be easily retrieved and played back on handheld devices, computers, and through other means |
| Advantages | Allows for information to be retrieved and played back on widely available, ubiquitous devices More suitable to auditory and visual learners |
| Disadvantages | In consumption (playback) mode, does not directly support collaboration Is not inherently interactive in nature |
| Educational applications | Recorded class lectures Case-based instruction Guest lectures in the form of podcasts Supplemental course materials Support for distance learning courses |
| Course/subject suitability | Subject matter lends itself to auditory format |
| Theoretical Foundations | Cultural-historical activity theory |
| | |

Lim (2005) discussed experiences in using podcasts for teaching geography. Because of the nature of the subject, it was found that video would have a greater impact and result than audio. Students were asked to submit assignments to be created and submitted as podcasts. Overall, this helped to bring about satisfaction and interest in terms of the subject. Ractham and Zhang (2006) looked at the potential for podcasts in a classroom setting. While there are the obvious benefits in terms of being able to distributing class materials, there also are benefits in terms of contributing to social networking in the class and continuing a flow of academic knowledge. Class discussions, announcements of research activities and conferences, and also campus activities could be distributed as podcasts. Review materials could be distributed effectively on an automatic basis to interested students. In addition, the ability for students to create podcasts to be distributed to others would also be a new means of submitting assignments or expressing creativity.

Podcasts, unlike IM, blogs, and wikis, offer a greater emphasis on providing engaging auditory and visual course materials to students, rather than on collaboration and group work. While not generally a substitute for traditional lectures and knowledge presentation, they offer the benefits of easily accessible and “digestible” course material. Whether it is excerpts from class lectures, highlights from a guest speaker, or an oral test review, the use of podcasts provides a means by which students can obtain and easily receive course-related information. In addition, it also provides a means by which students can express and present their work, which can then be “published” and distributed in podcast format.

DISCUSSION AND CONCLUSION

The face of education, whether online, hybrid, or classroom, is constantly changing, and it is

important for educators to stay abreast of the many opportunities and possibilities that are available.

In this article, several technologies, generally termed as conversational technologies due to their interactive and collaborative nature, were discussed in detail, together with their capabilities, benefits, and educational applications. Relevant research and case studies as they relate to classroom and educational applications were discussed.

In general, the tools discussed here fall into the class known as “conversational technologies” or “constructivist learning tools.” As such, they emphasize student interaction, group learning, and collaboration, rather than the more traditional classroom mode. In light of this, they are more suited to educational courses or environments where the emphasis is on student communication, where students have access to technology, and where creative output and thinking is encouraged.

In the situation where a course is primarily lecture-based, or is mainly concerned with the delivery of factual or conceptual information, these tools may have limited applicability. The one application that may be helpful in this case may be for interaction to be extended outside of the classroom, through the use of instant messenger, or for supplemental materials to be distributed as podcasts.

Since each of the tools has its own characteristics and suitable applications, it would be up to the educator to select those that are most appropriate to one’s course and activity.

Instant messenger, which is commonly used by students for personal use, has found its way not only into the business community, but also into the classroom, because of its strengths in terms of informal communications that are conducted real-time. There are some mixed results regarding the use of IM for use for education; benefits are claimed by some, but there are limitations

as well. The use of IM would best be employed in situations where group work, student communication, and real-time discussion would be helpful. However, it should be used cautiously, since it can be distracting, and students may end up carrying on personal, rather than course-related discussions.

Both blogs and wikis have been hailed as useful tools for education, and the specific advantages and disadvantages of each are noted and discussed. Blogs tend to be more one-sided, with an author presenting his or her information, with generally limited input from the readers and public. However, the use of the technology has been used effectively to promote information sharing and to support writing courses. The use of blogs to support online learning journals, class article/peer reviews, creating online portfolios and galleries, and for solving a specific problem or case would be advantageous. It would also appear to be a good medium for graduate research seminars, where papers and studies are analyzed and critiqued.

Wikis, which allow freedom in creation and in editing and enhancement by others, are especially useful in collaborative situations where the input of an entire group is desired instead of a single person’s contribution. In the classroom, wiki support for collaborative writing and group activities, where students contribute to the creation of a common result, would be useful. In general, any kind of learning activity that involves the collection and maintenance of knowledge or information may benefit from the use of wiki technology.

The use of podcasts, which may include audio or video, is growing in popularity and is being used for delivery of information to subscribers on an automatic basis. Educational podcasts, both for the delivery of audio and video-based knowledge to students, and also as a new medium for the creation and presentation of assignments, appear to have potential. While podcasts are useful as a means for publishing and distributing files of

multimedia-based class materials, there also exists the potential to create new podcast content, both for educators and as a course activity.

Clearly, the use of these new conversational technologies is allowing for the enhancement and continued evolution of new and innovative forms of support for teaching and learning.

FUTURE RESEARCH AREAS

Certainly, there are many benefits to the use of conversational technologies and constructivist tools for educational use. However, more research needs to be done, not only in terms of identifying additional types of applications and uses, but also in terms of how to more effectively identify and apply new approaches to learning with the aid of these kinds of technologies.

Some of the broader research issues that can be examined include measuring both learning, and the perceived quality of education, depending on the specific technology or tool employed. Are there measurable benefits to using a certain technology in terms of the material learned, better class performance, or more subjective factors? It would also be useful to determine, particularly when using blogs and wikis, the neutrality or bias in the entries, and how much these contribute to (or detract from) the material submitted for a course assignment.

Other research areas are more technology specific. It was mentioned earlier that wikis can be a useful tool in knowledge management. The application of wikis to effective knowledge management deserves further attention, both in terms of developing or adapting the wiki structure and features to knowledge management uses, and also for identifying various kinds of user interfaces and functionality that would improve usability. The establishment of wiki-supported communities of practice is one area where the tool could possibly be useful.

Podcasting also has many areas that are ripe for further investigation. There are issues that can be explored in the areas of knowledge management, collaboration, and the adoption of podcasts. Some of the specific topics of interest include the management and sharing of knowledge using podcasts, examining whether their use actually improves learning, studying their effects on collaboration and networking, and what the factors (or features) are that would help to promote its use.

There also has been work on the psychological aspects of distance learning and online courses (Dickey, 2004), and a study of learners' reactions to using IM, blogs, and wikis, for example, would yield insights into its appropriateness for its further use in education. Does the use of these technologies contribute to the satisfaction of students, or is more classroom face-to-face still better?

The realm of these new technologies is certainly ripe with a host of opportunities for both interesting and meaningful research studies.

REFERENCES

- Ahn, J., Han, K., & Han, B. (2005). Web-based education: Characteristics, problems, and some solutions. *International Journal of Innovation and Learning* 2005, 2(3), 274-282.
- Armstrong, L., Berry, M., & Lamshed, R. (2004). Blogs as electronic learning journals. *E-Journal of Instructional Science and Technology*, 7(1). Retrieved from http://www.usq.edu.au/electpub/e-jist/docs/Vol7_No1/CurrentPractice/Blogs.htm
- Barger, J. (1997). Weblog resources FAQ, Robot Wisdom Werblog. Retrieved from <http://www.robotwisdom.com/weblogs>
- BBC News. (2005). Wikipedia survives research test. BBC News, December 15, 2005.
- Beck, P., Kung, M., Park, Y., & Yang, S. (2004). E-learning architecture: Challenges and mapping

- of individuals in an Internet-based pedagogical interface. *International Journal of Innovation and Learning* 2004, 1(3) 279-292.
- Bergin, J. (2002). Teaching on the Wiki Web. *ACM SIGCSE Bulletin*, 1.
- Betts, J. D., & Glogoff, S. (2004). Instruction models for using Weblogs in e-learning. In *Proceedings of Syllabus 2004*. San Francisco.
- Blood, R. (2004). How blogging software reshapes the online community. *Communications of the ACM*, 47(12), 53-133.
- Bruns, A., & Humphreys, S. (2005). Wikis in teaching and assessment: The M/Cyclopedia Project. In *Proceedings WikiSim'05*. San Diego, CA.
- Burke, M. (2004). Instant messaging and course diaries. *CCSC Northeastern Conference Proceedings*, 19(5), 207-274.
- Chawner, B., & Gorman, G. E. (2002). Wikis are wicked. *New Library World*, 103(1182/1183), 483.
- Chawner, B., & Lewis, P. (2006). Wiki wiki webs: New ways to communicate in a Web environment. *Information Technology and Libraries*, 25(1), 33-43.
- Cherry, N. (1998). *Action research: A pathway to action, knowledge, and learning*. RMIT Publishing.
- Cheung, K., Lee, F., Ip, R., & Wagner, C. (2005). The development of successful online communities. *International Journal of the Computer, the Internet, and Management*, 13(1).
- Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review*, 3, 149-210.
- Cold, S. (2005). Using RSS to enhance student research. *ACM SIGITE Newsletter*, 3(1).
- Dearstyne, B. (2005). Blogs: The new information revolution. *Information Management Journal*, (September/October), 38-44.
- Descy, D. (2005). Podcasting: Online media delivery...with a twist. *TechTrends*, 49(5), 4-6.
- Desilets, A., Paquet, S., & Vinson, N. (2005). Are wikis usable? In *Proceedings WikiSim'05*. San Diego, CA
- Dickey, M. (2004). The impact of Weblogs on student perceptions of isolation and alienation in a Web-based distance learning environment. *Open Learning*, 19(3), 279-291.
- Ducate, L., & Lomicka, L. (2005). Exploring the blogosphere: Use of Weblogs in the foreign language classroom. *Foreign Language Annals*, 38(3), 410-421.
- Efimova, L., & Fiedler, S. (2004). Learning webs: Learning in Weblog networks. In Kommers, Isaias, & Nunes (Eds.), *Proceedings of the IADIS Intl. Conference on Web Based Communities 2004*. Lisbon: IADIS Press.
- Engestrom, Y. (2002). Cultural historical activity theory. Retrieved from <http://www.helsinki.fi/~jengestr/activity/6a.htm>
- Engstrom, M. E., & Jewitt, D. (2005). Collaborative learning the wiki way. *TechTrends*, 49(6), 12-15.
- Ferris, S. P., & Wilder, H. (2006). Uses and potentials of wikis in the classroom. *Innovate*, 1(5).
- Fisher, M., & Baird, D. (2005). Online learning design that fosters support, self-regulation, and retention. *Campus-Wide Information Systems*, 22(2), 88-107.
- Flatley, M. (2005). Blogging for enhanced teaching and learning. *Business Communication Quarterly*, 68(2005).

- Fuchs-Kittowski, F., & Kohler, A. (2002). Knowledge creating communities in the context of work processes. *SIGGROUP Bulletin*, 23(3).
- Fuchs-Kittowski, F., & Kohler, A. (2005). Wiki communities in the context of work processes. In *Proceedings WikiSim'05*. San Diego, CA.
- Fulwiler, T. (1987). *The journal book*. Portsmouth, NH: Boynton/Cook.
- Glogoff, S. (2005). Instructional blogging: Promoting interactivity, student-centered learning, and peer input. *Innovate*, 1(5).
- Grabinger, R. S. (1996). Rich environments for active learning. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 665-692). New York: Macmillan.
- Gronbeck, B., Farrell, T., & Soukup, P. (1991). *Media consciousness and culture*. Newbury Park, CA: Sage.
- Guernsey, L. (2003, July 24). In the lecture hall, a geek chorus. *The New York Times*.
- Haake, A., Lukosch, S., & Schummer, T. (2005). Wiki templates. In *Proceedings WikiSym'05* (pp. 41-51). San Diego, CA.
- Hargis, J., & Wilson, B. (2005). Fishing for learning with a podcast net. Instruction and Research Technology, Univ. of North Florida.
- Hembrooke, H., & Gay, G. (2003). The laptop and the lecture. *Journal of Computing in Higher Education*, 15(1).
- Herring, S., Scheidt, L., Bonus, S., & Wright, E. (2004). Bridging the gap: A genre analysis of Weblogs. In *Proceedings of HICSS 2004*. Big Island, HI.
- Higgins, C., Reeves, L., & Byrd, E. (2004). Interactive online journaling. In *Proceedings SIGUCCS'04*. Baltimore, MD.
- Honegger, B. (2005). Wikis—A rapidly growing phenomenon in the German-speaking school community. In *Proceedings WikiSim'05*. San Diego CA.
- Hsu, K., & Tanner, J. (2006). An assessment of classroom technology usage in business. *International Journal of Innovation and Learning*, 3(5), 488-498.
- Johnson, D. W., & Johnson, R. T. (1998). *Cooperation and competition*. Edina, MN: Interaction.
- Johnson, D. W., Johnson, R. T., & Holubec, E. (1991). *Cooperation in the classroom* (3rd ed.). Edina, MN: Interaction.
- Kinzie, S. (2005, February 12). Colleges land lines nearing an end. *The Washington Post*.
- Kinzie, M., Whitaker, S., & Hofer, M. (2005). Instructional uses of instant messaging during classroom lectures. *Educational Technology and Society*, 8(2), 150-160.
- KPMG. (2003). Insights from KPMG's European Knowledge Management Survey 2002/2003. KPMG Knowledge Advisory Services, Amsterdam.
- Krisnamurthy, S. (2002). *The multidimensionality of blog conversations*. *Internet research 3.0*. Maastricht, The Netherlands.
- Lamb, B. (2004). Wide open spaces Wikis ready or not. *Educause, September/October*, 36-48.
- Leontiev, A. (1978). *Activity, consciousness, and personality*. Englewood Cliffs, NJ: Prentice Hall.
- Leuf, B., & Cunningham, W. (1999). *The WIKI way: Quick collaboration on the Web*. Reading, MA: Addison Wesley.
- Lim, K. (2005). *Now hear this—Exploring podcasting as a tool in geography education*. Nanyang Technological University.

- Lipman, M. (1991). *Thinking in education*. New York: Cambridge University Press.
- Liu, C., & Chen, S. (2005). Determinants of knowledge sharing of e-learners. *International Journal of Innovation and Learning* 2005, 2(4), 434-445.
- Locke, C. et al. (2000). *The Cluetrain Manifesto: The end of business as usual*. Cambridge, MA: Perseus.
- Louridas, P. (2006). Using wikis in software development. *IEEE Software*, March/April, 88-91.
- Lum, L. (2006). The power of podcasting. *Diverse Issues in Higher Education*, 23(2), 32.
- Martindale, T., & Wiley, D. (2005). Using Weblogs in scholarship and teaching. *TechTrends*, 49(2).
- Mock, K. (2002). The use of Internet tools to supplement communication in the classroom. *CCSC Northeastern Conference Proceedings*, 17(2), 4-21.
- Nardi, B., & Bradner, E. (2000). Interaction and outeraction. In *Proceedings of CSCW'00*. Philadelphia, PA.
- Nardi, B., Schiano, D. J., & Gumbrecht, M. (2004). Blogging as social activity. In *Proceedings of CSCW 2004* (pp. 222-231). Chicago.
- Nardi, B., Schiano, D. J., Gumbrecht, M., & Swartz, L. (2004). Why we blog. *Communications of the ACM*, 47(12), 41-46.
- Nussbaum, E. (2004, January 11). My so-called blog. *The New York Times*.
- O'Neill, M. (2005). Automated use of a wiki for collaborative lecture notes. In *Proceedings SIGCSE'05* (pp. 267-271).
- Ong, W. (1982). *Orality and literacy*. New York: Routledge.
- Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon*, 9(5).
- Ractham, P., & Zhang, X. (2006). Podcasting in Academia. In *Proceedings SIGMIS-CPR'06*.
- Raman, M., Ryan, T., & Olfman, L. (2005). Designing knowledge management systems for teaching and learning with wiki technology. *Journal of Information Systems Education*, 16(3), 311-320.
- Schiano, D., Nardi, B., Gumbrecht, M., & Swartz, L. (2004). Blogging by the rest of us. In *Proceedings CHI 2004* (pp. 1143-1146).
- Seigenthaler, J. (2005, November 29). A false Wikipedia biography. *USA Today*.
- Seitzinger, J. (2006). Be constructive: Blogs, podcasts, and wikis as constructivist learning tools. *Learning Solutions*, July.
- Seng, J., & Lin, S. (2004). A mobility and knowledge-centric e-learning application design method. *International Journal of Innovation and Learning* 2004, 1(3), 293-311.
- Vygotsky, L. (1986). *Thought and cognition*. Cambridge, MA: MIT Press.
- Wagner, C. (2004). Wiki: A technology for conversational knowledge management and group collaboration. *Communications of the AIS*, 13(2004), 265-289.
- Wagner, C. (2006). Breaking the knowledge acquisition bottleneck through conversational knowledge management. *Information Management Resources Journal*, 19(1), 70-83.
- Walker, J. (2005). Weblog. Definition from the Routledge Encyclopedia of Narrative Theory.
- Wallace, M. (2005). *Notes towards a literacy for the digital age*. Retrieved from <http://uclacc.ucla.edu/articles/article-digitalage.htm>
- Wang, J., & Fang, Y. (2005). Benefits of cooperative learning in Weblog networks. In *Proceedings APAMALL2005 and ROCMELIA2005, Kun Shan University*.

Innovative Technologies for Education and Learning

Wenden, A. (1991). *Learning strategies for learner autonomy*. New York: Prentice-Hall.

Wickramasinghe, N., & Lichtenstein, S. (2006). Supporting knowledge creation with e-mail. *International Journal of Innovation and Learning* 2006, 3(4), 416-426.

Wikipedia. (2006). Mobile computing, definition. Retrieved August 25, 2006, from http://en.wikipedia.org/wiki/Mobile_computing

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 3, edited by L. A. Tomei, pp. 70-89, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.30

Introducing GIS for Business in Higher Education

David Gadish

California State University – Los Angeles, USA

ABSTRACT

Schools of business can benefit from adoption of geographic information systems (GIS). A brief overview of GIS technology is presented along with an example showcasing how it can be presented in a business school. GIS benefits for business schools, their students, and faculty are discussed. A comprehensive approach for promoting such spatial thinking is presented. The goal is to empower faculty to adopt GIS for their research and teaching, producing a large number of business school graduates that can promote spatial thinking in their organizations.

INTRODUCTION

This article discusses the introduction of GIS for higher business school education in departments such as management, marketing, economics, finance, and information systems. The goal is to have business school students, faculty, and administrators thinking about location and time issues

relating to their research, teachings, and business decisions using GIS technology to illustrate and to implement business ideas in terms of location and time. We begin with an overview of GIS and its benefits to business sectors and focus on business education. A detailed discussion of the approach ensues. It consists of an awareness campaign in which business school faculty, administration, and students are made aware of the benefits of thinking about business and business education in terms of location and time. Once an agreement is reached regarding the importance of spatial business thinking, resources must be secured to implement the approach. These include the purchasing and setup of GIS software, hardware, and data. Faculty must be trained in the use of GIS technology as well as in incorporating spatial thinking in the classroom. Faculty members also should be introduced to the benefits of GIS in their research activities. The article concludes with lessons learned from the author's experience, including the impact of spatial thinking and GIS technology on course curriculum.

California State University Los Angeles (CSULA) is reaching out to introduce spatial thinking in business education to build more academic-business bridges in the world. The school of business at CSULA, an AACSB accredited institute, is working to promote the use of GIS technology in business education as well as in the multicultural business community that it services.

GIS Overview

GIS is an integrated computer system capable of capturing, storing, retrieving, analyzing, and explaining spatial information that provides the user with knowledge of the location information in the context of time about the world, a business, a project, or an objective. GIS is also a location-based, decision-making tool that helps to produce useful information in a cost-effective manner. The ability of GIS to analyze spatial data frequently is seen as a key element in its definition and often has been used as a characteristic that distinguishes GIS from other systems. GIS facilitates spatial analysis, which is a set of analytical methods. It requires access to both attributes of objects under study and to their locational information and allows referencing traditional data sets to maps. Geographic Information Systems consist of a number of key components. These include computer hardware, software, data, procedures, and people. GIS data consists of spatial or mapping objects as well as non-spatial attribute data. Spatial data include points, lines, polygons, and other graphical representations, as well as text that represents buildings, customers, roads, and other real-world entities. GIS can help to answer different types of questions. It can help one to find what is at a particular location, where something specific is located, what has changed, what is the best way to get somewhere, what the pattern is, and what if certain conditions arise.

Higher education institutions have focused largely on training a select number of GIS special-

ists in certificate and Master's programs. Many of these specialists were hired by governmental organizations, which has resulted in a penetration of the technology in government and some private organizations. GIS currently is entrenched heavily in all levels of government across different departments and is making a substantial impact where it is used, including planning, coordination, and monitoring activities.

GIS Learning Case

Business school students may use GIS to learn about a way to make business decisions based on location. For example, consider using technology to define where a new health food store should be located in a city such as Los Angeles. The students may gather business data about different restaurants in the city, as well as their locations and what type of food they offer. The students then should gather information about the income of the citizens and other demographic information about the population (e.g., age, type of employment) based on zip codes in the city. This information can be overlaid visually on a map of the city using a GIS program such as ArcGIS. The students then can query the software to highlight the location of those zip codes where the income is the largest, the population is the youngest, and that currently do not have a store of the type the student is interested in, starting within a 10-mile radius of the zip code. The student learns that the GIS software supports their decision-making process.

GIS BENEFITS FOR BUSINESS

Business knowledge is power, which can be increased by looking at business data in terms of location and time. GIS enables one to view business information graphically, share information with others, as well as make appropriate business decisions. GIS can be used for managing

Table 1. GIS technology benefits to business organizations

| Business Sector | GIS Contribution |
|-------------------------|---|
| Publishing (Newspapers) | Increase newspaper readership by targeting new subscribers, mapping courier routes |
| Banking | Measure market potential |
| Retailing | Map customers and provide custom advertising |
| Health (Gyms) | Evaluate suitability of sites for new gyms |
| Dental Supply | Realign sales territories of salespeople |
| Healthcare | Evaluate healthcare resources, analyze demand for specific treatments by location to better serve the public |
| Real Estate | Determine where to locate commercial real estate — new shopping centers, new stores — by analysis of demographics and competition (Longley & Clarke 1996) |
| Food (Supermarkets) | Discover efficient delivery methods for food purchased via the Web or by phone order to homes |
| Insurance | Establish the value of real estate property to be insured |

information about a business; a business sector; or business activity in a region, a country, or the world (Grimshaw, 1999).

GIS can be used by businesses at a number of scales. GIS can be incorporated into individual projects, used at the departmental level or at the enterprise level responding to overall organizational needs, or used as a means for collaboration among multiple organizations. GIS allows organizations to make sense of large quantities of information that are prevalent in today’s business environment.

In the last few years, private business organizations started to see the benefits that GIS provides to the public sector and began adopting GIS technology for their own business needs. Table 1 lists a few business sectors and how GIS technology can benefit them (Boyles, 2002; Harder, 1997). This serves to demonstrate the wide-ranging applicability of GIS technology for business.

The GIS adoption process has proven to be lengthy and complex, as there are no sufficient human resources that understand and appreciate spatial thinking and its benefits to business

organizations. This gap in existing business and education appears more clearly as more businesses realize the benefits of the implementation of the technology and their inability to cope with it. This provides business schools with an opportunity to fill an important educational gap and a business need. Business schools, therefore, should begin to enhance their efforts to incorporate spatial thinking in their business education curriculum.

GIS BENEFITS FOR BUSINESS EDUCATION

Incorporating GIS into a business school benefits the school, the students, the faculty, and the business community. The following paragraphs outline key benefits to each stakeholder group.

GIS Benefits for the Business School

Business decision makers realize that the location of their organization’s facilities, employees,

competitors, clients, and potential clients must be taken into account when making business decisions. A school of business that would adopt GIS will be better able to address business needs by educating future business leaders to think and to make decisions in terms of location and time.

Early adopters of spatial thinking and GIS technology will have a competitive edge over other higher education institutions in satisfying the needs of business. Promoting closer ties with these organizations will allow for future collaborations and possible donations by these organizations in support of the business schools.

GIS Benefits for Students

Business school students will be exposed to a new way of thinking about business problems that included the analysis of location (at a specific point in time as well as the analysis of changes in location over time).

This will provide students with a competitive edge over those that have not been exposed to such spatial business thinking. GIS provides a visual learning environment. Visual environments are generally more fun, resulting in increased student interest in all that is business. These activities could allow students to become visionaries that are familiar with basic GIS functionality and can promote spatial thinking in the private sector.

GIS Benefits for the Faculty

School of Business Faculty can use GIS technology in the classroom to illustrate business concepts in terms of space and time. The technology enables them to convey their message more effectively.

Faculty members may use spatial thinking and GIS technology for their research objectives in order to gain a better understanding of business situations that they are researching in terms of location and time.

GIS Benefits for the Business Community

Graduates can look at the existing business processes and suggest new ways in which their organizations can leverage their spatial thinking (Wayne, 2002; Tomlinson, 2003).

THE PROPOSED METHODOLOGY

The author of this article has been working since 2002 to introduce GIS technology into CSULA's school of business. This is a multi-step approach that begins with an awareness campaign led by a champion and supported by one or more sponsors.

Introducing GIS requires a champion, a visionary within the school that believes in the approach and preferably is an expert in GIS technology. This person can be a faculty member in the business school, if such expertise is available, can be hired for this job, or can come from a different college of the same higher education institution. The champion must lead an awareness campaign, which should result in a certain level of interest.

An Awareness Campaign

The proposed approach begins with an awareness campaign in which the benefits of the use of GIS technology are presented to business school administrators, faculty, and students. For an effective and comprehensive campaign, both benefits and costs must be considered. Top school administrators, including the dean and associate deans, must be shown clearly the benefits of the technology. It is important to bring top college administrators, including the dean and associate deans, to sponsor the vision early on in the process. This sponsorship does not need to include a financial backing in an environment of strained resources. Department chairs and their faculty must be behind the campaign, as they will be the ones

implementing it at the grass-roots level. Faculty members, therefore, must believe in the benefits of GIS technology, as it will benefit their students as well as their own research activities.

Incorporating GIS into the Curriculum

Incorporating GIS can be achieved on a number of levels. Initially, one specialized GIS course can be introduced into the curriculum. The course should provide an overview of the theoretical aspects of spatial and temporal thinking and will be complemented by an introduction to GIS technology and its use.

Introduction to GIS Course Objectives

The course should be focused on introductory business GIS applications. Business students will be exposed to ways in which spatial thinking can be incorporated into business decision making, business operations processes, and business management. The course also would show how

GIS technology is used to solve specific business problems in a number of business sectors.

Introduction to GIS Course Outline

At CSULA, no GIS courses were offered at the business school prior to 2002. The author introduced GIS through the Computer Information Systems (CIS) Department of the business school. The author’s course outline used at CUSLA’s business school is presented in Table 2.

This business GIS course is offered at both undergraduate and graduate levels simultaneously and is open to all students at the school of business. The course complements the existing programs in the CIS department as well as those students from other non-CIS majors at the school of business. Some of programs and benefits the course provides are listed in Table 3.

Coursework is complemented with individual student projects. Each student selects an area (business sector or specific organization) that interests them and then pursues a theoretical application of the ideas discussed in the course to the topic. The

Table 2. Business GIS course: Topic outline

| Topic ID | Description |
|-----------------|--|
| 1 | What is GIS? |
| 2 | A Survey of the GIS Industry |
| 3 | Foundations of GIS: Data, Hardware, Software, Workflows, Science |
| 4 | Spatial Data: Collection, Build, and Maintenance |
| 5 | Spatial Data: Additional Sources of GIS Data |
| 6 | Analysis of Spatial Data: Buffer Analysis, Network Analysis |
| 7 | Business Applications of GIS: Telecommunications, Utilities, Banking and Finance, Retail/Wholesale, Government Sectors |
| 8 | GIS Data Display |
| 9 | Introduction to the Global Position System (GPS) |
| 10 | Applications of GPS Technology to Business |
| 11 | Future of GIS for Business: Internet GIS, Intranet GIS, Field GIS, GIS Database Integration |
| 12 | Case Studies |

Table 3. GIS technology benefits to the business school's programs

| Department | Program | Benefits |
|--------------------------|----------------------------|--|
| CIS | BA Business Track | Provides spatial thinking geared toward business applications |
| | BA Technical Track | Discussion of possible ways to apply software development practices to spatial problems using GIS technology |
| | MSIS (Graduate) | Provides spatial thinking geared toward effective management of business organizations |
| Management | Undergraduate and Graduate | Provides spatial thinking geared toward business applications and business management |
| Marketing | Undergraduate and Graduate | Provides spatial thinking geared toward marketing applications |
| Economics and Statistics | Undergraduate and Graduate | Spatial thinking about local, regional, and global economic issues, including labor, transportation, international trade, banking, and regulatory agencies |
| Finance and Law | Undergraduate and Graduate | Spatial thinking about regional and global financial/monetary patterns |

result is a paper discussing the existing state of GIS technology in the student's business area of interest. Each student shares his or her findings with the class during the last two weeks of the course. The paper provides students with an opportunity to see what others are doing in industry through Web and literature research as well as to provide them with the ability to come up with new and more effective ways of incorporating spatial thinking in their areas of interest.

Having such a business course can serve as a springboard for students use their theoretical and practical experience in their studies in other courses offered in the business school.

In addition to offering such a new GIS specific course, faculty members can incorporate the use of GIS into a large number of business courses. This can be limited to assignments that ask students to start thinking terms of space and time in order to solve business problems or assignments that explicitly require the use of GIS technology in

order to analyze business data. An introductory course about business information systems could be modified to include a lecture introducing GIS technology. An introductory management course could be modified to include a lecture introducing the benefits of spatial thinking to the management of an organization.

Purchase and Setup of GIS Software, Hardware, and Data

Incorporating GIS technology requires the purchase and setup of hardware and software. For the most part, existing hardware resources can be leveraged for GIS teachings and research. GIS requires more hardware resources than traditional computer programs such as word processors and spreadsheets. GIS software needs more disk space and computer memory. Most modern desktop computers that are two or three years old have

sufficient resources for GIS applications and, therefore, do not require any special or costly upgrades.

Major software vendors are interested in having education institutions adapt their technologies and having their capabilities known to future business leaders. This has created an environment in which GIS software can be licensed for GIS educational institutions at minimal cost.

Spatial data (mapping data) that would complement existing business data for analysis in the classroom as well as for faculty research purposes should be secured. Spatial data can be acquired from a number of sources in a variety of ways. Some GIS data can be downloaded at no cost from the Internet. Business data can be purchased at an educational discount from private sector spatial data vendors. GIS data can be licensed from various levels of government, often at no cost.

GIS Learning Support and Standards

A number of national non-profit organizations provide support for GIS faculty and students. These include URISA and GITA.

Additional support can be provided by the major GIS vendors. These include ESRI, Intergraph, and Bentley.

Training Faculty

Training faculty is fundamental to the success of the proposed approach. It is important for faculty members to feel comfortable in the use of the technology. It is also very important for faculty members to be comfortable explaining the benefits of the technology to themselves as well as to their students. It is important for faculty members to be comfortable with the software and the thinking processes to an extent that they can convey the appropriate message and teach the technology to their students with ease. Arriving at such a level of comfort with GIS technology may take time

and resources. This could include sending faculty members for training by GIS vendors on the use of GIS software. A better approach would be to bring in GIS experts, preferably from within the business school or, if not available, from the Department of Geography of the same university, to teach business faculty members how to use the technology. Initial training must be followed up with regular events (possibly coinciding with the annual World GIS Day) that reiterate and enhance the notion and the benefits of the use of the technology for business education as well as refresh faculty with new GIS capabilities and tools and their benefit for business teachings and research. This ongoing process would be beneficial for existing faculty members as well as new faculty members that join the business school. Such meetings could be used to provide faculty and students with an opportunity to share their research that pertains to spatial thinking and GIS technology as well as their teaching experiences.

CONCLUSION

The introduction of GIS technology to a business school requires a leader and must be done in a methodical way, realizing that the process will take time. Some faculty members may resist change due to fear of technology, in general, and the perceived complications that are added with the adoption of GIS technology, in particular. These concerns can be mitigated with time through a systematic and thorough campaign of educating faculty to the benefits of the technology and its use for their own teaching and research needs and showcasing the benefits gained by those faculty members who have adopted the technology.

Introducing GIS technology should and will have an impact on the course curriculum of the business school. A course specializing in GIS would be added to the curriculum. Other courses could be affected and their curriculum could be adjusted.

Introducing GIS for Business in Higher Education

The proposed approach will, with time and effort, allow an increased awareness of spatial thinking and use of GIS technology to the benefit of business school administrators, faculty, and students. The benefits are expected to propagate further to the business sector and the community.

In the case of CUSLA's business school, the results are positive and promising. Students from various departments of the business school have taken the course and have commented that it provides them with a new way of seeing the business world. Student retention in the course is very high. Twenty percent of the students have indicated their intent to pursue business GIS learning beyond the existing framework. Many of these students are working on various research activities that incorporate GIS and spatial thinking. Spatial thinking has been received positively by faculty in the school of business. The author presents an overview of business GIS as part of a number of other faculty members' courses. The school of business continues to support these efforts in terms of financial and technical resources.

The author recommends the outlined approach to other business schools. The effort should be gradual, taking one small step at a time.

REFERENCES

- Boyles, D. (2002). *GIS means business: Vol. 2*. ESRI Press.
- Grimshaw, J. D. (1999). *Bringing geographical information systems into business*. John Wiley & Sons.
- Harder, C. (1997). *GIS means business*. ESRI Press.
- Longley, P., & Clarke, G. (1996). *GIS for business and service planning*. John Wiley & Sons.
- Tomlinson, R. (2003). *Thinking about GIS: Geographic information system planning for managers*. ESRI Press.
- Wayne, R. (2002). Location, location, location. *SDMAGAZINE*.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 2, Issue 2, edited by L. A. Tomei, pp. 62-70, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.31

CAL Student Coaching Environment and Virtual Reality in Mechanical Engineering

S. Manjit Sidhu

University Tenaga Nasional, Malaysia

N. Selvanathan

University Malaya, Malaysia

S. Ramesh

University Tenaga Nasional, Malaysia

ABSTRACT

This work presents an extension of our study on multimedia patterns of interactions and development of computer aided-learning (CAL) engineering tools. We used four approaches in implementing the CAL tools for user visualization that is, that is, 2-D, 3-D, coach environment and desktop virtual reality. The designed CAL tools have been enhanced to enable the integration and investigation of visualization in various engineering problems for undergraduates with particular weak learners. Each problem was designed using different authoring tool. More significantly, we have enhanced some of the CAL tools to the degree where the user can interact and be coached

independently. This dramatically increases the quality of the tools i.e. patterns of interactions, 2-D and 3-D views of synthetic models. In general the result shows that the CAL tools could alleviate the user interacting and instill a sense of learning and the user understand the engineering problem better.

INTRODUCTION

Multimedia has been applied successfully in diverse areas of medicine, manufacturing, scientific engineering visualization and education (Manjit Sidhu, Selvanathan, Diljit, & Ramesh, 2002; Mcateer, Neil, Barr, Brown, Drapper, &

Henderson, 1996; Sheingold & Hadley, 1990). However today, both multimedia and desktop virtual reality CAL tools are becoming one of the most used technologies in delivering high quality teaching aids and allows virtual perception in general. Thus, the world of virtual perception has now extended into the area of engineering.

Before conducting a complicated experiment, a learner can now rehearse on a virtual engineering problem, that is, by using a computer simulation. By wearing a special pair of glasses, which produce the impression of a three-dimensional object, they are able to manipulate the objects parts as they would in a real situation.

Modern and powerful computers are capable of astonishing things, however they are still a long way from reaching their peak of performance. Engineers and technicians increasingly can enter into and interact with, an artificial, virtual reality environment that is more and more like the real world. Furthermore the computer can provide sensory impulses for our eyes and ears, creating a near perfect spatial object. As such, in the context of engineering users of CAL tools can interact, manipulate, and visualize the objects better.

The major aim of this study is to identify engineering problems that are difficult to visualize and understand among undergraduates with particular weak learners. The weak learners are students who take a longer time to complete the mechanical engineering course. The advanced students normally takes approximately four years to complete the undergraduate degree course, however the weak learners may take up to five years to complete. As such, the weak students need an alternative means of learning to improve their knowledge in the subject matter. Other aims of the study includes, to design and develop interactive multimedia and desktop virtual reality (DVR) CAL tools with appropriate patterns of interactions by providing interactive user interfaces for exploring, visualizing and problem solving. The study also identifies the ways that multimedia and DVR support the approach at both theoretical

and undergraduate practical level in engineering. The application area in this research is engineering mechanics and dynamics because this area contains a wealth of interesting and difficult to understand problems among weak learners at University Tenaga Nasional (UNITEN).

COMPUTERS AND PERCEPTION

Today, with the aid of virtual reality environments, a rich variety of applications and new three dimensional and imaging technologies ranging from automotive, engineering, and aerospace design to weather simulation, climate modeling, and medical applications, with many different research and engineering objectives, and user types are being carried out. Visualization can be useful and important in many ways. For example, an architect can walk in a house that has not been built, a doctor can travel through the respiratory system looking for malignant tumors, a chemist can create new compounds at a three dimensional drawing board and the builder of a new power station can put his designs on different foundations in order to test them for safety.

For many years now, automobile companies have developed their new model, using computer simulations; even high-speed crash tests are carried out with advanced computers. After the virtual crash, design engineers can inspect the vehicle from all sides and look into the mangled interior. Thus the use of computer simulation considerably reduces the number of prototype cars, which must be built before a vehicle is ready for production. Consequently, multimedia and desktop virtual reality CAL tools are increasingly being employed in industry and education.

VISUALIZATION

As an important component of the CAL engineering tools, the use of visualization for engineering

mechanics and dynamics is being studied. In order to facilitate the enhancements of new visualization paradigms as well as the integration of existing methods with the traditional learning process, new and enhanced interactive multimedia CAL tools were required to coach weak learners learn how to solve engineering problems during unsupervised laboratory work.

Existing CAL tools were either general-purpose visualization tools and lacks interactivity (Sheingold & Hadley, 1990). Numerous studies have found that interactivity has a strong positive effect on learning (Bosco, 1986; Cairncross & Mannion, 2001; Gupta, 2002; Hiroshi, 2002). For example, Bosco (1986) reviewed 75 learning studies and found that learners learn faster, and have better attitudes toward learning when using interactive multimedia tools. In addition, a study by Najjar (1996) found that learning was higher when information was presented via computer-based multimedia systems than traditional classroom lectures.

With general-purpose visualization CAL tools previously developed in UNITEN, lack of domain specific refinements limits use to visualization that makes user deployment for learning purposes difficult.

Furthermore, more specialized CAL tools almost lack interaction between user and machine and focus on linear leaning method rather than deep learning (Sheingold & Hadley, 1990). According to Entwistle, Thomson, and Tait (1992), deep learning is associated with not only acquiring the information but also understanding it through relating it to previous knowledge and experience.

In addition, previous studies have not dealt with concepts that lend themselves to visualization (Manjit Sidhu, Ramesh, & Selvanathan, 2003). By visual, the concept is dynamic and therefore more easily shown on a computer screen where the image can change back and forth between screens.

2-D Graphics and Animation

In this context, the previous work focused on the feasibility of using various animation techniques such as tweening an image and good quality graphics and color-coding to draw the users' attention to various concepts being presented. Tweening is a technique that allows "in-between" images to be created between supplied key-frames using linear interpolation. In the initial stage, simple animation of 2-D objects on screen was achieved by coloring significant parts of a structural diagram, connecting each part together to form an animation and then returning them to their original state.

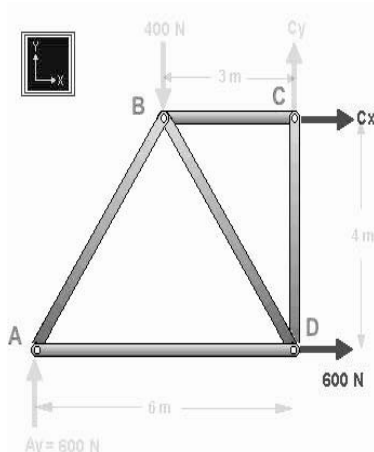
The content contained within the tutorials is intended to provide students with better understanding of the theoretical concepts taught in class as well as to enhance their ability to apply mechanics concepts in a variety of engineering design. One common occurrence in the use of such CAL tool is that the users tend to visualize the same material faster when they do not have to spend extra time using these learning aids (Entwistle et al., 1992; Mcateer et al., 1996). In addition there is compelling evidence that students develop more interest in the subject matter (Entwistle et al., 1992; Kruger, Frohlich, Bohn, Schuth, Strauss, & Wesche, 1995; Mcateer et al., 1996).

Mechanics statics, like many other engineering subjects, is fundamentally about problems solving through the application of scientific principles. However, there are many cognitive steps leading from problem to solution and consequently many educational difficulties such as students lack the ability to translate mathematical word problems into the form necessary for effective computation. These engineering problems are often complex, and relationships among the variables of an experiment can be difficult to visualize. As such, multimedia CAL tool provides an alternative for presenting engineering and scientific information in a way that is easier for students to understand. For instance, when a 2-D image is displayed in the right way, the user often has new insights

into the underlying principle being taught. Furthermore, most CAL tools demands some kind of user navigation. The non-linearity offered by many multimedia CAL tools provides a learner greater navigational and freedom (Manjit et al., 2003). Users may go onto any section in a multimedia tutorial and in any order. Dynamic media such as video and audio can be controlled, that is, pausing, playing and repeating clips.

Problems in mechanics statics are presented to the student as a combination of schematic diagrams and text descriptions. The student must immediately apply learned knowledge in order to form an internal model of what the problem means. The shapes and lines that make up the schematic diagram have very specific engineering meanings, and the words accompanying the diagram could also give rise to student error because critical information about the solution of the problem is often concealed in the text in unexpected ways. Our previous experience showed that an average student would be able to solve the problem at the first try but a weak student would require several trials before solving the problem (Manjit et al.,

Figure 1. To find force C_x , the forces A_y and C_y are made dim. When the forces in the x-direction are being considered, the computation appears in an animated form, i.e. $\sum F_x = 0 \quad C_x + 600 = 0$
 $\therefore C_x = 600 \text{ N}$



2003). The weaker students take a longer time to solve the problem mainly because these students lack the understanding of the theory that has been taught during normal lectures. As such, these students would require an alternative method of instruction to enhance their learning skills.

Therefore, the most effective way of learning the principles of engineering mechanics is to solve

Figure 2. Moments are taken at joint C with the assumption that counter-clock wise moment is positive.

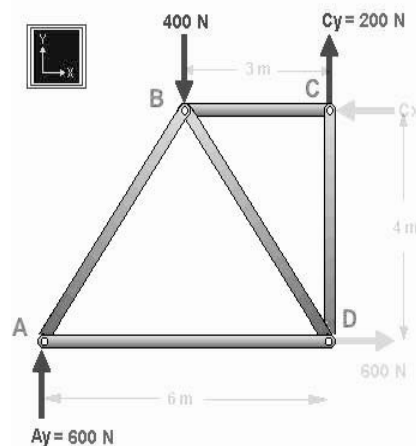
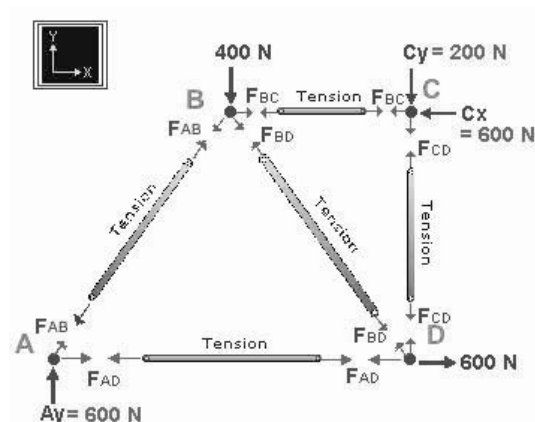


Figure 3. The final solution is analyzed and the correct free-body diagram showing all forces (tensile and compressive) acting in each member is drawn on the screen.



problems. To be successful at this, it is important always to present the work in a logical and orderly manner. In the case of structural analysis as in Figure 1, since all the forces acting at a joint must be taken into account, the importance of drawing the free-body diagram (FBD), Figures 2 and 3, before applying the equations of equilibrium to the solution of a problem cannot be overemphasized. However, prior to this the support reactions must be determined. In the FBD, the forces that are given should be labeled with their proper magnitudes and directions. Letters are used to represent the magnitudes and directions of forces that are unknown, for example in Figure 1, the reactions force components at the supports *A* and *C* are designated as A_y , C_x and C_y . In particular, if a force has a known line of action but unknown magnitude, the “arrowhead,” which defines the sense of the force, can be assumed. The correct sense will become apparent after solving for the unknown magnitude. By definition, the magnitude of a force is always positive so that, if the solution yields a negative scalar, the minus sign indicated that the arrowhead or sense of the force is opposite to that which was originally assumed. At the click of the “Continue” button, the analysis to compute the unknown reactions is carried out in a step-by-step approach. The ability to build a screen sequentially is extremely important to allow students to see the progression of the derivation and process steps. As the user clicks the “Continue” button, relevant forces causing moments about *C* is written on the screen.

Every attempt is made to minimize text on the screen and maximize the computer visualization capabilities. One strategy is to link text and graphics to reinforce a concept (e.g., to display a particular segment of an animation as typically shown in Figure 2, provide clarifying text, and so on). Highlighting text using boldface or color is also useful. Animations can also be displayed in sequence with supporting text to highlight each process as typically shown in Figure 3.

Coach Environment

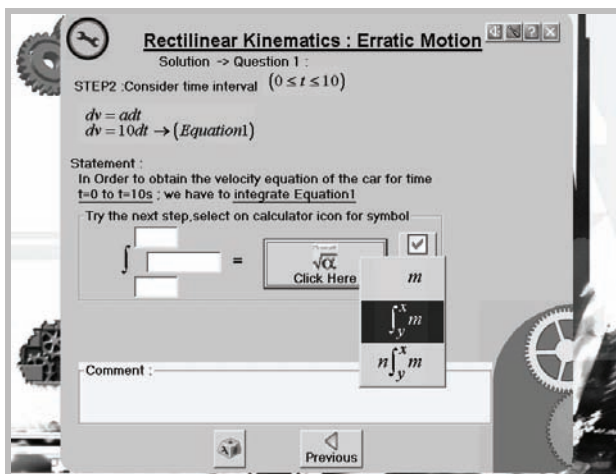
One of the early objectives of this CAL tool was to provide an environment that could help the user solve engineering mechanics problems without the help of a human instructor. We define coach environment as a CAL tool that can guide a user by providing a step-by-step approach to solve a task. In addition it provides the user with more dynamic, interactive support than does help as provided in general CAL tools. In coach environment, the user can approach the “Hint” and “Solve” buttons in the event the user reaches an impasse. Typical example in the coach environment CAL tool includes of basic information, context-sensitive hints or tips, or procedural steps required to solve a problem. Since not all students are capable of solving engineering problems by attending a single tutorial, the CAL tool is designed to help and show the user how to solve a problem leading from the question to a series of steps and solution. Every task and step is shown in an animated process on the screen with audio or video narrating more about the problem as shown in Figure 4. The CAL tool also provides reasoning support and explanations of complicated concepts while the user is trying to solve the problem presented in the tool. Thus this approach can help weak learners make decisions and complete tasks better and provide explanation for reasoning, enabling continual performance and improvement. In addition the CAL tool could further provide more classroom time for demonstrations and coverage of conceptual issues. The focus of this study was to investigate whether such a CAL tool could enhance understanding and effective to be used as an unsupervised learning aid particularly for weak learners.

The coach environment CAL tool was designed in such a way that it would not deviate from the method of teaching adopted by the lecturer teaching the mechanics dynamics course. The tool has striven to embed the same pedagogical philosophy that is used in the classroom. For example in solv-

Figure 4. Video explaining engineering concepts



Figure 5. A selection list of formulas and equations



ing mechanics problem, students are normally encouraged to draw free body diagrams and kinetic diagrams where appropriate, label all known forces, moments and other parameters, select appropriate datum or reference point, use appropriate formulas and equations to solve the problem. Past research [7, 8] indicated that immediate feedback has a positive impact on learning, and thus the tool was designed to provide immediate feedback such as by displaying blue colored messages in the comment box on the computer display to indicate

correct student actions, red to indicate incorrect ones and black to indicate no value entered in the text input box, and so on. In addition, if a student input the wrong answer, he/she may immediately be narrated and questioned prior to giving a hint by clicking the “hint” button.

In this CAL tool, users are encouraged to select and define the correct formula from a drop list and then to use them to enter symbolic equations, and finally to solve for the numerical answer as shown in Figure 5. In order to eliminate poor

algebraic skills from undermining the conceptual issues the user is trying to learn, the tool further enable the user to select an equation, and click on a “solve” button which will then perform the algebraic/arithmetic manipulations necessary to simplify the equation. This feature is considered to be important as it can help the slow learner memorize the correct formula or equation to be used for other similar problems.

The interface of the CAL tool provides an interactive environment in which the user works the mechanics dynamics problem as shown in Figure 6. It consists of several electronic turning pages and multiple user tools, that is, calculator, notepad, and glossary of commands.

In the preliminary development stage, the tool has been designed to solve rectilinear kinematics, erratic motion, and structure problems. It is anticipated that kinematics of a particle and motion of a projectile problems will be implemented and added to the tool in the next stage. This coach CAL tool is basically a powerful and flexible tool that is designed to work the solution of the problem in a step-by-step fashion. As the user click on the “next” button to proceed, the tool would then question the user on the next action by giving three options. In this way, interaction between

the user and the tool is achieved. Although the tool has been implemented using Microsoft Visual Basic and Swish, it is a stand-alone (PC based) application, which is available on the CD-ROM and currently runs on Windows platform.

In general, the evaluation discussed in section 6 revealed that the users gained knowledge from the multimedia session and the level of confidence in solving problems pertaining to that particular engineering problem that has already been taught in the classroom has increased.

Architecture

The coach CAL tool has a user-friendly environment that build on eight major modules: the action interpreter, the assessor, the interface, the help, the calculator, the glossary of commands table, graphs to show (velocity, time, and speed) $v-t$ and $s-t$ and a database to store the students progress score.

System Environment

The system environment consists of the given conditions of a problem and a dynamics problem-solving engine. The problem-solving engine

Figure 6. The interactive interface of the CAL tool

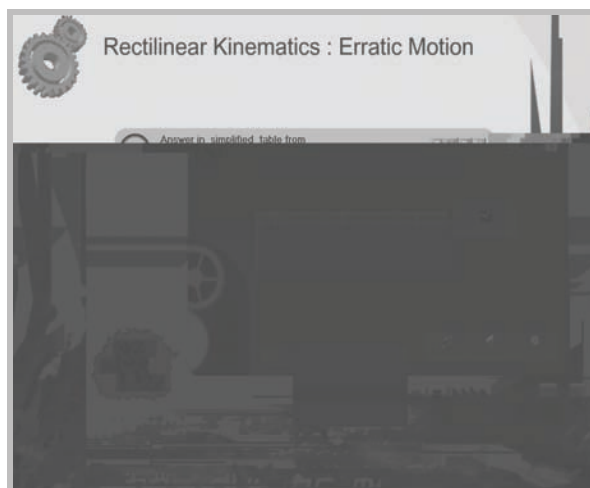


Figure 7. Typical coach CAL problem-solving decision making rules

| | | |
|---------------|------|---|
| STEP 1 | If | the sub goal is to determine the time needed to stop the car correct kinematics formula applied |
| | then | create a sub goal to find out how far has the car traveled |
| STEP 2 | If | correct symbolic equation selected correct values input in text boxes and correct value of velocity applied |
| | then | create a sub goal to determine the next subsequent step |
| STEP n | | |

contains approximately 15 conditions comprised of decision-making rules. An example of each type of rule is shown in Figure 7.

The given conditions of a problem are used as input to the problem-solving engine. As a matter of policy, the input matches the written problem statement as the exact answer with interpretation. Outputs from the problem-solving engine consist of all the equations necessary to solve the problem. These equations are then used by the action interpreter and assessor to provide appropriate hints.

Action Interpreter and Assessor

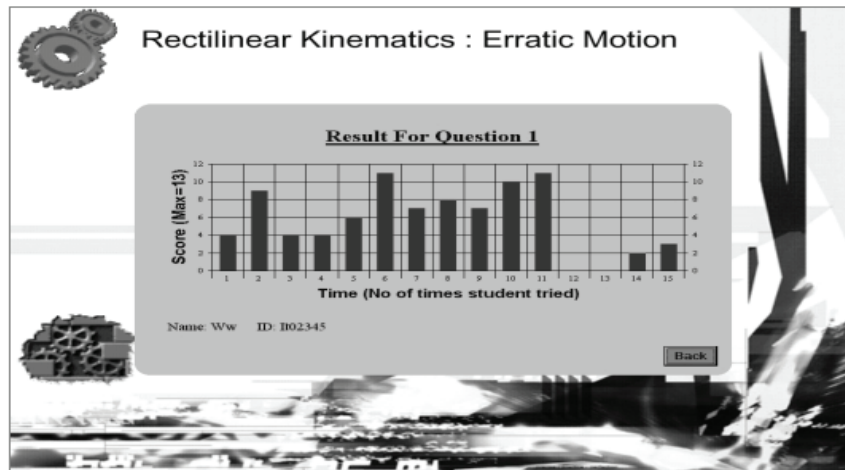
The action interpreter module interprets the user's problem solving action in the context of the current problem and determines the type of feedback to provide. For example, if the user enters an equation, it is compared to the set of equations produced by the problem-solving engine and if a match occurs, the message colored in blue indicating that the equation is right is displayed. If there is no match then the message colored in red indicating incorrect equation is displayed. When

the user has reached an impasse and has no idea how to proceed, he can click the "hint" button; which may aid the user solving the problem.

On the other hand, if the user has input the wrong formula, he will be narrated and ask if he needs a hint. If the answer is wrong again, a "solve" button will be visible. The user can click this button in order to let the CAL tool solve the problem. The solution will be shown in a step-by-step animated form. If the answer given by user is correct, he can then proceed to the next step. If a complete solution has been accomplished, except for numerical substitution, the user can consult the CAL tool to do the appropriate substitution. If the user correctly solves a step, the screen will display the consequent step to be solved. The steps are iterated until the last step is solved. During these actions, the user progress database is also updated accordingly. The progress results of the users are shown at the end of each complete attempt to solve the problem as typically shown in Figure 8.

High quality color graphics are used extensively and design features, such as interactivity, animation and a hypertext facility are used with

Figure 8. Typical user progress screen in the CAL tool



the intention to enhance student learning. Interactivity is promoted in several ways. For example, users are required to:

- Input numeric values in text boxes;
- Interpret time graphs of a car journey; and
- Perform calculations of distance the car traveled.

In addition, users must answer a variety of questions included in each step. These may be selecting the correct formula from a drop list and multiple choices with feedback and so on.

3-D Synthetic Models and Animation

One of the latest developments is the incorporation of interactivity multimedia to study 3-D motion involving the study of mechanics dynamics. As an example, in Figure 9, the movement of the rod as well as the motion of a collar on the rod can be studied simultaneously with the incorporation of multimedia technology. The benefit is two fold; the user can firstly visualize the relative motion of the collar with respect to the moving rod and secondly, that the path of the collar during a given time period, for example, $t = 0$ to $t = 5s$

can be viewed in real-time and analyzed. This is illustrated in Figure 10 where initially when time $t = 0$ the collar is originally located on the rod at p and after a time interval of say 5 seconds, the collar has moved from its original position to a new position q as shown in Figure 11. Close observation indicates that the collar has taken a curve path and thus has a curvilinear motion.

Desktop Virtual Reality

Virtual reality (VR) is defined as a highly interactive, computer based multimedia environment in which the user becomes the participant in a computer-generated world (Jong Heon et al., 2001). Interaction plays a very important role in virtual environments. Much has been published about interaction techniques in multimedia and virtual reality; however the mission for truly intuitive and natural interaction techniques is still on going. A key feature of VR is real-time interactivity where the computer is able to detect user inputs and instantaneously modify the virtual world in accordance with user interactions. VR environment often consists of technological hardware including head-mounted displays, 3-D goggles and motion-sensing data gloves. Although VR technology could be expensive and difficult to

Figure 9. Linear motion of the rod and collar rotating along y-axis ($t = 0s$)

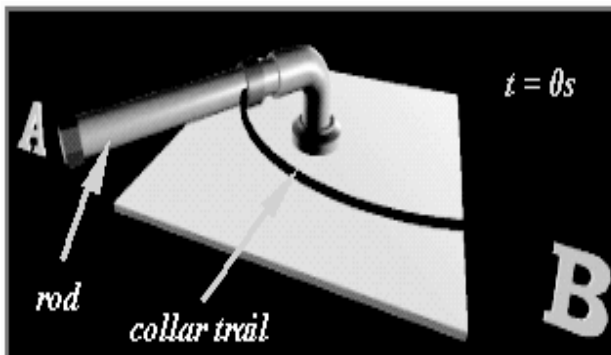
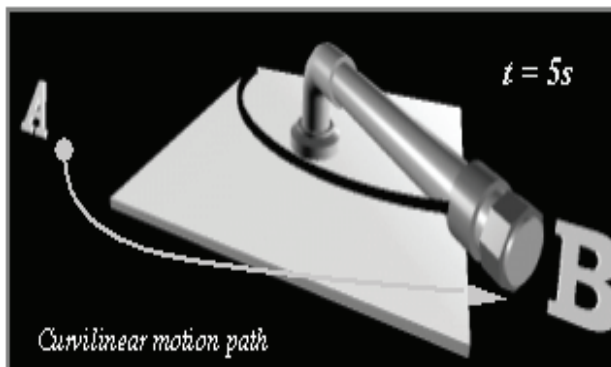


Figure 10. Linear motion of the rod and collar rotating along y-axis ($t = 3s$)



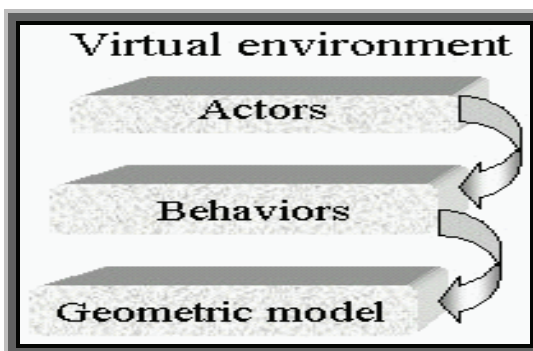
Figure 11. Linear motion of the rod and collar rotating along y-axis ($t = 5s$)



bring into classroom settings, the advent of new desktop virtual reality (non-immersive) software development tools does not require expensive hardware to be used when interacting with CAL tools. The minimum requirements for interacting with the CAL tools are by using a mouse, joystick, keyboard and simple 3-D glasses. In our latest CAL tool development, progress has been made to implement a 3-D model that is being tested in a desktop virtual reality (DVR) environment for greater interaction and visualization. In user interaction with virtual worlds, consistent realistic behavior of objects is very important (Bowman & Hodges, 1997). As such, it is desired that the objects can respond in a natural and predictable way to the actions.

The CAL tool attempts to help users to enhance their knowledge and understanding of curvilinear motion of engineering members. The virtual environment as illustrated by Figure 12 is a 3-D model of a robot arm (actor) that can be viewed and interacted with in a 3-D environment. Fundamentally the CAL tool assists with the direct visualization of 3-D geometric model created using Alias Maya™ (a 3-D modeler). It allows the users to explore the model by using the built-in features in the tool i.e. moving, walking, flying, examining, resizing, rotating and changing viewpoints. With these features, the user can

Figure 12. Components of the virtual environment



move along any direction on the screen and have the displayed 3-D robot arm continuously and instantaneously updated. The main interface of the DVR CAL tool is shown in Figure 13. The interface of this CAL tool has been implemented using Macromedia Director™ (an authoring tool), it is a stand-alone (PC-based) application, which is available on the CD-ROM and currently runs on Windows platform.

To further help the user with regards to visualize the robot arm, the model has been enhanced to animate and show the path of motion of particle in terms of cylindrical coordinates. In addition, a stereoscopic image gallery of the robotic arm is also available. This is the virtual reality part (non-immersive) of the CAL package. The “stereoscopic” button can be activated to get a better view of the 3-D robotic arm. The stereoscopic views are available as static images and 3-D animations. However, to view the stereoscopic images the user needs to wear an inexpensive pair of simple stereo glasses. One benefit of including the stereoscopic images is that the student can gain a better wider view of the trail (path) and motion of the 3-D robotic arm. To further help the users orient them with regards to the robot arm; polygonal views are available with their correct positions and orientations in a wire-frame (the model without textures) representing the physical extends of the robot arm. Figure 14 shows the image of a robot arm along in a wire-frame mode and the motion path trail. The trail is produced in a 3-D environment to show users how the robotic arm has moved from one point to another based on the time input by the user. As such it can be clearly seen that the robotic arm has taken a curvilinear motion.

As expected in most similar visualization CAL tools, the tool is in progress for further enhancements such as interfacing it to other hardware devices, that is, joystick, data gloves, and so on.

Figure 13. A caption of a robot arm and main interface of the industrial robotic arm

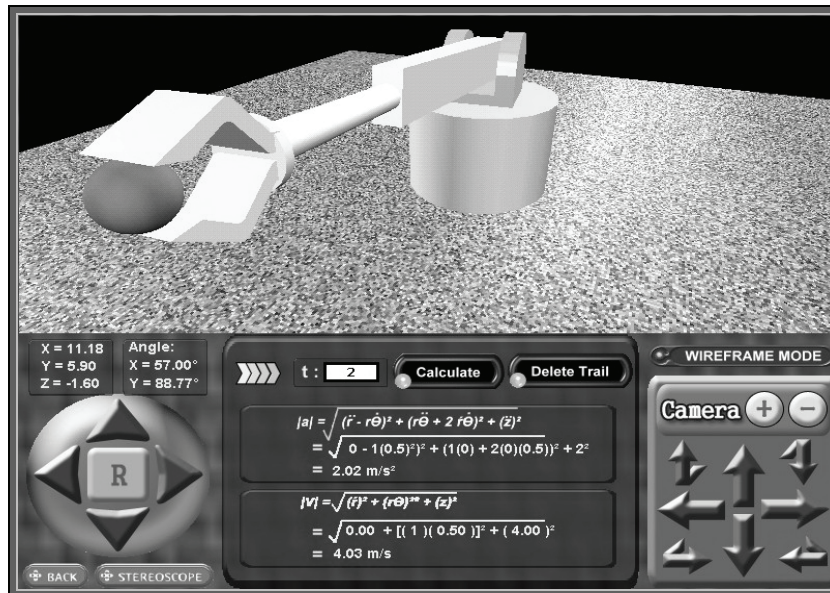
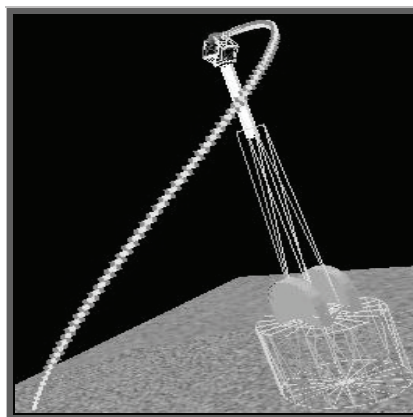


Figure 14. Polygonal view and motion path trail of the robot arm



RESULTS AND EVALUATION OF THE PEDAGOGICAL EFFECTIVENESS

The CAL tools were evaluated to confirm that the aims and objectives of the presentation had been met:

- To provide the learning opportunity, understanding and appreciate the advantages of incorporating multimedia and DVR as an interactive tool for education.
- To enhance student's knowledge with particular weak learners in the topic "Engineering mechanics and dynamics".

The previously-mentioned objectives were subsequently used as a baseline for the development of a questionnaire that was tailored to suit the audio, video, animation, and CAL tools respectively.

We selected a group of weak learners taking the engineering mechanics subject. The topics of the subject include analysis of an engineering structure, kinematics of a particle, and curvilinear motion. After presenting the CAL tools, we tested the students' knowledge improvement and surveyed the students' attitudes about the CAL tools. In general, the outcome of the pedagogical effectiveness evaluation of the CAL tools was very encouraging. The majority of users were in the agreement that the incorporation of audio, video, and animation in the CAL tools was beneficial in enhancing their understanding of various concepts that has been taught in the lectures. The results as obtained from the student feedback are presented in Figure 15, Table 1, and Table 2.

The beneficial effect of incorporating multimedia in teaching engineering mechanics and dynamics has been revealed. In particular, it can be noted that the level of confidence and understanding of the students in the subject matter greatly improved with the supplement of multimedia and DVR technology.

CONCLUSION

In this paper, four approaches for the study of multimedia patterns of interactions and visualization in engineering problem solution for undergraduates were described. These approaches can be employed and found to be suitable to aid engineering problem solutions in general. In addition to learning applications, the authors have also explored the potential for multimedia and VR as a general CAL tool, for eventual use in practical engineering applications. The educational benefit of multimedia and VR can benefit weak learners in some situations, when it is properly implemented. However these technologies should not be considered as replacement for real experiences but as an alternative to design and implementing additional CAL tools to help weak learners understand the concepts of engineering and learn better.

The present study revealed the following:

- The developed CAL tools are uniquely dedicated to the development and application of visualization in engineering that are difficult to understand and deliver as opposed to the traditional method of learning. In addition, its particular form of extensibility alleviates

Figure 15. Outcome of student evaluation

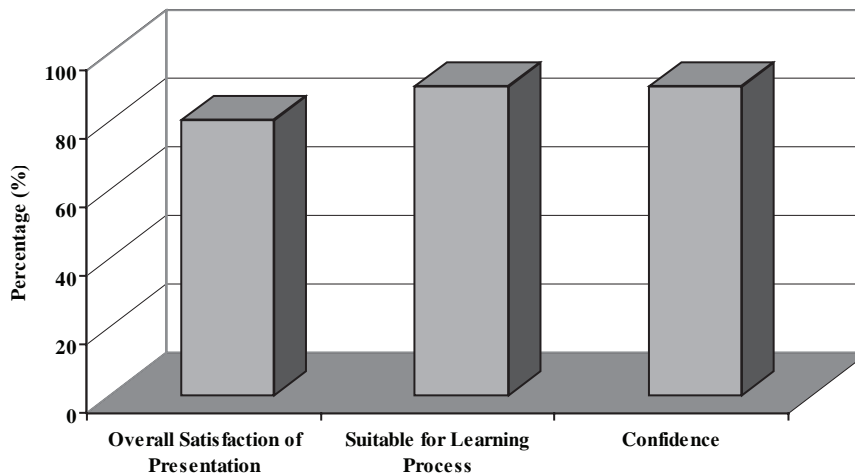


Table 1. Student response on the presentation format and language usage in the CAL tools

| Response | Percentage |
|---------------------------|-------------------|
| <i>Easy to understand</i> | 20% |
| <i>Can understand</i> | 80% |
| <i>Quite difficult</i> | 0% |
| <i>Very difficult</i> | 0% |
| <i>Difficult</i> | 0% |

Table 2. Typical student perception of the effectiveness of the developed CAL tools for mechanics engineering

| Questions | Yes | No |
|---|------------|-----------|
| <i>Do you think that all the facts or details in the learning tool are clearly explained and understandable?</i> | 100% | 0% |
| <i>Do you think that the learning tool is interesting?</i> | 100% | 0% |
| <i>Are you able to visualize the problem in this experiment?</i> | 100% | 0% |
| <p><i>What is your opinion about this interactive learning tool for Structural Analysis?</i> <i>Some user responses:</i></p> <ul style="list-style-type: none"> i. It is very helpful in the sense that it will enable a person like me who is not knowledgeable in Structural Analysis to understand the concept being explained. ii. May enhance the student's understanding but it is more suitable for self-learning activities. iii. It is suitable and learnable. | | |

- the often-encountered conflict between the requirements of specialized application and those of a flexible and open architecture.
- The developed prototypes have been found to be useful in reinforcing understanding of concepts such as equation of equilibrium through animation and the graphics give a good global impression in a 2-D image.
 - Preliminary evaluation of the coach environment tool indicated that it has great potential to aid teaching and thus provide an effective learning environment particularly for weak

- learners. In addition such an environment was found to be appropriate when the user want to find out how to do a more complex cognitive task and understand why a specific step must be done, or determine why a specific decision was suggested.
- In a 3-D animation and desktop virtual reality environment, such visualization and simulation tools can greatly benefit from the computational power of personal computers; furthermore problem solving using these powerful multimedia CAL tools permits

approaches beyond those traditionally selected because they minimize computational effort.

- In general, multimedia and DVR technology can facilitate a faster and more complete analysis of design alternatives by providing ways to rapidly create models or prototypes of proposed designs and to then simulate them in a more realistic way.

The pedagogical effectiveness evaluation results of the CAL tools developed and tested with weak learners showed positive feedback from students. In addition the students were motivated to use the CAL tools as they found it easier to learn as compared to textbooks alone.

The CAL tools are in progress of being enhanced to integrate with advanced predictive modeling, sound effects, and increasing functionality for engineering experiments. Thus, it is anticipated that the CAL tools will evolve to allow a broader range of patterns of interactions and visualization methods.

ACKNOWLEDGMENT

The authors would like to express their gratitude to UNITEN and University Malaya for the support provided.

REFERENCES

Bowman, D. & Hodges, L. (1997). User interface constraints for immersive virtual environment applications. In *Proceedings of IEEE VRAIS* (pp. 35-38).

Bosco, J. (1986). An analysis of evaluations of interactive video. *Educational Technology*, 26(5), 7-17.

Cairncross, S. & Mannion, M. (2001). Interactive multimedia and learning: Realizing the benefits.

Innovations in Education and Teaching International, 38(2), 156-164.

Entwistle, N., Thomson, S., & Tait, H. (1992). *Guidelines for promoting effective learning in higher education* (Technical Report). University of Edinburgh, Centre for Research on Learning and Instruction, Scotland.

Gupta, A. (2002). Content development for e-learning in engineering education. *Interactive Educational Multimedia Journal*, 2(4), 12-23.

Hiroshi, H. (2002). Multi-level, interactive Web-based simulations to teach fluid mechanics and aerodynamics from middle school to college levels. *International Journal of Engineering Education*, 1(18), 1-6.

John, H., Sang, T., Heebok, T., Keun, C., & Heeman, L. (2001). Virtual reality simulations in physics education. *IMEJ Journal*, 2(3), 1-7.

Kruger, W., Frohlich, B., Bohn, C. A., Schuth, H., Strauss, W., & Wesche, G. (1995). The responsive workbench: A virtual environment. *IEEE Computer*, 1(2), 42-48.

Manjit Sidhu, S., Ramesh S., & Selvanathan, N. (2003). The role of multimedia in engineering courseware. In *Proceedings of the 32nd International Conference On Computers and Industrial Engineering, Vol. 1* (pp. 367-372), Limerick, Ireland.

Manjit Sidhu, S., Selvanathan, N., Diljit, S., & Ramesh, S. (2002). Current challenges & trends of interactive multimedia in enhancing engineering education. In *Proceedings of the IEEE Region 10 Technical Conference on Computers, Communications, Control and Power Engineering* (pp. 265-268), Beijing China.

Mcateer, E., Neil, D., Barr, N., Brown, M., Drapper, S. & Henderson, F. (1996). Simulation software in a life sciences practical laboratory. *Computers and Education Journal*, 26(1-3), 101-112.

Najjar, J. L. (1996). Multimedia information and learning. *Journal of Educational Multimedia and Hypermedia*, 5(2), 129-150.

Sheingold, K., & Hadley, M. (1990). *Accomplished teachers: Integrating computers into classroom practice*. New York: Bank Street College of Education, Center for Technology in Education.

This work was previously published in International Journal of Information and Communication Technology Education, edited by L. A. Tomei, pp. 12-27, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.32

Assessing the Effectiveness of Programmed Instruction and Collaborative Peer Tutoring in Teaching Java™

Henry H. Emurian

University of Maryland, Baltimore County (UMBC), USA

ABSTRACT

Students in two Java programming classes completed an individualized tutoring system that taught a simple applet program. Before and after using the tutor, students completed questionnaires that assessed software self-efficacy and understanding of general programming principles. The questionnaires also were administered following a lecture session on the program that included having the students successfully run the applet in a browser on the Web. For the second class, a collaborative peer tutoring session based on the applet program occurred between completion of the tutor and the lecture session. Students in both classes increased in software self-efficacy and program understanding across the assessment occasions. For students in the second class, correct answers on the final test of understanding were higher than observed in the first class. Col-

laborative peer tutoring used in combination with a programmed instruction tutoring system may potentiate learning for novitiate students.

INTRODUCTION

Teaching computer programming is not easy (Traynor & Gibson, 2004). Reviews of the instructional literature indicate that many students struggle with their programming courses (Robins, Rountree, & Rountree, 2003), and the complexity and instability of Java pose unique challenges to both educators and students (Roberts, 2004). The research reported here, then, reflects an attempt to improve the effectiveness of Java programming instruction, as evidenced by enhanced student performance, which was accomplished by combining an individualized tutoring system with collaborative peer tutoring. This tactic of teach-

ing students with novel instructional approaches is fundamental to success-oriented classroom strategies, which are mindful of the alarming dropout rates reported for students in many science, technology, engineering, and mathematics (STEM) programs of study (Wormley, 2003).

Tutoring System

The research group previously reported a series of evaluations in the development of a Web-based tutoring system¹ and its classroom application as the first technical training exercise for students in a Java computer programming course (Emurian, 2004, 2005, in press; Emurian & Durham, 2001, 2002, 2003; Emurian, Hu, Wang, & Durham, 2000; Emurian, Wang, & Durham, 2003). The tutor teaches a simple 32-item, 10-line Java applet that displays a Label object in a browser window on the Web.² The learning theory supporting the development of the tutoring system is a behavior analysis model based upon the learn unit formulation (Greer & McDonough, 1999; Singer-Dudek & Greer, 2005) as applied to programmed instruction for technology education (Greer, 2002).

The objective of the tutor is to provide each and every student with elementary knowledge and skill in preparation for continuing study of the Java programming language. The tutoring system is effective in promoting skill and cultivating self-confidence in beginning students by giving them a successful learning experience that motivates their further study of Java using textbooks, lectures, laboratory demonstrations, independent problem solving, and the like. The tutoring system is intended to meet the needs of Information Systems majors, whose professional interests typically are outside of the scope of computer programming.

Dyadic Collaboration

Although group discussions involving three or more participants may have value in facilitating

learning to write computer programs (Davy & Jenkins, 1999), having students study together in dyads recently has been investigated as an even more powerful tactic to improve learning at the level of individuals. There are several variations to the structure of a dyadic interaction, which include reciprocal peer tutoring (Griffin & Griffin, 1998), pair programming (Williams et al., 2000), and interteaching (Boyce & Hineline, 2002). The variant of collaborative peer tutoring that was adopted in the present study is the interteaching dialog, which is a mutually probing, mutually informing conversation between two people (Boyce & Hineline, 2002). Interteaching has the objective of insuring by the participants as a team that each member of a dyad can answer a previously disclosed set of questions. This approach is similar to the peer collaboration paradigm to teach recursion that was studied by Jehng (1997). It is suggested here that an interteaching session following individualized tutoring can potentiate the prior learning and result in enhanced competency and understanding.

Background and Rationale

Our previous research (Emurian, 2005, in press) showed that students who completed the Java tutoring system learned general rules of Java programming that could be applied to answer questions on problems not explicitly presented in the tutor itself. These findings supported the value of the tutor to produce meaningful learning (Mayer, 2002) or far transfer of learning (Barnett & Ceci, 2002), indicating that informed students could apply general rules to solve novel problems. The research methodology is similar to design-based research (Brown, 1992; Design-Based Research Collective, 2003; Hoadley, 2004) in that instructional design effectiveness was assessed within the context of the classroom over several successive semesters. In assessing meaningful learning over the semesters, the number of rule-based questions was increased, and the

opportunity to evaluate tutor effectiveness with several different groups of students showed the reliability and generality of the tutor's application. These outcomes were encouraging, but the magnitude of the learning effects assessed immediately after students completed the tutor and after a final lecture on the material left room for improvement, especially when the number of rule-based questions was increased from four (Emurian, 2005) to 10 (Emurian, in press). The present study intends to potentiate the learning effects by combining programmed instruction and interteaching in the classroom.

The research reported here is based upon two successive offerings of an elective course entitled Graphical User Interface Systems Using Java.³ The first class, offered during the summer of 2004, consisted of master's degree students, and the second class, offered during the fall of 2004, consisted of advanced undergraduate students. The content and objectives of the course were equivalent for both classes. Students in the first class completed the Java tutor only, and students in the second class completed the Java tutor and an interteaching dialog. In comparison to the number of rule questions administered to students in the Emurian (in press) study, the number of rule questions was increased in the present study to 12 for students in both classes. The rationale for adopting this design-based approach to compare learning outcomes between two successive classes will be discussed.

METHOD

Materials

All questionnaires and study materials are available as documents on the Web.⁴ Appendix A presents the interteaching report. An example of one of the 12 questions on the rules test is as follows:

Which of the following sequences is correct?

- a. Declare a TextField object, construct a TextField object, add a TextField object to a container.
- b. Construct a TextField object, declare a TextField object, add a TextField object to a container.
- c. Declare a TextField object, add a TextField object to a container, construct a TextField object.
- d. Add a TextField object to a container, declare a TextField object, construct a TextField object.

Java Tutor

Tutor figures are presented in Emurian (in press). The learning stages in the tutor are as follows:

1. **Introduction.** This stage gives an orientation to the tutor and how it works. It also gives an example of the applet running in a browser window.
2. **Item Familiarity.** This stage teaches the symbols to be used. The student copies each identifier, keyword, or separator, displayed one at a time, into a text field. This stage is invaluable to ineffective novices (Robins et al., 2003) who deserve the opportunity to be prepared adequately for the learning that follows. The fact that students do make errors on this tutor stage is demonstrated in Emurian (2004).
3. **Item Identification.** This stage teaches the student to recognize differences among the 21 unique symbols. This is accomplished by having the student highlight a displayed symbol from a list of all symbols.
4. **Item Learning.** This is the primary stage for learning the semantics of all items in the code and learning to enter the item at the correct sequential location in the program. First, the item is displayed in a highlighted

fashion in a text area at the location in which it will appear in the code. Second, a textual display presents the meaning of the item at that point in the code. Third, a multiple-choice test is presented on the meaning of the specific item. If the answer is incorrect, the explanation is presented again, and the explanation-test cycle is repeated until the test is answered correctly. Fourth, the student types the item into a text field that is displayed in the proper location in the code. If the item is entered incorrectly, the explanation-test cycle is repeated until the item is entered correctly. When the item is entered correctly, the tutor progresses to the next item. As individual items are entered into the text field correctly, the developing program displays cumulatively.

5. **Line Familiarity.** This stage is functionally similar to Stage 2, but the unit of learning is a line rather than an item.
6. **Line Identification.** This stage is functionally similar to Stage 3, but the unit of learning is a line rather than an item.
7. **Line Learning.** This stage is functionally similar to Stage 4. The size of the learn unit, however, is at the level of a line rather than an item.
8. **Program Learning.** This is the last stage in the tutor. This stage requires entering the entire program into a text window. The input is repeated until the code is entered correctly. The learner is able to view the correct program, but selection of that option clears the input window so that the code has to be entered again from memory. The purpose of this stage is to solidify the organizational structure of learning into a manageable sequential stream or a singular unit in which the components have been previously networked into smaller units that can be combined within a new context under conditions showing meaningful learning.

Interteaching

For the interteaching sessions, subjects were paired unsystematically, and a listing of team partners was posted prior to the class meeting. The interteaching reports were available to be downloaded from the course Blackboard site. Subjects were informed to follow the interteaching instructions and to discuss the material together for 30 minutes. At the conclusion of the interteaching session, each team member completed the interteaching evaluation section. Appendix A presents the interteaching report relevant to the present article. The remaining three reports were similar in that they all had questions that could appear on a quiz for the students to discuss.

Subjects

There were 14 students in each of two classes titled Graphical User Interface Systems Using Java. This is an elective course for advanced undergraduate students and for master's degree students. Although the objectives, performance requirements, and prerequisites (one prior programming course) are identical, the classes were offered separately. In this study, the graduate class, identified as the Tutor (T) class, met in the summer of 2004. The undergraduate class, identified as the Tutor-plus-Interteaching (T+I) class, met in the fall of 2004. Background data were collected during the first questionnaire administration (Pre-Tutor Questionnaire). The T class had six female and eight male students, and the T+I class had one female and 13 male students (chi-square = 4.76, df = 1, $p < .05$). The protocols, to be presented next, were exempt from informed consent requirements, because they reflected instructional practices in the classroom.

Experience ratings were based on a 10-point scale where 1 = Novice to 10 = Expert. Comparisons between the two classes were based on the Kruskal-Wallis test. Median ratings were as follows: Java experience (T = 3, T+I = 1.5; chi-

square = 3.51, $p > .05$); general programming experience ($T = 4$, $T+I = 5.5$; chi-square = 3.34, $p > .05$); and total number of prior programming courses taken ($T = 3$, $T+I = 4$; chi-square = 2.31, $p > .10$). The median age of the students was 26 years for the T class and 25 years for the T+I class (chi-square = 1.85, $p > .10$). Although the students were undergraduates in one class and graduates in the other, the evidence did not support differences between the classes on these measures. However, the gender composition between the classes differed, with proportionally more female students in the summer graduate class in comparison to the fall undergraduate class.

Procedure

Table 1 presents the sequence of events for each of the two classes. The summer 2004 class met twice each week for six weeks. The fall 2004 class met once each week for 14 weeks. All classes met for

2.5 hours. The students were informed fully about the requirements of each class, and the sequence of events was included on the syllabus. At the first meeting, students in the fall 2004 class were informed that the rules questions would appear later as part of a graded quiz. All students completed the tutor during Session 1, the first class period. After Session 1 for the fall 2004 students, a study manual was released that duplicated the instructional text within the tutor but omitted the multiple choice tests that were embedded within the tutor. The study manual did not present the 12 rules multiple-choice questions. Students were informed that the manual could be used to prepare for the interteaching on Session 2.

The sequence of events was a compromise that allowed student behavior to be evaluated within the context of a classroom. The justification for such a design-based research approach, together with its strengths and limitations, will be discussed.

Table 1. Sequence of events

| | Summer 2004 Master's Degree Students n = 14 | Fall 2004 Advanced Undergraduates n = 14 |
|------------------|---|---|
| 2.5 Hours | Tutor Questionnaires: SSE & Rules | Tutor + Interteaching Questionnaires: SSE & Rules |
| Session 1 | 1. Pre-Tutor Questionnaires 2. Tutor 3. Post-Tutor Questionnaires | 1. Pre-Tutor Questionnaires 2. Tutor |
| | | Access to Study Manual |
| Session 2 | 1. Lecture 2. Run the Program 3. Final Questionnaires | 1. Post-Tutor Questionnaires 2. Interteaching 3. Lecture 4. Run the Program |
| Session 3 | | 1. Final Questionnaires <ul style="list-style-type: none"> • Test Credit for Rules |

RESULTS

Figure 1 presents boxplots of total correct answers on the rules test across the three occasions for both classes. For the T class, a Friedman's test was significant (chi-square = 18.84, $df = 2$, $p < .001$). Pairwise contrasts, Bonferroni corrected, were not significant only between the Post-Tutor and Final occasions ($p > .05$). For the T+I class, a Friedman's test was significant (chi-square = 23.57, $df = 2$, $p < .001$). Pairwise contrasts, Bonferroni corrected, were significant for all pairs ($p < .05$). Kruskal-Wallis tests showed no significant difference between the classes for the Pre-Tutor test (chi-square = 0.24, $df = 1$, $p > .50$) and the Post-Tutor test (chi-square = 0.00, $df = 1$, $p > .50$). The difference for the Final test was significant (chi-square = 8.40, $df = 1$, $p < .005$).

For each of the 12 questions on the rules test, the subject was asked to rate the confidence that the correct answer had been selected among the four alternatives. Figure 2 presents confidence ratings for correct and incorrect answers for the T and T+I classes across the three assessment occasions. The boxplots were calculated from the

set of median confidence ratings for correct and incorrect answers for all subjects. Where there are fewer than 14 subjects for a given boxplot, this indicates that not all subjects made at least one incorrect answer on that occasion.⁵

For the T class, a Friedman's test for confidence ratings of correct answers across the three occasions was significant (chi-square = 19.24, $df = 2$, $p < .001$). Pairwise contrasts, Bonferroni corrected, were significant for all pairs ($p < .05$) except between the Post-Tutor and Final occasions ($p > .05$). A Friedman's test for confidence ratings of incorrect answers across the three occasions was also significant (chi-square = 21.23, $df = 2$, $p < .001$). Pairwise contrasts, Bonferroni corrected, were significant for all pairs ($p < .05$) except between the Post-Tutor and Final occasions ($p > .05$). A Friedman's test between confidence ratings for correct and incorrect answers was marginally significant for the Pre-Tutor occasion (chi-square = 3.60, $p < .06$), significant for the Post-Tutor occasion (chi-square = 7.00, $p < .01$), and significant for the Final occasion (chi-square = 4.50, $p < .05$).

Figure 1. Boxplots of total correct answers on the rules test (circles are outliers and triangles are extreme values)

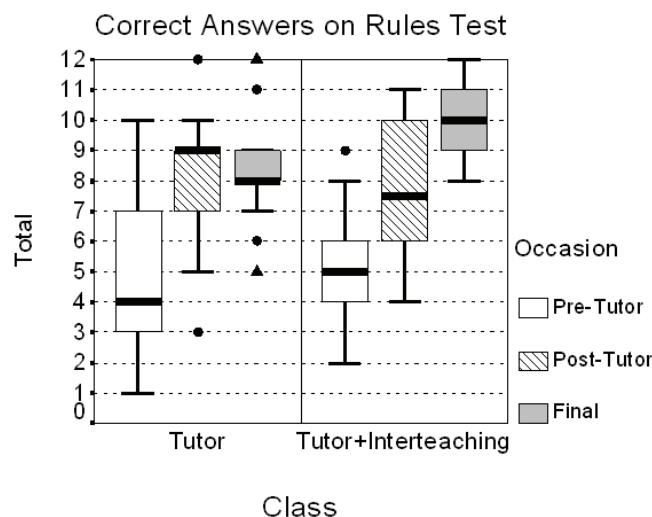
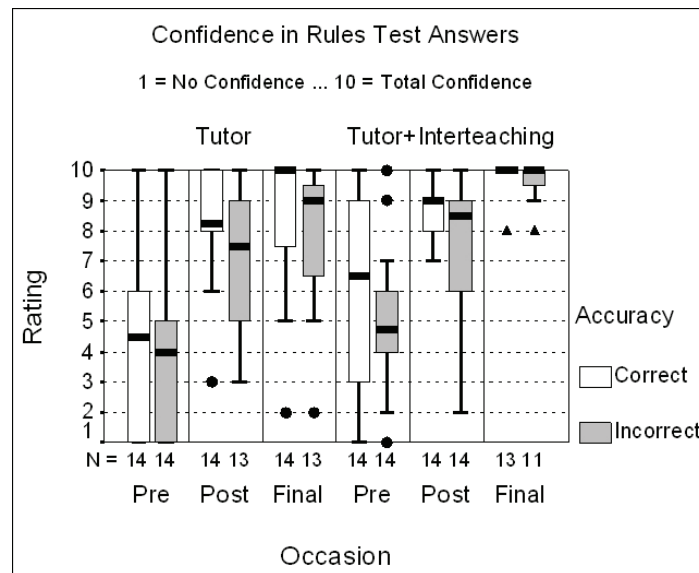


Figure 2. Boxplots of confidence ratings for correct and incorrect answers on the rules test (circles are outliers and triangles are extreme values)

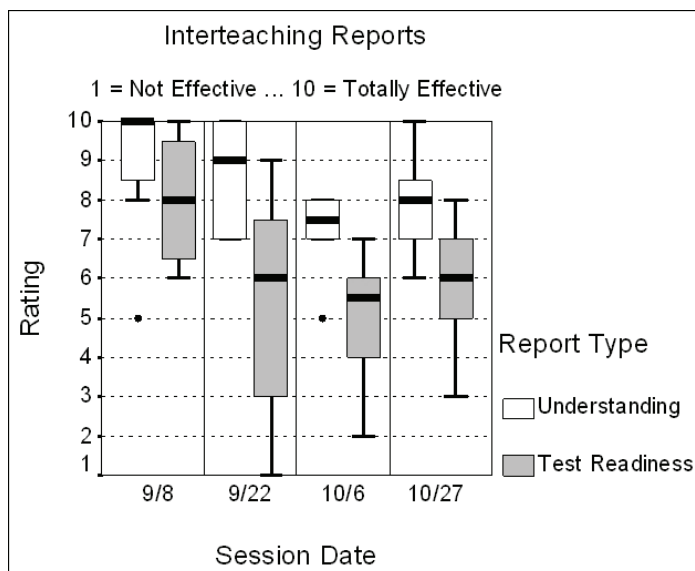


For the T+I class, a Friedman's test for confidence ratings of correct answers across the three occasions was significant (chi-square = 20.54, $df = 2$, $p < .001$). Pairwise contrasts, Bonferroni corrected, were significant for all pairs ($p < .05$). A Friedman's test for confidence ratings of incorrect answers across the three occasions was also significant (chi-square = 13.29, $df = 2$, $p < .01$). Pairwise contrasts, Bonferroni corrected, were significant for all pairs ($p < .05$) except between the Pre-Tutor and Post-Tutor occasions ($p > .05$). A Friedman's test between confidence ratings for correct and incorrect answers was significant for the Pre-Tutor occasion (chi-square = 5.44, $p < .05$), marginally significant for the Post-Tutor occasion (chi-square = 3.57, $p < .06$), and not significant for the Final occasion (chi-square = 2.00, $p > .10$).

Figure 3 presents boxplots of ratings of the effectiveness of the interteaching session in the T+I class for the two types of ratings: (1) effectiveness of the dialog in understanding the material and (2) effectiveness of the dialog in preparing for a test. The figure presents median ratings across

the four sessions for the eight students who were present on all four occasions of interteaching. For understanding, the figure shows graphically that the highest median rating was observed on the first session, in which the value was the maximum of 10. Medians declined thereafter over the next two sessions, and the median increased somewhat during the fourth session. A Friedman's test, however, was not significant (chi-square = 5.10, $df = 3$, $p > .15$), indicating insufficient evidence to conclude that the changes in medians observed graphically were significantly different from each other. For test preparation, the figure shows graphically that the highest median rating was observed on the first session, and ratings were comparatively lower on the other three sessions. A Friedman's test was significant (chi-square = 11.11, $df = 3$, $p < .05$). Figure 3 also shows graphically that the median understanding rating was higher than the corresponding test readiness median across all four sessions. A Kruskal-Wallis comparison of the differences between the understanding and test readiness ratings for all subjects across the four sessions with a population of zeros was

Figure 3. Boxplots of interteaching effectiveness ratings (circles are outliers)



significant (chi-square = 33.75, $df = 1$, $p < .001$). The correlation between the two sets of ratings was not significant ($r = 0.28$, $p > .10$).

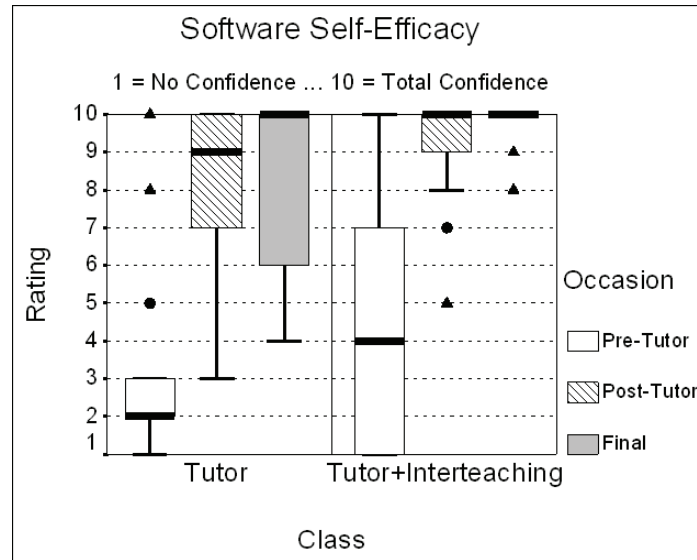
Figure 4 presents boxplots of software self-efficacy ratings across the three occasions for both classes. The ratings are based on the median confidence rating for all 21 unique items of code in the program. The figure shows graphically that students in both classes reported robust increases in confidence between the Pre-Tutor and Post-Tutor occasions, and the median rating reached the ceiling of 10 on the Final occasion. For the T class, Cronbach's alphas for Pre-Tutor, Post-Tutor, and Final occasions were 0.98, 0.99, and 0.99, respectively. The Final alpha was not significant ($p > .05$). A Friedman's test was significant (chi-square = 23.24, $df = 2$, $p < .001$). For the T+I class, Cronbach's alphas for Pre-Tutor, Post-Tutor, and Final occasions were 0.98, 0.98, and 0.97, respectively. All were significant ($p < .05$). A Friedman's test was significant (chi-square = 20.49, $df = 2$, $p < .001$). Kruskal-Wallis tests of median ratings between the two classes were not significant for Pre-Tutor, Post-Tutor, and Final occasions (all $p > .05$).

During the Final occasion, students in both classes evaluated the tutor along three dimensions, where 1 = Negative Opinion to 10 = Positive Opinion. The median ratings were as follows: (1) overall impression (T = 8, T+I = 9), (2) effectiveness of the tutor in learning Java (T = 8, T+I = 8.5), and (3) usability of the tutor (T = 8.5, T+I = 9). Kruskal-Wallis tests between the medians were not significant for any of the three scales (all $p > .05$). The generally positive evaluation of the tutor is indicated by the fact that all medians are eight or higher.

DISCUSSION

Students in two classes showed gains in program understanding and software self-efficacy as a function of participation in several consecutive instructional experiences that were designed to facilitate learning a Java computer program. A programmed instruction tutoring system was effective in promoting initial student confidence and learning, and an interteaching dialog also contributed to performance when these tactics

Figure 4. Boxplots of software self-efficacy (circles are outliers and triangles are extreme values)



were used within the context of a classroom. Collaborative peer tutoring may have potentiated a student's understanding of general principles of Java that were intended to be taught by the individualized tutoring system. Regarding confidence in understanding, however, the results showed that as student expertise improved, overconfidence was stated in performance, as evidenced by progressively higher confidence ratings for incorrect answers on the rules test. This finding warrants further analysis, especially in light of recent concerns about the validity of the purported relationship between self-efficacy and future performance (Heggstad & Kanfer, 2005).

Taken together, the outcomes of this investigation show how several instructional tactics, including a traditional lecture, may be managed in the classroom to the benefit of introductory programming students. The several tactics applied in sequence provided the occasion for rehearsal, corrective interactions, and overlearning, and these factors have long been related to knowledge and skill development and retention (Salas & Cannon-Bowers, 2001; Swezey & Llaneras, 1997).

The present study falls within the scope of design-based research. This is an attempt to

engineer a learning environment by applying principle-based interventions to the classroom and by collecting data on learning effectiveness. It is acknowledged that an actual classroom intervention introduces multiple sources of confounding variables that make causal attribution problematic (Brown, 1992; Collins, 1992; Edelson, 2002). Against a background of increasing criticism that hypothesis-driven laboratory experiments or randomized controlled trials, such as advocated by the U.S. Department of Education (2003), may not yield results having relevance to educational practice, design-based research is emerging as an alternative methodological paradigm. Design-based interdisciplinary activities are now evident by collections of papers in recent special issues of *Educational Researcher* (Kelly, 2002), *Educational Psychologist* (Sandoval & Bell, 2004), and *The Journal of the Learning Sciences* (Barab & Squire, 2004).

As a type of formative evaluation (Collins et al., 2004), the essence of design-based research is systematic replication (Sidman, 1960) in the classroom. Improvements to a previously established and meritorious instructional approach are introduced and evaluated iteratively across suc-

cessive offerings of a course. Theory informs the design, and the evaluations stimulate theoretical revisions and subsequent design alterations.

As stated by the Design-Based Research Collective (2003), "Claiming success for an educational intervention is a tricky business" (p. 5). That axiom applies to the present study. To argue that the interteaching improved student performance, it is a given that we accept the potential for confounding influences in the assessments to include the particular students within a class, the gender differences between classes, the time of course delivery, the sequence of events within a class, the sociability of the students, the amount of time spent studying, and perhaps other factors as well. The fundamental question was posed originally by Brown (1992): "What are the absolutely essential features that must be in place to cause change under conditions that one can reasonably hope to exist in normal school settings?" (p. 33). Collins et al. (2004) provide a framework for implementing design-based research to include summative evaluation that is in furtherance of answering that question.

The tactics reported in the present study evolved over several successive semesters. When the author first taught an introductory course in Java, lectures and supervised laboratories were the primary media to deliver information to the students. The reason that the author did that was because he was taught that way, and the traditional approach was the lore of the university culture at the time. The student learning was somewhat active, however, in the sense that students wrote code while the author presented and discussed it. Nevertheless, it was obvious that many bright and highly motivated students, especially international students using English as a second language, were struggling with basic issues such as learning how to type the Java symbols correctly.

In response, an individualized tutoring system was developed that first provided the opportunity for students to learn to type the symbols composing a Java program. The tutor also taught the

meaning of the items of code in the program. From a design-based perspective, the tutoring system followed principles of an applied behavior analysis systems approach (Greer, 2002), and the underlying theoretical rationale for the particular design that was implemented is presented in Emurian, Wang, and Durham (2003) and Emurian and Durham (2003). The first tutoring system, which was based on Java AWT, was reported in Emurian, Hu, Wang, and Durham (2000) and Emurian and Durham (2001). Over the years, the tutoring system content and performance were upgraded (Emurian, 2004), and the textual presentation of information was revised to facilitate meaningful learning (Emurian, 2005).

In that latter regard, the current design of the tutor's textual frames follows many of the guidelines offered by Mayer (2002) to promote meaningful learning, which relates to the goal of having students complete the tutoring experience with new knowledge and skill that can be applied to novel situations. Embedded within the tutor frames are advance organizers; signaling; adjunct questions; immediate feedback for performance accuracy and tested understanding of facts, concepts, and rules; and sequential structure building as a superordinate objective that organizes the learning process within a single conceptual framework — the production and understanding of a Java applet.

The features just mentioned were evident in the tutor presented to the summer 2004 class. Although there were alternatives to the interteaching tactic that was adopted for the fall 2004 class, such as additional lectures and assigned readings, the introduction of a structured social dimension to the classroom learning process was considered the best choice for the next design-based iteration. The theoretical and empirical evidence supporting the value of collaborative peer tutoring was compelling (Rittschof & Griffin, 2001; Slavin, 1996), and teamwork, even in a dyadic situation, provided the occasion for students to accumulate collaborative experiences that are increasingly

important in the workplace. That the interteaching also was valuable to the students was evidenced by their positive evaluations of the sessions and by the enhanced performance on the rules-based questions. The reliability and generality of the current outcomes must be determined by subsequent applications of these instructional tactics in the classroom with new groups of students.

According to the Bureau of Labor Statistics (2005), the demand for computer programmers is expected to grow at an average rate with all other occupations through 2012, and employment prospects will be best for programmers with expertise in such object-oriented languages as Java. However, many students in introductory computer programming courses show poor performance that leads to dropping out of courses and programs of study. The tactics presented here revealed a teaching technology that is intended to improve the performance of novice students when they first learn the syntax and semantics of a computer program.

Attempts to understand and overcome the persistently high dropout rates in STEM courses and programs (Thomas et al., 2000; Wormley, 2003) suggest the potential contributions of this study to that objective. The systematic replications over many semesters, which provide the foundation for the present and future work, repeatedly and consistently show the value of providing students with several instructional opportunities that may interact synergistically to promote skill and confidence that are the intended outcomes of our teaching tactics for each and every student in our classes.

REFERENCES

- Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *The Journal of the Learning Sciences*, 13(1), 1-14.
- Barnett, S. M., & Ceci, S. J. (2002). When and where do we apply what we learn? A taxonomy for far transfer. *Psychological Bulletin*, 128(4), 612-637.
- Boyce, T. E., & Hineline, P. N. (2002). Interteaching: A strategy for enhancing the user-friendliness of behavioral arrangements in the college classroom. *The Behavior Analyst*, 25(2), 215-226.
- Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences*, 2(2), 141-178.
- Bureau of Labor Statistics, U.S. Department of Labor. (2005). *Occupational outlook handbook, 2004-05 edition*. Retrieved September 29, 2005, from <http://www.bls.gov/oco/ocos110.htm>
- Collins, A. (1992). Toward a design science of education. In E. Scanlon, & T. O'Shea (Eds.), *New directions in educational technology* (pp. 15-22). New York: Springer-Verlag.
- Collins, A., Joseph, D., & Bielaczyc, K. (2004). Design research: Theoretical and methodological issues. *The Journal of the Learning Sciences*, 13(1), 15-42.
- Davy, J., & Jenkins, T. (1999). Research-led innovation in teaching and learning computer programming. In *Proceedings of the 4th Annual SIGCSE/SIGCUE ITiCSE Conference on Innovation* (pp. 5-8). Retrieved September 29, 2005, from <http://portal.acm.org/citation.cfm?id=305786.305826>
- Design-Based Research Collective. (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 32(1), 5-8.
- Edelson, D. C. (2002). Design research: What we learn when we engage in design. *The Journal of the Learning Sciences*, 11(1), 105-121.
- Emurian, H. H. (2004). A programmed instruction tutoring system for Java™ Consideration of learning performance and software self-efficacy. *Computers in Human Behavior*, 20(3), 423-459.

- Emurian, H. H. (2005). Web-based programmed instruction: Evidence of rule-governed learning. *Computers in Human Behavior, 21*(6), 893-915.
- Emurian, H. H. (in press). A Web-based tutor for Java™ Evidence of meaningful learning. *International Journal of Distance Education Technologies*.
- Emurian, H. H., & Durham, A. G. (2001, May 20-23). A personalized system of instruction for teaching Java. In M. Khosrow-Pour (Ed.), *Managing Information Technology in a Global Economy, 2001 Information Resources Management Association International Conference* (pp. 155-160), Toronto, Ontario, Canada. Hershey, PA: Idea Group Publishing.
- Emurian, H. H., & Durham, A. G. (2002, May 19-22). Enhanced learning on a programmed instruction tutoring system for JAVA. In M. Khosrow-Pour (Ed.), *Issues and Trends of Information Technology Management in Contemporary Organizations, 2002 Information Resources Management Association International Conference* (pp. 205-208), Seattle, Washington, USA. Hershey, PA: Idea Group Publishing.
- Emurian, H. H., & Durham, A. G. (2003). Computer-based tutoring systems: A behavioral approach. In J. A. Jacko, & A. Sears (Eds.), *Handbook of human-computer interaction* (pp. 677-697). Mahwah, NJ: Lawrence Erlbaum & Associates.
- Emurian, H. H., Hu, X., Wang, J., & Durham, A. G. (2000). Learning Java: A programmed instruction approach using applets. *Computers in Human Behavior, 16*(4), 395-422.
- Emurian, H. H., Wang, J., & Durham, A. G. (2003). Analysis of learner performance on a tutoring system for Java. In T. McGill (Ed.), *Current issues in IT education* (pp. 46-76). Hershey, PA: IRM Press.
- Greer, R. D. (2002). *Designing teaching strategies: An applied behavior analysis systems approach*. New York: Academic Press.
- Greer, R. D., & McDonough, S. H. (1999). Is the learn unit a fundamental measure of pedagogy? *The Behavior Analyst, 22*(1), 5-16.
- Griffin, M. M., & Griffin, B. W. (1998). An investigation of the effects of reciprocal peer tutoring on achievement, self-efficacy, and test anxiety. *Contemporary Educational Psychology, 23*(3), 298-311.
- Heggstad, E. D., & Kanfer, R. (2005). The predictive validity of self-efficacy in training performance: Little more than past performance. *Journal of Experimental Psychology: Applied, 11*(2), 84-97.
- Hoadley, C. M. (2004). Methodological alignment in design-based research. *Educational Psychologist, 39*(4), 203-212.
- Jehng, J-C. J. (1997). The psycho-social processes and cognitive effects of peer-based collaborative interactions with computers. *Journal of Educational Computing Research, 17*(1), 19-46.
- Kelly, A. F. (2002). Research as design. *Educational Researcher, 32*(1), 3-4.
- Mayer, R. E. (2002). *The promise of educational psychology. Volume II. Teaching for meaningful learning*. Upper Saddle River, NJ: Pearson Education.
- Rittschof, K. A., & Griffin, B. W. (2001). Reciprocal peer tutoring: Re-examining the value of a co-operative learning technique to college students and instructors. *Educational Psychology, 21*(3), 313-331.
- Roberts, E. (2004). Resources to support the use of Java in introductory computer science. In *Proceedings of the 35th SIGCSE Technical Symposium on Computer Science Education* (pp. 233-234), Norfolk, Virginia. Retrieved September 29, 2005, from <http://portal.acm.org/citation.cfm?id=971384>
- Robins, A., Rountree, J., & Rountree, N. (2003). Learning and teaching programming: A review

and discussion. *Computer Science Education*, 13(2), 137-172.

Salas, E., & Cannon-Bowers, J. A. (2001). The science of training: A decade of progress. *Annual Review of Psychology*, 52, 471-499.

Sandoval, W., & Bell, P. (2004). Design-based research methods for studying learning in context: Introduction. *Educational Psychologist*, 39(4), 199-201.

Sidman, M. (1960). *Tactics of scientific research*. New York: Basic Books.

Singer-Dudek, J., & Greer, R. D. (2005, Summer). A long-term analysis of the relationship between fluency and the training and maintenance of complex math skills. *The Psychological Record*, 55, 361-376.

Slavin, R. E. (1996). Research on cooperative learning and achievement: What we know, what we need to know. *Contemporary Educational Psychology*, 21, 43-69.

Swezey, R. W., & Llaneras, R. E. (1997). Models in training and instruction. In G. Salvendy (Ed.), *Handbook of human factors and ergonomics* (pp. 514-577). New York: Wiley.

Thomas, A., Benne, M. R., Marr, M. J., Thomas, E. W., & Hume, R. M. (2000). The evidence remains stable: the MBTI predicts attraction and attrition in an engineering program. *Journal of Psychological Type*, 55, 35-42.

Traynor, D., & Gibson, J. P. (2004). Towards the development of a cognitive model of programming: A software engineering approach. In *Proceedings of the 16th Meeting of the Psychology of Programming Interest Group*. Retrieved August 10, 2005, from <http://www.cs.may.ie/~dtraynor/papers/PPIGarticle.pdf>

U.S. Department of Education. (2003). *Identifying and implementing educational practices supported by rigorous evidence*. Retrieved September 29, 2005, from <http://www.excelgov.org/evidence>

Williams, L. A., Kessler, R. R., Cunningham, W., & Jeffries, R. (2000). Strengthening the case for pair-programming. *IEEE Software*, 17(4), 19-25.

Williams, L. A., Wiebe, E., Yang, K., Ferzli, M., & Miller, C. (2002). In support of pair programming in the introductory computer science course. *Computer Science Education*, 12(3), 197-212.

Wormley, D. (2003). Engineering education and the science and engineering workforce. In M. A. Fox (Ed.), *Pan-organizational summit on the U.S. science and engineering workforce: Meeting summary* (pp. 40-46). Washington, DC: National Academy of Science.

ENDNOTES

¹ The tutoring system is freely accessible on the Web at <http://nasal.ifsm.umbc.edu/learnJava/tutorLinks/TutorLinks.html>. Since this article was written, the tutor has been updated to teach Java Swing. Both versions of the tutor are accessible from the link provided. The source code for the Java tutor is freely available and may be obtained by contacting the author.

² The program is presented in Appendix A.

³ The course description and online material are available on the Web at http://nasal.ifsm.umbc.edu/IFSM413_613/

⁴ <http://userpages.umbc.edu/~emurian/learn-Java/ijictel/>

⁵ Data were missing for one T+I student in the Final occasion.

APPENDIX A

Interteaching Report #1

Your name _____ Date _____

Your partner's name: _____

You should understand the components of the program below at a level given in the Java Tutor. Discuss these components with the intention to understand the specific item and any general principle that is reflected in an item or collection of items. An example of a general principle would be to begin the name of a class with a capital letter.

```
import java.applet.Applet;
import java.awt.Label;
public class MyProgram extends Applet {
Label myLabel;
public void init() {
myLabel = new Label("This is my first program.");
add(myLabel);
myLabel.setVisible(true);
}
}
```

How effective was this session in helping you to learn the material?

1 = Not at all effective. The session did not contribute to my learning of the material.

10 = Totally effective. The session contributed to my learning of the material.

(Not effective) **1 2 3 4 5 6 7 8 9 10** (Totally effective)

Enter one number that describes the effectiveness for you: _____.

How confident are you that you could answer all the questions correctly if you were tested on this program right now?

1 = Not at all confident. I could not answer any question correctly.

10 = Totally confident. I could answer all the questions correctly.

(Not confident) **1 2 3 4 5 6 7 8 9 10** (Totally confident)

Enter one number that describes your confidence: _____.

Chapter 3.33

An Interactive Tool for Teaching and Learning LAN Design

Nurul I. Sarkar

Auckland University of Technology, New Zealand

ABSTRACT

It is often difficult to motivate students to learn local area network (LAN) design, because many students appear to find the subject rather dry, technical and boring. To overcome this problem, the author has developed a software tool (named LAN-Designer) that gives students an interactive learning experience in LAN design concepts. The LAN-Designer is suitable for classroom use in introductory computer networking courses. This chapter describes LAN-Designer and its effectiveness in teaching and learning LAN design. The effectiveness of LAN-Designer has been evaluated both formally by students and informally in discussion within the teaching team. The feedback from students indicates that the development and implementation of LAN-Designer were successful. It also discusses the impact of LAN-Designer on student learning and comprehension.

INTRODUCTION

LANs are often included as a topic in computer science, information technology (IT), engineering and business courses, as LANs are a fundamental component of IT systems today. Unfortunately, motivating students to learn about LAN design is often difficult, because they find the subject rather technical, dry and boring. However, the view is frequently supported in educational literature (Anderson, Reder, & Simon, 1996; Young, 1993) that incorporating practical demonstrations into these courses, thereby illustrating theoretical concepts and providing opportunities for interactive learning experiences, significantly enhances student learning about LAN design. Yet, despite the Chinese adage attributed to Confucius (551-479 BC), 'I hear, I know. I see, I remember. I do, I understand,' only a limited amount of material designed to supplement the teaching of LAN design is publicly available, as searches of the

Computer Science Teaching Center (Grissom, Knox, Fox, & Heller, 2005) and SIGCSE Education Links (Anonymous, 2005) sites reveal.

The author strongly believes, as do many others (Belding-Royer, 2004; Casado & McKeown, 2005; Hacker & Sitte, 2004; Lopez-Martin, 2004; Midkiff, 2005; Moallem, 2004), that students learn more effectively from courses that provide for active involvement in interactive learning experiences. To that end, the author has developed LAN-Designer (using Authorware 6 under MS Windows), which facilitates an interactive teaching and learning of LAN design concepts.

LAN-Designer can be used either in the classroom or at home. Both teacher and students can benefit from the use of LAN-Designer in different teaching and learning contexts. For example, a teacher is able to use LAN-Designer in the classroom as a demonstration, to liven up the traditional lecture environment; students, on the other hand, can use server-based networking tutorials and verify the results of in-class tasks and exercises on LAN design.

LAN design concepts are described in many textbooks (Forouzan, 2003, 2004; Kurose & Ross, 2005; Palmer & Sinclair, 2003; Stamper, 2001), and commercial LAN design is described extensively in the literature (Fitzgerald & Dennis, 2002).

The main contribution and strength of this chapter is the emphasis that an interactive learning experience using a software tool is crucial in motivating students to learn LAN design concepts. Perhaps the innovative aspect of this work is the development and evaluation of such a tool so as to be effective in complementing the lecture content of LAN design. The chapter is organized as follows. First is a review of some existing network simulation and modeling tools, followed by a description of LAN-Designer and highlights of its educational benefits. Test results are presented to verify the successful implementation of LAN-Designer. The effectiveness of LAN-Designer is evaluated, and a brief conclusion ends the chapter.

Existing Simulation and Modeling Tools

Many network researchers have developed network simulation and modeling tools suitable for classroom demonstration of various aspects of computer and data communication networks. The motivation for designing such tools is to create a substitute environment for a live network (Tymann, 1991) so students can experiment with various network topologies without any risks of damaging the networks (Davis, Ransbottom, & Hamilton, 1998). Many network simulators provide animation and visualization to develop a better understanding of the real-world systems.

A number of both open-source and commercial simulation and modeling tools are available for developing a variety of LAN models (Chang, 1999; Zheng & Ni, 2003). White (2001) categorized network simulation tools into four classes: 1) network loads and topology display; 2) network topology design; 3) Web traffic analysis and display; and 4) multimedia-based pedagogy. LAN-Designer, further introduced later, is a class of tool for network physical topology simulation and display diagrams. In this chapter, for brevity, we refer only to a selected set of literature indicative of the approaches used in the first two categories mentioned above.

- **ns-2** (Fall & Varadhan, 2003): ns-2 (network simulator) is a powerful text-based simulation software package suitable for modeling and performance analysis of computer and communication networks. It is a discrete event simulator originally developed at Lawrence Berkeley Laboratory at the University of California – Berkeley as part of the Virtual InterNetwork Testbed (VINT) project. The Monarch project at Carnegie Mellon University has extended the ns-2 by adding support for IEEE 802.11 wireless LANs (Monarch, 2004).

- **OPNET Modeler** (OPNET, 2005): Opnet is a popular commercial software package commonly used by researchers and practitioners for modeling and simulation of computer networks. It is menu driven, with an easy-to-use graphical user interface for rapid model construction, data collection and other simulation tasks. It might be suitable for advanced networking classes in which students can develop new network models for experimentation.
- **cnet** (McDonald, 2005): The *cnet* network simulator allows students to experiment with various protocols at the data link, routing and transport layers in networks consisting of any combination of LANs and wireless LAN links. Although *cnet* is being used worldwide, the need to prepare a network topology file as the basis of network topology display might be a challenging task for beginners.
- **DlpSim** (King, 2004): DlpSim (data link protocol simulator) may be suitable for classroom use as an aid to enhance teaching and learning network protocols by simulation. However, DlpSim emphasizes data link layer protocols.
- **JASPER** (Turner & Robin, 2001): JASPER (JAVA Simulation of Protocols for Education and Research) is a protocol simulator that can be used as an aid to enhance teaching and learning communication protocols. It is an extensible tool in which students can readily add new protocols.
- **WebTrafMon** (Hong, Kwon, & Kim, 1999): WebTrafMon is a Web-based system for network analysis and traffic monitoring, including traffic loads, types, sources and destinations. However, the system focuses exclusively on network analysis and traffic monitoring.
- **NetMod** (Bachmann, Segal, Srinivasan, & Teorey, 1991): NetMod is a network modeling tool that uses some simple analytical models, providing designers of large interconnected LANs with an in-depth analysis of the potential performance of such systems. The tool can be used in university, industrial or governmental campus networking environments, and might serve as a useful tool for classroom demonstration.
- **WLAN-Designer** (Sarkar, 2004): WLAN-Designer is a Web-based software tool (prototype) for modeling wireless LANs. The software is easy to use and can be accessed through the Internet. It is suitable for classroom use to enhance teaching and learning various aspects of wireless LAN design. However, the current version of WLAN-Designer requires an improvement.
- **iNetwork** (Sandrasegaran & Trieu, 2005): iNetwork is an interactive software tool for teaching and learning data communication networks. It allows students to assemble and build customized networks using networking devices, such as workstations, switches, routers, domain name system (DNS) and dynamic host configuration protocol (DHCP) servers. Through experimenting with key parameters, students gain insights into the key concepts of communication network design and analysis.
- **Network Intelligence** (Nieuwelaar & Hunt, 2004): Network Intelligence (NI) provides an easy way to view complex traffic patterns in a wide-area networking environment. NI can perform simulations of network topologies using actual gathered data, as opposed to arbitrary data.

In conclusion, the proposed LAN-Designer seems to be almost alone in its goals and capabilities.

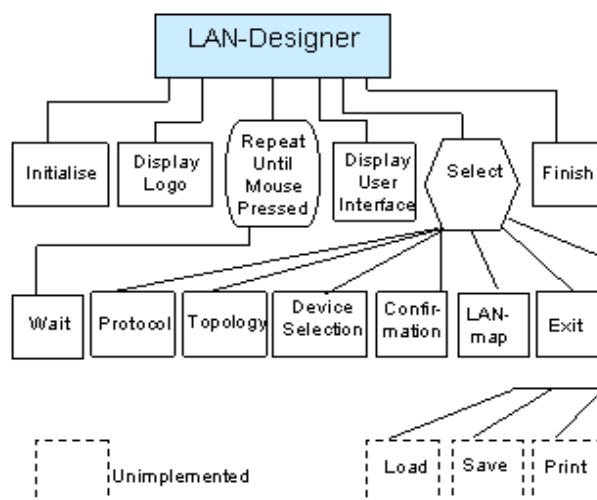
Description of LAN-Designer

Figure 1 shows a structured diagram of the system. LAN-Designer is an easy-to-use, user-friendly

tool and can be used as an aid to enhance teaching and learning LAN design concepts. The main features of LAN-Designer are described below:

- **Channel access protocol:** This is an important parameter that needs to be considered when designing LANs. The channel access protocol efficiently controls the transmission when multiple users shared a common channel (i.e., a transmission medium). LAN-Designer allows users to select either Ethernet carrier sense multiple access with collision detection (CSMA/CD) or token passing network access protocols.
 - **Physical topology:** A topology represents the physical layout (i.e., architecture) of the network. It is another of the important parameters in server-based LAN design. In the case of Ethernet CSMA/CD networks, either bus or star physical topology can be chosen. For token passing networks, either physical ring or bus topology can be chosen.
 - **Network component selection:** This feature allows users to enter LAN components, such as the number of workstations and the number of printers for the proposed LAN design.
- A file server will be selected by default.
- **Confirmation:** This feature allows users to verify LAN components that have been selected for LAN design and make changes if necessary before proceeding to the final step of LAN modeling.
 - **LAN-map:** Based on the user selection of an access protocol, physical topology and LAN components, the LAN-map displays the proposed LAN diagram on the screen. With this, students can verify the solution of LAN design exercises.
 - **Mesh topology:** The mesh physical topology is not very common for a LAN design because of large wiring connectivity and more input/output ports required per node. This feature provides a short tutorial (both textual and graphical) on mesh topology.
 - **Advanced networking:** Both corporate and campus-wide LANs are based on a high-speed switching backbone (for example, Gigabit Ethernet switch). This feature provides a tutorial on switched-based LAN design.
 - **Exit:** It allows users to exit from LAN-Designer at any time.

Figure 1. Structure diagram of the LAN-Designer



The following three features have not been implemented yet, and are considered as future work:

- **Load:** This feature will allow users to view existing LAN modeling for further analysis and modifications.
- **Save:** It will allow users to save LAN modeling on disk for later use.
- **Print:** This feature will allow users to produce a hard copy of LAN diagrams.

Additional information about channel access protocol, physical topology, cabling, hubs and switches is presented at the bottom part of relevant pages (see Figure 2).

To extend the functionality of LAN-Designer, we have recently developed a Web-based tool called WebLan-Designer for interactive teaching and learning both wired and wireless LAN design (Sarkar & Petrova, 2005). Figure 3 shows the wired LAN modeling page of WebLan-Designer. Let us briefly highlight some of the important features of WebLan-Designer. Using the 'modeling' page, students can experiment with a variety of LAN topologies and channel access protocols. Students can also test their knowledge about various aspects

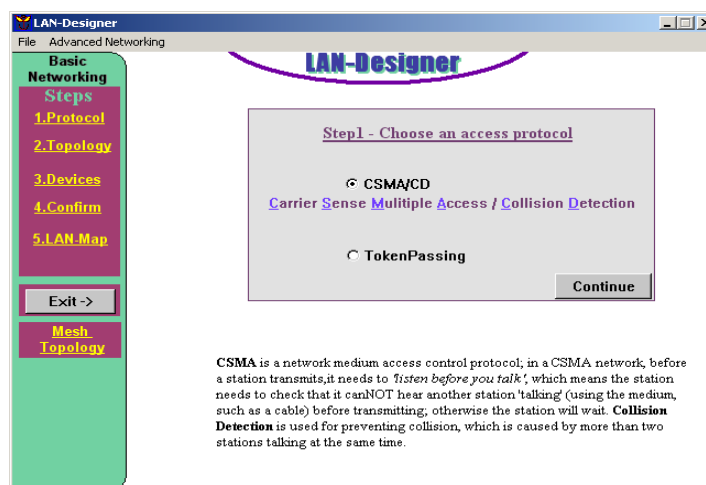
of LAN design by using two interactive quizzes. Each quiz consists of a set of 25 multiple-choice questions, and each question has four possible answers. At the end of each quiz session, the system displays the total score, which allows students to assess their prior knowledge about LAN design. The system provides a friendly environment for interactive quiz management. This is particularly useful for the teacher to update quizzes on a regular basis. Although WebLan-Designer has more functionalities than LAN-Designer, both tools can be used independently.

LAN-Designer in Practice

For simplicity and ease of use, LAN-Designer has been implemented with a graphical user interface (GUI). The point-and-click GUI interface is easy to use and self-explanatory, which makes LAN-Designer well suited to both students and teachers.

Now let us briefly highlight the value of LAN-Designer and how we use this tool in the teaching and learning context. At the Auckland University of Technology (AUT), we teach various aspects of LAN design, including wireless networking across three undergraduate programs (bachelor

Figure 2. A sample screenshot of the interface of LAN-Designer



An Interactive Tool for Teaching and Learning LAN Design

Figure 3. A sample screenshot of the LAN modeling page of WebLan-Designer

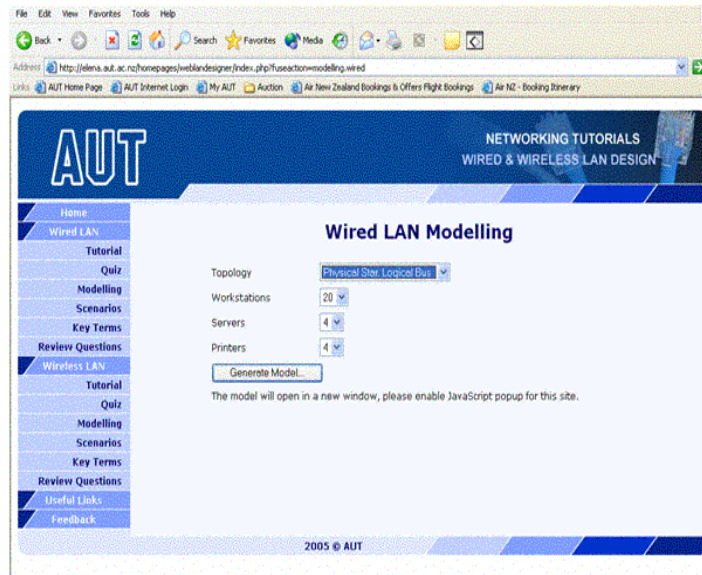
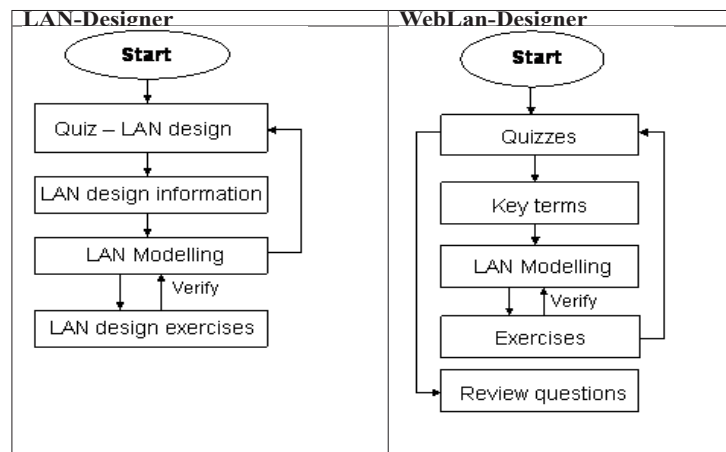


Figure 4. A suggested sequence of study using LAN-Designer and WebLan-Designer



(a)

(b)

of business, bachelor of computer and information sciences, and diploma in IT). We observe that motivating students to learn LAN design concepts using the traditional lecture-only method is very difficult, because students find the subject rather technical and dry and, thus, boring. To make the lesson more interesting and to encourage students' class participation, we use LAN-Designer as an integral part of a 2-hour session. In the classroom, an in-class task is given to the students to design server-based LANs on paper. After a prescribed period of time (for example, 15 minutes), LAN-Designer is introduced to the students on a step-by-step basis to enable them to verify (visually and interactively) their solutions and to learn more about LAN design.

The tutorial covers the following topics: CSMA, CSMA/CD, token passing, Ethernet and token ring hubs, media access control protocols, logical and physical topologies for a LAN, mesh topology, and switched-based LAN design. In addition to classroom use, the students can use LAN-Designer at home and complete exercises and tutorials at their own pace.

As mentioned earlier, WebLan-Designer offers additional learning resources, including quizzes, tutorials, review questions and scenario-based LAN design to supplement teaching server-based LAN design. Both LAN-Designer and WebLan-Designer are available at no cost for educational use (more information about these tools can be found by contacting the author). The suggested study guideline using LAN-Designer and WebLan-Designer are shown in Figures 4(a) and 4(b), respectively.

Benefits of LAN-Designer

LAN-Designer provides the following main benefits:

- **Hands-on:** LAN-Designer facilitates an interactive learning experience in LAN design.

- **Modeling:** It provides a simple and easy way to develop a variety of LAN models. With this, students can experiment with a variety of LAN topologies and channel access protocols to enhance their knowledge and understanding of LAN design concepts.
- **Ease of use:** LAN-Designer is an easy-to-use, user-friendly tool and can easily be installed on PCs operating under MS Windows.
- **Usefulness:** It enhances face-to-face teaching with online learning and can be used either in the classroom or at home.
- **Challenging:** It provides a challenging yet friendly environment where students can test their knowledge about LAN design concepts.

TEST RESULTS

To evaluate its performance and robustness, LAN-Designer has been installed and tested on various PCs in computer laboratories across campuses. Figures 5 and 6 show screenshots of LAN-Designer test results. For 10Base T network, the following components have been selected and LAN-Designer has produced the valid LAN diagram (see Figure 5): Access protocol: Ethernet CSMA/CD; Physical topology: Star; Number of PCs: 5 (excluding a server); Number of printers: 2.

For 10Base 2 network, the following components have been selected and the LAN-Designer has produced the valid LAN diagram (see Figure 6): Access protocol: Ethernet CSMA/CD; Physical topology: Bus;

number of PCs: 5 (excluding a server); number of printers: 1.

The screenshots of WebLan-Designer test results for wired LAN and wireless LAN modeling are shown in Figures 7 and 8, respectively.

An Interactive Tool for Teaching and Learning LAN Design

Figure 5. 10Base T. A server-based Ethernet LAN with five PCs and two printers (physical star topology)

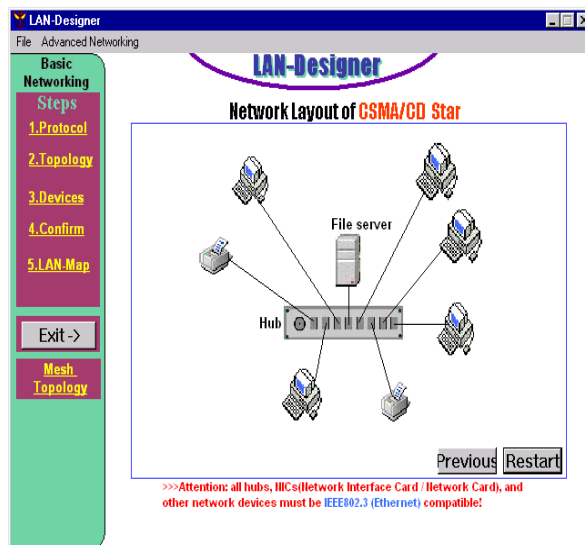
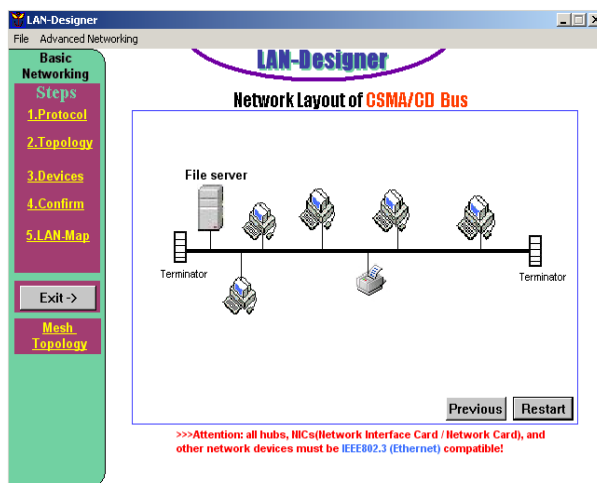


Figure 6. 10 Base 2. A server-based Ethernet LAN with five PCs and one printer (physical bus topology)



Evaluation by Student Feedback

To assess the educational value of LAN-Designer, it has been evaluated extensively both formally by students (in survey form) and informally by discussion within the teaching team. The evaluation

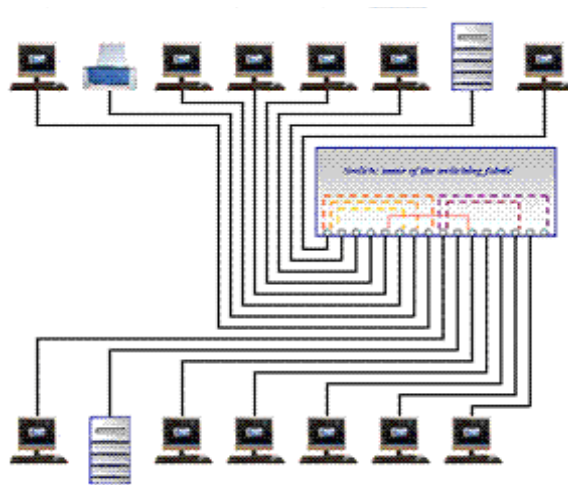
of LAN-Designer was conducted in the classroom by a member of the teaching team, and anonymity of the respondents was protected. As part of the formal evaluation process, students were asked to complete a questionnaire, and were asked the following six questions:

Figure 7. A model of an Ethernet LAN with 12 workstations, two servers and one printer (physical and logical star topology)

Summary

Topology: Physical & Logical Star
Workstations: 12
Servers: 2
Printers: 1

There are many ways of connecting up a network. To see a different way of connecting this network up, press the "F5" button or click *Refresh*.
Once you have finished viewing the model, click *Close*.

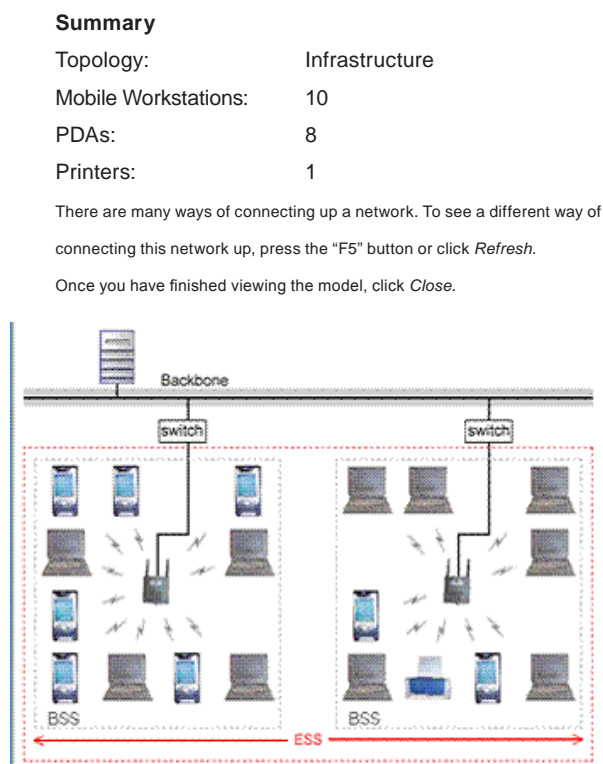


1. **User interface:** How useful did you find the user interface of the LAN-Designer to use?
2. **LAN design information:** How useful did you find the information about LAN design to be?
3. **Easy to use:** How easy (overall) did you find the LAN-Designer to use and follow?
4. **Robustness:** How easy did you find it to start and exit from the LAN-Designer?
5. **Measure of success:** How effective was the LAN-Designer in helping you to improve your understanding of LAN design concepts?
6. **Hands-on:** Would you like to have more tools of this kind as part of your course?

A 5-point Likert scale was used in the questionnaire. For Questions 1 to 5, a scale of 1 (Poor) to 5 (Excellent) was used. For Question 6, a scale of 1 (no) and 5 (Yes) was used. Fifty undergraduate students (about 60% male and 40% female) from both E-business IT Infrastructure (EBITI) and Networking and Telecommunications (N&T) courses completed the questionnaire, and their responses are plotted in Figure 9. The responses were interpreted as follows:

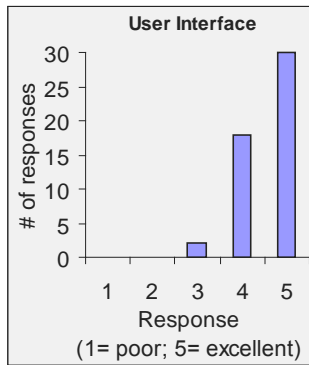
1. The GUI of the LAN-Designer is found to be easy to use. Forty-eight students indicated they were quite satisfied with the LAN-Designer interface, whereas the other two students were neutral (see Figure 9a).

Figure 8. Wireless LAN modeling with 10 mobile workstations, eight PDAs and one printer using infrastructure network

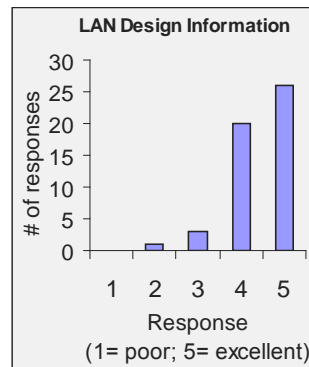


- Forty-six students have indicated that the LAN design information presented at the bottom part of each page is very useful. One student was not very satisfied about LAN design information, whereas the rest (three) were neutral (see Figure 9b).
 - LAN-Designer was found to be a user-friendly tool. Forty-seven students indicated they were happy with the current version of the LAN-Designer, and the other three were neutral (see Figure 9c).
 - LAN-Designer is easy to install and run, and can be exited from at any time. All 50 students indicated they found LAN-Designer to be robust (see Figure 9d).
 - Forty-five students indicated that LAN-Designer had clearly assisted them in developing a better understanding of the concepts of LAN design; the other five were neutral (see Figure 9e).
 - Forty-four students indicated they would like to have more hands-on activities in the course. One student was not very interested in trying more hands-on activities, and the other five were neutral (see Figure 9f).
- We observed that by participating in the hands-on interactive activities in the classroom, students became increasingly motivated to learn more about LAN design and enjoyed this course more than previous courses that consisted of lectures only. We are seeking feedback regularly both from students and staff for further improvement of the LAN-Designer.

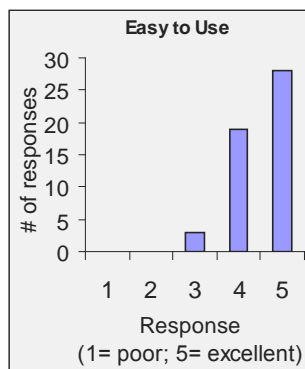
Figure 9. Student-response graphs illustrating the number of respondents in each category for each of the six questions in the questionnaire



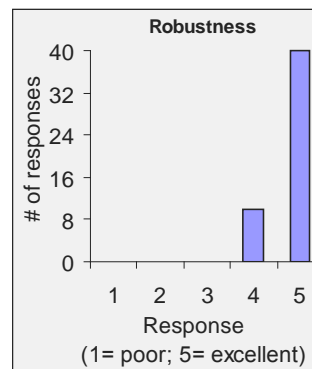
(a)



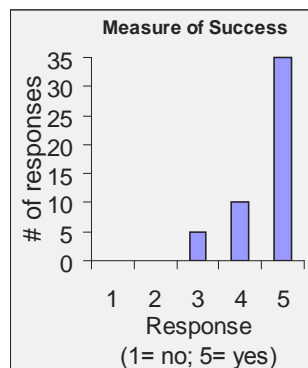
(b)



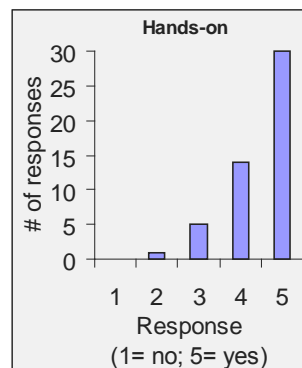
(c)



(d)



(e)

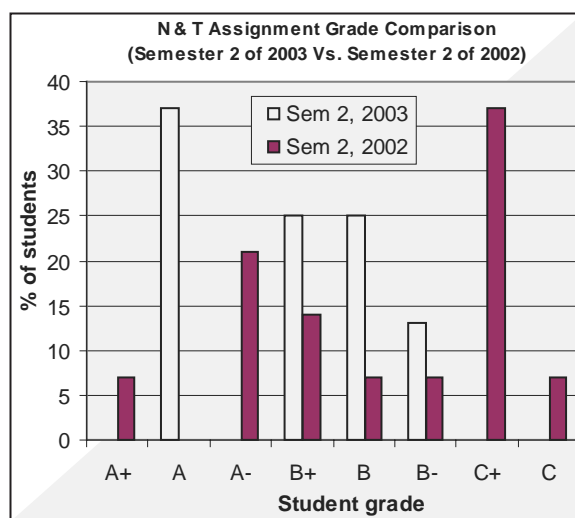


(f)

Table 1. Comparison of student performance in the final examinations with and without LAN-Designer experience

| | Semester | Year of study | Student pass rate (%) | |
|---|----------|---------------|-----------------------|------------|
| | | | EBITI course | N&T course |
| With LAN-Designer | 1 | 2004 | 100 | 96 |
| | 2 | 2003 | 100 | 95 |
| Without LAN-Designer | 1 | 2003 | 95 | 92 |
| | 2 | 2002 | 93 | 91 |
| | 1 | 2002 | 95 | 92 |
| Pass-rate improvement (with LAN-Designer) | | | up to 7% | up to 5% |

Figure 10. Assignment grade comparison of student performance in the N&T assignment with and without LAN-Designer experience



Impact of LAN-Designer on Students’ Performance

We have run LAN-Designer in our two undergraduate courses, EBITI and N&T, in Semester 1 of 2004 and Semester 2 of 2003. Both the EBITI (Petrova, 2000) and N&T (Sarkar & Petrova, 2001) courses are at level 6, or first-year degree level, and constitute 15 credit points (150 hours of student learning) at AUT. Most of the EBITI students are studying toward their bachelor of business qualification and have a very limited

background in the IT and computer and information sciences (CIS) fields. On the other hand, the N&T students are studying toward the bachelor of IT and have a good background in the IT and CIS fields.

LAN-Designer has had quite a positive impact on students’ learning about LAN design. As seen in Table 1, the overall student pass rate in the final examinations in both Semester 1 of 2004 and Semester 2 of 2003 is slightly higher compared to students in Semester 1 of 2003 and Semesters 1 and 2 of 2002. It is considered that much of this

difference can be accounted for by the fact that students in both Semester 1 of 2004 and Semester 2 of 2003 used LAN-Designer, whereas the students in Semester 1 of 2003 and Semesters 1 and 2 of 2002 did not get an opportunity to use LAN-Designer. We also observed that EBITI students benefited even more from LAN-Designer (7% pass-rate improvement) than the N&T students (5% improvement) did. This is probably due to EBITI students' limited background in the IT and CIS fields compared to N&T students.

In Figure 10, we plot student grade in assignment of the N&T course vs. the percentage of students in Semester 2 of 2003 and Semester 2 of 2002. The grading scheme used for assessing assignment (according to the B.InfoTech program) was as follows: A+ (90-100), A (85-89), A- (80-84), B+ (75-79), B (70-74), B- (65-69), C+ (60-64), C (55-59), C- (50-54) and D (0-49). Note that A+ to C- is pass grade and D is the fail grade.

We found that students in Semester 2 of 2003 have done better in the assignment than students in Semester 2 of 2002. It is believed that much of the improvement in students' grade in the assignment is due to the LAN-Designer experience students had in Semester 2 of 2003.

CONCLUSION

A software tool (LAN-Designer) has been developed that can be used either in the classroom or at home to enhance the teaching and learning of various aspects of LAN design. LAN-Designer was evaluated by students, and their responses to the questionnaire about LAN-Designer were mostly favorable. Students indicated that they found LAN-Designer easy to use and robust, and that it helped them gain an understanding of LAN design concepts. LAN-Designer has had a positive impact on students' performance. Results show that both EBITI and N&T students scored better in the final examinations with LAN-Designer experience students without LAN-designer experience.

Currently, LAN-Designer displays LAN diagrams involving components of up to eight (including a server), which is adequate for demonstration purposes. The software can be easily upgraded to accommodate any number of LAN devices. Features such as access protocol, physical topology, component selection, confirmation, LAN-map, mesh topology, advanced networking and exit have been implemented. More features (e.g., load, save and print) are still under development.

We have developed a Web-based tool called WebLan-Designer to extend LAN-Designer by including wireless LAN components. Both LAN-Designer and WebLan-Designer can be used independently either in the classroom or at home. The incorporation of Gigabit Ethernet and TCP/IP networking is suggested for future work. More information about LAN-Designer and WebLan-Designer can be obtained by contacting the author.

ACKNOWLEDGMENT

I would like to thank Jason Lian for programming LAN-Designer. An earlier version of the chapter appears as: Sarkar, N.I. (2005). LAN-Designer: A software tool to enhance learning and teaching server-based LAN design. *International Journal of Information and Communication Technology Education*, 1(2), 74-86.

REFERENCES

- Anderson, J. R., Reder, L. M., & Simon, H. A. (1996). Situated learning and education. *Educational Researcher*, 25(4), 5-11.
- Anonymous. (2005). *SIGCSE education links*. Retrieved October 10, from <http://sigcse.org/topics/>

- Bachmann, D. W., Segal, M. E., Srinivasan, M. M., & Teorey, T. J. (1991). NetMod: A design tool for large-scale heterogeneous campus networks. *IEEE Journal of Selected Areas in Communications*, 9(1), 15-24.
- Belding-Royer, E. M. (2004, March 14-17). *Escape from the computer lab: Education in mobile wireless networks*. Proceedings of the IEEE 2nd Annual Conference on Pervasive Computing and Communications Workshops.
- Casado, M., & McKeown, N. (2005, February 23-27). The virtual network system. *Proceedings of the 36th SIGCSE Technical Symposium on Computer Science Education*, St. Louis, MO.
- Chang, X. (1999, December). *Network simulations with Opnet*. Proceedings of the 1999 Winter Simulation Conference: Simulation – A bridge to the future, Piscataway, NJ.
- Davis, N., Ransbottom, S., & Hamilton, D. (1998). Teaching computer networks through modeling. *ACM SigAda Ada Letters*, 18(5), 104-110.
- Fall, K., & Varadhan, K. (2003). *The ns manual*. Retrieved from www.isi.edu/nsnam/ns/
- Fitzgerald, J. & Dennis, A. (2002). *Business data communications and networking* (7th ed.). New York: John Wiley & Sons.
- Forouzan, B.A. (2003). *Local area networks* (1st ed.). New York: McGraw Hill.
- Forouzan, B.A. (2004). *Data communications and networking* (3rd ed.). New York: McGraw Hill.
- Grissom, S., Knox, D., Fox, E., & Heller, R. (2005). *Computer Science Teaching Center (CSTC)*. Retrieved October 30, 2005, from www.cstc.org/
- Hacker, C., & Sitte, R. (2004). Interactive teaching of elementary digital logic design with WinLogiLab. *IEEE Transactions on Education*, 47(2), 196-203.
- Hong, J. W.-K., Kwon, S.-S., & Kim, J.-Y. (1999). WebTrafMon: Web-based Internet/Intranet network traffic monitoring and analysis system. *Computer Communications*, 22(14), 1333-1342.
- King, P.J.B. (2004). *Data link protocol simulator*. Retrieved from www.cee.hw.ac.uk/~pjbk/dlpsim/index.html
- Kurose, J. F., & Ross, K. W. (2005). *Computer networking: A top-down approach featuring the Internet* (3rd ed.). New York: Addison Wesley.
- Lopez-Martin, A. J. (2004). Teaching random signals and noise: An experimental approach. *IEEE Transactions on Education*, 47(2), 174-179.
- McDonald, C. (2005). *The cnet network simulator* (v2.0.9). Retrieved January 10, 2005, from www.csse.uwa.edu.au/cnet/
- Midkiff, S.F. (2005). An experiential course in wireless networks and mobile systems. *Pervasive Computing, IEEE*, 4(1), 9-13.
- Moallem, M. (2004). A laboratory testbed for embedded computer control. *IEEE Transactions on Education*, 47(3), 340-347.
- Monarch. (2004). *CMU Monarch project*. Retrieved October 10, 2005, from www.monarch.cs.cmu.edu
- Nieuwelaar, M. V. D., & Hunt, R. (2004). Real-time carrier network traffic measurement, visualisation and topology modelling. *Computer Communications*, 27, 128-140.
- OPNET. (2005). *OPNET Technologies – Commercial simulation software*. Retrieved September 20, 2005, from www.opnet.com
- Palmer, M. & Sinclair, R.B. (2003). *Guide to designing and implementing local and wide area networks* (2nd ed.). Canada: Course Technology.
- Petrova, K. (2000). Teaching electronic commerce: An information technology infrastructure design & management approach. *New Zealand Journal*

of *Applied Computing & Information Technology*, 4(1), 70-77.

Sandrasegaran, K., & Trieu, M. (2005). INetwork: An interactive learning tool for communication networks. In N.I. Sarkar (Ed.), *Tools for teaching computer networking and hardware concepts*. Hershey, PA: Idea Group Publishing.

Sarkar, N. I. (2004, August 30-September 1). *WLAN-designer: A Web-based software tool to enhance learning and teaching wireless LAN design*. Proceedings of the 4th IEEE International Conference on Advanced Learning Technologies, Joensuu, Finland.

Sarkar, N. I., & Petrova, K. (2001, July 2-5). *Teaching computer networking & telecommunications: A network analysis and software development Approach*. Proceedings of the 14th annual conference of the NACCQ, Napier, New Zealand.

Sarkar, N. I., & Petrova, K. (2005). *The WebLan-Designer*. Retrieved October 15, 2005, from <http://elena.aut.ac.nz/homepages/weblandesigner/>

Stamper, D. (2001). *Local area networks* (3rd ed.). New Jersey, NJ: Prentice Hall.

Turner, K. J., & Robin, I. A. (2001). An interactive visual protocol simulator. *Computer Standards & Interfaces*, 23, 279-310.

Tymann, P. (1991, March). *VNET: A tool for teaching computer networking to undergraduates*. Proceedings of the 22nd SIGCSE Technical Symposium on Computer Science Education, San Antonio, TX.

White, C. (2001). Visualization tools to support data communications and computer network courses. *Journal of Computing in Small Colleges*, 17(1), 81-88.

Young, M. F. (1993). Instructional design for situated learning. *Educational Technology*, 41(1), 43-58.

Zheng, P., & Ni, L. M. (2003, March 30-April 3). *EMPOWER: A network emulator for Wireline and wireless networks*. Proceedings of the 22nd annual joint Conference of the IEEE Computer and Communication Societies, San Francisco.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. A. Tomei, pp. 235-271, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 3.34

LAN Designer: A Software Tool to Enhance Learning and Teaching Server-Based LAN Design

Nurul I. Sarkar

Auckland University of Technology, New Zealand

ABSTRACT

Until recently, it has been difficult to motivate students to learn about server-based local area network (LAN) design because students find the subject very technical, dry, and boring. A software tool (named LAN-Designer) has been developed at the Auckland University of Technology that gives students an interactive, hands-on experience in server-based LAN design. LAN-Designer is suitable for classroom use in introductory-level courses in server-based networking. This article describes LAN-Designer and its effectiveness as an aid to teaching and learning about LAN design. The effectiveness of LAN-Designer has been evaluated both formally by students (student evaluation forms) and informally through discussion within the teaching team. The conclusions drawn are based on survey data collected from students. The feedback from students indicates that the development and implementation of LAN-

Designer were successful. The article concludes by discussing the strengths and weaknesses of LAN-Designer and its future development. The impact of LAN-Designer on students' performance is also discussed.

INTRODUCTION

Local area networks (LANs) are often included as a topic in computer science, information technology, engineering, and business courses, as LANs are a fundamental component of computer networks today. It is believed that incorporating practical demonstrations into these courses, thereby illustrating theoretical concepts and providing opportunity for interactive hands-on experience, significantly enhances student learning about server-based LAN design. Yet very little material designed to supplement the teaching of server-based LAN design is publicly available,

as a search of the Computer Science Teaching Center (Grissom, Knox, Fox, & Heller, 2004) and SIGCSE Education Links (Anonymous, 2004) sites reveals.

We strongly believe, as do many others (Abe et al., 2004; Bhunia, Giri, Kar, Haldar, & Purkait, 2004; Cigas, 2003; Liebeherr & El Zarki, 2004; Richards & Waisbrot, 2002), that students learn more effectively from courses that provide for active involvement in hands-on learning activities.

Server-based LAN design is one of the most difficult topics to learn and teach in a meaningful way because students find the subject full of technical jargon, dry, and boring, more than other subjects. Researchers at the Auckland University of Technology (AUT) have developed LAN-Designer (prototype) in Authorware 6.X (Authorware, 2004) under MS Windows that gives students an interactive, hands-on learning experience in server-based LAN design. A teacher is able to use LAN-Designer in the classroom, as a demonstration, to enhance the traditional lecture environment at an introductory level, and students can use its tutorials on server-based networking, and to verify (interactively and visually) the results of in-class tasks and exercises on LAN design. LAN-Designer, as reported here, can be used either in the classroom or at home.

The main objective of this article is to describe LAN-Designer and its effectiveness as an aid to teaching and learning about LAN design. The article is organized as follows. First we examine various open source tools and network simulators. We then describe LAN-Designer and highlight its educational benefits in teaching and learning contexts. Test results, which verify the successful implementation of LAN-Designer, are presented. The effectiveness of LAN-Designer is evaluated and interpreted, followed by a brief discussion and conclusion.

RELATED WORK

A detailed discussion on LAN design, in general, can be found in many references (e.g., Dennis, 2002; Forouzan, 2003, 2004; Palmer & Sinclair, 2003; Stamper, 2001), and commercial LAN design and planning is described extensively in literature (e.g., Fitzgerald & Dennis, 2002). A number of open source and commercial network simulation tools exist for building a variety of network models (Chang, 1999; Garrison, 1991; Zheng & Ni, 2003). However, these powerful tools can have steep learning curves and, while excellent for doing in-depth performance modeling and evaluation of computer networks, often simulate a networking environment in far more detail than is necessary for a simple introduction to the subject.

“Netwire emulator” is a software tool which may be suitable for teaching and learning computer networks (Carniani & Davoli, 2001). But this tool is targeted for more advanced networking concepts such as data link layer protocols. ‘EMPOWER’ is another network animation tool that can be used to illustrate the concept of both wired and wireless networking (Zheng & Ni, 2003). To use this tool, students are required to have some basic knowledge and background in networking. Garrison (1991) examined various software tools such as NETWORK II.5, LANNET II.5, and COMNET II.5, which are more suitable for networking research rather than teaching and learning contexts.

Various network simulation software packages are available for modeling and performance analysis of computer networks. For example, ns-2 network simulator (Fall & Varadhan, 2003) is one of the most commonly used simulators and is very popular among researchers, specially CS and EE students around the world. This is partly because ns-2 is open-source software (freely available), and provides an environment for rapid model devel-

LAN Designer

opment and validation. However, it is of limited use as a teaching and learning tool because of its text-based interface which is not user friendly. In conclusion, LAN-Designer seems to be almost alone in its goals and capabilities.

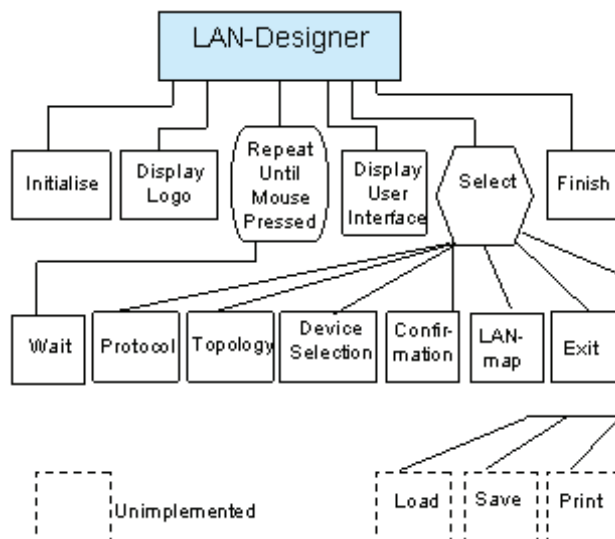
LAN-DESIGNER

LAN-Designer is easy to use and reliable, and can be used to enhance the learning and teaching of various aspects of LAN design. Figure 1 shows a structured diagram of the system. LAN-Designer, as reported here, has the following main features:

- **Channel Access Protocol:** This is an important parameter that needs to be considered when designing server-based LANs. The channel access protocol efficiently controls the transmission when multiple users shared a common channel (i.e., transmission media). LAN-Designer allows users to select either Ethernet CSMA/CD (carrier-sense multiple access with collision detection) or token passing network access protocols.

- **Physical Topology:** A topology represents the physical layout (i.e., architecture) of the network. It is another of the important parameters in server-based LAN design. In the case of Ethernet CSMA/CD networks, either bus or star physical topology can be chosen. For token passing networks, either physical ring or bus topology can be chosen.
- **Component Selection:** This feature allows users to enter LAN components such as the number of workstations and the number of printers for the proposed LAN design. A file server will be selected by default.
- **Confirmation:** This feature allows users to verify LAN components that have been selected for LAN design and make changes if necessary before proceeding to the final step of LAN modeling.
- **LAN-Map:** Based on the user selection of access protocol, physical topology, and LAN components, the 'LAN-Map' displays the proposed LAN diagram on the screen. With this, students can verify their solution of LAN design exercises.
- **Mesh Topology:** The mesh physical topology is not very common for a LAN design

Figure 1. Structure diagram of LAN-Designer



because of large wiring connectivity and more input/output ports required per node. This feature provides a short tutorial (both textual and graphical) on mesh topology.

- **Advanced Networking:** Both corporate and campus-wide local area networks are based on high-speed switching backbone (for example, Gigabit Ethernet switch). This feature also provides a tutorial on switch-based LAN design.
- **Exit:** This feature allows users to exit from LAN-Designer at any time.

The following three features have not been implemented yet, and are considered as future work:

- **Load:** This feature will allow users to view existing modeling for further analysis and modifications.
- **Save:** This feature will allow users to store each and every LAN modeling on disk for later use and further modification.
- **Print:** This feature will allow users to produce a hardcopy of LAN modelings.

TEACHING AND LEARNING CONTEXT

For simplicity and ease of use, LAN-Designer was implemented with a graphical user interface (GUI). The point-and-click GUI interface is easy to use and self-explanatory, which make it well suited both to students and to teachers (Shneiderman, 1998).

Now let us briefly highlight the value of LAN-Designer and how we use this tool in the teaching and learning context. At the Auckland University of Technology, we teach various aspects of server-based LAN design across three different programs, namely B.InfoTech, BBus, and Diploma in IT. It is difficult to motivate students to learn about server-based LAN design

using the traditional lecture-only method because students find the subject full of technical jargon and boring. To make the lesson more interesting and to encourage students' class participation, we use LAN-Designer as an integral part of a two-hour session. An in-class task is given to the students to design server-based LANs on paper. After a prescribed period of time (for example, 15 minutes), LAN-Designer is introduced to the students on a step-by-step basis to enable them to verify (visually and interactively) their solutions and to learn more about server-based LAN design. We also developed quizzes and tutorials based on LAN-Designer to supplement teaching of various aspects of server-based LAN design. By using LAN-Designer, students can go through the tutorials and learn more about networking terms and various aspects of server-based LAN design. The tutorial covers the following topics: CSMA, CSMA/CD, token passing, Ethernet and token ring hubs, media access control protocols, logical and physical topologies for a LAN, mesh topology, and switched-based LAN design.

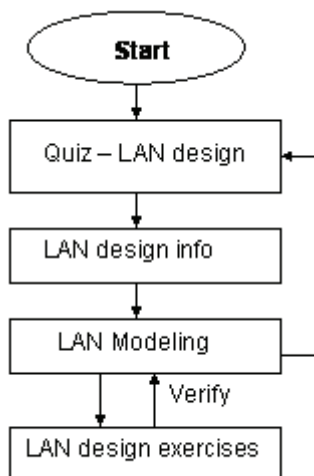
In addition to classroom use, the students use LAN-Designer at home to work on their homework exercises and tutorials at their own time and convenience. LAN-Designer is freely available for download at <http://homepages.ihug.co.nz/~jasonlhl> and can be easily installed on PCs under MS Windows. Figure 2 shows the suggested study guideline using LAN-Designer.

BENEFITS OF LAN-DESIGNER

The main benefits of LAN-Designer are as follows:

- **Hands-On:** Facilitates an interactive, hands-on introduction to server-based LAN design.
- **Modeling:** Provides a simple and easy way to develop a variety of LAN models. With this, students can experiment with a variety

Figure 2. A suggested sequence of study using LAN-Designer



of LAN topologies, and hence enhance their knowledge and understanding of server-based LAN design.

- **Easy to Use:** The GUI makes LAN-Designer an easy-to-use and user-friendly tool. LAN-Designer can be easily installed and run on any PCs operating under MS Windows.
- **Usefulness:** Enhances face-to-face teaching with online learning and can be used either

in the classroom or at home to provide a hands-on learning experience.

- **Robustness:** Tested on various PCs across campuses and found to be robust.
- **Challenging:** Provides an environment for students to test their knowledge about server-based LANs design.

TEST RESULTS

To evaluate its performance and robustness, LAN-Designer has been installed and tested in various computer laboratories and classrooms around the campus. Figures 3 and 4 show screenshots of LAN design test results. For a 10Base T network, the following components have been selected and LAN-Designer produced the valid LAN diagram (Figure 4): {Access protocol: Ethernet CSMA/CD; Physical topology: Star; number of PCs: 5 (excluding a server); number of printer: 2}.

For a 10Base 2 network, the following components have been selected and LAN-Designer produced the valid LAN diagram (Figure 5): {Access protocol: Ethernet CSMA/CD; Physical topology: Bus; number of PCs: 5 (excluding a server); number of printer: 1}.

Figure 3. 10Base T—a server-based Ethernet LAN with 5 PCs and 2 printers (physical star topology)

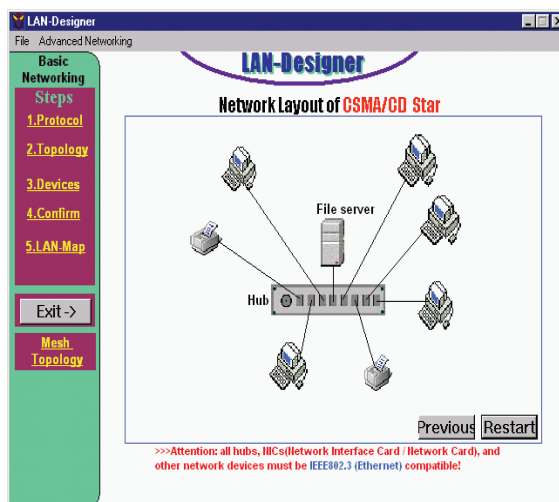
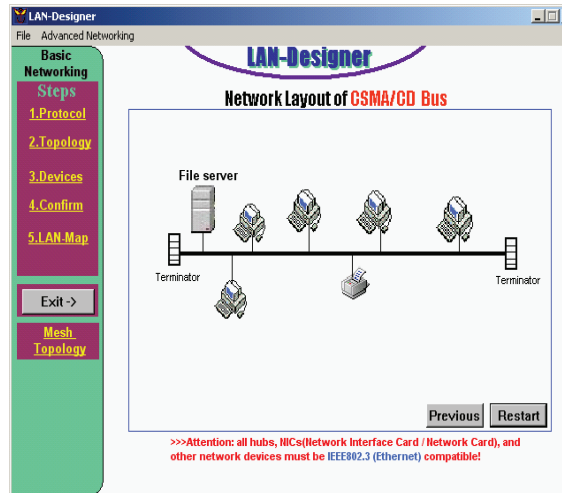


Figure 4. 10 Base 2—a server-based Ethernet LAN with 5 PCs and 1 printer (physical bus topology)



ANALYSIS AND INTERPRETATION

Evaluation

The educational value of LAN-Designer was evaluated extensively, both formally by students (student evaluation forms) and informally through discussion within the teaching team. The formal evaluation of LAN-Designer was conducted in the classroom by a member of the teaching team, and anonymity of the respondents was protected. As part of the formal evaluation process, students were asked to complete a questionnaire. They were asked the following six questions:

1. **User Interface:** How convenient did you find the 'user interface' of LAN-Designer to use?
2. **LAN Design Information:** How useful did you find the information about LAN design at the bottom part of each screen?
3. **Easy to Use:** How easy (overall) did you find LAN-Designer to use and follow?
4. **Robustness:** How easy did you find it to start and exit from LAN-Designer?
5. **Measure of Success:** How effective was LAN-Designer in helping you to improve

your understanding of server-based LAN design concepts?

6. **Hands-On:** Would you like to have more tools of this kind as part of your course?

A Likert scale with five points (1-5) was used in the questionnaire. For questions (1) - (5): 1=poor; 5=excellent; for question (6): 1=No, 5=Yes. Fifty undergraduate students (about 60% male and 40% female) from both "E-business IT Infrastructure" and "Networking & Telecommunications" courses completed the questionnaire, and their responses are plotted in Figure 5. The responses were interpreted as follows:

1. The graphical user interface of LAN-Designer is found to be easy to use. About 96% of the students indicated that they were quite satisfied with the LAN-Designer interface, whereas the rest (4%) were neutral (Figure 5a).
2. About 94% of the students indicated that the LAN design information presented in the bottom part of each page is very useful, and the rest (6%) were neutral (Figure 5b).
3. LAN-Designer was found to be a user-friendly tool. About 94% of the students

- were happy with the current version of LAN-Designer, and the rest (6%) were neutral (Figure 5c).
4. LAN-Designer is easier to install and run, and can be exited from the program at any time. About 100% of the students indicated that they found LAN-Designer robust (Figure 5d).
 5. About 90% of the students indicated that LAN-Designer had clearly assisted them in developing a better understanding of the concepts of LAN design, and the rest (10%) were neutral (Figure 5e).
 6. About 88% of the students indicated that they would like to have more hands-on activities in the course. About 2% of the students were not very interested in trying more hands-on activities, and the rest (10%) were neutral (Figure 5f).

We observed that by participating in the hands-on interactive activities in the classroom, students became increasingly motivated to learn more about server-based LAN design and enjoyed this course more than previous courses that consisted of lectures only. We are seeking feedback regularly, both from students and staff, for further improvement of LAN-Designer.

INFLUENCE OF LAN-DESIGNER ON STUDENTS' PERFORMANCE

A trial run of LAN-Designer was conducted in our two undergraduate courses — “E-Business IT Infrastructure (EBITI)” and “Networking & Telecommunications (N&T)” — in two semesters, namely semester 1, 2004, and semester 2, 2003. Both the EBITI (Petrova, 2000) and N&T (Sarkar & Petrova, 2001) courses are at level six or first-year degree level and constitute 15 credit points (150 hours of student learning) at AUT. Most of the EBITI students are studying towards their

Bachelor's of Business (BBus), qualification and have a very limited background in IT and CIS fields. On the other hand, the N&T students are studying toward their Bachelor's of Information Technology, and have a good background in IT and CIS fields.

LAN-Designer has had quite a positive impact on students' learning about server-based LAN design. As can be seen in Table 1, the overall student pass rate in the final examinations in both semester 1, 2004, and the semester 2, 2003, is slightly higher compared to students in semester 1, 2003, and semester 1 and 2, 2002. It is considered that much of this difference can be accounted for by the fact that the students in both semester 1, 2004, and semester 2, 2003, used LAN-Designer, whereas the students in semester 1, 2003, and semesters 1 and 2, 2002, did not get an opportunity to use LAN-Designer at all. We also observed that EBITI students benefited even more from LAN-Designer (up to 7% pass rate improvement) than the N&T students (up to 5% improvement) did. This is probably due to EBITI students' limited background in the IT and CIS fields compared to N&T students.

In Figure 6, we plot student grade in assignment (Networking and Telecommunications course) versus percentage of students in semester 2, 2003, and semester 2, 2002. The grading scheme we use for assessing assignment (according to the B.InfoTech program) is as follows: A+ (90-100), A (85-89), A- (80-84), B+ (75-79), B (70-74), B- (65-69), C+ (60-64), C (55-59), C- (50-54), and D (0-49). Note that A+ to C- is pass grade and D is the fail grade.

We found that students in semester 2, 2003, have done better in the assignment compared to students in semester 2, 2002. It is believed that much of the improvement in students' grades in the assignment is due to the LAN-Designer experience that students had in semester 2, 2003, whereas the students in semester 2, 2002, did not get an opportunity to use LAN-Designer.

Figure 5. Student responses

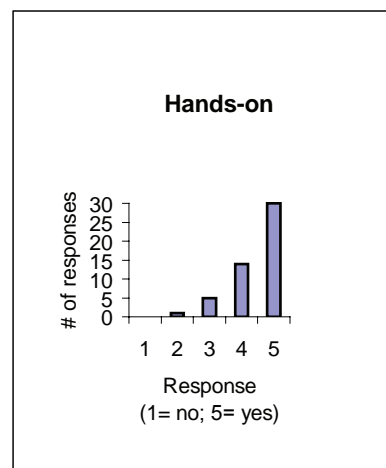
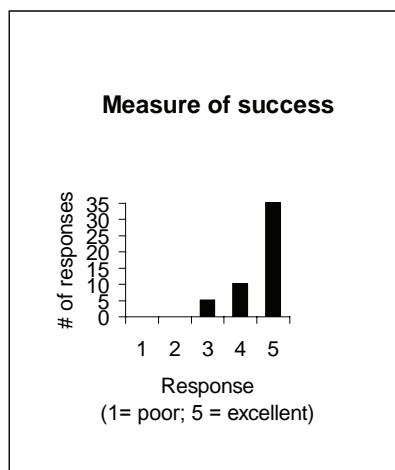
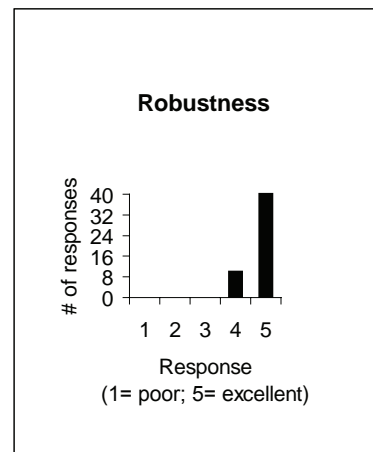
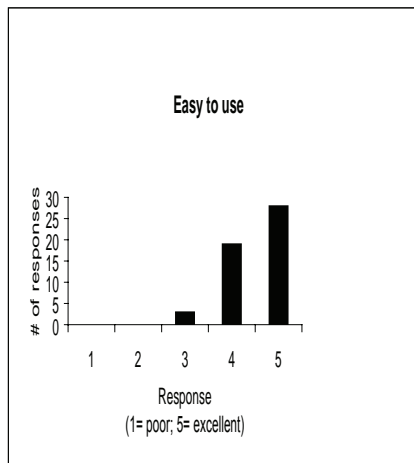
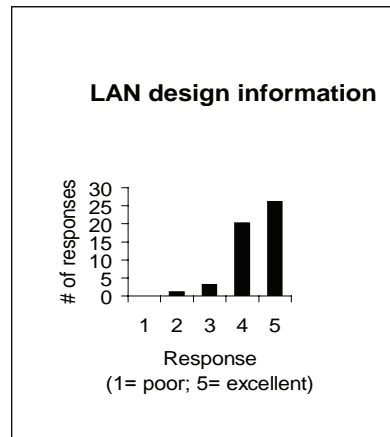
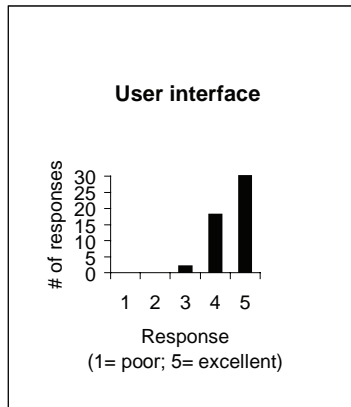
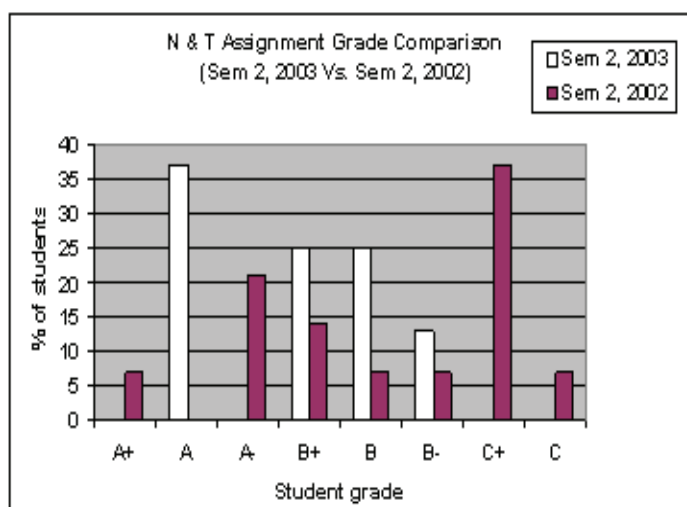


Table 1. Comparison of student performance

| | Semester | Year of study | Student pass rate (%) | |
|---|----------|---------------|-----------------------|------------|
| | | | EBITI course | N&T course |
| With LAN-Designer | 1 | 2004 | 100 | 96 |
| | 2 | 2003 | 100 | 95 |
| Without LAN-Designer | 1 | 2003 | 95 | 92 |
| | 2 | 2002 | 93 | 91 |
| | 1 | 2002 | 95 | 92 |
| Pass rate improvement (with LAN-Designer) | | | u p to 7% | up to 5% |

Figure 6. Grade assignment



DISCUSSION AND CONCLUSION

A software tool (LAN-Designer) has been developed that can be used either in the classroom or at home to enhance the learning and teaching of various aspects of server-based LAN design. LAN-Designer is an easy-to-use and user-friendly tool that can be run from any PCs operating under MS Windows. It was evaluated by students, and their responses to the questionnaire about LAN-Designer were mostly favorable. The students indicated that they had found LAN-Designer easy

to use and robust, and that it helped them to gain an understanding of LAN design concepts. LAN-Designer has had a positive impact on students' performance. Results show that both EBITI and N&T students scored better in both the final examinations with LAN-Designer experience than the students without LAN-designer experience.

Currently, LAN-Designer displays LAN diagrams involving components of up to eight (including a server), which is adequate for demonstration purposes. The software can be easily upgraded to accommodate any number of LAN

components (e.g., workstations). Features such as *access protocol, physical topology, component selection, confirmation, LAN-map, mesh topology, advanced networking, and exit* have been implemented. More features (e.g., *load, save, and print*) are still under development. The incorporation of Gigabit Ethernet is also suggested for future work.

LAN-Designer is freely available to faculty interested in using it to supplement teaching courses involving LAN design. More information about LAN-Designer can be obtained by contacting the author, and the software can be downloaded from the Web site at <http://homepages.ihug.co.nz/~jasonhl>.

ACKNOWLEDGMENT

I would like to thank Jason Lian for extensive programming. I am also indebted to the anonymous reviewers for their constructive comments and suggestions.

REFERENCES

- Abe, K., Tateoka, T., Suzuki, M., Maeda, Y., Kono, K., & Watanabe, T. (2004). An integrated laboratory for processor organization, compiler design, and computer networking. *IEEE Transactions on Education*, 47(3), 311-320.
- Anonymous. (2004). *SIGCSE education links*. Retrieved May 29, 2004, from <http://sigcse.org/topics/>
- Authorware. (2004). Retrieved January 20, 2004: <http://www.macro-media.com/software/authorware/>
- Bhunia, C., Giri, S., Kar, S., Haldar, S., & Purkait, P. (2004). A low-cost PC-based virtual oscilloscope. *IEEE Transactions on Education*, 47(2), 295-299.
- Carniani, E. & Davoli, R. (2001). The Netwire emulator: A tool for teaching and understanding networks. *Proceedings of the Integrating Technology into Computer Science Education (ITiCSE)*.
- Chang, X. (1999). Network simulations with Opnet. *Proceedings of the 1999 Winter Simulation Conference: Simulation—A Bridge to the Future*.
- Cigas, J. (2003). An introductory course in network administration. *Proceedings of SIGCSE'03*, Reno, Nevada, USA.
- Dennis, A. (2002). *Networking in the Internet age*. New York: John Wiley & Sons.
- Fall, K. & Varadhan, K. (2003). *The ns manual. The VINT project*. Retrieved from <http://www.isi.edu/nsnam/ns/>
- Fitzgerald, J. & Dennis, A. (2002). *Business data communications and networking* (7th edition). New York: John Wiley & Sons.
- Forouzan, B.A. (2003). *Local area networks* (1st edition). New York: McGraw-Hill.
- Forouzan, B.A. (2004). *Data communications and networking* (3rd edition). New York: McGraw-Hill.
- Garrison, W.J. (1991). NETWORKII.5, LANNET II.5 AND COMNET II.5. *Proceedings of the 23rd Conference on Winter Simulation*, Phoenix, Arizona, USA.
- Grissom, S., Knox, D., Fox, E., & Heller, R. (2004). *Computer science teaching center (CSTC)*. Retrieved May 29, 2004, from <http://www.cstc.org/>
- Liebeherr, J. & El Zarki, M. (2004). *Mastering networks—an Internet lab manual*. Boston: Addison-Wesley.
- Palmer, M. & Sinclair, R.B. (2003). *Guide to designing and implementing local and wide area networks* (2nd edition). Course Technology.

LAN Designer

Petrova, K. (2000). Teaching electronic commerce: An information technology infrastructure design & management approach. *New Zealand Journal of Applied Computing & Information Technology*, 4(1), 70-77.

Richards, B. & Waisbrot, N. (2002). Illustrating networking concepts with wireless handheld devices. *Proceedings of the 7th Annual SIGCSE Conference on Innovation and Technology in Computer Science Education (ITiCSE)*.

Sarkar, N. & Petrova, K. (2001). Teaching computer networking & telecommunications: A network analysis and software development approach. *Proceedings of the 14th Annual Conference of the NACCQ*, Napier, New Zealand.

Shneiderman, B. (1998). *Designing the user interface*. Boston: Addison-Wesley-Longman.

Stamper, D. (2001). *Local area networks* (3rd edition). Englewood Cliffs, NJ: Prentice-Hall.

Zheng, P. & Ni, L.M. (2003). EMPOWER: A network emulator for wireline and wireless networks. *Proceedings of the 22nd Annual Joint Conference of the IEEE Computer and Communication Societies (INFOCOM)*.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 1, Issue 2, edited by L. A. Tomei, pp. 74-86, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.35

Mobile ICT

Dermott McMeel

University of Edinburgh, Scotland

INTRODUCTION

Within building construction, the appropriation of a specific technology can vary across different job functions and participants (designer, foreman, stone mason, etc.). Embraced by some yet ignored by others, we can illicit insights into certain technologies and devices by reflecting not only on where they are successful but where they are problematic (Wiszniewski, Coyne, & Christopher, 1999) causing breakdowns and dysfunction in systems.

The rugged nature of the site condition quite often prohibits the proliferation of very delicate or expensive mobile equipment. Laser levels, point cloud generators, proprietary information and communication technology (ICT) devices, and so forth are limited to specific instances on the site where the usage is supervised and controlled, and all too often, “construction organisations have found that the ICT investment has failed to meet their expectations” (Peansupap & Walker, 2005). Robust, less expensive equipment is not subject to such extensive regulation (tape mea-

ures, bubble levels, nail guns), and their usage is often more prolific and creative. Various groups are charged with—and attempt to—fit ICTs into the current construction process; these ICTs are shown to create a much ‘smoother’ flowchart (COMIT, 2004). It is an established fact that the way in which a problem is presented generates a particular type of solution (Ortony, 1979; Schön, 1979); we would then suggest that contrary to popular representation and documentation of the construction process (Cox & Hamilton, 1995), there are perhaps more revealing models for presenting and understanding the communicative processes of the construction site than the established flowchart. Focusing on the ICT technology of mobile phones, we reflect on three different roles within a construction project: a director of a large construction organization, a site manager within that organization, and ‘micro-contractors’ of construction—that is, specialist subcontractors or small building contractors. We explore the usage and effects of the mobile phone in these different roles within a construction project.

OFFICIAL/UNOFFICIAL: THE FALSE DICOTOMY

There has always been unregulated communication within regulated work, and mobile phone usage has contributed to powerful unregulated and ‘unofficial’ (in the litigious sense) means for communication within construction. Theorists readily draw on concepts of space and containment to define communications. At the very least, language is an exercise in categorization, assuming similar meanings under a particular word or sign. Reddy (1979) suggests that these assumptions contribute to miscommunication, particularly when communicating across differing cultural categories. In formal communications there is an understanding that certain communiqués are meant for particular recipients, within certain categories of communications. This bureaucratization of communications has its place, but communication also requires the transgression of boundaries (Deleuze, 1988; Shannon & Weaver, 1963).

It has been suggested in a previous paper that parallels exist between construction and Carnival (McMeel, Coyne, & Lee, 2005). These unofficial means breakdown boundaries and thresholds (a distinctive feature of Carnival) and enables unexpected interaction, not unlike the ‘crossroads’ extensively employed when discussing native American Trickster figures (Hyde, 1998). These unexpected interactions cause discomfort and empowerment, both of which are symptoms of the Carnival condition.

CONSTRUCTION AS CARNIVAL

All the symbols of the Carnival idiom are filled with this pathos of change and renewal...of prevailing truths and authorities. We find here a characteristic logic, the peculiar logic of the ‘inside out’ (a l’envers), of the ‘turnabout,’ of a continual shifting from the top to bottom, from

front to rear, of numerous parodies and travesties. (Bakhtin, 1984)

The construction process too has “prevailing truths and authorities”; we suggest that mobile phones have contributed to further breakdown or “suspension, both ideal and real, of hierarchical rank” (Bakhtin, 1984) within construction. Other features of Carnival introduce notions of re-interpretation and redundancy (Attali, 1985). Here we provide theoretical grounding to such assertions, and draw upon our findings from interviews and observation on the construction site and discuss the pros and cons of mobile ICT in construction under the emergent themes of contiguity, abstractedness, porosity, and instantaneity.

Contiguity (Contact)

This temporary suspension, both ideal and real, of hierarchical rank created during Carnival time a special type of communication impossible in everyday life...permitting no distance between those who came in contact with each other and liberating from norms of etiquette and decency imposed at other times. (Bakhtin, 1984)

According to Bakhtin, the renewal and revitalization are the hallmarks of the Carnival, and are brought about when hierarchical barriers are momentarily dropped and populations cross-pollinate. This created an intriguing relationship between high and low society, and the interstices between. Ritual has played—and arguable continues to play—a part in construction (Jones, 2000). We have previously suggested (McMeel et al., 2005) that traditional ritualistic ceremonies (groundbreaking, topping of) served as a melting pot for laborers, architects, clients, and engineers—groups who would not otherwise meet—to mix. Pedreschi (2000) reflects on the architect/engineer Eladio Dieste and attributes his success, in part, to his skill in choosing excellent interlocutors to work for him, thus his team encouraged discussion rather than dictation.

Our findings suggest that mobile phones encourage this crossing of boundaries and reveal the predominant tendency by users to contact the ‘top of the pile’, as in the case of the director of a small specialist stair manufacturer subcontractor. If the director (SF) as the ‘top of the pile’ is contacted, it will indeed garner results, by virtue of the fact that his company is relatively small and SF oversees every set of stairs manufactured. Within a large construction company, contacting the director (EMC) who is ‘out of the loop’ of the day-to-day running of most projects would still allow him to re-direct the query to achieve resolution. Either way contiguity was expected and, when not achieved, often generated feelings of offense, as discussed with SF who deposits his mobile phone with the administration staff when he is attending a meeting or is on the workshop floor. The administrative staff regularly encounters hostility from callers who take exception to calling SF’s personal number and speaking to someone else.

Distraction (Abstractedness)

Shock from the Carnival-esque can be caused by distraction from it; when surrounded by and embraced, it can be both surreal, exciting, and invigorating; if however it is thrust upon you, it is distracting and perhaps frightening. The construction site differs here in that distraction when in a dangerous environment can be fatal. In the words of EMC: “If you can’t use a mobile phone when you’re driving, you shouldn’t be allowed to use one if your operating heavy machinery should you?”

Perhaps the process of ‘making’ things (either stairs or buildings) has its own unique environment, one of noise and dirt in this particular case. The ‘making’ process perhaps suffers from distraction, not from traditional notions of distraction (i.e., noise and dirt), but from the distraction of outside interventions: “If I’m on the workshop floor it’s not to wander round and have a break...I’m

probably attending to something a dam side more important than a phone call” (SF). Several other examples were discussed where site workers received calls (while guiding cranes, for example), and while no accidents ensued, their concentration on the task at hand was compromised. Whether it was the skill of the workshop environment or individuals in high-risk areas, distractions were problematic and repeatedly caused by incoming messages or calls.

Porosity (Screening)

This comes from the Greek ‘pore’, literally meaning ‘passage’ or ‘gateway’ (OED). When finding the gateway closed, we find callers either lose interest, as in the case of the estate agents who would call CR (site manager of a large construction company) on a daily basis. The information they require can be obtained elsewhere; CR as the site manager is simply most up to date on matters such as completion time, floor areas, and so forth—he is the ‘top of the (sub-)pile’, so to speak. Or callers focus their attention on times when the ‘gateway’ is open, in the case of site manager CR at designated break times, when he would be in his site hut close to his phone.

When receiving calls we have seen smaller ‘micro-contractors’ (7-10 employees) prioritize their calls. By looking at the name and number, they can decide whether the call requires immediate attention or could wait or was unimportant and could be ignored. Depending on the decision, the call is answered, noted for a call back, or ignored.

Within the realm of Web portals, permeability and porosity has been explored (Coyne, Lee, & Parker, 2004) in terms of commerce, discourse, and interaction. At an organizational site level, the porosity of the mobile phone allowed for incoming calls to be prioritized by knowing who was calling and what their role on a specific job was. It could then be determined by the recipient if the call required an immediate quick answer,

in which case it was answered with only a small pause to the task at hand, or if it was urgent and required a substantial break until the matter was resolved. What seemed to be problematic was “this automatic reaction to answer the phone” (director of a large construction company).

Instantaneity (Immediacy)

The quality of being instantaneous; instantaneity. (OED online)

The Carnival—like the construction of a building—is a momentary occurrence, and it is always in flux, changing and evolving; as a result, the ability to make an instant connection is perhaps highly beneficial. An immediate discussion or the ability to make an instant order is strongly valued, particularly by the micro-contractor who may have three or four projects running concurrently: “I can get a call from one of the other jobs about something that has come up and I can give them an answer straight away ... then the job can keep moving ... do you know what I mean?” SF gives this example: “Yesterday ... someone told me we were running low on nails, I forgot until I was in the car and phoned admin to order them and here (holds up an invoice) is the docket confirming the order.”

The mobile phone affordance of going directly to ‘the top of the pile’ would seem to be complemented—in terms of problem solving at least—by the ability to immediately resolve or pass the query from the top of the pile to whomever is appropriate—like the ‘game of catch’ (Attali, 1985), where the ‘ball’ is constantly moving and changing hands, only when it stops is it forgotten about.

This immediacy however also has the tendency to act as a displacement activity and a distraction, which can of course be ameliorated by the porosity of the mobile. Opinion is divided however in its effects on forward planning. EMC, the director of a large construction company, feels there is a

tendency to use the phone as a substitute for planning, leaving things to the last minute and dealing with them on the phone. As a result EMC is quite proactive in methods of training new management staff. The micro-contractor however feels they enhance his planning, he can keep update, make orders, and change his strategy during the course of the day as he gets updates from other sites.

CONCLUSION

While the contact afforded by mobile ICTs would certainly seem to enhance communication within the construction industry, it is undoubtedly in certain environs dangerous to allow devices that cause distraction. With caller id, they also present the opportunity to avoid or displace people or subjects that are particularly problematic to the receiver; unlike formal means of communication, no formal record exists of the process of attempted communication.

Apart from the health and safety issues of distraction, the next major concern with the use of mobile phones was for organization and planning. While the micro-contractor and small subcontractor felt it perhaps enhanced the particular nature of their business, the director of a large construction company felt it was in danger of being used as a substitute for forward planning; while this is discouraged, there is perhaps the anxiety that such behavior undermines the procedural aspects of day-to-day working and—more importantly—the management skill of individuals.

There is no prescription here for successful implementation of mobile ICTs, just the realization that the dispersal of the mobile phone across many groups and participants within the construction industry has affected the dynamics of communication within construction and thus affected construction itself. We suggest alternative models might give insights into understanding communication on the construction site and different technologies’ effects on it. Even usage of the

common phone is both diverse and complex, yet the features of the mobile phone are undoubtedly still underutilized. Our work continues to look into how we might use these devices as portals for site workers to access relevant information.

ACKNOWLEDGMENT

The themes in this article have been inspired and nurtured by discussions with Richard Coyne and John Lee. Thanks must also be extended to E. Mc Kenna, Sean Farrell, and Cyril Ronaghan for their insights into their business and practice, and for their time and patience.

REFERENCES

- Attali, J. (1985). *Noise: The political economy of music* (B. Massumi, trans., vol. 16). Manchester University Press.
- Bakhtin, M. (1984). *Rabelais and his world* (H. Iswolsky, trans.). Bloomington, IN: Indiana University Press.
- COMIT. (2004). *Site design problem resolution*. Retrieved June 5, 2005, from <http://www.comitproject.org.uk/downloads/processMaps/narratives/p7.pdf>
- Cox, S., & Hamilton, A. (1995). *Architect's job book* (6th ed.). London: RIBA.
- Coyne, R., Lee, J., & Parker, M. (2004). Permeable portals: Designing congenial Web sites for the e-society. *Proceedings of the IADIS International Conference: E-Society*, Avila, Spain.
- Deleuze, G. (1988). *Bergsonism*. New York: Zone Books.
- Hyde, L. (1998). *Trickster makes this world: Mischief, myth, and art*. New York: Farrar, Straus and Giroux.
- Jones, L. (2000). *The hermeneutics of sacred architecture: Experience, interpretation, comparison*. Cambridge, MA: Distributed by Harvard University Press for the Harvard University Center for the Study of World Religions.
- McMeel, D., Coyne, R., & Lee, J. (2005). Talking dirty: Formal and informal communication in construction projects. *Proceedings of CAADFutures: Learning from the Past*, Vienna.
- Ortony, A. (1979). *Metaphor and thought*. Cambridge: Cambridge University Press.
- Peansupap, D. V., & Walker, P. D. H. T. (2005). Factors enabling information and communication technology diffusion and actual implementation in construction organizations. *ITcon*, 10, 193-218.
- Pedreschi, R. (2000). *Eladio dieste. The engineer's contribution to contemporary architecture*. London: Thomas Telford.
- Reddy, M. J. (1979). The conduit metaphor: A case for frame conflict in our language about language. In A. Ortony (Ed.), *Metaphor and thought* (pp. 284-324). Cambridge: Cambridge University Press.
- Schön, D. (1979). Generative metaphor: A perspective on problem-setting in social policy. In A. Ortony (Ed.), *Metaphor and thought*. Cambridge: Cambridge University Press.
- Shannon, C. E., & Weaver, W. (1963). *The mathematical theory of communication* (reissue). Urbana: The University of Illinois Press.
- Wiszniewski, D., Coyne, R., & Christopher, P. (1999). Turing's machines. *Proceedings of the Architectural Computing from Turing to 2000*, Liverpool.

KEY TERMS

Anthropology: Much of the theoretical underpinning for this article comes from anthropo-

logical sources, writers who have studied social and cultural phenomenon. We suggest that this pool of information has much to contribute to the discussion of mobile ICTs in construction.

Bakhtin: Writer who has extensively studied and written on Carnival in its most primitive form.

Carnival: This is taken in the Bakhtinian sense, a primal event in which everyone participates, there is no differentiation—in true Carnival—between spectator and performer, both are one in the same, as such new forms of communication would emerge.

Construction: The process of building a building, and more generally, making something.

Dirt: Anthropologically, ‘dirt’ is a potent metaphor which we invoke here as a representation of things which do not have allotted place. It represents material which is non-placed and problematic for systems to handle.

Information and Communication Technology (ICT): Term usually associated with e-mail, phones, skype, and so on; a technology used for communication. Not however exclusive to digital means, for example a pen could be an ICT.

Micro-Contractor: A term used here to identify a specific sort of building contractor. This type is a contractor/entrepreneurial company of 7-10 people. The size seems important to the adoption and seeming benefits of using ICT.

This work was previously published in Encyclopedia of Mobile Computing and Commerce, edited by D. Taniar, pp. 516-519, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 3.36

Innovation in Wireless Technologies

Diego Ragazzi

CEFRIEL – Politecnico di Milano, Italy

INTRODUCTION

There is no doubt that wireless communication technologies have been one of the most interesting innovation fields in the telecommunications industry in recent years. The spectacular rate of innovation in this field has enforced the vision of ubiquitous connectivity: the vision of a world where every human being and every electronic device, from high-end supercomputers to tiny sensors of temperature in your car, can talk to each other through a dense web of communication links. A vision of this kind, although more “human-centric,” is proposed, for example, in the “Book of Visions” (2001) published by the Wireless World Research Forum. Of course, wireless communication technologies are instrumental in accomplishing this vision, as we cannot possibly imagine to connect everything by means of cables. Moreover, wireless communications offer the advantage of supporting mobility even at high speed.

The goal of this short paper is to propose one possible explanation why wireless technologies have shown such a dramatic innovation rate, and to overview some of the main and most recent technology achievements in this field. We will see that innovation is fostered mainly by freedom to experiment, and that countries offering such freedom, by means of wise regulation, can benefit most of these innovations. Wireless technologies, in fact, have a number of features which make them the best candidate solution for developing countries wanting to create a communications infrastructure with low costs and in a short time frame.

One of the main features of wireless technology can be summarized in one word, *freedom*. Freedom, to some extent, from physical constraints, as there’s no need of laying cables through land, roads and buildings, from cost constraints, as most of the times the cost of a wireless infrastructure is significantly lower than that of a wired one, from time constraints, as usually wireless

networks can be deployed in a very short time-frame compared to wired infrastructures, from location constraints, as wireless connections can be established potentially everywhere, even in motion, finally, and most significantly for this discussion, in some cases freedom from access constraints, as some frequency bands have been wisely set aside by national and international regulatory administrations to be used as a “spectrum commons” (Lessig, 2002). These bands, such as the 2.4 GHz “industrial, scientific and medical” (ISM) band, are allocated for license-exempt use, meaning that you don’t need to ask permission to anybody for using the spectrum. “Users in these bands are liable for interfering emissions they cause, but are not protected from interference from others. Significant incentives are therefore created for users to deploy innovative systems” (Lie, 2004, p. 16) which can minimize interference between different transmissions, as well as optimize the co-existence of many different wireless systems. Moreover, the freedom of access to spectrum has fostered innovation, as there’s no administrative or market restriction for innovators to experiment.

Lessig (2002) argues that the staggering innovation fostered by the Internet was mainly due to its character of openness, neutrality and freedom of access. In much the same way, “spectrum commons” have favored innovation at the physical layer, by giving innovators the right to design, implement and deploy innovative systems without asking permission from anybody. Most of the recent technological innovations have been designed to operate in license-exempt bands. On the other hand, if spectrum policy had an impact on the innovation rate of the wireless world, in turn technological advances and innovative services are changing the way regulatory administrations allocate and manage spectrum (Lie, 2004; Reynolds, 2004; see also the “next generation” program of the U.S. Defense Advanced Research Projects Agency).

There is another reason why “spectrum commons” favored innovation, and this is linked in some way to the “end-to-end principle” (Saltzer et al., 1981). This principle, when applied to network design, states that the network should be as simple and neutral as possible, leaving the “intelligence” at the ends, that is to the applications. The reason why this principle fosters innovation is that it allows flexibility for future uses: a very complex architecture might be optimized for one or more uses, but most probably it will not be good for all the future uses yet unseen. In much the same way, radio devices emitting in the spectrum commons have to respect very general rules, mainly aimed at reducing mutual interference and allowing the peaceful coexistence of different systems in the same frequency bands (see for example the Part 15 rules of the U.S. Federal Communication Commission, that define conditions under which radio devices can operate license-free). Moreover, because emission in the spectrum commons is free, developers are pushed to design advanced techniques in order to protect their system from unwanted interference of any kind (e.g., other radio systems, microwave ovens, etc.) and to share the available spectrum in the best way. Traditional wireless systems assume the receiving terminal is “dumb,” in the sense that it cannot easily differentiate between the information signal and background noise. In traditional systems, interference should be avoided at all costs, and this is usually achieved by imposing exclusive licenses and strict regulations about how the spectrum must be used, by whom and for what use. The intelligence is placed in the way the spectrum is managed by regulatory administrations, not at the ends in smart terminals. Recent smart radio terminals developed for use in the license-exempt bands, on the other hand, embed advanced signal processing techniques to sift through interference and pick out the information signal.

REFERENCE MODELS

The vision of the wireless world proposed by the Wireless World Research Forum (The Book of Visions, 2001) puts users and their needs at the core of the definition of network architecture. This user-centric approach can be described by a “multi-sphere model,” where the user and the external resources interact via communication links on different levels that can be depicted as concentric spheres around the user. The inner sphere represents the closest interaction with small devices in the personal area of the user. This involves Body Area Networks (BAN), connecting wearable appliances, body sensors and portable devices, such as cellular phones and audio headsets. The next level of interaction is with objects around us, such as personal computers, TV sets and other home appliances that form our Personal Area Network (PAN). The next concentric sphere outwards represents interaction with resources confined in a limited area, usually building-wide, connected together to form a Local Area Network (LAN). Over wider areas, we can interact with any resource in the world through Metropolitan Area Networks (MAN) at city level and Wide Area Networks (WAN) at regional, national and international level, represented by the outermost sphere. Because of regulatory limitations of the allowed transmission power, the advanced wireless technologies developed for use in license-exempt bands can operate only in the inner spheres, up to LAN level included.

This reference model, however, developed around a human user, is not well suited for yet another increasingly important scenario of innovation: Machine-to-Machine (M2M) networking. In this case, the vision is of a world of interconnected devices with distributed “intelligence” that can talk to each other through a mesh of communication links. Some of these devices can be extremely simple and small, such as tiny sensors or smart tags that can be spread over a wide area for monitoring or control purposes (“sensor

dust”). In this case, the best reference model is arguably a peer-to-peer architecture supported by a “mesh network,” where there’s no central or focal point such as in the multi-sphere model, but every node of the network is functionally identical to every other node.

MULTIPLICITY AND CONVERGENCE

Within the inner spheres of the multi-sphere model, a multiplicity of heterogeneous wireless technologies have been designed and deployed, to better fulfill specific user needs at different mobility levels, bit-rates, costs and services provided. Each radio technology is best suited to specific scenarios and applications, hence multiple wireless technologies are foreseen to co-exist in the short-term at different levels of interaction with the user (Redaelli, De Francesco & Ragazzi, 2003).

The transmission techniques developed for license-exempt use must comply with local regulations and must be designed to cope with harsh propagation environments and all sorts of unwanted interferers. The most important transmission techniques for this kind of applications are: *spread spectrum*, frequently used in today’s wireless products due to its robustness against noise and interference; *orthogonal frequency division multiplexing* (OFDM), implemented in more recent wireless LAN products and considered also for use in Metropolitan Area Networks; *ultra wide band* (UWB), currently under investigation.

Spread spectrum is a technique pioneered by the army trading bandwidth for robustness. It uses more bandwidth than required to reduce the impact of localized interferences. Usually, one of two main spread spectrum technique is used: *direct sequence* and *frequency hopping*.

The principle of direct sequence spread spectrum is to spread the signal energy on a larger band by multiplying it with a *code*, a fast repetitive pattern of bits. In this way, for each bit of

information the system actually transmits many bits of code organized in a pre-defined pattern known both at the transmitter and the receiver. The energy of the signal is spread over so a large bandwidth that it looks just like background noise to “traditional” radio receivers, which may not be significantly interfered with by spread spectrum transmissions. At the intended receiver, the original signal is recovered by correlating the wideband signal with the same spreading code used by the transmitter. Only the original signal gives the best match at the correlator block and therefore the impact of any other interfering signal is reduced. This technique is used, apart from the newest generation of mobile phones also known as Third Generation or 3G, by the widespread WiFi technology based on the IEEE 802.11b standard. The WiFi industry is one of the fastest growing and has a lot of interesting applications in many different market sectors such as home offices, small offices, enterprises, retail, logistic, healthcare, Internet service providers, telecom operators. Direct sequence spread spectrum is also used in the newly born Zigbee technology, backed by IEEE 802.15.4 standard (draft), which has been designed for use in the M2M scenario to interconnect a large number of tiny electronic devices to form what is sometimes termed the “Internet of things.”

Frequency hopping is another spread spectrum technique that divides the available bandwidth into a number of narrow-band channels and uses all of them in a pre-defined sequence. Periodically, the system “hops” to a new channel, following a pre-determined cyclic *hopping pattern*, which is known both at the transmitter and the receiver. The system avoids interferences by continuously jumping from channel to channel. If a channel is interfered, the system might not be able to use it and just waits for the next good channel, thus averaging away the effect of bad channels. This technique is employed by Bluetooth/IEEE 802.15.1, the main technology available today within the inner sphere of the reference model for Body/Personal Area Networks.

The idea behind OFDM is to divide the available spectrum into many sub-channels or sub-carriers. Conceptually, we can think of dividing the original data stream into n parallel data streams, then modulate each of them and transmit all together in the same band. This system, if supported by intelligent optimization algorithms which can adaptively and dynamically choose the best modulation and coding technique to be employed on each sub-carrier, is a powerful tool to cope with dynamically changing radio channels and unpredictable interference patterns. OFDM technology is used today in new generation wireless LAN products of the 802.11 family, notably 802.11g and 802.11a, and it is the basic building block for the next generation of wireless MANs, based on the recent IEEE 802.16 standards family.

The FCC loosely defines “UWB technology” as any wireless transmission scheme that occupies a bandwidth of more than 25% of the center frequency, or more than 1.5 GHz. But the main innovation here comes from the unconventional transmission technique proposed for some UWB implementations. UWB is typically implemented in a carrier-less fashion: conventional systems transmit information by modulating a continuous sinewave; conversely, some UWB implementations transmit a train of ultra short impulses and remain “silent” between consecutive pulses. This technique is also known as “impulse radio” (Sholtz & Win, 1998). Besides claimed advantages of low implementation costs, low power consumption, robustness to both interference and intentional jamming, UWB technology promises to co-exist with other conventional radio systems without causing noticeable interference, due to the extremely low power spectral density of the signal, which is perceived as background noise by conventional receivers. This opens up new possibilities of spectrum re-use, by letting UWB devices transmit on the same frequencies already allocated to other services. Moreover, the ultra short duration of impulses is instrumental in achieving very precise distance measurements (as

a matter of fact, UWB technology was pioneered mainly by the radar industry), thus allowing the design of a radio modem that can simultaneously transmit information and measure the distances of surrounding objects. This could be applied in many applications of great interest, such as monitoring and control systems for warehousing, logistic, public protection, industrial plants.

On February 14, 2002, the FCC adopted a First Report and Order that permits the marketing and operation of certain types of UWB products under Part 15 rules, that is, license-free operation. These rules represent a cautious first step and set very restrictive emission limits, as there is little operational experience with the impact of UWB on other radio services. Nevertheless, putting UWB under the license-exempt regulation will undoubtedly spur innovation in this emerging field in the near future. The most promising applications for UWB technology appear to be in two distinct scenarios: high bit rate PANs for distribution of multi-media contents in homes and offices, and low-rate, low-power networks of sensors and small devices with added localization capabilities.

It is not the goal of this paper to cover all the innovations and research trends in wireless technology, but just to review some of the main innovative techniques proposed for use in the license-exempt part of the spectrum, and to highlight how this wealth of innovation can be related to the existence of "spectrum commons" which give innovators the right to experiment and deploy new systems without asking permission from governments or monopoly holders.

However, the discussion wouldn't be complete without mentioning briefly the need of "technology convergence," at the terminal and network layer, in order to handle the growing number of available radio technologies that otherwise would be unmanageable by users, telecom operators, software developers and service providers. From the user's perspective, convergence of different

wireless communication technologies at the end terminal is a critical point, since it would be obviously impractical to use one terminal per radio interface. The user wants to be always connected in the best possible way using the same terminal. Therefore flexibility and self-reconfigurability are key concepts of current research activities. The system has to dynamically adapt to the changing communication link quality, service requirements and traffic loads supporting different communication protocols. In the long run, software-defined radio concepts (Reed, 2002) may play a key role, for it is conceptually easier to implement advanced self-reconfigurable and adaptive communication interfaces in software rather than in hardwired chipsets.

At the network layer, current trends are towards an integrated, multi-service, packet-switched network based on IP technology. The worldwide deployment of such an integrated network is by no means an easy task. Telecom operators and enterprises have a huge deployed base of legacy communication systems. The entire infrastructure has to move from circuit-switched technology, used for plain old telephone networks, to packet switching, while preserving interoperability between systems in the transition period. Besides traditional and innovative data services, the new IP-based network needs to provide the same services people are used to receiving from circuit-switched systems, including voice and video. Despite the tough challenges, there are a number of good reasons for going in this direction: today's dramatic surge of data traffic as compared to voice traffic, cost reduction due to the deployment and maintenance of a single-technology infrastructure, more efficient use of communication resources, increased interoperability between products and applications, support of new integrated services. To match all these requirements, the IP technology needs to evolve, in order to provide better quality of service, support mobility, improve security and reliability.

CONCLUSION

Wireless communication technologies have been one of the most interesting innovation fields in the telecommunications industry in recent years. Innovation is fostered mainly by freedom to experiment, which could be insured by national and international regulations setting how the radio spectrum is used, i.e., by the specific “spectrum policy.” The freedom of access to the radio spectrum (and therefore freedom to experiment and deploy innovative wireless systems without asking permission from anybody) brought about a multiplicity of wireless technologies, each one suited to different needs and requirements. This multiplicity, which is foreseen to stay in the near future, would be totally unmanageable should it not be accompanied by a convergence at the network and application layers, which is also going on based on the IP framework.

In conclusion, wireless technologies, due to their peculiar characteristics, are the best candidate solution for developing countries wanting to deploy communications infrastructures at low costs and in a short time-frame. But only those countries which will introduce wise regulation of spectrum management will benefit most of the wireless revolution.

REFERENCES

- Barrett, T. W. (2000). History of UltraWideBand (UWB) Radar & Communications: Pioneers and Innovators. Paper presented at *Progress In Electromagnetics Symposium 2000 (PIERS2000)*, Cambridge, MA, July.
- Defense Advanced Research Projects Agency (DARPA) neXt Generation (XG) Communications program. “The XG Vision, Request for Comments, version 2.0”, prepared by BBN Technologies, CA, MA, USA. Retrieved from <http://www.darpa.mil/ato/programs/XG>
- The Federal Communication Commission rules and regulations are codified in Title 47 of the Code of Federal Regulations (CFR). Part 15 rules define conditions under which radio devices can operate license-free. Retrieved from <http://wireless.fcc.gov>
- Foerster et al. (2001, Second Quarter). Ultra-wideband technology for short- or medium-range wireless communications. *Intel Technology Journal*. Retrieved from <http://developer.intel.com/technology/itj>
- Gast, M. S. (2002). *802.11 Wireless networks: The definitive guide*. Chicago: O’Reilly.
- Haartsen, J. (2000, February). The Bluetooth Radio System. *IEEE Personal Communications*, 28.
- Lessig, L. (2002). *The future of ideas. The fate of the commons in a connected world*. New York: Vintage Books.
- Lie, E. (2004). *Radio spectrum management for a converging world*. Background Paper prepared as part of the ITU Workshop on Radio Spectrum Management for a Converging World, Geneva, CH, 16-18. Retrieved February 2004 from <http://www.itu.int/osg/spu/ni/spectrum>
- Proakis, J. G. (2001). *Digital communications* (4th Ed.) Boston: McGraw-Hill.
- Redaelli, G., De Francesco, L., & Ragazzi, D. (2003). *Multiplicity and convergence in wireless telecommunication networks. Business briefing: Wireless technology*, World Markets Research Centre, p. 70. Retrieved from www.wmrc.com
- Reed, J. H. (2002). *Software Radio: A modern approach to radio engineering*. Upper Saddle River, NJ: Prentice Hall.
- Reynolds, T. (2004). *Advanced wireless technologies and Spectrum Management*. Background Paper prepared as part of the ITU Workshop on Radio Spectrum Management for a Converging World,

Geneva, CH, 16-18. Retrieved February 2004 from <http://www.itu.int/osg/spu/ni/spectrum>

Saltzer, J. H., Reed D. P., & Clark, D. D. (1981). *End-to-end arguments in system design*. Second International Conference on Distributed Computing Systems (April 1981) pp. 509-512. Retrieved from <http://web.mit.edu/Saltzer/www/publications/pubs.html>

Win, M. Z., & Scholtz, R. A. (1998, January). Impulse radio: How it works. *IEEE Communications, Letters*, 2(1).

Wireless World Research Forum (WWRF). (2001). *The Book of Visions 2001 – Vision of the Wireless World*. Retrieved from <http://www.wireless-world-research.org>

KEY TERMS

Bandwidth: The difference between the limiting frequencies (highest frequency minus lowest frequency) of a continuous frequency band.

Bit Rate: In a bit stream, the number of bits occurring per unit time, usually expressed in bits per second. Usually, it measures the rate of transmission of information

(Electromagnetic) Spectrum: The range of frequencies of electromagnetic radiation from zero to infinity. The electromagnetic spectrum has been, by custom and practice, divided into “frequency bands.”

Interference: In general, extraneous energy, from natural or man-made sources, that impedes the reception of desired signals.

Noise:

1. An undesired disturbance within the frequency band of interest; the summation of unwanted or disturbing energy introduced into a communications system from man-made and natural sources.
2. A disturbance that affects a signal and that may distort the information carried by the signal.

Power Spectral Density: The total power of the signal in the specified bandwidth divided by the specified bandwidth. Note: power spectral density is usually expressed in watts per hertz.

(Radio) Channel: An assigned band of frequencies sufficient for radio communication. A channel is usually assigned for a specified radio service to be provided by a specified transmitter.

Signal:

1. Detectable transmitted energy that can be used to carry information.
2. A time-dependent variation of a characteristic of a physical phenomenon, used to convey information.

Since the works of the French mathematician Jean Baptiste Fourier (1768 - 1830), we know that each signal can be represented equally well as a time-varying function or as a sum of sinusoids of different frequencies. Therefore, to each signal can be associated a “frequency band,” that is the portion of the spectrum comprising all the frequencies of the sinusoidal components of the signal.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 458-462, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.37

New Challenges for Smart Organizations: Demands for Mobility—Wireless Communication Technologies

István Mezgár

Budapest University of Technology, Hungary

ABSTRACT

The chapter introduces the different types of wireless technologies that can be applied in smart organizations. Smart organization (SO) is an outstanding representative of networked organizations, as its organization structure, communication, and knowledge-based applications are coordinated and all networked. The chapter describes the communication demands of SO, taking care on wired and especially wireless networks that offer mobility for users. Access at anytime from anywhere to enterprise information for registered users guarantees mobility that is a basic demand for a dynamic organization today. Security, trust, and interoperability aspects are also discussed as important characteristics of the up-to-date infocom systems. Finally, the main

impacts of wireless technologies on smart organizations are summarized. Through the survey of the structure and operation of wireless technologies and their impacts, it is easy to understand that wireless communication technology has a strategic role in the effective, competitive operation of networked organizations.

INTRODUCTION

Today, the developments of information technology, telecommunication, and consumer electronics are extremely fast. The ability of different network platforms to carry similar kinds of services and the coming together of consumer devices such as the telephone and personal computer is called “technology convergence.” The ICT (information

and communication technology), the “infocom” technology, covers the fields of telecommunication, informatics, broadcasting, and e-media. A very fast-developing field of telecommunication, wireless communication gets a growing role in many fields as well. The connection of mobile devices to the Internet established basically new possibilities and services for the users.

Based on the results of the information and communications technologies, a new digital economy is arising, as the result of this technological convergence is not just about technology. It is also about services and about new ways of doing business and of interacting within the society. The impact of the new services resulting from convergence can be felt in the economy and in the society as a whole, as well as in the relevant sectors themselves. Because of this great impact of information, technologies, and the level of knowledge content in products and services, the society of the 21st century is called the Information and Knowledge Society (Ungson, 1999).

This new economy needs a new set of rules and values, which determine the behavior of its actors. Participants in the digital market realize that traditional attitudes and perspectives in doing business need to be redefined. In this dynamic and turbulent environment that requires flexible and fast responses to changing business needs, organizations have to respond by adopting decentralized, team-based, and distributed structures variously described in the literature as virtual-, networked-, cluster-, and *smart* organizations. One main aspect of these approaches is that organizations in this environment are networked; that is, interlinked on various levels through the use of different networking technologies.

Since the base of networked organizations are the interdependent, separate production and service teams and units, cooperation and collaboration among them is of vital importance. The structure, the communication systems and the collaborating people, teams, and organizations that define today’s organizations characteristics

must be harmonized to accomplish complex, demanding tasks. The collaboration means contacts among users, so human beings have outstanding importance. A very important element of this human contact is trust, so in a networked organization, trust is the atmosphere, the medium in which actors are moving.

The collaboration is done through different media according to the actual demands of the tasks. A new way of connection is the application of different wireless technologies for communication in networked organizations where interoperability is an additional important factor. Wireless technology means mobility, namely individuals are available independently from location and time. This mobility is an important attribute of today’s organizations.

The chapter introduces the basic wired and wireless communication possibilities for smart organizations and some connected techniques, and technologies as well. As trust is the base for all cooperation and collaboration, its role in smart organization is also presented. Security is an important component in trust building, so security services and their application in the different networks are introduced as well.

SMART ORGANIZATIONS AND ICT

The Smart Organization

The digital economy offers a market environment for participants with the following characteristics and demands:

- Networking and horizontal communication, including the smart product,
- Networked environment,
- Knowledge-based technologies,
- Simplification and coordination of structure,
- Customer focus and real-time, ubiquitous responsiveness to technical and market

New Challenges for Smart Organizations

- trends (what customers want, anytime, anywhere),
- Flexibility, adaptability, agility, mobility,
 - Organizational extendibility, virtuality,
 - Shared values, trust, confidence, transparency, and integrity,
 - Ability to operate globally, cooperating with local cultures.

In this turbulent environment only those organizations can survive which effectively apply the results of the different disciplines. Smart organization (SO) belongs to this kind of category. A definition of SO is as follows: “The term “smart organization” is used for organizations that are knowledge-driven, internetworked, dynamically adaptive to new organizational forms and practices, learning as well as agile in their ability to create and exploit the opportunities offered by the new economy”(Filos & Banahan, 2000).

There are three characteristics of smart organizations that make them really special:

- They are motivated to build collaborative partnerships, which encourage and promote the discussion of ideas. Customer focus and meeting customer expectations is recognized as a key success factor.
- Smart organizations can respond positively and adequately to change and uncertainty, so they survive and prosper in the new economy.
- Smart organizations can identify and exploit new opportunities through applying the strength of “smart” resources; that is, information, knowledge, relationships, and innovative and collaborative intelligence.

Cooperation and communication are the basic technologies for SO operation. In the following sections the important technologies, services and methods connected to communication technologies will be discussed trust, security and their applications.

Besides the Internet, new (or pilot phase) solutions are offered: powerline communication (using the electric power grid), and as an efficient extension of the Internet the Grid technology and different types of wireless networks.

Demand of Mobility

Mobility means availability everywhere, the possibility to be connected in the office, in the meeting room, in the car, in a train, in the airport, and even at home. Today, most companies are aware of the importance of employees continuously being connected. Being connected and being able to contact anybody associated with the organization (e.g., customers, colleagues) is very important both for the individual and for the overall efficiency of the organization. The “classic” networked companies aspire to mobilize their workforces through application of wireless communication technologies as mobility brings obvious advantages to the enterprises, including increased productivity, improved communications, cost reductions, and revenue creation.

This mobile connection can be either a voice or a data connection to an enterprise network or to the Internet. Depending on the employee’s position inside the organization, the requirements for this connectivity in terms of bandwidth, end user devices, services, and so forth are very different.

Mobility can be addressed with different solutions and technologies; each solution or technology has its own advantages and inconveniences. Mobility can be achieved by using different types of wireless networks such as satellite communication, Wireless Wide Area Networks (WWAN—different types of mobile phone systems—GSM, GPRS, UMTS, iMode), Wireless Metropolitan Area Network (WMAN), Wireless Local Area Networks (WLAN, such as Wi-Fi—also called mobile Internet [IEEE standard 802.11a/b/g]) and Wireless Personal Area (or Pico) Network (WPAN—e.g., Bluetooth, RFID, IrDA2).

The main structural factor for a mobility solution is the radio and access technology deployed. In the last ten years, some technologies have been developed from a technical as well as a business point of view. Two very strong drivers for mobility are now in place at the infrastructure level, one for indoor (WLAN), and another one for outdoor (cellular solutions such as FLASH-OFDM).

For voice transmission, most of these users will want to use the same phone with a single directory, a single voice mailbox, and a common set of services. A single phone using, for example, Voice over IP (VoIP) through a broadband connection when at home or in the office, but switching automatically to a mobile network when on the move.

Beyond the enterprise, consumers are also discovering the advantage of mobility. Phones became mobiles some years ago, and the same trend is currently happening to the computer world, where consumers are shifting from fixed desktops to more convenient laptops. Most users want to be able to communicate on any device, anytime, anywhere, without any configuration limitation. These users want session continuity between various access networks, giving them continuous and seamless connection to the best available network. (e.g., existing Satellite-GSM phones). There are various solutions (some under research still) that enable seamless mobility between different access networks for voice and data connections. These solutions will make the end-user's experience more enjoyable and will open new opportunities for operators and enterprises. With Mobile IP, the enterprise and public operator can provide seamless "always-on" network access to mobile professionals.

Mobility between the different networks (WLAN, WiMAX, UMTS, etc.) can be coordinated at the Internet Protocol (IP) level, where

- no user intervention is required when the access network changes,
- connectivity is not interrupted during the move,

- any application that tolerates packet loss will remain available, allowing ongoing session recovery.

So, main advantages of wireless and mobile communication are that anybody, from anywhere at anytime, can make contacts, which means increased flexibility and time reduction in business processes. Today, some type of mobility is a must for enterprises that want to hold on in the global market competition. According to market researcher Gartner (2003), 45% of the American workforce is using mobile technology of some kind, including laptops, PDAs, and new sensor networks. By 2007 more than 50% of enterprises with more than 1,000 employees will make use of at least five different wireless networking technologies.

Demands of Communication in SO

Communication in SO is very intensive and a great amount of confidential data and information is changed among the partners. The list of general requirements can contain, in some cases, contradictory items as well. The main requirements in case of novel networks are as follows:

- great communication speed,
- shared access to files, data/knowledge bases,
- exchange of picture, voice—multimedia applications,
- online/real-time access,
- access for anybody, from anywhere, at any time—mobility,
- reliable, secure exchange of information,
- intelligent user interfaces,
- easy and cheap installation.

The additional demands for present wireless communication technologies from the side of production systems are:

New Challenges for Smart Organizations

- security level should be equivalent with wired systems,
- increase data transfer speed,
- decrease operation costs,
- develop wireless communication chain (satellite -> WPAN)

The general communication requirements for an SO can be summarized in the following:

- **Integration of different communication forms and resources:** Communication through connected telephone-, computer-, and cable networks, and application possibilities of different protocols, connecting wired and wireless equipment.
- **Reliable and high quality communication services:** Reliability covers the high on-service time (technical reliability), the high availability (well designed/balanced network—resource reliability), the HW and SW security, both for equipment and communication lines (access reliability), well controlled/organized networks (organization reliability), all with reasonable cost.
- **Global time coordination:** It is essential the exact coordination of the different actions in time, so a “general time” has to be declared for communication.
- **Traceable communication:** Traceability means to document and audit the communication in a way that fulfills the requirements of bookkeeping (e.g., delivery report and receipt notification) and legal aspects (e.g., digital signature).

The security requirements for an SO can be listed as follows:

1. Protection of all types of enterprise data (for all company forming the SO). Privacy and integrity of all types of documents during all phases of storage and communication (Data and communication security—Certification, Encryption),

2. To enable companies confidential access control,
3. Authorization and authentication of services (digital signature).

These services need to be flexible and customized to meet a wide array of security needs, including specific high-level requirements. In order to fulfill the communication and security demands, some basic aspects have to be taken into consideration while selecting security and communication technologies:

1. Platform independent SW tools have to be applied,
2. Standards have to be applied (accepted and “de facto” standards as well),
3. Appropriate architectures with ability to integrate different resources.

Fulfilling all types of the introduced requirements for individual enterprises would be very hard if not impossible, so different general network and organizational structures have been developed that have been carefully designed and tested. These structures can be defined as reference architectures, and they are available both for the organization and for the information infrastructure of networked organizations.

Selection of Communication Network Technologies for SO

In the case of networked organizations, the most important market demands are the time-to-market (throughput time) and flexibility, so decreasing time and increasing flexibility are the main goals for enterprises. In order to shorten the throughput and operation time there are numerous opportunities, in the following some of them are listed:

- speed up communication among departments/individuals/machines,

- optimize (business) processes - > optimize information/material flow-routes,
- make more effective the working process— workflow modifications,
- increase availability—extend effective working time (24/7/365 method),
- increase efficiency of information/knowledge exchange (team-work, cooperation, coordination).

Information and communication technologies play a key role in most of the points of the above items. In the cooperation and coordination technologies communication and its speed, and the availability rate of partners, have basic importance.

In communication the conventional tools are the telephone, fax, and writing letters. On the next level are the computer network-based solutions, such as e-mail, ftp, and telnet. A higher quality of communication media is the WEB-based communication solutions. Through WEB pages a secure, easy and fast communication can be realized.

In case of WWAN, SMS, MMS (multimedia messages), and Mobile Internet (WAP) are the forms of communication. Mobile network solutions are spreading quickly also in enterprise communication. Developers and service providers offer compact mobile phone-based packages for enterprises that makes possible receiving e-mails and browsing company databases from anywhere.

Today, there is no communication technology (data or voice) that would entirely fulfill alone the communication demands of smart organization. The main characteristics listed in the previous subchapter cannot be represented by one network type yet, so there are different approaches that cover partially the demands of the market; networked organizations are using both wired and wireless technologies in an integrated way.

Wired communication remains the base for communication, but in many fields mobile and wireless tools take over the first place. Internet

technology (IP) is the base of broadband wireless communication. A smooth integration of wired and wireless, mobile communication technologies can be seen on the market as well. There are some novel wired technologies as Powerline communication (PLC—ease of installation, operation) and the GRID technology (easy information access and handling) that have special characteristics and they are applied parallel with wireless technologies. In the field of voice transfer, VoIP seems to be a ruling technology.

The different wireless networks—Satellite, WWAN, WMAN, WLAN and WPAN—(today) can be partially connected and integrated according to the actual needs, developing very complex and powerful networks for the networked organizations. The new networking technologies extend company data, back-end information systems, and e-mail to mobile employees, broadens the accessibility of mission critical data. Mobile access modifies the way workers interact with colleagues, customers, and suppliers.

Based on the main characteristics of WN the main advantages that wireless communication can offer for DPS are the following:

- mobility—from anywhere,
- availability—at any time,
- flexibility—for anybody,
- easy and fast installation,
- low installation/operation costs,
- competitive (with the wired systems) data exchange speed.
- specialized protocols (e.g., in the case of WPAN)—for sensors and communication.

Comparing the demands of enterprises, firms, and novel production systems with the characteristics of wireless communication systems (that can be/has been already integrated with computer and information systems) it can be stated that wireless networks have an outstanding strategic role in life cycle of enterprises.

Selection Aspects of Wireless Networks

There are different orientations of networked systems approaching production in general: service industry, manufacturing industry, energy industry, and so forth. The applications of the various types of wireless technologies are in these cases extremely diverse. The latest generation of communication technology, the wireless and mobile networking technologies, have an especially great influence on time factor and flexibility that is very critical in today's production, so wireless technology has a strategic role. The aspects that are influencing the application of wireless technologies can be grouped as follows (Lucent, 2003):

- **Need of Users:** The primary driving need for enterprise users to adopt a mobile data service is access. Key horizontal applications that apply to virtually all users are e-mail (with attachments), corporate intranet access, and general Internet access. The always-on, the real-time access is important for field sales and service workers. To be most productive, they require an always-on, high-performance mobile data solution that can be relied upon wherever they need it. Coverage is critical, and adequate speed for their key applications is very important. In order to define a solution that can provide coverage to users wherever they go, it is necessary to understand where mobile workers travel throughout the course of their work day, and what they need to do in different locations.
- **High-Level Security:** applications, speed, and coverage are not enough. Solutions must address corporate security standards for the enterprise. The corporate IT department must be assured that the user's information will be secure and that company PCs, servers, and data networks cannot be compromised through the mobile data network by unauthorized intruders. Ease of use and

cost control are also corporate concerns that are tightly linked and, to a certain extent, addressed by using standardized technologies.

- **Cost Factor:** Installation and operation costs are important for all types of users. In the case of manufacturing companies, the installation costs of a WLAN or WPAN can be far more lower than a wired system. An additional advantage can be that the reconfiguration of their shop floors, cells cost also less than in the case of using wired networks. These aspects are valid of course for all companies.

In order to increase user productivity, combining 3G mobile networks and wireless LANs is a possible way of the future. Wireless LAN is an excellent technology to satisfy the demands of mobile employees within their enterprise locations, or in homes where they have multiple computers. Because of the very high-speed expectations and intrapremises dominated communication, the wireless LAN provides cost-effective mobility functioning as an extension to the wired LAN, optimizing private networking costs and minimizing facilities bottlenecks to speed. Outside the enterprise, 3G wireless technology provides a means for users to do what could not be done before—remain connected to their business critical applications wherever they need to go. The wide area coverage of mobile networks will make it possible for users to do business in entirely new ways, and significantly improve ease of use by using the same connection procedures wherever they may be outside of the office.

COMMUNICATION NETWORKS FOR SMART ORGANIZATIONS

Wired Communication Networks

The Internet and WWW technologies, or some of their protocols and philosophies, are applied also

by the wireless communication technologies, so a short summary will be given on these technologies. Two novel, wired technologies will be also introduced, as they offer technical and service possibilities that are in certain aspects competitive with wireless technologies. PLC offers very low-cost, flexible, reliable, secure communication inside buildings or limited areas. The latest results of GRID technology make possible the very easy, integrated, and user-friendly access to databases, programs, and other computing resources. This section will be closed by the short description of VoIP, as this technology has an increasing importance in voice communication of enterprises.

Internet

Communication systems, wired as well as wireless, employ a layered approach to data transmission protocols. In the following, only the base will be introduced very briefly, in order to give a background for communication technologies presented later on.

Open systems architectures (OSA) have become an important approach to develop flexible, adaptable sets of methodologies, standards, and protocols for structured communication systems. OSA is a layered hierarchical structure, configuration, or model of a communications or distributed data processing system that enables system description, design, development, installation, operation, improvement, and maintenance to be performed at a given layer or layers in the hierarchical structure. It allows each layer to provide a set of accessible functions that can be controlled and used by the functions in the layer above it, enables each layer to be implemented without affecting the implementation of other layers, and allows the alteration of system performance by the modification of one or more layers without altering the existing equipment, procedures, and protocols at the remaining layers .

An OSA may be implemented using the open systems interconnection-reference model (OSI-

RM) as a guide while designing the system to meet performance requirements. The model employs a hierarchical structure of seven layers, Each layer performs value-added service at the request of the neighboring higher layer and, in turn, requests more basic services from the next lower layer. The names of the seven layers and the protocols are shown in Table 1. In the table the security protocols are also shown; they will be discussed in the security section later on. A good and detailed work on computer networks is the book of Tanenbaum (1996).

Transmission Control Protocol/Internet Protocol - TCP/IP

The TCP/IP is two interrelated protocols that are part of the Internet protocol suite. TCP operates on the OSI Transport Layer and breaks data into packets, controlling host-to-host transmissions over packet-switched communication networks (Table 1). Internet protocol (IP) was designed for use in interconnected systems of packet-switched computer communication networks. IP operates on the OSI Network Layer and routes packets. The Internet protocol provides for transmitting blocks of data called datagrams from sources to destinations, where sources and destinations are hosts identified by fixed-length addresses.

The short descriptions of layers are as follows:

- Physical layer transmits information carrying signals over a communications channel. The communications channel (or medium) may be wireless, such as analogue or digital radio, or wired, such as optical fiber or coaxial cable.
- Link layer runs over, and utilizes, the physical layer to carry data from a transmitter to a receiver. The link layer uses frames (e.g., a collection of bytes) as its data communication unit, and is responsible for their transmission between two or more

Table 1. TCP/IP- and security protocols in the network

| Layer Number | Layers of the OSI reference model | TCP/IP Protocols | SECURITY PROTOCOLS |
|--------------|-----------------------------------|--|--|
| 7. | Application | FTP, SMTP, TELNET, SNMP, NFS, Xwindows, NNTP, IRC, HTTP, WAP | S-HTTP, SET S/MIME, PEM, PGP, MOSS SMTP |
| 6. | Presentation | ASCII, EBCDIC, ASN1, XDR | SSL, SSH, SSH2 |
| 5. | Session | RPC | |
| 4. | Transport | TCP, UDP | TLS (Transport Layer Security Protocol), WAP/WTLS |
| 3. | Network | IP | IPv6, VPN |
| 2. | Data link | X.25, SLIP, PPP, Frame Relay | Electromagnetic Emission standard (89/336/EEC - European Economical Community guideline) |
| 1. | Physical | LAN, ARPANET | |

communication nodes sharing a medium. An example of a link layer standard is the (IEEE) 802.11 Wireless Local Area Network (WLAN).

- Network layer enables communication between nodes that do not necessarily share a communications medium. For packet-switched networks, the link layer carries network layer datagram units (or packets) between neighboring nodes in link layer frames. This process may require fragmentation of large packets into smaller datagrams with additional network and link layer-specific headers.
- Transport layer runs over the network layer. It may or may not ensure reliable, in-order delivery of the data generated by the application layer.
- Application layer contains functions for particular application services, such as file transfer, remote file access and virtual terminals.

The World Wide Web

The World Wide Web (“WWW,” or simply “Web”) is an information space in which the items of interest, referred to as resources, are identified by global identifiers called Uniform Resource Identifiers (URI). The term is often mistakenly used as a synonym for the Internet, but the Web is actually a service that operates *over* the Internet.

The Web is made up of three standards: The *Uniform Resource Locator* (URL), which specifies how each page of information is given a unique “address” at which it can be found; the *Hyper Text Transfer Protocol* (HTTP), which specifies how the browser and server send the information to each other; and the *Hyper Text Markup Language* (HTML), a method of encoding the information so it can be displayed on a variety of devices.

Hypertext does not have a linear order from beginning to end. It is not broken down into the hierarchy of chapters, sections, subsections, and so forth. From the Web many kinds of information are available; private persons, organizations,

universities and enterprises have “home pages” that contain basic information on the owner with very easy access. Today a home page is a must-have for enterprises that want to take part in the global competition.

Grid Computing

“Grid” computing is an important new field that has to be distinguished from conventional distributed computing by its focus on large-scale resource sharing, innovative applications, and high-performance orientation. “Grid” can be defined as a hardware and software infrastructure that provides dependable, consistent, pervasive, and inexpensive access to high-end computational capabilities resulting in flexible, secure, coordinated resource-sharing among dynamic collections of individuals, institutions, and resources—to sum up, virtual organizations (Foster, 2000).

The real and specific problem that underlies the Grid concept is coordinated resource-sharing and problem-solving in dynamic, multi-institutional virtual organizations. The sharing is not primarily file exchange, but rather direct access to computers, software, data, and other resources, as is required by a range of collaborative problem-solving and resource brokering strategies emerging in industry, science, and engineering. This sharing is highly controlled, clearly and carefully defined by what is shared, who is allowed to share, and the conditions under which sharing occurs. A set of individuals and/or institutions defined by such sharing rules form is called a virtual organization (VO).

Furthermore, sharing is about more than simply document exchange (as in “virtual enterprises”): it can involve direct access to remote software, computers, data, sensors, and other resources. For example, members of a consortium may provide access to specialized software and data, and/or pool their computational resources. The members of a Virtual Organization do not necessarily have

to work together on the same site, but the Grid will make it feel, to the members, as if they are on the same network.

The Grid architecture is a protocol architecture, with protocols defining the basic mechanisms by which VO users and resources negotiate, establish, manage, and exploit sharing relationships. A standards-based open architecture facilitates extensibility, interoperability, portability, and code sharing; standard protocols make it easy to define standard services that provide enhanced capabilities

The primary goal of the Grid at the moment is to allow coordinated resource sharing in virtual organizations. Current Internet technologies address communication and information exchange among computers but do not provide integrated approaches to the coordinated use of resources at multiple sites for computation. Business-to-business exchanges focus on information sharing (often via centralized servers); virtual enterprise technologies do the same. Enterprise distributed computing technologies like CORBA and Enterprise Java are not able to resource-share within the organization.

Grid is building on these existing technologies, rather than compete with them; the Grid will act as a middleware between high-level behaviors of the Internet (such as its protocols, and the lower levels, for example the application layer), complement its functionality, and to add flexibility. The Grid can be viewed as an extension to the Web, building on its protocols, and offering new functionality (Foster, Kesselman, & Tuecke, 2000).

As the Grid is built on the existing Internet, it will share its capabilities, such as simple data retrieval and transfer, as well as the basic file-sharing functions provided by peer-to-peer applications. The prospects for the future, however, are far greater, and could not only change the way of sharing information, but also the way computers interpret information and even, by integrating developing technologies such as Jini and Bluetooth, how this technology can involve the daily life.

Powerline Communications

As cable, telephone, and wireless companies compete to provide high-speed Internet access to homes, a new challenger is emerging based on a decidedly old technology. The idea is to connect the Internet and network computers in a LAN, by using the world's largest existing network, the power grid. Powerline communications (PLC)—communications over the electricity distribution grid—has become a hot topic recently. Although this technology has been in use for special applications for several decades—for example, street lighting is frequently operated according to this principle—communication in these cases is exclusively in the narrowband range and transmission rates are correspondingly low.

The first attempts to realize the power grid as a communication network were not really successful, but the technological advancements over the last few years have overcome the technical issues, most notably that of line noise or interference from electrical devices plugged into the same electricity grid, which can disrupt data-transmission. PLC works by transmitting data signals through the same power cables that transmit electricity, but it uses a different frequency. To do this, every PC needs to be attached with a PLC adapter, which also functions as a modem (Hübscher, 2004).

The operation procedure of PLC can be divided into two phases:

- **Procedures, which are performed outside the home (outdoor):** The conventional telecommunications infrastructure is used to connect the relevant local network station with the telephone network or a specific Internet backbone. Depending on distance and local conditions, the connection is enabled by radio, copper lines, or optical cables. The local network station combines data and voice signals on the power grid and sends them as a data stream to any socket in connected households; that is, to the end user via the low-voltage network.
- **Procedures inside the home (indoor):** The access point forwards incoming data streams to the indoor network, and an indoor master in the household controls and coordinates all (externally and internally) transmitted data signals. Intermediate adapters separate data and power at the socket and forward the data to individual applications. There is no need for separate telephone or data cabling since the socket, far from being a mere electrical point, becomes a powerful communications interface which bridges the last mile for high-speed Internet access, thus enabling networking throughout the building or household.

The powerline technology applied today transmits data at 4.5 Megabits per second (Mbit/s) via the electricity supply grid—in the medium-term rates of up to 20 Mbit/s are possible—and provides permanent high speed access to the Internet (always online) from every main voltage supply socket in a building, and makes broadband capacity cost-efficiently available over the “last mile.” It is no longer necessary to always dial into the network, or indeed to install additional cabling within a building, so PLC is also an interesting alternative for an in-house data network.

Because PLC uses the existing electrical wirings hidden in the walls of homes and buildings, users can do away with messy cables and do not need to open floorboards, hack walls, and break ceilings to run the wires. PLC also enables indoor networking for PCs and printers, plus shared Internet access between PCs in an office or home. In addition, PLC boasts a superior distance of 300m (without using repeaters), compared to 100m for standard Fast-Ethernet and about 100m for 802.11b wireless connections.

For utility suppliers, PLC opens a whole new revenue stream for them, which they can deploy quickly. For service providers buying wholesale services from utility companies, PLC also offer various benefits, including the speed and cost of

deployment and the ability to break the telephone company monopoly on last-mile access in many countries.

Voice Over Internet Protocol

Voice over Internet Protocol (VoIP) is a technology that allows people to make telephone calls using a broadband Internet connection instead of a regular (or analog) phone line. VoIP technologies convert digitized voice into data packets that are encapsulated in Internet protocol. Internet telephony refers to communications services—voice, facsimile, and/or voice-messaging applications—that are transported via the Internet, rather than the public switched telephone network (PSTN).

The basic steps involved in originating an Internet telephone call are conversion of the analog voice signal to digital format and compression/translation of the signal into Internet protocol (IP) packets for transmission over the Internet; the process is reversed at the receiving end.

There are different services included into VoIP technology. Some services using VoIP may only allow the user to call other users using the same service, but others may allow to call anyone who has a telephone number—including local, long distance, mobile, and international numbers. There are services only working over computer or a special VoIP phone, other services allow to use a traditional phone through an adaptor.

As VoIP technology unites the telephony and data worlds, companies can be the winners of this new technology because VoIP allows users to integrate their phone calls, faxes, and voice traffic over corporate Intranets and the Internet. Companies that use VoIP technologies can save a lot on long distance calls.

Making Voice over IP function efficiently in a corporate enterprise network requires adequate bandwidth allocation and management. For each call to be sent across an IP network, 17Kbps is needed of the total bandwidth. If properly designed and operated, a company's network can use a 56

or 64 Kbps link to simultaneously share several voice calls and data traffic without any delays or problems. In larger organizations, where a large amount of data is carried across a network, Voice over IP would need a separate infrastructure in order to be utilized. Especially in companies where up to 50 phone lines can be used simultaneously, an Intranet type of infrastructure will be needed to process the calls with PSPN quality.

Voice over IP technology has several advantages that will result a fast growth, especially among companies:

- Cost reduction. It is cheaper to make an IP telephony call than a circuit call because the operators avoid paying interconnect charges.
- Better utilization of infrastructure. Circuit switched telephony call takes up 64 KBPS while an IP telephony call takes up 6-8 KBPS.
- Possibilities for new added value services. Such value added opportunities include: IP multicast conferencing and telephony distance learning applications, phone directories and screen popping via IP, and “voice web browsing” where the caller can interact with a Web page by speaking commands.
- Possibility to manage a single network handling both voice and data.

IP telephony will also create great demand for new services. It will allow people to control different media and different types of terminals, such as PC and fixed phone, straight from their Web browser.

The main problems of VoIP technology applications are the interoperability, security, and bandwidth management. When these problems are solved even partially the spread of VoIP will grow extremely fast first of all among enterprises. VoIP technology can revolutionize both telecommunication services and industry and can create many advantages for companies and private users as well.

Wireless Communication Networks

Types of Wireless Networks

Wireless networks (WN) serve as the transport mechanism between and among devices and the traditional wired networks (enterprise networks and the Internet). Wireless networks have many types and are diverse, but can be categorized into four groups based on their coverage range:

- Satellite communication (SC),
- Wireless Wide Area Networks (WWAN),
- Wireless Metropolitan Area Network (WMAN),
- Wireless Local Area Networks (WLAN), and
- Wireless Personal Area (or Pico) Network (WPAN).

The main characteristics of wireless networks are as follows:

- access for anybody, from anywhere, at any time—mobility,
- on-line/real-time access,
- relative high communication speed,
- shared access to files, data/knowledge bases, and
- exchange of picture, voice—multimedia applications.

In the followings the main types of wireless networks will be introduced. In Table 2 the main characteristics of these wireless technologies are summarized.

Table 2. Main characteristics of wireless networks

| Wireless network type | Operation frequency | Data rate | Operation range | Characteristics |
|-----------------------|--|----------------------------------|--------------------|---|
| Satellite | 2170–2200 MHz | Different (9.6 kbps - 2 Mbps) | Satellite coverage | Relative high cost, availability |
| WWAN | | | | |
| GSM (2-2.5 G) | 824-1880 MHz | 9.6 - 384 kbps (EDGE) | Cellular coverage | Reach, quality, low cost |
| 3G/UMTS | 1755-2200 MHz | 2.4 Mbps | Cellular coverage | Speed, big attachments |
| iMode (3G/ FOMA) | 800 MHz | 64 - 384kbps (W-CDMA) | Cellular coverage | Always on, easy to use |
| FLASH-OFDM | 450 MHz | Max. 3 Mbps | Cellular coverage | High speed, respond time less then 50 milliseconds |
| WMAN | | | | |
| IEEE 802.16 | 2-11 GHz | Max.70 Mbps | 3-10 (max. 45) km | Speed, high operation range |
| WWLAN | | | | |
| IEEE 802.11A | 5 GHz | 54 Mbps | 30m | Speed, limited range |
| IEEE 802.11b | 2.4 GHz | 11 Mbps | 100 m | Medium data rate |
| IEEE 802.11g | 2.4 GHz | 54 Mbps | 100-150m | Speed, flexibility |
| WPAN | | | | |
| BLUETOOTH | 2.4 GHz | 720 kbps | 10 m | Cost, convenience |
| UWB | 1.5 – 4 GHz | 50-100 Mbps | 100-150 m | Low cost, low power |
| ZigBee | 2.4 GHz, 915 - 868 Mhz | 250 Kbps | 1-75 m | Reliable, low power, cost effective |
| Infrared | 300 GHz | 9.6 kbps-4Mbps | 0.2-2 m | Non interfere, low cost |
| RFID | 30-500 KHz 850-950 MHz 2.4-2.5 GHz | linked to bandwidth, max. 2 Mbps | 0.02–30 m | High reading speeds, responding in less than 100 milliseconds |

Satellite Communication

Satellite communication systems offer the users independent and reliable communication with any chosen subscriber in the world in the covered area, offering high quality telephone calls, fax transmissions, high-speed data access, and e-mail messaging. Today satellite communication providers purchase services and phone sets that are appropriate for dual mode, such as Satellite-GSM Phones.

These handheld satellite telephones provide voice, fax, Internet access, short messaging, and remote location determination services (GPS) in the covered area. All of this is provided through geosynchronous satellites, but when satellite coverage is not necessary, the handset can also access the GSM cellular network. Fax and digital data is transmitted at 9600 bps throughputs, but in case users need high-speed Internet access (144 kbps) this also can be achieved by using special lightweight terminals. In special cases, 2 Mbps data transmission rate can be achieved (Sheriff & Fun Hu, 2001).

A satellite phone can fulfill all the requirements regarding mobile communications in many application fields. Interdisciplinary applications are paralleled with equipment functionality—currently available satellite phones have the size of a standard notebook computer. Their use does not require complicated procedures; activation and call charging is done similarly to cellular phone networks (Elbert, 2004).

Wireless Wide Area Networks (WWAN)

Mobile Phone

Mobile communication is connected to using mobile phones. Mobile phone was the device that offered for a great number of people the possibility to make contact with others from anywhere, at anytime, and for anybody. Mobile phone is the device that realizes mobility on a society level, as

in many countries more than 70% of the population has a mobile phone.

There are different mobile systems/network protocols, which are developing very fast.

- **CDMA (Code Division Multiple Access—2G):** CDMA networks incorporate spread-spectrum technology to gracefully allocate data over available cells.
- **CDPD (Cellular Digital Packet Data—2G):** CDPD is a protocol built exclusively for sending wireless data over cellular networks. CDPD is built on TCP/IP standards.
- **GSM (Global System for Mobile Communications—2G):** GSM networks, mainly popular in Europe.
- **GPRS (General Packet Radio Service—2.5 G):** GPRS technology offers significant speed improvements over existing 2G technology.
- **iMode (from DoCoMo—2.5G):** iMode was developed by DoCoMo and is the standard wireless data service for Japan. iMode is known for its custom markup language enabling multimedia applications to run on phones.
- **3G:** 3G networks promise speeds rivaling wired connections. Both in Europe and North America, carriers have aggressively bid for a 3G spectrum but no standard has yet emerged.

The introduction of WAP (Wireless Application Protocol) was a big step forward for the mobile communication as this protocol made it possible to connect mobile devices to the Internet. By enabling WAP applications, a full range of wireless devices, including mobile phones, smart-phones, PDAs, and handheld PCs, gain a common method for accessing Internet information. The spread of WAP became even more intensive as the mobile phone industry actively supported WAP by installing it into the new devices. WAP applications exist today to view a variety of WEB content, manage

New Challenges for Smart Organizations

e-mail from the handset and gain better access to network operators' enhanced services. Beyond these information services, content providers have developed different mobile solutions, such as mobile e-commerce (mCommerce).

Mobile technology affects the operation of enterprises as well. The main reasons to develop a mobile solution in the enterprise are listed in the following:

- Provide access to company e-mail,
- Provide access to Intranet applications,
- Develop specific company applications,
- Permanent contact with service workers,
- Improve work scheduling,
- Possibility for mCommerce.

Mobile communication extends company data, back-end information systems, and e-mail to mobile employees and broadens the accessibility of mission critical data. Mobile access modifies the way workers interact with colleagues, customers, and suppliers.

FLASH-OFDM

FLASH-OFDM (Fast, Low-latency Access with seamless Handoff—Orthogonal Frequency Division Multiplexing) is a cellular, IP-based broadband technology for data services on the 450 MHz band. It has full cellular mobility, 3.2 Mbps peak data rates, 384 kbps at the edge of the cell and less than 20 milliseconds of latency.

The FLASH-OFDM system consists of an airlink, an integrated physical and media access control layer, and IP-based layers above the network layer (layer 3). The IP-based layers support applications using standard IP protocols.

Radio-router technology uses a radio-transmission framework for packet-based, broadband, IP wireless communications. Radio-router technology is designed to make links in an IP network mobile. A radio-router network can be built atop the existing IP infrastructure, and since

IP network technology is already well-developed and inexpensive, radio-router systems will be relatively easy, quick, and economical to implement (Flarion, 2004).

FLASH-OFDM is a wide-area technology enabling full mobility up to speeds of up to 250 km/h (critical to vehicle and rail commuters). Its ability to support a large number of users over a large area, and nationwide build outs (via wireless carriers), will do for data as the cellular networks did for voice. The IP (Internet Protocol) Interfaces In Flash-OFDM Enable operators to offer their enterprise customers access to their LANs (Local Area Networks) and users the benefits of the mobile Internet.

FLASH-OFDM support voice-packet-switched voice, not circuit-switched voice, Radio routers, IP routers with radio adjuncts, would handle packet traffic, and serve as the equivalent of cellular base stations. Consumers would connect with Flash-OFDM networks via PC cards in their notebooks and via flash-memory cards in handheld devices.

Wireless Metropolitan Area Network (WMAN)

The term WiMAX (Worldwide Interoperability for Microwave Access) has become synonymous with the IEEE 802.16 Metropolitan Area Network (MAN) air interface standard. Metropolitan area networks or MANs are large computer networks usually spanning a campus or a city. They typically use optical fiber connections to link their sites.

WiMAX is the new shorthand term for IEEE Standard 802.16, also known as "Air Interface" for Fixed Broadband Wireless Access Systems. In its original release (in early 2002) the 802.16 standard addressed applications in licensed bands in the 10 to 66 GHz frequency range and requires line-of-sight towers called fixed wireless. Here a backbone of base stations is connected to a public network, and each base station supports hundreds of fixed subscriber stations, which can

be both public Wi-Fi “hot spots” and enterprise networks with firewall.

The 802.16a extension, (issued in January 2003), covers non-line of sight (NLOS) applications and allows use of lower frequencies (2 to 11 GHz), many of which are unregulated. The 802.16a extension is a wireless metropolitan area network (WMAN) technology that will connect 802.11 hot spots to the Internet and provide a wireless extension to cable and DSL for last mile broadband access. The 802.16a provides up to 50 km of linear service area range. The technology also provides shared data rates up to 70 Mbps, which is enough bandwidth to simultaneously support more than 60 businesses with T1-type connectivity and hundreds of homes at DSL-type connectivity.

The 802.16e version is under development (scheduled publication is October 2005), and is expected to support mobile wireless technology—that is, wireless transmissions directly to mobile end users, so mobile applications thus enable broadband access directly to WiMAX-enabled portable devices ranging from smartphones and PDAs to notebook and laptop computers. This will be similar in function to the General Packet Radio Service and the “one times” radio transmission technology (1xRTT) offered by phone companies.

WiMAX is considered the next step beyond Wi-Fi because it is optimized for broadband operation, fixed and later mobile, in the wide area network. It already includes numerous advances that are slated for introduction into the 802.11 standard, such as quality of service, enhanced security, higher data rates, and mesh and smart antenna technology, allowing better utilization of the spectrum.

Wireless Local Area Network (WLAN)

Local area wireless networking, generally called Wi-Fi (also known as 802.11b Ethernet) is a hot topic. Companies, universities, and home users

are setting up wireless access points and running notebook computers without network wires.

Wi-Fi, or Wireless Fidelity, allows users to connect to the Internet from their home, from a hotel room, or from a conference room at work without wires. Wi-Fi enabled computers send and receive data anywhere within the range of a base station with a speed that is several times faster than the fastest cable modem connection.

Wi-Fi connects the user to others and to the Internet without the restriction of wires, cables or fixed connections. Wi-Fi gives the user freedom to change locations (mobility)—and to have full access to files, office, and network connections wherever she or he is. In addition Wi-Fi will easily extend an established wired network (Anderson, 2003).

Wi-Fi networks use radio technologies called IEEE 802.11b or 802.11a standards to provide secure, reliable, and fast wireless connectivity. A Wi-Fi network can be used to connect computers to each other, to the Internet, and to wired networks (which use IEEE 802.3 or Ethernet). Wi-Fi networks operate in the 2.4 (802.11b) and 5 GHz (802.11a) radio bands, with an 11 Mbps (802.11b) or 54 Mbps (802.11a) data rate or with products that contain both bands (dual band), so they can provide real-world performance similar to the basic 10BaseT wired Ethernet networks used in many offices. 802.11b has a range of approximately 100 meters.

Products based on the 802.11a standard were first introduced in late 2001. Its strengths are the high speed and lower risk of radio frequency interference than either 802.11b or 802.11g. Its weakness is that “a” is incompatible with the more popular “b” and the emerging “g,” because it strayed from the 2.4-GHz band. As WLAN is spreading, it could prove essential to serving large populations in a concentrated area, such as downtowns, universities, and business centers.

The 802.11g promises complete interoperability with “b” and transmission rates up to five times faster in the same 2.4-GHz band. Early

products are already on the market. The higher vulnerability to radio frequency interference from other 2.4-GHz devices (late-generation cordless phones) is a big challenge for 802.11g (Engst & Fleishman, 2003).

Wi-Fi networks can work well both for home (connecting a family's computers together to share such hardware and software resources as printers and the Internet) and for small businesses (providing connectivity between mobile salespeople, floor staff, and "behind-the-scenes" departments). Because small businesses are dynamic, the built-in flexibility of a Wi-Fi network makes it easy and affordable for them to change and grow.

Large companies and universities use enterprise-level Wi-Fi technology to extend standard wired Ethernet networks to public areas like meeting rooms, training classrooms, and large auditoriums, and also to connect buildings. Many corporations also provide wireless networks to their off-site and telecommuting workers to use at home or in remote offices.

It is easy to extend the existing networks with a Wi-Fi LAN to add another wireless computer to a Wi-Fi network. There is no need to purchase or lay more cable or find an available Ethernet port on the hub or router; just the card has to be plugged in to the computer and it is connected to the network.

Wireless Personal Area (or Pico) Network (WPAN)

WPAN represents wireless personal area network technologies such as Ultra-wideband (UWB) (Kelland, 2003), ZigBee, Bluetooth, RFID, WiMedia and IrDA.

Designed for data and voice transmission, low data rate standards include ZigBee, (IEEE 802.15.4) (Karayannis, 2003) and Bluetooth (IEEE 802.15.1), and enables wireless personal area networks to communicate over short distances, generating a new way of interacting with our personal and business environment. ZigBee

provides ultra-low cost solutions for applications requiring low data rates and long battery-life, such as remote controls and sensor applications (free frequency bands including 2.4 GHz, 915 MHz and 868 MHz, transmission ranges of 30-100 m are possible). In the home, this will mean a single remote control device will operate TVs, DVD players, audio systems, and other entertainment and computing equipment, as well as controlling lights, heating, home appliances, security systems, and even toys. Bluetooth chipsets, now on their third and fourth generation, are targeted primarily at the cell phone and PC peripheral industries (2.4 GHz band, peak data throughput of 720 Kbps, distances about 10 m).

Two technologies of the WPAN group the RFID and Bluetooth will be introduced more detailed in the following.

Radio Frequency Identification (RFID)

The main purpose of the RFID (radio frequency identification) technology is the automated identification of objects with electromagnetic fields. An RFID system has three basic components: transponders (tags), readers (scanners), and application systems for further processing of the acquired data. There is a large variety of different RFID systems; they can use low, high, or ultra-high frequencies, tags may emanate only a fixed identifier or can have significant memory and processing capabilities. Transponders can contain effective security protocols or no security features at all. Most of the tags have passive powered by the radio field emitted by the reader but there are also active tags with a separate power supply (Finkenzeller, 2003).

RFID systems can be distinguished according to their frequency ranges. Low-frequency (30 KHz to 500 KHz) systems have short reading ranges and lower system costs. They are usually used in, for example, security access and animal identification applications. High-frequency (850 MHz to 950 MHz and 2.4 GHz to 2.5 GHz)

systems, offering long read ranges (greater than 25 meters) and high reading speeds, are used for such applications as railroad car tracking and automated toll collection. However, the higher performance of high-frequency RFID systems generate higher system costs.

In determining data transfer rates, carrier wave frequency is of primary importance. In general, a higher data transfer belongs to a higher frequency. In case of the 2.4-2.5 GHz spread spectrum band, 2 megabits per second data rates can be achieved. Spread the spectrum apart, and increasing the bandwidth allows an increase in noise level and a reduction in signal-to-noise ratio, so bandwidth is an important consideration in this respect.

According to the reader's power output and the used radio frequency, the range extends from a few centimeters to 30 meters or more. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.

RFID as an automatic identification technology has got an increasing importance in recent years and is now being seen as a radical means of enhancing data handling processes. A range of devices and associated systems are available to satisfy an even broader range of applications. Data within a tag may provide identification for goods in transit, an item in manufacturing process, or the identity of a vehicle, animal, or individual. By including additional data the prospect is provided for supporting applications through item-specific information or instructions immediately available on reading the tag.

Bluetooth

Bluetooth is a short-range radio device that replaces cables with low-power radio waves to connect electronic devices, whether they are

portable or fixed. It is a wireless personal area network (WPAN) specified in IEEE 802.15, Working Group for wireless personal area networks. Bluetooth, named after Harald Bluetooth, the 10th century Viking king, is a consortium of companies (3Com, Ericsson, Intel, IBM, Lucent Technologies, Motorola, Nokia, and Toshiba) bonded together to form a wireless standard (Bakker & Gilster, 2002).

The Bluetooth device also uses frequency-hopping to ensure a secure, quality link, and it uses ad hoc networks, meaning that it connects peer-to-peer. When devices are communicating with each other they are known as piconets, and each device is designated as a master unit or slave unit, usually depending on who initiates the connection. However, both devices have the potential to be either a master or a slave.

The Bluetooth user has the choice of point-to-point or point-to-multipoint links, whereby communication can be held between two devices, or up to eight.

Bluetooth is not only a standard, but it is also a product. The hardware consists of a microchip with a radio transceiver. It can be incorporated into a laptop or wireless phone. It can access other ad hoc networks or local access points. It is a short-range system, operating at a normal range of 10m (0 dBm) and an optional range of 100 m (+20 dBm). It uses 2.4 GHz as its base frequency. It can reach 6 Mbps in a multiple piconet ad hoc structure.

The new version of Bluetooth, Bluetooth 2.0+EDR (Enhanced Data Rate) offers a significant speed over version 1.2. While Bluetooth 1.2 offers a data transfer rate of 1Mbps, Bluetooth 2.0 offers data transfer speed 3Mbps. As an addition, a significant increase in power efficiency results in longer battery life—that is a very important factor for mobile users. The new version is backwards-compatible to earlier versions and allows the connection of multiple devices.

TRUST AND SECURITY IN SMART ORGANIZATIONS

Role of Trust in Smart Organizations

Trust and Trust Building in SO

In all information and communication systems there is a common factor: the human being. This factor plays the most important role in every level and in every aspect. A human can be a designer, a developer, or a user of the system. The most frequent instantiation of the human being is the average user, who maybe is not well-informed or skilled in computer science, but has his or her own personality and psyche.

In order to move the individuals to use a certain information system, they have to be convinced that it is safe to use the system, that their data will not be modified, lost, used in other way as defined previously, and so forth. If the individuals have been convinced they will trust the system and they will use it.

Trust can be defined as a psychological condition comprising the trustor's intention to accept vulnerability based upon positive expectations of the trustee's intentions or behavior (Rousseau, Sitkin, Burt, & Camerer, 1998). Those positive expectations are based upon the trustor's cognitive and affective evaluations of the trustee and the system and world, as well as of the disposition of the trustor to trust. Trust is interpreted in terms of expectation, attitude, willingness, or perceived probability. Trust can cause or result from trusting behavior (e.g., cooperation, taking a risk) but is not behavior itself.

The following components are included into most definitions of trust:

- willingness to be vulnerable or to rely,
- confident, positive expectation and positive attitude towards others,
- risk and interdependence as necessary conditions.

Trust has different forms, such as

- **Intrapersonal trust:** trust in one's own abilities; self-confidence basic trust (in others).
- **Interpersonal trust:** expectation based on cognitive and affective evaluation of the partners; in primary relationships (e.g., family) and non-primary relationships (e.g., business partners).
- **System trust:** trust in depersonalized systems or the world that function independently (e.g., economic system, regulations, legal system, technology); requires voluntary abandonment of control and knowledge (Luhmann, 1979).
- **Object trust:** trust in non-social objects; trust in its correct functioning (e.g., in an electronic device).

Collaboration and cooperation are main characteristics of networked organizations, so the contacts among the users, the human beings, have outstanding importance. A very important element of this human contact is trust. In a networked organization, trust is the atmosphere, the medium in which actors are moving (Castelfranchi & Yao-Hua, 2001). Trust is the base of cooperation, the normal behavior of the human being in the society. The ability of enterprises to form networked systems depends on the existing level of trust in the society and on the capital of society (Fukuyama, 1995). As the rate of cooperation is increasing in all fields of life, the importance of trust is evolving even faster.

In this new organizational environment, new methods and techniques of trust building have to be developed, as the conventional rules cannot be applied. According to different experiments, the level of trust between cooperating virtual teams is highly influenced by the type of communication and the duration of contacts.

Technology Component of Trust

In building trust there are two approaches: information technology approach, and human centered approach, based on culture and morality. Information technology approach means that security has to increase by different architectures, protocols, certifications, cryptography, authentication procedures and standards, and this increased security generates the trust of users. This means access control (passwords, firewalls), protect integrity and privacy of messages and databases (cryptography), and identification of users. Parallel stressing the effectiveness of these technologies for the humans (users) can cause that they will trust in the systems based on these convincing actions. Based on the technological approach, 100% security never can be obtained (there will be always security holes somewhere in the systems), so full trust can not guaranteed based on these mechanisms.

Human Side of Trust Building: Feeling of Trust

The feeling of security experienced by a user of an interactive system does not depend on technical security measures alone. Other (psychological) factors can play a determining role; the user's feeling of control can be one of these factors.

It has to be analyzed why people feel safe and secure, what causes these feelings. The hypothesis of D'Hertefelt (2000) was that "The feeling of security experienced by a user of an interactive system is determined by the user's feeling of control of the interactive system." The more a user feels in control of an interactive program, the more the user will trust the site and the program. From this aspect user interface has the main role, that is, the menu structure, the messages send for the user by the system. In the case the user feels that it is easy to use, it is transparent; he or she can control the system (even with low-level computer knowledge)—that is, the system is "user

friendly," and through this he can be convinced that he is using a trustworthy system.

It would be a mistake to think that applying only the human-centered approach would generate trust; the technological part has to be added as well (e.g., biometrical identification), so the structured integration of the two approaches can result in the expected level of trust.

Relation of Trust and Time

Trust is a dynamic process and it alters based on experience. The trusting process begins when an individual perceives indications that suggest a person or organization may be worthy of trust. These indications can include behaviors such as manners, professionalism, and sensitivity, and these forms are designed to represent trustworthiness. These formal claims to trustworthiness become strengthened over time and are eventually transformed into "character traits," such as dependability, reliability, and honesty.

The process of building trust is slow; trust is formed gradually, and it takes quite a lot of time and repeated positive experiences (Cheskin, 1999). Online trust can be described as a kind of human relationship. The initial stage is that of interest and distrust; there has to be a motivation, a need, to get interested in the service, or coworking. In subsequent phases the trust will evolve, or in the case of negative experiences the cooperation will terminate.

Trust depends on the time span of cooperation and the type of connection as well. It can be stated that there are differences in the trust-building process in short-term and long-term relationships. In the case of short-term relationships (e.g., in a virtual organization), trust must be achieved quickly, and then maintain with no, or rare face-to-face interaction. The members of these teams must assume that other remote team members are trustworthy, and then later on modify their assumptions according their positive or negative experiences.

New Challenges for Smart Organizations

In long-term relationships there are four factors that influence trust-building (Rocco, Finholt, Hofer, & Herbsleb, 2001):

- expectation of future interaction may motivate greater investment in building trustworthy relationships,
- long-term relationships offer more time to establish trustworthiness through routines and culture,
- people have more communication channels, which may affect trust to the extent that participants have additional ways to clarify misunderstandings or to correct failures,
- participants are interested in successful task performance, and trust formation may assume a higher priority.

Developing Trust in Networked Organizations

Today the different types of networked organizations need new types of cooperation; as the members of the working teams are geographically (physically) separated, they use shared documents, and communicate through e-mail and high-quality audio and video channels. These teams are called “virtual teams,” as they never meet personally and they have no face-to-face (FTF) contact. The work of teams without FTF contact is less effective and reliable based on the observation stated by Handy (1995) that “trust needs touch.” According to case studies, it is evident that trust of virtual team members is significantly lower than trust in conventional teams (Rocco, Finholt, Hofer, & Herbsleb, 2001). In other experiments where interaction was primarily via e-mail, very similar results have gained as in geographically distributed teams (Jarvenpaa & Leidner, 1999)

In an experiment introduced in Bos (2002), four media types were compared: Chat (text), phone conference, videoconference, and face-to-face. Chat was significantly worse than each of the other three conditions, but audio and video did

as well as face-to-face in overall cooperation, and were a definite improvement over text-chat only CMC. However, these two channels still showed evidence of delayed trust, in that they took longer to reach high levels of cooperation.

The latest research shows that if people meet before using computer-mediated communication, they trust each other, as trust is being established through touch. In case participants do not meet formally but they initiate various getting-acquainted activities over a network, trust is much higher than if they do nothing before, and nearly as good as a prior meeting. Using chat forums to get acquainted is nearly as good as meeting, and “even just seeing a picture is better than nothing” (Zheng, Veinott, Bos, Olson, Gary, & Olson, 2002).

Security in Smart Organizations

What is Security?

Security is a conscious risk-taking, so in every phase of a computer system’s life cycle must be applied that security level which costs less than the expense of a successful attack. In other words, security must be so strong that it would not be worth it to attack the system, because the investment of an attack would be higher than the expected benefits. Data and system security are needed for all types of network-connected devices, such as a personal computer or a mobile phone. Data security involves protecting user and administrative data against unauthorized monitoring or modification, while system security deals with the consistency of the system component itself. As an addition, communication systems must address the issue of network security, which involves vice versa protection of the user device and the network. In Table 3, the main practical fields of ICT security are summarized.

In essence, security is a practice of risk management. There is no open system that is completely secure, and increases in system secu-

Table 3. Main fields of ICT security

| | Organization security | Personal security | Network (channel) security | Computer (end point) security |
|---------------------|---|---|---|--|
| Human & SW security | Security policy (e.g., access rights). | Trained and reliable staff under control. | Using reliable network tools, and frequently checked communication channels and well configured network elements. | Using tested application SW tools, and frequently checked operation system, and properly configured HW systems. |
| Physical security | Computers in secure places of the building and offices. | Physical identification technologies (fingerprints, etc.) | Prevent direct, or close access to network cables, or application of special technologies. | Prevent direct physical access to computers by unauthorized persons, or block close access in electromagnetic way. |

ity typically decrease system performance and usefulness. At different system levels, different security solutions have to be applied, and these separate parts have to cover the entire system consistently.

A carefully designed security system process has the following basic steps:

- Definition of threats and their attack types from which the system has to be protected.
- The degree of protection that should be applied.
- The place and mode of the protection that should be applied.
- Selection of security mechanisms and services.
- Selection of HW and SW solutions.

To develop the proper security policy, to select the proper equipment, tools, and the best-fitting methodology, algorithm needs high-level expertise as in case such a multidimensional, interdisciplinary decision problem there is no optimal, only suboptimal solution in many cases.

The problem space is extremely complex, as the whole economy is based on networked information management and all sectors are strongly influenced by the ICT, and in the information society the behavior and habits of the people are

dynamically changing, and government supported programs can speed up certain processes.

Threats and Trends of Cyber Crimes

The first step is the definition of the threat model of the ICT system. The threat model is the collection of probable attack types, so it defines the system protection requirements as well. In the following, the active attacks will be described, but passive attacks precede active attacks in many cases.

In order to define a very general, but at the same time very typical, attack tree the CSI statistics will be used. The “Computer Crime and Security Survey” of the Computer Security Institute (CSI) is based on responses from 486 computer security practitioners in U.S. corporations, government agencies, financial institutions, medical institutions, and universities (FBI, 2004). The survey confirms that the threat from computer crime and other information security breaches continues unabated.

The total reported financial loss of 251 responders was \$141,496,560 in 2004, while in 2000 this sum was \$265,589,940 of 249 responders. These numbers demonstrate that the value or the loss and damage caused by the attacks is decreasing. One reason of this shrinkage could be that the companies use security technologies today to a greater extent than they did several years before.

New Challenges for Smart Organizations

The 483 responders use the following security technologies (in %): smart cards-35, intrusion detection-68, encrypted login-56, firewalls-98, anti-virus SW-99, encrypted files-42, biometrics-11, access control-71. The most frequent types of attacks and the financial loss caused by them are listed in Table 4. (The percentage gives the rate of responders involved in the attack; the losses are in USD).

Security Services and Mechanisms

The following services form together the sense of “trust” for a human being who uses a service or a given equipment (Menezes, van Oorschot, & Vanstone, 1996):

- Confidentiality/privacy ensures that only the sender and the intended recipient of an encrypted message can read the contents of that message. To guarantee privacy, a security solution must ensure that no one can see, access or use private information, such as addresses, credit card information, and phone numbers, as it is transmitted over the Internet.
- Integrity ensures the detection of any change in the content of a message between the

time it is sent and the time it is received. In many systems, if an alteration is detected, the receiving system requests that the message be resent.

- Authentication ensures that all parties in a communication are who they claim to be. Server authentication provides a way for users to verify that they are really communicating with the Web site they believe they are connected to. Client authentication ensures that the user is who they claim to be.
- Non-repudiation provides a method to guarantee that a party to a transaction cannot falsely claim that they did not participate in that transaction. In the real world, handwritten signatures are used to ensure this.

The means for achieving these services depends on the collection of security mechanisms that supply security services, the correct implementation of these mechanisms, and how these mechanisms are used. Three basic building blocks of security mechanisms are used:

- Encryption is used to provide confidentiality and can provide authentication and integrity protection.

Table 4. Most frequent types of attacks in US (FBI, 2004)

| Type of attack | In % | Caused financial loss |
|----------------------------------|------|-----------------------|
| Virus | 78 | 55,053,900 |
| Insider abuse of net access | 59 | 10,601,055 |
| Laptop/mobile theft | 49 | 6,734,500 |
| System penetration | 39 | 901,400 |
| Unauthorized access | 37 | 4,278,205 |
| Denial of service | 17 | 26,064,050 |
| Abuse of wireless networks | 15 | 10,159,250 |
| Thief of proprietary information | 10 | 11,460,000 |
| Misuse of public WEB | 10 | 2,747,000 |
| Web site defacement | 7 | 958,100 |
| Telecom fraud | 5 | 3,997,500 |

- Digital signatures are used to provide authentication, integrity protection, and non-repudiation.
- Checksums/hash algorithms are used to provide integrity protection and can provide authentication.

One or more security mechanisms are combined to provide a security service, and a typical security protocol provides one or more services. As there are too many security technologies, tools, and equipment to be introduced in this place, only the most frequently used, or some new ones, will be shortly described in the following. Detailed descriptions can be found in Menezes et al. (1996), Anderson (2001), and Schneier (1996).

Tools, Methods, and Techniques for Security

Achieving Confidentiality

The main factor of trust is confidentiality, which can be achieved by technologies that convert or hide the data or text in a form that cannot be interpreted by unauthorized persons. There are two major techniques to fulfill this goal: encryption and steganography.

- Encryption is transforming the message to a ciphertext, so that an enemy who monitors the ciphertext cannot determine the message sent. The legitimate receiver possesses a secret decryption key that allows him to reverse the encryption transformation and retrieve the message. The sender may have used the same key to encrypt the message (with symmetric encryption schemes) or used a different, but related key (with public key schemes). Public key infrastructure (PKI) technology is widely used, as DES and RSA are well-known examples of encryption schemes, while the AES (with the Rijndael algorithm) belongs to the new generation.

- Steganography is the art of hiding a secret message within a larger one in such a way that the opponent cannot discern the presence or contents of the hidden message. For example, a message might be hidden within a picture by changing the low-order pixel bits to be the message bits.

Security Architectures

The security architectures represent a structured set of security functions (and the needed hardware and software methods, technologies, tools, etc.) that can serve the security goals of the distributed system. In addition to the security and distributed enterprise functionality, the issue of security is as much (or more) a deployment and user-ergonomics issue as technology issue. That is, the problem is as much trying to find out how to integrate good security into the industrial environment so that it will be used, trusted to provide the protection that it offers, easily administered, and really useful.

Firewalls

Firewalls can make the user's network appear invisible to the Internet, and they can block unauthorized and unwanted users from accessing files and systems. Hardware and software firewall systems monitor and control the flow of data in and out of computers in wired and wireless enterprise, business, and home networks. They can be set to intercept, analyze, and stop a wide range of Internet intruders and hackers. Like VPNs, there are many types and levels of firewall technology. Many firewall solutions are software only; many are powerful hardware and software combinations.

Virus Defense

Viruses and other malicious code (worms and Trojans) can be extremely destructive to the vital information and the computing systems both for

New Challenges for Smart Organizations

individuals and businesses systems. There are big advances in anti-virus technology, but malicious codes remain a permanent threat. The reason is that the highest-level security technology can be only as effective as the users who operate them. In the chain of computer security, human beings seem to be the weakest point, so there is no absolute security in virus defense.

Virtual Private Network (VPN)

Today most companies use VPN to protect their remote-access workers and their connections. It works by creating a secure virtual “tunnel” from the end-user’s computer through the end-user’s access point or gateway, through the Internet, all the way to the servers and systems of the company. It works both for wired and wireless networks and can effectively protect transmissions, for example, from Wi-Fi equipped computers to corporate servers and systems.

A VPN works through the VPN server at the company headquarters, creating an encryption scheme for data transferred to computers outside the corporate offices. The special VPN software on the remote computer or laptop uses the same encryption scheme, enabling the data to be safely transferred back and forth with no chance of interception. However, VPN access, which enables access to the company network, e-mail, and communications systems, is provided only to those who’ve been given authorization.

To provide a full VPN service, wireless communications systems must support the following requirements:

- broadband data access (e.g., average sustainable throughput of 1.5 Mbps downlink/600 Kbps uplink),
- low latency connectivity (~35 ms roundtrip),
- end-to-end security (authentication, integrity protection, and/or encryption),
- full mobility (at vehicular speeds).

VPN remote access protocols typically reduce throughput by 25-30%. Even without this drawback, dial-up and 2.5G data services (at around 40-56 Kbps) do not support a satisfactory remote VPN experience. VPN requires a broadband connection, particularly for file sharing, enterprise-specific applications, and large e-mail attachments so critical to today’s business communications.

Identification of Persons

Generally, biometrics refers to the study of measurable biological characteristics. In computer security, biometric technologies are defined as automated methods of identifying or authenticating the identity of a living person based on his or her physiological (e.g., fingerprint, hand, ear, face, iris, or retina) or behavioral (e.g., signature, voice, keystroke) characteristic. This method of identification is preferred over current methods involving passwords and pin numbers, as the person to be identified is required to be physically present at the point-of-identification, so the person of user is identified, not the device, as in case of PIN and password.

Biometric techniques provide a significantly higher level of identification than passwords or smart cards alone. Because biometric characteristics are unique to each individual, they can be used to prevent theft or fraud. Unlike a password or personal identification number (PIN), a biometric trait cannot be forgotten, lost, or stolen. According to security experts, biometrics is considered as providing the highest level of security. Biometry can be used in IC systems instead of passwords, as with biometry the person can be identified, not the device.

Smart Cards

There is a strong need for a tool that can fulfill the functions connected to trustworthy services. Smart card (SC) technology can offer a solution for current problems of secure communication

by fulfilling simultaneously the main demands of identification, security, and authenticity besides the functions of the actual application.

Smart card is a plastic plate that contains a microprocessor, a chip, similar to computers. It has its own operation system, memory, file system, and interfaces. A smart card can handle all authorized requests coming from the “outside world.” There are different SC configurations equipped with different interfaces. The crypto-card has a built-in chip for doing encryption and decryption, other cards have keyboards, and the SC for secure identification has fingerprint sensor (Koller, 2001). Smart cards can help in secure signing of digital documents, as well. Smart cards can be read by SC-readers integrated or connected to PCs or any other equipment. Smart cards are also important parts of physical or logical access systems for enterprises.

The application of SCs in the security field can result in the next step of the technological revolution because of new possibilities in effective integration of the functions of security and the actual application field. In this way, the SC can be the general, and at the same time personalized, “key” of the citizens for the information society.

Personal Trusted Device

People like smart, small equipment, tools that they can keep in their hands, can bring them permanently with them, so they can control them both physically and in time. This physical and time controllability makes people think these devices are secure (physically nobody else can access them), so they trust them (even this approach is not always really true). In the case that such a device can be used for communication, it is called mobile phone.

Today mobile phones represent the first generation of Personal Trusted Devices (PTD) as they can be used not only for talking but for different other functions as well, and PKI and

other crypto-systems can be installed on them. The user authentication could be done based on biometry (fingerprint or voice). The connection of mobile phones with the Internet made a big leap in the direction to become mobile phones to PTD. The scale of functions became really wide and different mobile technologies have appeared (*mTechnologies*).

Security Standards

In the field of security standards and quasi standards have an important role. In the following some of the most relevant ones are introduced briefly, only to show the directions and status of these significant works.

In order to classify the reliability and security level of computer systems, an evaluation system has been developed and the criteria have been summarized in the so-called “Orange book” (Orange book, 1985). Its purpose is to provide technical hardware/firmware/software security criteria and associated technical evaluation methodologies in support of the overall ADP system security policy, evaluation, and approval/accreditation responsibilities promulgated by DoD Directive 5200.28.

The ISO/IEC 10181- multi-part (1-8) “International Standard on Security Frameworks for Open Systems” addresses the application of security services in an “Open Systems” environment, where the term “Open System” is taken to include areas such as database, distributed applications, open distributed processing, and OSI (ISO, 1996). The Security Frameworks are concerned with defining the means of providing protection for systems and objects within systems, and with the interactions between systems. The Security Frameworks are not concerned with the methodology for constructing systems or mechanisms. The Security Frameworks address both data elements and sequences of operations (but not protocol elements), which may be used to obtain specific security services. These security services may

apply to the communicating entities of systems as well as to data exchanged between systems, and to data managed by systems.

The ISO/IEC 15408 standard (ISO, 1999) consists of three parts, under the general title “Evaluation Criteria for Information Technology Security” (Part 1: Introduction and general model, Part 2: Security functional requirements, Part 3: Security assurance requirements). This multipart standard defines criteria to be used as the basis for evaluation of security properties of IT products and systems. This standard originates from the well-known work called “Common Criteria” (CC). By establishing such a common criteria base, the results of an IT security evaluation will be meaningful to a wider audience.

Security in Networked Environments

In networked enterprises such as smart organizations the goal for security is to reflect, in a computing and communication-based working environment, the general principles that have been established in society for policy-based resource access control.

Each involved entity or node should be able to make their assertions without reference to a mediator and especially without reference to a centralized mediator (e.g., a system administrator) who must act on their behalf. Only in this way will computer-based security systems achieve the decentralization needed for scalability in large distributed environments.

The resource access control mechanisms should be able to collect all of the relevant allegations and make an unambiguous access decision without requiring entity-specific or resource-specific local, static configuration information that must be centrally administered.

In order to be the security a successful part of the distributed, networked environment—providing both protection and policy enforcement—each principal entity should have neither more nor less involvement than they do in the currently

established procedure that operates in the absence of computer security. Only the form has to be changed, such as a digital signature instead of signing a paper. In case of such system, this sort of a security infrastructure should provide the basis of automated management of resources that precedes the construction of dynamically and just-in-time configured systems to support different user defined application-oriented requirements.

The expected advantage of computer-based systems is in maintaining access control policy, but with greatly increased independence from temporal and spatial factors (e.g., time zone differences and geographic separation), together with automation of redundant tasks such as credential checking and auditing. The security architectures represent a structured set of security functions (and the needed hardware and software methods, technologies, tools, etc.) that can serve the security goals of the distributed system.

As an addition to the “classic” networked environments, companies aspire to mobilize their workforces through application of wireless communication technology. Mobility brings obvious advantages to the enterprises, including increased productivity, improved communications, cost reductions, and revenue creation.

But as the amount of information that is transported over a wireless link increases, security attentions increase. The same security troubles that currently exist in the wired network, fear of identity theft and unauthorized monitoring of financial information and trade secrets, also apply to the wireless world. In addition, the wireless network is an open and easily accessible medium. To address these concerns, carriers must deploy security solutions for wireless technologies that are secure enough to satisfy stringent enterprise requirements.

Wireless communication systems (as well as wired systems) employ a “layered” network protocol design. The physical-, link-, network-, transport-, and application layers are each responsible for certain functions in the network whereby

appropriate security mechanisms are applied at each layer to ensure the optimum combination of high security and peak network performance.

NETWORK SECURITY IN SMART ORGANIZATION

In this subchapter, the security characteristics of the different network types will be introduced briefly. The technologies applied in wired networks will be presented first, as many of them are applied in the wireless networks as well. There are four different concerns that all security systems can address: privacy (confidentiality), integrity, authenticity, and non-repudiation. This is the goal in the case of the different networks as well, independently what type of media they use for data transmission.

Wired Network Security

Internet and WWW

At the beginning of networking there was a need mainly for the reliable operation, but the secure and authentic communication has become a key factor for today. According to Internet users, security and privacy are the most important functions to be ensured and by increasing the security the number of Internet users could be double or triple according to different surveys. The main reason for the increased demand is the spread of electronic commerce through the Internet, where money transactions are made in the amount of millions of dollars a day. It is not just the question of content of the communication or the user account—it is the question of money.

There are several solutions to secure the network; just security is in inverse proportion to usability and the most of the security tools are patches, extra solutions and rather stand-alone techniques. There are alternatives to use secure connections, some examples from the everyday applications (Table 1).

The FTP (file transfer protocol) application is used to provide file transfer services across a wide variety of systems. Usually implemented as application-level programs, FTP uses the Telnet and TCP protocols. The server side requires a client to supply a login identifier and password before it will honor requests. The information travels in plain, and with ftp dump is possible to sniff the communication, therefore advisable to use SSH-based SCP (secure copy) for file transfer. SSH is a Secure Shell, secure access method of a remote server instead of telnet (includes secure copy service instead of FTP, and transfers securely X sessions too).

Instead of HTTP there is SHTTP (secure hypertext transport protocol), which is HTTP over SSL (secure socket layer). Instead of simply e-mail there is the PGP (pretty good privacy) signed e-mail. With these techniques it can be guaranteed that the information in e-mail, file, or on a Web page will be reached only by authorized parties.

Over the Internet, the secure socket layer (SSL) protocol, digital certificates, and either user name/password pairs or digital signatures are used together to provide all four types of security.

SSL uses public key cryptography, bulk encryption algorithms, and shared secret key exchange techniques to provide privacy over the Internet. To provide integrity, SSL uses hashing algorithms that create a small mathematical fingerprint of a message. If any part of the message is altered, it will not match its fingerprint when the message is checked at the receiving end. In this case, the sender is asked to resend the message.

The remaining issue to address is non-repudiation. As with client authentication, most Web applications today simply rely on the entry of a user name and password to provide non-repudiation.

Applications can request a digital signature from a client, which requests that the user specifically authorize a transaction. The authorization is then encrypted utilizing the user's private key from their client certificate. Not surprisingly, a

digital signature is analogous to a real signature on a check and serves the same purpose. So far though, the adoption of client certificates for use by individuals on the Internet has been slow.

Different combinations of all of these security techniques are used for different applications, depending on which forms of security are important and the degree to which the solution needs to be balanced with the convenience for the user. For example, certificate-based client authentication and non-repudiation are not widely used on the Web today because most users don't want to be bothered with the administrative tasks of obtaining and safely maintaining a client certificate.

Security in the Grid

It is important to fix that the Grid can be viewed as an "extension" of the Internet, so it is rather a set of additional protocols and services that build on Internet protocols and services to support the creation and use of computation- and data-enriched environments. Any resource that belongs to the Grid also, by definition, belongs to the Internet.

As a result of the research and development efforts of the Grid community protocols, services and tools have been produced that include, for example, security solutions that support certificate management, coordination policies and services supporting secure remote access to computing and data resources and the co-allocation of multiple resources.

With respect to security aspects of the connectivity layer of the Grid, it is obvious that the complexity of the security problem makes it important that any solutions should be based on existing standards whenever possible. As with communication, many of the security standards developed within the context of the Internet protocol suite are applicable (e.g., user "log on" [authenticate,] integration with various local security solutions, user-based trust relationships).

The public key-based grid security infrastructure (GSI) protocols are used for authentication, communication protection, and authorization. GSI builds on and extends the transport layer security (TLS) protocols to address most of the issues listed above; in particular, single sign-on, delegation, integration with various local security solutions (including Kerberos), and user-based trust relationships.

The Grid will also offer a larger variety of resources; for example, remote execution of software, use of computing power, and secure access to remote networks, similar to virtual private networks (VPN).

Security Issues in PLC

From a cyber security perspective, the electric power grids are now more fragile, and margins for error are significantly less. With diminishing margins and power reserves, the probability for cascading catastrophic effects is higher.

There are opinions that hackers could shut down the Internet and the electric power grid if they wanted to, based on some theories of how networks work. The idea that certain nodes on a network are more important than others is nothing new, but that doesn't explain how the Internet gets shut down or (even more unlikely) how a "hacker" would shut down a power grid. There are theories to suggest some useful things about how certain nodes should be even more carefully protected from such attacks.

But the highly decentralized structure of the power plants—generators are not connected to the networks, which are hooked to the Internet—means that the damage hackers can cause is limited. Power plants are complex technological organizations, so to shut down a generator, one has to open circuit breakers and instruct generators to lower the "set points," the levels at which they are transmitting power. This is not something that can be done solely via a computer network. Security experts say that energy companies are

becoming increasingly sophisticated with network security, and have software systems in place allowing them to monitor any suspicious activity. That's important, because while the networks controlling power grids are currently offline, the utilities will come to rely more and more on the Internet. Companies recently launched a Web-based service for its customers, which will eventually offer services including online bill payment. This is where the companies are vulnerable; hackers could break into the network and "modify" the billing system.

However, there are potential security issues because a single power line from the utility company goes to multiple homes and office buildings. This means that hackers can "listen in" on the shared bandwidth. To further protect the data, this technology includes sophisticated encryption techniques built into the hardware (into powerline network adapters) so all data packets are automatically encrypted prior to transmission over the powerline network. Only computers that know the password can decrypt the packets and read data.

VoIP Security

VoIP systems have the same security risks as other IP-based systems. Systems without effective protection can be wiretapped, spilt (similar to e-mail spam) can be received, and so forth. If a company started to use VoIP focusing only on financial advantages without knowing the "dark side" of the technology, the financial balance could easily turn to negative.

Currently encryption and authentication of user access is only a recommendation by H.323. (H.323 is the international standard for multimedia communication over packet-switched networks, including LANs, WANs, and the Internet.) This means that any H.323-aware user inside the company can tap into any conversation on the system and any outside person can monitor every conversation with access from her or his desk.

In the case VoIP technology is used for a remote access location, another type of serious security risk arises because of problems with firewalls. H.323's firewall negotiation mechanisms require direct access into the corporate network, so the company has to open its entire network up to all UDP and TCP traffic. The solution is to use an H.323-aware firewall.

Security is one issue that most companies have take into account when implementing new communication systems and this is a good reason for gradually introducing new technology.

Security Technologies for Wireless Communication

Wireless Wide Area Networks (WWAN)

Mobile Security

Mobile security is inherently different from LAN-based security. The basic demands for privacy (confidentiality), integrity, authenticity, and non-repudiation are even harder, as the range of users is broader than in traditional networks. As security in the mobile world is more complex and different, it needs more advanced network security models. It can state that mobile communication is one of the biggest changes in the security market. Mobile security measures depend on the types of data and applications being mobilized. The more sensitive the data, the more strict security measures must be introduced.

Enterprises must be aware of how traditional security challenges change in relevance in a mobile world. Some special considerations for mobile security include the following:

- **Problem of authentication.** As companies report very high numbers of mobile device theft or loss, simply authenticating the mobile device is insufficient. A process of "Two Factor Authentication" had to be introduced.

This technology is used to verify both the device and the identity of the end-user during a secure transaction (i.e., two-factor authentication confirms that both the device and the user are authorized agents). Two-factor authentication is critical in protecting network integrity from the inevitability of stolen or lost devices.

- **Minimize end user requirements.** End users are impatient when using mobile services. They want access to applications and data immediately and will resist time-consuming accessing tasks. Requiring end users to conduct complex security processes is counterproductive to the purpose of mobile computing, and further exposes the enterprise to security breach. While a successful mobile application will require some user participation, involvement should be restricted to quick, easy, and mandatory tasks. Password-protect enterprise applications, an alternative to power-on password authentication, require users to enter a password or pen-based signature when accessing company content. This is a critical first-step in mobile security procedures.

It is critical that a mobile application supports industry-standard security protocols, including:

- **SHTTP:** This is Secure Hypertext Transport Protocol run on a Secure Socket Layer (SSL).
- **WTLS:** Standard for Wireless Transport Layer Security. This protocol provides authentication and encryption for WAP devices.
- **WPKI:** WAP PKI (used by VeriSign) to maintain security. PKI provides an infrastructure and procedures required to enable trusted partnerships needed to authenticate servers and clients in wireless application environments.

- **Any type of standard encryption technology:** e.g., RSA, Triple DES.

Implement WPKI authentication technology.

PKI, or Public Key Infrastructure, is a protocol-enabling digital certificates on wired devices. WPKI is an adaptation of PKI for mobile devices that meets m-commerce security requirements. Because PKI functions are bandwidth intensive and require processors tuned expressly for PKI operations, using a PKI proxy server allows balancing processing between the mobile device, the mobile application server, and the proxy server.

WTLS. WAP includes the wireless transport layer security (WTLS) specification, which defines how Internet security is extended to the mobile Internet. WTLS is poised to do for the wireless Internet what SSL did for the Internet—open whole new markets to m-commerce opportunities.

There are three steps to the WAP security model:

- WAP gateway simply uses SSL to communicate securely with a Web server, ensuring privacy, integrity, and server authenticity.
- WAP gateway takes SSL-encrypted messages from the Web and translates them for transmission over wireless networks using WAP's WTLS security protocol.
- Messages from the mobile device to the Web server are likewise converted from WTLS to SSL. In essence, the WAP gateway is a bridge between the WTLS and SSL security protocols.

WTLS was specifically designed to conduct secure transactions without requiring desktop levels of processing power and memory in the mobile device. WTLS processes security algorithms faster by minimizing protocol overhead and enables more data compression than traditional SSL solutions. As a result, WTLS can perform security well within the constraints of a wireless

network. These optimizations mean that smaller, portable consumer devices can now communicate securely over the Internet. The translation between SSL and WTLS takes milliseconds and occurs in the memory of the WAP gateway, allowing for a virtual, secure connection between the two protocols.

FLASH-OFDM Security

FLASH-OFDM has ideal characteristics for VPN application. It has broadband speed, low-latency connectivity, authenticated access, and full mobility. As the application of VPN decreases the downlink rate approximately 25-30%, there is enough reserve in the technology. Its end-to-end latency of 35 milliseconds enables the timely LAN-VPN synchronization so critical to the success of the application.

The FLASH-OFDM link layer security can protect the air interface between the wireless device and the network access node. This involves integrity protection, encryption, or both. Also, to address security concerns that affect multiple protocol layers and applications, an enterprise should cost-effectively employ security at the network layer or higher.

Wireless Metropolitan Area Network (WMAN)

Taking into consideration the problems of the WEP in the 802.11 Wi-Fi history, the standardization bodies have prioritized security from the beginning. Therefore, base station designers require a dedicated high performance security processor. The WiMAX standard requires that all traffic must be encrypted with CCMP (Counter Mode with Cipher Block Chaining Message Authentication Code Protocol). CCMP uses AES to provide the encryption for secure transmission as well as data authentication for data integrity.

WiMAX will face the same challenges once certified equipment starts to become available.

Although the 802.16 standards have far greater security functionality built into the base than Wi-Fi did, the perception of their safety will have to be high before they win the trust of enterprise and carrier users. As in the case of other standards, many advances will come from individual vendors, whether as enhancements that differentiate an individual product, or work that may be fed back into the standards process.

There are security processors that have been specially developed for WiMAX offering a suitable encryption and security solution for the evolving 802.16e standard. The symmetric key cores, which include the ability to perform AES-CCM function, perform at 200 Mbps with 1500-byte packets. It is this small packet performance, coupled with the internal 32Kb of memory, that makes the processor ideal for WiMAX base stations by performing the complex encryption/decryption with minimal latency. For multiple-channel base stations a processor can perform AES-CCM with 1500 Byte packets at 275 Mbps.

The best processors are designed for advanced networking applications like virtual private networking (VPN) broadband routers, wireless access points, VPN edge router/gateways, firewall/VPN appliances, and other network and customer premise equipment. Some of them can handle a variety of IPsec and SSL/TLS protocols including DES, 3 DES, AES and public key. In addition to IPsec and SSL protocols, the temporal key integrity protocol (TKIP) and AES counter mode encryption can be also supported.

Wireless Local Area Networks (WLAN)

A user of the wireless network can apply a variety of simple security procedures to protect the Wi-Fi connection. These include enabling 64-bit or 128-bit Wi-Fi encryption (Wired Equivalent Privacy-WEP), changing the password or network name and closing the network. These basic techniques work in both small offices and large corporations. However, additional, more sophis-

ticated technologies and techniques can also be employed to further secure the business network (WI-FI Alliance, 2004).

WEP and other wireless encryption methods operate strictly between the Wi-Fi computer and the Wi-Fi access point or gateway. When data reaches the access point or gateway, it is unencrypted and unprotected while it is being transmitted out on the public Internet to its destination—unless it is also encrypted at the source with SSL or when using a VPN (Virtual Private Network). WEP protects the user from most external intruders, but to reach a more secure connection additional technologies have to be applied, as WEP also has known security holes. There are several technologies available, but currently the VPN works best.

There are other security technologies that can apply for WI-FI. Kerberos—Another way to protect the wireless data is by using a technology called Kerberos. Created by MIT, Kerberos is a network authentication system based on key distribution. It allows entities to communicate over a wired or wireless network to prove their identity to each other while preventing eavesdropping or replay attacks. It also provides for data stream integrity (detection of modification) and secrecy (preventing unauthorized reading) using cryptography systems such as DES.

The Media Access Control (MAC) Filtering—As part of the 802.11b standard, every Wi-Fi radio has its unique Media Access Control (MAC) number allocated by the manufacturer. To increase wireless network security, it is possible for an IT manager to program a corporate Wi-Fi access point to accept only certain MAC addresses and filter out all others.

The RADIUS (Remote Access Dial-Up User Service) Authentication and Authorization is another standard technology that is already in use by many companies to protect access to wireless networks. RADIUS is a user name and password scheme that enables only approved users to access the network; it does not affect or encrypt data.

Because of the extraordinary success and adoption of Wi-Fi networks, many other security technologies have been developed and are under development. Security is a constant challenge, and there are thousands of companies developing different solutions. There are a variety of security solutions that effectively are put on the “top” of the standard Wi-Fi transmission and provide encryption, firewall, and authentication services. Many Wi-Fi manufacturers have also developed proprietary encryption technologies that greatly enhance basic Wi-Fi security.

An important problem is the Wi-Fi Security in public spaces. Wireless networks in public areas and “Hot Spots” like Internet cafes may not provide any security. Although some service providers do provide this with their custom software, many Hot Spots leave all security turned off to make it easier to access and get on the network in the first place. If security is important for the user the best way to achieve this when one is connecting back to the office is to use a VPN. In case the user does not have access to a VPN and security is important, it is better to limit the use of wireless network in these areas to noncritical e-mail and basic Internet surfing.

Individuals and companies that have the need to go beyond basic security mechanisms can choose to implement and combine these basic technologies to increase protection for their mobile workers and their data. As with any network, wired or wireless, the more layers of security that are added, the more secure the transmissions can be.

Wireless Personal Area (or Pico) Network (WPAN)

Bluetooth Security

As Bluetooth is a relatively new technology and attacks on Bluetooth devices at this stage are relatively new to consumers, the attacks are not widely seen as a real threat. But for today it becomes clear that there are sensitive information on both

company and personal levels that can be accessed relatively easily. So, it is important to know what types of information are in danger, how attacks can be committed, and how to fight against them (Gehrmann, Persson, & Smeets, 2004).

By Bluetooth attacks the following confidential data are in danger:

- In the case of mobile phones the entire phone book, calendar and the phone's IMEI.
- Complete memory contents of some mobile phones can be accessed by a previously trusted ("paired") device that has since been removed from the trusted list.
- Access can be gained to the AT command set of the device, giving full access to the higher level commands and channels, such as data, voice, and messaging.

When Bluetooth are included in laptop PCs this raises the possibility of opening a wireless back door into all data stored on the PCs.

The main attack types and their possible results are as follows:

- The "Snarf" attack—It is possible for attackers to connect to the device without alerting the user, and once in the system sensitive data can be retrieved, such as the phone book, business cards, images, messages, and voice messages.
- The "Backdoor" attack allows attackers to establish a trust relationship through the "pairing" mechanism, but ensuring that the user cannot see the target's register of paired devices. In doing this attackers have access to all the data on the device, as well as access to use the modem or internet; WAP and GPRS gateways may also be accessed without the owner's knowledge or consent.
- The "Bluebug" attack—This attack gives access to the AT command set; in other words, it allows the attacker to make premium-priced phone calls, allows the use of

SMS, or connection the Internet. Attackers cannot only use the device for such fraudulent exercises—it also allows identity theft by impersonating the user.

- "Bluejacking" allows attackers to send messages to strangers in public via Bluetooth. When the phones 'pair' the attacker can write a message to the user. Once connected the attacker may then have access to any data on the user's Bluetooth device, which has obvious concerns.
- Phones are vulnerable when they are in "discoverable" or "visible" mode, and the Bluetooth functionality is enabled. Visible mode lets Bluetooth phones find other Bluetooth phones in their vicinity so phone owners can exchange electronic contact information. Users can turn the visible mode off, but some models can be attacked even when a user turns off the visible mode. There are lists of Bluetooth devices on the Internet that give the security level of each device.

RFID Security

When talking about security it should be taken into account that the primary purpose of the RFID technology is the realization of cheap and automated identification. So, standard security mechanisms cannot be implemented because of their relative complexity compared to the limited computing resources of a tag. Cryptography like DES, AES, or efficient public-key protocols is too memory-consuming for low-cost tags.

Recently, breaking tags and disturbing the identification systems became "popular," so the security of RFID systems came into focus. The communication between reader and tag is unprotected in most cases, so eavesdroppers may thus listen in if they are in immediate vicinity. The tag's memory can be read if access control is not implemented. The attacks against RFID systems can be grouped according to which security service is under fire (Knospe, 2004):

- With the exception of high-end ISO 14443 systems, which use message authentication codes (MACs), the integrity of transmitted information cannot be assured. Checksums (CRCs) are often employed on the communication interface but protect only against random failures. Furthermore, the writeable tag memory can be manipulated if access control is not implemented.
- Any RFID system can easily be disturbed by frequency jamming. But, denial-of-service attacks are also feasible on higher communication layers. The so-called “RFID Blocker” disturbs the communication of a reader with all or with specific tags to protect the privacy of consumers.

RFID systems are already used for a large number of applications related to object identification. But, there remain still a number of issues to be resolved. Open technical issues are related to tag orientation, reader coordination, and the relatively short range, to name a few. Furthermore, a number of security and in particular privacy questions are still open. Consumer concerns may form an obstacle to further commercial deployment. Although today sophisticated mechanisms cannot be implemented on a 5-cent tag, a number of proposals exist even for very restricted resources.

INTEROPERABILITY IN SMART ORGANIZATIONS

Importance of Interoperability

There is an extremely big number of different information systems operating in connecting fields all around the world. Many of them are or should be connected to other systems somehow, as data, information, or knowledge exchange would be needed. The speed and reliability of this exchange is also important. Interoperability deals with the

solution of this problem. Interoperability is the ability of two or more systems or components to exchange information and to use the information that has been exchanged (IEEE, 1990).

Interoperability is the capability to provide successful communication between end-users across a mixed environment of different domains, networks, facilities, equipment, and so forth from different manufacturers and/or providers. In this context, the communication is meant between end-users or between an end-user and a service provider.

Interoperability is a real and expensive problem. A study of National Institute of Standards and Technology (NIST, 1999) reported that the U.S. automotive sector alone expends one billion dollars per year to resolve interoperability problems. Half of this cost was spent on data file exchange issues.

With a good solution millions of dollars can be saved. According to a study of NIST (NIST, 2002) with the application of the most widely used component of the STEP (Standard for the Exchange of Product Model Data) standard (ISO 10303-203 ([ISO 1994b], Configuration controlled design) only the transportation equipment manufacturing community saved over \$150 million per year. This figure is expected to rise to \$700 million by 2010.

The STEP standard became so important and popular that an international organization, the International Alliance for Interoperability (IAI) has been founded to make the new results even more effective (IAI, 2005).

Levels of Interoperability

The exchange of data and information can happen in a very wide range. There is a need to give some type of classification. As interoperability is a practical problem and users and enterprises had to solve these types of problems on their own, so the classifications have evolved according to professional fields and communities. Interoper-

ability is about information exchange, so these questions arise when connecting two or more systems. When approaching this connecting activity from the other side, experts are talking about system integration. There are different approaches to integration according to the object and field of integration.

Interoperability can be qualified at different levels in networking (e.g., protocol interoperability, service interoperability). It can be achieved through various types of interworking and interconnection:

1. Network interworking: interactions between different types of networks, end-systems, or parts thereof, with the aim of providing an end-to-end communication for a specific service;
2. Service interworking;
3. Terminal and peripheral interworking and interconnection.

In the field of manufacturing and design the integration of the application systems of the product model, the CAD/CAM systems can be done at two levels (Eversheim, 1991):

1. Data/information integration through data/information exchange between CAD and CAM applications without losing intention, content, and so forth. Tools: IGES, SET, STEP, etc.
2. Functional integration through the communication between CAD and CAM applications. This communication organizes and links the various functional areas. Integrating all aspects of the information involved in a product life cycle into a single shared information model. Tools: product model, manufacturing model, enterprise models.

In case of smart organizations, the three-level integration/interoperability hierarchy can be applied, originally developed for enterprise integration by the AMICE Consortium (AMICE, 1993).

1. Physical, or System Integration

Integration aspects: basic computer communication, message passing, and interconnection. Applied technologies: OMG/CORBA, TCP/IP, Internet/WWW.

2. Application Integration

Integration aspects: distributed co-operative applications, data/information exchange, and application interoperability. Applied technologies: EDIFACT, STEP/PDES, KIF/KQML, HTML.

There are different big projects, development in progress or already finished in this field. In the followings some of them are introduced briefly:

TMF/NGOSS and OMG/MDA

The mission of Object Management Group (OMG) is to help computer users solve integration problems by supplying open, vendor neutral interoperability specifications. The Model Driven Architecture™ (MDA™ is OMG's current strategy in solving integration problems.

The NGOSS (New Generation Operations Software and Systems) architecture of TeleManagement Forum (TMF) is described using technology-neutral constructs. These include concepts taken from RM-ODP as well as extensions to the basic UML metamodel to represent fundamental NGOSS concepts and principles. It does not prescribe a single new technology—rather, it allows for a federation of different technological approaches, each of which offers particular advantages at the business and system levels

Some of the main goals of TMF/NGOSS and OMG/MDA work are to provide benefits through technology neutral architecture; that is, architecture that is sustainable through technology changes, cost effective application integration, such as interworking and interoperability through application of standards (Faurer, Fleck, Huang, Richardson, & Strassner, 2004).

NIIP (National Industrial Information Infrastructure Protocols)

In the case of virtual enterprises, the National Industrial Information Infrastructure Protocols (NIIP) Reference Architecture (NIST, 1998) has been developed for global information exchange and sharing by the NIST. This architecture is one of the most complete realizations of virtual enterprise architectures. It intends to bring together the product realization process integration efforts, by developing general global protocols for the technical standards of product data definition, communication, and object technology and workflow management. The NIIP doesn't intend to develop a new system, but rather apply existing standards to consolidate, harmonize, and integrate the many sets of existing protocols. The main goals of the NIIP reference architecture is to help the establishing and operating of VEs in the industry by applying standardized solutions for VE connectivity, for industrial information modeling and exchange and management of VE projects and tasks. NIIP defines a series of protocols that make the STEP-defined data available as data objects in an OMG CORBA environment.

KIF (Knowledge Interchange Format)

The application of knowledge-based systems become more frequent, so the knowledge exchange and knowledge sharing have an increasing role. In this field, KIF (Knowledge Interchange Format) is a language designed for use in the interchange of knowledge among disparate computer systems (Genesereth, 1992). It has declarative semantics (i.e., the meaning of expressions in the representation can be understood without appeal to an interpreter for manipulating those expressions); it is logically comprehensive (i.e., it provides for the expression of arbitrary sentences in the first-order predicate calculus); and it provides for the representation of knowledge about knowledge.

PIF (Process Interchange Format)

The PIF (Process Interchange Format) serves to exchange process information (Lee, 1994). The goal of PIF is to offer an interchange format that helps automatically exchange process descriptions among a wide variety of business process modeling and support systems, such as workflow software, flow charting tools, process simulation systems, and process repositories.

3. Business Integration

Integration aspects: business process coordination, enterprise-wide knowledge sharing, interworking. Applied technologies: CIMOSA, GERAM, ENV 40003.

AMIS (Automated Methods for Integrating Systems) Project

In the field of manufacturing automation the NIST has started the AMIS project (Libes et al., 2004).

There are three main areas of work in the AMIS project: interaction ontology formulation, semantic mapping, and connector transformation. Interaction ontology formation is concerned with capturing the "business" and "engineering" interaction concerns in a form suitable for reasoning. Semantic mapping pertains to building tools to create semantic maps among ontologies. Connector transformation is concerned with creating generators for dynamic message converters; this will ultimately expand to support dynamic protocol conversion. Efforts in each of these areas must come together to support automation in the integration process.

Systems engineers use a combination of top-down and bottom-up approaches to match business process objectives with component functionality. The AMIS approach is to formalize and capture the information the system engineer uses to perform this matching and then use software-based

reasoning tools to support automation of the integration task.

IMPACTS OF WIRELESS TECHNOLOGIES ON SMART ORGANIZATIONS

Fields of Impacts

According to different studies, the introduction of new ICT to firms can indicate changes generally in organizational structure, in the competitive strategies, and environment (appearance of new products and services). Other studies declare that the introduction of new ICT and the organizational changes are designed to achieve greater productivity and flexibility. The conclusion of the study (Bocquet & Brossard, 2003) is (probably it is the most realistic) that there is no general model how ICT effects a company; the extent, the fields, and type of changes vary from company to company. So, all the impacts introduced in this chapter usually cannot be detected in one enterprise, and impacts not listed here can be found in other cases.

The new networking technologies extend company data, back-end information systems, and e-mail to mobile employees, broadens the accessibility of mission critical data. Mobile access modifies the way workers interact with colleagues, customers, and suppliers.

The possible fields of impact introducing wireless communication systems are:

- organizational structures
- SW and HW elements
- physical elements in administration/production
- human resources
- working environment—office structure, equipments for people, physical env.
- workflow
- business processes

- speed of communication, the validity/availability of information, reliability of communication, security (trust), cost of implementation, cost of reconfiguration (on shop floor level)
- market strategy
- management

Main Impacts

The first big change for enterprise information systems was caused by the application of Internet, the introduction of the global network. The next step forward was caused by the WEB-based technologies and to a lesser extent the mobile technology also has appeared on the scene. The latest effect on organizations (both in structures and operation) is caused by the different advanced wireless technologies. The result of their integration can be really called “cyberspace.”

Mobile technology affects both the structure and the operation of enterprises. The main reasons to develop a mobile solution in the organization can be to provide access to company e-mail and to intranet applications, to develop specific company applications, to keep permanent contact with service workers, to improve work scheduling, and offer possibility for m-commerce.

The interactions among organizations become easier and more transparent. Wireless technologies simplify the processes of maintaining visibility and control over transactions within a networked organization and allow real-time collaboration. The change from wired to wireless technology is probably even harder than the change in the previous cases, as the application of these technologies and means (e.g., mobile phones) alters not only work processes but the social and cultural environments as well.

The listed influences are general ones, as their effects can vary according to the application field (service company, automated manufacturing company using sensors, etc.), size of the organization, the cultural environment, and many other factors.

New Challenges for Smart Organizations

In the following, only the main areas of impacts will be presented.

Impacts on Organization (Structure and Work Processes)

- Organizational structure has to change to flat, open, lean structure with a 24-hour 365-day availability.
- Traditional functional and hierarchical barriers have to be eliminated while supporting teamwork and open access to people and information.
- Clear responsibilities for basic and auxiliary activities.
- The whole organization has to change to customer-oriented—real-time information collaboration among the participants. Benefits: innovative and agile work process.

Impacts on Working Technology

- It is important to separate basic/core activities from auxiliary activities. A basic activity is one that contributes to the competitive advantage of the organization. Auxiliary activities don't contribute directly to the competitive edge (e.g., administration). The right selection and the balance of the two activities are essential for the organization (Sifonis, 2003).
- The significance of team-work is growing.
- Remote meetings of different groups on different levels help collaboration.

Impacts on Information Technology

- Besides standard word processing and spreadsheet applications, groupware technologies are also included which require not only new technical skills but the development of new ways of working.
- Technologies such as shared databases and a calendaring and scheduling tool support

asynchronous group work, networked electronic whiteboard (which allows for shared viewing and manipulation of files between multiple sites), remote video linkages across multiple sites, and desktop conferencing (joint use of a single application running on two desktops) support synchronous group work.

- The different databases have an outstanding role. The various databases encompass routine and non-routine work, and form a kind of glue that holds different groups together.
- Secure communication is a very important demand in a system continuously connected, as in case of wireless networks, so WNs need stronger security as wired systems (e.g., VPN). This enhanced security demand needs modification in system infrastructure and in architecture as well. Other security related services like access right structure and archiving of documents also has to be modified.

Interoperability

The development of wireless technologies is very fast, and there are solutions that did not exist a year ago. These technologies converge data, voice, graphics, and video over a single network, and they allow each member of the network to access them without any space and time limitation. The representation and exchange form all of these descriptions have to be standardized, or else their access would not be possible for the different systems.

Impacts on Human Resources

- For the management, it is important to re-define authorities and responsibilities more clearly.
- Organizing remote meetings on different levels helps to better solve integrated prob-

lems, and these videoconferences also help trust building among the teams and members of the organization.

- For the staff, continuous training is important in order to use the new technology effectively, so for them the motivation for learning is a basic must.

Future Trends in Communication of Smart Organizations

The development and breakthrough of wireless communication is extremely fast, so today it can be seen what happens when a society, economy, and networked communication goes unwired. The application of mobile/wireless equipment of different kinds is dramatically increasing, and new technologies are appearing. The effects of this mobility are also remarkable in working communities and enterprises.

The basic trend in wireless communication technology is the convergence and integration of the different technologies and the efforts to increase the speed of data transmission rates. An additional reason for integration is to extend the coverage; that is, to increase the geographical availability and reach. Finally, the decrease of service costs is a general requirement of the market. Of course, these are visible technical and economical tasks for the wireless technology; in the background huge investments have to be done to realize these objectives that are important for the users.

Some examples of the efforts to increase speed and covered area include the present effort to develop the fourth generation (4G) mobile communication, which will have higher data transmission rates than 3G and are planned to be up to 20 megabits per second (about 10 times faster than top transmission rates planned for 3G mobile) (Gupta, 2004). In principle, 4G will allow high-quality, smooth video transmission. Another result of the developments is the dual-mode GSM/satellite phones that are switching

automatically according to the covered area using the more economic operation mode.

Parallel with the integration of existing technologies, big efforts are invested into the development and standardization of new wireless technologies (e.g., WiMAX, FLESH-OFDM, UWB). The IP-based fixed and wireless broadband technologies can significantly redraw the world of communication.

WLAN and 2.5/3G can be considered as complementary technologies. Wi-Fi offers great bandwidth in close proximity to a base station, but has limitations as users move out of range, and currently there aren't enough Wi-Fi base stations deployed publicly to support ubiquitous access. GPRS technologies like 2.5 can support speeds that beat dial-up from practically anywhere in the network's coverage area—which in most cases is a substantial range. Manufacturers integrate their data connect product with 802.11 technology—in this case, it is a GPRS-based PC Card for laptops and PDAs.

The wireless network of the future will be a hybrid solution of WWAN/WLAN/WPAN (e.g., 3G/Wi-Fi/Bluetooth/UWB), technologies with roaming and billing systems that provide the bridge. This “wireless chain” will offer continuous Wi-Fi coverage in dense metro areas and 2.5G or 3G in more outlying areas (Vaughan-Nichols, 2003). Wireless systems will become pervasive and will exist in a multitude of flavors (sensors, satellites, LANs, PANs, cellular, access, etc.).

Different wireless communication technologies are developing very fast. From a practical aspect this means that their integration will be holistic; that is, the user can move anywhere smoothly, with full broadband availability and without realizing that he or she changes the different types of network. The user's body area network (BAN) moves together like a “bubble” through the space.

This level and type of availability will result in additional changes in society and all sectors of economy. Smart organizations can operate more

effectively with this information infrastructure, unless there will be new production and service organization structures and smart organization will be history only.

In spite of the many positive characteristics and effects introduced so far, mobile communication has negative sides as well; for example, the possibility of tracking services and routes of owners by agencies and competitors and marketers using information from wireless devices. The same can be applied for RFID technology, so it is not suggested to use this technology in certain states because of privacy reasons. A general problem is that wireless communication is more sensitive for illegal wire-tapping and in some cases (e.g., Wi-Fi) the security of networks is not guaranteed when using improper security packages.

Of course, it is impossible to predict exactly the technology developments and the evolution of culture and customer needs, but customers do not really care about which technology is used, but about cost and speed. Indeed, speed, cost, and coverage are what are likely to decide whether one technology will triumph or the other or whether they'll work best for users together.

CONCLUSION

Network-based organizations, like smart organizations, are the main components of the information and knowledge society. The market competition force networked organizations in the direction of continuous change to be able to follow the frequently changing market demands.

These organizations apply ICT very intensively, both for internal and external communication, supporting their cooperation in order to react flexibly to changing business environment. As wireless information and communication technologies make their operation more effective both in the fields of production and finance, the competitiveness of networked production systems is increased through wireless networks.

The infocom systems applied by the companies have their human part (users) as well, so the importance of trust is increasing very quickly. As it is pointed out by different analyses based on real-life statistics, when users do not trust an IC system or service they do not use it. Security services partially provide this trust for the users, while the human side of trust depends on the media of communication, the structure of interfaces, and on the duration of contacts. The organizations have to adapt their IC systems to these requirements as well, even by slightly changing their culture or organizational structures.

The different types of wireless communication technologies originating from their openness and flexibility will be always a security risk. The managers of information technology have to adapt those technologies, tools, and devices into their systems that can induce high trust-level in all humans involved in different levels of the smart organizations.

The new generations of networking technologies, the different types of wireless communication systems make significant changes not only in the operation of networked-based organizations, but in the cultural and social environments as well. The paper introduced briefly the main groups of wireless networks and their effects on networked organizations. The main conclusion is that the wireless networking technologies can cause remarkable modifications in the structure, in the operation, in the collaboration techniques, in the cost structure, and in business processes of any type of organizations, so their application has strategic importance for all types of companies.

REFERENCES

AMICE. (1993). *CIMOSA: Open System Architecture for CIM* (2nd revised and extended version). Berlin: Springer Verlag.

- Anderson, C. (2003). The Wi-Fi Revolution [Special Issue]. *Wired Magazine*, 11(5).
- Anderson, R. (2001). *Security engineering: A guide to building dependable distributed systems*. New York: John Wiley & Sons.
- Bakker, D. M., & McMichael Gilster, D. (2002). *Bluetooth end to end*. John Wiley & Sons.
- Bocquet, R. & Brossard, O. (2003, November 7-10). Determinants of IT adoption, organizational change and the nature of the firm: An empirical study of French survey data, EAEPE 2003. *The Information Society, Understanding Its Institutions Interdisciplinary* (pp. 30-31). Maastricht, The Netherlands, in Book of Abstracts.
- Bos, N. D., Olson, J. S., Gergle, D., Olson, G. M., & Wright, Z. (2002). Effects of four computer-mediated channels on trust development. *Proceedings of CHI 2002*. New York: ACM Press.
- Castelfranchi, C., & Yao-Hua, T. (Eds.). (2001). *Trust and deception in virtual societies*. Kluwer Academic Publishers.
- Cheskin, (1999). *eCommerce trust: A joint research study with Studio Archetype*. Sapient and Cheskin, Retrieved December 15, 2004, from <http://www.cheskin.com/p/ar.asp?mlid=7&arid=10&art=0>
- D'Hertefelt, S. (2000). *Trust and the perception of security*. Retrieved December 15, 2004, from <http://www.interactionarchitect.com/research/report20000103shd.htm>
- Elbert, B. R. (2004). *The satellite communication applications handbook* (2nd ed.). Boston; London: Artech House, Inc.
- Engst, A., & Fleishman, G. (2003). *The wireless networking starter kit*. Berkeley, CA: Peachpit Press.
- Eversheim, W., & Gross, M. (1991, May). Trends and experiences in applying simultaneous engineering. *Proceedings of the Seventh CIM-Europe Annual Conference* (pp. 3-11).
- Faurer, C., Fleck, J., Huang, J., Richardson, T., & Strassner, J. (2004). *TMF White Paper on NGOSS and MDA*. Retrieved December 15, 2004, from <http://www.tmforum.org/browse.asp?catID=1705&linkID=28796>
- FBI (2004). *The 2004 CSI/FBI Computer Crime and Security*. Vol. IX. No. 1. Retrieved December 15, 2004, from <http://www.gocsi.com/forms/fbi/pdf.html>
- Filos, E., & Banahan, E. (2000). Will the organisation disappear? The challenges of the new economy and future perspectives. In L. M. Camarinha-Matos, H Afsarmanesh, & R. J. Rabelo (Eds.), *E-business & virtual enterprises* (pp. 3-20). Dordrecht: Kluwer.
- Finkenzeller, K. (2003). *RFID Handbook: Fundamentals and Applications in Contactless Smart Cards and Identification* (2nd ed.). John Wiley & Sons.
- Flarion Technologies, Inc. (2004). *The benefits of a packet-switched, all-IP mobile broadband network*. White paper, February.
- Foster, I. (2000). Internet computing and the emerging grid. *Nature*, 7, December.
- Foster, Kesselman, & Tuecke. (2000). *The anatomy of the grid—Enabling scalable virtual organisations*. (2000, White Paper).
- Fukuyama, F. (1995). *Trust—The social virtues and the creation of prosperity*. New York: The Free Press.
- Gartner Symposium/Itxpo. (2003, October). Lake Buena Vista, Florida, USA, 19-24.
- Gehrmann, C., Persson, J., & Smeets, B. (2004). *Bluetooth security*. Boston: Artech House, Inc.
- Genesereth, M. R., & Fikes, R. E. (1992). *Knowledge interchange format, Version 3.0 reference manual* (Tech. Rep. Logic-92-1). Stanford University, Computer Science Department.

- Gupta, P. (2004). Mobile wireless communications tomorrow. In *Wireless Developer Network*. Retrieved December 15, 2004, from <http://www.wirelessdevnet.com/channels/wireless/training/mobilewirelesstomorrow.html>
- Handy, C. (1995). Trust and the virtual organization. *Harvard Business Review*, 73(3), 40-50.
- Hübscher, B. (2004). *Highspeed Internet on the power grid*. Retrieved November 10, 2004, from http://www.ascom-astel.com.ua/plc_ovr.pdf,
- Institute of Electrical and Electronics Engineers (IEEE). (1990). *IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries*. New York.
- International Alliance for Interoperability (IAI). (2004). <http://www.iai-international.org/>
- ISO 10303-203. (1994). Industrial automation systems and integration — Product data representation and exchange — Part 203: Application Protocol: Configuration controlled design. International Organization for Standardization, Geneva, Switzerland.
- ISO/IEC 10181-1. (1996). Information technology—Open Systems Interconnection—Security frameworks for open systems: Overview.
- ISO/IEC 15408. (1999). Evaluation Criteria for Information Technology Security.
- Jarvenpaa, S. L., & D. E. Leidner. (1999). Communication and trust in global virtual teams. *Organization Science*, 10(6), 791-815.
- Karayannis, G. (2003, December). Standards-based wireless networking alternatives. *Sensors Online*. Retrieved December 15, 2004, from <http://www.sensorsmag.com/articles/1203/26/main.shtml>
- Kelland, B. (2003, January). *Ultra-wideband wireless technology*. Paper presented at 3rd Annual CM316 Conference on Multimedia Systems, Southampton University, UK.
- Knospe, H., & Pohl, H. (2004). RFID Security, Information Security Technical Report. Vol. 9, No. 4, pp30-41.
- Knospe, H., Pohl, H., (2004). RFID security. *Information Security Technical Report*, 9(4), 30-41.
- Koller, L. (2001). Biometrics Get Real. *CardTechnology*, August, 24-32.
- Lee, J., Gregg, G., & the PIF Working Group. (1994). The PIF Process Interchange Format and Framework. December 1994. MIT Center For Coordination Science, 1994 WORKING PAPER No. 180.
- Libes, D., Barkmeyer, E. J., Denno, P., Flater, D., Steves, M. P., et al. (2004). *The AMIS approach to systems integration: An overview* Tech. Rep. No. NISTIR 7101). National Institute of Standards and Technology, Manufacturing Systems Integration Division.
- Lucent Technologies (2003). *3G wireless networks, wi-fi wireless LANs, and secure VPNs: Perspectives for the business on-the-move*. White Paper, March 2003.
- Luhman, N. (1979). *Trust and power*. Chichester, UK: Wiley.
- Menezes, A. P., van Oorschot, & Vanstone, S. (1996). *Handbook of Applied Cryptography*. CRC Press.
- NIST. (1998). NIIIP Reference Architecture Books 0-6. RA 3.1.
- NIST. (1999). *Interoperability cost analysis of the U.S. automotive supply chain* (Planning Report #99-1). Retrieved December 15, 2004, from <http://www.nist.gov/director/prog-ofc/report99-1.pdf>
- NIST. (2002). *Economic impact assessment of the international standard for the exchange of product model data (STEP) in transportation equipment industries* (Planning Report #02-5). Retrieved December 15, 2004, from <http://www.nist.gov/director/prog-ofc/report02-5.pdf>

Orange book. (1985). Trusted computer system evaluation criteria DoD 5200.28-STD. Department of Defense, December 26, Revision: 1.1 Date: 95/07/14.

Rocco, E., Finholt, T. A., Hofer, E. C., & Herbsleb, J. D. (2001, April). *Out of sight, short of trust*. Presentation at the Founding Conference of the European Academy of Management. Barcelona, Spain.

Rousseau, D. M., Sitkin, S. B., Burt, R. S., & Camerer, C. (1998). Not so different after all: A cross-discipline view of trust. *Academy of Management Review*, 23(3), 393-404.

Schneier, B. (1996). *Applied Cryptography*. John Wiley & Sons.

Sheriff, R. E. & Fun, H. Y. (2001). *Mobile satellite communication networks*. UK: John Wiley & Sons.

Sifonis, J. (2003, March/April). The networked virtual organization—A business model for today's uncertain environment. *iQ Magazine*.

Tanenbaum, A. S. (1996). *Computer networks* (3rd ed). Prentice-Hall.

Ungson, G. R., & Trudel J. D. (1999, May). *The emerging knowledge-based economy*. IEEE Spectrum.

Vaughan-Nichols, S. J. (2003, June 20). Wi-fi and 3G together? *Wi-Fi Planet*. Retrieved December 15, 2004, from <http://www.wi-fiplanet.com/columns/article.php/2225411>

Wi-Fi Alliance. (2004). *WI-FI security*. <http://www.weca.net/>

Zheng, J., Veinott, E, Bos, N., Olson, J. S., Gary, Olson, G. M. (2002). Trust without touch: Jump-starting long-distance trust with initial social activities. *Proceedings of the SIGCHI conference on Human factors in computing systems*, Minneapolis, Minnesota (pp. 141-146).

This work was previously published in Integration of ICT in Smart Organizations, edited by I. Mezgar, pp. 187-256, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.38

Foreseeing the Future Lifestyle with Digital Music: A Comparative Study between Mobile Phone Ring Tones and iPod

Masataka Yoshikawa
Hakuhodo Inc., Japan

ABSTRACT

This chapter aims to explore the future trajectory of enjoying digital music entertainment among consumers comparing the characteristics of the usage patterns of digital music appliances in the U.S. and those in Japan. As the first step of this research, the author conducted two empirical surveys in the U.S. and Japan, and found some basic differences in the usage patterns of a variety of digital music appliances. Next, a series of ethnographical research based on focus-group interviews with Japanese young women was done and some interesting reasons of the differences were discovered. In Japan, sharing the experiences of listening to the latest hit songs with friends by playing them with mobile phones that have the high quality, ring tone functions can be a new way of enjoying music contents, while hard-disk music players like iPod have become a de facto standard of the digital music appliances in the world.

INTRODUCTION: CENTRAL QUESTIONS

The November 2001 debut of iPod and the subsequent opening of iTunes Music Store have brought a rapid expansion of the digital music market around the world. Some estimate that the market will be worth \$1.7 billion dollars by 2009 (Jupiter Research). Now, iTunes Music Store service is available in 30 countries around the world, with the total number of downloaded songs surpassing the 500 million mark in July 2005.

The store only opened in Japan in August 2005 and sold over 1 million songs in the first 4 days. This is an astonishing achievement, considering that Japan's largest online music store Mora has monthly sales of around 450,000 songs. In March and April 2005, SONY, which has long led the portable music player market, released a new digital music player under the Walkman brand, offering both the hard disk type and USB

flash memory type to launch a marketing drive against iPod. The developments have finally begun to provide Japanese music lovers with an environment whereby digital music contents are broadly enjoyed in terms of both services and hardware devices.

One of the major characteristics of Japan's digital music market has been the presence of digital music contents for use on mobile phones. The use of digital music contents on mobile phones, which started as regular ring tones, has gradually evolved into Chaku-uta® (true-tone ring tones) by December 2002, and to Chaku-uta Full™ (mobile-phone-based music distribution service launched in December 2004 by the mobile carrier "au"). Chaku-uta® and Chaku-uta Full™ have sold over 100 million songs and 10 million songs respectively, making the digital music service the largest segment in mobile-phone content services.

The environment for enjoying digital music content is set to expand even further into the future. How would such a development affect the way Japanese music fans listen to music in general? This paper examines future ways of enjoying digital music content in Japan, and the competition between music players like iPod for use with personal computers and mobile phones that have adopted the usage as music players.

JAPAN'S DIGITAL MUSIC CONTENT MARKET AND THE PROLIFERATION OF MOBILE PHONES BEFORE 2005

Firstly, let us examine past developments of the digital music content market in Japan. Japan's first digital music distribution service started in April 1997. A company called MUSIC.CO.JP began offering songs mainly from independent labels. Coinciding with the launch of numerous music download services in the U.S., a number of online music Web sites opened one after another, orches-

trated by individual artists and record labels. In December 1999, SONY Music Entertainment became the first major record company to start an online music store bitmusic. Toshiba EMI, Avex Records, and other major companies followed suit. Yet, since early 2005, the system for online distribution of digital music contents has been underdeveloped, as can be seen in the fact that Mora's supposed largest online music catalog in Japan contained just 100,000 songs, as opposed to iTunes Music Store's lineup of 1 million songs upon its launch in August in Japan.

There is no denying that mobile-phone-related music services have been the driving force of the nation's digital music market. The launch of the i-mode service by NTT DoCoMo in February 1999 marked the start of digital content downloading services via mobile phones. The connection speed of 9600bps in those days made it, initially, difficult to distribute songs in high audio quality. Faced with the adversity, businesses began offering Chaku-melo music ring tones, instead of distributing actual music contents, achieving dramatic growth. The Chaku-melo market has rapidly expanded to 80-90 billion yen in 2002. What makes this development unique was the fact that this service was initiated not by record companies rather by major online Karaoke service providers like GIGA and XING, computer game companies like SEGA, and other companies operating in the peripheral areas of the music industry itself. The market size of 80-90 billion yen as of 2002 is among the highest of all mobile-related digital content services, proving the market-led proliferation of digital content services for mobile phones.

Amidst the flourishing success of the Chaku-melo market, supported by peripheral music businesses, record companies that lead the music industry initiated a move to provide the Chaku-uta® service, offering true-tone music as ring tones, instead of Chaku-melo MIDI-based ring tone melodies. The service was initially started solely by Japan's second largest mobile carrier au

in December 2002. While the Chaku-melo service was employed by all mobile carriers rapidly, the Chaku-uta® service was not adopted by the industry leader NTT DoCoMo until February 2004 and by the number three mobile carrier Vodafone until March 2004. However, the service picked up substantial support from younger generations. As the preceding proliferation of the Chaku-melo service had already familiarized mobile phone users with the concept of *obtaining music over mobile phone*, Chaku-uta® sales reached 100 million songs by July 2004, and surpassed 200 million songs by April 2005 to establish a market of substantial scale. Record companies joined forces to establish Label Mobile, which currently provides around 300,000 songs, approximately three times the catalog size of computer-based online music stores.

After Chaku-uta® came the Chaku-uta Full™ service, which provides whole songs as ring tones to become a de facto digital music store over mobile phones. It reached its fifth million download in April, just 6 months after its launch in October 2004. The cumulative total of downloaded songs reached 10 million in June, causing a dramatic expansion in market size. Although the number of songs available remains smaller than Chaku-uta® at 37,000, the catalog is expected to keep on expanding.

As described thus far, the digital-music-content industry has rapidly mushroomed as one of mobile phone services, but it has been less than 1 year since a full-scale music distribution service (Chaku-uta Full™) was launched. Music has been merely distributed as an additional function to mobile phones, that is, the ring tone. Consumption has been initiated by mobile phone use, instead of music itself. In other words, an explosive proliferation of a new communications device called mobile phones, has triggered the consumption of digital music content as a natural course of evolution. Amidst this situation, a series of dedicated digital music players called iPod has emerged with major success, triggering the launch

of the iTunes Music Store offering downloads of digital music content. With the development of a fully fledged environment for computer-based consumption of digital music contents, what has been the course of competition between different types of devices in today's digital music content market? Let us examine the overview based on the results of a quantitative survey.

TODAY'S DIGITAL MUSIC CONTENT MARKETS: JAPAN AND U.S. MARKETS

In order to grasp the state of today's digital music content market in Japan, we have simultaneously conducted a survey consisting of identical questions for use in both Japan and the U.S. Results from the two countries were compared against each other in order to identify characteristics of the Japanese market. The survey was titled *Survey on Digital Contents*, and the survey period it ran online was between February and March 2005.¹ The following samples were included: Japan, N=677 aged 15-59 and in the U.S., N=700 aged 18-59.

First, let us take a look at the rate of music-terminal use in the two countries: 6.9% of Japanese respondents used hard-disk music players like iPod, whereas the ratio was almost double at 11.5% in the U.S. The ratio of people using USB flash-memory music players was 7.2% in Japan and 16.1% in the U.S., more than double the Japanese figure. However, the ratio of those using mobile phones as music players was 19.8% in Japan, nearly three times the U.S. result of 6.1%. These figures demonstrated a clear tendency of U.S. users opting for hard-disk or flash-memory devices with music transferred via computers, and Japanese users choosing mobile phones to listen to music.

Next, the survey examined how samples typically downloaded digital music contents: 28.9% of U.S. respondents have downloaded music via

computer, over 10 percentage points higher than the Japanese ratio of 17.4%. On the other hand, 42.2% have downloaded music (music ring tones) over mobile phones in Japan, around three times the equivalent U.S. figure of 14.2%. The ratio of people who have downloaded true-tone ring tones was 20.4% in Japan, an astonishing lead of around seven fold compared to the U.S. result of 3.0%. The clear tendency of computer orientation in the U.S. and mobile phone orientation in Japan, observed in the choice of music-playing terminals, was also evident in terms of the practice of music downloading.

As explained in the previous section, these findings are a natural outcome reflecting how the digital-music-content market emerged and established itself around mobile phones from the early days in Japan in contrast to market development that evolved around computers and the Internet in the U.S. However, there is some interesting data—the survey asked those who do not own a portable digital music player which type of device they would like to possess. The results indicated almost identical tendencies between Japanese and U.S. respondents, unlike the stark differences they demonstrated in previous questions. Those who intend to purchase a hard-disk music player accounted for 26.7% in Japan and 26.1% in the U.S. The figures for flash-memory players were also very similar at 21.4% in Japan and 21.7% in the U.S. Finally, the ratio of those using a mobile phone as a music player is 5.3% in Japan and 3.0% in the U.S. Even though the Japanese figure is slightly higher than the U.S. figure, they can be viewed as almost at the same level, in comparison to the ratio gaps observed in other questions.

This data demonstrates a strong contrast to previous data, which showed a noticeable computer orientation for the U.S., and mobile phone orientation for Japan. In both countries, purchase intention appears higher for computer-based music players based on either hard disk or USB flash memory, and relatively low for mobile phones doubling as music players.

Until now, Japan's digital-music-content market has been characterized, in terms of hardware, with proliferated use of mobile phones, as opposed to the U.S. market where more users download music via computer. However, as the results of the aforementioned survey suggest, computer-based music players will be used increasingly for the consumption of digital music content, in addition to mobile phones, in the future Japanese market. Then, what changes will emerge in consumer's music playing styles when such hardware competition (spread of computer-based music players) evolves?

FUTURE STYLE OF DIGITAL MUSIC LISTENING IN JAPAN: OVERALL TREND

We have projected future changes in the style of digital music listening in Japan, dividing the samples of the aforementioned survey into the following three groups and comparing the profiles, music listening styles, and mentalities of the current and future users.

1. Current digital music content users—Those who own hard-disk/USB flash-memory music players N=42.
2. Digital music content potential users—Those who intend to purchase hard-disk/USB flash-memory music players N=307.
3. Nonusers of digital music contents—Those excluding the above two groups N=319.

We made a particular comparison between current digital music content users who have constituted the computer-oriented digital music market, and digital-music-content potential users who intend to join the market from now, so as to identify how the listening style of this market is likely to change, and what impact such changes will have on the market, which has evolved through downloading by means of mobile phones thus far.

First, we compared samples' demographic profiles and basic indicators in music consumption.

Gender Comparison

Current digital-music-content users mainly consist of men, accounting for 66.7%, as opposed to women at 33.3%. Digital-music-content potential users have a more even gender distribution, consisting of men and women at respectively 54.4% and 45.6%. Nonusers of digital music contents have a greater proportion of women at 58.4%, compared to men at 43.6%.

Comparison by Gender and Generation

The generation factor was then incorporated to characterize the three groups more clearly. Among current digital-music-content users, men in their 20s claimed the largest proportion at 29.6%, followed by women in their 20s at 23.8%, and men in their 30s at 16.7%. These three groups alone represent over 70% (70.1%), indicating that digital music content is primarily enjoyed among younger people—both men and women. In comparison, among digital-music-content potential users, men in various age groups accounted for around 10% each, that is, men in their 20s at 11.1%, men in their 30s at 10.7%, men in their 40s at 15.3%, and men in their 50s at 11.7%. Women in their 20s and 30s also represented, around the same proportion, at 11.4% and 8.5% respectively. Compared to current digital-music-content users, there is a more even distribution of age and gender groups. As for nonusers of digital music contents, women in the middle to high age groups made up over 40%, including women in their 30s at 14.7%, women in their 40s at 12.3%, and women in their 50s at 16.3%. The data analysis incorporating generation factors highlighted distinctive characteristics among the three user categories.

Comparison of the Number of CDs Owned

When asked how many CDs they own, 18.7% of current digital-music-content users said 50 to 99, followed by 23.8% owning 100-199 CDs and 11.9% owning over 200 CDs. These three groups represent over 50% (54.4%). Among digital-music-content potential users, 18.2% own 0-9 CDs, whereas those owning 10-19 CDs, 20-29 CDs, and 30-49 CDs accounted for 14.0%, 13.7%, and 16.3% respectively. Combined, over 60% (62.2%) owned less than 50 CDs. Almost 70% (69.8%) of nonusers of digital music contents also own less than 50 CDs, broken down into those with 0-9 CDs, 10-19 CDs, 20-29 CDs, and 30-49 CDs at respectively 31.7%, 14.7%, 12.2%, and 11.6%. As the figures show, current users have a large proportion of people with a substantial CD collection, whereas nonusers have a large proportion of people with limited CD ownership.

Comparison of Monthly Music Spending

Similarly to the former, the ratio of those spending over 3,000 yen (equivalent to the cost of one CD album) per month was 61.8% among current digital-music-content users but less than 40% (39.1%) among digital-music-content potential users. Over 70% (75.9%) of potential users spent at least 1,000 yen (equivalent to the cost of one CD single) per month. Nonusers of digital music contents demonstrated a similar tendency to potential users, with 28.8% spending over 3,000 yen, and 66.1% spending over 1,000 yen. As the figures indicate, current users have a large proportion of people who spend more on CDs, whereas nonusers have a large proportion of people who spend less on them.

Summarizing the results thus far, current digital-music-content users are mainly young men and women in their 20s, with substantial CD

ownership and high music-related spending per month. They can be described as *music fans* with substantial music-related consumption. Potential users of digital music content, who are expected to enter this market, are distributed across both genders and broad generations, from youth to those in middle age. They are characterized as middle-level users in music consumption. Nonusers of digital music content are mainly women in higher age groups, with relative inactiveness in terms of music consumption. The results illustrate clear differences in demographic characteristics and music consumption behavior. There are major differences between consumers who have bolstered the computer-based, digital-music-content market until now, and those who will support the market from now on. These facts alone point to the possibility that the current market is set to undergo substantial changes in its nature. In order to examine details of anticipated changes, we have compared the three groups in their attitude and mentality in listening to music.

Formats of Music Ownership

Of current digital-music-content users 61.9% acknowledge the desire to store all of their CD collection on the computer, a significantly higher ratio than digital-music-content potential users at 26.7% and nonusers of digital music contents at 17.2%. Current users appear to have a strong desire to manage their music by computer and use computers as the main device for handling music content. In comparison, such desire is not as strong among the other two groups.

Intention Regarding Songs Available for Downloading

Next, in order to examine the number of songs that are available for downloading, we looked at whether people want a greater selection from download services via computer or those via mobile phone. When asked whether the number

of songs downloadable via computer on the Internet should be increased, 45.2% of current digital-music-content users said “yes,” much greater than 30.0% among digital-music-content potential users and 15.0% among nonusers of digital music content. As for whether they want to see the number of songs available via mobile phone increased, just 7.1% of current users agreed, whereas the ratio was more than double at 15.0% among potential users, and 9.7% among nonusers. Although with not as stark a difference as the last paragraph, these groups clearly demonstrated different preferences in catalog enhancement between downloading services via computers or those via mobile phones. In short, current users want to see enhancement of the computer-downloadable catalogs, while potential users want enhancement of mobile-phone-based catalogs just as much as of computer-based catalogs. The results, once again, indicate a strong preference among current users on computer-based services. In comparison, potential users are requesting catalog enhancement to both computer-based and mobile-phone-based services. In other words, potential users and nonusers wish to use both computers and mobile phones to listen to music rather than mere computers.

Style of Using Songs

We also asked several questions on how people wish to use songs they own. Of current digital-music-content users 35.7% said they want to store all CDs they own on a computer and edit them, for example, compiling a collection of favorite songs. The ratio was 22.5% among digital-music-content potential users and 11.0% among nonusers of digital music contents. These figures again confirmed the computer-oriented style of current users and highlighted another of their characteristics, that is, actively using downloaded songs for their personal enjoyment. This characteristic became even more evident in the next question.

People were asked whether they like to compile a collection of songs from CDs they own according to specific themes and use the original CD as a gift for friends on a suitable occasion of some sort. Of current users 11.9% said “yes,” whereas the ratio was 15.3% among potential users and 6.0% among nonusers. A greater proportion of potential users expressed preference to this style than current users.

The third question was on whether they wanted to burn their favorite songs on CD-R or DVD more casually to give away to friends and acquaintances. The results showed a similar tendency to the results for the second question. Of current users 7.1% agreed, while the ratio among potential users was greater at 12.7%. Even nonusers had a greater proportion at 9.1%. Looking at the results to these three questions, current users have a self-contained approach in enjoying music with a preference to downloading via computers, whereas potential users are more inclined towards exchanging and distributing music with others.

Finally, we asked whether they wanted to give away or exchange songs, downloaded via mobile phone, to friends over the mobile phone. Again, only 7.1% of current users, who have the preference to computer-based song purchase, agreed to the concept, whereas the ratio was greater among potential users (9.1%), with even nonusers reaching the same level as potential users (8.8%). All the numbers point to the computer-oriented and self-contained nature of current users, and the potential users’ tendency of combined computer and mobile phone use and a strong inclination towards distributing and exchanging songs.

When these analysis results are combined with the demographic characteristics and basic indicators in music consumption, current digital-music-content users can be defined as those with a strong computer preference, wishing to use digital music content for their personal enjoyment in a self-contained approach. In contrast, digital music content, potential users who are entering the

market from now, are combining computers and mobile phones for this purpose and are inclined towards enjoying music with others in addition to appreciating it by themselves. This group has a particular tendency of using music as one of the tools for communicating with other people around them.

Let us take a closer look at the results to enable us to explore the direction of how Japan’s digital music market may change, while reflecting upon the trends of both hardware and people’s music listening styles.

The digital-music-content market in Japan originally evolved from the distribution of mobile phone ring tones. Then, music content was merely one of the functions or menus available in using mobile phones. They did not go beyond the ring tone boundary. Amidst this situation, the market embraced the emergence of a new type of music device that contains a hard disk or USB flash memory, designed to be used with a computer. Contemporary music fans were among the first to adhere to such devices, consisting of men and women in their 20s that are most active consumers of music. They stored and managed all music content they already had in a computer, thereby converting them into digital content, and began carrying songs in portable music players and in so doing they were enjoying music for themselves in a rather self-contained fashion.

Today, digital music content that takes the form of mobile phone ring tones exists alongside digital music content that can be carried on hard-disk or USB flash-memory music players. We have investigated the future course of the market in view of the profile and music mentality of potential users of digital music content, who are making a full-scale entry into this market in the future. Future users will be combining computers and mobile phones, and, unlike contemporary users, enjoying music as both a communication tool with others and for personal entertainment purposes. Digitizing music contents gives music a new function as a communication promotion factor,

in addition to the current functions as ring tones and personal enjoyment.

In order to further clarify this new style of enjoying digital music content, we conducted an oral qualitative survey on two groups, that is, current iPod users who represent those enjoying digital music content via computers, and Chaku-uta® and Chaku-uta Full™ users who represent those enjoying digital music content via mobile phones. The survey clarified their styles in listening to digital music content, so as to obtain an insight into the future direction of music-listening styles.

FUTURE OF THE DIGITAL MUSIC CONTENT MARKET IN JAPAN: CHANGES IN MUSIC CONTENT CONSUMPTION

The *Survey on the usage of iPod and Chaku-uta®* was conducted in the period between December 2004 and February 2005. In-depth interviews were held with three male and female iPod users in their 20s and 30s, and with three male and female Chaku-uta® Mobile users in their 10s and 20s.²

Comments From iPod Users

What follows are typical comments made by iPod users on their style of enjoying music:

I find the Random Play function to be very refreshing. I can 'rediscover' songs on CDs that I did not pay much attention previously. [...] I can store a lot of songs without having to worry about how much space is left. Now, I am storing whatever songs I have, even ones that I would skip if I am playing it on CD. [A 37-year-old man who has used iPod for 1.5 years, SOHO, 6,000 songs are held]

I now realize how much I have restricted myself with frameworks of genres and artists when listen-

ing to music. The Shuffle function highlights the raw power of individual songs. [...] Occasions like that have broadened the range of music genres I listen to, making me feel like trying out CDs I would never have dreamed of listening to before. [26-year-old woman who has used iPod for 1 year, office worker, 1,500 songs are held]

I never used to carry music around, but now I do not go anywhere without my iPod. This has widened the variety of occasions I listen to music, for example, while on a train or on the way home after a drink. [...] There are times when a song I frequently listened to on CD sounds very different on a portable player, because of various situations you are in at the time. That gives me fun. [39-year-old man who has used iPod for 6 months, office worker, 700 songs are held]

As suggested in the results of the quantitative survey, they typically—to some extent—have a self-contained approach in music entertainment. Their remarks illustrate new ways of enjoying music (consumption styles) they have attained through hard-disk music players like iPod. For them, a hard-disk music player is a device that allows them to randomly enjoy music out of a greater selection of songs than previously possible in conventional devices (cassette player, MD player), loaded from their CD collection. A hard-disk music player is a true portable music player strictly for personal use. In order for the device to be self-contained, it must be able to carry a massive number of songs, which in turn, facilitates random playing. This random playing then releases listeners from the boundaries of existing music context (by genre, by artist, etc.) and invites the creation of new contexts, thereby enhancing the self-contained nature even further. They are enjoying music in this cycle.

For them, consumption of music content is not about listening to each individual song, but about enjoying a stream of music. It must always be a fresh string or stream of music different from

what they have already experienced previously. Their consumption of digital music content is characterized as *self-contained context consumption*. This is an emergence of a new style of music consumption, only possible for hard-disk music players like iPod. The style is facilitated with the concept of *play list* in iPod and other devices. The ability to compile a new string or stream of music, has diluted the concept of *album*, presented conventionally from package providers and artists as producers, and encouraged individual users to compile their own music streams. Consequently, music is increasingly evaluated on the merit of each song. One example is the way iTunes Music Store presented its proliferation scale in the unit of individual songs downloaded, rather than albums. This kind of presentation appears to depict a transition of mentality, with listeners focusing more on individual songs, rather than embracing the supplier-defined unit of *album*.

The following comments are derived from Chaku-uta® Mobile users on their style of enjoying music:

During a break time at work, I just leave my mobile phone to play songs to provide some background music. [...] They are all songs that everyone knows, and will not trigger any music talk. However, it is better than having no music, and stimulates conversation. [...] I don't mind if each song may be just 30 seconds long. It is actually better to have short tunes to enjoy them with my colleagues and build up a lively atmosphere. [25-year-old man who has used Chaku-uta® Mobile for 6 months, office worker, 10 songs are held]

I like upbeat Techno music. I use these types of songs as Chaku-uta, and play them during break time when my friends are around, so that I can show them how to dance to the tunes. [...] The other day, I had my mobile hanging around my neck, and playing Chaku-uta, as I danced across a Shinjuku intersection with my friend. [21-year-old woman who has used Chaku-uta® Mobile for 6 months, university student, three songs are held]

I might listen to and check out music with my friends, but I am more likely to use it as the Sleep Timer when I go to bed. [...] I can operate it by hand, and put it on charge at the same time. It is very convenient. [...] I don't care about (each song being the ring tone length of 30 seconds and) not having the complete song. I fall asleep as I listen to the same songs repeatedly. [19-year-old woman who has used Chaku-uta® Mobile for 1 year, vocational school student, five songs are held]

The analysis of the quantitative survey results also indicated that persons entering the digital-music-content market from now use *both computer-based music players and mobile phones*, and use music to enhance their relationship or communication with their friends and acquaintances instead of merely enjoying music by themselves. Comments from Chaku-uta® Mobile users substantiate the tendency, that is, using music as a tool for sharing various occasions with friends.

As part of the quantitative survey described earlier, people were asked how they use ring tones and Chaku-uta® on mobile phones. The top three answers were as “ring tones (87.3%),” “alarm clock (60.4%),” and “other alarm sounds (46.3%),” The fourth highest ranked answer, however, was to “enjoy them alone as music” (44.0%), and 41.7% said they “enjoy them together with friends or use them to entertain others”—as such indicating that people are beginning to enjoy mobile-downloaded tunes as stand alone songs with friends.

What can be noted in these comments is that songs are enjoyed in the ring tone length of 30 seconds, rather than in their entirety, which is quite different to that of hard-disk music player users, who consume a massive amount of randomly replayed music in various contexts. Their consumption style is summarized as “sharing the occasion of playing popular songs, rather than personal favorites with others to magnify enjoyment.” What counts is how good each NETA (=song as conversation topic) is, rather than how many songs you have in store. Their consumption

of digital music content is characterized as “NETA consumption to be shared among friends.” For them, Chaku-uta® Mobile is perceived as a “music player that plays 30-seconds of everyone’s favorite songs for a shared experience.” The emergence of a new service called Chaku-uta® has brought about this new style in music consumption, while now, the style seems to transform formats of music content.

CONCLUSION

As we have examined, Japan’s digital-music-content market—which started off with the distribution of ring tones as one mobile phone service—has embraced the arrival of fully fledged digital music players and online stores, both designed to be used via computers, such as iPod and iTunes Music Store. From the viewpoint of hardware competition, the market has now entered a stage of combined development of mobile-phone-based devices and computer-based devices. It has brought about two contrasting consumption styles with distinctive characteristics (computer-based and mobile-phone-based consumption of digital music content), and diversified people’s styles in enjoying music at the same time.

People who use a computer-based means to enjoy digital music content, have a self-contained style of consuming music in a specific context, loading a hard-disk music player with a greater amount of music from their personal CD collection than previously possible and enjoying songs in random order. In contrast, people who use mobile-phone-based devices, employ a mobile phone as a communal music player for playing 30-second tunes of high popularity and consume music as topics (information) for sharing various occasions with friends or enhancing the atmosphere.

At present, these styles are separate tendencies and can be observed among users of hard-disk music players and users of mobile phones as music players as two extremes. However, a steady

proliferation of hard-disk or USB flash-memory music players may cause these styles to merge on the side of individual users. Competition between two types of devices has created two distinctive styles of listening to music. Now, each user may start using both of these devices at the same time, hence adopting both styles alongside each other. Such a user may eventually begin to seek both of the styles in one of the two types of devices, which may amount to hardware integration, brought about by the symbiosis of the two different music-listening styles. Closely paying attention to consumer behavior and practices in the future will then give way to rich empirical data to be used to develop and elaborate the stream of thought outlined in this study further.

FURTHER READING

Institute for Information and Communications Policy. (Eds.). (2005). *Henbou suru contents business. (Contents business.)* Tokyo: Toyo keizai shinpo sha.

Masuda, S. (2005). *Sono ongaku no sakusha toha dare ka.* Tokyo: Misuzu shobo.

Masuda, S., & Taniguchi, F. (2005). *Ongaku mirai kei.* Tokyo: Yosen sha.

Ministry of Internal Affairs and Communications. (Eds.). (2005). *Information and communications in Japan 2005.* Tokyo: Gyousei.

Tsuda, D. (2004). *Dare ga ongaku wo korosu no ka.* Tokyo: Shoei sha.

Yoshimi, S. (2004). *Media bunka ron. (Invitation to media cultural studies.)* Tokyo: Yuhikaku.

ENDNOTES

- ¹ The survey was conducted by Macromill Inc. in Japan and Zoomerang, Inc. in the

Foreseeing the Future Lifestyle with Digital Music

U.S. And, it was organized by Hakuhodo Institute of Life and Living and Hakuhodo DY Media Partners' Media Environment Laboratory.

² The survey was conducted by Oval Communication and was organized by Hakuhodo Institute of Life and Living and Hakuhodo DY Media partners' Media Environment Laboratory.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 59-75, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.39

Screening in High Standard: Innovating Film and Television in a Digital age through High Definition

Bas Agterberg

Utrecht University, The Netherlands

ABSTRACT

This chapter introduces the innovation of television by looking at the development of high definition television (HDTV). It argues that the way that the interaction of technological, industrial, and political actors has been crucial in several stages of the development of this innovation. Central question is how industry, broadcasters, and consumers have debated and defined a medium and consequently redefine a medium through innovations. The complexity and the way actors have played a part within the changing media environment is analyzed by looking at the necessity for technological change of the television standard, by relating the media film and television in transition from analogue to digital and by studying case studies of political debates and policy in Europe and the United States.

INTRODUCTION

As a domestic medium, television has basically not changed since the 1950's. The programming, the way of viewing and the technological quality of the image all suggest that the medium's history is a stable one. The major changes have been the introduction of colour in the 60's and cable and satellite in the 80's, offering more channels. The VCR influenced the viewers' possibilities for time shifting. Despite these changes William Uricchio (2002) argues that the applications, cultural status and our assumptions regarding the medium have hardly changed over the past half-century. Digitalisation has offered new possibilities for the medium, but so far consumers have hardly adopted digital television. One of the developments associated with Digital Television (DTV) has been the innovation of the television screen in High Definition Television. This chapter explores

aspects that have affected the so far unsuccessful implementation of HDTV.

The way in which innovation of a medium is promoted often resembles the discourse that was used with the introduction of a previous medium; in the case of Digital TV it's for instance radio and television. William Boddy (2004) argues that the digital moving image has been celebrated within "compelling imaginary scenarios of work and leisure, identity and community" (p. 1). Obviously the cultural and economic stakes in the transition from analogue to digital should be considered by looking at the way the media have been anticipated, debated and taken up by the industry, politics, and audiences.

Technology has to be considered as a cultural construct, so it is essential to look at the way that medium has developed. In terms of television this means how industry, broadcasters and consumers have debated and defined a medium and consequently redefine a medium through innovations.

Within this context the introduction of High Definition Television offers a compelling case study for the pattern in such a technological innovation. The changing media environment is studied by looking at the necessity for technological change of the television standard, by relating the media film and television in transition from analogue to digital and by studying case studies of political debates and policy in Europe and the United States.

DEVELOPING THE HIGH STANDARD

The process of defining a standard for the television image at the beginning of the medium shows the complex interaction of different actors involved in television technology.

The standard for the black and white television image has been set in the 40's and 50's and for colour in the 50's and in the 60's. Andreas Fickers (2004) argues that in the process of standardisation three actors or terrains were active,

the technological, the industrial and the political. The standardisation of the television image has an important political dimension. The difference in the development of colour television in the US and Europe is exemplary for this process. In the U.S. the Federal Communications Commission (FCC) already forced the television industry in 1948 to develop colour TV by freezing the granting of frequencies for television. In 1950 the National Television Committee (NTSC) was founded to create a colour television standard compatible with black and white. In cooperative research of the American radio and television industry an electronic and compatible system was developed within three years. The FCC made the NTSC, with 525 lines, the U.S. standard of colour TV in 1953. In Europe however the black and white television standard was still debated in the beginning of the 50's. Colour would not be introduced until the 60's. The different European countries—Britain, Germany and France—had different standards, PAL (625 lines) and SECAM (819 lines). National interests were more important than the European interests at that moment. The international authorities and organisations such as the International Telecommunication Union (ITU), founded in 1865, and the International Consultative Committee for Radio Transmission (CCRT) did not have the authority to prevent the different standards. As Andreas Fickers (2004) concludes, the decision remained a national one. The choice for a television standard could not be made on the basis of quality of the picture and thus became a political and industrial decision. For the industry the prospect of a reasonable share was better than ending up as the "losing" system. The introduction of two standards of colour television in Europe in 1967 was the result.

The world standards of television are still NTSC (525 lines), PAL (625) and SECAM (625). The digitalisation of media technology makes the improvement of the quality of the screen only a matter of time. However, the development of so called High Definition Television started decades

ago and what seems to be a matter innovation of the quality of television has become an interesting case to show the effects of the transition from analogue to digital, in terms of the changing roles of industry, global politics, of broadcasters and the convergence of different media like television, film and computer.

DEFINING A NEW STANDARD

The Japanese public broadcaster NHK worked on a new television standard since 1968. The idea was to design a system of 1125 lines and a wide screen ratio of 16:9. The necessity for research seemed a bargaining strategy of NHK, according to Winston (1998) it was tradition to use technological advances such as colour or teletext for the renegotiating of the domestic television licence fee level with the Japanese government.

When NHK presented the new HDTV system at international meetings, the quality of its images was admired, but the innovation was observed with suspicion.

During the meetings of the CCRT in 1983 in Algiers a worldwide standard for HDTV was mandated. Three years later, in 1986 at a meeting in Dubrovnik HDTV was put on hold. Technically it was the incompatibility with the existing television standard that was considered a problem by many countries. Yet more important was a socio-economical fear for a Japanese take over that led to a hold.

By putting the world standard for HDTV on a hold in 1986, Winston (1996) slows down the process of innovation, because of fear of losing a market share. It was not the technology, but the economic stakes that suppressed the potential of HDTV (p. 94). This period can be considered the first phase in the development of HDTV.

Technologically the HDTV of the 80's was far from perfect. Although most of the technical problems could be solved within the near future, it was an analogue system in a digitalizing world.

The signals of High definition require a lot of bandwidth, which means that consumers would only get one fifth of the number of television channels. It was however the digital High Definition could use compression techniques to solve this problem.

Most important was that in the 80's the infrastructure was not equipped to deliver HDTV. Therefore in the early stage HDTV was no competitor for film or television in production, distribution or exhibition. It was however promoted as a challenge to the existing concepts of film and television. It was believed that HDTV would change both media fundamentally.

The introduction of HDTV in the 80's has to be considered within a broader range of changes. William Boddy (2004) argues that the new TV delivery systems of cable and direct broadcast satellites, the ongoing consolidation of the telecommunications and computer industries, the international trend toward broadcast deregulation, and the growth of significant new transnational entrepreneurs all point to the late 1980s as the beginning of a period of the greatest change in global television since the decisive growth of international television in the second half of the 1950s. HDTV can thus only be understood in an international context in which the infrastructure and political deregulation play a crucial part in the development (Berghaus, 1994).

INNOVATING AUDIOVISUAL MEDIA

The objective for improving the quality of the image was to achieve an electronic equivalent 35mm film. If the television screen equals the cinema, how does it affect the film industry in terms of production, distribution and exhibition?

Francis Ford Coppola claimed he would never make movies on 35mm again after shooting *One from the Heart* in 1981 with Sony's HDTV equipment (Winston, 1996). Coppola's film failed, costing him his Zoetrope studio and he continued making films on 35mm.

Film industry has in general responded conservatively to digitalisation. Brian Winston (1996) shows in *Technologies of Seeing* that Hollywood responds conservatively to innovation by analysing the way in which Hollywood responded to colour film, 16mm film and HDTV.

In film production nowadays, digital techniques such as video assist for instant reviews of what is shot on film during production on the set, editing and creating visual effects in postproduction are in general use. The shooting and exhibition have remained analogue in a 35mm standard. Some films used the video camera as an aesthetic choice, such as *The Blair Witch Project* (1999) or the Danish DOGMA 95 films. In the case of *The Blair Witch Project* the documentary look, the suggestion that the depicted events actually took place, was also used for a new way of promoting the film through the Internet. Despite specific use of new technologies, these examples do not differ much from traditional ways of producing and releasing a film.

High Definition however offers the possibility to change cinema fundamentally. In shooting a digital file would replace the vulnerable celluloid. Exhibition would even be possible through satellite, involving no material at all. Costs would especially be reduced in distribution and exhibition. How have different actors play a significant part in a possible change to digital cinema so far?

Both film and television are considered “old” media. In this case you might say that in terms of organisation of industry and content the traditions have led to a resistance to innovations.

Thomas Elsaesser (1998) argues that “For this remarkably stable product, digitalisation is a contradictory factor, at once an ingenious technical process of translation, generation and storage, and the totem-notion around a notoriously conservative industry is in the process of reorganizing—and this eventually means reinventing—itsself in order to do much the same as it has always done” (p. 203). The Hollywood industry has already changed a lot after 1950, the

blockbuster films and cinema are only one part of a marketing of products such as related video games, theme parks and the video/DVD market, the pay tv and cable tv.

Within the film infrastructure the exhibitors have no gain in investing in new digital equipment. The distributors would benefit, but are unable to invest in theatres. For Hollywood the change for delivering digital films would only work if it could deliver digitally worldwide. The complex interaction in distribution and exhibition means that little has changed so far.

The transformation of film and television cannot be restricted by looking at the technological innovation, but has to be considered as a fundamental transformation of the concept of the media. Siegfried Zielinski (1999) argues that ‘the particular constellations that arise in this way under the hegemony of the culture industry, structure the process historically’ (p. 19) He distinguishes four dispositif arrangements, the production of illusions of motion in space and time with the aid of picture machines, the cinema, television and advanced audiovision, The transformation is a process in which the periods overlap, interlock, attract and repel each other. In this sense we do not only look at the way the innovation has been developed and implemented, but how it redefines the existing media in a changed system of advanced audiovision that differs fundamentally from the traditional constellations that we knew as cinema and television.

THE INTERNATIONAL POLITICS IN TECHNOLOGICAL INNOVATION

In the development of HD it has been the electronics industry that has played a major part Although HDTV became a public debate in the 80’s, different countries already researched new standards. The American Society of Motion Picture and Television Engineers (SMPTE) set up an HDTV Study Group in 1977. Initially they felt that home

HDTV would depend on audiences becoming used to the standard first in the theatres. But without the interest of the film industry, the researchers introduced it as a new television standard.

In Japan, Europe and the US the electronics industry used the technology debate for lobbying in politics to make governments invest in research.

After 1986 the innovation of HD became a national interest. As Republican congressman Norman Lent put it in 1989 “our future competitiveness in high tech electronics could be at stake here”, or even more fundamental as another republican said “[HDTV] is one of the most important inventions of the 20th century. This is a crown-jewel product” (Winston, 1996, p. 95).

In comparison to the 60's the European Community had in the 80's gained power as a political force. The European Commission launched its strategy on HDTV in 1985. The five year program was called Eureka and was aimed at cornering a lucrative multi-billion dollar market for European electronics companies. It was to help producers, broadcasters and studios to make HDTV format programs.

The Dutch electronics giant Philips and French company Thomson worked together to develop a European HDTV standard. At first it was the analogue MAC device that was subsidized by the EC. In Japan the government supported the electronic industry to develop the MUSE system. Both examples indicate the high expectations for the national electronic industries in the development of HDTV. Despite a political lobby, the US government was reluctant to subsidize the industry. In 1989 Jeffrey Hart argued that the U.S. policy should adapt a national standard to add to U.S. competitiveness in consumer electronics and second that the formation of R&D consortia to develop HDTV technologies should be encouraged and assisted. In short term the development of HDTV was interesting for producers of semi conductors because the digital TV needs much more chips than the Standard Television.

During the 90's the electronic industries tend to cooperate intensively in research and development of new television sets. Philips and Thomson worked in Europe, but also participated in an American research program with Sarnoff Research Laboratory, thus creating a win-win situation (Anonymous, *Economist*, 1992).

IMPLEMENTING THE NEW SCREENS

During the early 90's the first steps in implementing HDTV were taken. In Europe the industry and several (public) broadcasters worked together to produce and screen a growing number of programs in 16:9 with 1250 lines as standard. It was meant to boost the sales of 'wide screen' televisions.

The European countries also created national platforms to promote the changes. In the Netherlands the HDTV Platform was established in December 1989 as a national mechanism to prepare for the introduction of HDTV (Van der Louw, 1990). Basically, coordination, research, information and international cooperation were the key issues for this platform. The foundation was formed by the National Broadcasting Corporation (NOS), the Broadcasting Service Corporation (NOB), the Dutch Telecom service (PTT Telecom), the association of Cable Antenna Operators and Authorities (VECAI) and Philips. Three governmental departments were involved.

The platform had three taskforces, one to stimulate the number of HDTV productions, one to coordinate transmission and one to investigate other electronic services of HDTV (van der Louw, 1990).

Subsidizing HD productions, demonstrating programmes at festivals and research, made promotion for HD. A channel, TVplus, was created in 1991. It broadcasted four hours HD weekly.

Transmission of the HDTV signal became one of the crucial problems to be solved. Therefore cable operators were essential. In the Netherlands

Screening in High Standard

90% of the country is supplied through cable. Although the network was not able to transmit the HD data in the early 90's, solutions were foreseen in the near future (van der Louw, 1990).

The proposed non-broadcast services were for instance HDTV pictures of collections of various museums, or an HDTV theatre showing public events. Most of these services in fact reflect the way in which television was promoted in the 30's and at trade shows throughout Europe and the U.S. in the 40's and 50's.

The platforms were the cooperation between the local governments, cable and telecom organisations and local industries. In the Netherlands the platform played an important part to promote the use of HDTV, but the long term development was decided by European politics.

In the U.S., the FCC played a central part in developments. In 1987 the FCC began to define the technical and juridical aspects of HDTV. In 1990 it held an open entry for the new HDTV standard. The compatibility with the existing NTSC was to be ensured and the enhancement signals were to be sent through a second channel. This solution was possible because in parts of the U.S. there were still channels available. None of the three main consortia, that were in the game for the frequencies, offered the solution. For the FCC it was clear that the digital TV would be the solution and therefore the three consortia were asked to cooperate. In 1993 a so-called Grand Alliance was founded with the companies Zenith, AT&T, General Instruments, that also had MIT and several small companies. To prevent Anti-trust lawsuits, European Philips and Thomson were included as well as the promise to release the patented technology (Kleinsteuber, 1994).

In the meantime the EC debated the subsidy, the standards and implementation. The idea was to renew the EUREKA project. But the UK vetoed the program, because it argued that the analogue-based system would be overruled by the digital development in the U.S. Other arguments were the advantages such as interactivity and suitability

for all forms of distribution, terrestrial, cable and satellite. Some European members feared that the fact that British view on European subsidies was motivated by the fact that British electronics industry was foreign owned.

The EC launched the Advanced Digital Television Technologies, Eureka 1187 in 1994. The Dutch Platform wrote that one and a half year were lost due to the debate and that it meant the end of the European HDMAC system. According to the platform it was a pity because HDMAC was semi digital and it did not share the American optimism on the digital HD. Despite an initial European initiative in developing HD, once again a division within the EC resulted in a slowdown of the process.

By the mid 90's HDTV was a technology that mostly interested the electronic industries, hardly anyone was interested in the content. "The only people talking about HDTV are those who are developing it" according to management consultant John Rose (*Economist*, 1994)

In 1993 Philips announced it was halting its production of HDTV sets and would review its entire strategy if the EC would not come up with the promised subsidy (Barnard, 1993).

For the success of HDTV, not only a subsidy for developing the technology and the infrastructure was required, but also the introduction to the market needed state intervention. However the growing tendency towards liberal market policy made governments careful in subsidizing implementing an innovation like HD.

It turned out that neither the broadcasters, nor the consumers were interested. Was there no audience because there was no content? Or were broadcasters right that the audience did not want to buy expensive HDTV sets?

When television was introduced in the late 40's it was the medium itself that was being sold From manufacturer Allan B. Dumont, "... Sell television on what it can do for the customer. You are selling more than just a gadget—you are selling television itself" (Boddy, 2004, pp. 53-54). With

HDTV the customer knows what television as a medium offers. As van Vliet (2002) observes, "HDTV does not work, because better picture and sound quality do not change Sesame Street."

During the 90's there is a growing market for wide screen televisions, although they only partly offer the quality of the high definition. Advertisements appeal to quality of the screen in relation to lifestyle, offering status, financially as well as a sign of taste. The flat screens of the late 90's are an example of this. However a massive breakthrough has not been achieved.

By the end of the 90's there were two HD world standards, of 1080 and 720 lines. Most technical problems in HD equipment and delivery were solved, so there was no reason why broadcasters and audiences would not adopt the new standard. But in fact especially in Europe at that moment HDTV was unimportant for the broadcasting industries.

THE END OF HDTV?

During the 90's the attention for HDTV faded. The Dutch Platform wrote in September 1994 that all goals had been achieved within four years. It suggests that it created the infrastructure, but denied responsibility for the implementation of HD (Van Eupen, 1994). The way in which HDTV was studied and promoted showed a technological interest, but failed to take into account the social status of film and television at the period. The audience was not attracted to HD by initiatives such as activities by the platform, in 1996 the platform was resolved (Vos, 2000).

None of the initiatives in Europe and the U.S. in the early 90's led to a regular production and screening of HDTV. In 2000, a Dutch professional production magazine Call Sheet wrote:

if you wonder when the HDTV format will be there? It will not. Some years ago the NOB (facility service television) has thrown all standards and

equipment over board, and thus all broadcasting in HD are history. All well known manufacturers have developed HD techniques, but aim at the US, where special TV-stations broadcast in this standard. In the Netherlands HDTV is restricted to some experiments. (Een overzicht, p. 12)

The failure of HDTV is international. The innovation was promoted within the context of television, but did not add anything to the existing concept of television. Brian Winston (1998) offers a model for development of technologies in which this interaction of competence of science is related to social necessity and processes of diffusion. If we consider the case of HDTV in this model, the lack of social necessity and the way of diffusion have been crucial in the innovation's slow acceptance.

Even in several studies at the end of the 1980s noted some of the problems. *Is HDTV a new medium?* was the question at a conference organised by German broadcaster ZDF in 1990. (Lüscher, Paech, & Ziemer, 1991). It was an attempt to discuss the innovation in an interdisciplinary approach, looking at technical aspects, the aesthetics of HDTV and the social consequences of the changes of television.

According to participants a change of content for HDTV was required due to the quality of the screen. As long as there would be compromises with the existing forms of television, HDTV would fail. One of the conclusions was that the innovation could only be successful after 2000 (Lüscher et al., 1991).

Why have governments and electronic industry tried to start the medium a decade earlier? There is a similarity in the development of television standards in Europe in the 50's. Fear of a monopoly made it more attractive to get a part of the cake instead of risking getting none at all.

Consequences of the transformation of this new medium were issues that put the relation of viewer and medium into question. It was the VCR, cable and satellite that played a significant

part in debates on changing media environments. Only few academics discussed issues such as telepresence and a development in aesthetics that would change the concept of television in terms of its social status. At the start of the 90's none of these changes were related to digitalisation, for instance in interactive services in television and other media. It was only five years later that the debate on media shifted to concepts of interactivity and connectivity. HDTV, however, has hardly been part in this debate. Of the few studies, the most compelling one is Brian Winston's case (1996), set as an example for his model technological development and views on how we tend to forget the process of media changes.

REVIVING HDTV IN A DIGITAL CONTEXT

A third phase of HDTV started when it was linked to digital television in the U.S.

Digital television is most of all the change in accessibility of large quantities of digital content on a huge scale. It was no longer cinema that was related to television, but television partly merging with the Internet. The consumer's needs individualize and therefore new services are directed to the individual demands, for instance in electronic program guides (EPG) and video-on-demand (VoD). Harry van Vliet (2002) argues DTV will affect the content, economics and politics of the television business. In short term digital television has not been a commercial success. William Boddy's (2004) examination of digital television's distinct fortunes in the U.S. and GB offers revealing insights into some of the most persistent and difficult issues in media historiography, including roles of national culture, market structures, and ideological valence in setting the course of technological innovation.

In 1997 the FCC granted the free duplicate UHF channels to each U.S. broadcaster. The strategy was due to the political lobby by the

broadcasters, in cooperation with the consumer electronics industry, who were hoping to revive the domestic market. The FCC planned to shut down and auction off all analogue television channels by 2006. Even in a continuing internationalization of media ownership and programme flows, the nationalist sentiment remained a crucial element within political debates.

Immediately after the allocation, broadcast executives expressed reservations about the costs involving HDTV for networks and consumers. The HD broadcast made only one channel available, whereas multicasting in standard definition and interactive services were more attractive for broadcasters.

Only CBS started to produce HDTV programs. But with the approaching 2006 deadline, other broadcasters started to do the same. By 2003 both ABC and CBS delivered their entire prime-time slate of about 15 hours a week in high definition (Snider, 2003).

Despite the slow start in the new millennium more HD content is produced in the U.S. By the end of 2004, 10% of U.S. households had a television capable of displaying HDTV. The question is whether this is the critical mass of 12.8 million sets to make a turning point in the technology's adoption (Harrison, 2005).

In the UK the development of digital television has not been related to HD. The difference between the U.S. and the UK in infrastructure is significant. Britain had a low penetration of cable, only five terrestrial channels and a satellite service by Rupert Murdoch delivering to 3.6 million households. In this context two digital services were launched in Britain in 1998. The first one was Murdoch's new digital satellite service of BskyB, offering 140 channels, and the second one OnDigital by a consortium of ITV broadcasters, offering 30 channels. BskyB offered limited interactivity, OnDigital none at all. The number of channels, all in standard definition, was the main selling point. Despite 1.2 million subscribers, OnDigital failed due to a variety of problems, technological as well as in marketing and management.

Yet digital television in the UK is successful, 44 % of British household had digital television in 2003, more than anywhere in the world (Boddy, 2004). Especially BskyB was successful. To attract the audience Murdoch had given away set top boxes to subscribers in 1999.

Digital television in Britain offered nothing new, but due to the infrastructure its selling point was the number of channels. Within Europe differences in infrastructure have probably determined the adoption of digital television. In the Netherlands the liberalisation of media politics resulted in seven new commercial channels within 15 years, apart from three existing public ones and some regional channels. With a cable penetration of 90%, Dutch viewers receive about 20 foreign channels and some pay TV channels. In 2004 Dutch Telecom company KPN was the first to offer a digital service. Several cable companies, also offering telephone, Internet and television services, soon followed KPN. In 2005 Internet provider Versatel started offering all football matches live. About 10% of Dutch consumers switched to digital television by 2005. In a European context the development is similar to a country like Germany (Döbler, Mühlendorf, & Stark, 2003).

Although the innovations have not been successful yet, it shows the instability of the media constellations. First of all cable companies and telephone companies offer services in delivering a variety of services in Internet, television and telephony. Another thread for existing models of broadcasting are technological devices such as the digital video recorder—especially its possibility of recording and watching with a small delay changes television's sense of liveness or simultaneity. The fear of advertisers and commercial networks is a decrease of revenues. Therefore ways of advertising and participating in programmes or offering onscreen services will change content of television.

These changes will affect the social position of television in terms its relation to the audience. As Boddy (2004) quotes a newspaper statement

by BBC chairman John Birt, “the end may be in sight for broadcasting as a communal experience” (p. 86). Of course the traditional models of broadcasting will exist in future, but not be as dominant as it used to be in the second half of the 20th century. Changes in the relation to the audience and the way cultural products are consumed have and will change in digitalisation if television and Internet tend to merge.

With the development of digital services, HD has become a small part in the discourse on changing media. Yet in recent years it seems to become more important. The U.S. strategy definitely plays a part. The necessity to produce HDTV has resulted in an increase in HD productions. The improvement of the equipment is another reason. Within the context of digitalisation changes within cinema create possibilities as well.

To promote digital cinema, the European Media program has subsidized a project offering equipment to arthouse cinemas at low costs. The condition is to screen national and European films digitally. Especially documentaries have found a possibility for theatrical release.

It seems that it's not the Hollywood industry that initiates a change to digital high standard, but the marginalized media industry. Most European films are low budget and the production costs are hardly affected by producing digitally. But because public broadcasters and national film funds finance most European films, by stimulating digital cinema they also play a part in distribution and screening.

Although Peter Greenaway already used HD in his feature film *Prospero's Books* (1989), in 2003 the first Dutch feature was to be shot in HD completely. In postproduction the film *Pipo and the PPParelders* was transferred to 35mm released in theatres. Since then more films have been shot digitally and some of them also released digitally. The film *0605* (2005), a conspiracy thriller about the murder of politician Pim Fortuyn in 2002, was even first released on the Internet by co-producer and provider Tiscali. It caused a media hype, but eventually only a few people did download, pay and watch the film.

Now that broadcasters, independent producers and related industries seem to adopt the HD technology, the consumers will have to follow. Although so far consumers have not adopted HDTV, for several reasons HD will become standard for consumers. Even computer monitors have a higher resolution than standard television, thus if Internet and Television merge, it might use a higher standard to do so.

Van Vliet (2002) argues that media developments can be considered in the context of what Pine and Gilmore call the new economy, meaning that people do not want 'just' a product, but want an experience. HD as an innovation has been promoted as a new experience. In this sense HD also recalls film historian Tom Gunning's concept of early cinema as a cinema of attraction, because it was the sensation of imagery that was the attraction for the cinema audiences before 1905.

This sense of attraction is reflected in the European broadcaster Euro1080, set up as an HDTV channel. Gabriel Fehervari, a Belgian Hungarian launched the channel in 2004. It aims at producing sports and concerts, making 1200 productions each year. In an interview with Belgium newspaper *De Standaard* Fehervari argues that other initiatives by broadcasters like French TF1 or BskyB make clear that HDTV is becoming more important to European broadcasters (Petitjean, 2005). In the Netherlands regional broadcasters, public channels that deliver to a small market of several million viewers, announced to experiment with HDTV in April 2005 by opening its channel for programmes of Euro1080. But the promotion of a sensation has been the sole attraction of the innovation of HDTV up until 2005.

CONCLUSION

The case of HD shows that within 25 years the media landscape has changed. The initial innovation of HDTV was the quality and ratio of the electronic picture. The idea was that it would

change television and film into a new medium. More important, the development of HDTV was a necessity for the consumers electronics industry; it would boost sales of chips and sales of new sets. The dichotomy between possibilities and necessity has determined the developments of HDTV.

In response to Japanese prototypes, the American and European industry made sure that a new standard would not lead to a Japanese monopoly. National interests made the innovation of television a political issue.

The electronics industry convinced regulators since the 1980's that HDTV is necessary for consumers electronics industry and for the economy. The U.S. and Japanese authorities as well as the European Union have in different ways contributed to the eventual success of HDTV.

Despite political back up, especially in Europe, the implementation of HDTV did not succeed. HD did not only concern the technology of television, but also of infrastructure through cable and satellite. The infrastructure did improve, but broadcasters and film industry were only interested in HDTV in controlling their position within the media. Consumers seemed to be ignored, there was, and perhaps still is, no demand for improvement of the pictorial quality by the audience. By the middle of the 1990s the HDTV hype was over. The European authorities cut subsidies for HD developments. The U.S. authorities granted UHF channels for digital broadcasting in HD to the American broadcasting companies.

After 2000, the digital HD revived. The FCC grant of free spectrum to the broadcasters to produce digital HDTV television may have been crucial for HD, but changes within cinema and the change of interaction between media such as telephony and the Internet has changed the actors involved. New digital services of interactivity change the traditional concept of television as a domestic broadcast medium. The opportunities for theatrical release at low costs, combined with other media for releasing films in high definition standard do offer new ways of thinking about traditional media film and television.

Initially the promise of new content, for instance in a change of aesthetics in programmes or in a concept like telepresence, was discussed as consequence of HD. However the electronics industry was depending on companies that used HD in traditional production. Thus the audience could hardly be shown the advantages of the innovation.

The HD technology has improved over the past 15 years. The compatibility, the definition of a world standard and improvement of camera equipment all made it easier for broadcasters or independent producers to adopt the HD technology. In different ways we see changes in production, postproduction and distribution in which HD plays a part. So far, these changes do not change the traditional concept of film or television. Now that both industry and broadcasters finally plan to use HD, the audience will be forced to buy HDTV-sets. The FCC will shut down analogue television in the near future.

Therefore it can be argued that HD will succeed, due to political and manufacturers persistence. For the audience the main attraction in digital television is the number of channels and interactivity. If HD is associated with these services, consumers will be more eager to adopt.

The digital developments will change the use of "old" media like film and television, although the traditional concepts will remain, at least for a while. The question remains in what way the developments will change socio-cultural concepts. How does digital HD affect ways of production, distribution and exhibition? In what way will it change the content of this Audiovision?

The study of innovating a medium like television shows that an unstable constellation of audiovisual media has developed. The consequences for media organisations, content and audience trends involve many different actors. It's my belief that the process of transition of traditional concepts into a new audiovision will only be developed in adoption and applications of an innovation by new generations.

REFERENCES

Anonymous (1992, October 3). Big Television, Big deal. *Economist*, 325(7779), 89-90.

Anonymous (1994, September 24). Screened Out, *Economist*, 332(7882), 66.

Anonymus (2000, November). *Call sheet 27* (p. 12).

Barnard, B. (1993, October 1). HDTV – High definition debate. *Europe*, (330), 34.

Berghaus, M. (1994). Multimedia-Zukunft – Herausforderung für die Medien- und Kommunikationswissenschaft: Multimedia future, challenges for the media and communication studies. *Rundfunk und Fernsehen 42. Jahrgang nr, 3*, 404-412.

Big television, big deal. (1992, October 3). *Economist*, 325(7779), 89-90.

Boddy, W. (2004). *New Media and popular imagination*. Oxford: Oxford University Press.

Döbler, T., Mühlenfeld, H., & Stark, B. (2003). Acceptance and diffusion of digital television in Germany. In A. Schorr, B. Campbell, & M. Schenk (Eds.), *Communication research and media science in Europe* (pp. 336-379). Berlin: Mouton de Gruyter.

Een overzicht van IBC Amsterdam 2000 - An overview of International Broadcasting Convention, Amsterdam 2000. (2000). *Call sheet 27*, p. 12.

Elsaesser, T. (1998). Digital cinema: Delivery, event, time. In T. Elsaesser (Ed.), *Cinema futures: Cain, Able or cable* (pp. 201-222). Amsterdam: Amsterdam University Press.

Eupen, T. van (1994). *Handbook HDTV Platform 1990-1994*. Hilversum: Netherlands Platform HCTV.

Screening in High Standard

- Fickers, A. (2004). De coloribus dispanndem est - About colour is disrupted. The failure of standardising colour TV in Europe. In O. de Wit (Ed.), *Tijdschrift voor Mediageschiedenis - Magazine for Media History* (Vol. 7, pp. 90-117). Amsterdam: Boom.
- Harrison, C. (2005, April 30). *HDTV sales keep rising, but content is scarce*. Retrieved August 25, 2005, from <http://www.northjersey.com>
- Hart, J. A. (1989, summer). Responding to the challenge of HDTV. *California Management Review*, 31(4), 132-145.
- Kleinsteuber, H. J. (1994). HDTV-Politik; Die Entstehung der hochauflösenden Fernsehtechnik im High Tech-Dreieck Japan, Europa, USA - HDTV Politics, the development of high definition television technique in the tech-triangle Japan, Europe, USA. *Rundfunk und Fernsehen* 42. Jahrgang nr, 1, 5-23.
- Louw, A. van der (1990). Paper on founding 'Stichting Nederlands Platform HDTV. Hilversum: Dutch Platform HDTV Foundation.
- Lüscher, K., Paech, J., & Ziemer, A. (Eds.) (1991). *HDTV—ein neues Medium? - HDTV—A new medium?* Mainz: Zweite Deutsche Rundfunk.
- Petitjean, F.c (2005, May 19). Euro1080 laat Europa proeven van HDTV - Euro1080 does Europe taste HDTV. *De Standaard*, Groot-Bijgaarden (B), 19. Retrieved August 25, 2005, from <http://www.standaard.be/Thema/Multimedia/index.asp?articleID=G9AEVER&subsectionid=11>
- Snider, M. (2003, January 7). A defining moment for TV. *USA Today*, 7B-8B.
- Uricchio, W. (2002). Cinema as television. In D. Harris (Ed.), *New media book*. London: BFI Press.
- Van Vliet, H. (2002). Where television and Internet meet. Retrieved March 13, 2002, from E-view02-1.comcom.kub.nl/e-view/02-1/vliet.htm
- Vos, B. (2000, January). HDTV Platform ter ziele. In *Video&Audio Report* (pp. 40-41).
- Winston, B. (1996). *Technologies of seeing*. London: BFI Publishing.
- Winston, B. (1998). *Media technology and society*. London: Routledge.
- Zielinski, S. (1999). *Audiovisions, Cinema and television as entr'actes in history*. Amsterdam: Amsterdam University Press.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 191-208, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.40

Digital Cinema as Disruptive Technology: Exploring New Business Models in the Age of Digital Distribution

Nigel Culkin

University of Hertfordshire, UK

Keith Randle

University of Hertfordshire, UK

Norbert Morawetz

University of Hertfordshire, UK

ABSTRACT

The distribution and exhibition of motion pictures are at a crossroads. Ever since the medium was invented in the 1890s the “picture” has been brought to the spectator in the form of photochemical images stored on strips of celluloid film passed in intermittent motion through a projector. Now, at the beginning of the 21st century, an entirely new method has emerged, using digitally stored data in place of film and barely needing any physical support other than a computerised file. This opens an intriguing portfolio of revenue-generating opportunities for the movie exhibitor. This chapter

will give an overview of current developments in digital cinema (d-cinema). It will examine potential new business models in an industry wedded to the analogue process. The authors will consider the strategies of companies at the forefront of the technology; implications associated with the change; and how different territories might adapt in order to accommodate this transition.

INTRODUCTION

In this chapter we will consider how the transition from film to digital product is likely to affect an

industry that has been wedded to an analogue process for more than 100 years. Rather than contributing further to the debate about the qualities of competing technologies or the creative merits or demerits of digital product, this chapter will focus on the development of potentially new business models in the global film industry. The authors will examine the strategies of the companies at the forefront of the technology; the financial implications associated with change; and how different territories are adapting in order to accommodate this transition.

D-Cinema: An Idle Revolution?

Ever since 1999, when George Lucas launched *Star Wars: Phantom Menace* on four digital screens in America, prophets of d-cinema (that is using digitally stored data in place of film) have proclaimed that it will change the film industry forever. Six years later d-cinema is still far away from wide implementation.

Belton (2002) has even declared d-cinema to be a “false revolution” because it does not transform the nature of the motion picture experience for the audience, stating that “One obvious problem with digital cinema is that it has no novelty value, at least not for film audiences.” He argues that in a marketplace in which the word “digital” sells consumer products, “it is digital sound (and not digital projection) that marks for consumers the entry of motion pictures into the digital era.”

His arguments cannot be easily dismissed especially when considering the explicit goal of digital projector manufacturers to produce an image quality that *equals* that of traditional film prints. Slater (2002) has compared the cinema exhibition chain of traditional film and electronic/d-cinema. When looking for an answer to the question what problem electronic/d-cinema is trying to solve, he could not find “one single good technical or operational reason why the whole system should

be replaced” (p. 43), with film being high quality, flexible, and most important future proof.

Still key players in the industry seem to be determined to make d-cinema happen, such as John Filthian, president of the National Association of Theater Owners (NATO) in America, who has said that “digital cinema will be the biggest transition technology in the history of the movie industry” (Baird, 2004).

The Dilemma

However, with just over 120,000 screens worldwide, the cinema market has been deemed too small to support any major technological innovation by itself (*Screen Digest*, 2003). This means that no manufacturer is currently in the position to produce a digital projector at such a competitive price, that exhibitors could afford to pay for the switching costs themselves. Consequently, the matter of financing the conversion to d-cinema has been passed on to distributors, who are claimed to benefit the most from d-cinema by saving on print costs.

The problem is further intensified, when more than one company for d-cinema equipment tries to serve the market, and more than one standard exists. For distributors however, it does only make sense to fund d-cinema conversion, if a single standard exists (similar to the 35mm standard), otherwise the cost savings of digital are offset by producing several masters for different standards.

Thus the need arises for a clearly specified standard—an issue that took the participating players more than 6 years to resolve.

These players can be categorized into three basic groups: equipment manufacturers, institutional players, and distributors. In the following section the major players and their stakes in d-cinema will be introduced briefly while reflecting on their role in the search for a single standard.

SETTING A STANDARD, SHAPING THE MARKET

The earliest attempts to gain a dominant market position and to set standards have been made by the main competitors in digital projector manufacturing, Texas Instruments (TI) (DLP Cinema), Sony (GLV), and JVC (D-ILA).

While JVC's position in the market has been marginalised, TI has licensed its DLP Cinema technology to projector manufacturers such as Barco, Christie Digital, and DPI/NEC and has by doing so gained an early advantage for its standard over Sony. It soon became evident however, that a working business model for d-cinema has to include not just a projector, but must consist of a bundle with digital distribution and server hardware. The main competitors in this area are companies such as QuVis, GDC, XDC, and AccessIT.

As technology companies are clearly wedded to their own solutions, pointing out flaws in competing technologies while downplaying the shortcomings of their own, institutional players stepped in to help specify a single standard and support the development of d-cinema.

In the U.S. the institution in charge is a special commission (DC-28) of the Society of Motion Picture and Television Engineers (SMPTE), in Europe it is the European Digital Cinema Forum (EDCF), in Japan the Digital Cinema Consortium of Japan (DCCJ NPO), and in China the State Administration of Radio, Film, and Television (SARFT).

The power of these institutions has however been limited, as they tend to avoid taking sides and promote all solutions equally.

In 2002 the Digital Cinema Incentive (DCI) was formed, a joint venture of the seven major Hollywood studios (Disney, Fox, MGM, Paramount, Sony Pictures Entertainment, Universal, and Warner Bros.) that has dwarfed the importance of the other institutions to establish guidelines for

d-cinema into insignificance. Although it still is the SMPTE that ratifies technical standards for cinema and television in America, even Peter Symes, vice president engineering at SMPTE has to admit that "the DCI represents a significant party of interest" and it was very unlikely that the SMPTE could reach consensus on something if the DCI was in favour of something else (Crabtree, 2004).

In July 2005 the DCI had published its final overall system requirements and specifications for d-cinema. In their guidelines they have opted for a scalable solution from 2K to 4K and have therefore left the decision which projector technology will be used in theatres to the market.

They have however selected JPG2000 as the image coding system to be used in the delivery of digital motion pictures. This decision is very likely to eliminate competing systems, such as various MPEG standards or newcomer eTreppid from the market and forces all major manufacturers to comply with the standard (Crabtree, 2004).

DCI specifications have consequently been branded to be synonymous with the term *d-cinema*, as Tim Partridge, senior vice president and general manager of the professional division for Dolby Laboratories has explained: "I think we [Dolby Laboratories] use the terms in what has become the standard way. D-cinema to us means DCI standard equipment, E-cinema is everything below that" (DCR, 2005b).

The question arises, why the *d-cinema revolution* still has not fully begun, when the dominating market forces (the Hollywood studios) can so easily safeguard their interests. One might argue that all they have to do, to continue their international market supremacy, is to replicate the existing power structure and apply it to the d-cinema market. What does stop them? Can the hesitancy of the "majors" to move along with d-cinema quickly be interpreted as an indication of concern about the impact the digital transition will have on the industry?

D-CINEMA: A DISRUPTIVE TECHNOLOGY?

Digital cinema [...] is perhaps the most significant challenge to the cinema industry since the introduction of sound on film. As with any new technology, there are those who want to do it fast, and those who want to do it right. As we move down this path, let's not forget the lesson learned with the introduction of digital audio for film in the '90s. Cinema Digital Sound, a division of Optical Radiation Corporation, was the first to put digital audio on 35mm film. Very, very few remember CDS, who closed their doors long ago. Such are the rewards for being first. (MKPE Consulting LLC, 2005)

As the previous statement shows, there are considerable risks attached with moving into a market too fast. Indeed some of the companies who tried to find an early foothold in d-cinema have already closed their business in this field (most notably Boeing).

However as the literature on *disruptive innovation* and *disruptive technology* has pointed out, one of the biggest risks for incumbents in any market is to move too slowly.

Disruptive innovation and disruptive technology are emerging and increasingly prominent business terms describing a revolutionary change in an industry (Thomond et al., 2003). The term disruptive technology was first marked by Christensen (1997) to describe a technological discontinuity that causes the failure of incumbents in a market. Danneels (2004) defines disruptive technology as a technology that changes the bases of competition by changing the performance metrics along which firms compete. Customers seeking certain benefits determine which attributes they value in a product, with different customer groups valuing different attributes. New products based on a disruptive technology have different attribute sets than existing products. They tend to have initially a lower level of performance on

dimensions relevant to mainstream market segments but have higher performance on dimensions valued by remote or emerging market segments. Christensen (2000) has characterized disruptive technologies as typically “simpler, cheaper, and more reliable and convenient than established technologies” (p. 192).

When the disruption has established itself in an underserved customer segment, major players may be displaced as disrupter's develop new wealth opportunities. The consequences of not securing disruptive innovations can be “far more devastating than simply lost opportunities or lost market share” (Thomond et al., 2003, p. 6). Following these definitions d-cinema can easily be identified as a disruptive technology.

In the following sections we will map out current important issues stopping incumbents from embracing the technology and exploiting its full potential. We will show how d-cinema changes the basis of competition in the industry and helps new markets to emerge. We will also show how incumbents can slow down the development to their advantage, and in doing so deliberately risk losing niche markets.

Single Standard vs. Consumer Market

One of the prerequisites for a wide roll out of d-cinema has been the readiness of tested equipment. There is a broad consent among industry experts that the problems of digital projectors with image quality have now been solved. However the availability of technology that meets the requirements has not propelled the number of installed d-cinema projectors tremendously. Walt Ordway, chief technology officer for the DCI, does not see a wide implementation of d-cinema for at least 4-6 years, although an initial roll out could take place “in the next year or so.” Ordway notes that one problem with the systems that are currently fielded is their lack of security constraints and a common standard (DCR, 2005a).

On an exhibitor's wish list for regulators of d-cinema, a common global standard would rank among the top objectives.¹ There are two rivalling technologies in the projector market, namely TIs 2K (DLP) standard, and Sony's 4K (GLV) standard.² TI has invested an "unspeakably large amount of money" (Screen Digest, 2003, p. 30) into its DLP technology, revealing the exact amount not even to its shareholders, and currently controls the market. Sony on the other hand keeps announcing its 4K projector and plays on the preference of studios for a 4K solution. Despite Sony's de facto, zero-market share, the DCI (in which Sony is a member) has endorsed both 2K and 4K standards when choosing the JPEG 2000 codec for studio d-cinema release masters.

Although the revenues from the high-end d-cinema market can be substantial, the real market to be won is the home cinema market. For both companies the market for d-cinema is therefore a kind of branding exercise for reaping rewards in the consumer electronics (CE) market. The underlying logic (e.g., for TI) is the following:

Cinema audiences will see the DLP logo before the start of every film in a d-cinema and come to associate it with the highest quality of picture viewing. They will then seek it out or of opt for it in their local CE market. (Screen Digest, 2003)

The situation is similar to the introduction of digital sound into cinemas, which was also seen as a preliminary battle "for the potentially much more lucrative market for digital sound in the home" (Belton, 2002, p. 101). During the 1990s three different companies tried to establish their proprietary technology as a cinema standard, namely DTS (Universal/MCA), SDDS (Sony), and Dolby digital (Dolby Laboratories). Since each standard was able to capture a sufficient market share, multi-standards in cinema sound continue to exist.

Multi-standards in d-cinema are certainly not a desired outcome for film distributors as well as

exhibitors. Still, as long as d-cinema is only considered as a prefacing market for the companies who actually develop the technologies in use, standards will be an issue.

A Market with Network Effects

One of the reasons why a common standard is so desirable is that the market for d-cinema exhibits positive consumption and production externalities. Positive consumption (network) externalities exist, when the value of a unit of the good increases with the expected number of units sold (Economides, 1996).

If both TI (2K) and Sony (4K) establish their incompatible projectors in the market, the market is split into two different networks, one for 2K projectors and one for 4K projectors. Each of these networks consists of sellers (the Hollywood studios plus independent content producers) and buyers (exhibitors). If an exhibitor installs a 2K projector he joins the 2K network, and the utility of this projector increases with every exhibitor who joins this network because the increasing size of the (2K) market increases the expected utility of all participants as they have more partners to trade with. This is especially true for the Hollywood studios, as for them the utility of the market is at a maximum, when there is only one standard (either 2K or 4K) and they can trade with all the exhibitors without incurring any additional costs.

Charles Swartz, CEO of the USC Entertainment Technology Center, has stressed the importance of a single, global, interoperable standard for d-cinema by referring to 35mm which had all these characteristics; the single standard ultimately enabled film to become a "medium of tremendous power" (Crabtree, 2003). A situation with a double standard would therefore not be progress but a step backward for the industry.

Waiting for Sony

As a vertical integrated corporation Sony faces competition on each stage of the value chain,

with contradicting objectives adding to the complexity.

Being a member of the DCI, Sony, the studio, has been able to secure that the DCI agreed on scalable format standards from 2K to 4K, and has thereby strengthened the position of Sony, the projector manufacturer. On the other side however, it has also agreed to accept rival technology as a standard.

There is a strong and compelling argument that says that since the studios are the real beneficiaries of d-cinema (through print savings) they should also fund the projector installation (Baird, 2004).

One possible way to realize this funding sees the majors setting up an independent financing entity that allows cinema owners to decide on their own on how to use the funds to upgrade their cinemas along DCI standards (Kilday, 2004).

If this happens, Sony will find itself in the contradictory situation, where as a member of the DCI it will have to (directly or indirectly) subsidize its competitors in equipment manufacturing.

As an equipment manufacturer Sony competes against TI and its licensees Christie Digital, Barco, and NEC. It has to do so because it wants to protect its market prospects in consumer electronics, where it again competes against TI licensees, for example, Samsung, Sanyo, or Marantz.

On each stage of the value chain Sony has more to lose than its competitors (the subsequent market) but it is also the only player that can exacerbate power at a higher level by participating in the DCI. Although Sony has not even proved yet that its 4K projector is more than a functioning prototype, it is therefore still a market force one has to take into account.

Sony's strategy clearly is to play on time, and by cleverly doing so, it has managed to stay in a race that otherwise would have been long over. Through repeatedly announcing its 4K projector it has raised industry uncertainty and stopped investments. As Travis Reid, president of the cinema chain Loews Cineplex said:

... the fact that (a 4K projector) exists is making everyone stop to think, and admitted that if there was no deployment (of 4K), then 2K would have been the initial rollout. (Sperling, 2004)

An exhibitor quoted in *Hollywood Reporter* said that:

They [Sony] are clearly trying to slow down the forward momentum of 2K being adopted and rolled out. It will be interesting to see how they've come along to being a real live projector; there are a lot of studios saying, "If this is close, then let's wait." TI [Texas Instruments] can't be happy about it. (Sperling, 2004)

Doug Darrow, Project Manager for d-cinema at TI challenges Sony with the strong argument that it has not demonstrated that 4K projectors will actually work in theatres for a few years, in contrast to TI. However, this argument could backfire. If there is no pressing economic need (and there is none) to switch to digital projection immediately, then exhibitors and studios might well postpone their investment decisions and wait to see if Sony's 4K projector can deliver.

TI has expressed little interest in the race to 4K and focuses on the commercialisation of 2K, with "the biggest challenge not lying in resolution but in costs" (Kaufman, 2004).

A Complex Transition

John Fithian, president of the National Association of Theatre Owners (NATO), states "it is fairly clear that studios will fund the transition," since "they will save a tremendous amount of money from the conversion" (Baird, 2004).

The modus operandi of this transition is far away from being "fairly clear," though. The roll-out plan that determines which cinemas will get converted first must be consensually negotiated with all interest parties. Should the transition start only in North America or internationally, by state, by exhibitor, by market, or where low

technology and penetration allow for fast entry? (Fuchs, 2004b).

The Board of directors of the NATO (2004) has formulated a resolution of requirements that need to be fulfilled for the transition to be a success. A key point for them is that interoperable, reliable equipment is in place (both NATO and DCI have pledged for a beta testing phase) that at least equals the image quality of 35mm. The equipment must further be easy to upgrade at reasonable cost, as technology advances; must be built around clearly defined standards; and has to be produced by competing multiple vendors.

For exhibitors a desirable financing plan for the transition has to ensure that all movie complexes and auditoriums, regardless of size or geographic location can participate within reasonable time, studios are committed to provide digital content, and exhibitors can independently select the equipment, and own it at the end of the financing period. Furthermore they ask for a “no dark screen” policy, meaning that films play in a nonrepudiate manner unless the exhibitor attempts to play the film in a completely different venue and that they can decide on their own about schedules, advertisements, trailers, and other content (NATO, 2004, p. 3).

From a studio point of view, subsidising the full cost of the equipment without any obligations to exhibitors does not seem to be a very healthy economic proposition. A solution that does not contain any obligations to exhibitors to show content is a de facto cross-subsidisation for independent filmmakers, as they will benefit from the installation without contributing to the costs.

In the question of ownership therefore rests a crucial point in the transition to d-cinema. The immense undertaking to convert thousands of screens in America and internationally is not an “everyday” logistic and organisational challenge. To resolve the major issues it will take time. For the moment this will delay the d-cinema revolution further, as exhibitors have little incentive to enter the market on their own before the studios have come to a decision.

THE NEW DIGITAL DEAL

The paralysis that results from the funding problem has left the market for the moment to third-party players.

A first wave of third-party players proposed to pay the upfront costs for digital projectors in return for a fee (per-print, per-screening, per-ticket, or an annual contract) and promised to ensure that there is no shift in the balance of power between distributors and exhibitors (*Screen Digest*, 2003). The success of these companies (with some exemptions such as Kodak) has been very modest so far. In 2003 Boeing Digital Cinema closed its d-cinema business that was once projected to bring \$1 billion a year in revenue (Gates, 2003). At the same time, Technicolor has scaled down its ambitions and based on latest reports, Elsacom is still in the testing phase.

A new wave of investment into d-cinema comes from state initiatives and independent film distributors. By targeting niche markets these players fragment the market and can then gradually expand their business into the mainstream.

These dynamics are reflected in Christensen’s (1997) disruptive technology framework. He argues that incumbents are resource dependent (Pfeffer & Salancik, 1978) on their most demanding customers and focus their investment towards innovations that are valued by their mainstream customers. In contrast to this, new entrants are not constraint by and can not rely on an existing customer base, thus they are “forced to identify consumers who value the new features offered by the new technology and support its further development” (Adner, 2002).

In this regard, it seems as if the first wave of new entrants into d-cinema failed to correctly identify these “new customers.” Most of these ventures were aimed right from the beginning at the mainstream market, ignoring the importance to segment the market that has been strongly underlined by Moore (1991). This is in stark contrast to the new wave of entrants, who are very

focused on niche markets, namely the distribution of independent content.

It is remarkable in this context that major new initiatives (e.g., the UK Film Councils Screen Network) are state driven. So far government support for the film industry was mainly aimed at subsidising film production, often resulting in the so-produced films not finding exhibition and reaching only a very limited audience. The idea to provide distribution and exhibition for this content through installing digital screens is a strong shift away from the traditional production-oriented subsidy logic to a more market oriented one. It directly addresses a market failure in exhibition that provides only very limited “screen space” to “art-house” films.

While d-cinema might potentially help independent filmmakers to overcome the market barriers to distribution, this does not necessarily mean that the even bigger barriers of consumer habits and tastes can be overcome as well. The American film industry has shaped audience tastes for generations resulting in a market share of up to over 90% in Western countries. Although this domination might be a portrait of distorted consumer preferences, resulting from restricted consumer choice offered in local cinemas, the majority of mainstream audience taste is unlikely to change overnight. It will take more than access to the market to re-win significant audience shares for independent (European) cinema. Nevertheless higher exposure to content is an essential first step to alter cinema goer’s habits in the long run.

IMPLICATIONS FOR THE CURRENT STRUCTURE OF THE FILM INDUSTRY

As the aforementioned examples clearly show, d-cinema not only allows smaller competitors to carve out viable market niches but can bring completely new markets into existence. Remote areas whose access to audiovisual content that has been limited so far will now be as easily reached

as regions with developed infrastructures. Both developments will increase competition: Firstly through players who fragment the market and then try to expand their strongholds into the mainstream market, and secondly through companies who operate from new strong domestic markets.

Without additional costs in supplying additional “prints” for screens, economies of scale that have shielded Hollywood studios from low-budget competitors for nearly a century are eradicated. Consequently, the release of a film will become “less of a financial decision and more of a marketing decision” (TI, 2003). If this will truly give independents leverage remains to be seen.

The majors themselves have hardly ever regarded printing costs as an obstacle to distribution. With “ultrawide releases” (3000+ prints) on the rise (*Screen Digest*, 2003), d-cinema opens the door to an ever higher pervasiveness of Hollywood product.

The studios have recently shortened the time lags between release dates in international markets and global, simultaneous, film starts have become a trend (e.g., *The Matrix II, III*, *Star Wars*, *Harry Potter*, *Lord of The Rings*). One reason for this might be that the Internet has facilitated the development of a global film audience with increasingly convergent tastes. This audience readily turns to pirated copies of films if time lags between national releases are too long. The combination of d-cinema and global simultaneous film starts is likely to propel this trend further with studios staging and marketing their productions as global events for a global box office.

Another advantage studios will take along into the era of d-cinema will be their business model of a portfolio approach to film production and distribution. The strategy to spread risk onto a slate of films is even more effective with d-cinema: If a film is a success, studios can immediately supply additional screens at virtually no cost, if a film is a failure, it can be withdrawn without bearing the sunk costs of film prints.

In this context d-cinema appears to be less a disruptive but rather a sustaining technology for the majors. Sustaining technologies are consistent with a firm's business model (Christensen & Raynor, 2003) and improve the performance of established products through the "current technology product paradigm" (Kostoff, Boylan, & Simons, 2004). D-cinema bears both the characteristics of a sustaining and a disruptive technology, making it difficult to recognize the distinction. It is exactly this failure to address technological innovations appropriately that according to Christensen causes successful incumbents to stumble or even disappear from the market.

Historically, the film industry has already mastered a number of disruptive technologies (e.g., television, video recorder), despite its traditional reluctance to embrace new technologies. Its nostrum on how to deal with new technologies seems to be a combined strategy of vertical disintegration and diversification, which has led to an oligopolistic industry structure.

During the 1990s the major studios diversified themselves into the independent market by setting up or buying independent distributors (New Line Cinema, Miramax, Fox Searchlight, etc.), a trend that is likely to be intensified by d-cinema. Thus, if entrepreneurial firms take advantage of the disruptive technology d-cinema and "redefine current markets" (Kostoff et al., 2004) the majors might simply counter them through acquisition and integration into their corporate structure.

As local independent distributors develop an expertise on how to successfully handle "difficult" films in their markets, the majors might also begin to disintegrate further and try to outsource some of their distribution to these companies in the same way that they have outsourced production through flexible specialization (see Christopherson & Storper, 1986, 1989).

As the importance of a physical distribution structure diminishes their means to keep control over the industry would then be through controlling intellectual property rights as well as keeping

a strong stake in development, packaging, and financing and providing expertise in film production, marketing and distribution to contractors.

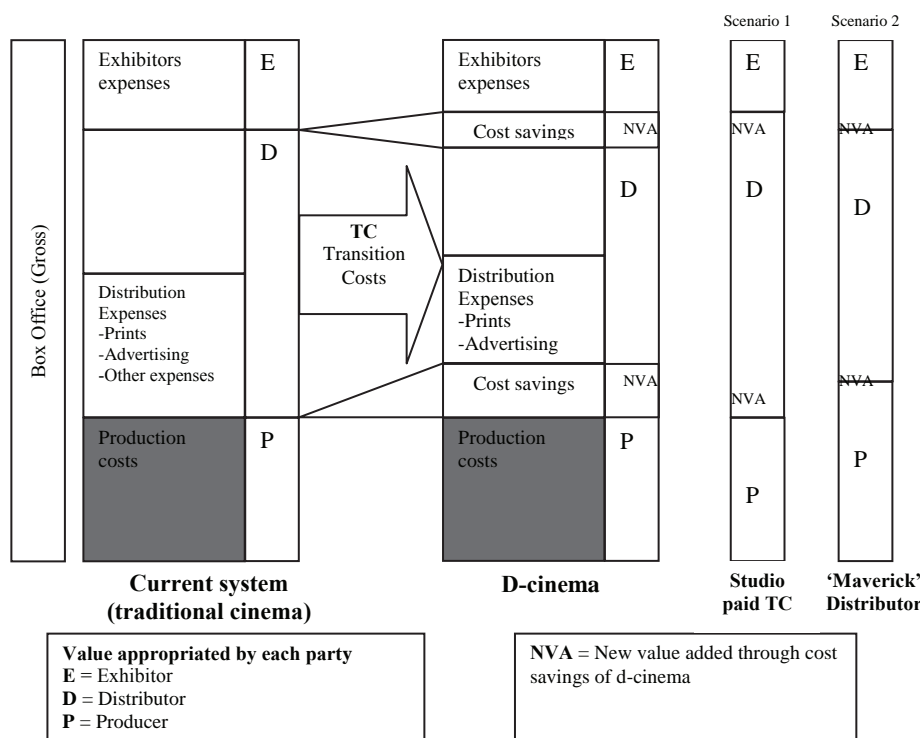
The Hold Up Problem

Figure 1 shows a simplified model of money flows in the traditional film industry value chain and in a system of d-cinema (a comprehensive discussion on profit calculation and accounting practices in the Hollywood studio system can be found in Daniels, Leedy, & Sills, 1998).

In the current system, box office receipts are first split between exhibitors and distributors. Exhibitors are the first to deduct their expenses, the value they appropriate is E. Distributors then deduct their *distribution fee*, which is intended to cover their overhead costs (offices, corporate expenses, distribution efforts) and the *distribution expenses* (prints and advertising). The distribution fee varies according to geographic area and market between 25% and up to 50% of the revenue. The value the distributors appropriate is D. The remainder, P, is allocated to the producers of the film.

After the transition to a system of d-cinema, cost savings arise: distribution expenses are reduced through cutting print costs, distribution fees are lowered through reduced studio overhead. It will be interesting to see if studios can appropriate the added value they have created through cost savings for themselves or if they will have to share it with the other parties. If studios pay for the transition costs, they are likely to demand the added value on the ground that they have paid for it (scenario 1 in Figure 1). However, if a new distributor enters the game at this stage ("Maverick distributor"), he/she would be able to offer both exhibitors and producers a better deal than the existing studios (scenario 2, Figure 1), since the distributor can pass on the cost savings to them without having paid for them. In this scenario, studios will eventually have to pass on cost savings to producers as well, if they do not

Figure 1. Money flows in the film industry / the hold up problem of d-cinema



want to continuously lose potential box office hits to maverick distributors. The prospect of being held up by other parties in the value chain in the long run is therefore another factor that severely decreases the studios financial incentive to pay the transition costs for d-cinema.

Companies like Hollywood Software already offer independent film distributors and producers to outsource the distribution of entire release slates or individual films to their company. Hollywood Software is a major player that provides information systems to the industry (including the majors) that automatically create sales charts, track film bookings, print shipment orders, and credit payments (Hollywood Software, 2005). The company is a subsidiary of one of the largest server and d-cinema platform manufacturers in the market, Access Integrated Technologies (Access IT). AccessIT has bought and recommissioned all 28 installed d-cinema systems from Boeing Digital Cinema in 2004, placing itself in the “centre of

the digital revolution” (Fuchs, 2004a). Their most recent development is the Theatre Command Console which supports multiple brands and models of d-cinema projectors and is operated through an easy-to-use graphic interface. The president and COO of the company, Dave Gajda has said:

The idea is to have fingertip access to and control of all critical d-cinema operations, including print-movements and pre-show content such as advertising and trailers. Whether on-site by the manager or directed remotely from the central home office, ..., operators can easily employ a single user interface to simplify training and flexibly integrate multiple technology solutions into a unified system. (Fuchs, 2004a)

This gives rise to a tangible set of questions about training needs of staff and the transition to d-cinema. Slater (2002) has predicted that the new projection equipment will use built-in diagnostic

software and straightforward test routines. As a consequence d-cinema projectors will be far easier to remotely control when connected via a cinema management system that both controls their inputs and outputs. AccessIT's Theatre Command Console is therefore a predecessor to an era where it will be possible to look after hundreds of screens in the country from a single control room (a situation that already has come true for UK broadcasting [Slater, 2004]).

The simplicity of a graphical interface and remote control dismisses concerns from exhibitors that new digital projectors will require advanced technical knowledge (McQuire, 2004) but could mean bleak prospects for some projector staff.

CONCLUSION

In this chapter we have tried to situate current developments in d-cinema within Christensen's framework of disruptive technologies. We have focused the attention on what we see as the major players in d-cinema, namely the major Hollywood studios and have tried to map the implications of d-cinema on the relationships within the film industry value chain. It was shown that the market for d-cinema exhibits network externalities and that therefore a common standard is desirable. The discussion on standards also revealed the conflicting interests a diversified and vertical integrated corporation such as Sony faces, as the competition in d-cinema becomes a "preliminary battle" for the CE market. As a major incumbent, Sony is able to delay the progress of the whole transition to d-cinema for its own benefit, a strategy worth examining more closely.

We have also briefly outlined some of the complexities linked to organising a satisfying transition to d-cinema for all parties.

The emergence of new markets and new entrants into the d-cinema market was examined in respect to the implications for major players in the industry. Although d-cinema was found

to benefit independent players that can carve out market niches, it was also shown that the majors have a strong leverage to exploit the technology to their advantage. However, the combination of a change in the terms of competition and a potential hold up problem, are likely to lead to a further diversification and possibly a further disintegration of major distributors.

In addition we have discussed important issues associated with d-cinema, such as alternative content, training, and digital rights management.

Further research is needed to explore strategies of new entrants and incumbents in this market, survey successful and unsuccessful business models, and discuss how the research on d-cinema can contribute to and be enriched by literature on strategic management and disruptive technologies. Interesting research questions are related to the performance of third party initiatives such as the UK Film Council's Screen Network (2005); the complexity of organising a transition to d-cinema for the mainstream market; and the role of diversified, vertically integrated corporations in the process of setting standards for d-cinema, branding for subsequent markets, and market fragmentation.

In conclusion it shall be mentioned that d-cinema has not solved the problem of long-term digital storage yet. As Phil Feiner, CEO of the renowned optical service company Pacific Title Digital, has remarked: "It's not archival" (Parisi, 2004). Digital intermediates are stored on magnetic tapes that have an archival life of 30 years at best. In contrast, a three-strip black-and-white masters, the current archival standard, lasts as long as 1,500 years. This means that even if a film is shot, edited, distributed, and projected digitally, in the end it has to be transferred to film.

Therefore, in the uncertain future of d-cinema, at least one thing is for sure: Even if the "d-cinema fairy" converts all the screens in the world overnight to digital, traditional film is still going to stay with us for a very, very, very long time.

REFERENCES

- Adner, R. (2002). When are technologies disruptive? A demand-based view of the emergence of competition. *Strategic Management Journal*, 23, 667-688.
- Baird, K. (2004, April 22). *The age of digital movies is coming (or so it seems)*. Las Vegas: Sun Herald.
- BBC News. (2005, March 20). *Irish cinema 'set to go digital'*. Retrieved March 23, 2005, from http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk_news/northern_ireland/4365875.stm
- Belton, J. (2002). Digital cinema: A false revolution. *October*, 100(1), 98-114.
- Christensen, C. M. (1997). *The innovator's dilemma*. Harvard Business School Press.
- Christensen, C. M., & Raynor, M. E. (2003). *The innovator's solution. Creating and sustaining successful growth*. Boston: Harvard Business School Press.
- Christopherson, S., & Storper, M. (1986). The city as studio – The world as backlot: The impact of vertical disintegration on the location of the motion picture industry. *Environment and Planning, D: Society and Space*, 4, 305-320.
- Christopherson, S., & Storper, M. (1989). The effects of flexible specialization on industrial politics and the labor market: The motion picture industry. *Industrial and Labor Relations Review*, 42(3), 331-347.
- Crabtree, S. (2003, August 27). Single, global standard eyed for digital cinema. *The Hollywood Reporter*.
- Crabtree, S. (2004, June 21). Studios pick digital system. *The Hollywood Reporter*.
- Culkin, N., & Randle, K. R. (2003, Winter). Digital cinema: Opportunities and challenges. *Convergence: The Journal of Research into New Media Technologies*, 9(4).
- Culkin, N., & Randle, K. R. (2003, August 25). Stelios v America, the latest big screen bout. *The Guardian*, p. 19.
- Daneels, E. (2004). Disruptive technology reconsidered: A critique and research agenda. *Product Development & Management Association*, 21, 246-258.
- Daniels, B., Leedy, D., & Sills, S. (1998). *Movie money: Understanding Hollywood's (creative) accounting practices*. Los Angeles: Silman-James Press.
- Department for Culture, Media and Sport (DCMS). (2002). *The implications of digital technology for the film industry*. London: TSO.
- Digital Cinema Report (DCR). (2005a). *The big picture*. Retrieved March 14, 2005, from www.digitalcinemareport.com/thebigpicture_53.html
- Digital Cinema Report (DCR). (2005b). *A conversation with Tim Partridge*. Retrieved March 14, 2005, from www.digitalcinemareport.com/qatimpartridge.html
- Economides, N. (1996, October). The economics of networks. *International Journal of Industrial Organization*, 14(6), 673-699.
- Fuchs, A. (2004a, September). Gaining access: Former Boeing digital sites re-lit & linked by satellite. *Film Journal International*. Retrieved March 25, 2005, from http://www.filmjournal.com/filmjournal/search/article_display.jsp?vnu_content_id=1000692659
- Fuchs, A. (2004b). The Hollywood Titanic. ETA Conference Asks: Is D-Cinema the Iceberg. *Film Journal International*. Retrieved March 25, 2005, from http://www.filmjournal.com/filmjournal/search/article_display.jsp?vnu_content_id=1000729613

- Gates, D. (2003, December 2). Condit steered Boeing to be No. 2. *Seattle Times*. Retrieved March 23, 2005, from <http://seattletimes.nwsources.com>
- Giardina, C. (2004). Independent thinking. *The Hollywood Reporter* (Ed.). White Paper: Digital Intermediates, p. 14.
- HollywoodSoftware. (2005). *Indiedirect*. Retrieved March 14, 2005, from <http://www.ukfilmcouncil.org.uk/news/?p=D4A15778059152EF9EkRn2455D6C&skip>
- Hubbard, P. (2002). Screen shifting: Consumption, 'riskless risks' and the changing geographies of cinema. *Environment and Planning A*, 34, 1239-1258.
- Huettig, M. D. (1944). *Economic control of the motion picture industry*. MPhil dissertation, University of Pennsylvania, Philadelphia.
- Husak, W. (2004) Economic and other considerations for digital cinema. *Image Communication*, 19, 921-936.
- Kaufman, D. (2004). DI facilities adopt 2K Projectors. *The Hollywood Reporter* (Ed.). White Paper: Digital Intermediates, pp 10-11. Retrieved March 14, 2005, from http://www.hollywoodreporter.com/threast/pdfs/di_whitepaper.pdf
- Kilday, G. (2004, March 25). Studios shifting d-cinema stance: Hint at subsidizing transition. *The Hollywood Reporter*.
- Kostoff, R.N., Boylan R., Simons, G.R. (2004). Disruptive technology roadmaps. *Technological Forecasting & Social Change*, 71, 141-159.
- Litman, B. R. (1998). *The motion picture mega industry*. Needham Heights, MA: Allyn and Bacon.
- McQuire, S. (2004, February). Slow train coming? The Transition to digital distribution and exhibition in cinema. *Media International Australia incorporating Culture and Policy*, p. 110.
- MKPE Consulting. (2005). *Humble thoughts*. Retrieved March 14, 2005, from http://mkpe.com/digital_cinema/index.php
- Moore, G. (1991). *Crossing the chasm*. New York: Harper Business Press.
- (NATO) National Association of theatre owners (2004, November 18). *Digital Resolution*. Retrieved March 14, 2005, from <http://www.natoonline.org/DigitalResolution%2011-18-04.pdf>
- Parisi, P. (2004). Aged to perfection. *The Hollywood Reporter* (Ed.). White Paper: Digital Intermediates, p. 15. Retrieved March 14, 2005, from http://www.hollywoodreporter.com/threast/pdfs/di_whitepaper.pdf
- Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. New York: Harper & Row.
- Schilling, M. et al. (2005, January 21). Conquering Alexander. *Screen Int.*, p. 4, 6.
- Scott, A. J. (2002). A new map of Hollywood: The production and distribution of American motion pictures. *Regional Studies*, 36(9), 957-975.
- Scott, J. (2005). *On Hollywood. The place, the industry*. Princeton University Press.
- Screen Digest. (2003). *Report on the implications of digital technology for the film industry*. London: Screen Digest.
- Slater, J. (2002, August). *Electronic cinema—A business as much as a technology*. *Ingenia*, 13, 41-46.
- Sony. (2005, March 15). *Digital cinema gets to billing with Sony, Landmark Theatres Alliance*. Retrieved March 23, 2005, from <http://news.sel.sony.com/pressrelease/5701>
- Sperling, N. (2004, October 22). Double standards. *The Hollywood Reporter*. Retrieved March 25, 2005, from http://www.hollywoodreporter.com/thr/film/feature_display.jsp?vnu_content_id=1000682865

Digital Cinema as Disruptive Technology

Texas Instruments (TI). (2003, June 9). Interview with Director Bryan Singer. Retrieved March 21, 2005, from http://www.dlp.com/dlp_cinema/dlp_cinema_feature_article_brian_singer_interview.asp

Texas Instruments (TI). (2005, March 15). *George Lucas and James Cameron to highlight digital cinema and 3D movies at ShoWest 2005*. Retrieved March 23, 2005, from http://www.dlp.com/about_dlp/about_dlp_press_release.asp?id=1232

Thomond, P., & Lettice, F. (2002). *Understanding and enabling disruptive innovation*. Doctoral paper. International Ecotechnology Research Centre.

UK Film Council. (2005, February 26). UK film council selects arts alliance digital cinema to manage world's first large scale digital screen network. Press Release. London

Von Sychowski, P. (2003). *Digital cinema business models: The global outlook*. London: Screen Digest.

ENDNOTES

- ¹ In fact it is one of the primary objectives of a resolution by the board of directors of the National Association of Theatre Owners in America (NATO, 2004).
- ² JVC does not seem to actively participate in the competition at the moment.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 160-178, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.41

Access to the Living Room: Triple Play and Interactive Television Reshaping the Producer/Consumer Relation

Eggo Müller

Utrecht University, The Netherlands

ABSTRACT

Whereas the advent of interactive TV has been discussed as one of the key added values of digitization and convergence of “old” and “new media” for years, current marketing strategies of the big players in the Dutch telecommunications market avoid the term interactivity. Providers promise users “more fun” and increased ease of media consumption when connected digitally to the media world by offering broadband Internet, cable television, and telephone services in one package. They aim at another added quality of interactive media consumption: gaining access to the living room means gaining access to consumption patterns that can be traced back to the individual consumer. This article discusses media convergence and the current development of interactive television in the context of the re-configuration of the relation between producers and consumers in the new online economy.

CONCEPTS OF INTERACTIVITY

For almost three decades, one magic word has dominated professional and public debates on the future of television: *interactivity*. The story goes that when finally provided with a return channel, our “good old television” would become a true means of real two-way-communication. Viewers would not only compose their own program schedules, watch any program at any time, get more background information, and do their shopping at home, they would also contribute to and participate in programs and would even become directors themselves. Although the first field tests of interactive television services in the U.S. in the 1970s, then still based on analogous technologies, failed (Richeri, 2004), and although audience research in the early 1990s still showed that the average public was not ready for interactive television programming (Berghaus, 1995), the industry’s expectations remained optimistic, especially since the introduction of the Internet

in the early 1990s; progress in digitization and compression of audiovisual information; and household's fast growing computer and broadband penetration. The convergence of television and computer-based communication technologies would help to finally disseminate the envisioned interactive television or multimedia system (Owen, 1999; Van Vliet, 2002).

This vision of the industry was echoed by a new brand of media theory that in the name of technological potentials of new media uncritically promoted a fundamental transformation of traditional power relations that were inherent to "old-fashioned" broadcast media and their traditional forms of mass communication. For example, Pearce (1997) praised this "interactive revolution" in a McLuhanian style:

The interactive revolution is [...] about creating machines that extend our mental and creative faculties, that enable us to store, manage, and most important, share massive amounts of knowledge on a global level. It is about using powerful tools to create our own educational and entertainment experiences rather than passively accepting that which is fed to us by so-called experts. It is about the dissolution of boundaries and the translation of all thought into a common vocabulary. Binary code is the digital Esperanto that is leading concurrently to individual empowerment and worldwide unity. (p. xvii)

According to this view, the New Media technologies would fundamentally transform the relation between producers and consumers. Through interactive media, consumers would increasingly gain control of the means of production and distribution, contribute to public opinion, and participate in cultural production processes. Interactive media would help to empower the, by then passive, media consumers and transform them, as the argument goes, into active "prosumers" (Toffler, 1981).

Pearce's (1997) view can be characterized as a quite extreme example of what Boddy (2003) has called the "polemical ontology" (p. 191): the ideological self-promotion of a new medium that highlights the technological features and social advantages of the new medium and, at the same time, disparages those of the old media. In the past few years, this utopian view has been challenged by more critical if not dystopian accounts of New Media (Andrejevic, 2003) and especially by the development and introduction of interactive television. As Kim (2001) and Kim and Sawhney (2002) argue, the concepts of interactive television as envisioned by firms rooted in the traditional television business do not sufficiently take advantage of the new possibilities interactive technologies provide to extend the user's control of mediated communication. On the contrary, according to Kim and Sawhney, interactive services such as enhanced television, video-on-demand, or Web TV as developed by the TV industry cannot be regarded as "interactive" at all. These services fail to realize the "inherently" participatory, empowering, and democratic potential of the new computer-based communication technologies:

[...] interactive TV requires television to change its historically and culturally built-in centralized character. Due to this built-in bias, the TV communication model limits interactivity to mechanical transactions, while the center retains in control. In interactive TV, 'interactivity' is artificially grafted onto TV without taking into consideration the contradiction between interactivity and TV. (Kim & Sawhney, 2002, p. 224)

This view obviously implies a normative definition of the concept of interactivity and subsumes that there are inherent qualities of a technology as such. Like many other scholars, Kim and Sawhney (2002) define interactivity in qualitative terms as the radical sharing of power and control between producers and consumers in mediated communication (Jensen, 1999; Pearce,

1997; Rafaeli, 1988)—a quality that has to be unfolded when interactive television is developed. But as numerous studies of technological innovation have shown, technology is constructed in a social environment and thus shaped by the economic, political, and cultural contexts in which a technology is developed, realized, and introduced (Bijker & Law, 1992; Williams, 1974; Winston, 1998). In an international survey of producers' and developers' concepts of interactivity concerning the new interactive technologies, Van Dijk and De Vos (2001) have shown that the concepts of experts working in television-based industry differs significantly from those experts affiliated with the world of the Internet. Television defines interactivity "as an extension of current TV with a number of additional facilities" (p. 457), while interactive applications on the Internet are associated with the transformation of the television viewers "into users and producers of audiovisual programs, or into more active participants in e-commerce by making continuous price comparisons and by offering products themselves" (p. 457). Depending on different business models, different concepts of interactive TV are developed. Considering the economic, political, and cultural power of the established transnational media firms that invest massively in the growing online economy, and engage in the development and exploitation of interactive services and applications, their concept of interactivity will increasingly shape interactive media technologies and, as a consequence, reconfigure the relationship between producer and consumer in the media and communication market. In the following paragraphs, the launch of the Windows Media Center and the competition of the distributors of digital television on the Dutch market will be discussed as two indicators of this reconfiguration.

TARGETING AT THE LIVING ROOM

When Microsoft launched the Windows XP Media Center Edition 2005 in the beginning of 2005, the

magic word that for decades propagated the key-added-value of new digital media in public and scholarly discourses did not show up even once in Microsoft's Dutch marketing campaign. Instead of promoting "interactivity," the company chose a more accessible value in simply promising: "It's more fun." On Microsoft's Web site, the advantages of the new system software are explained in the following tempting words:

Microsoft Windows XP Media Center Edition 2005 lets you do everything other Windows XP PCs do—and a whole lot more. Browse the Web, play your favorite PC games, e-mail and instant message your friends, and install and use programs designed for Windows XP. Media Center also delivers a powerful yet familiar way to enjoy all of your digital entertainment—photos, music, TV, movies, home videos, radio, and a world of applications and services whether you're sitting in front of your Windows desktop or across the room with a remote control. Media Center is your all-in-one PC and home entertainment center. (<http://www.microsoft.com/windowsxp/media-center/evaluation/features.msp>)

The same is true for Hewlett Packard's (HP) marketing campaign of its new Media Center PC that was released at the same time, dovetailing with Microsoft's new version of the system software. The Dutch folder for HP's Media Center PC shows four young people sitting on a huge designer couch in front of a big flat screen television enjoying the new possibilities of the Media Center. One of the male participants points to the significant start menu on the big TV screen with its standard options that suggest a personalizing character of the applications: Online Spotlight, My Videos, My Pictures, My TV, My Music, More Programs, and so forth. The text praises the following advantages of the Media Center PC:

HP introduces the HP Media Center for the living room. TV and stereo, your pictures and films, Internet and many other technological triumphs

Access to the Living Room

all in one set. Operated by only one remote control and a very easy accessible menu on your television screen. The whole family will enjoy anything that home entertainment offers to you. That's what we call Digital Entertainment. (Hewlett Packard, 2005, p. 1)

The marketing campaign of a Dutch computer brand adapted this model of addressing the consumer in terms of the accessibility, ease of technical handling, and the promise of personal entertainment. As the flyer for the Paradigit Enjoy TV 2005 promises:

The Enjoy TV 2005 transforms your living room into the ultimate media center. In one top designed system you'll combine the best of a computer and home entertainment! Beyond that, the Enjoy TV2005 is noiseless. All your photographs, videos and music documents will be accessible from your couch. You'll be able to pause and rewind all your TV programs 'live.' Programs to be recorded, you'll chose in the online program guide by pressing just one button. (Paradigit, 2005, p. 1)

By deliberately avoiding the term *interactivity* and replacing it with concepts like “fun,” “entertainment,” or “easy handling,” these marketing campaigns obviously aim at a more and more crucial target: the living room as the headquarter of a family's media consumption. The Media Center PC is designed to replace different analogous hardware systems such as the stereo and VCR, by *one* computer. This central computer is not only used to digitally store and manage a family's music, photos, videos, and computer games. Logged on to the Internet, it also allows e-mailing, surfing on the Internet, e-banking, online shopping, and so forth. It can be used for Internet information retrieval as well as for downloading any information, service, or entertainment product required. Although in technological terms it is not necessary to login when starting up the computer, using a Media Center PC would practically imply that

the user will be connected to the Internet at any moment that they are engaged with media. The Media Center software is designed in such a way that listening to music, watching “regular” television programs, or archiving photographs would mean that the user *is* connected, unless he or she actively changes the default options of the software. For the industry this is not only a prerequisite in terms of exploiting online services and e-commerce, but according to experts the interesting fact arises that whenever the consumer is connected to the Internet, any act of consuming a media product or an online service can be monitored, registered, and related to the individual's profile. As Bertelsmann Group media consultant Carel Mackenbach explained bluntly in a Dutch TV documentary on the future of the media market, this data is the target of the media and communication industry:

If you look at the big international media concerns, be it Bertelsmann, AOL/Time Warner, or Vivendi: these are global players that engaged in television, radio, and print at the same time, and right at the moment there is a battle for the consumer going on in The Netherlands and in Europe. All these concerns are investing in pan-European databases of consumer profiles on a large scale. The following generation of consumer databases does not just register names, addresses and more or less accidental subscription of a daily newspaper, it registers behavior like what you think about certain topics, when you buy goods or when you require a financial service of a certain type or when you plan to change your telephone provider and what the reasons are to do so. (Rottenberg, 2005)

Compared to data utilized by traditional audience research such as the Nielson Media Research, the “new generation” of data Mackenbach (Rottenberg, 2005) refers to is of special value for providers and advertisers. These data not only register patterns of media and consumption behavior, they can be related to profiles of

individuals. An individual user's phone numbers would be accessible to the provider when the user has subscribed for all three services, Internet, television, and telephone, the so-called triple play or "multi play."

Although regulations and privacy legislation do prohibit the industry from registering such personal data, the example of Californian-based provider and distributor of personal or hard disk recorders TiVo clearly shows that there is no technological problem in doing so. In the U.S., TiVo is a widespread brand of digital video recorder that not only allows users to capture television programming on internal hard disk storage for later viewing, it also registers viewing habits and program preferences of the individual viewer in order to help him to "personalize" the overall television programming: a TiVo preselects and records a user's preferred programming and alerts the viewer when a preferred shows is on. Therefore, these digital video recorders are also known as "personal video recorders." The crucial difference between this and average hard disk recorders that have been marketed in the last few years all over the world, is that a TiVo must be connected via a telephone line to the provider that not only sends the program schedule to the hard disk of the user, but also registers his or her viewing habits. As Martin (2001) has convincingly shown by analyzing the log files automatically transmitted from the individual TiVo box at home to the TiVo headquarters, these files not only tell down to the second what has been watched, which commercials have been skipped, and what moments have been rewind and played again. According to Martin's (2001) findings, TiVo:

gathers enough information to track back individual user's home viewing habits while apparently promising not to do so; could identify the personal viewing habits of subscribers at will; has a much more explicit privacy policy disclosure on its Web site than in the printed material that accompanies the purchase of the product. (p. 2)

Though TiVo spokespeople admit that TiVo could investigate an individual's viewing habits, they recurrently deny that TiVo would do so (Charny, 2004). However, taking Carel Mackenbach's statement into account, the long term strategy of cable distributors, telephone companies, and Internet providers is obvious: gaining digital access to the living room means access to an enormous capital in the online economy, by providing information about individual user's consumption habits (Rottenberg, 2005).

Only against this background can one understand the enormous competition in the Dutch telecommunication market that arose in 2004 when the former national postal and telephone company, KPN (Royal Dutch Post) launched the first set top box in the Dutch market for terrestrial digital television broadcasting. As the former national telephone provider, the KPN has traditionally held a strong position in the market of (mobile) telephony and broadband Internet. Yet since about 96% of television broadcasting is distributed regionally by commercial cable companies, only a few public channels are broadcasted terrestrially and there is no significant satellite penetration (Koetje, 2003), KPN would miss television programming as an indispensable part of a future triple-play strategy. Media experts expected—then and right now—that by means of new media technologies replacing the good old "telly" in the living room, one could get the economically crucial access to the average family's living room, since television was and still is the most frequently used domestic medium.

The competing cable distributors took their chance and denied KPN access to cable distribution, while getting the coaxial cable system ready for broadband Internet, analogous and digital telephony and for digital television distribution for themselves. In neighboring countries such as Flanders, the government forced entrepreneurs to agree on one common standard accessible for digital encoding for any provider (Baaren, 2006). In Germany, public and commercial broadcasters

defined one standard for terrestrial digital broadcasting (DBV-t). However, in The Netherlands, the Dutch authorities defined neither a common standard for digital broadcasting, nor one for terrestrial, cable, or satellite distribution. The result of this neo-liberal policy is that besides the KPN there are other competitors on the market offering television via the cable—each using its own exclusive standard to encode the digital signal: cable television companies that formerly operated only regionally such as Casema and Essent, but also UPC and Versatel, two competitors that operate nationally (Gorter, 2005, pp. 28-29). Some of these and some new competitors prepare digital television distribution via the next generation of broadband Internet (ADSL-2); each company making use of its own standard and thus set top box, respectively smart card, offering its own, exclusive package of TV channels via Internet Protocol Television.

According to market research held in June 2005, a total of 30% of the Dutch consumers said that they were interested (19%) or might be interested (11 %) in subscribing for a triple-play package to get digital television, broadband Internet, and telephony for a relatively cheap price (Heliview Nieuws, 2005). However, the competing companies use different standards to gain exclusive access to the living room. Their strategy is based on the expectation that in the long run exclusive access will be the gold mine of the online economy. As the former owner of one of Europe's biggest independent television production companies, John de Mol, revealed in a television interview in August 2005, providers would invest 1,500 euros for any consumer subscribing to digital television. John de Mol had just launched a new television channel called TALPA on the highly competitive—and according to experts saturated—Dutch television market. TALPA is De Mol's second attempt to conquer Dutch television. His first attempt to market a commercial sports channel failed within only a few months, when too few viewers subscribed

(Maarsen, 1999, pp. 108-123). As opposed to this short-term strategy targeting a niche market, John de Mol's new TALPA enterprise is designed as a family channel. As a business plan it only makes sense when seen as a strategy that anticipates the crucial transformation of the television market in the context of a developing online economy.

At the moment, De Mol's TALPA is broadcasted as free-TV and accessible via all television providers within the Dutch market. It is part of the various analogous or digital cable TV packages and can be received digitally via satellite (CanalDigitaal) or terrestrial (KPN Digitenne). But there is one significant exception: UPC's digital television package does not contain John de Mol's TALPA that owns the exclusive rights for live broadcast and other coverage of the national football competitions. As everywhere in Europe, coverage of national football has been the most attractive programming for decades. De Mol, who up until 2005 held a total of 42% of the Versatel stocks, cooperates closely with Versatel, whereas UPC is next to the regional cable distributors, Versatel's fiercest competitor on the market of digital TV and triple-play packages. In the long run, TALPA will only be accessible for subscribers of exclusive digital TV packages or as pay per view, as De Mol honestly announced in a TV interview on the occasion of TALPA's release. According to his strategy, TALPA's exclusive national football coverage would help TALPA and thus Versatel too, to achieve a dominant position in the Dutch television market. De Mol's enormous investment in his new television network is not just the realization of the multi-millionaire's old dream of owning a television channel, but follows a well-calculated economic strategy aimed at the business model of future interactive television. Television functions as a portal that not only provides exclusively access to the living room, but also one that cashes in on and registers any form of (media) consumption.

CORPORATE INDUSTRY'S REDEFINITION OF INTERACTIVITY

Although the Dutch television market has nationally specific characteristics, the business strategies of the Dutch television industry can be seen as an example of international developments. Television is no longer developed and marketed as a distinct medium, but is part of a media center in the living room that gives users access to many different types of media and other forms of consumption. At the same time, it makes the living room accessible to the industry in terms of consumption patterns and consumption behavior. Both an individual's actual consumption and the data registering these acts of consumption as a personal profile are cashable, and thus form the economic sources for media concerns in the online economy. Whereas the promise of interactive TV and the new interactive media was that the user would gain control of media communication, these developments point to a reconfiguration of the relationship between the industry and the audience that can not be correctly described in terms of "participation" or "empowerment" of the user as active citizen. In his fundamental critique of the new online economy Andrejevic (2003) describes this redefinition of the relationship between industry and users in terms of an increasing exploitation of the users' consumption:

Interactive media are rapidly being assimilated into an economic framework in which participation has nothing at all to do with power sharing. [...] Instead of power sharing, the contemporary deployment of interactivity exploits participation as a form of labor. Consumers generate marketable commodities by submitting to comprehensive monitoring. They are not so much participating, in the progressive sense of collective self-determination, as they are working by submitting to interactive monitoring. The advent of digital interactivity does not challenge the social relations associated with capitalist rationalization, it reinforces them

and expands the scale on which they operate (pp. 196-197, emphasis in original).

Here Andrejevic (2003) describes the result of a well-known process in media history. Following a phase of invention and appropriation by amateurs and activists, economically promising new media technologies will subsequently be incorporated by the established concerns on the market. That which in a first utopian phase of the invention is discussed and appropriated as a means of communication, is turned into a medium of distribution tailored to industry interests (Zielinski, 1999). Regarding the Internet, this process has been referred to as the "normalization of cyberspace" (Resnick, 1998, p. 48).

Looking at the recent and current development of the so-called interactive television that uses the return channel to register user profiles and behavior, the advent of the "prosumer" era should no longer be embraced with enthusiasm. In this media order a user who is logged on and connected whenever he or she consumes media or other services, cannot *choose not to* interact. The media center in the living room, be it a Media Center PC or a set top box, interacts behind the user's back all the time thanks to the return channel. Instead of being the "active prosumer" one should think of the future fettered consumer as the "conducer." The conducer has no option but to collaborate, intentionally or unintentionally, at any given time, being seduced by the ever increasing entertaining value of contents, applications, and services of the converged media center in the living room. The interactive revolution is not just about people—as Pearce (1997) has put it—it's about a reconfiguration of power relations between the industry and the consumer.

REFERENCES

Andrejevic, M. (2003). *Reality TV: The work of being watched*. Lanham, MD: Rowman & Littlefield.

Access to the Living Room

- Baaren, E. (2006). *Achter de schermen van iTV: De institutionele ontwikkeling van digitale interactieve televisie in Nederland en Vlaanderen. (Behind the screens of iTV: The institutional development of interactive television in The Netherlands and Flanders.)* Unpublished masters thesis, Utrecht University, Utrecht, The Netherlands.
- Berghaus, M. (1995). Zuschauer für interaktives Fernsehen. Ergebnisse einer qualitativen Befragung. (Interactive television and its audience. Results of an empirical study.) *Rundfunk und Fernsehen*, 43(4), 506-517.
- Bijker, W. E., & Law, J., (Eds.). (1992). *Shaping technology/building society: Studies in sociotechnological change*. Cambridge, MA: MIT Press.
- Boddy, W. (2003). Redefining the home screen: Technological convergence as trauma and business plan. In D. Thornborn & H. Jenkins (Eds.), *Rethinking media change. The aesthetics of transition* (pp. 92-100). Cambridge, MA: MIT Press.
- Charny, B. (2004, February 5). TiVo watchers uneasy after post-Super Bowl report. *CNet News.Com*. Retrieved September 12, 2005, from http://news.com.com/2100-1041_3-5154219.html
- Gorter, E. (2005). *Televisie: Van Nipkowschijf tot harde schijf. Apparatus en discours rond digitale televisie in Nederland. (Television: From Nipkow disc to hard disc. Apparatus and the discourse on digital television in The Netherlands.)* Unpublished masters thesis, Utrecht University, Utrecht, The Netherlands.
- Heliview Nieuws. (2005, June 6). Interesse in multi play aanbod is aanzienlijk... (Notable interest in multi play supply) *Heliview Nieuws*. Retrieved September 12, 2005, from <http://www.heliview.com/Applications/Heliview.nsf/Nieuws/ID=160>
- Hewlett Packard. (2005). *HP media center edition 2005*. [Folder]. Amstelveen.
- Jensen, J. F. (1999). Interactivity: Tracking a new concept in media and communication studies. In P. Mayer (Ed.), *Computer media and communication* (pp. 160-188). Oxford University Press.
- Kim, P. (2001). New media, old ideas: The organizing ideology of interactive TV. *Journal of Communication Inquiry*, 25(1), 72-88.
- Kim, P., & Sawhney, H. (2002). A machine-like new medium: Theoretical examination of interactive TV. *Media Culture and Society*, 24, 217-233.
- Koetje, H. (2003). *Advies commissie switch-off: Afschakelen om digitaal door te starten. (Advisory board switch-off: Switch off and take off digitally.)* The Hague, The Netherlands: Ministry of Economics.
- Maarsen, M. (1999). *Betaalde liefde. Voetbal, van volkssport tot entertainment-industrie. (Soccer: From the people's sport to entertainment industry.)* Nijmegen, The Netherlands: Sun.
- Martin, D. (2001, March 26). *TiVo's data collection and privacy practices*. Retrieved September 12, 2005, from <http://www.cs.uml.edu/~dm/pubs/TiVo%20report.htm>
- McChesney, R. W. (1996). The Internet and U.S. communication policy-making in historical and critical perspective. *Journal of Communication*, 46, 98-124.
- Owen, B. M. (1999). *The Internet challenge to television*. Cambridge, MA: Harvard University Press.
- Paradigit. (2005). *Paradigit enjoy TV 2005*. [Folder]. Eindhoven.
- Pearce, C. (1997). *The interactive book. A guide to the interactive revolution*. Indianapolis, IN: Macmillan.
- Rafaeli, S. (1988). Interactivity: From new media to communication. In R. P. Hawkins, J. M. Wiemann, & S. Pingree (Eds.), *Advancing communication science: Merging mass and interpersonal*

processes (pp. 110-134). Newbury Park: Sage Publications.

Resnick, D. (1998). Politics on the Internet: The normalization of cyberspace. In C. Toulousee & T. W. Luke (Eds.), *The politics of cyberspace* (pp. 48-68). New York; London: Routledge.

Richeri, G. (2004). The history of interactive TV. In F. Colombo (Ed.), *TV and interactivity in Europe* (pp. 57-68). Milano: Vita e Pensiero.

Rottenberg, F. (2005). *De Media en de market, de kijker en de macht. (The media and the market, the audience and the power.)* VPRO, NL 2005. Retrieved October 15, 2005, from <http://www.vpro.nl/tegenlicht/afleveringen/23/901551/>

Toffler, A. (1981). *The third wave*. London: Pan Books.

Van Dijk, J. A. M. G., & De Vos, L. (2001). Searching for the Holy Grail. Images of interactive television. *New Media & Society*, 3(4), 443-465.

Van Vliet, H. (2002). Where television and Internet meet. *E-View*, 02-1. Retrieved September 12, 2005, from <http://comcom.uvt.nl/e-view/02-1/vliet.htm>

Williams, R. (1974). *Television: Technology and cultural form*. New York: Schocken.

Winston, B. (1998). *Media technology and society: A history*. London: Routledge.

Zielinski, S. (1999). *Audiovisions: Cinema and television as entr'actes in history*. Amsterdam, The Netherlands: Amsterdam University Press.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 179-190, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.42

Beauty and the Nerd: Ethnographical Analyses in the Japanese Digitalization

Gaby Anne Wildenbos

Utrecht University, The Netherlands

Yuichi Washida

Hakuhodo Inc., and The University of Tokyo, Japan

ABSTRACT

This chapter focuses on the Japanese usage of digital products. Both the consumer and production side are addressed, whereby emphasizing the mobile phone industry on the basis of two consumer groups *otakus* and *kogals*. First, key characteristics of each consumer group are described. Second, social and cultural aspects related to consumption behavior of the *otakus* and *kogals* are examined—that is, collectivism, individualism and *kawaii*ness (cuteness or coolness). This is followed by the production side of digital products in Japan, highlighting two major companies involved in mobile telephony: NTT DoCoMo and Label Mobile, which in their turn, are linked to the consumption cultures of *otaku* and *kogals*.

JAPAN IN RELATION TO THE WEST

Japan plays a key role throughout the world, especially regarding technological innovation. Barclay (2004) surveys the state of contemporary Japanese technology in his report *The Technology of Japan*. In this survey it is apparent that Japanese technological capabilities are on the same level as those of the U.S. Moreover, Japan and the U.S. have a long-lasting relationship regarding this matter, which dates from the postwar period. Together with Russia, the U.S. has been in charge of Japan after World War II until the beginning of the 1950s. With regard to technology it wanted to make sure that Japan would lose its military nature. Evidently, it can be said Japan owes its strong economic position to this occupation period: “They chose to forge a new path, a path that led to postwar Japan being a military-political

dwarf but an economic giant.” (Nakayama, 2001, p. 2). Japan cannot afford to withdraw from the technological relationship with the U.S., since its technological dependence on America is essential. Another way of saying it would be that the technological alliance between both countries is a matter of strategic interest for the U.S., whereas it is one of economic and technological necessity for Japan (Barclay, 2004).

Where does this place other Western countries, like Europe? Although some countries in Europe import technologies from Japan, their relationship on this matter is less strong than the Japanese-American alliance. Nevertheless, Europe’s influence on Japan is noticeable in a more general sense, namely Japan’s movement towards Westernization. Westernization was first offered to Japan in the 16th century through southern European countries. Not only did the Europeans transport an interesting cuisine, more importantly, they brought medical and scientific knowledge. However, at that time the European or Western influence was limited, since the practical needs for their science and technology was small. The second period when Japan came into contact with Westernization was at the beginning of the 20th century. Then they did experience an internal need to adapt to some of the Western modernization (Kasulis, 1995). The Japanese saw Westernization as an import item; they could use modern European and American ideas or products for practical needs related to political, military, and economic necessities. Nowadays, it is even said that “seeing the skyscrapers of Tokyo’s downtown districts, hearing Western rock or classical music even in village coffee shops, or tasting the French cuisine of its fine restaurants, it is easy for one to think of Japan as part of the Western-based family of cultures” (Kasulis, 1995, p. 1).

JAPAN VS. THE WEST

Yet, apart from Westernization, Japan seems to present totally different characteristics as well. Ian Condry (personal interview, March 24, 2005), Professor of Japanese Cultural Studies, says that Japanese see their country as: “Japan is that which is not the West.” This can be related to the period that stands in between the first and second introduction of Westernization, in which the foreign influence was kept to a minimum. After this period of isolation the Japanese realized that in order to “relate and compete with the U.S. and Europe, it is they who would have to adapt.” Within the process of modification it seems as if the Japanese value their modes of behavior insignificant compared to the ones of the West, which shows itself in their ability to copy almost any Western attribute. Idealized versions of the West are presented in Tokyo Disneyland, German Happiness Kingdom, Canadian World in Hokkaido, Garasunosato “the Venice of Japan,” Huis ten Bosch “Dutch Village,” and so on.

Paradoxically, every time Japan tries to catch up with the West, their national identity becomes stronger in this process:

They [Japanese] ended up ahead of the power they were catching up to and redefining their own uniqueness. The Japanese view their entire past in terms of foreign influence and native sentiment. They consciously distinguish what came from China and the West and what is natively Japanese. (Eckstein, 1999, p. 9)

In other words, by means of westernization, Japanese people are in search of what is “Japanese-ness”—A pursuit that is accompanied by the West. Other than Japanese technology, Japanese popular culture and lifestyle also appear to be booming

in Western countries, especially in the U.S. Since it is not exactly clear where this interest comes from, recent writings on the influence of Japan on Western countries seems to be focusing on which specific Japanese characteristics attract the West, which can be exemplified by this chapter.

CONSUMPTION: BEAUTY AND THE NERD

What is most striking about Japanese mobile communication or usage of mobile phones? First of all, mobile phones appear everywhere: on the streets, in the elevators, in the trains, during lunch, during meetings, in back pockets or Louis Vuitton bags of girls (and boys), and so on. This would imply that everywhere mobile phones will be ringing; however the usage of the mobile phones is apparently silent. When people use their phones to communicate with each other they mostly speak quietly. Moreover, the ability to send a text message is frequently used; especially in young girls, they send more text messages than they use their phone to actually make a call. More than 70% of Japanese send e-mail through mobile phones at least once a day (Washida, 2005). Another characteristic of the silent usage differs from the original communication means of a (mobile) phone. The phones are often used as wireless devices to obtain information and entertainment. It is possible to use your phone to listen to original music, to get information about your favorite restaurants, and what is more, discount coupons of that restaurant can be stored in the same device. Recently, even systems are developed to use your mobile phone as a mobile wallet; for example, to pay for your train ticket. Besides a communication tool or content provider, mobile phones are used as a means for self-expression. Although the design of the mobile phones is rather similar, the added straps and decorations speak for themselves.

There are two important consumer cultures surrounding digital products, that is, the otaku

and the kogal culture. These terms may sound familiar yet there exists no detailed analysis of these cultures in relation to digital products. Therefore, I attempt to provide an in-depth study of these cultures in order describe their relevance to the Japanese usage of digitalization whereby focusing on both the production side and the consumption side.

OTAKU: TECHNOLOGIES AS LIFE VALUE

Otaku and kogal do not mean male and female, still their association with gender is evident (Washida, 2005). They are of importance to the Japanese high-tech manufacturers since they offer a double-feedback structure; the small group of otakus give detailed technological feedback, whereas the large cluster of kogals provide information that is useful for a wide-ranging market. In general this means that the manufacturers use otakus to do test marketing when they initially release their products. The information obtained during this test marketing is used to improve products successfully. On the other hand, manufacturers get hold of kogals' curious behaviors regarding digital products. Feedback provided by marketing research helps the manufactures to make their products more attractive and competitive for the general market. Manufacturers even imitate kogals' behavior: They transform the new uses invented by the kogals into their own new commercial services (Washida, 2005).

Originally the term otaku can be translated into "fanboy" or "geek." "It refers to a person who is so involved with a particular kind of fan subculture that he or she comes obsessed with it, or even insane" (Newitz, 1997, p. 1). This is probably the most known reference. Nevertheless, the term can be put into a broader perspective. Nowadays otaku is used in the U.S. to describe the affiliation and love of fans towards a specific category differing from anime to motorcycles.

This goes for Japan as well, however here the term is still mostly associated with males.

The first generation of otakus in Japan are generally referred to as “banana generation” and they are now in the end of their 30s and early 40s. They are today’s managers of small companies, which they run according to the traditional business hierarchy in Japan. The second generation of otakus is called *dankai* junior generation. They are in the end of their 20s or in the beginning of their 30s and the main difference with the former otakus is that they do not support the traditional (business) hierarchy in Japan, because they experienced the difficulties in getting jobs or promotions due to the poor economic situation after the Japanese economic bubble.

Key characteristic to otakus is that they find out about new information and products soon. Therefore, they are “usually the impulse buyers of electronic devices in the very early phase of the development of products, and also abandon them easily if they find the product unsatisfactory” (Washida, 2005, p. 27). This specific consumption behavior is rooted in deep and narrow personal desires. In general, otakus experience trouble in their social life; it is difficult for them to establish a good relationship with the elderly or girls. The label otaku did not come out of the blue, since the Japanese nuance of this word includes the meaning of “you isolated in your house” (Washida, 2005, p. 27). As a solution to dissatisfaction with their social life otakus constitute a technological dream. Successful technological stories, like *Star Wars* movies and the rise of Apple Macintosh or NASA, influence the otakus in such a way that they believe that technology can make everything in life pleasant, whereas reality cannot. Consequently, even some of the otakus detract from society.

One could say that otakus think technological innovations can help them to accomplish things in society; things like status, marriage, and moreover, a better future. Probably they can be best compared with *hackers*, since hackers are also influenced by technological innovations by

which they think they can change society for the better (Levy, 1984).

Some of these ideas are confirmed by information from the contemporary otakus that is obtained at interviews that were conducted with two employees of Hakuodo, Japan’s second largest advertising agency. These young men are employed in the branding and marketing division of Hakuodo and appear formally dressed with a willing attitude to cooperate; both seem content with working at a large advertising agency and are adjusted to the corporate style. However, they do want to be noticed as an individual. This shows itself for instance in their clothing, which is formal as well as distinctive from most outfits in the company. In other words, although they may not agree with the traditional business hierarchy, still the otakus choose to change society by accomplishing success within an organization. On the contrary, the hackers attack an organization with the same purpose. Nevertheless, both hackers and otakus possess the aspect of fanaticism. The fandom of anime is typical for otakus and consequently it is at the core of our interview.

Both men knew that the interview would be focusing on otakus and therefore they brought two anime DVDs with them: *Gundam* and *Innocence*, which shows loving anime is characteristic for otakus in their opinion as well. As a result they use these movies as an example to explain more about this topic. Most apparent is their passion for anime along with their enthusiasm to talk about it; they categorize it into different types, explain which people are attracted to what type, and why this is the case. Their interest shines through in the detailed knowledge they have. In a fragmented manner they tell about many different anime examples and almost without pausing they anticipate each other’s information. During this explanation the relation between anime and technology is at the center. *Gundam* and *Innocence*, both masterpieces of anime according to the interviewed otakus, deal with technological subjects since it involves humans next to robots and the interac-

tion between them. The otakus state they go beyond Hollywood movies like *I-Robot*, because the main question in the anime movies is how to identify yourself rather than a battle between humans and robots. Moreover, anime seems to be an inspiration for Hollywood—though it can be questioned how the main theme of these specific Hollywood movies differs from anime movies as robots in anime movies seem less threatening to human beings. They often function as a protection shield or weapons that support humans fighting evil creatures.

This observation may be helpful when contemplating the approach of otakus to technology. As one man said during the interview: “These [anime movies] make you think more about life, and that is why those anime movies can be recognized as masterpieces.” In other words, the anime does not make him question the (threatening) difference between technology and humans; instead technology and humans seem to be familiar with each other in the otaku’s perspective. It must be said this line of thought is mere speculation, because the relationship between technology and otakus is a personal matter which makes it impossible to expect a straight answer while questioning them on this topic. Still, there is a noticeable observation which has less to do with the explanation of anime from the otakus themselves. That is to say, since the otakus alternate in talking during the interview, one otaku is drawing anime pictures in his notebook to kill time while being silent. All the more this indicates their unconscious familiarity and passion towards the animation style.

The passion for anime does not only express the fandom associated with otakus, it also concerns their values in life. When asking the otakus what is most important to them in daily life they fall silent. After some thinking they answer that, of course, working and friendships are essential. Nonetheless, of more importance is thinking about life, looking deeper, and being moved; the effects they experienced while watching anime movies. Consequently, they have ideas about how

life and technology or digitalization is involved with each other. This might sound paradoxical regarding the previous statement that the otakus have no answer on the subject of the relationship between technology and themselves—A paradox that can be justified. In Japan it is not custom to share personal information with unfamiliar persons, which makes it difficult to obtain information about the otakus themselves in relation to technology and digitalization. On the other hand, it is less complicated to talk about this matter in general and therefore some interesting insights on this matter are provided during the interview.

When discussing the concept of digitalization with the otakus the technological or digital dream comes to mind. Especially in their childhood they used to have specific thoughts about how technology and digitalization would be at hand in the future. One of the men explained that at school there was a special name for the child who had many of these futuristic ideas: doctor. Children, like a doctor, used to have dreams about a technological world that were very physical, such as flying cars. These dreams turned out to be different in the perspective of the interviewee. He thinks digitalization is humanistic; it can make a package of life. For instance, when using digital systems and products a person can make a “blog” to let someone in on his own thoughts or share files adjusted to personal taste. These insights are interesting since they confirm the presence of a technological dream in the minds of otakus. Yet, the current otaku perspective on technology can be best seen in the final words during the interview. At the question why one of the men understood technology, his colleague took the privilege to answer: “Because he loves it! He just bought a new gadget, just because it is cool!”

KOGAL: COLLECTIVISM VS. INDIVIDUALISM?

Kogal literally means “girlish female.” “They are very active young girls, who love shopping,

chatting, and being fashionable” (Washida, 2005, p. 27). Whereas the kogals used to be associated with the Japanese girls dressed up in school uniforms on purpose, nowadays their fashion is quite different and varied.¹ Another important characteristic is that “they are surprisingly good inventors of new ways of using electronic devices” (Washida, 2005, p. 27). These innovations are an expression of the heavy use of electronic devices. For instance, through the 24-hour use of mobile phones kogals thought of adding music data to phones to change the traditional tone into a music ring tone; a popular feature nowadays.

Kogals can also be divided into different generations. The first generation of kogals is now 30-34 years old. These women, however, used to be kogals in their teenage years and in their early 20s. At that time, they suffered from the economic depression and had to develop a new lifestyle. The second generation consists of today’s teenagers and can generally be said to be in their early 20s. They are used to the shifting economy in Japan, which causes them to think they have to be unique in order to succeed in making a living. They use new media and technologies to experiment with different lifestyles and to promote their uniqueness.

Before discussing the importance of the kogals’ use of mobile phones, it is necessary to explain some aspects of the Japanese culture to understand the kogals’ consumption behavior, that is, collectivism and individualism in Japan. The concepts of collectivism and individualism have been widely researched in the fields of psychology as well as sociology in order to explain cultural differences. Initially, the difference between collectivism and individualism was viewed as a contrast. Psychologists Strunk and Chang (1999) write:

Collectivism promotes a sense of the self as interdependent. Collectivistic people are motivated by the norms and duties of their collectives, give priority to the goals of the collectives and emphasize their connectedness to members of the

collectives. In contrast, individualism promotes a sense of the self as independent. Individualistic people are motivated by their own desires, give priority to their personal goals and use reason to analyze the advantages and disadvantages of associating with others. (p. 2)

Since the beginning of the 1990s, scholars have sought to revise the contrast between the terms. Niles (1998) explains this by describing the writings of Harry Triandis, a well-known professor in psychology. Triandis (1995) states that most cultures include a mixture of collectivism and individualism. Moreover, the dimensions became characterized by rather specific attributes of which the ones most important to the situation of the kogals are described. The difference in defining oneself as part of a group rather than focusing on a concept of the self that is independent of the group stays the same. More significant is the contrast in commitment to a group or relationships. The social behavior of collectivists tends to be driven by duty and obligations, whereas among individualists social behavior relates to attitudes and other internal processes. Furthermore, relationships are of great importance among collectivists, even when it requires personal sacrifice. Individualists tend to let go of relationships when they involve too many personal costs (Niles, 1998).

Perspectives on collectivism and individualism in Japan are changing, due to Western influences such as globalization. In particular the younger generation is less keen on the traditional values including collectivism. This does not mean that they do not hold on to these values, but they are open to other perspectives or lifestyles as well. In other words, nowadays the contradiction between collectivism and individualism is not as straightforward as was once thought. Relating to the statement of Triandis, a mixture of both dimensions can be found in Japan. Indeed so, this is a complicated mixture, since either collectivism or individualism takes lead depending on a particular context.

Beauty and the Nerd

Considering now kogals, it seems difficult for these young girls to cope with what direction in life to choose. Or, how can you decide on a way of life if your options are not clear? As a result, the kogals wish not to choose at all, which can be associated with mobile phone usage. The mobile phones of the girls that are interviewed are mostly used for sending e-mails; this includes keeping in contact with close friends as well as making new friends, which is an important difference as will be shown later. The girls divide their friends in categories, based on which school they attended. In other words, they talk about friends from elementary school, junior high school, and high school. Moreover, they value high school friendships as less close than primary school and junior high school friends; the latter seems to be valued as being closest to the interviewed kogals, which can be related to their use of mobile phones.

When kogals are asked when they got their first mobile phone, they said that it was during the period they attended high school. Then they started to use their mobile phone to communicate with friends rather than talking to them face-to-face which is referred to by the terms *pre-mobile-phone-stage-of-life* and *mobile-phone-stage-of-life*. Although perhaps slightly exaggerated and simplified, owning a mobile phone is important in the process of making new friends. The first thing to do is the exchanging of e-mail addresses, preferably mobile addresses as it makes an instant reply possible. Getting an immediate response implicates you are going to become friends. On the other hand, not receiving a response at once means you most likely are not going to be friends. The use of mobile e-mail gives the young girls the opportunity to have more control over who they include as their friends. Therefore, they can use it as a tool to form groups as well.

Also, it allows them to manage the distance or closeness of communication within these groups, which gives the girls a chance to keep in touch with many friends and to belong to many groups, while simultaneously not becoming a true part as

the communication device allows them to have little intimacy. Put aptly by Leopoldina Fortunati in *Towards a Sociological Theory of the Mobile Phone*:

Cell phones can even better be used to shield oneself from wider surroundings by escaping into the narrower realm of highly familiar, predictable and self-controlled social relationships with close kin or friends. (Geser, 2004, p. 10)

Although the Japanese girls do make new friends through their mobile phones, their families and close friends are those they are most intimate with. The information derived from the interviewees confirm this by stating that they value friendship most with friends with whom they communicate face-to-face more often than friendships with friends from the mobile-phone-stage-of-life.

Another example that may indicate that kogals face a hard time making decisions can be illustrated by the mobile phone devices themselves and their ability to provide entertainment and information. Although the design of mobile phones is rather similar, the decoration of the phones is not. For example, each phone has different straps that can be a means of self-expression or individualism. On the other hand, the decoration often includes many pictures of friends as well, which shows the girls belonging to a group. The phones of the girls interviewed are a good example as well: They are made fancy with straps and key cords, most likely to express the girls' own vision on *kawaii*.

Then, what does *kawaii* mean? Moreover, why is it important within the description of the kogals consumption behavior? It is difficult to translate what this word exactly means. "Cute" is one translation; "adorable" might also be used. Japanese people use the word *kawaii* to describe the value of wishing to own the described object. In other words, where Japanese people use *kawaii*, Western people would probably use the word

“cool.”¹ In the interviews it became apparent that the girls choose their products on kawaii-ness. A mobile phone is kawaii for communication and e-mail. However, it is less kawaii to use it for listening to music. Instead, an iPod is most kawaii for listening to music nowadays.

Choosing products on kawaii-ness is most likely related to the role models of the girls. In general, they do not have a straight answer to who their role model might be; they describe powerful women who are beautiful, successful, and independent. Moreover, they have a strong focus on study and career for their futures and are eager to put effort into achieving this image of the powerful woman. This causes them to appear very strong and well balanced; even the conductors of the interviews are impressed by the seriousness and confidence of the girls. Nevertheless, from in-depth conversations with researchers from Hakuhodo Institute of Life and Learning (HILL) it becomes clear that this seriousness can be easily mistaken. It is rather loneliness that causes the girls to appear that way.

The description of the kogals' usage of mobile phones tells us about the combination of silent communication and the longing for entertainment and information through mobile phones—a combination causing the girls feeling pressured. Contemplating this and the framework of collectivism and individualism, it seems plausible that this pressure can be said to derive from the inability to choose a lifestyle. On the one hand, there is the longing to become part of a group which brings along obligations and personal sacrifices. On the other hand, they see new opportunities to let go of certain relationships, which involves both courage and anxiety since this choice is rather unfamiliar to these Japanese girls. A feeling of loneliness is the result of these pressures.

Consequently, the mobile phone becomes more than just a device; it becomes an indispensable friend. All the girls say that they “freak” if they do not have their phone near or if the network is not working properly. In other words, the mobile

phone becomes an item to fill the lonely gap since it is capable of fulfilling both desires of the kogals: belonging to a group as well as being an individual. Moreover, consumption of other (digital) products based on kawaii-ness can conceal their loneliness as it contributes to the image of being a powerful woman.

PRODUCTION: NTT DOCOMO AND LABEL MOBILE

Today the penetration rate of the mobile phone among Japanese consumers has reached approximately 70%. The usage frequency of mobile phones in daily life has surpassed that of fixed-line phones. The biggest market share is held by NTT DoCoMo, who has approximately 56% of the market share. The key factor for success of NTT DoCoMo is its aggressive strategy to expand data communication usage, for example, text messaging and Web browsing via mobile phone, based on the popular i-mode service that launched in 1998, while competitors focused on voice communication services and pricing strategies. For the ordinary Japanese, the mobile phone has become the primary everyday life communication tool (both voice and data) alike, for example, the situation of a cell phone in the U.S.

Another important aspect of the Japanese mobile phone industry is the emergence of other mobile-phone-related markets such as the ring tone business. In 2004, the total market size of the Japanese ring tone business—including the latest digital music distribution business via mobile phone—had reached approximately \$1 billion per year, while that of traditional music products such as CDs, is approximately \$4 billion indicating that, in Japan, the mobile phone industry has become a “hub” for various other digitalized industries.

The influence of production on the use of (digital) products can be divided into three key elements: organization structure among the pro-

ducers, motivation, and the actual production itself. Information deriving from several interviews with Japanese manufacturers illustrates these three aspects. Two of these interviews are most relevant for this research. The first is a meeting with a marketing manager from NTT DoCoMo. The second is a conversation with a marketing manager at Label Mobile, a company that offers music ring tones, called *chaku-uta*'s. Both will be discussed in relation to the three aspects of the production side.

It has been said that manufacturers imitate kogals' behavior regarding digital products. NTT DoCoMo is an example of such a manufacturer—kogals can be said to be responsible for using mobile devices for written communication. Initially, the girls used pagers to exchange information with each other silently. NTT DoCoMo noticed the kogals' use of pagers and applied it in their development of i-mode; they developed the idea of developing an e-mailing service together with their subscriptions targeted at young people. One of the founders of i-mode says:

At first, a lot of people didn't understand our decision. But I knew (...) young people had strong communication needs. (...) Plus, they were attracted to new things; they liked innovation. I felt that if we could capture this group of people, everyone else would follow their lead. (Moon, 2002, p. 3)

The reason why NTT DoCoMo is able to pick up on this information from kogals, and create services like i-mode, is related to their organizational structure.² During the interview the manager at NTT DoCoMo made clear that they invest a lot of money in research that can help to develop and improve their products along with their services. Sometimes this research is put out to contract to survey companies, for instance when mapping the future market. Nevertheless, most research is done by NTT DoCoMo's significant research and development division.

Label Mobile is another company that learned from kogals as well. They copied the invention of adding music ring tones to mobile phones. Label Mobile was founded by record companies; these included almost all major record companies in Japan. Its mission is to make a structure for distribution for music content. In other words, the record companies use Label Mobile to sell their music to consumers, in which Label Mobile adjusts the systems and the Web sites properly to provide and distribute the content.

During the development of Label Mobile, the record companies have put shared effort into making it a success and they still have numerous meetings to maintain its popularity. Moreover, the relationship of Label Mobile with the handset makers and providers of mobile phones is beneficial, since the latter have influence in the development of *chaku-uta*'s. In other words, the organizational structure of this company is trustworthy and stable as well as unique, motivated by its employees that besides making money, have a love for music, which they want to share with their clients. As a result, the actual production of *chaku-uta*'s is fast, adequately targeted at consumers, and has been profitable for a few years now.

The examples of NTT DoCoMo and Label Mobile can then be linked to the otaku and kogal cultures. This is best explained by the example of NTT DoCoMo. Here, the motivation to produce (digital) devices and services is highly related to a belief in the technological dream. To illustrate this, a recent press release article from NTT DoCoMo states: "Every employee of the NTT DoCoMo Group will create MAGIC by following our DREAM" (1999, <http://www.nttdocomo.co.jp/>). This is result of the influence of the otaku employees working at large companies such as NTT DoCoMo. Otakus are motivated to create technological innovations as they believe these innovations will benefit and enrich their lives. Nevertheless, (digital) technology can not survive without the social and cultural aspects of consumption surrounding it, shown by the influence of ko-

gals' consumption behavior. The examples of NTT DoCoMo and Label Mobile explain how innovative behavior of kogals impact on the development of new products, which—indirectly—relates to the kogals' emotional consumption behavior; kogals invent new usages of digital products by using these products extensively which, in turn, helps them to experiment with different lifestyles.

CONCLUSION

This chapter has investigated Japanese consumption behavior of (digital) technological products by providing an overview of consumer groups: otaku and kogal, followed by the production side of technology in relation to these consumer groups. In so doing, it hoped to provide accurate information on the Japanese consumption and production of (digital) technologies in order to widen the Western perspective on Japanese digitalization. This study also meant to trigger questions about which aspects of what characteristics attract the West. How do consumer groups in the West correspond to Japanese consumers? How are economical issues related to “emotional” consumption behavior on a global scale? Where is the attraction of Japanese technology and popular culture heading for? Will Japan become of growing importance in these matters or is the interest of the West in Japan just a fad? What gives the West the idea that Japan is “awesome”? Having raised more questions than answers, further investigation is needed to build a theoretical and empirical framework on the relations between West and East and digitization issues.

ACKNOWLEDGMENT

We appreciate the great contributions and stimulating collaborations through personal interviews, focus group interviews, and discussions with Kasai, M. (on 6 April 2005 at NTT DoCoMo),

Mizuno, S. (on 11 March 2005 at Hakuodo Inc.), Oval Communications (on 12-13 April 2005), Takeuchi, K. (on 26 April 2005, Hakuodo Inc.), Tamura, H. (on 11 April 2005, at Hakuodo.Inc.), Uchiyama, D. (on 26 April 2005, at Hakuodo Inc.), Yanagi, M. (on 1 March 2005, at Hakuodo Inc.), Yokoi, M., (on 10 March 2005, at Label Mobile Inc.), and Yoshikawa, M. (on 5 April 2005, at Hakuodo Inc.). We also appreciate the great suggestion by the personal interview with Condry, I. (on 24 March 2005 at Hakuodo Inc.).

REFERENCES

Barclay, D. (2004). The technology of Japan. *Massachusetts Institute of Technology Undergraduate Research Journal - MURJ*, 11, 13-18.

Eckstein, A. J. (1999). *Japan's national identity: Nationalists or not?* Retrieved January 4, 2006, from <http://www.lehigh.edu/~rfw1/courses/1999/spring/ir163/Papers/pdf/aje3.pdf>

Geser, H. (2004). Towards a sociological theory of the mobile phone. Retrieved December 21, 2005, from http://socio.ch/mobile/t_geser1.pdf

Kasulis, T. (1995). Sushi, science, and spirituality: Modern Japanese philosophy and its views of Western science. *Philosophy East & West*, 45(2), 227-248.

Levy, S. (1984). *HACKERS: Heroes of the computer revolution*. Garden City, NY: Doubleday Books.

Moon, Y. (2002). NTT DoCoMo. *Marketing i-mode*. Boston: Harvard Business School.

Nakayama, S. (Ed.). (2001). *A social history of science and technology in contemporary Japan: Volume 1: The occupation period 1945-1952*. Melbourne, Australia: Trans Pacific Press.

Newitz, A. (1997). Anime otaku: Japanese animation fans outside Japan. In J. Lyon (Ed.), *Bad*

Beauty and the Nerd

subjects: *Political education for everyday life*. New York University Press.

Niles, S. (1998). Individualism-collectivism revisited. *Cross-Cultural Research*, 32, 315-335.

NTT DoCoMo (1999). *2010 NTT DoCoMo Future Vision*. Tokyo, Japan: NTT Publishing. Retrieved from <http://www.nttdocomo.co.jp/>

Strunk, D. R., & Chang, C. (1999). *Personality and individual differences*, 27(4), 665-671.

Triandis, H. (1995). *Individualism and collectivism: New direction in social psychology*. Bolder, CO: Westview Press.

Washida, Y. (2005). Collaborative structure between Japanese high-tech manufacturers and Consumers. *Journal of Consumer Marketing*, 22(1), 25-34.

FURTHER READING

Bolter, J. D., & Grusin, R. (2000). *Remediation: Understanding new media*, Cambridge, MA: MIT Press.

Dohi, T. (2004, June). A cut above. *The Japan Journal*, 6, 26-29.

Fisher, C. (1992). *America calling: A social history of the telephone in 1940*. Berkeley: University of California Press.

Hakuhodo Institute of Life and Living. (2004). *HILL bi-annual report 2004*. Hakuhodo Inc. Tokyo, Japan.

Hirsch, E. (1998). New technologies and domestic consumption. In C. Geraghty & D. Lusted (Eds.), *The television studies book*. London: Arnold.

Mul, J. de (Ed.). (2002). *Filosofie in cyberspace: Reflecties op de informatie- en*. Amsterdam.

Communicatietechnologie. Kampen, Rotterdam: The Netherlands.

Sudoh, O. (2004, August). Community stores in cyberspace. *The Japan Journal*, 8, 22-23.

ENDNOTES

¹ Some scholars and students at Harvard University named these phenomena *cutism* and explored how influential it has been to current Japanese society at the *Cutism Conference in 2004* (Harvard Project for Asian and International Relations, and the Reischauer Institute of Japanese Studies at Harvard University, Cutism, Harvard Hall 201 in Harvard Yard, 2004). They discussed that kogal generation is significantly important not only when we think about Japanese youth culture such as girl's comics and female celebrities, but also Japanese marketing trends and transnational culture diffusion among East Asian countries. The exact definition of cutism was not given at the conference. However, they shared the certain significance of the kogal phenomena, using this keyword, to identify current characteristics of Japanese society.

² The organization structure is intertwined with the business goals of the company. The Web site of NTT DoCoMo explains it is NTT DoCoMo's intention to stimulate "further growth of the mobile communications market via mobile multimedia, and thus improving the quality of life and revitalizing industry." The opportunity for NTT DoCoMo to achieve this goal is provided by investments in research and development. These major investments are also used to show recent achievements of NTT DoCoMo regarding technological innovations. For instance, the Web site of NTT DoCoMo contains a short movie of a future vision, titled *Vision 2010*. In this movie the company presents their "insight into a world enriched by wireless communications services in

the near future.” Nowadays NTT DoCoMo presents their actual production as a step forward towards that future. Nevertheless, the recently released services which are related to videophones and e-commerce rather appear to be entertainment or convenient, instead of resembling the future as portrayed in *Vision 2010*. For example, according to

NTT DoCoMo the main advantage of video phones is that people can see each other anytime and anywhere, regardless of the distance between them. In contrast, at this time the actual service of video phoning offers the ability to create an avatar in case you do not want to be seen.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 20-35, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.43

Digital Imaging Trek: A Practical Model for Managing the Demand of the Digitally Enabled Traveller

Stephen C. Andrade

Johnson & Wales University, USA

Hilary Mason

Johnson & Wales University, USA

ABSTRACT

This chapter introduces the concept and activities of the digitally enabled tourist and the impact such as tourist has on the travel and tourism industry. It summarizes the existing and emerging technical environments that encourage the use of hand held digital recording devices and personal Internet communications. Additionally, it looks at ways tourists publish and exhibit digital visual and written artifacts of their travel experience. The chapter introduces general types of digital communication infrastructure to be considered by the industry to create an experience to support this type of tourism. The authors hope that further understanding of the digitally enabled tourist will inform travel professionals to better facilitate commerce and practice in the industry.

INTRODUCTION

Technology has had a great influence on the tourism and travel industry. In recent years digital communication platforms and technologies have evolved and become accessible to a wide mainstream audience of tourists and travelers. Organizations engaging in travel and tourism commerce need to understand this wave of innovative behavior among their customers. From cell phones to high speed wireless Internet connection to the variety of creative ways customers have applied digital technologies—the travel and tourism industry is being widely affected by these emerging trends in information and communications technologies (ICT). Is the digitally enabled traveler the wave of the future? How will companies and services shift business models to optimize the experience of people with digital devices? Are there commercial opportunities

embedded in these? What does a traveler need to know to keep current with changing technologies? It is critical that services providers and travelers alike stay informed, because one thing is certain, technological innovation and change will be a constant companion for the travel and tourism industry.

This chapter provides insight into technology trends that will be helpful to the practitioner, student, educator and the tourist-travelers themselves. Being prepared to meet the new demands of customers will provide rewarding experiences for parties on all sides of the tourism equation.

BACKGROUND

Since the wide spread use of the telephone in the 1920s, information and communications technologies (ICT) have had a great influence on the industry of tourism. In the 1990s, the wide spread use of powerful desktop computers, enterprise wide systems, and the World Wide Web (WWW) continued to transform the way business was conducted in all facets of the travel and tourism. While ICTs have had a dramatic impact on the mechanics of tourism business practices, the virtual explosion of new inexpensive digital communication technologies is transforming the experience of tourism from the traveler's point of view.

The new generation of hand held mobile technologies, the expansion of wireless (WiFi) networks and the surge in digitally hosted social interchange services present new opportunities for engaging all sectors of the tourism industry. This new generation of technologies also presents new challenges to the industry to structure services with the digital service users in mind.

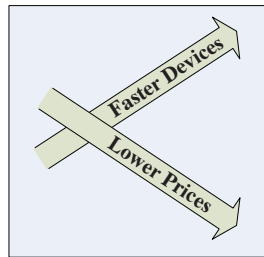
New services that provide online collaborative and social interaction through the World Wide Web now shape and influence vast communities of millions of online customers. Traveler-centered mobile technologies are increasingly used

for many activities embedded in the tourist and traveler experience. This chapter will explore the model of the digital imaging trek and the digitally enabled traveler as a way to structure experiences to satisfy the demand of the technically savvy traveler in a world of advancing mobile technologies and online services. It also will provide basic technical background about the devices and infrastructure that drives these technological innovations.

Understanding the use of advanced hand held devices from the traveler's point of view is becoming more critical to tourism industry providers. Both new and veteran professionals in the tourism industry need to think about how these technologies influence the customers' choices, activities and ultimately their economic decisions about tourism. Customers have eagerly adopted the cheap and easy to use digital technologies. Tourism professionals need to understand the role mobile digital technologies play in the expanding global tourism field. For customers, mobile digital technologies are helping to shape the experience of tourism from initial research of a destination, through the reservation process to the final visual record of the experience.

Mobile digital technologies include a wide array of products that are inexpensive and easy to use. When mobile digital technologies are used to shape a tourist's experience they become powerful digital communication tools reaching out to an infinite audience of like-minded users on the World Wide Web. New products in cellular telephony, visual still imaging, motion and sound recording, wireless digital connections to the World Wide Web and the services on the World Wide Web, all converge to offer a digital environment unlike any before it. The combinations of these technologies are dynamic, unique and ever expanding. These digital technologies are in a constant state of enhancement—services become faster, devices become more powerful and feature-rich, and prices come down. This evolution of technology is known as "Moore's

Figure 1. Moore's Law



Moore's Law predicts:
Computer chip devices get faster as prices come down over time.

Law" (see Figure 1). Just what is Moore's Law and why is it important?

Moore's Law is the observation made in 1965 by Gordon Moore, co-founder of Intel. In it he states that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. Moore predicted that this trend would continue for the foreseeable future. In subsequent years, the pace slowed down a bit, but data density has doubled approximately every 18 months, and this is the current definition of Moore's Law, which Moore himself has blessed. Most experts, including Moore himself, expect Moore's Law to hold for at least another two decades. (<http://www.webopedia.com>)

Consider what it means to double the capacity of digital technologies every 12-18 months. Few if any physical systems or resources in the world of tourism have this capacity and potential. Moore's Law not only means faster and better technology, it also enables dynamic changes in the way people use technology. In fact, it is difficult to predict exactly how consumers will respond to innovative devices and new digital gadgets. Tourism professionals need to understand this dynamic process and prepare for the digitally enabled traveler.

Who is the Digitally Enabled Traveler?

The digitally enabled traveler is a new breed of traveler equipped with devices, connectivity, skill

and motivation to create and access real-time, online, rich media knowledge bases of travel and tourism experience.

The digitally enabled traveler is motivated by the same principles as the conventional tourist. People involved in tourism are visiting locations for leisure, recreation, sight seeing, vacation and other activities. The global travel industry hosts not only tourists, but professional travelers on professional missions as well. People travel for business, cultural, scientific, educational, governmental and other kinds of activities in the world of global tourism. Most forecasts for travel of all types indicate a steady rise of 4% a year over the next decade. Even a causal observation in any busy transportation hub, such as an airport or train station will reveal how critical mobile technologies and wireless connections are to both the recreational and professional traveler alike.

People who travel with digital devices are highly motivated to stay connected to business and social networks. Minimally, most travelers today require basic voice and Internet connectivity service to maintain contact with families and tourism providers. Travelers want to stay in touch with the sources of lodging, travel bookings, reservations and other critical contacts during their trip. Some travelers thrive on constant digital connection to not only monitor progress in plans, but also stay in touch with their virtual communities.

Beyond the basic business function and family contact, travelers are using a wide array of digital devices to capture, record, edit, and exhibit the

experience of tourism and travel. The days of a single film camera used in a casual manner to take pictures of highlights are over. As the tourism industry embraces near-endless global locations for travel destinations, travelers are highly motivated to capture and share their experience with digital recording and connection devices. Why? In spite of all the technical gadgetry, it is still human nature to want to discover and share a new experience. This mode of communication has been going on for generations, only now, it is played out on a global digital stage.

Digital still and video cameras along with powerful laptops and hand held devices have opened new territory for the digitally enabled traveler. These new digital technologies also offer new service-business opportunities for the tourism industry.

Today's digitally enabled traveler is highly motivated to stay in-touch with a virtual community of people through services on the Internet. With millions of people subscribing to World Wide Web sites that host virtual communities the trend of communicating in digital interactive space has been set. Social networking through digital services is widely accepted as common practice. This segment of the technology service industry is rapidly growing as the each successive generation matures into an economic demographic that can afford the expense of travel and tourism. Millions of people are now involved in what is called "social networking." As counter intuitive as it may seem, the way to establish human bonds is through digital technologies. Numerous Web sites have been established as sources for self-published digital image galleries, digital video galleries, audio files, user profiles, and blogs.

Social Networking: The Latest Trend

Social networking systems are an emerging technology that is beginning to have a significant influence on how people communicate. Social networking systems are Web sites that offer a

collaborative or shared virtual experience, generally around a particular theme or human interest. Visitors to the site can connect with each other through shared attributes, such as interests, activities, or geographic location.

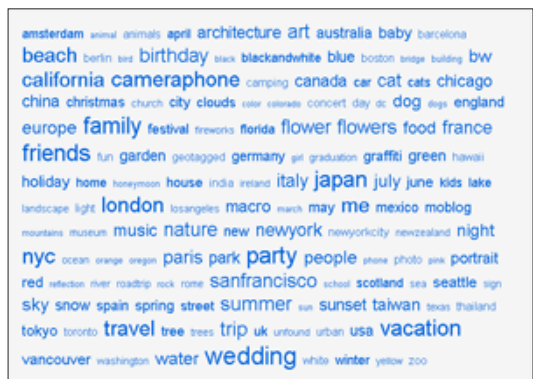
Some social networking sites, such as Facebook (<http://www.facebook.com>), are designed simply to facilitate the process of making social connections. Other sites, such as Delicious (<http://del.icio.us>), offer a core application, such as allowing users to share Web site bookmarks. An essential quality of a social networking site is that it must allow users to share information via a network of nodes (users) and connections (users with similarities). Users also can easily identify other users with similar interests.

Most social network sites utilize the community to develop an ontology via tagging. Tagging is a simple method of allowing users to attach key words to a piece of data. Users searching for those keywords can then locate a wide variety of matching media. This works on the assumption that humans will generally choose similar terms to describe similar items. Most of the time, the assumptions works well, and people network with other people's experiences.

Tags are often represented in a "tag cloud" (see Figure 2). Larger text indicates a more popular tag. Other visualizations include history, topics, and information origin. This visual model of popularity makes these sites friendly to even the most non-technical visitors.

Social networking sites are beginning to have a large impact in business. Consider the common professional activity of attending industry-specific conferences. Attendees meet for seminars, meals, and networking. Several attendees may take photos of this event. They can upload their photos to a photo networking site such as Flickr (<http://www.flickr.com>), and tag them with the name of the conference. Anyone searching for the conference would be able to find a complete photographic record of the event.

Figure 2. Sample tag cloud



Social networking has even made an impact in tourism. “Where Are You Now?” (<http://www.wayn.com>) is a site that connects travelers, for logging trips and comparing destinations, finding travel buddies, and making friends with like-minded people. WAYN even helps with off-line networking by allowing users to send SMS (short text messages) to each other’s cell phones.

Social networking presents an innovative solution to the problem of information overload. By organizing information collaboratively, useful content filters toward the people who would most like it, while useless content is dropped altogether. Finally, it is a core technology with implications that will touch all disciplines in the years to come.

A blog, or “Web log” for short, is a collection of posts around a theme or topic collected on a Web site. At the time of this writing, blog search firm Technorati (<http://www.technorati.com/>) was tracking 25.4 million blogs with 1.9 billion links.

A blog is a collection of time-stamped journal entries on any possible topic. Blogs cover every subject from politics to education to technology to one particular person’s social life. Some blogs are only of interest to a few people while others have thousands of readers daily.

The Pew Internet Survey estimates that about 11%, or 50 million people, read blogs. (http://www.pewInternet.org/PPF/r/113/report_display.asp).

Eighty percent of people contacted by the Business Blog Consulting Web site, a site focused on the growing use of blogs in business, believe that blogs are not a fad. Traditional media outlets (such as the BBC) have begun to add blogs to their media offerings.

The digitally enabled traveler is motivated to share experience in an immediate, visual and highly subjective manner. For a digitally enabled traveler, the personal reaction to a destination like a museum, a historic site, or a travel adventure is typically recorded as a highly personalized written blog. The digitally enabled traveler will supplement the blog with a gallery of digital images. The gallery will then be linked to a short video, compressed for Web hosting, of the activity at the site. With a reasonably fast wireless Internet connection or access to a local Internet café, this material can be posted within minutes of the experience, or in some cases, in near real time. Digitally enabled travelers with the proper digital gear and Internet connection can produce a personalized digital stream of video, images and words. Often defined as “rich” media, the mix of all these files—sound, still, motion, text—are a critical and creative connection to a virtual world for the digitally enabled traveler. For the digitally enabled traveler, contact with the social network on the Web is critical. This technical and

artistic practice is easy to achieve and among the members of the digital generation, a routine and necessary activity.

Table 1 offers a way to understand the devices, practices, skills, and motivations of a digitally enabled traveler.

Professionals in travel and tourism should understand that the focus of these technologies is the individual consumer, not necessarily the business enterprise.


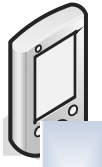
Digital Imaging Trek: A Model for the Tourism Industry

The digitally enabled traveler is equipped with an endless array of digital products designed to cap-

ture and record the tourism experience. Through these devices travelers are highly motivated to stay connected to virtual communities online. Patrons of tourism will use their technology skills to create visual and rich media collateral—high quality digital media artifacts. There are countless Web-based outlets to connect the traveler’s experience and collateral to an eager virtual community and social interaction network. As digitally enabled tourism becomes an expectation among patrons and customers, tourism professionals need to understand and shape usage models.



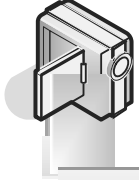
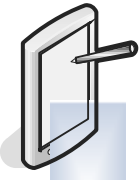
The model of the digital imaging trek proposes information and technical architectures to capture travel experience, create a virtual record of tourism, and meet the demands of the digitally enabled traveler.

Table 1. Understanding the devices, practices, skills, and motivations of the digitally enabled traveler

| Device | Connectivity | Skill | Motivation |
|--|--|--|--|
| <p>Cellular phone with low resolution camera function</p>  | <p>Commercial wireless network, satellite connection in remote areas</p> <p>Multifunction chips available for international functionality</p> <p>Limited WWW access if available</p> | <p>Easy to use, entry level skill</p> | <ul style="list-style-type: none"> • Basic voice communications; real time voice conversations with social and business network; voice mail. • Basic e-mail if function available • Basic organizational information: names, addresses, telephone, fax • Basic low resolution images, very limited storage • Limited to real time voice based research and basic business functions such as reservations, bookings, and so on • Limited keyboarding if necessary |
| <p>Hand held multifunction PDA- personal digital assistant</p>  | <p>Commercial wireless network, satellite connection in remote areas</p> <p>Multifunction chips available for international functionality</p> <p>Limited WWW access if available</p> | <p>Entry to moderate level, requires some experience</p> | <ul style="list-style-type: none"> • Voice function if feature available on device • E-mail • Moderate organization of rich information itinerary, dates, addresses, images, URLs, and so on • Low resolution imaging if available, limited storage • Wireless connectivity to basic navigating on WWW • Basic keyboarding for research and booking business functions such as reservations, bookings, and so on |

continued on following page

Table 1. (cont.)

| | | | |
|--|--|---|---|
| <p>Battery power laptop with wireless connectivity</p>  | <p>Commercial or free wireless, Internet café, locally provided high speed network connection</p> <p>Satellite connection in remote areas</p> <p>Wireless chip functional in international standards</p> <p>Access to rich sources of information on WWW</p> | <p>Moderate to advanced, able to detect wireless signal; may require some basic problem-solving</p> <p>Powerful image editing software applications</p> | <ul style="list-style-type: none"> • Voice over IP if function available • E-mail, online social networking, post digital images and video • Advanced organization of rich information on device's data sources • Edits and stores high resolution still images and digital video with sound • Likely to use laptop for extensive research and business functions such as reservations, bookings, and so on • Uses laptop as critical extension of travel experience; connectivity to online, social network a priority |
| <p>Digital still camera</p>  | <p>Direct connect to laptop or other device with Firewire.</p> <p>Interconnect to Web through computer device</p> | <p>Easy to expert level skill</p> | <ul style="list-style-type: none"> • Record images • Record technical file type and related information • Field edit • Organize image files • May be critical to business communications • Critical to social network and social communications |
| <p>Digital video camera</p>  | <p>Direct connect to laptop or other devices with Firewire</p> | <p>Easy to expert level skill</p> | <ul style="list-style-type: none"> • Record motion and sound • Record technical file type and related information • Field edit: shoot to edit • May be critical to business communications • Critical to social network and social communications |
| <p>Computing tablet</p>  | <p>Direct connect to laptop or other devices with Firewire</p> <p>Essentially same connectivity as laptop, yet these devices are relatively new to the marketplace and not widely adopted by travelers</p> | <p>Moderate to advanced, able to detect wireless signal; may require some basic problem-solving</p> <p>Application base still developing</p> | <ul style="list-style-type: none"> • Typically less functional than laptop • Consumers are urged to match intended use to tablet functionality |

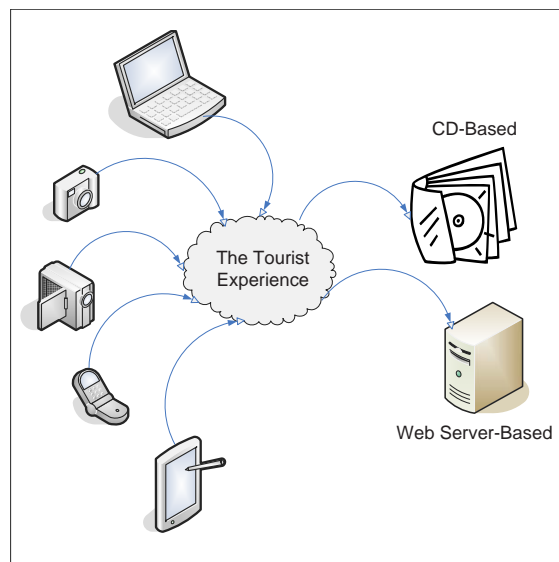
From early times of travel, the notion of a “trek” has long been regarded as a journey of self-exploration for the traveler. Many tourists and travelers today are seeking a heightened experience as part of their tourism through digital communication technologies. Putting practice in to models, especially the practice of the digital imaging trek, is a way to understand the processes and practices of the digitally enabled traveler (See Figure 3). Using all the digital tools available, a digital trekker will produce files from a wide range of sources and self-publish material in two methods; saved as CD-based files (or some other permanent memory such as DVD or portable USB Flash Memory) or published on the World Wide Web.

A typical day on digital imaging trek starts with a destination selection. Digitally enabled travelers will turn to the Internet to locate and decide upon a location. Whether it is a museum, a regional historic location or a cultural performance, the digitally enabled traveler will seek all types of information from Web site based services

to make plans. When made available on a Web based system, transportation schedules, phone numbers, hours of operations, special information about exhibits, costs, and other related information about the region, are always instantly available to the traveler. Web based systems allow the digitally enabled traveler to acquire information regardless of time and in a preferred language.

In digital imaging trek model, the traveler is focused on acquisition of digital still and video images that record the daily experience of the trip. In any environment—built or natural—the visitor will always encounter new scenes that are novel, exciting, and educational and from the perspective of the traveler, representative of the tourism experience. With cheap recording memory in the form of Flash Memory, a digitally enabled traveler has near infinite storage space to capture images. Digitally enabled travelers also can edit on the fly. The advantage of digital imaging over traditional film imaging is in the use of storage and field editing. If an image is not worth keeping, it can be immediately erased. Images worth keeping are filed and stored until needed later.

Figure 3. The general digital imaging trek model embraces technology communication devices and self publishing



Digital Imaging Trek

As the day progresses on the digital imaging trek, travelers will want to spend time reviewing images, editing images, and corresponding to the social network with e-mail, uploads and blogs. Editing and organizing images are tasks that most travelers will conduct when time is available. Typically image editing is done on a portable laptop computer. Many people prefer to travel with laptop computers as they are light weight, highly functional, and a repository of software tools and information necessary to conduct digital imaging while traveling. (For the business traveler, a laptop is practically required gear for the trip.) Editing image files requires some time and concentration and will likely occur during a break in activities. When editing still images with a popular image editing software such as Adobe Photoshop, travelers will crop, color-correct, merge and manipulate images.

Similarly, digital video footage also will be edited. Travelers on a digital imaging trek will likely download and edit video footage with commonly available video editing software such as Adobe Premiere or Apple's iMovie and Final

Cut Pro. Still image editing software and video editing software is widely available. With basic skill and proficiency, digital travelers can achieve remarkably high quality results. For travelers on a digital imaging trek, it is the primary focus of experience and a rewarding achievement to acquire these images.

The ease of use of digital imaging equipment—still cameras, video cameras and laptops, promotes the phenomena of “hyper-imaging”—taking thousands of images to sort through later. Travelers who are serious about digital imaging are continuously shooting images throughout the day and night. The result of hyper-imaging is an overabundance of images and footage that must be sorted and organized. Powerful laptop computers with optimized internal and external storage are perfect for this task. Sorting and organizing images and footage is typically done to suit the desires of the traveler on a digital imaging trek. Images are categorized by group or class and notated with keywords for access at a later time. Various gallery and filing software makes the task of organizing relatively easy.

Figure 4. Students and faculty from Johnson & Wales University on a digital imaging trek to Paris; wireless digital connection to the Internet is abundant in urban environments; checking e-mail and editing images in a street side café is now a common tourist experience



A Short Primer on Digital Photography

Unlike film cameras, which store images on film, digital cameras capture images via electric sensors and store those images on reusable solid-state memory.

The first digital cameras targeted toward consumers were released in the early 1990s. Since then the digital camera revolution has taken off, and there are hundreds of models available. Competition has remained fierce and manufacturers are producing digital cameras with limitless capacity. Just 15 years after the introduction of the first consumer digital cameras, current models are taking pictures that are as high or higher quality than film cameras. Digital cameras take some getting used to, but tourists and travelers who taking digital imaging seriously will find numerous camera choices in the marketplace.

Digital cameras fall into three general categories: consumer, prosumer, and professional. Consumer cameras generally have a single, non-removable lens that mimics a standard 35mm film lens. However, manufacturers now produce consumer level models with nearly every feature of a traditional Single-Lens Reflex or SLR camera.

The term prosumer is a blend of “professional” and “consumer” and refers to consumers who demand more than the standard technology available while being unable to afford professional equipment. In the digital camera market, the prosumer devices are Single-Lens Reflex, or SLR, models, and are falling below the \$1000 price point. Prosumers tend to be technologically savvy and more tolerant of quirks and bugs in new products.

Many professional photographers are moving entirely to digital photography, enticed by the low cost of shots, ease of printing, high resolutions, and ability to edit photos easily with software such as Adobe Photoshop. Professional cameras generally accept the same standard lenses as film cameras and store photos in RAW format, which allows for greater flexibility in editing. The RAW format can be thought of as a digital negative.

The editing and sorting activity is often a precursor activity to the act of e-mail, blogging and posting images on a Web site to interact with digitally connected social network. Travelers with a laptop and access to the Internet will use the online connection to communicate frequently and for sustained periods of time—sometimes hours at a time. If connectivity is available from

Figure 5. Digital cameras are popular among travelers and tourists; they are portable, easy to use, and affordable



a wireless service, the traveler with a laptop will connect, log in to services, and communicate on a frequent basis throughout the day. If the Internet connection is more concentrated, in an Internet café with computers for instance, the traveler will dedicate a portion of the day to connect and communicate online. It is not unusual to see Internet cafés through Europe and Asia, but the model is less attractive in the U.S. Internet connection services should allow the traveler to connect and spend as much time as necessary to conduct the typical activities as blogging, image posting, e-mail, checking itinerary, and so on. As the day winds down on the digital imaging trek, the digitally enabled traveler has acquired a new database of images, published and shared select image-files, and communicated stories of their experience with their social network online through e-mail and blogs.

Taking pictures on a vacation is not new to the world of tourism, but digital equipment has changed the business and behavior equation. Given the proper technical infrastructure, im-

ages can be acquired and posted—essentially published—to a world-wide audience in a matter of minutes.

Digital photos are easy to share. Most photos are already stored on a computer or memory card, and it is a simple matter to upload them to the Internet, either through a private gallery (such as the digitaltrek.org site), or a social photography Web site such as Flickr (www.flickr.com).

Most thriving urban centers and developed destination resort complexes have a mature ICT infrastructure to support instant access to the Internet. Even smaller rural locations now boast access to the greater world of the Internet. The goal of a traveler on a digital imaging trek is to capture and publish images that reflect travel experience in new places and foreign cultures.

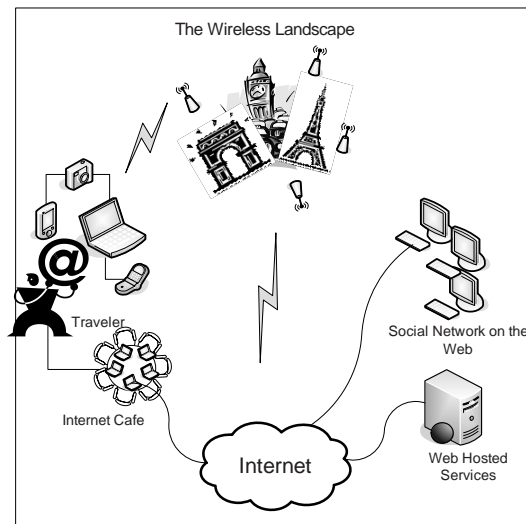
Tourism and Information Architecture

It is critical that both traveler and tourism enterprise alike prepare for the use of digital tech-

Figure 6. Digital imaging trek file types, platforms, and purpose

| File Type | Hardware Platform | Software Platform | Purpose |
|------------------|---|--|--|
| Text file | Laptop, desktop, or handheld device with keyboard. Privately owned, or available through Internet cafe | Word processor-editor software | Written log of experience. Creating and sending attachments on e-mail. Creating and posting blog on Web services |
| Still image | Digital still camera Cell phone with still camera function Multifunction still and video camera | Embedded software in camera platform. Image editing with additional software on laptop or other device | Create a visual record of still images of travel experience. Sort and publish on Web server to share with social network. Send as attachments in e-mail. |
| Motion images | Digital video camera Cell phone with motion camera function Multifunction still and video camera | Embedded software in camera platform. Editing with additional software on laptop or other device | Create a visual record of motion images and sound. Edit and publishing on Web site to share with social network. Send attachments. |
| Hyperlink | Web based hosting services – social networks | Embedded feature on Web site | Allows author to ‘link’ from one type of information to another. Series of links create trails for others to follow. |

Figure 7. The architecture for wireless network and infrastructure model for digitally enabled traveler



nologies through “architecture.” Travelers and organizations need to plan and think ahead of how to respond and conduct activities through the travel and tourism experience. While some things are left to chance or serendipity the deployment of digital infrastructure requires some thought. That plan is called “architecture.”

Architecture for information services is similar to that of architecture for buildings—it is the deliberate planning, modeling, and delivery of ICT services. Architecture requires adopting a model of approach and solution, both in systems architecture and information architecture. How does a highly connected, fast speed digital environment that serves the digitally enabled traveler sprout up? It is not a singular act by any tourism organization, but a system wide policy approach of local and national partners in business and governmental bodies. In most cases, experts from companies that provide ICT services will consult on the array of services available in the technology marketplace.

Much of the communications infrastructure that has developed in the past decade is a confluence of commercial profit-driven interest, digital user culture, and regional policy and laws. The

combined effect of the built ICT environment serves residents and visitors alike. Localities with new digital infrastructure enjoy digital connection to a broader world. Travelers to areas that are served with high speed digital services also reach out and use the infrastructure for all their related travel communication activities. This ever growing presence of widely accessible digital communication services represents different challenges to different cultures. While most Western cultural sensibilities accept the openness of access to the World Wide Web, other cultures are more circumspect and reserved, wishing to control the vast onslaught of information pouring out of the Web.

Cost has always been considered the primary barrier for entry in the world of ICT. The receding cost barrier—as Moore’s Law predicts—has lowered the cost barrier, particularly with technology products and services. Tourist properties such as hotels and resorts now can achieve Internet access as easily as telephone access. In many instances, travel infrastructure such as airports, train stations, and the aircraft and trains themselves, provide Internet and advanced telephone access. Countries and regions are now adopting

ICT's and installing a fiber-optic telecommunications system with wide spread wireless digital access points, which has distinct advantages over older, legacy "wire based" telecommunications infrastructures—particularly for the traveler. In some ways, the new fiber and wireless based connectivity infrastructure offers advantages for the digitally enabled traveler.

Of course, this entire ICT infrastructure model represents enormous business opportunity for the properties in which they exist. Hotels, resorts, travel destinations, travel hubs, restaurants, coffee houses, business outlets can differentiate themselves from competitors by providing ICT for a fee to the traveler. Travelers in turn, view access to ICT as a cost associated with travel and plan to spend money to acquire it. It is common for travelers to purchase short term access to ICT services at these sites on terms ranging from a few hours to several days.

When collaboration on planning and development of digital infrastructure occurs, the stage is set to promote services to the digitally enabled traveler. A highly developed infrastructure and usage model promotes rapid creation and publishing of rich media collateral by the digitally enabled traveler. All parts of the technology infrastructure work in unison to support the activities of the traveler.

Digital communication technologies of many platforms have become accessible to even the most inexperienced traveler. Mobile technologies of all types and sizes and wireless network signal have brought the Internet to the most distant of locations. This convergence of technical infrastructure and tourism presents opportunities and challenges to the tourism industry.

Yet even as the cyber-record of digital travel experience explodes, there are many issues the profession must consider. The more available common digital technologies become, the more travelers and tourism enterprises grapple with the complexity (and confusion) of choices including but not limited to privacy, intellectual property,

systems integration, systems management, training, best practice, and so on.

Digitally Enabled Travel: Knowledge Targets for the Novice

As the digitally enabled traveler becomes more of an influence in the world of travel and tourism, young professionals seeking degree based education and career opportunities in the field need to be familiar with basic technology. Whether looking at a college level curriculum or training opportunities for adults wishing to gain new skills, look for some of the topics covered here.

College level curriculum in hospitality, travel, and tourism programs should include an introductory level course in this area of digital technology. The topics taught in such a course do not necessarily have to be technical but young professionals entering the business should know the basics and be prepared to research and understand technology. A sample of college level curriculum might include topics such as the following.

Foundations in Technology

Many professionals and educators mistakenly think that learners know all there is to know about basic computer operations, productivity software and Internet access, Web searching and surfing. While these topics are often part of many school systems, not everyone has mastered basic skill and techniques in all these areas. Interacting with computer interfaces and mastering the sophistication of some productivity tools such as word processing, spreadsheets, databases and browsers requires instruction, time and practice. Many colleges, universities, technical institutions and similar educational organizations offer courses in computer technology. The popular press is filled with instructional books complete with CD based video for those who are adept at self instruction. Many conferences, training seminars, and "Webinars" (seminars of text, sound, and motion hosted

on the Web), offer similar instruction. Regardless of the model one uses to get trained, using digital technologies requires constant “tune ups” to one’s skill set. Find the type of education that works for you and take advantage of it.

Basic Information and Systems Architecture

Information and systems architecture introduces models to help solve problems in the field of technology. As with providing digital services for travels to use to communicate with social networks, technology applications start as a way to provide a solution to a problem.

While it is convenient to say technology will solve a problem or make some situation more efficient or less cumbersome, the idea has to be communicated in a visual model. Professionals in the world of information technology communicate regularly with visual models that reflect the structure or architecture of a system. Devices and the networks that connect them are shown so all can understand and agree on system solutions. Understanding basic architecture in work flow, information flow, and management, networking, service devices, client side devices, and so on will be very valuable for new professionals in the world of hospitality, travel, and tourism.

Basic Web Design and Interface

Many professionals in the field of hospitality, travel, and tourism will likely be asked to participate in design teams to design and build Web sites that will host information for customers or be used internally as sources of information for the business enterprise. Conceptualizing and building a Web site is a skill that requires practice and experience although of software tools such as Microsoft FrontPage and Adobe (formerly Macromedia) Dreamweaver make it easy to try this

activity. With a little training in software features of such applications, college level courses can quickly teach students the essentials in basic Web site design. This is both a technical and creative challenge, but most people quickly see the results of a little effort. For people just wishing to start with a simple Web site to host information about a trip or a destination, these tools are cheap, accessible, and relatively easy to learn.

Basic Digital Imaging and Image Manipulation

There are an abundance of off-the-shelf software tools in the marketplace that will introduce college student (or anyone with the motivation to learn) skills in digital imaging and image manipulation. While many people have digital cameras a course on digital photography will introduce a wide range of topics from composition to technical specifications. Understanding the wide range of options in today’s digital cameras can be helpful for young professionals who need to deal with a customer base that is armed with the latest camera gadgetry. Learning the process involved in capturing an image and uploading an image to a devices that can store the image in important. More knowledge in these areas will help improve customer empathy and ultimately customer satisfaction.

Editing images in software like Adobe Photoshop has a double benefit to a college curriculum. Students with added technical skills such as digital photo editing are in more demand. Many businesses need such skills to help with developing creative collateral to promote the commercial activity of the business. Understanding the creative process from image acquisition to image editing also will help the professional in dealing with agencies that provide that service. For instance, image editing is a time consuming activity, and in negotiating advertising contracts, such knowledge will be helpful.

Desktop Publishing

Desktop publishing is a content area that will provide a young professional with the knowledge of how to put assets such as text and images together in print collateral to serve the business. Even in the digital age, many businesses still have a great need for printed products to advertise, inform and attract potential customers. Tourism properties still have a great need for pamphlets, brochures and signage to keep customers informed about policies, regulations, events, calendars, and so on. A course in desktop publishing will give practitioners an opportunity to learn a skill that will help promote and organize business. In desktop publishing, students can learn how to conceive and construct various types of print pieces using software such as Microsoft Publishing or Adobe Indesign.

Editorial, Content Creation and Content Management

While learning technical tools is vital, helping young professionals identify and manage the message is critical to the success of travel and tourism businesses. Courses that emphasize the basics of how to construct the message in both text and visual design are important for a basic college curriculum.

Systems and Technology Primer for the Digitally Enabled Traveler

As digital communications platforms and technologies have become adopted by a wide mainstream audience two factors have been critical to widespread use—practicality and ubiquity. Along with the explosion of digital gadgets, contemporary travelers now have high expectations of availability of connectivity and complimentary technologies.

If the tourism industry is to appropriately harness and cater to this new and demanding audience,

the industry must build a model of digitally enabled travel that supports both traditional goals of tourism and the new goals of digital media acquisition. Understanding the pieces of the technology puzzle can serve as a starting point.

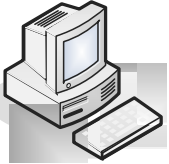



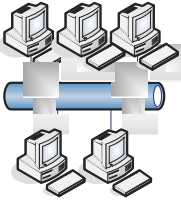

Several recent world events have highlighted the role mobile technology plays on the world stage. The first images of the London tube bombing in 2005 came from the cell phone cameras of survivors. These images were published by the BBC and forwarded around the world within minutes of the attack. Similarly dramatic images, particularly digital video, were quickly spread after the 2005 tsunami disaster in the Indian Ocean. Whether it is a global or local scale, digital imaging devices are ever present and serve as eyes to the world. Building a world class digital environment brings with it many more challenges, not just in the technical realm, but in the human realm as well.

A Word on Privacy and Security in the Digital Age

Privacy, security of information, copyright, information ownership, censored, and uncensored material are all issues that become concerns of the industry when technology is introduced. It is a grey area because decorum and respect relies as much on personal behavior as it does on personal technology. Travelers with powerful digital recording tools must understand the local cultural norms, as well as the global broadcast power of the World Wide Web.

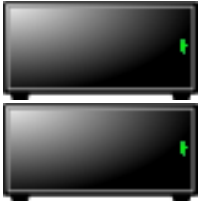

Privacy is an important and sensitive issue. Visitors to a Web site may be reluctant to share information—such as their e-mail address—because they fear that their personal information will be sold and they will be subjected to unsolicited advertisements. Spam, the endless barrage of meaningless e-mail advertising, has become an onerous burden to all citizens using online tools. It is best avoided by constricting the use of e-mail addresses.

Table 2. Core components of an information technology system

| Technology | Location | Skill-level | Description |
|---|--|---|--|
| <p>Computer Client</p>  | <p>Computing cluster such as an Internet café, business service office, hotel lobby, etc. One or more for use by customers</p> | <p>Basic to advanced software such as e-mail, word processing, file management; basic computer knowledge</p> | <p>The computer client serves as the starting point for the customer. Recreational and business travelers alike will budget time and funds to access basic computing services such as e-mail, word processing, file uploading.</p> |
| <p>Laptop Computers</p>  | <p>Anywhere, travelers port and manage</p> | <p>Basic to advanced software such as e-mail, word processing, file management; basic computer knowledge</p> | <p>A laptop computer is a computer client and the traveler's link to the Internet and workstation for writing blogs or editing digital photos.</p> |
| <p>Card Readers</p>  | <p>Anywhere</p> | <p>Basic computer knowledge required.</p> | <p>Digital cameras accept different memory cards depending on brand. A generic card reader will allow any computer to read any card from any camera, with no additional software.</p> |
| <p>Portable Storage</p>  | <p>Anywhere</p> | <p>Basic computer knowledge required.</p> | <p>Backups are a major issue for travelers concerned about potential data loss (from theft or equipment failure). A portable hard drive (or a device that can burn CD's) provides a cheap and easy backup solution on the road. Small and easily packed.</p> |
| <p>Network-wired</p>  | <p>Anywhere</p> | <p>Intermediate to advanced computer knowledge required to build and support. Entry level user knowledge to access and use.</p> | <p>Wired Internet connections are generally located in institutions (such as hotels, business services, universities), and may incur a cost for access.</p> |
| <p>Network-wireless</p>  | <p>Anywhere</p> | <p>Intermediate to advanced computer knowledge required to build and support. Entry level user knowledge to access and use.</p> | <p>Wireless Internet connections can be found in built environments, particularly popular in urban settings with restaurants, parks, museums, hotels, and cafes.</p> |

continued on following page

Table 2. (cont.)

| | | | |
|---|---|--|--|
| <p>Mass Storage</p>  | <p>Any secure building location, typically attached to host devices such as advanced workstations or mainframes.</p> | <p>Intermediate computer knowledge required to configure, install and support.</p> | <p>A mass storage device, is a very large, commercial grade hard drive. It supports data and functions core to large businesses. While computer users may see the results of such devices in a routine Web search, these devices work in the background of daily user activities.</p> |
| <p>Servers</p>  | <p>At a hosting company; typically a technology company which provides a secure physical location, as well as technical knowledge to support services. Locations are typically built specifically to house the servers.</p> | <p>Advanced technical skills in Web hosting and server based data services.</p> | <p>The server will host all of the content for a Web site and code for Web applications such as a gallery or blog. Often a class of computers known as workstations; function solely as servers. A hosting service provider will maintain and support all server hardware and software. Computer users access these devices through client computers to update Web sites, post images in galleries and blog.</p> |

Information that may be personal or sensitive, such as vacation photos or a travel journal, should be posted with care. In many cultures people do not wish to have their images posted for the world to see. Privacy for individuals is a sensitive matter. Even in public tourism venues, digital photographers are challenged when taking images and asked to refrain. Religious and private properties often post requests to refrain from photography and video recordings.

Institutional Web sites should consider developing a privacy policy, or a legal statement that reflects what the institution may and may not do with information provided by users. The World Wide Web Consortium (the standards body for the Web) has developed the Platform for Privacy Preferences (P3P) (<http://www.w3.org/P3P/>), a standardized language which provides Web site administrators with a simple and automated way to quickly generate a customized policy for their site. Individual digital travelers, eager to capture a unique image, must apply their own standards.

The golden rule though is “do unto others” as you would have done to yourself. Consider the impact of each image that is posted.

Travelers must be aware of their physical safety and security at all times. Broadcasting information on the Web can add to this worry. For example, travelers, especially solo-travelers, are advised against posting a personal and complete itinerary until their trip is complete. No only does it tell the world where you will be, but it also tells the world where you are not. Home safety as well as trip safety is the paramount concern.

With reasonable precautions, a Web site can *increase* safety. It allows a large number of people to check in on the well-being of travelers. While theft and other dangers cannot be eliminated, careful use of a Web site, instant messaging, and e-mail can reassure those back home. The personal technology of a digital enabled traveler is an attractive target for thieves. Common sense should guide the novice and experienced traveler in protecting personal possessions.

Web Hosting: What Travel and Tourism Professionals Need to Know

All Internet applications such as a Web site or a search engine run on a server. The server is a computer workstation in a class of computing machines that is specially constructed to manage the constant demand of service to clients on the network. Servers require special software and in most cases, comparably advanced knowledge and skill to configure and maintain. While it is possible to run a server in-house, it involves purchasing a machine, installing and supporting an operating system and applications, and maintaining an “always-on” Internet connection. Managing a server requires routine management as well as prompt response emergencies, 24 hours a day, 7 days a week. For most travel and tourism providers, becoming a technology company is a distraction from the core business. It is generally advisable that any business requiring a host on a server be outsourced to a Web host business provider.

A Web host is a company that provides space on their Web servers, use of their programs, and a certain amount of bandwidth use for a monthly

cost. Often referred to as a “solutions provider” or a “Web hosting service” the hosting company will handle all computer hardware and software issues such as installations, configurations, back-ups, updates, and any unforeseen maintenance. Of course, solution providers contract these services for a fee, but competition works in this marketplace as it does in any other, and a shopper is wise to research and compare costs and services among a range of businesses.

There are many Web hosting companies and there are many attributes to consider when researching them. Choosing a hosting company is a long-term commitment. Transferring a site from one hosting service to another generally involves several days of unreliability and possible downtime. Carefully consider all of the factors onlined in Table 3 before making a decision.

All of these considerations are important indicators of a successful Web hosting experience. Remember, anyone can run a server, including a college student living in an apartment with a space for a computer on a network. Make sure that you are dealing with a professional company that has a reputation for handling routine business as well

Table 3. Qualities for evaluating a hosting company

| Factor | Description |
|-------------|--|
| Reputation | Every company must market itself on its reputation for service to customers. Ask for reference of other businesses that have used the services. Search for comments on the Web about the company and its performance. Are there any instances of how the company performed in a crisis, such as a virus attack or power failure? Have you toured the facilities or conducted due diligence on the company? |
| Reliability | Does the company publish statistics on technical performance? What level of support and customer service contact is there? Will you be able to contact people in off hours? What kind of technology do they support? Is there a specific platform or hardware and software and do you recognize the vendor? Ask about back-up, power supply, physical security, data security, and so forth. Do they publish their reliability data? Conduct an Internet search through popular search engines to find information about them. |
| Technology | Is the hardware and software platform up to date and current? Can you speak to vendors who supply the company with technology. Do they publish any related information about platforms? |
| People | Making a business agreement is as much about people as it is price structure. Have you met the principals of the company? Are you generally familiar with their organization and business structure? Do you have confidence in the people you have met? Is there generally superior business communication to your proposals? |

as crises. Like the travel and tourism industry, professional protocol in handling technical matters as well as high grades on customer service are key to sound business practice in the technology marketplace.

As with every business, hosting is about people as much as technology. Find a company with knowledgeable employees who are happy to deal with their clients. You should find support personnel who are professional, courteous and eager to answer questions at your knowledge level, no matter how basic or advanced.

Every good host publishes their uptime (the amount of time the service has run without interruptions) and customer testimonials. Don't necessarily trust the quotes on the company's Web site; do an Internet search with any popular search engine (Yahoo, Google, etc.), and find out for yourself.

Once you have identified a few companies that you feel comfortable dealing with, consider the technical requirements of your project. The first decision is about the type of hosting that the project requires. The options are:

- **Dedicated hosting** means that you are leasing an entire computer, which gives you access to the entire hard drive and allows you to make certain configuration requests that are not possible on a shared machine. By leasing a server (rather than purchasing it and placing it in your office), you outsource the need for physical setup, administration and backup services. You also avoid the upfront cost of a powerful machine, and take advantage of your hosting company's ability to quickly purchase and maintain the machine with professional qualified vendors.
- **Shared hosting**, sometimes called managed hosting, means that you are leasing part of a server, which you will share with other customers. This kind of plan generally involves very low monthly fees (as low as

\$10/month) and provides complete technical support. Unless you are hosting multiple blogs or Web sites, a shared hosting plan is probably sufficient.

Travel and tourism organizations could have a range of needs to contract an outside hosting provider. Setting up a Web page to inform customers of features and offerings of a property or package, or architecting more advanced online services for customers may be among the ideas you will have. The next step in this process of selecting a hosting provider is to explore what you want to do with your hosting provider. The type of service you offer will determine the software applications that the hosting provider will need to run on the server. Additionally, your requirements will guide the features that you'll select for the server. Each software package will list the special requirements on their Web site, but some general guidelines are:

- **Static Web page:** Simple Web pages that hyperlink information that is relatively static. Information does not change too often. Static Web pages require little to no special software or technical support.
- **Downloadable images:** No special requirements, similar to static Web page
- **Image gallery with uploading:** Image galleries containing collections of image (often hundreds and thousands) require server-side programs. Server side programs mean that special software has been loaded and manipulated to provide an easy user interface and experience. A database will be required to track and maintain a medium to large size collection of gallery images.
- **Blogs:** Blogs, or written text entries also require special server-side software to accepted entries, organize them and display them, blog software, like image galleries is generally database-driven.

Several hosts offer blog-friendly plans that require minimal configuration and no technical skills. Lists of these can be found at <http://wordpress.org/hosting/> and <http://www.sixapart.com/movabletype/hosting>.

Identify your minimum technical requirements. In general, look for the criteria listed in Table 4.

More Technical Tools of the Digitally Enabled Traveler

Digitally enabled travelers will quickly embrace new and experimental technologies. For them, it is a challenge to figure out ways to adopt a technology and make it work in the daily flow of travel.

For instance, instant messaging, or “IM,” is a technology for rapid-fire asynchronous mes-

saging across a network. Instant messages can be thought of “instant e-mail,” and are generally used to communicate to a select social network, but often composed on the computer screen while doing something else. Digitally enabled travelers multitask on the computer—that is, they conduct more than one activity at the same time—with ease.

IM was first popularized in the mid-1990s by ICQ, a product introduced by Mirabilis Ltd in 1996. Mirabilis Ltd was later acquired by America Online, which ran a competing product called “AOL Instant Messenger,” or AIM. By acquiring ICQ, AOL became the largest operator of instant messaging networks in the world.

Other competitors include Microsoft, which offers an instant messaging feature as part of the Microsoft Network (MSN), and Yahoo!, which offers the feature as part of their community-build-

Table 4. Criteria for evaluating Web hosting services

| Feature | What to Look For |
|----------------------------|---|
| Technical Support | At the very least, 24-hour e-mail technical support. Also consider telephone support (generally, the company promises to address your problem and call you back within 24 hours). |
| Domain | Most hosting plans include one domain registration (for example, www.yournamehere.com) for free. Make sure that the price for a second is reasonable (not more than \$20/year). |
| Disk space allocation | Disk space, the space on the hard drive that is allocated to you, should be adequate for your application. Storing Web pages or blogs requires a small amount of space, while storing photographs requires multiple gigabytes. Look for at least 10GB of space. Also, research in advance what it will cost to expand your allocated space. Understand the incremental hikes in cost for more disk space. |
| Server-side program access | The applications that you wish to run will guide your need for server-side program access. In general, look for PHP, which is a coding language that manages how customers see and interact with your services. |
| E-mail addresses | Your plan should offer the ability to create your own me@mydomain.com e-mail addresses. Web-based e-mail access is a nice feature for frequent travelers, and is offered at no additional cost by many hosts. |
| Bandwidth | Bandwidth refers to the total amount of data transfer between your server and visitors to your Web site. More bandwidth is good. Understand that bandwidth to the end user is limited by their personal connection and rate of speed. |
| Statistics | It’s always helpful to know exactly how many visitors your site has. Hosting companies typically provide this information with some graphics and analysis. |
| Databases | If you wish to run a dynamic application such as a blog, you’ll need access to a database. |
| Operating System | Your operating system choice should be guided by your application requirements. Most hosting plans are based on either Linux (which tends to be cheaper), or Windows. |

ing options. All of these services are free to use, though some may display advertisements.

Unfortunately, all of these services are based on proprietary protocols and do not interoperate. Therefore, a digital traveler must choose the service that most of the people that they wish to communicate with use. If this is not practical, digital travelers can invest in a product such as Trillian, from Cerulean Studios (<http://www.ceruleanstudios.com/>), which is an IM program that supports all major networks.

Instant messaging is favored by digital travelers, because it allows instant communication with anyone on the network, no matter where their physically located. If a device (such as a computer or cellular telephone) has Internet access, it can connect to an IM network. This is an extremely low-cost method for travelers to communicate with their social network of friends, family, and colleagues around the world.

More recently, voice over Internet protocol (VoIP) has become an important buzzword in the latest digital tools becoming available to digital travelers. VoIP is a technology for transmitting traditional “telephone calls” over the Internet. Imagine using a laptop as a phone and conducting routine two-way audible conversations. Such calls are indistinguishable from normal Internet data and promise to make international conversational calls extremely cheap. Imagine no more phone calling cards and the end to frustrated travelers trying to decipher local and international calling codes.

While still in the early stages, VoIP is available to any digital traveler with a laptop, speakers, and a microphone. Services such as Google Talk or Skype (<http://www.skype.com/>) are up and running and can be used to converse with telephone quality audio for free. Skype also offers “Skype Out,” which permits computers to connect with telephone numbers anywhere in the world for extremely reasonable rates.

Needless to say, it is important for travel and tourism organizations to be familiar with trends such as VoIP for two reasons. The early adopters of such technology—the digitally enabled traveler—are the bell weather for change in the industry. It won’t take long for entrepreneurial technology providers to create a competitive business model for VoIP and shift the commerce to a new marketplace.

CONVERGENCE AND FUTURE TRENDS

Given the rapid evolution of digital communication tools, both hardware and software based, it is not hard to imagine that many of these products will continue to transform.

The technology industry is creating faster, lighter, devices that better integrate with each other. This trend of “convergence” is one to watch for. It wasn’t long ago that a cell phone was simply a way to have voice conversations with other parties. Today, other features have converged on the platform of a cell phone. Is a cell phone a camera, a video recorder, a video viewer, organizer and personal digital library? The answer is “yes”—it is all those things and more.

A digital camera is no longer a camera; it is an image processing workstation. Images can be acquired, edited, filed, and stored. Images are dynamic files that merge and morph into other applications and devices through infrared proximity connections.

The ubiquitous iPod from Apple computer started off not too long ago as a just another platform for listening to music. Today an entire lucrative industry revolves around providing rich media content for viewing on a tiny screen. Need an exercise multimedia instruction package for keeping fit during travel, it can be purchased and downloaded to your iPod.

CONCLUSION

Digital gear to enhance the travel and tourism industry is a constantly evolving marketplace. The future is part evolution and part revolution, from wildly popular devices to culturally challenging information flow. Regardless of the intricacy, allure or popularity of digital devices, the seasoned digitally enabled traveler will always find ways of incorporating new devices and new services to enhance experience and communicate to a social network in digital space. Travel and tourism providers must influence the role of the digital imaging trek by understanding the role they themselves play in this ever changing landscape. Who is the provider, the host, the arbitrator of this new world of digital travel? By seeing and

understanding the big digital picture, tourism and travel providers will retain perspective and offer quality services to patrons worldwide.

NOTE

- All images are provided with permission to reproduce by the authors.
- Illustrations are public domain license free illustrations from Microsoft Visio.
- Figures representing models are provide with permission to reproduce by the authors.
- Illustrations in models are public domain license free illustrations from Microsoft Visio.

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper, pp. 286-313, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.44

Adaptive Use of ICT in Response to Disintermediation

Pramod Sharma

University of Queensland, Australia

Dean Carson

Southern Cross University, Australia

Andrew Taylor

Southern Cross University, Australia

INTRODUCTION: EVOLUTION OF THE WEBMAIL SYSTEM

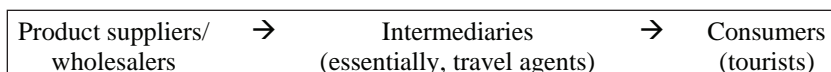
Traditionally, the Australian travel agency sector has operated as the premium intermediary in a relatively simple distribution chain that can be depicted in Box 1.

In such a system, it is estimated that travel agents have traditionally handled over 85% of consumer transactions (Wilde & Rosen, 2000). The advance of online technologies and ICT-based distribution systems has changed the dominant role of travel agents in the distribution and sup-

ply of travel products. This has impacted on their relevance, returns, and individual financial viability.

There is a vast amount of literature on new forms of product distribution made possible by developments in ICT. This literature has raised many issues (see, for example, Clemons & Hann, 1999; Klein, 2002; Anckar, 2003), but our comments are restricted to the concept of disintermediation and, in particular, to its application to the travel agency sector in the tourism industry (Anckar & Walden, 2002; Buhalis & Licata, 2002).

Box 1.



The key literature on disintermediation has been summarised by Anckar (2003) as follows: the threatened intermediaries (or disintermediation) hypothesis essentially describes the reduction or elimination of the role of the middleman in transactions between the producer and the customer, as in the new electronic marketplace, where consumers interact directly with producers. With the resulting bypass of intermediaries, which adds significant costs to the value chain, there could be shifts in power from one channel layer to another. Due to the presumed suitability of the tourist product for e-commerce and the fact that the travel distribution chain traditionally has been heavily dependent on middlemen, the travel industry has been hypothesized to be among the first sectors to experience disintermediation on a large scale as a result of ICT developments.

While there is voluminous theoretical literature, the empirical evidence of disintermediation in the international tourism industry is still patchy (Alamdari, 2002; Klein, 2002). In the United States, for example, while online transactions have grown dramatically, the overall industry impact in terms of market share has been significantly less than predicted—the evidence certainly does not support “travel agents are extinct” predictions (St. Clair, 2000). In Asia, a region with rapidly growing air travel, over 80% of all ticket sales are still made through travel agents (Alamdari, 2002). One can speculate that the drivers for disintermediation have not been as strong as expected, or that travel agents have been successful in their adaptive response, or as one writer (Klein, 2002) observed, “...the incumbents tend to fight back and leverage their financial power, their brands, established relationships, and click and mortar strategies” (p. 227). Consumer reluctance to use new technologies used for product distribution may also be a factor (Anckar & Walden, 2000; Alamdari, 2002), although more recent evidence indicates that substantial “conversion” might be underway (Anckar, 2003; Buhalis & Licata, 2002; Mowat, 2003).

We have noted that although travel agents still appear to have a substantial role in the industry, forces at work (including ICT impacts, e-ticketing, changes to commission arrangements, consolidation in the industry, etc.) have been working toward a significant diminution of that role. In this context, it is not important as to whether the debate is on disintermediation, reintermediation, or cybermediation, the impact on travel agents is generally negative. It is difficult to promote a scenario in which travel agents will become *more* important (Vasudavan & Standing, 2000; Klein, 2002).

This article discusses the development and implementation of the WebMAIL initiative as a response to the disintermediation of travel agents in Australia.

BACKGROUND

The Australian Federation of Travel Agents (AFTA) is the main industry body representing Australian travel agents. Its WebMAIL initiative is an Internet-based, business-to-business (B2B) system for the distribution and management of sales-related information covering “regular” travel and offerings products as well as “special” options. It is the only multisupplier, consolidated, product promotion database of its type in the country. WebMAIL provides suppliers with an Internet-based communication link to the Australian travel agency sector. It presents AFTA members with opportunities to embrace new technologies and to counter the threat of disintermediation. AFTA hopes that WebMAIL will reinforce the position of travel agencies in the distribution channels.

The WebMAIL tool is, in effect, a reintermediation of service provision. The initiative is a response by the sector’s industry representative body rather than by the individual enterprises that comprise the sector. Also, while the technology underlying WebMAIL is relatively simple, its

business model is self-funding in that the suppliers (the source of disintermediation and associated threats) fund the entire system. Initial success with this business model suggests that in Australia, at least, the travel agent sector can still add sufficient value to retain a viable role in the supply chain of travel and product services.

WEBMAIL FUNCTIONALITY

Prior to the development of WebMAIL, individual suppliers of travel services contacted individual travel agencies by fax or by e-mail. In recent times, most travel service suppliers have also developed Web sites. Typically, a travel supplier would send information on various offerings to the travel agents in its distribution chain. Until the advent of WebMAIL, this information was generally stored in physical personal folders or in individually designed electronic folders. Effective use of such systems is heavily dependent upon individual skill and memory and has in-built difficulties with regard to currency, uniformity, and rapid ease of access. Clearly, with the continual emergence of more efficient electronic systems becoming widely available in workplaces and home environments in Australia, there was a need for a system that would better manage the information flow and for creation of a database that not only manages filing but contains an effective search and retrieval facility.

WebMAIL (Figure 1) collects and collates travel product and service offers from participating travel industry suppliers around Australia and compiles these with the individual user profile of each travel agent registered in the system. The system provides travel agents with one e-mail per day (usually at the start of the business day). WebMAIL supports this targeted communication with an automated filing and archiving system, along with simple-to-use search and retrieval functions.

Travel product and service suppliers can load information regarding their products and marketing initiatives directly into a central, searchable database. Suppliers also control when and to whom this information will be available. They stipulate the validity period for their information, and it is automatically removed from the “current” area upon expiry date. This reduces the chances of agents offering out-of-date information.

In addition to the notification by the “daily alert,” travel agents can search for information in the WebMAIL database by supplier name, product type, information type, region, country, or date of issue. Hence, using WebMAIL, suppliers are no longer reliant on agents trying to maintain their own filing systems for this information.

ICT-RELATED BENEFITS OF THE WEBMAIL SYSTEM

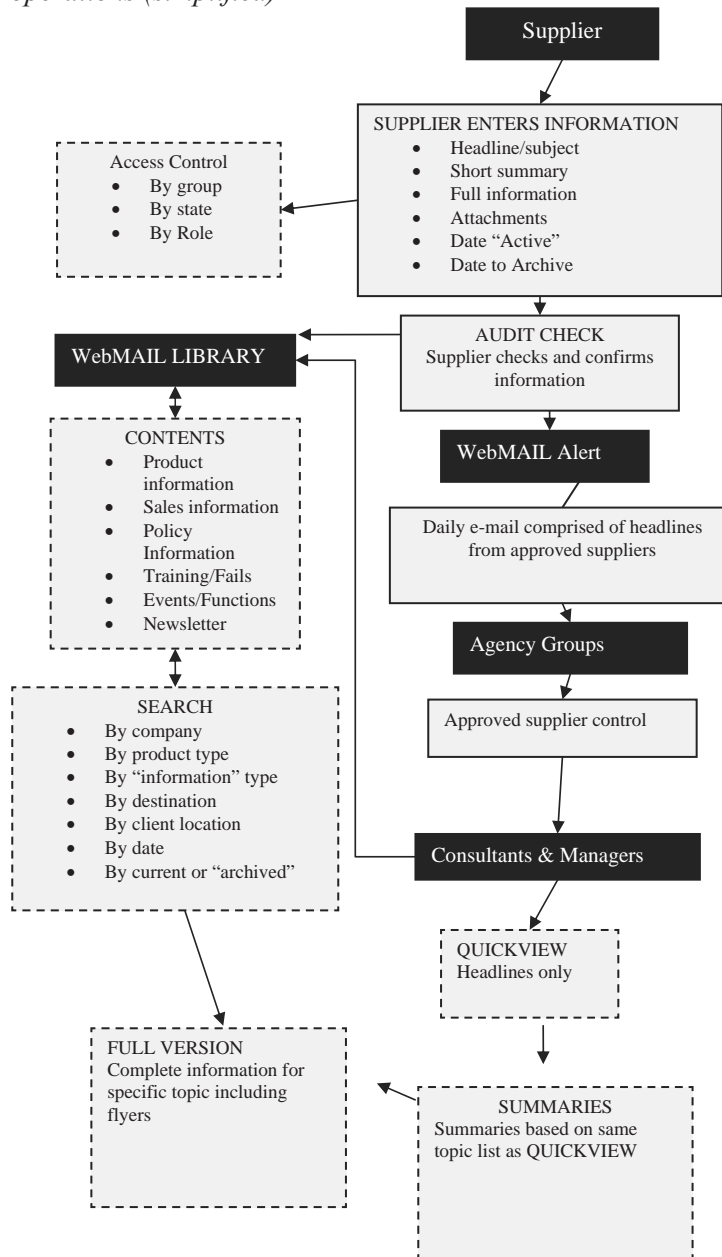
Table 1 summarises some of the benefits that the WebMAIL technology has brought to the travel-agent sector.

POTENTIAL REGIONAL BENEFITS

The WebMAIL system may offer several benefits for regional travel agencies. Perhaps the main one is to effectively level out the availability of product information for all agencies, regardless of location. Importantly, it achieves this without requiring any extra financial outlay from individual agencies. WebMAIL opens up suites of product information and details previously inaccessible to regional clients through their local agencies. The result is that, should it choose to, a small, low-turnover regional travel agency can access and obtain the same product information as its large, city-based counterparts.

The method of access to information through WebMAIL may also result in real savings for

Figure 1. WebMAIL operations (simplified)



regional agencies. Prior to its inception, for example, regional agencies bore the costs of staff time and telecommunications access in obtaining up-to-date information about tourism products. Keeping in mind that regional travel agencies are generally small operations that are sometimes co-located with other retail outlets (for example,

a news agent/travel agency business), these savings may prove to be significant.

In summary, WebMAIL can be described as friendly to small regional business, because it offers a low-cost and low-risk solution to obtaining up-to-date product information. It enhances the timeliness, quantity, and quality of information

Adaptive Use of ICT in Response to Disintermediation

Table 1. The benefits of WebMAIL to suppliers and travel agents

| WebMAIL Features | Benefits to Suppliers | Benefits to Travel Agents |
|---|---|---|
| Productivity and cost savings | <ul style="list-style-type: none"> Suppliers can load product and marketing information directly into a central, searchable database. This greatly reduces costs of continuous and scattered fax and e-mail broadcasts. | <ul style="list-style-type: none"> Travel agents no longer waste time searching for missing information they have misfiled. All supplier updates are on the database and can be easily searched and retrieved. Business model whereby suppliers pay to have their information distributed, rather than the travel agents paying to receive that information. |
| Information management | <ul style="list-style-type: none"> Provides automated filing and archiving, so supplier information is always available to agents. Links to supplier Web sites and booking portals can also be included. Promotional documents like flyers can be attached for agents to download and supply direct to the customers. | <ul style="list-style-type: none"> Receive one concise e-mail notification of all the latest updates from all suppliers each day. This greatly reduces the administrative burden in fax notifications, e-mail broadcasts, and all other forms of marketing directed by suppliers to agents. Set their own profile for information to be tailored to their needs. This allows for the provision of superior service to potential clients. Provides easy access to all past updates. Agents can quickly check the product information and advise both the customer and the supplier. |
| Product management and target marketing | <ul style="list-style-type: none"> Suppliers can choose to send updates to all agents, or to specified groups only; to all consultants, or to managers only; and to all states or to specified states only. They can also choose when the information will be shown as “current” and when the information will be transferred to the “noncurrent” archive. | <ul style="list-style-type: none"> Searches of all previous “alerts”/updates can be made in the AFTA WebMAIL database (see Figure 1). |

that is available to the enterprise so that a level information playing field is established for all travel agencies.

RESULTS: WEBMAIL IMPACTS

Since the introduction of WebMAIL in Australia in September 2002, more than 5800 travel agents now access the WebMAIL system, with 120 unique travel product and service suppliers subscribed as of September 2003. In this introductory 12-month period, over 4,000 product offer notices (many referring to multiple products) were lodged with WebMAIL; the site receives approximately 1000 unique visits from travel agents per day. In the January to March 2003 quarter, the Web

site monitoring company Hitwise ranked *www.afta.com.au* number 7 in Australia in the Travel Agency category and number 5 in the Business & Finance—Professional Associations category. Responses to an online survey in September 2003 indicated a high level of satisfaction with WebMAIL.

CONCLUSION

The introduction of online technologies into travel and tourism distribution channels has had a substantial impact on the relationship between product suppliers and intermediaries. AFTA has responded to the threats created by the process of disintermediation with the WebMAIL ICT system.

The WebMAIL initiative has enabled suppliers to realise substantial benefits in maintaining intermediary channels, including the capacity to enlist distribution mechanisms that are seen as largely independent and objective. Travel agents have benefited from reduced “information overload,” while both groups have improved information management practices. Importantly, this ICT initiative may realise real benefits for travel agencies in regional areas.

One indicator of the success of WebMAIL has been the subscription of suppliers to the business model, whereby it is the suppliers who pay to have their information distributed, rather than the travel agents who pay to receive that information. This model has proven successful in the first year of WebMAIL’s operation; however, the future of WebMAIL is undoubtedly in the hands of the suppliers. The challenge is for travel agents to continue to provide value for money for subscribing suppliers, and in this sense, WebMAIL represents one component of adaptive responses to potential disintermediation in Australia. Further research is required to identify what other components are required and how online technology may be employed more effectively.

REFERENCES

- Alamdari, F. (2002). Regional development in airlines and travel agent relationship. *Journal of Air Transport Management*, 8, 339-348.
- Anckar, B. (2003). Consumer intentions in terms of electronic travel distribution: Implications for future market structures. *E-Service Journal*, 68-86.
- Anckar, B., & Walden, P. (2000). Destination Maui? An exploratory assessment of the efficacy of self-booking in travel. *Electronic Markets*, 10(2), 110-119.
- Anckar, B., & Walden, P. (2002). Self booking of high- and low complexity travel products: Exploratory findings. *Information Technology & Tourism*, 4(3/4), 151-166.
- Bedard, F. (2000). Tomorrow’s Travel Agency: A survey of adaptation and positioning strategies to new technologies in services. In D. Fesenmaier, S. Klein, & D. Buhalis (Eds.), *Information and communication technologies in tourism 2000* (pp. 336-342). New York: Springer.
- Benckendorff, P. J., & N. L. Black. (2000). Destination marketing on the Internet: A case study of Australian regional tourism authorities. *Journal of Tourism Studies*, 10(1), 11-21.
- Buhalis, D., & M. C. Licata. (2002). The future of eTourism intermediaries. *Tourism Management*, 23, 207-220.
- Clemons, E. K., & I. Hann. (1999). Rosenbluth International: Strategic transformation of a successful enterprise. *Journal of Management Information Systems*, 16(2), 9-27.
- Klein, S. (2002). Web impact on the distribution structure for flight tickets. In K. Wober, A. Frew, & M. Hitz (Eds.), *Information and communication technologies in tourism 2002* (pp. 219-228). New York: Springer.
- Mowat, T. (2003). Exploding myths: Web booking just a phase. *Travel Press*, 36(2), 1,16.
- Reinders, J., & M. Baker. (1998). The future for direct retailing of travel and tourism products: The influence of information technology. *Progress in Tourism and Hospitality Research* (4), 1-15.
- St. Clair, K. (2000). Modern travel industry: Debunking the myths. *FIU Hospitality Review*, 18(2), 98-102.
- Standing, C., & T. Vasudavan. (2000). The impact of Internet on travel industry in Australia. *Tourism Recreation Research*, 25(3), 45-54.

Adaptive Use of ICT in Response to Disintermediation

Vasudavan, T., & C. Standing. (2000). A human resources perspective of travel agencies and the Internet. *CAUTHE*, 230–241.

Wilde, C., & C. Rosen. (2000). Up in the air. *Information Week*, November 13, RB19–RB23.

KEY TERMS

AFTA: The Australian Federation of Travel Agents. AFTA is the peak representative body for Australia's Travel Agents, representing the majority of travel agencies in Australia. Its aim

is to "...stimulate, encourage and promote travel, and to uphold the interests of travel agents" (AFTA Web site: www.afta.com.au, 2004).

Disintermediation: Describes the reduction or elimination of the role the middlemen in transactions between the producer and the customer as, in new electronic marketplaces, consumers interact directly with producers.

WebMAIL: An online system developed by AFTA providing travel agencies in Australia with access to tourism product and service offerings from participating industry suppliers.

This work was previously published in the Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by Marshall, S., Taylor, W., and Yu, X., pp. 6-10, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 3.45

Virtual Reality

Mapping Revisited: IT Tools for the Divide Between Knowledge and Action in Tourism

Malcolm Cooper

Ritsumeikan Asian Pacific University, Japan

Neil MacNeil

Ritsumeikan Asian Pacific University, Japan

ABSTRACT

This chapter provides a brief overview of the available technologies and opportunities for the use of virtual reality in tourism marketing. It acknowledges that in almost all formulations of the tourism marketing model to date however, much has been made of the notion that tourism is unique because production and consumption occur not only at the same time but in the same place, and therefore that location or proximity is often a critical determinant of the take-up of tourism opportunities. The chapter then goes on to posit the question: what if the place variable could be removed from this equation through the further development of virtual reality techniques? The impacts of this might include: less requirement for travel per se (perhaps); better and more real information about the physical actuality of

a destination for the potential consumer (likely); price and service quality information very much simplified and improved (definitely), and changed tourism promotion strategies would change (undoubtedly). At the barest minimum, the uncertainties involved in relying on unverified initial information for tourism travel decision-making could be considerably reduced.

INTRODUCTION

As consumers become more committed “Web surfers,” their processes of decision making based on the information found there will become more sophisticated, particularly when purchasing products and services (Buhalis, 1998; Sheldon, 1997). In the early days of mass use of the Internet to contact potential clients, anyone with anything

to sell or provide information on could develop a Web site to advertise their intention to trade; a process that was really nothing more than transferring print or television/cinema-based static visual information to the new medium (Buhalis, 1998). With respect to tourism and hospitality such users ranged from the major airlines and hotel/resort chains to the family with a holiday villa for rent in Europe, or to a bed and breakfast operator in Australia, or to an *Onsen* proprietor in Japan. By assisting the promotion of tourism services in this way the early e-commerce boom certainly dramatically extended the marketing reach of tourist operators (Buhalis, 1998). With maturity however, markets generally become more sophisticated and demanding, and require higher standards of interaction, particularly at the more expensive end of product cost (Weiermair & Mathies, 2004). As a result, the variety and scale of information the purchaser of tourism product now has in terms of making informed buying decisions, and the increasing sophistication of both consumers and tourism marketing organizations is leading to more creative applications of the Web as a channel to reach consumers in this industry (Sitepal, 2005).

Nevertheless, much of the information currently provided to tourism consumers remains 2-dimensional; if it is visual then it is at best generally only composed of good photographs with associated text, unless video capture is used. However, very high processor and memory demands on the destination computer make the latter less attractive to the average Internet user. So, in practice, consumer processing power constraints mean that operations on current tourism Web sites remain heavily dependent on text for their message delivery, with software robots used “behind the scenes” to retrieve text-based information for consumers (Ishida, 2002). Obviously this search and retrieve metaphor works well, even on a global basis, but if the Internet is to be used for real personal interaction with the tourism environment an immersive image-based

geographical interface is ultimately going to be needed. One way to provide this is to construct a 3-D virtual image of a destination or travel route for the potential consumer; however there has to date only been limited adoption of virtual reality (VR) technology in the sales pitch of tourism organizations and businesses large and small, so despite the widespread availability of appropriate receiving media this form of message representation has not really entered the mainstream as yet (however, see Google Earth, <http://earth.google.com/tour/>).

THE ADVENT OF NEW TECHNOLOGIES

This situation is likely to change in the near future as products like more sophisticated digital cameras become accessible to the wider consumer market, allowing tourists themselves to depict destinations in virtual reality terms to their friends and contacts. The technical sophistication of the Canon IXY is one example of what the next generation of digital cameras will be capable of. With a photo-stitch assistant built in, the photographer using one of these cameras (and others like them) is able to make seamless panoramic images over 360 degrees. The wider spread of technology of this nature will force producers of commercial promotional material in tourism to undertake more sophisticated use of VR to ensure that their products are visible in these ways to the more sophisticated user. In this context it is no surprise to see that immersive video and the ability to stream high quality video content to the Web consumer are now becoming increasingly acknowledged as an acceptable technology in promotional terms (Buhalis, 2002), and for this reason we argue in this chapter that such advances in technology will add to the VR impact of tourism marketing on the Web in the very near future.

Set against the development and general societal take-up of new technology is the extent and

speed of its adoption by individual consumers, subjects of much interest to the marketing and tourism industries for many years (Bierman, 2002; Buhalis, 2002; Cetron, 2001; Hall, 2000; Inkpen 1998; Leiper, 1995; Prideaux, 2000, 2002; Weaver & Lawton, 2002; Witt & Moutinho, 1995). Most studies have found that there is a lag between the introduction of technological innovations and their widespread acceptance (Witt & Moutinho, 1995, pp. 273-284). Here, individual differences in learning and, indeed the whole human learning process come into play (Bednar, Cunningham, Duffy, & Perry, 1995). Effective learning derives from an individual developing a mixture of behavioural (new behavioural patterns being repeated until they become automatic), cognitive (the effects of changes in behaviour are observed and used as indicators to future useful behaviour), and constructive solutions to a given problem. This concept is based on the premise that we personally construct our own perspective of the world, especially with respect to problem solving in ambiguous situations, rather than have it done for us by an external agency (Schwier, 1995). As a result of this mechanism, because a human learner is able to interpret multiple realities depending on need, they are better able to deal with real life situations if they can actively problem-solve within them or before they occur. The actual circumstances surrounding the particular situation help us decide which approach to learning is most appropriate, but the process is intermediated by personal experience, cognitive and physical ability and other specific and non-specific situational variables. The end result is that some problems require highly prescriptive solutions outside the learner's control, whereas others are more suited to the control of his or her environment by that learner (Schwier, 1995).

From these, and earlier observations, a number of conclusions can be drawn about the likely learning behaviors and responses of the tourist to the type of almost total immersion environments (3-D) exemplified by virtual reality techniques (Bitgood,

1990; Psotka, 1995). The most general one is that users will still use specific environmental features as clues to behavior on entering a virtual space, just as they do in real space. Authentic environmental reproduction is therefore required to convey that sense of place. In fact, the inclusion of accurate renditions of artifacts and real environmental elements from the actual places being recreated is essential to effective immersion environments, even if initially the learners involved have very little directly transferable prior knowledge about the content area. What this means is that properly constructed virtual environments could quite easily and satisfactorily replace actual travel for some potential tourists, given the way in which human beings learn experientially, in theory at least.

Prideaux (2002) tested this theoretical conclusion in a small study carried out in 2001 of the reactions of tourism students to the likely impact of the virtual reality concept on the tourist experience, but instead found that while the benefits of virtual reality as an information and marketing tool were well recognized by such technologically-savvy groups, as a substitute for a real-life experience it had not gained any form of mass acceptance and was not in fact much welcomed as a replacement for this. In the light of this result, this chapter investigates the *potential* of virtual reality tools to describe tourist experiences and attractions (especially over the Internet) as a form of tourism marketing, and the current constraints on the full realization of this potential. Through an examination of the advantages of the Internet as a marketing tool and of the characteristics of the 21st century tourism industry and of the social, political, and natural environments in many countries, it is suggested that the use of virtual reality via this medium is likely to become very important for marketing and experiencing tourism for the general public in the near future, notwithstanding the conclusions of the earlier study.

The chapter also looks at some of the reasons why although it might be apparent that imaging

technology can and will be able to help market tourism product at least to the experienced internet user and/or the user interested in specific sites, it currently remains underutilized in most other tourism applications. To provide a partial answer to this question, an online survey of VR imaging professionals was undertaken in early 2005. The results are outlined later in this chapter, but in essence suggest that marketing using fully VR enabled tools is as yet only partly accepted due to cost and perceived difficulty of use. Thus, VR is not yet an essential part of the marketing mix for any significant number of destinations, although its potential is well recognized, at least by the IT industry professionals that would be required by the tourism industry to make its use feasible.

TOURIST DESTINATION DECISION MAKING AND THE INTERNET

The critical components that determine the demand for a destination or product may be collectively characterized according to the 6P model (Weaver & Lawton, 2002, p. 222), and includes such items as place, product, price, packaging, promotion, and people, when applied to the service industries. In regard to marketing most emphasis is usually placed on the dimensions of product and place attributes, price, packaging and promotion. The additional people dimension within the overall model in this case includes tourists, service workers and residents and refers to consumer behavior, service quality and resident support for, or opposition to tourism and has been extensively studied in the tourism literature (Witt & Moutinho, 1995). Topics of interest to tourism market researchers have been how to better evaluate the predictors of destination and travel mode choice, or how to determine the best promotional campaign for a particular destination.

In almost all formulations of the demand-side model to date place has been included not only for its intrinsic value as the location in space of

the desired tourism product, but also because it is generally asserted that tourists must *travel* to a destination in order to consume the tourism product (Weaver & Lawton, 2002, p. 223). Much has in fact been made in tourism marketing theory of the notion that tourism is unique because production and consumption occur not only at the same time but in the same place (Morrison, 2002; Ritchie, 1996), and that relative location (proximity) is often a critical determinant of the take-up of tourism opportunities. While place is of course as much influenced by accessibility (price and physical accessibility) as relative physical location in determining how effective any given connection between market demand and a particular destination actually is, insisting on the importance of relative physical location nevertheless reinforces the notion of the centrality of place and by implication a requirement for travel before tourism opportunities can be realized. But what if the physical nature of the place variable could be removed from this equation through the further development of virtual reality (VR)? There might indeed be less requirement for actual travel, but even if this did not happen at the very least the traveler could be better informed about the physical actuality of a potential destination before travel, assuming that the realities are fully described and adverse aspects not covered up by the VR equivalent of air-brushing. In this way the uncertainties involved in tourism destination decision making could be considerably reduced.

THE INTERNET AS A MARKETING TOOL AND RESOURCE

Before examining the question of whether or not VR will contribute a great deal to future destination decision making, or indeed remove the need for actual travel entirely, it is useful to look at the current use of the Internet in the marketing and experiencing of tourism. Tourism has been amongst the top three commercial users of

the Internet for some time and information and communications technologies (ICT) continue to rapidly change “spatial relationships” in society as a whole and in tourism in particular (Buhalis, 2002). For example, e-mail is pervasive, the Internet is everywhere despite some attempts at its control in some countries, there has been a massive uptake of broadband capability, and there has been a very high penetration of mobile devices as both information sources and as communication facilitators; indeed the use of ICT is pervasive in the workplace and the home. With respect to tourism, using the Internet to research, request and feedback information and to purchase is now “taken for granted” by tourists (Prideaux, 2002). It is probably therefore possible, even at this relatively early stage in our use of the Internet as a marketing tool to say, as do Buhalis, Jafari and Werthner (1997) that there is really no choice for many tourism operators but to include this new technology as a central part of their marketing repertoire in order to satisfy tourist demand and to survive in the marketplace in the long run. Organizations that fail to participate in the electronic marketplace in the future face severe competitive disadvantage and may lose market share (Buhalis, 1998).

The Internet also is very important on the supply-side of the market. It offers a means to sell to final consumers at a reasonable price without many overheads, allowing individual tourist operators to compete with wholesalers (agents), and to improve their distribution channels in many cases. It is a particularly important information source for international and domestic travelers, with the travel sector rated amongst the top three product/service categories purchased via the internet (Heung, 2003; Weber & Roehl, 1999). As Buhalis has noted, this could be very important for small and medium enterprises in a market traditionally dominated by larger firms (and their allies in government tourism organizations—Buhalis, 1998, 2002). By using the Internet their costs of marketing can be contained, the

influence of often peripheral spatial locations reduced (Vich-I-Martorell, 2002), and/or the small firm’s almost universal inability to effectively utilize local/regional business assistance and tourism promotional organisations offset (Cooper & Abubakar, 2004).

On the demand side how does the Internet currently impact on buyer behaviour? Models of consumer purchase decision making range from the very simple *need—information search—evaluation—decision—post purchase evaluation* type to more complex formulations for services that are based on a range of psychological and socio-economic factors (Palmer, 1994, pp. 116-120). These models incorporate the following elements:

- **Inputs:** Information about the range of competing services and products that may satisfy the immediate felt need
- **Behavioral determinants:** The individual factors in decision making, influenced by socialization, personality, culture, level of information, and so on
- **Perceptual reactions:** Interpretation of information inputs through personality and experience
- **Processing determinants:** The way in which a decision is made, incorporating motivation to satisfy felt needs, critical product requirements and attributes, past experiences of suppliers, ability to use and recognize available information, and so on
- **Inhibitors:** Ease of access, price, terms and conditions for delivery
- **Outputs:** The outcome of the decision process (proceed, defer, do not proceed)

Palmer (1994, p. 118) notes that most buyers of services do not act with total rationality—to be able to do so would require that all possible sources of information would be known to them and that their contents could be fully and logically evaluated. Of all the service industries, tourism

is a confidence or experience good (Werthner & Klein, 1999), where product characteristics such as quality or price value are difficult to observe and can only be fully ascertained upon actual consumption (or from a reasonable facsimile of this provided by the much discussed 'word of mouth' phenomenon). Experience goods pose difficulties for consumers in accurately making consumption choices because at the moment of decision making only information about the product, but not the product itself, is available. Moreover, the role of experience in consumption decisions is only now being realized in effective marketing strategies for tourism (Gretzel & Fesenmaier, 2002). This is based on the fact that experiential learning, often assisted by friends and relations is not only entertaining and stimulating but also central to the travel decision making process because it lets consumers understand and evaluate the travel product in ways not bound by the need to describe such products in functional terms or in monetary values (Vogt & Fesenmaier, 1998). This is precisely why those VR technologies that allow experiential learning of an environment independently of travel to the actual destination should have a great future in the tourism industry.

But, beyond the use of evocative photographs there has been little virtual reality product in the tourism industry's commercial uses of the Internet to date. While consumers are becoming mature Internet users, in that they are more "cyber-savvy," more demanding, more willing to search, and more willing to provide community feedback to business, these "consumers with attitude" are not apparently demanding VR products in addition to text and 2-D image based information (see Chapter VII of this book). So, while the process of attracting, drawing-in, and retaining potential consumers of tourism product is becoming more challenging for operators and their agents, and consumers are talking to each other like never before on the Internet through blogs, review sites, opinion sites, user groups, chat, or other online communities, business is not yet taking the next

step and providing virtual reality experiences for their potential customers, other than the 2-dimensional photograph or the video clip.

VIRTUAL REALITY TOOLS TO ENHANCE THE TOURIST EXPERIENCE

As a marketing channel, the Internet is thus now a mature medium for the tourism industry. The travel and tourism sector blazed the trail of e-commerce in the 1990s (Buhalis, 1998). Even as long ago as 1999 "Travel" was the No.1 online product; considerably exceeding the combined online sales of books, software, computers, music, flowers, and toys, so why are the new VR technologies of the 21st century not being taken up in a similar fashion to develop the individual consumer's experience of tourism products? By being able to "walk through" or otherwise experience a more complete model of a destination for example before purchasing accommodation and/or tours surely the potential consumer would be able to gather more information than is available through 2-D photographs and the like. On this question Prideaux (2002) notes that, in an increasingly affluent world the pressure of numbers of tourists on particular environments may in fact encourage tourists to begin to demand this alternation between real and cyberspace experiences in a much more systematic way than at present. In other words, the use of virtual reality in tourism may be in fact more likely as a replacement for *travel* than as a more sophisticated tool for marketing destinations, under pressure from external factors like conservation of the environment. Thus while for some "tourists" the increasing possibility of becoming a voyeur in a personalized and private cyber-world may be strong (Williams & Hobson, 1995), for a greater number the chance to visit an otherwise *unattainable* location may be paramount in their decision to make use of such technologies in the future.

Nevertheless, VR has been a buzzword for over ten years now, and despite widely available VR imaging technologies such as QuickTime, Java, and other authoring tools, widespread use of the medium remains elusive in the tourism industry. In the next section we define virtual reality as it is currently used with respect to human experience of environments, and describe some of the tools for constructing such virtual realities that presently exist or may be developed in the near future to enhance the tourism experience.

The Nature of Virtual Reality

Virtual reality is exactly that, a computer generated environment that seems real to the user (HarperCollins, 1996). Extensively used in computer gaming software, with increasing levels of “reality” as computing power has evolved, in the business world educational/instruction virtual reality-based tools are moving from highly specialized uses such as flight simulations to building business skills for sales and call centre reps and enhancing coaching and leadership skills for managers and executives. The use of simulations through immersion in virtual realities increases the efficacy of online teaching as much as 75% by involving employees for example in virtual job situations in which they gain experience without the risk of making mistakes (Psotka, 1995). Equally, IMAX and other large-format immersive experiences, from a realistic 360° panorama of objects and landscapes to a flythrough of an interactive virtual world on the Internet, aim to stimulate the senses of the user to get them as close to the real world as possible, virtually.

Alternatively known as Immersive Media (Bitgood, 1990; Psotka, 1995), virtual reality also can be used as a component of e-brochures, e-catalogues, Web sites, and other interactive presentations to provide a realistic look and feel of consumer products, hotels, cars, real estate, or other facilities. In addition, technologies such as *Immersive Television* that can engender in view-

ers a “sense of being there” in depicted scenes and 3D broadcast experiences may be widely available to the consumer in less than 10 years time. Immersive imaging is a technology that lets users experience 3D photographic scenes at if they were really there.

There are two types of immersive images that may be used for tourism experience and marketing purposes: panoramas and objects. *Panorama* (panospheric—panographic) type images are 360 degree views that allow users to look up and down, turn around, and zoom in to see the detail, or zoom out for a broader view. These are photographic images, presented in a software “player” that permits navigation on each of the x, y, & z axes. Multiple, overlapping images are stitched together with software tools and photos are taken using special tripod attachments or the multiple image features of digital camera software. As users change the view of a scene the correct perspective is maintained, giving the ability to look around just as in real life. Panorama images are currently used to provide realistic views and walk-throughs of real estate, outdoor scenes, and hotel resorts. Figure 1 is a 2-D static representation of a 360 degree panorama by Spinning-Eye, a specialist VR imaging company that can be experienced as 3-D on the Internet. Many other tourism and hospitality examples may be found on the Internet sites.

Object imagery on the other hand allows users to “pick up” and view an item from all sides using software tools. Its uses include being able to look more closely at consumer products, fashion, automobiles, and heritage items as if the consumer was really handling or otherwise experiencing them physically, and this applies as much to the tourism facility (from airplane seats through attractions) as it does to any other item. Virtual manipulation of, to the observer, an apparently physical object has immediately obvious uses in heritage and cultural tourism for example, while its combination with panoramas would allow

Figure 1. Panoramic view of a hotel room (Courtesy of Jens Look, Spinning Eye)



much richer sampling of potential environments before purchase of the “trip.”

Digital Preservation, Digital Visitation

For those lacking the desire or money to travel, or where there are restrictions on travel for environmental or political reasons, a virtual destination could provide an acceptable substitute for actual visitation (Sung, Lee, Kim, Kwon, & Jang, 2000). This may be especially so where the tourist’s desire is actually for re-creation of history or heritage rather than in visiting the current physical remains of a past culture. Virtual reality special effects are already being used to great effect in the television documentary format and in “epic” film making such as the Lord of the Rings film trilogy, and these will ultimately allow the virtual tourist to visit a site during different (re-created) stages in its history. Along with this opportunity virtual guides or “avatars” also are available to provide expert commentary and feedback in a number of languages, a service that can be quite costly to provide in the real world (Weaver & Lawton, 2002). An important example of the use of this technology is the World Heritage Preservation Project, initiated by UNESCO in 2001, and designed to ultimately provide panoramic VR tours through the creation of a documentary image bank of panoramic pictures and virtual reality films

for all sites registered as World Heritage by the United Nations Educational, Scientific and Cultural Organization (<http://www.world-heritage-tour.org/list.html>, 2005). At the time of writing, a *virtual* tourist can visit World Heritage Sites in Afghanistan, Bangladesh, Eastern Canada, China, Cambodia, Egypt, India, Indonesia, Iran, Korea, Laos, Malaysia, Nepal, Pakistan, Sri Lanka, Thailand, The Philippines, and Vietnam. This represents 15% of all 812 such sites, and covers 125 sites in 700+ panoramographies, a number of which are of sites that are in areas of political tension (for example in Sri Lanka, Afghanistan).

Is the Potential of VR for Tourism Going to be Realized in the Near Future?

From this brief discussion it is readily apparent that imaging technology (the creation of virtual realities) could be of assistance in the marketing of tourism products to the internet consumer and/or the consumer interested in historical/heritage sites, but has not been taken up in any significant way as yet. The prevailing view amongst developers and users of existing VR technology is that it is ideally suited for these tasks because it is immersive, compelling, and the consumer is in control, even though it remains underutilized by the industry and consumers. To examine possible industry-based reasons for this situation an

online survey of VR imaging professionals was undertaken in late 2005. The respondents were sourced from professional mailing lists and user groups available to the authors, and the data was collected using an open source survey tool. The respondents represent a small but fairly representative sample of the major players in this field; however care should be taken in generalizing from the results as no corresponding survey of either tourism marketers or of the use of VR technology by tourists themselves has been undertaken at this stage.

Results of the Industry Survey

The aim of the survey was to determine how easy it is to produce VR images of tourist destination and heritage items, to determine if the technology, expertise, and knowledge required was a real barrier to its wider use and adoption in tourism marketing, or is the real reason for underutilization something else entirely? Our respondents (n

= 80) were ICT professionals, with 57% having been in this industry for four or more years, and 86% for more than two years (Figure 2). Respondents self proclaimed status in the industry with respect to their expertise in VR simulations was expert (25%), advanced but not yet expert (45%), intermediate (19%) and novice (11%—Figure 3). Of the respondents, 86% produce VR images professionally, and 65% have produced VR images for tourism marketing purposes. Overwhelmingly however, 80% of respondents said that it was still difficult to produce such images and required specialist knowledge, equipment and expertise, but 92% believed that they were more effective than normal photographic images, and 80% believed that VR is more popular now than before in the industry. We also asked if they thought that consumers “enjoy” using VR imaging and if VR images more effectively promote tourism products than regular images. Again, over 90% of respondents thought this was true in both cases given their intimate contact with the tour-

Figure 2. ICT Industry experience of respondents

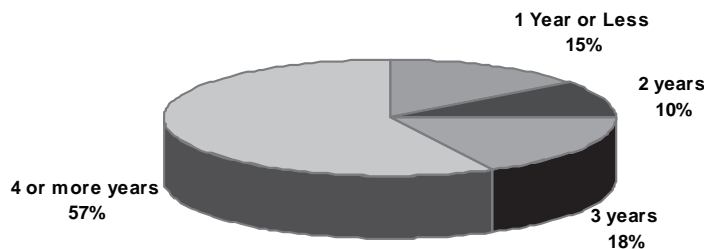
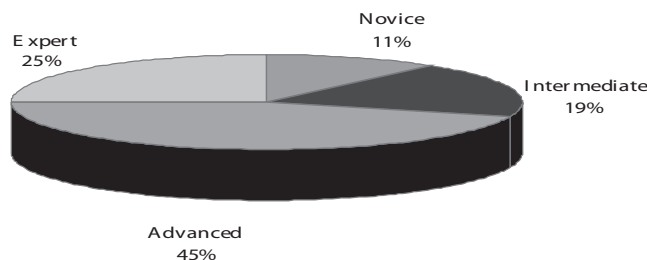


Figure 3. Expertise status of respondents



Virtual Reality Mapping Revisited

ism industry. The key issues for the respondents with respect to the further development of VR technologies for tourism came down to the following (Figure 4):

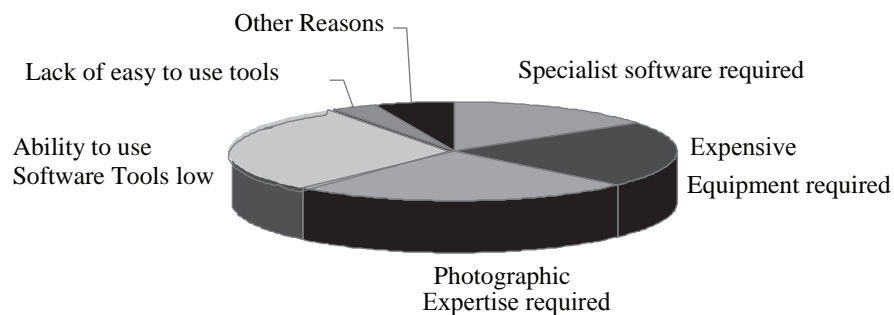
- Tourism operators are not aware of the technology.
- If they are aware, they believe it is very expensive at this time.
- Many Web designers also are not aware of the technology.
- If they are, they are reluctant to engage a specialist to translate their needs into suitable presentations.
- File size and download time remain a real concern (despite increasing broadband use).
- There is a prevailing fear that readily available browser software will not be capable of displaying the image.
- There is no “easy to use” software for potential consumers.

Until these concerns can be overcome, either through overwhelming user demand or through the advent of even newer technologies, the VR professionals surveyed concluded that there will be a continuing resistance to the use of 3D virtual reality techniques in tourism marketing. Instead,

the current 2D enhanced methods will remain the standard at least for the short term future (to 5 years). The reason for this is the prevailing opinion amongst the professionals that while VR imaging and tourism appear to be a great fit, this is only really true in the context of skilled Web or multimedia advertising and promotion. Their view is that at the present stage of development a quality photograph is more usable, can be produced by far more people, can be used in both printed and Web-based media with little or no specialized training, and can be accurately judged for quality by tourism marketing professionals and the public in real time. Video and VR is presently restricted to knowledgeable producers and developers and used in Web, CD, or trade-show kiosk delivery. In these contexts VR is easier and cheaper to produce than a promotional video, but still more difficult than traditional photography. It will only be when the cost and quality of VR imagery is close to that found in computer-based gaming that the tourism marketer and the tourist will consider the technique as having more than just novelty value, except perhaps for its uses in the heritage preservation field as outlined above.

In summary, the VR production industry appears to believe that tourism marketers are either not aware of the possibilities of this new technique for promotion, or that these are seen

Figure 4. Issues in the further development of VR technologies for tourism



by the tourism industry as being just a different format of photography that costs more and doesn't dramatically improve public perception or use of the end product. Alternatively, it may be that the key problem is in fact that VR producers themselves do not know how to market their services to the tourism marketing and promotional people, and this problem itself ultimately reflects on the current low acceptance of VR for tourism promotion.

CONCLUSION

This chapter undertook a brief overview of the available technologies and opportunities for the use of virtual reality in tourism marketing. It acknowledged that in almost all formulations of the tourism marketing model to date much has been made of the notion that tourism is unique because production and consumption occur not only at the same time but in the same place, and therefore that location or proximity is often *the* critical determinant of the take-up of tourism opportunities (e.g., Weaver & Lawson, 2002, pp. 222-223). But it then posited the question: what if the place variable could be removed from this equation through the further development of virtual reality techniques? The impacts of this possibility have been seen to include: less requirement for travel per se (perhaps); better and more real information about the physical actuality of a destination for the potential consumer (likely); price and service quality information very much simplified and improved (definitely), and changed tourism promotion strategies (undoubtedly). At the barest minimum, the uncertainties involved in relying on unverified 2D or text-based information for tourism travel decision-making could be considerably reduced using VR techniques.

Many educationalists and psychologists have noted that effective learning in human beings is closely associated with experiencing and therefore comprehending in a more structured way

something that they have never seen before, or is dependent on being exposed to new and usable information that adds to and/or refines their existing knowledge base (summarized by Schwier, 1995, and many others). From these discussions certain general conclusions can be drawn about the likely responses of the tourist to virtual reality immersion environments. The most general one is that such users will notice and use the same way specific environmental features as clues to understanding and perhaps action on entering a new virtual space, just as they do in real space. For virtual reality tourism marketing to succeed then, authentic reproduction of a given environment (or as close as it is possible to get to it given available technology and funds) is required to convey the all-important sense of place. Secondly, the inclusion of accurate renditions of artifacts and action elements from the actual places being recreated (i.e., walk through and similar renditions) is essential to the creation of effective immersion environments. Despite the technical difficulties in doing this, and the expense of current versions of software and hardware, these criteria can now be fulfilled according to the VR professionals we surveyed for this discussion, so the use of virtual reality simulations of real places in order to provide either extra pre-travel information, or ultimately perhaps to replace travel entirely is now possible.

For the future, the VR industry is apparently much more excited about the possibilities inherent in these emerging technologies than the tourism and hospitality industry. Therefore it will require consumers (tourists) and their agents to reach the same level of understanding before their use will become ubiquitous throughout the tourism industry. At the very least however these technologies now support the creation of a documentary and educational image bank of panographies (online virtual tours) for all sites registered as World Heritage by United Nations Educational, Scientific and Cultural Organization (UNESCO) and for hotel marketing, etc, thus enabling tour-

ists and other users to visit and learn about such facilities and sites before actual travel or indeed to replace travel entirely. The availability in the future of more and more powerful and cheaper recording and display facilities for virtual tourism, ultimately in the form of personalized ubiquitous devices (Hoshino, 2005) that also provide GIS, travel information, and interpretation of language and artifacts (heritage archives and tourist attractions) in real time will allow the tourist the freedom to choose between a virtual reality experience and/or actual physical presence in that environment at will.

REFERENCES

- Bednar, A. K., Cunningham, D., Duffy, T. M., & Perry, J. P. (1995). Theory into practice: How do we link? In G.J. Anglin, (Ed.), *Instructional technology: Past, present and future* (2nd ed., pp. 100-111). Englewood, CO: Libraries Unlimited, Inc.
- Bierman, D. (2002) *Restoring tourism destinations in crisis*. Sydney: Allen & Unwin.
- Bitgood, S. (1990). *The role of simulated immersion in exhibition* (Tech. Rep. No. 90-20). Jacksonville, AL: Centre for Social Design.
- Buhalis, D. (1998). Strategic use of Internet technologies in the tourist industry. *Tourism Management*, 19(5), 409-421.
- Buhalis, D. (2002). *eTourism: Information technology for strategic tourism management*. London: Pearson Education.
- Buhalis, D., Jafari, J., & Werthner, H. (1997). Information technology and re-engineering of tourism. *Annals of Tourism Research*, 24(1), 245-248.
- Cetron, M. (2001). The world of today and tomorrow: The global view. In A. Lockwood & S. Medlik, (Eds.), *Tourism and hospitality in the 21st century* (pp. 18-28). Oxford: Butterworth Heinemann.
- Cooper, M. J. and Abubakar, B. (2004). The role of tourism bureaux in the development of tourist attractions in Australia: A case study of Hervey Bay, Queensland. *Journal of Hospitality & Tourism* 1(2), 1-10.
- Crownreef Web site. (2005). Retrieved June 20, 2005 from http://www.crownreef.com/virtual_tour.cfm (java)
- Gretzel, U., & Fesenmaier, D. R. (2002). Building narrative logic into tourism information systems. *IEEE Intelligent Systems*, 17(6), 53-64.
- Google Earth. (2005). Retrieved July 17, 2005 from <http://earth.google.com/tour/>
- Hall, C. M. (2000). *Tourism planning*, London: Prentice-Hall.
- HarperCollins Dictionaries. (1996). *Collins compact Australian dictionary*. Sydney: HarperCollins.
- Heung, V. S. (2003). Internet Usage by International Travelers: reasons and barriers, *International Journal of Contemporary Hospitality Management* 15(7), 370-378.
- Hoshino, Y. (2005, July 16). *Relaxation research in a multicultural society*. Presented to the Science and Technology for Art III—Digital Archiving of Cultural Assets—International Symposium, Ritsumeikan Asia Pacific University.
- Inkpen, G. (1998). *Information technology for travel and tourism* (2nd ed.). London: Pearson Education.
- Ishida, T. (2002). Q: A scenario description language for interactive agents. *IEEE Computer* 35(11), 54-59.
- Kootenay Virtual Tours Web site. (2005). Retrieved June 20, 2005 http://www.kootenayvirtualtours.com/topics/accomm/eagle/eagle_q.htm

- Leiper, N. (1995). *Tourism management*. Melbourne: RMIT Press.
- Morrison, A. (2002). *Hospitality and travel marketing* (3rd ed.). New York: Delmar.
- Naturebase Web site. (2005). Retrieved June 20, 2005 from http://www.naturebase.net/national_parks/shark_bay_qtvr.html (QuickTime)
- Optima Cruises Web site. (2005). Retrieved June 20, 2005 from http://www.optimacruises.com/Am_virtual.asp;
- Palmer, A. (1994). *Principles of services marketing*. London: McGraw-Hill.
- Prideaux, B. (2000). Transport and tourism, past, present and future. In E. Laws & B. Faulkner (Eds.), *Tourism in the 21st century: Lessons from experience* (pp. 91-109). London: Continuum.
- Prideaux, B. (2002). The cybertourist. In Dann, G. (Ed.), *The tourist as a metaphor of the social world* (pp. 317-339). Oxford: CAB International.
- Psotka, J. (1995). Immersive training systems: Virtual reality and education and training, *Instructional Science* 23 (5-6), 405-431.
- Real World Imaging Web Site. (2005). Retrieved June 20, 2005 from <http://www.realworldimaging.com.au/>
- Ritchie, J. R. Brent. (1996). Beacons of light in an expanding universe: An assessment of the state-of-the-art in tourism marketing/market research, *Journal of Travel & Tourism Marketing* 5(4), 49-84.
- Schwier, R. A. (1995). Issues in emerging interactive technologies. In G. J. Anglin (Ed.), *Instructional technology: Past, present and future* (2nd ed., pp. 119-127). Englewood, CO: Libraries Unlimited, Inc.
- Sheldon, P. (1997). *Tourism information technology*. Oxford: CAB International.
- Sitepal Web site. (2005). Retrieved January 2005, from <http://www.sitepal.com>
- Sung, P., Lee, Y., Kim, Y., Kwon, Y. and Jang, B. (2000). Development of Virtual Cybertours in the virtual reality system, *Asia Pacific Journal of Tourism Research* 3(2), 45-50.
- Vich-I-Martorell, G. A. (2002). The Internet as a marketing tool for tourism in the Balearic Islands. *Information Technology & Tourism* 5, 91-104.
- Vogt, C. A., & Fesenmaier, D. M. (1998). Expanding the functional search model, *Annals of Tourism Research*, 25(3), 551-578.
- Weaver, D., & Lawton, L. (2002). *Tourism management* (2nd ed.). London: Wiley.
- Weber, K., & Roehl, W. S. (1999). Profiling people searching and purchasing travel products on the world wide Web. *Journal of Travel Research* 37(3), 291-298.
- Weiermair, K., & Mathies, C. (2004). *The tourism and leisure industry: Shaping the future*. New York: Haworth Press.
- Werthner, H., & Klein, S. (1999). *Information technology and tourism—a challenging relationship*. New York: Springer-Verlag.
- Williams, P., & Hobson, P. S. (1995). Virtual reality and tourism: Fact or fantasy? *Tourism Management* 16, 423-427.
- Witt, S. F., & Moutinho, L. (1995). *Tourism marketing and management handbook*. London: Prentice-Hall.
- World Heritage Tour Web site. (2005). Retrieved March 2005, from <http://www.world-heritage-tour.org>

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper, pp. 198-214, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.46

USE IT to Create Patient–Relation Management for Multiple Sclerosis Patients

Margreet B. Michel-Verkerke

University of Twente, The Netherlands

Roel W. Schuring

University of Twente, The Netherlands

Ton A. M. Spil

University of Twente, The Netherlands

ABSTRACT

Patients with multiple sclerosis (MS) visit various healthcare providers during the course of their disease. It was suggested that information and communication technology might help to orchestrate their care provision. We have applied the USE IT tool to get insight in the relevant problems, solutions, and constraints of MS care both in the organizational and the information-technological area. There is hardly a chain of healthcare, but rather, a network in which informal communication plays an important role. This informal network worked reasonably effective, but it was inefficient and slow. The MS patient count is small for most care providers. Patients thought that a

lack of experience caused their major problems: insufficient and inadequate care. To improve care, we proposed a solution that combines an MS protocol, the introduction of a central coordinator of care and a patient-relation management (PRM) system. This is a simple Web-based application based on an agreement by the caregivers that supports routing, tracking, and tracing for an MS patient and supplies the caregivers with professional guidelines. It is likely that we would have suggested a far more complicated ICT solution if we had only analyzed the MS care process as such without specific consideration of the dimensions in the USE IT tool.

INTRODUCTION

Research in human-computer interaction (HCI) has been spectacularly successful, and has fundamentally changed computing (Myers, 1998). The adoption of information technology has changed less dramatically and is a major problem in healthcare today (Berg, 2001). The HCI community has tended to portray the average user as someone who knows how to deal with IT and who willingly participates in this interaction (Marsden & Hollnagel, 1996). The average user does not exist in healthcare, they range from laggards to innovators (Rogers, 1995), and most times HCI is designed to address the innovators (Spil, Schuring, & Michel-Verkerke, 2004). This means that highly complex systems are designed that have to be used by people that have limited capacity to deal with computers. Interaction design, a newly coined discipline (Coiera, 2003), believes that information-systems design should include the people who will use them. We developed an interview model, called USE IT, that includes the end user in the IS design process by determining his or her user characteristics before the actual system design process starts.

In this article, the USE IT model (Spil et al., 2004) is applied to define what use of information and communication technology would support healthcare professionals in providing care to patients suffering from multiple sclerosis (MS). Two aspects of the relation between technology and humans will be discussed in this research: first, technology partly replacing human interaction, and second, factors that influence the success of human interaction with technology in respect to actual use.

The next section describes what problems in the MS healthcare chain motivated us to conduct the research. Then, it is discussed why the USE IT model is the appropriate methodology for this research. The complete research design is given next. After that, the results of the case study are

presented. The discussion of the findings will then lead to the presentation of patient-relation management (PRM) as a solution for the problem. In the last section, overall conclusions will be drawn.

BACKGROUND AND MOTIVATION

A rehabilitation hospital asked us to study the healthcare chain of MS in a Dutch region that serves about 500 MS patients and includes three large hospitals (with a total of about 1,800 beds) in order to know what ICT solution could improve MS care. In this research, a healthcare chain is defined as follows: The healthcare chain is constituted of all care providers involved in the care for a particular group of patients (Michel-Verkerke, Schuring, Spil, & Hummel, 2003). In the ideal situation, a healthcare chain is designed and implemented and is not a randomly originated collection of care providers. To make a healthcare chain a chain, the care providers should be linked by binding engagements concerning the care to provide to the particular patient group. These engagements comprise agreement on (1) what care should be provided by whom in what way for how long in what place, (2) how and when patients are transferred from one care provider to another, and (3) how patient information is communicated. Since healthcare is organized in a functional way (i.e., wards and practices are grouped by the profession or specialty of the care provider) and not in a process-oriented or product-oriented way, it is hard to organize and implement healthcare chains cross-organizationally (i.e., across the healthcare institutions). For the same reason, and because the level of ICT resources in healthcare is low, none of the participants used an electronic patient record (EPR). Many healthcare professionals consider implementing a cross-organizational EPR to support the care processes in a healthcare chain to be utopian at this moment. Still, a strong desire

to improve MS care and the awareness of the potential benefits of the use of ICT in healthcare were the motivation to start this research.

The challenge of this research project was to find a solution that on the one hand is locally, practically applicable, and that on the other hand can serve as a base for a more general, broader solution like an EPR. Since it was not clear to what kind of ICT solution the research would lead, the second challenge was to find an appropriate methodology to perform the research. As will be explained in the next section, we considered a methodology for requirements analysis not adequate to comply with the explorative aspects of our research. Based on the results of a previous research, we decided to use this research to investigate whether the USE IT methodology, developed from an evaluation study on IS success, is also suitable for reveal-

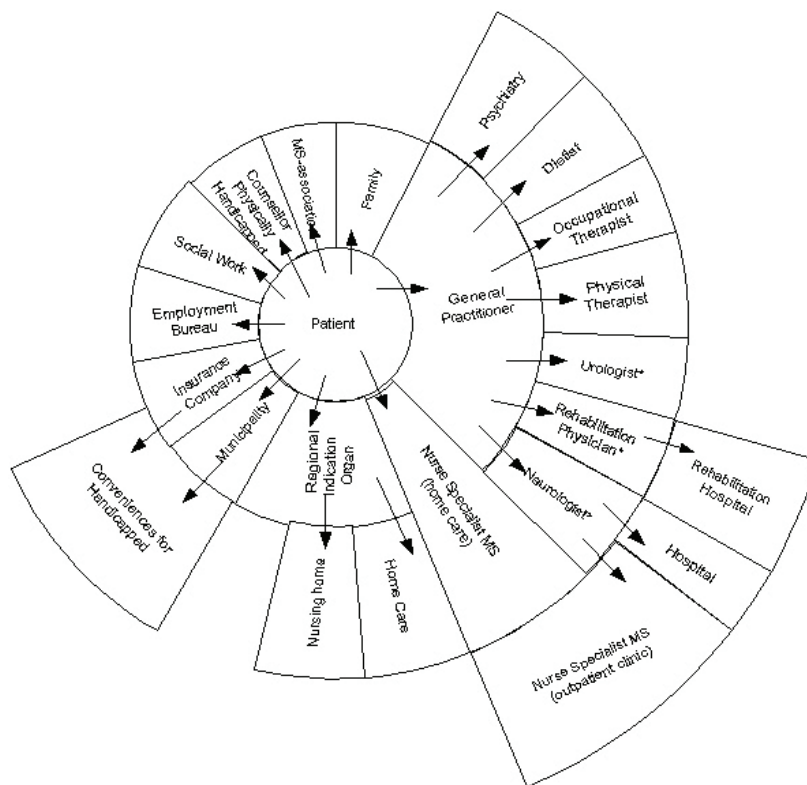
ing the factors that determine IS success in this particular case (Spil et al., 2004).

MULTIPLE SCLEROSIS

MS is a disease that affects the central nervous system. Due to causes that are not entirely understood, the sheaths of the nerves change, which reduces the ability to transmit signals. Patients may suffer from tiredness, have difficulty moving, and may have reduced sight and a range of other problems. There is no cure available for MS; treatment may be able to relieve the patients' symptoms, and by that extend the period that the patient is able to function independently.

Patients with multiple sclerosis visit various healthcare providers during the course of their disease. A general practitioner (GP) might be

Figure 1. The formal referral model of the MS health-care chain



their first contact, but, as the disease progresses, a neurologist, urologist, rehabilitation hospital, home care, home adaptation, and many other types of support are normally needed. In a perfect world, all these types of care are delivered in an orchestrated way. However, reality is different. Each care provider uses his or her own patient records and working method. The patient needs to be self-managing. Based on the formal documents we studied, we were able to model the formal referral model through the MS chain (see Figure 1; Michel-Verkerke, Schuring, Spil et al., 2003).

Referral takes place from the inside to the outside. The patient does not need any official referral to go to the GP, regional indication office (RIO), municipality, insurance company, employment bureau, social worker, counselor, or the MS association. The RIO is an organ independent of healthcare organizations subsidized by the local municipality. Its task is to indicate and allocate home care, or admission to a nursing home or old-people's home. Adapted conveniences are available through the healthcare insurance company or the municipality, that is, the Dutch Wet Voorzieningen Gehandicaptten (WVG) authority, which can be translated as law facilities for the handicapped.

The RIO decides on admission to a nursing home or whether the patient is eligible for home care. The latter may concern nursing or general care. Advice, information, or instruction by home care is available without intervention of the primary physician or the RIO. This is the type of home care that is given by a nurse specialist who is specialized in MS patients. Referral by the GP is needed to get access to treatment by other

physicians or paramedics. The asterisks in the boxes for the physicians indicate that physicians may generate referrals to the same paramedical healthcare workers as the GP. The rehabilitation physician serves as the gate to other healthcare providers in the rehabilitation hospital. The neurologist decides on admission to the hospital and is also the person who refers to a nursing specialist in the outpatient clinic. In one part of the area that was studied, these two specialized nurses are in fact the same person.

METHODOLOGY

As was stated in the introduction, the attitude of healthcare professionals toward the use of computers varies as viewpoints from innovators to laggards (Rogers, 1995). Because of this, the actual use of available computers cannot be taken for granted, and we consider an information system only successful when it is actually used in practice as part of the care process. In order to discover what factors make care providers use an information system, we reviewed papers on tools to reveal the user's requirements or tools to stimulate user participation in the development of information systems in healthcare that have been published in the previous years (e.g., Beuscart-Zépher, Anceaux, Crinquette, & Renard, 2001; Brender & McNair, 2001; Meijden, Tange, Troost, & Hasman, 2001; Staccini, Joubert, Quaranta, Fieschi, & Fieschi, 2001). These tools usually focus on a fit between the developed system and the user on one aspect of innovation diffusion. The USE IT tool is built on a large number of such publications

Table 1. The USE IT model (Michel-Verkerke, Schuring, & Spil, 2003)

| USE IT-model | <i>User Domain</i> | <i>Information Technology Domain</i> |
|---------------------|--------------------|--------------------------------------|
| <i>Product</i> | Relevance | Requirements |
| <i>Process</i> | Resistance | Resources |

and helps to get insight in the nature and relevance of problems and of possible solutions, and thus considers all of the above-mentioned aspects of the problem. It considers constraints and prerequisites, which are particularly relevant when resources are limited and choices have to be made as to which problems will be solved and which will not. The USE IT tool also demonstrates that the requirements determinant is not the only determinant of user adoption. Proposed solutions that come to mind after the analysis can be organizational changes, IT-related changes, or both.

USE IT Methodology: Overview

First, we present the dimensions of the USE IT model — the innovation dimension and the domain dimension — to predict and evaluate the innovation and diffusion of information systems. They

make four determinants for success: relevance, requirements, resistance, and resources (Rogers, 1995; Spil et al., 2004).

With the process, the innovation process is meant, similar to the process defined by Saarinen and Sääksjärvi (1992) and the innovation process structure of Larsen (1998). The product is the result of this innovation process. This corresponds with the definition of the product by Saarinen and Sääksjärvi, and the artifact structure in the framework of Larsen. Also, the IT domain is part of the artifact structure; the user domain represents the organizational structure in Larsen’s framework. The time horizon structure can be part of the requirements, and the knowledge structure can be considered as an element of the resources.

Table 2 shows the determinants with their subdeterminants. Every determinant comprises two levels: the macrolevel and the microlevel. The

Table 2. The USE IT determinants based on Michel-Verkerke, Schuring, and Spil (2003)

| Determinant | Sub-determinants |
|--------------|--|
| Relevance | Macro-relevance: Economic improvements Social improvements Functional improvements Saving time and effort Micro-relevance: Solve here-and-now problems Compatibility with working process |
| Resistance | Macro-resistance: Lack of opportunity to change Micro-resistance: Inability to change Bad attitude |
| Requirements | Macro-requirements: Strategic general requirements Tactical approach Micro-requirements: Functional Performance requirements |
| Resources | Material: Hardware & Software Time Money Immaterial: Adaptability Capabilities Reliability |

macrolevel represents a general perspective, for example, the organizational level. The microlevel refers to the individual user.

The relevance determinant is defined by Schuring and Spil (2003) as “the degree to which the user expects that the IT-system will solve his [or her] problems or help to realize his [or her] actually relevant goals.” The word *expects* expresses that relevance is a factor that is important in the course of the adoption process, not only in evaluation. The word *actually* is crucial in view of relevance. Relevance is not to be confused with the degree to which the user considers outcomes as being positive. The set of outcome dimensions that someone considers positive is larger than the set of outcome dimensions that are relevant. Imagine a physician who basically considers IT outcomes of a computer decision-support system, such as for assistance in diagnosis, disease prevention, or for the more appropriate dosing of drugs, as positive. This does not automatically imply that the IT adoption is relevant to him; it is only relevant if these dimensions are high on his goal agenda.

Relevance defined in this way comprises relative advantage (Rogers, 1995), net benefits (DeLone & McLean, 2002), perceived usefulness (Davis, 1989), and job relevance (Chismar & Wiley-Patton, 2003). It results in task support satisfaction, which is a criterion for user satisfaction (Garrity & Sanders, 1998).

In their study on the implementation of an electronic prescription system, Spil et al. (2004) found that a lack of relevance was the major determinant that explained the failure of the implementation.

Resistance is the personal attitude of all stakeholder groups toward the introduction of an information system (Spil, 2003). The main IS quality aspect of resistance is the attitude and the willingness to change. Pare and Elam (1999) also focus on the attitude of the professional when they assess clinical information systems. The end users have an important role because their

norms and values determine the effectiveness of the information system. Resistance was found to be the cumulative effect of the other three determinants (Spil et al., 2004).

The expectance of reduced quality in work-life satisfaction, high complexity, and the lack of trialability can result in resistance (Garrity & Sanders, 1998; Rogers, 1995). Observability reduces resistance (Rogers). Offenbeek and Koopman (1996) connect people with resistance potential because they can feel that the quality of their working life will be decreased. Mumford (1995) observed that user participation contributes to effective organizational change. Wissemma (1987) defines resistance as willingness to change and the difference between results and expectations.

Resources are defined as the degree to which material and immaterial goods are available to design, operate, and maintain the information system (Spil & Schuring, 2003). The main focus of the determinant resources will be on the people and on the costs these people cause. Next to that, the reliability of the information technology and the information systems are considered. Resources defined in this way refer to service and system quality (DeLone & McLean, 2002), management support, and mature IS functions (Saarinen & Sääksjärvi, 1992). Resources (human, physical, and monetary components; Ansoff, 1965) are needed to implement the new information system into the organization. The human resources can be insufficient both in time and in experience (risk of technology). Insufficient material resources (Offenbeek & Koopman, 1996) will have a limiting influence on the other three risk domains.

The requirements determinant evaluates the meaning of the information system. Requirements are defined as the degree to which the user is satisfied with the product quality of the innovation (Spil & Schuring, 2003). This includes such aspects as the functional capability, ease of start-up, and ease of use. Meeting the end user’s requirements results in high information quality, high system quality (DeLone & McLean, 2002), high interface

satisfaction (Garrity & Sanders, 1998), and high compatibility (Rogers, 1995).

USE IT Methodology: Strategy

To measure the determinants, the USE IT tool consists of structured interviews. In this way, more precise insight can be obtained in the nature and relevance of problems and solutions before implementation, and this insight can be tested with the same tool during the evaluation of the implementation. For the interviews with patients, we used a much shorter questionnaire, which is listed in Table 3.

RESEARCH DESIGN

From the literature review, it can be learned that the successful implementation of an information system depends on the degree to which the characteristics of the intended end users — being relevance, requirements, resistance, and resources — are taken into consideration. This knowledge, together with the purpose of the research as described earlier, leads to the formulation of the following research questions:

1. In what way does an improvement of the information services in the healthcare chain contribute to the improvement of the

quality of care for patients with multiple sclerosis?

2. What should a solution look like that solves the local problem, but that also aligns with knowledge and standards on EPR and serves as a first step or building block of an EPR?
3. What user characteristics of care providers will influence the successful implementation of a proposed solution?
4. Is the USE IT tool an adequate tool to reveal these user characteristics?

So, could ICT help to coordinate the work flow for MS patients, and does the USE IT tool help to find out?

At the start of the research project, a workshop was organized to generate commitment for the research. Of each institution or profession involved with MS care in the region, those care providers with a special interest in treating MS and who were actually involved in providing care to MS patients were invited to be interviewed. This resulted in 17 USE IT interviews. Each interview took about one and one-half hours. Table 4 gives an overview of the categories of interview questions. Table 5 shows the professions and institutions of the interviewees.

Also, 6 of the approximately 500 patients were interviewed to get an impression of how they experienced the provided care (see Table 3).

Table 3. The USE IT interview protocol for patients

| MS-patient (Pat.) | |
|-------------------|--|
| Pat.1 | Would you be so kind to describe the course of your illness to me, and especially your route through healthcare? |
| Pat.2 | What care do you receive at the moment? |
| Pat.3 | Do you experience bottlenecks in the care delivered? |
| Pat.4 | What role does MS play in your life? |
| Pat.5 | How do you experience the cooperation between care providers or institutions? |
| Pat.6 | How do you experience the supply of information on MS? |
| Pat.7 | How do you experience the way care providers deal with the information about you? |

Table 4. Interview protocol

| Category | Explanation |
|-----------------|--|
| Primary process | Given care, co-operation, referrals |
| Information | Information-needs, communication, desired and available services |
| Relevance | Relevance of MS-care compared with other groups of patients |
| Resistance | Resistance to change and resistance to ICT |
| Resources | Available ICT-services, available time for change |
| Priority | Other projects, innovations |
| Local system | Political forces |

Table 5. Professions and institutions of the interviewees

| Institution | Profession | Number |
|---|----------------------------------|--------|
| MS-patient-association | Counselor (volunteer) | 2 |
| Regional hospital 1 | Nurse-specialist | 1 |
| Regional hospital 1 | Neurologist | 1 |
| Co-operation of the regional hospital 2 and home-care 1 | Nurse-specialist | 1 |
| Rehabilitation hospital | Physiotherapist | 1 |
| Rehabilitation hospital | Medical doctor | 1 |
| Home-care 1 | Manager Care | 1 |
| Home-care 1 | Nurse | 1 |
| Psychiatry | Manager ambulant care | 1 |
| Regional Indication Organ | Counselor | 1 |
| Insurance company | Medical adviser | 1 |
| Municipality (WVG) | Counselor | 1 |
| Center for Occupational Therapy | Occupational therapist | 1 |
| Nursing-home | Medical doctor | 1 |
| Social Pedagogic Service | Counselor Physically Handicapped | 1 |

These interviews took about one hour. A report was made of each interview and all reports were analyzed. The results are presented in the next section.

RESULTS

Studying the communication patterns, as reported by the care providers in the interviews, showed the lack of orchestration of patient flow or work flow in MS care. Actual communication between

care providers does not at all match the formal referral pattern. Depicting the actual communication on Figure 1 would give a tangle of dozens of arrows. Table 6 is a cross-table of information flows between the parties involved. From this, it can be learned that there is hardly a chain of healthcare; rather, a complex network with many cross-relations exists.

The two coordination mechanisms that could be found were the official referral system and informal communication (mutual adjustment; Mintzberg, 1979). Formal communication did

USE IT to Create Patient-Relation Management for Multiple Sclerosis Patients

Table 6. Patient-related contacts between care providers

| Interviewed (number) | MS-association (2) | Nurse-specialist MS (2) | Rehabilitation-Hospital (2) | Neurologist | Home-care (2) | Regional Indication Organ | Social Counselor Physically Handicapped | Municipality (Conveniences) | Occupational Therapist | Nursing-home | total |
|----------------------------------|--------------------|-------------------------|-----------------------------|-------------|---------------|---------------------------|---|-----------------------------|------------------------|--------------|-------|
| MS-association | 1 | 1 | | 1 | | | 1 | | | | 4 |
| Nurse-specialist MS | 1 | | | | 1 | | | 1 | 1 | | 4 |
| Rehabilitation Hospital | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 9 |
| Neurologist | 1 | 1 | 1 | | | | | | 1 | 1 | 5 |
| Home-care | 1 | 1 | 1 | | 1 | 1 | 1 | | 1 | | 7 |
| Psychiatry | | 1 | 1 | | | | | | | | 2 |
| Regional Indication Organ | 1 | 1 | | | 1 | | 1 | 1 | | 1 | 6 |
| Insurance company | 1 | | | | | | | | | | 1 |
| Municipality (Conveniences) | 1 | | | | 1 | 1 | | | | | 3 |
| Occupational Therapist | 1 | 1 | | | 1 | | | | | | 3 |
| Nursing-home | | 1 | | | | 1 | | 1 | 1 | | 5 |
| Physical Therapist | | 1 | 1 | 1 | 1 | | | | | | 4 |
| General Practitioner | | 1 | 1 | 1 | 1 | 1 | 1 | | | 1 | 7 |
| Family | 1 | 1 | | | 1 | 1 | | | 1 | | 5 |
| Hospital ward | 1 | | 1 | | 1 | | | | | | 2 |
| Urologist | 1 | 1 | 1 | 1 | | | | | | | 4 |
| Dietician | | | | | 1 | | | | | | 1 |
| Social Work | 1 | | | | | | 1 | | | | 2 |
| Counselor Physically Handicapped | | 1 | | | | | | | | | 1 |
| Employment Bureau | | 1 | | | | | 1 | | | | 2 |
| Others | 1 | | | | | 2 | 5 | 1 | | | 10 |
| total | 15 | 14 | 8 | 5 | 11 | 7 | 12 | 5 | 6 | 4 | 87 |

(Horizontal are positions or institutions that were interviewed. Vertical are positions or institutions with whom they have patient-related contacts, marked with the number 1. Grey boxes indicate that formal referral is possible.)

not suffice for two reasons: Not all information needs were covered and the GP cannot fulfill his or her formal role as central coordinator of care because he or she is too busy with other tasks. The informal network between care providers seemed reasonably effective, but also inefficient and often slow. Within this network, we found

handovers between caregivers that were executed by the patient. Six care providers indicated that the patient is the major source of information. A survey of the care provided and the progress of the care process was missed by both patient and care provider. Electronic records, when in use, only contain administrative information. Care-

related information was only recorded in local paper patient records.

It is not a great surprise that patients and caregivers sometimes get lost or stuck in the jumble of MS care, although patients felt these problems to a lesser extent than caregivers. All in all, patients seemed satisfied about the provided care, although they consider it very fatiguing to arrange new facilities or access new caregivers since a very proactive role of the patient is necessary; the patient needs to be his or her own case manager. This is especially bothersome because MS patients get less energetic when the disease develops. The patients had little complaints about the low level of contacts that have been noticed to exist between caregivers. The relation with each caregiver may continue for years, so, they saw little need for intensive contact between these caregivers. Table 7 gives an overview of the bottlenecks and disturbances as reported by care providers.

The USE IT interviews also made clear that MS care is not very relevant for most care providers. That is to say, caregivers have high compassion toward MS patients, but most caregivers only occasionally saw MS patients. The only notable

exceptions to this were the specialized MS nurse and some of the caregivers in the rehabilitation hospital. But even in this group, the maximum percentage of patient time spent on MS patients does not exceed 40%. The neurologist in the largest hospital in the area is specialized in MS. However, also for him, MS patients create just above 10% of his work.

Because of this infrequent contact with MS patients, the knowledge of caregivers about MS care seemed to be lacking at times. All interviewed patients said this lack of knowledge was the cause of one of the major problems they reported: incidents of insufficient and inadequate care. It should be noted that none of the care providers mentioned this theme. Not all healthcare providers were aware of the service that other caregivers could provide in general and do provide for a specific patient. Another consequence of the rather low prevalence of multiple sclerosis is a lack of knowledge present at the municipality, RIO, and insurance companies about the urge and specifications of needed conveniences.

The low relevance of MS care for care providers also caused resistance toward a specific solution for MS care. Care providers feared the

Table 7. Bottlenecks and disturbances (care providers)

| Bottlenecks and disturbances | Total |
|--|--------------|
| Waiting-lists for conveniences, nursing home and psychologist | 9 |
| Coordination, communication, working according to plan | 9 |
| Double work, fragmentation and lack of survey, due to lack of coordination | 5 |
| Care providers do not know each others possibilities in care | 5 |
| Care providers do not know about each others progress according to the patient | 5 |
| Limited time for providing care | 4 |
| Insurance companies, municipality and GP are unfamiliar with MS | 3 |
| Care provider only listens to the patient and ignores advise of other care providers | 3 |
| The patient does not have survey of who is treating him | 2 |
| The MS-association behaves as being a professional care provider | 2 |
| Patients wait too long before requesting a convenience | 2 |
| General Practitioner should be coordinator, not just referrer | 2 |

situation where each patient group has its own computer-based record. They feared to be loaded with separate solutions for every separate chronic disease. Little or no resistance toward the use of ICT as such is reported. The reported lack of time to provide proper care and long waiting lists for nursing homes are general healthcare problems and not specific to MS care.

DISCUSSION

The interview results clearly show that formal referral is not the backbone of the healthcare chain, and the GP and neurologist do not play a central role in MS care. Since referrals not only comprise the transfer of the patient to another care provider but also the transfer of the patient data, the failure of the formal referral tree has major consequences for the transfer of patient information. The many communications between care providers proved to be a very inefficient and slow compensation for the lack of information flow through the healthcare chain. The hampering information flow caused a reduced quality of provided care: The patients do not receive all the care they need at the moment they need it. This leads to the answer of the first research question: To improve the quality of care for MS patients, the information services should be improved in such a way that all care providers have all relevant patient data available at the time they see the patient, know what care is provided already, and know what care they themselves should provide to the patient. They also need to know to whom they should or could refer the patient when he or she has finished treatment. This means that the information services should support the transfer of relevant patient data, provide relevant up-to-date medical knowledge about MS to each care provider, and expose knowledge about the structure of the MS healthcare chain.

The interview data did not result in a straightforward answer to the second research question;

that is, they did not give a clear design of the best solution, but they gave the constraints and prerequisites that have to be taken into account when designing a solution. These constraints and prerequisites follow from the user characteristics as described in the results: the low relevance of MS care and low resistance to ICT, but high resistance to a specific solution, little resources, and a desire for good coordinated care and good communication. This means that a solution to the problems in MS care has to meet the following constraints: (1) There is no isolated solution for MS care as a specific solution must be expandable for other diseases, (2) implementation and maintenance must take very little effort and costs, and (3) the solution must adhere to the present conditions. Since the future users of the solution can be characterized as care providers with little to no resistance to the use of ICT as such and in favor of innovations as long as it is clear what benefits these will bring to the patient, the implementation of a solution that meets the constraints and prerequisites can be expected to be successful. What this solution could look like is further described in the next section.

The USE IT tool proved to be very helpful in revealing the user characteristics. The interviewed care providers appreciated the chance to express themselves, but at the same time, the interview questions did not provoke the interviewees to exaggerate or to trivialize. Information on all determinants was gained, but before designing an information system, a requirements analysis on a detailed level should be performed.

PATIENT-RELATION MANAGEMENT

The discussion of the results revealed the objectives a solution has to achieve. First of all, care for MS patients must be orchestrated in order to improve the flow of patients and related information through the healthcare chain. The second purpose of the solution is to raise the level of

knowledge about MS, its treatment, and the way MS care is organized. To accomplish these results, it is crucial that care providers actually use the solution and comply to the agreed way to provide care to patients with multiple sclerosis.

Several interviewed caregivers considered a regional cross-functional and cross-organizational EPR as the solution to the problems in MS care; however, many did not consider this a realistic solution since no regional electronic patient record or likewise ICT facility that could serve as a basis for a solution existed in the area studied. The main benefits of an EPR would be to know who is involved with what patient and to have access to the necessary information without being dependent of other caregivers such as the GP as “a pass-on desk” of information. An EPR could help to make clear amongst care providers what each of them does for an individual patient. However, both the realization and the use of a regional EPR for all patients (not just people suffering of MS) and all care providers (not just involved in MS care) demand much more effort, time, and expenses than is available for improving MS care. Also, the fact that MS patients make up a small percentage of the total patient population for most healthcare professionals is unaffected. As a consequence, patients will retain the problem that healthcare providers do not give adequate care, and they are unsure that referral patterns will improve.

That is why we suggest a solution that combines three elements. First, we suggest the orchestration of MS care by an MS protocol that lists the options of care that each of the care providers offers, and in which an agreement is accomplished about the routing of a patient through the healthcare chain when the patient is diagnosed as having MS.

Second, we suggest that the nurse specialist should play a central role as coordinator of care. But to fulfill this coordinating role, support is needed. So, the third element is to build a patient-relation management system. Since almost all care providers had (or would have in short notice) access

to e-mail or the Internet, this PRM will consist of a Web-based patient-routing system based on an agreement of the caregivers in the region on patient flow (cf the MS protocol). When a patient is reported to the system, a message will be sent automatically to those caregivers that should be informed. The information in the system comprises the names of the reported patients, the names and functions of the caregivers that are or have been involved with the treatment of the patient, and the likely next steps (of caregivers) in the treatment. PRM does not substitute the patient records from the various caregivers. PRM also does not contain any medical data of the patient in its simplest version, but it could be considered to expand PRM with two options: (1) composing structured notes about the patient contacts, and (2) composing referral or transfer letters or messages. Both options are meant to support the information flow through the healthcare chain. The composed notes and messages should be structured and standardized, for example, by using HL7, in such a way that they can be received and processed by linked healthcare information systems, like a hospital information system (HIS) and EPR. The system is accessible via a Web site that contains general information on MS and medical guidelines for caregivers.

PRM is based on both work-flow management and customer-relationship management (CRM). The MS protocol is incorporated in PRM and serves as the work-flow definition (Reijers, 2003). In this way, PRM steers the care processes; care providers are alerted when a patient is referred to them, and are advised to whom they should refer the patient. In this way, PRM acts as a work-flow management system (WfMS): PRM “delivers the right piece of work to the right resource at the right time” (Reijers, 2003). Since care providers have their professional responsibilities, they are free to ignore the given advice. PRM users can also track and trace the patient’s contacts with healthcare professionals. Although PRM lightens the task of the coordinator of care, a human coordinator

is still required to evaluate and to update the MS protocol and the system.

Improving communication and cooperation in healthcare by linking care providers of different professions can cause communication problems of a different nature. Each profession uses its own terminology, and the same terms can have different meanings and trigger different actions. Although the care providers only mentioned the lack of communication and information and did not complain about misinterpretation of information, the risk of semantic problems is real when human communication is partly replaced by information systems, especially when information systems are linked to create a WfMS (Cardoso & Sheth, 2003). When creating PRM, it is important to manage the risk of semantic heterogeneity from the start, that is, at the compilation of the MS protocol. All professional terms and actions should be clearly defined and agreed upon by the participating care providers. Using a standard like HL7 when designing and implementing PRM can be very helpful to prevent semantic problems.

The CRM aspect of PRM helps to create an overview of the nature and progress of patient contacts (Peppers & Rogers, 1999; Scheers, 2001). In contrast to the application of CRM in commerce, PRM is not intended to raise the number of client (i.e., patient) contacts, but to raise the satisfaction of the client and the efficiency and effectiveness of the patient contacts. PRM supplies the patient and care provider with a survey of patient contacts that occurred, and the option of making notes can serve as a record of agreed arrangements and actions. The information in PRM can also be used to evaluate the MS protocol and PRM.

PRM supports the organizational solution of the main problem of the caregivers by making the agreed guidelines and patient flow available and easy to maintain, and enriching it with knowledge caregivers need. They know to whom they should refer the patient and which caregivers can be asked for more information about the patient. From the USE IT model, we can learn

that an information system is only actually used when it is relevant to the end users. The interview results showed us that relevance for a specific MS solution is low and any solution will only be used when use takes little effort. The motivation to use PRM originates from the high compassion care providers have with patients suffering from MS and their desire to provide good care. We expect that the effort to report a patient to the system is rewarded by the more efficient communication that results and the information the caregiver can retrieve about the treatment of the patient. Many caregivers who seldom see an MS patient lack this knowledge.

Eventually, PRM could serve as a first step to accomplish a cross-functional, cross-organizational regional EPR. During the interviews, it became clear that other chronic diseases have similar problems (Michel-Verkerke, Schuring, & Harten, 2003). So, PRM could be expanded to healthcare chains for other chronic diseases.

To be a building block of an EPR, PRM must be designed and built according to international standards. Its architecture has to be open and transparent to make linking possible to different information systems, such as an EPR or an HIS in a different institution. Since PRM contains information of patients and caregivers, security is important and should conform to the security code for healthcare.

A major advantage of PRM is that it is a simple, inexpensive solution to actual problems experienced by local caregivers that does not create a new island of automation. Neither does PRM prohibit the development and implementation of an EPR. On the contrary, we think that PRM can pave the way. The success of an EPR is determined by several conditions. When looking at physicians, an EPR has to meet three requirements to be successful: (1) The EPR must expose all relevant data and functions anywhere and anytime, (2) using the EPR must be compatible with the medical process of each individual physician, and (3) the EPR must allow different levels

of authorization to protect professional autonomy (Michel-Verkerke, 2003). According to several authors, an EPR should also contain active elements (Dick, Steen, & Detmer, 1997; Ginneken & Moorman, 1997). To meet these four criteria of success, an EPR must cross the borders of its orientation (Michel-Verkerke & Spil, 2002). The importance of a well-designed architecture and the use of standards are stressed by Ginneken (2002) and Stegwee (1999).

PRM does not offer all of this. PRM stems from the care process orientation, but could also be applied in the medical technology or administration orientation (Michel-Verkerke, Schuring, & Spil, 2003). PRM fails on the first EPR criterion, and its activity is limited to notifying caregivers that a patient who should be seen is reported. Further analysis would be needed after the introduction of PRM to clarify which design of a regional EPR could have added value.

CONCLUSION

Existing tools to identify processes and interviews with future users are common ways to map the conditions where IT solutions can be applied in healthcare. We learned from this research that the USE IT analysis of the characteristics of the end user helps to provide a more appropriate picture of the problem, and the constraints and prerequisites for solving it. It is likely that we would have suggested a far more complicated ICT solution if we had only analyzed the MS care process as such without specific consideration of the USE IT dimensions. The USE IT analysis helped us to balance the breadth of the proposed solution with the nature of the situation the future users of the system will be in. The use of IT does not automatically mean that an EPR is needed (Berg, 2002).

This article gave an example of a thorough analysis of problems of work-flow management in a healthcare setting. The solution we suggest

is specifically geared for this type of care (i.e., for a network rather than chain, and one that has chronic low relevance for most care providers). It is a complex solution in the sense that it combines the creation of a protocol with the introduction of a new organization form (the coordinator) and with the introduction of the PRM. It is a simple solution in the sense that none of these three elements is in itself complex or difficult to realize. Each of these three elements is equally important as only the introduction of all three elements will lead to improved work-flow management. When we particularly focus on the role of IT for work-flow management in the healthcare network, it is once again an essential enabler for new organizational forms. We have tried to find solutions that were entirely organizational or IT related, but we have not managed to design one that could work. So, in line with what many thought when we started the project, IT was essential to create a solution, although it could not bring a solution on its own.

REFERENCES

- Ansoff, I. (1965). *Corporate strategy*. New York: McGraw-Hill.
- Berg, M. (2001). Implementing information systems in health care organizations: Myths and challenges. *International Journal of Medical Informatics*, 64(2-3), 143-156.
- Berg, M. (2002). Transmurale elektronische dossiers als bron van conflict. In *Presentation at the EMD 2002*.
- Beuscart-Zéphir, M. C., Anceaux, F., Crinquette, V., & Renard, J. M. (2001). Integrating users' activity modeling in the design and assessment of hospital electronic patient records: The example of anesthesia. *International Journal of Medical Informatics*, 64(2-3), 157-171.

- Brender, J., & McNair, P. (2001). User requirements specifications: A hierarchical structure covering strategic, tactical and operational requirements. *International Journal of Medical Informatics*, 64(2/3), 83-98.
- Cardoso, J., & Sheth, A. (2003). Semantic e-workflow composition. *Journal of Intelligent Information Systems*, 21(3), 119-225.
- Chismar, W. G., & Wiley-Patton, S. (2003). Does the extended technology acceptance model apply to physicians? In *Paper presented at the 36th Hawaii International Conference on System Sciences*, Hawaii.
- Coiera, E. (2003). Interaction design theory. *International Journal of Medical Informatics*, 69, 205-222.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319-340.
- DeLone, W. H., & McLean, E. R. (2002). Information systems success revisited. In *Proceedings of the 35th Hawaii International Conference on System Sciences*.
- Dick, R. S., Steen, E. B., & Detmer, D. E. (1997). *The computer-based patient record: An essential technology for health care* (Rev. ed.). Washington, DC: National Academy Press.
- Garrity, E. J., & Sanders, G. L. (1998). Dimensions of information success. In E. J. Garrity & G. L. Sanders (Eds.), *Information systems success measurement* (pp. 13-45). Hershey, PA: Idea Group Publishing.
- Ginneken, A. M. v. (2002). The computerized patient record: Balancing effort and benefit. *International Journal of Medical Informatics*, 64(2-3), 97-119.
- Ginneken, A. M. v., & Moorman, P. W. (1997). The patient record. In J. H. v. Bommel & M. A. Musen (Eds.), *Handbook of medical informatics*. Houten, The Netherlands: Bohn, Stafleu, Van Loghum.
- Larsen, T. J. (1998). Information systems innovation: A framework for research and practice. In *Information systems innovation and diffusion: Issues and directions* (pp. 411-434). Hershey, PA: Idea Group Publishing.
- Marsden, P., & Hollnagel, E. (1996). Human interaction with technology: The accidental user. *Acta Psychologica*, 91, 345-358.
- Meijden, M. J. v. d., Tange, H. J., Troost, J., & Hasman, A. (2001). Development and implementation of an EPR: How to encourage the user. *International Journal of Medical Informatics*, 64(2-3), 173-185.
- Michel-Verkerke, M. B. (2003). *What makes doctors use the electronic patient record?* Enschede: University of Twente.
- Michel-Verkerke, M. B., Schuring, R. W., & Harten, W. H. v. (2003). *Needs, requirements, interests and impact of integrated wireless ICT in care*. Enschede: University of Twente.
- Michel-Verkerke, M. B., Schuring, R. W., & Spil, T. A. M. (2003). Use IT or leave IT: A model to reveal user satisfaction of ICT-support in health care processes ex ante and ex post. In *Proceedings of the Third International Conference: The Hospital of the Future*. Warwick: Association for Healthcare Technology and Management.
- Michel-Verkerke, M. B., Schuring, R. W., Spil, T. A. M., & Hummel, M. (2003). *De MS-zorgketen in Twente: Eindverslag van het onderzoek naar de informatiestromen in de MS-zorgketen*. Enschede: University of Twente.
- Michel-Verkerke, M. B., & Spil, T. A. M. (2002). Electronic patient records in the Netherlands. Luctor et emergo: But who is struggling and what will emerge? In *Proceedings of the 10th European Conference on Information Systems*.

- Mintzberg, H. (1979). *The structuring of organizations: A synthesis of the research*. Englewood Cliffs, NJ: Prentice-Hall.
- Mumford, E. (1995). *Effective systems design and requirements analysis*. London: MacMillan.
- Myers, B. (1998). A brief history of human computer interaction technology. *ACM Interactions*, 5(2), 44-54.
- Offenbeek, M. v., & Koopman, P. (1996). Interaction and decision making in project teams. In M. A. West (Ed.), *Handbook of work group psychology*. John Wiley & Sons, Ltd.
- Pare, G., & Elam, J. (1999). Physicians' acceptance of clinical information systems: An empirical look at attitudes, expectations and skills. *International Journal of Healthcare Technology and Management*, 1(1), 46-61.
- Peppers, D., & Rogers, M. (1999). *One to one manager: Real-world lessons in customer relationship management*. New York: Currency.
- Reijers, H. A. (2003). *Design and control of workflow processes* (Vol. 2617). Berlin, Germany: Springer.
- Rogers, E. M. (1995). *Diffusion of innovations*. New York: The Free Press.
- Saarinen, T., & Sääksjärvi, M. (1992). Process and product success in information systems development. *Journal of Strategic Information Systems*, 1(5), 266-277.
- Scheers, D. (2001). *Netwerken aan ketens* (Vol. 10). Deventer: Kluwer.
- Schuring, R. W., & Spil, T. A. M. (2003). Relevance and micro-relevance for the professionals as determinants of IT diffusion and IT-use in healthcare. In G. Grant (Ed.), *ERP & datawarehousing in organizations: Issues and challenges*. Hershey, PA: IRM Press.
- Spil, T. A. M. (2003). Assessing resistance of professional users as a determinant of IT-diffusion and IT-use in healthcare. In *Proceedings of ECITE 2002*, Paris.
- Spil, T. A. M., & Schuring, R. W. (2003). Assessing requirements and resources of information systems as determinants of IT-diffusion and IT-use in healthcare. In working paper.
- Spil, T. A. M., Schuring, R. W., & Michel-Verkerke, M. B. (2004). Electronic prescription system: Do the professionals use it? *International Journal of Healthcare Technology and Management*, 6(1), 32-55.
- Staccini, P., Joubert, M., Quaranta, J.-F., Fieschi, D., & Fieschi, M. (2001). Modelling health care processes for eliciting user requirements: A way to link a quality paradigm and clinical information system design. *International Journal of Medical Informatics*, 64(2-3), 129-142.
- Stegwee, R. A. (1999). The electronic patient record: An architecture for successful introduction. In *Proceedings: Toward an Electronic Health Record Europe*, (pp. 58-63).
- Wissema, J. G. (1987). *Angst om te veranderen? Een mythe!* Assen: Van Gorcum.

This work was previously published in the International Journal of Technology and Human Interaction, Vol. 1, No. 4, edited by B. C. Stahl, pp. 58-75, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 3.47

Participatory 3D Modelling

Giacomo Rambaldi

Technical Centre for Agriculture and Rural Co-Operation (CTA), The Netherlands

INTRODUCTION

Mapping is a fundamental way for displaying spatial human cognition. “It is a representational medium that both has a history and is part of the practice of history” (Herrington, 2003). For centuries and increasingly with the advent of Geographic Information Technologies (GIT), graphic representations of part or the whole of Earth in cartographic, electronic, two or three dimensional formats have been playing significant roles as media (Sui & Goodchild, 2001) used to store, display and convey information and as basis of analysis for decision support.

BACKGROUND

In the past maps have been made primarily to serve precise tasks like describing discoveries, navigating space, defining boundaries, registering ownership and locating resources. In the early '90s, Monmonier (1996, p. 2) wrote that,

a single map is one of an indefinitely large number of graphical models of the spatial aspects of real-

ity that might be produced for the same situation or from the same data.

Changes have occurred since GIT have become accessible to civil society and graphic representations of space have been used as channels for two-way communication purposes to support social learning, dialogue and negotiation processes.

The participatory use of maps started in the late '80s. At that time, development practitioners were inclined to adopt PRA¹ *sketch mapping* tools (Mascarenhas et al., 1991) rather than venturing into more complex, demanding and time consuming *scale mapping*, particularly because preference was given to eliciting village dynamics and facilitating communication between insiders and outsiders (researchers), rather than to courses of action enabling communities to interact efficiently with policymakers (Rambaldi et al., 2002a). In addition, in many developing countries aerial photography, satellite imagery and official large-scale topographic maps were under governmental control and their access restricted because of national security concerns.

The situation changed in the '90s, with the diffusion of modern GIT including geographic information systems (GIS), low-cost global positioning

systems (GPS), remote sensing image analysis software, open access to data via the Internet and steadily decreasing cost of hardware. Spatial data, previously controlled by government institutions became available to and mastered by non-governmental and community-based organisations, minority groups and sectors of society traditionally disenfranchised by maps and marginalized from decision-making processes (Fox et al., 2003). This new environment facilitated the integration of GIT into community-centred initiatives particularly to deal with spatial information and communication management (ICM). Practitioners and researchers around the world have been working on different approaches making use of a variety of GIT, but all sharing the goals of placing ordinary people in the position to generate, analyse, manage and exchange geo-referenced data, integrate multiple realities and diverse forms of information to foster social learning and broaden public participation across socio-economic contexts, locations and sectors. This has spurred a rapid development in the management of spatial multimedia information through what is generally termed as Public Participation GIS (PPGIS), where maps are conceived as interactive vehicles for discussion and information exchange, are physical or virtual, in 2-or 3-Dimensional formats and are enriched by an array of data types including sound and images (Aberley et al., 2002).

Large scale maps (> 1:20,000 scale) and physical or digital terrain elevation models have been used for conducting collaborative research (Hampson et al., 2003; Tran Trong Hieu et al., 2002; Martin et al., 2001; Tan-Kim-Yong, 1994 and 1992), community-based planning, monitoring change, asserting territorial claims (McCall, 2004; Bersalona et al., 2004; Rambaldi et al., 2002a; Zingapan et al., 1999; Poole, 1995), managing territorial disputes and supporting related negotiations (Chacon, 2003; Carton, 2002a; Rambaldi et al., 2002b; Wood, 2000; Johnson, 1999) and consultative policy making (Carton, 2002b). While most authors point to the effectiveness of GIT &

GIS used in a participative mode, McCall (2004), Fox (2003), Rambaldi (2002a), Abbot (1998) and Rundstrom (1995) call for caution as these may lead to increased conflict, resource privatization, and loss of common property.

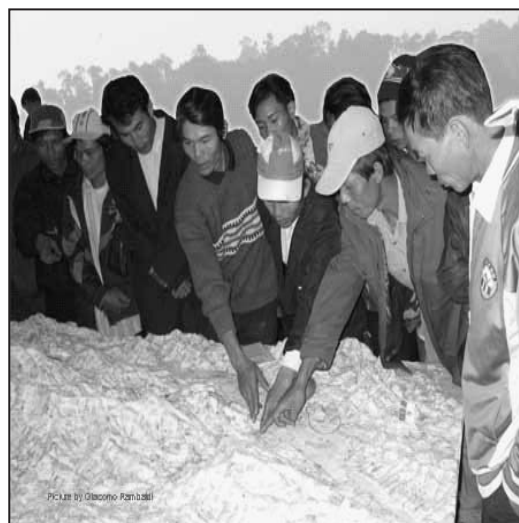
PARTICIPATORY 3D MODELS

Participatory 3D Modelling (P3DM) is a relatively new communicative facilitation method conceived to support collaborative processes related mainly to resource use and tenure and aimed at facilitating grassroots participation in problem analysis and decision-making.

P3DM integrates people's knowledge and spatial information (contour lines) to produce stand-alone scale relief models that have proved to be user-friendly and relatively accurate data storage and analysis devices and at the same time excellent communication media. Relief models works best when used jointly with GPS and GIS facilities.

Participatory 3D models are manufactured at the village level based on the merger of tra-

Figure 1. Discovery learning, the first step for informed decision-making



ditional spatial information (elevation contours) and peoples' spatial knowledge (cognitive maps). Elevation contours are used as templates for cutting out sheets of carton board of a given thickness (i.e., expressing the vertical scale). Cut-out sheets are progressively superimposed to build the relief. Based on their spatial cognition, informants depict land use and cover and other features on the model by the use of pushpins (points), yarns (lines) and paint (polygons). Once the model is completed, a scaled grid is applied to transpose spatial and geo-referenced data into GIS. The grid offers on one hand the opportunity of adding geo-coded data generated by GPS readings or obtained from secondary sources to the model, and on the other hand to take approximate coordinates on the model and verify these on the ground by means of GPS. This is extremely useful when models are used to support boundary negotiations.

P3DM brings GIS potentials closer to rural communities and bridges the gap existing between externally supported GIS and capacities found among marginalised, isolated, and frequently natural resource-dependent communities.

The manufacture of a 3D model leads participants through a collective learning process (Figure 1) to the visualization of their economic and cultural domains in the form of scaled and geo-referenced relief models which can be used subsequently for different purposes.

One major constraint of physical elevation models is their limited mobility. Their use is therefore confined to those in the position to convene around them.

To upscale its utilization, P3DM is best integrated with GPS and GIS. Such integration allows adding precisely geo-referenced data, conducting additional analysis and producing impressive cartographic outputs. Resulting synergies make community knowledge portable and sharable at all levels of society and more importantly add veracity and authority to it. This paves the way for peer-to-peer dialogue and more balanced power-sharing when territorial issues are at stake.

Practitioners using relief models at the community level in the Philippines (Rambaldi et al., 2002a and 2002b; PAFID, 2001; Zingapan et al., 1999), Vietnam (Rambaldi et al., 2003; Hardcastle et al., 2004), Thailand (Tan-Kim-Yong, 1992; Hoare et al., 2002) and India (Chakraborty, 2003), have experienced that when informants are provided with a blank relief model instead of a blank contour map or a blank sheet of paper, they can easily depict their spatial knowledge in a scaled, geo-referenced manner and add a lot of precise details.

The fact that 3D models augment the power of mind and facilitate scaling, allows for filling in information more fully and accurately on a given area. Generally this is not the case with sketch mapping, which has been widely used to represent spatial knowledge in the context of participatory action research. The difference between a blank contour map and the corresponding relief model is the physical vertical dimension that provides essential cues for stimulating memory, establishing spatial associations and depicting cognitive maps (Rambaldi et al., 2002).

LESSONS LEARNED

By carefully documenting and analysing over 20 cases where P3DM has been applied in developing countries (Tan-Kim-Yong, 1992; SM-HDP, 1998; Srimongkontip, 2000; Rambaldi et al., 2000, 2002a, 2002b, 2003; Martin et al., 2001; Tran Trong Hieu et al., 2002; Hoare et al., 2002; Hampson et al., 2003; Hardcastle et al., 2004) practitioners and users noted the following advantages of P3DM.

Enhancing Learning Capacity and the Power of the Mind

3D models offer a more efficient spatial interpretation base by displaying the vertical dimension which provides additional cues to memory and

facilitates mental spatial knowledge processing. By providing a bird's eye view, and by accommodating different layers of information², relief models contribute to widening the users' evaluative frame of reference on spatially defined issues, and thus stimulate active learning and analysis. In other words, scaled relief models help participants in understanding bio-physical and socio-economic dynamics going beyond their individual cognitive boundaries.

Fostering Self-Esteem and Social Cohesion among Marginalised Communities

Both process and output fuel self-esteem, raise local awareness of linked ecosystems and delineate intellectual ownership of the territory. Experience documented in the Philippines has shown that P3DM exercises conducted at the community level and as a response to local needs versus external threats have yielded positive effects in terms of community-cohesion and identity building, through the revival of local knowledge. "Old people share history with young people, passing on legends and religious beliefs, sacred rites and places so essential to conserving tradition" (Alcorn, 2000, pp. 1-2).

Bridging Communication Barriers by Offering a Shared Perspective and Visual Language

Different opinions are frequently based on different perspectives and the quality of the media used to communicate. When a process is geared towards addressing conflicts bound to the territory, appropriate communication channels are essential to grant all parties equal access to information in order to develop a common understanding of the issues at stake. Case in point is the so-called *bird's eye view* offered by a scaled relief model through which a viewer acquires a holistic view

of the landscape wherein landmarks and salient features are equally visible to everyone. In addition, when language barriers represent a constraint, information exchange best occurs via visual communication means based on colour, shape and texture, like in a 3D model.

Filling the Data Gap According to Users Perspectives

In developing countries baseline data available from official sources are frequently limited, inconsistent, outdated, scarce and/or inaccurate. Local geo-referenced knowledge is very valuable in such environments. If P3DM is applied in a genuinely participatory manner, it generates relatively accurate qualitative and quantitative geo-referenced data that are intellectually owned and understood by those who have compiled them (Chambers, 2002).

Scaling the Territory to Bridge Isolation

By miniaturising (1:5,000 – 1:20,000) real world features as known and perceived by participants, the method has proved to be particularly effective in dealing with relatively large and remote areas, and overcoming logistical and practical constraints to public participation in land/resource use planning and management.

Dealing with Boundary Conflicts

Resource use, control and access are increasingly the issues at stake in latent or explicit conflicts. P3DM has been successfully used in the Philippines (Rambaldi et al., 2002b) and Thailand (Srimongkontip, 2000) to deal with such controversies. By creating shared vantage points and offering a common visual vocabulary, 3D models and derived maps are instrumental in bridging

communication barriers, facilitating dialogue and limiting subjective interpretations, thus setting the basis for fruitful negotiations.

Surfacing “Submerged” Knowledge

The possibility of using 3D modelling for mapping out water bodies deserves special mention, due to the partially hidden nature of these environments and the value of human cognition in its description and depiction.

Mapping out wetlands and coastal areas characterised by shallow waters is difficult, because of their instability and frequent change (e.g., river deltas). Nonetheless, in cases where the topography has been stable for a long period and reliable contour and bathymetric lines are available, the production of a participatory 3D model leads to generating an extremely rich information base on existing ecosystems and their interaction with wetland-dependent communities.

The reproduction of the seabed also depends on the availability of bathymetric lines. Exercises carried out in the Philippines (Figure 2) have demonstrated how well fishermen could map out the details of their fishing grounds including the detailed description of coastal and marine ecosystems (Rambaldi et al., 2002).

Figure 2. El Nido-Taytay managed resource protected area, Palawan, Philippines (1999)



Inherent Risks and Mitigating Measures

Because of their accuracy, relief models may have also negative implications. Alone or combined with GIS, “they turn local knowledge into public knowledge and conceivably out of local control. This can be used by outsiders to locate resources and meet development needs, or merely, to extract more resources, or increase outside control” (Abbot et al., 1999). Researchers, planners and practitioners should be aware of these possible drawbacks and be careful applying the method.

Being on a map, on one hand, means to exist vis-à-vis the external world, thus to be in the position to get or claim services and assistance. On the other hand, for communities wanting to maintain their cultural identity and traditions, it may carry undesired development pressures. From a biodiversity conservation perspective, depicting habitats of endangered species, or rare resources in demand on the black market, may lead to their further depletion (Rambaldi et al., 2002).

Therefore, exercises dealing with sensitive issues should be carried out with caution and behind closed doors in the course of focus group discussions.

Data at risk of abuse or culturally sensitive, should be removed from the model and eventually stored as confidential GIS layers with limited or protected access (Harmsworth, 1998).

CONCLUSION

The most important lesson learned with respect to the analysis done, is that the use to which the P3DM outputs can be put definitely depends on their integration with appropriate geographic information technologies and systems, and on the existence of an enabling regulatory environment.

As part of a widespread capacity-building effort involving institutional and customary custodi-

ans of natural resources, P3DM has been gaining increasing recognition as an efficient method to facilitate learning, analysis and proactive community involvement in dealing with spatial issues related to the territory. If properly administered, P3DM can support collaborative natural resource management initiatives and transcend the local contexts by establishing a peer-to-peer dialogue among communities and central institutions, agencies and projects.

REFERENCES

- Abbot et al. (1998). *Participatory GIS: Opportunity or oxymoron?* PLA Notes 33: 27-34. IIED: London.
- Aberley, D. & Sieber, R. (2002). *Public participation GIS (PPGIS) guiding principles*. First International PPGIS Conference held by URISA at Rutgers University, New Brunswick, New Jersey, July 20-22.
- Bersalona, R., & Zingapan K. (2004). P3DM: Mapping out the future of Indigenous Peoples in 3D. *ICT Update*, Vol. 17, May, CTA, Wageningen, The Netherlands.
- Carton, L. (2002). The power of maps in interactive policymaking: Visualization as debating instrument in strategic spatial policy processes. In E.F. ten Heuvelhof (Ed.), *Proceedings of the First International Doctoral Consortium on Technology, Policy and Management* Delft, 17-18 June 2002. TU Delft, Delft (pp. 269-283).
- Carton, L. (2002). *Strengths and weaknesses of spatial language: Mapping activities as debating instrument in a spatial planning process*. FIG XXII International Congress, Washington, D.C., April 19-26.
- Chacon, M. (2003). *Principles of PPGIS for land conflict resolution in Guatemala*. Geography Department, UCGIS Summer Assembly 2003.
- Chakraborty, S.K. (2003). *Sasatgre takes up P3DM tool for new land use planning*. Interim Report, ICIMOD, Nepal (unpublished).
- Chambers, R. (2002). *Participatory numbers: Experience, questions and the future*. Paper presented at the *Conference on Combining Qualitative and Quantitative Methods in Development Research*, Centre for Development Studies, University of Wales Swansea, UK. July 1-2.
- Fox, J., Krisnawati Suryanata Hershock, P., & Hadi Pramono, A. (2003). *Mapping power: Ironic effects of spatial information technology*. Spatial Information Technology and Society: Ethics, Values, and Practice Papers. East-West Center, Hawaii, USA.
- Hampson et al. (2003). *Wildlife and conservation in the Polillo Islands, Philippines*. Polillo Project Final Report. Viper Press.
- Hardcastle, J., Rambaldi, G., Long, B., Le Van, L. & Do Quoc, S. (2004). *The use of participatory 3 dimensional modelling in community-based planning in Quang Nam province, Vietnam*. PLA Notes No. 49: 70-76, IIED, London.
- Harmsworth, G. (1998, December). Indigenous values and GIS: A method and a framework. *Indigenous Knowledge and Development Monitor*, 6(3).
- Hoare, P., Maneeratana, B., Songwadhana, W., Suwanmanee A., & Sricharoen, Y. (2002). Relief models, a multipurpose tool for improved natural resource management. The Experience of the Upper Nan Watershed Management Project in Thailand. *ASEAN Biodiversity*, Vol. 2 No. 1, 11-16. ARCBC, Los Baños, Philippines.
- Herrington, S., & McIver Lopes, D. (2003). *Maps: Here, then, and now*. Vancouver: Peter Wall Institute for Advanced Studies University of British Columbia.
- Martin, C., Eguienta, Y., Castella, J.C., Hieu, T.T., & Lecompte, P. (2001). *Combination of participatory landscape analysis and spatial*

Participatory 3D Modelling

graphic models as a common language between researchers and local stakeholders. SAM Paper Series. IRRI-IRD.

Mascarenhas, J., & Prem Kumar, P.D. (1991). *Participatory mapping and modelling users' notes.* RRA Notes (1991), Issue 12, pp. 9-20, IIED London.

McCall, M. (2004). *Can participatory GIS strengthen local-level planning? suggestions for better practice.* The Seventh International Conference on GIS for Developing Countries (GISDECO 2004), 10-12 May 2004, Universiti Teknologi Malaysia, Johor Malaysia.

Monmonier, M. (1996). *How to lie with maps,* (2nd Ed.). Chicago and London: University of Chicago Press.

PAFID. (2001). *National land tenure for indigenous people in the Philippines.* Terminal Report.

Poole, P. (1995). *Indigenous peoples, mapping & biodiversity conservation, an analysis of current activities and opportunities for applying geomatics technologies.* Peoples and Forest Program Discussion Paper. Biodiversity Support Program (BSP). Washington, DC.

Rambaldi, G., Bugna, S., Tiangco, A., & de Vera, D. (2002). *Bringing the vertical dimension to the negotiating table. Preliminary Assessment of a Conflict Resolution Case in the Philippines.* ASEAN Biodiversity, Vol. 2 No. 1, 17-26. ARCBC, Los Baños, Philippines.

Rambaldi, G., & Callosa-Tarr, J. (2000). *Manual on participatory 3D modeling for natural resource management. Essentials of Protected Area Management: Vol. 7; National Integrated Protected Areas Programme.* Quezon City, Philippines.

Rambaldi, G., & Callosa-Tarr, J. (2002). *Participatory 3Dimensional Modelling: Guiding Principles and Applications.* Los Baños, Philippines: ARCBC

Rambaldi, G., & Le Van, L. (2003). *The seventh helper: The vertical dimension. Feedback from a training exercise in Vietnam.* PLA Notes No. 46: 77-83, IIED, London.

Rundstrom, R. (1995). GIS, indigenous people, and epistemological diversity. *Cartography and Geographic Information Systems*, 22(1), 45-57.

SM-HDP. (1998). *Final Report, Doi Sam Mun Highland Development Project, AD/THAI 86/334-335, 1987-1994, Chiang Mai, Thailand.*

Sui, D., & Goodchild, M. (2001). GIS as media? *International Journal of Geographical Information Science*, 15(5), 387-390.

Srimongkontip, S. (2000). *Building the capacity of watershed networks to resolve natural resource conflicts: Field experiences from the CARE Thailand Project.* Asia-Pacific Community Forestry Newsletter, 13, 2.

Tan-Kim-Yong, U. (1992). *Participatory land use planning for natural resource management in northern Thailand, Rural Development Forestry Network.* Network Paper 14b.

Tran Trong, H., Castella, J.C., & Eguienta, Y. (2002). *Participatory 3D landscape modeling: Towards a common spatial language among researchers and local stakeholders.* In PAOPA (Eds.), *Scaling-up innovative approaches in agricultural development* (p. 13). Hanoi, Vietnam: Agricultural Publishing House.

Wood, B. W. (2000). GIS as a tool for territorial negotiations. *IBRU Boundary and Security Bulletin*, 8(3), 72-78.

Zingapan, K., & De Vera, D. (1999). *Mapping the ancestral lands and waters of the Calamian Tagbanwa of Coron, Northern Palawan.* Paper presented at the Conference on NGO Best Practices, Davao City, Philippines.

NOTE

Additional information on Participatory 3D Modelling is found at www.iapad.org. Pictures in the text courtesy by Giacomo Rambaldi.

KEY TERMS

Cognitive Maps: Internal representations of the world and its spatial properties stored in memory (also called mental maps).

Geo-Reference: The relationship between page-coordinates on a planar map and known, real-world co-ordinates.

Geographic Information Systems (GIS): An organized collection of computer hardware, software, data, and personnel designed to capture, store and update, manipulate, analyze and display geographically referenced information.

Participatory 3D Modelling (P3DM): A participatory mapping method based on the merger of traditional spatial information (elevation contours) and peoples' spatial knowledge (cognitive maps), the output of which are solid terrain models and derived maps. The models are used in development and natural resource management contexts and have proved to be user-friendly and relatively accurate data storage and analysis devices and at the same time excellent communication media.

Participatory Learning and Action (PLA): Umbrella term for a wide range of similar ap-

proaches and methodologies to involve communities in self-help and development projects. The common theme to all of these approaches is the full participation of people in the processes of learning about their needs and opportunities and the action required to address them.

Public Participation GIS (PPGIS): A spontaneous merger of participatory development methods with geo-spatial technologies (P-mapping, P3DM, GIS, GPS and remote sensing). PPGIS is usually geared towards community empowerment through measured, demand-driven and user-friendly applications of geographic information technologies and systems. PPGIS is an integrated practice which has multiple dimensions, builds on diverse tools, and highlights the integration of outsider with socially differentiated local knowledge, and builds essentially on high levels of participation at all stages of project implementation.

ENDNOTES

- ¹ Participatory Rural Appraisal, currently known as Participatory Learning and Action (PLA).
- ² Thanks to the variety of coding means (paint, yarns and pins), a 3D model can accommodate overlapping layers of information like, for example, "land use" and "land tenure" depicted by colour-coded paints and yarns respectively.

This work was previously published in the Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by Marshall, S., Taylor, W., and Yu, X., pp. 538-543, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Section 4

Utilization and Application of Information Communication Technologies

This section introduces and discusses a variety of the existing applications of ICT that have influenced government, culture, and education and also proposes new ways in which ICT can be implemented in society. Within these selections, particular issues related to ICT utilization, such as the existence of a cross-cultural digital divide and the existence of a gender barrier, are explored and debated. Contributions included in this section provide excellent coverage of today's IT community and insight into how ICT impacts the social fabric of our present-day global village.

Chapter 4.1

A Dissemination Strategy for the Management of Knowledge in Rural Communities

Ken Stevens

Memorial University of Newfoundland, Canada

ABSTRACT

Schools in rural communities of the Canadian province of Newfoundland and Labrador have been reorganized in the last decade. Because of rural to urban migration and the consequent challenge to the continued existence of many small schools, new academically and administratively open structures have been established within an Internet-based environment. Accordingly, traditional closed, autonomous schools in this province have increasingly become open sites within Internet-linked teaching and learning environments. What began as a research project linking eight schools in a single Digital Intranet has been extended to include schools across the province managed by a recently established branch of the Department of Education of Newfoundland and Labrador—the Centre for Distance Learning and Innovation. This chapter provides an outline of how information and communication technologies have been used to reshape education in a

predominantly rural Canadian province, thereby preparing people for participation in the emerging knowledge-based economy.

INTRODUCTION

A decade ago tele-learning (e-learning) was described as the future of distance learning (Collis, 1996). In spite of this, e-learning remains, for many people, an unfamiliar term in the educational lexicon, the implications of which for teaching, learning, the management of schools, and educational policy are unclear. At the present time, many schools are in transition between traditional and virtual ways of organizing teaching and learning as they seek to integrate information and communication technologies in classrooms. This chapter outlines the transition from traditional (face to face) to virtual teaching and learning environments in a small network of rural Canadian high schools. It is argued, on the

basis of research in science classes in this network in Newfoundland and Labrador, that the introduction of e-learning in schools involves a shift from a closed to an open model of teaching and learning. The shift from closed to open teaching and learning has implications beyond the school for regional development.

In most states of the United States and provinces of Canada there are communities that live beyond major centers of population. Although most North Americans live in urban centers, many Americans and Canadians live in small communities in rural and sometimes remote parts of the continent, in Alaska, Wyoming, and Montana, for example in the United States, and the in the Canadian prairie provinces of Saskatchewan and Manitoba as well as in Atlantic Canada. The development of natural resources such as lumber and fishing and the extraction of oil and gas that are important to the economies of both countries, often takes place in locations far from major centers of population. In the resource-based Canadian economy rural schools are, therefore, integral to the economic infrastructure. A decline in the viability of rural education has implications for provincial, and, indirectly, national economic infrastructures. However, it is sometimes difficult for professional people to justify enrolling their sons and daughters in small schools in rural communities if they provide fewer curriculum options than urban institutions.

Information and communication technologies (ICTs) are central to the development of the knowledge economy whose significance for rural schools was recognized in the mid-1990s (Barker, 1994; Stevens, 1994). Almost a decade ago the Canadian government set out two documents (1995, 1997) to prepare the country for the digital world. Small schools in rural communities have been particularly active in Canada (Cey, 2001; Healey and Stevens, 2002; Stevens, 2000, 2001) in using new technologies to promote educational opportunities for students and more efficient ways of

organizing and managing knowledge in connected (Ertl & Plante, 2004), collaborative, electronic structures. The rapid growth and educational application of the Internet has led to a challenge to traditional ways of teaching and learning at a distance (Ben-Jacob, Levin & Ben-Jacob, 2000) that were based on paper and the postal system. The introduction of e-learning in schools in Atlantic Canada has been particularly noticeable in rural communities and has been influenced by declining enrollments because of rural to urban migration (Brown, Sheppard & Stevens, 2000). While the population of rural Atlantic Canadian communities has declined, the management of schools has been changed so that actual and virtual classes have, to some extent, been integrated. One of the Atlantic Canadian provinces—Newfoundland and Labrador—provides an example of rural population decline, a challenge to the continued existence of many small schools and a loss of local educational and economic opportunities. These changes have been countered by the development of a dissemination strategy for the management of knowledge in small communities in this province that provides a possible model for other parts of North America.

RURAL EDUCATION IN ATLANTIC CANADA: NEWFOUNDLAND AND LABRADOR

Atlantic Canada consists of four provinces: New Brunswick, Prince Edward Island, Nova Scotia, and Newfoundland and Labrador. Newfoundland and Labrador covers by far the largest area of Atlantic Canada and, particularly in Labrador, there is very sparse population settlement. Newfoundland and Labrador's small population of approximately 550,000 residents in a large geographic area (156,185 square miles) presents challenges for the delivery of education, particularly at the senior high school level. Newfoundland and Labrador

has many small coastal communities a predominantly rural lifestyle in most of the province and a distinctive history and culture.

31% of educational institutions in the Canadian province of Newfoundland and Labrador are designated “small rural schools” (N = 122) and 75 of these have fewer than 100 students. 70 of the small rural schools in this province are classified as “all-grade” (K–12) which means that they must offer a senior high school program. The search for appropriate new educational structures for the delivery of education to students in rural Newfoundland and Labrador led to the development of School District Digital Intranets, within which virtual classes, based on e-learning, have been organized. The large proportion of small schools located in rural communities, required special consideration in the development of these new, electronic educational structures.

In the last decade there has been considerable reorganization of the school system in Newfoundland and Labrador, largely because of rural to urban migration together with a net outflow of people from the province. Small schools are not only getting smaller; many of them have been closed permanently. In 1996, 10 Anglophone school district boards were created in the province together with one province-wide Francophone board, a reduction from 26 school boards. In this reorganization of school boards, the Vista School District was created. With continued reduction in school size in most rural Newfoundland and Labrador communities, the provincial administration of schools was further reorganized in 2003 to create four Anglophone and one Francophone school board. This study was conducted before the most recent reorganization, when there were ten school boards, one of them serving the Vista district.

The Vista School District contained 18 schools ranging in student enrollment from 650 down to 40, including Eastern High School (not its real name). The region in which the Vista School District is located extends from Bonavista in

the north, (the place where John Cabot landed in North America in 1497) to the Burin Peninsula in the South. It is a large geographic area covering about 7,000 square kilometers. The region had a population of about 35,000 people and an economy supported by a diverse infrastructure including fishing, forestry, farming, mining, aquaculture, and tourism. There were 5,165 students enrolled in 18 schools in the district, taught by 366 teachers. The Vista School District was approximately two hours by road from the capital city, St Johns. Eastern High School, (not its real name) with a student enrollment of 480, was initially chosen for intensive study.

The path from a closed model of the school in rural Newfoundland and Labrador to the beginnings of an open model began in selected science classes of Eastern High School. At the time of the study, computers and the Internet were fairly new in schools and many teachers were not aware of the nature and potential extent of their applications for teaching and learning. Five phases can be identified in the ways these technologies were organized in what became a move from closed to open teaching and learning in the Vista School District.

Five Phases in the Move from Closed to Open Classes

The introduction of computers and the Internet to schools in Newfoundland and Labrador took place gradually, in closed teaching and learning environments which gradually became more open. At the beginning of the study, Eastern High School was at phase four.

Phase One: The Introduction of Computers in Schools

In the late 1980s and early 1990s computer technology was introduced to classes with little or no formal training of the teachers who used it. Teachers frequently learnt how computers worked

though their own study of them with little help from outside sources. In this phase of e-learning, computers were a subject of study. Some teachers studied computers to find out how they worked and how they could be programmed while, to most of the profession, this technology was not considered to be directly relevant to classroom life. There was little thought given to the integration of computers to teaching and learning.

Phase Two: Computers and Course Redevelopment

In the early 1990s increasing numbers of teachers began to realize the potential of computers for both teaching and student learning. Local Area Networks (LANs) were introduced in Newfoundland and Labrador. While there was awareness of the Internet, it was not used in Newfoundland and Labrador schools at this time. However, computers were used to capture data for science experiments using Vernier hardware and software. Students were shown how to use word processing, spreadsheets, and graphing software in completing their assignments and some entire courses were re-developed around such uses of computer technology.

Phase Three: Internet Access

In 1993 the introduction of Internet access to selected teachers in Newfoundland and Labrador led to the formation of STEM~Net, the provincial arm of the federal program SchoolNet which was established to encourage computer and Internet use in Canadian classrooms. STEM~Net was based at Memorial University of Newfoundland, the only university in the province. Within a two-year period more than 5,000 teachers were provided with access to the Internet through STEM~Net. Training sessions were provided in the use of e-mail and the development of Web pages using HTML.

Phase Four: Integrating Technologies

By 1996-97 Newfoundland and Labrador schools had a high level of connectivity, per capita. The development of Web pages by students in schools was accompanied by the introduction of other areas of school life to the Web such as homework exercises, answers to questions, school policies, and schedules of events. Early attempts to bring information technologies into teaching and learning were in the form of text on line and links to other sites (mostly universities). Internet resources and CD-ROMs became increasingly available to both teachers and learners, facilitating interaction between dispersed sites.

Phase Five: The Vista School District Digital Intranet

The Vista School District Digital Intranet project that began in 1998 was an attempt to determine how to deliver real-time instruction across dispersed sites, all of which were located in rural Newfoundland. Lead teachers in biology, chemistry, mathematics, and physics piloted the delivery of Advanced Placement (AP) courses in these subjects. Advanced Placement courses are available to students in both Canada and the United States. As the name suggests, these courses are designed for students who wish to prepare for university by undertaking studies over and above their final-year high school program. Universities throughout North America determine the level of credit towards first-year courses they will award students who pass AP subjects. Students who pass AP courses, therefore, often enter North American universities with a small part of their degrees already completed. Success in AP examinations (all of which are moderated in Baltimore, Maryland) gives students confidence that they can succeed in university-level courses and provide a useful bridge between high school and university-level studies. AP credits are of considerable value to

high school leavers in gaining entry to the college or university of their choice.

THE CLOSED MODEL OF TEACHING SCIENCE USING INFORMATION TECHNOLOGIES: BIOLOGY AT EASTERN HIGH SCHOOL

Biology was chosen for study at Eastern High School because of the breadth it provided for research. Physics and chemistry were not considered to be as appropriate because of the much narrower and more academic stream of students who enrolled in these courses. Biology attracted a wider range of students within the school than either chemistry or physics. All the biology courses in this school were taught by one teacher who had advanced computer skills.

Students taking the course Biology 2201 were involved in a study to evaluate the use of Internet resources to enhance their education in this subject. Three Biology 2201 classes were selected to take part in the study. The study involved three topics taken from Unit IV—Homeostasis. Each of the three classes was taught using three different methods of instruction defined as:

1. **Traditional** (lectures and assignments). In the traditional group, students were taught face to face by the teacher from the textbook. This was the way in which students were used to being taught so this created no change for either teacher or students. The students in this group did not experience any changes in their mode of instruction.
2. **Cooperative** (students being much more responsible for their own learning and sharing what they learn with their peers). In the cooperative group, students were able to work together on learning biology, using text sources as well as a Web site that enabled them to visit appropriate areas of the
3. **Internet** (students gathering information from Internet resources to complete the intended learning outcomes). In this group, students were to work individually and to use Internet sources to complete their biology units of study. Internet students were able to work with more freedom than those being taught face to face and were, therefore, dependent to some extent on personal discipline as well as facility in using information technologies.

Each topic of study involved 9 periods (57 minutes) of instructional time and one period for evaluation (pre-test and post-test) over a 14 day school cycle. Upon completing each cycle of instruction in a given methodology, each study group began the next topic using a different instructional practice. By the end of the study each class group would be exposed to all three instructional methodologies. The topics chosen were considered by the instructor to be of equal difficulty. Pre-test and post-test data was collected so that a quantitative comparison could be made. Upon completion of the study, students completed a qualitative evaluation which asked them to provide information about their preferences for each instructional method. All students had the same prescribed text, *Biology: The Study of Life* (Schraer & Stoltze, 1995). The tables below indicate the pre-test and post-test class averages and standard deviations. Each pre-test and post-test (Tables 2, 3, and 4) contained 25 multiple choice questions, and each question had 4 possible answers. Data in the tables are raw scores and are not corrected for guessing.

Table 1 compares the three Biology 2201 classes that took part in the study. The letters “B,” “C,” and “D” only refer to the slot within the school timetable and have no other significance. The Eastern High School timetable ran over a

Table 1. General information for comparison

| Class | Number of Students | Class Average Prior to Study | Class Average Unit examination | Standard Deviation Unit Examination |
|-------|--------------------|------------------------------|--------------------------------|-------------------------------------|
| B | 21 | 61.7 | 46.8 | 12.7 |
| C | 33 | 68.5 | 60.6 | 17.5 |
| D | 29 | 68.4 | 58.2 | 14.4 |

Table 2. Chapter 14

| Class | Method of Instruction | Pretest Average Mark | Pretest Standard Deviation | Posttest Average Mark | Posttest Standard Deviation |
|-------|-----------------------|----------------------|----------------------------|-----------------------|-----------------------------|
| B | Traditional | 25.0 | 8.2 | 54.9 | 14.6 |
| C | Cooperative | 30.6 | 9.5 | 59.9 | 23.3 |
| D | Computer | 25.9 | 10.0 | 59.4 | 21.8 |

period of 14 school days. Each 14 day cycle had 10 periods (57 min. each) of biology instruction. “Number” refers to the number of students in each of the Biology 2201 classes. “Class Average Prior to Study” refers to the class average mark based on all work prior to the start of the study. This mark represents the average of 27 pieces of evaluation in each of the three classes. Each quiz, lab report, and assignment was the same for all students and all three classes and was collected throughout the year of instruction prior to the study period. “Class Average Unit Examination” refers to the class average on the unit examination completed at the end of the study. “Standard Deviation Unit Exam” is the standard deviation for each class on the unit examination. The unit examination covered five (5) sections (Chapters 12-16) of work. Only three sections (Chapters 14-6) were part of the study.

Table 2 shows the results of the first round in the study. This was a study of the nervous system (Chapter 14). Each class was taught using a different teaching strategy as indicated in the

table. Students received 9 periods of instruction during a 14 day cycle. Period 10 of the cycle was used for evaluation.

Table 3 indicates the results of the second round (Chapter 15). The classes remained the same in terms of the students but the teaching strategy was changed as indicated under “Method of Instruction.” Again, students received 9 periods of exposure to the teaching strategy in the 14 day cycle. The 10th period was used for evaluation.

Table 4 indicates the results of the third round in the study (Chapter 16). Again the students remained the same but the teaching strategy was shifted. Students of Class B and D received 9 hours of instruction and 1 hour for evaluation. Class C (33 students) received six periods using computer, three periods using traditional instruction, and one period for evaluation. With 33 students in the Class C, it became necessary to abandon the study after six periods (rather than the intended nine periods). This was due to several factors including: students complaining about overcrowded conditions, the room being

Table 3. Chapter 15

| Class | Method of Instruction | Pretest Average Mark | Pretest Standard Deviation | Posttest Average Mark | Posttest Standard Deviation |
|-------|-----------------------|----------------------|----------------------------|-----------------------|-----------------------------|
| B | Computer | N/A | N/A | 41.6 | 21.3 |
| C | Traditional | N/A | N/A | 63.6 | 22.8 |
| D | Cooperative | N/A | N/A | 64.9 | 18.6 |

Table 4. Chapter 16

| Class | Method of Instruction | Pretest Average Mark | Pretest Standard Deviation | Posttest Average Mark | Posttest Standard Deviation |
|-------|-----------------------|----------------------|----------------------------|-----------------------|-----------------------------|
| B | Cooperative | 27.5 | 11.0 | 67.4 | 8.2 |
| C | Computer | 31.8 | 7.7 | 66.4 | 19.9 |
| D | Traditional | 29.0 | 13.2 | 71.7 | 11.1 |

too hot and uncomfortable, no printer, and only 11 computers were in service.

On completion of the study students completed a qualitative evaluation survey intended to gather data regarding their experience with each teaching method. Each student was asked to explain in their own words, what “traditional,” “cooperative,” and “computer” teaching strategies meant to them. The student also wrote a brief description of what they believed represented the best teaching method—how they would like to be taught in future.

Traditional:

“The teacher told us what we needed to know and gave us notes.”

“The teacher stands in front of the class writing out notes ... it’s basically boring.”

“I feel this type of learning was good, but it is the most boring.”

Cooperative:

“I think this is a very effective way of learning”

“Students look for information themselves and help each other. The teacher is just there for guidance.”

“The teacher gives us a concept or question—we form into groups and do the research.”

Internet:

“Very hard to use but if used right it can help a great deal.”

“This was the greatest method but people got off the topic.”

“Most students spend their time on topics completely unrelated to the subject and the teacher doesn’t know.”

The feedback indicated that students preferred to be taught using a combination of strategies. All three groups indicated that reliance on a single instructional strategy was not to their benefit. It was suggested that students first receive training in the use of the technology (to become familiar with the software and hardware) before they could make efficient use of Internet resources. Most students reported some degree of frustration, mostly associated with their lack of computer skills and their inability to focus on the task assigned.

It was found, from this experiment, to be necessary to provide time for students to learn how to make efficient use of the technology before engaging in the study of science. It appeared, however, that use of Internet resources had some potential to enhance student learning in biology. The possibility of using computers in other subjects was raised in an end of year meeting during which the above work in biology was outlined. Other schools in the district were interested in the possibilities that computers offered for teaching and learning.

The closed model of the teaching of science in a single high school, using computers, was the basis for the creation of the open model that followed. In the closed model, the school teachers and students engage with one another within a single, autonomous institution to which teachers are exclusively appointed and students enrolled. From this traditional model of schooling a new possibility emerged based on earlier work in New Zealand (Stevens, 1995a, b) and Iceland (Stefansdottir, 1993) in which selected classes in some schools within a district were linked so that teachers and learners could collaborate. This became known as the open model within which schools began to open to one another both academically and administratively. Teachers appointed to a particular institution also taught selected classes in other schools by linking them electronically from the school to which they were appointed. In Newfoundland and Labrador the open model

had its beginnings in the Vista school district digital Intranet.

THE OPEN MODEL OF TEACHING SCIENCE: THE DEVELOPMENT OF A SCHOOL DISTRICT DIGITAL INTRANET

The electronic linking of nine rural schools across dispersed sites within the Vista School district to collaborate in the teaching of Advanced Placement biology, chemistry, mathematics, and physics created a series of virtual classes in Newfoundland. Classes began in September 1998 and several reports were completed (Stevens, 1998, 1999; Stevens, Piper & Power, 1998; Stevens, Power & Barry, 1999). The introduction of the Vista School District Digital Intranet represented two dimensions of change: in the relationship between curriculum and technology and the reorganization of classes within an Intranet.

THE INTEGRATION OF INFORMATION TECHNOLOGIES INTO THE SCIENCE CURRICULUM

The development of Advanced Placement Web-based courses in biology, chemistry, mathematics, and physics took place within a development team in each subject area. A lead science teacher in each discipline was paired with a recent graduate in Biology, Chemistry, Mathematics and Physics respectively who possessed advanced computer skills including Web page design, Java and HTML. The lead teacher and the graduate student were, ideally, to have been assisted by a Faculty of Education specialist in each curriculum area together with a scientist from the Faculty of Science at Memorial University of Newfoundland. The extent to which each Web-based course was developed by a team of four people varied. Most of

the development was through interaction between the lead teacher and the recent graduate with reference, as appropriate, to two professors (of science education and science). This model provided a measure of interaction between schools, graduate students, and the Faculties of Education and Science of Memorial University of Newfoundland. To provide a connection between the high school and Memorial University, faculty members were asked to take part in providing resources, quality control evaluation, and suggestions for improvement. Although at times professors had different opinions as to the most appropriate way to design the courses, this approach enabled each of the four subjects to be developed over the summer vacation in time for the new school year. Many software packages were evaluated and finally WebCT was selected. This package enabled the instructor to track student progress, it contained online testing and evaluation, private e-mail, a calendar feature, public bulletin board for use by both instructor and student, a link to lessons and chat rooms for communication between teacher and student. For real time instruction, Meeting Point and Microsoft NetMeeting were selected. This combination of software enabled a teacher to present real-time interactive instruction to multiple sites. An orientation session was provided for students in June of the year prior to implementation. Visits by instructors were made to participating schools from time to time and students learnt how to communicate with each other and with their instructor using these new technologies.

THE REORGANIZATION OF CLASSES IN A SCHOOL DISTRICT DIGITAL INTRANET

The question how students would work in a largely independent learning environment was prominent in the minds of researchers from the outset of each AP course. There was no AP teacher present on

site for these courses. Students were not used to being alone and largely unsupervised for much of the time even though most of the initial AP students were considered by their schools to be “independent learners.”

It was recognized that a common schedule had to be adopted throughout the Vista school district to allow students to interact in real time with their instructors at selected times during the week. The initial plan was to allow for five online sessions and five offline sessions. This schedule was not followed in all schools. Online sessions were scheduled in the mornings when network traffic was at its lowest point. Offline sessions were scheduled for afternoons. Some schools chose not to be coordinated with the AP schedule for various valid reasons. As a result the instructor might be teaching another subject when the AP student would be in a traditional face to face class. Students in different schools throughout the Vista district, therefore, had differing access to their AP Instructors.

FIVE PHASES IN THE DEVELOPMENT OF A DISSEMINATION STRATEGY FOR THE MANAGEMENT OF KNOWLEDGE

The move from closed to open classes in Newfoundland and Labrador, based on the introduction of computers and the Internet and the creation of school district digital Intranets, provided a basis for the dissemination of knowledge among the participant schools. There were five phases in this process.

Phase One: The Introduction of a Digital Intranet

The creation of the School District Digital Intranet within which AP biology, chemistry, mathematics, and physics were taught, was an attempt to

use information and communication technologies to provide geographically-isolated students with extended educational and, indirectly, vocational opportunities, that would otherwise not be locally available. This was part of a broader pan-Canadian initiative since 1997 to prepare people in Canada for the Information Age (Information Highway Advisory Council, 1997). The significance of the first digital Intranet within a single school district was in moving the management of knowledge from closed, autonomous schools to an open teaching and learning structure for selected students. Adjustments had to be made administratively and academically in each participating site so that AP classes could be taught within the fledgling open learning structure.

This development was a milestone in the organization of education in Newfoundland and Labrador for two reasons. First, while AP courses are a well-established feature of senior secondary education in the United States and Canada, it was unusual for students to be able to enroll for instruction at this level in small schools in remote communities. The organizers of the project could find no other rural sites in North America in which AP subjects were available. Second, the provision of AP subjects within the Vista school district digital Intranet was, as far as could be established, the first time this curriculum had been offered online, anywhere.

Phase Two: The Development of Online Courses

In the process of developing e-teaching and e-learning within digital Intranets in rural Newfoundland and Labrador, teachers, learners and administrators had to adapt to a new, electronic educational structure. In the open teaching and learning environment of a school district digital Intranet, participating institutions academically and administratively interface for that part of the school day during which classes are being

taught. This is a different educational structure from the traditional and, by comparison, closed educational environment of the autonomous school with its own teachers and its own students. There is a potential conflict between a school as an autonomous educational institution serving a designated district and schools which become, in effect, sites within electronic teaching and learning networks. Principals and teachers appointed to the closed, autonomous learning environments of traditional schools frequently discovered that the administration of knowledge required the development of open structures within which they were increasingly expected to collaborate with their peers located on a range of distant sites. Some principals found that the positions to which they were appointed in traditional (closed) schools had become, in effect, collaborative roles within the new open electronic environment.

Students in the initial digital Intranet were frequently subject to scrutiny by their peers as they responded through chat rooms, audio, video, and with their AP online teacher. The digital Intranet provided students with access to multiple sites simultaneously, as well as the opportunity to work independently of a teacher for part of the day. The need to prepare for classes before going online became increasingly apparent to both teachers and students if the open, synchronous, science classes were to succeed. The advent of the Vista School District Digital Intranet had implications for students who began to interact with teachers and their peers in a variety of new ways. Many students experienced difficulty in expressing themselves and, in particular, asking questions in open electronic classes when they did not know their peers from other small communities. The organization of social occasions for students learning science in open classes in the first Intranet in the province helped overcome these problems. As students became more comfortable with one another after meeting in person, inhibitions such as asking questions online were overcome.

Phase Three: Increased Access to Online Courses

The Vista School District Digital Intranet provided new pathways for senior students to higher education through the initial AP subjects. By linking traditional schools to create open teaching and learning environments expertise was shared and new learning spaces for students were created. Since this pioneering venture in rural Newfoundland, other AP subjects have been added, as well as subjects from the regular school curriculum. The Internet-enhanced learning environments that have succeeded the initial Intranet have been extended province wide, including schools in Labrador, by a branch of the provincial Department of Education. The Centre for Distance Learning and Innovation (CDLI) has extended learning opportunities for students in the province's schools to all school districts and across the curriculum (<http://www.cdli.ca/>). Henceforth, online education is no longer the preserve of AP students in the senior school.

Although the Vista School District Digital Intranet opened new possibilities for teaching and for learning, particularly for senior students, many adults in rural Newfoundland and Labrador remain unemployed or underemployed in their rural communities. This is an outcome of the demise of the traditional source of employment in this province—the cod fishery. While an increasing number of schools in Newfoundland and Labrador have become high-technology beacons that connect with one another to add a virtual dimension to traditional face to face instruction, many adult learners have not been able to take advantage of the new, open learning environment. Therefore, exploration of the adult-learning potential of the high-technology hubs that many small schools throughout rural Newfoundland and Labrador have become remains an untapped aspect of regional economic development.

Phase Four: The Integration of On-Site and Online Teaching and Learning

The advent of digital Intranets across all school districts of Newfoundland and Labrador has led to a prominent role for the Centre for Distance Learning and Innovation in the organization of the province's schools. Distance learning, in the form of e-learning, is increasingly integrated with traditional face to face instruction. Students in many of the province's rural schools now receive part of their education on-site in traditional classrooms through face to face instruction. E-teaching has developed from the initial four teachers in the Vista School District Digital Intranet to become an established part of the profession today. New professional positions have been established to support e-teaching: m-teachers and a range of technical support staff. M-teachers (mediating teachers) support e-teachers within schools that receive e-learning for students on-site (Barbour & Mulcahy, 2005). Usually, m-teachers have traditional classroom roles but also have responsibilities to support e-learners by mediating between problems they present on site, with e-teachers who provide instruction from other places. Recently the concept of m-teams, outlined below, has been considered to replace m-teachers that include technical and administrative support as well as the on-site mentoring of e-students.

Phase Five: A Dissemination Strategy for the Management of Knowledge

The introduction of inter-school electronic networks added a new dimension to education in Newfoundland and Labrador and continues to bring new challenges for teachers and learners (Stevens & Stewart, 2005; Van Manen, 2002), and administrators. The linking of schools within an interactive electronic structure was a direct use of ICT for rural development that had three

immediate outcomes for regional development. First, rural to urban student migration was considerably reduced as senior students could access an extended range of subjects within the School District Digital Intranet. Second, new Internet-based pathways from schools to homes became possible with implications for adult learners, although there is much work still to be undertaken in this sector of Newfoundland and Labrador society, and thirdly, access to information became transparent, facilitating engagement between schools and local as well as non-local expertise.

THE COFFIN MODEL OF M-TEACHING TO INTEGRATE ON-SITE AND ONLINE EDUCATION

In the development of small schools in rural Canadian communities as centres of information and communications technologies for teaching and learning, a more central role for all staff, particularly those at the senior high school level, is needed. In a concept paper that compared m-teachers and m-teams, Coffin (2002) pointed out that:

The benefits of a technology-enabled school will not be realized unless the human resources in those schools also possess the knowledge and skills needed to function effectively in those technologies. Technologically advanced schools need to prepare and organize their human resources so as to support an alternative delivery method which operates not as a competitor to traditional face to face (teaching and learning), but as a complement to it. Assigning one individual as a school's only resource to mediate between e-teachers and e-learners is far from sufficient to realize that vision. (p. 2)

Coffin (2002) argued against the practice of appointing m-teachers to support e-teachers and

e-learners by creating a team approach. He suggested that m-teams be established, with specific responsibilities to replace m-teachers in rural schools in Newfoundland and Labrador:

The report Supporting Learning (Government of Newfoundland and Labrador, 2000) envisioned a teaching role to provide school-based support for students who were instructed by an off-site e-teacher. Initially conceived of as a singular role, that is, one performed by a single teacher, evolving research ... suggests that a team concept is perhaps better suited to fulfilling CDLI's vision of small schools as "beacons of technological innovation" with respect to distance learning. Conceptually, then, e-learning needs the support of a team of people providing four sets of skills: technical, coaching, administrative and resource advisor. We can attach an order of priority to those tasks as well, based on research. We have noted that students in e-learning courses have a high dependence on the technology used to deliver the courses. The higher the dependency, the greater the requirement that the technology be reliable. This feature is so important that it deserves the highest ranking among tasks performed by m-teams. Using students' assessments of the role of m-teachers, the coaching function is the next most helpful role, followed by administrative and, then, that of the resource teacher. Teams may be real or virtual or a combination of both.

By that we mean the expertise can reside on-site in the form of a teacher or staff person or it can exist apart from the school, for example, a content-area Web-site maintained by a teacher in another school or province. So the idea of a team doesn't have to imply people getting together periodically to plan strategy or solve problems. The team represents more of a bank of resources easily accessible to on-line students which can be used to facilitate their learning. (p. 1)

An m-teaching scenario, outlined by Coffin (2002) in a moderate-size rural high school with 100-250 students may have:

- At least six teachers teaching high school courses.
- A resource center with at least a part-time resource teacher.
- Some secretarial time assigned to the school.
- Technical expertise located in the school (or community) and additional expertise available within two hours drive of the school.
- A toll-free help-line for technical advice.
- There is no on-site subject area expertise that can be made available to online students.
- The technology teacher and coach would have some time in their schedules for discharging their responsibilities to online students.

The m-team could consist of a technology teacher, a technician, help line desk, advanced computer studies student(s), a coach (another teacher with an interest in distance learning), the school secretary, the resource teacher, and an administrator. Each person on the team would be responsible for specific support services. The technology teacher, the technician and the help-line desk and students will handle technical problems according to an agreed set of protocols. The coach will provide the nurturing, encouragement and advice that students need to persist in their studies. The technology teacher could also be the coach. The coach will also be the school-based contact for the e-teacher when that is necessary. These two professionals together will handle most of the pedagogical functions associated with online learning. Coaches should be assigned to students, rather than courses because the services they need to provide are client-oriented rather than content-oriented. The school secretary will take responsibility for conveying hard-copy correspondence between the e-teacher and students and other clerical functions.

The resource teacher will provide services similar to those provided for classroom instructed students. This person could also catalog, store and

control the distribution of the learning resources for the online courses. The administrator would provide the administrative support services that ensure the smooth and efficient operation of online learning (including supervision of instruction).

In the Coffin model, the m-team may be the whole staff, consisting of teachers, support staff, and administration. The configuration of small schools varies considerably, so it is not appropriate to consider a single model for m-teams in all schools. This approach to supporting e-learning in rural schools has recently been adopted in Newfoundland and Labrador by the Centre for Distance Learning and Innovation and m-teams are replacing m-teachers.

FUTURE RESEARCH

There have been major changes in the management and dissemination of knowledge in rural communities in the last decade and this has been particularly noticeable in the Canadian province of Newfoundland and Labrador. With the introduction of new organizational structures such as digital Intranets and the Centre for Distance Learning and Innovation together with internet-based instruction, there are several possibilities for research in the immediate future. The term “digital divide” is often heard in relation to those who are technologically literate and those who are not. Nowhere is this more evident than in rural communities. With the introduction of an increasing range of online courses, young people who live in rural communities in Newfoundland and Labrador have been provided with electronic educational pathways to other institutions while their parents are often left behind both figuratively and actually. They are left behind because the new technologies that have transformed small rural schools into regional high-technology hubs for accessing educational facilities and, thereby, job opportunities, have not yet been able to influence the lives of unemployed local people who have

little formal education. Future research could very useful in finding ways of strengthening regional economic development by linking adult learners in local (and non-local) homes with the technologically enhanced rural schools that have emerged in the last decade in Atlantic Canada.

A second area of future research is the implications of mobile technologies for rural schools and regional economic development. Computers have become increasingly mobile in the ubiquity of laptops (Lowther, Ross & Morrison, 2003; Rockman, 2003; Russell, Bebell & Higgins, 2004), an expanding range of hand-held devices (Norris & Solloway, 2004), and wireless technology. The possibilities of using mobile technologies for linking homes and, if appropriate, workplaces, in rural communities with technologically enhanced local schools has not been considered.

Finally, there is the possibility of making much stronger teaching and learning connections between small schools in rural communities and large urban schools, particularly in specialized areas of the senior curriculum. The developments outlined above in Newfoundland and Labrador provide a possible template for sharing educational resources, particularly teachers, and enabling students to engage in enlarged peer groups. There is now a need for policy research into the significance of geography and school size (as determined by students who physically attend on a daily basis), into the equitable distribution of educational resources.

CONCLUSION

The claim a decade ago that e-learning was the future of distance learning (Collis, 1996) has proved to be the case in the Canadian province of Newfoundland and Labrador and in other places with many rural schools (Griffin & Sherrod, 2005; Hawkes & Halverson, 2002). New electronic structures in the form of school district digital Intranets to support e-learning have de-

veloped that have changed the nature of schools, encouraging them to become increasingly open to one another. Within the electronic structures that have become part of the education system in this province new processes have also emerged. As electronic structures have been developed to complement traditional schools, particularly in rural communities, the possibility of new pedagogy has emerged (Cavanaugh, 2001) and with it, new expectations for teaching (Mathiasen, 2004). The term “cybercell” (Stevens & Stewart, 2005) has recently been coined to describe the integration of actual and virtual classes. A cybercell is a face to face group whose members extend their discussions to include virtual visitors. As students and teachers across Newfoundland and Labrador further integrate actual and virtual teaching and learning, cybercells are likely to develop.

Schools in rural Newfoundland and Labrador have been reorganized in the last decade. Traditional (closed, autonomous) schools have increasingly become open sites within Internet-linked teaching and learning environments. What began as a research project linking eight schools in the Vista School District Digital Intranet has been extended to include schools across the province managed by a recently established branch of the Department of Education of Newfoundland and Labrador—the Centre for Distance Learning and Innovation. Perhaps the most significant development that has taken place is one that is not readily seen—the challenge to the notion of the school as an autonomous institution with its own teachers and its own students. Because of rural to urban migration and the consequent challenge to the continued existence of many small schools, new administratively and academically open structures were created. The next challenge is to develop pedagogy that will take advantage of the extended learning environments across Newfoundland and Labrador. Cybercells—within which actual and virtual teaching and learning take place simultaneously—may become the next step in the management of knowledge in rural communities.

The establishment of electronic educational structures and processes linking small, dispersed communities in Newfoundland and Labrador has provided a model for economic development in the knowledge society that Canada has become. Through the dissemination of these methodologies and the effective utilization of ICT in other parts of the world, competitive knowledge based communities can be created. Knowledge based communities are likely to yield knowledge products that could act as catalytic agents for regional development.

REFERENCES

- Barbour, M., & Mulcahy, D. (2005, September). The role of mediating teachers in Newfoundland's new model of distance education. *The Morning Watch*, 32, 1-2. <http://www.mun.ca/educ/faculty/mwatch/fall04.htm>
- Barker, B.A. (1994). Distance education in rural schools: Technologies and practice. *Journal of Research in Rural Education*, 10(2), 126-128.
- Ben-Jacob, M.G., Levin, D.S., & Ben-Jacob, T.K. (2000). The learning environment of the 21st century. *Educational Technology Review*, 13, 8-12.
- Brown, J., Sheppard, D., & Stevens, K. (2000) *Effective schooling in a tele-learning environment*. Newfoundland: St. John's, NL, Centre for Tele-Learning and Rural Education, Faculty of Education, Memorial University of Newfoundland.
- Cavanaugh, C. (2001). The effectiveness of interactive distance education technologies in K-12 learning: A meta-analysis. *International Journal of Educational Telecommunications*, 7(1), 73-88.
- Cey, R. (2001). *Technology use in rural Saskatchewan: Opportunities and challenges* (unpublished manuscript). Saskatchewan, Canada: University of Saskatchewan, Saskatchewan, Canada. Retrieved June 26, 2006, from <http://www.usask.ca/education/coursework/802papers/ceyr/ceyr.pdf>
- Coffin, G. (2002). *Mediating e-learning: M-teacher or m-team?* Newfoundland: Centre for Distance Learning and Innovation, Department of Education of Newfoundland and Labrador, St John's.
- Collis, B. (1996). *Telelearning in a digital world: The future of distance learning*. London: Thompson Computer Press.
- Ertl, H., & Plante, J. (2004). *Connectivity and learning in Canada's schools*. Ottawa: Statistics Canada, Government of Canada. Retrieved June 26, 2006, from <http://www.statcan.ca/english/research/56F0004MIE/56F0004MIE2004011.pdf>
- Government of Newfoundland and Labrador. (2000). *Supporting learning: Report on the ministerial panel on educational delivery in the classroom*. St John's, NL, Department of Education.
- Griffin, D., & Sherrod, B. (2005). *Technology use in rural high schools improves opportunity for student achievement*. Southern Regional Education Board, Atlanta, GA. Retrieved June 26, 2006, from <http://www.sreb.org/programs/EdTech/pubs/PDF/05T01-TechnologyUseinRuralHS/pdf>
- Hawkes, M., & Halverson, P. (2002) Technology facilitation in the rural school: An analysis of options. *Journal of Research in Rural Education*, 17(3), 162-170.
- Healey, D., & Stevens, K. (2002). Student access to information technology and perceptions of future opportunities in two small Labrador communities. *Canadian Journal of Learning and Technology/La Revue Canadienne de l'Apprentissage et de la Technologie*, 28(1), 7-18.
- Information Highway Advisory Council. (1995). *The challenge of the information highway*. Ottawa: Industry Canada.

- Information Highway Advisory Council. (1997). *Preparing Canada for a digital world*. Ottawa: Industry Canada.
- Lowther, D., Ross, S., & Morrison, G. (2003). When each has one: The influences on teaching strategies and student achievement of using laptops in the classroom. *Educational Technology Research and Development*, 51(3), 23-44.
- Mathiasen, H. (2004). Expectations of technology: When the intensive application of IT in teaching becomes a possibility. *Journal of Research on Technology in Education*, 36(3), 273-294.
- Norris, C., & Solloway, E. (2004). Envisioning the handheld-centric classroom. *Journal of Educational Computing Research*, 30(4), 281-294.
- Rockman, S. (2003). Learning from laptops. *Threshold*, 1(1), 24-28.
- Russell, M., Bebell, D., & Higgins, J. (2004). Laptop learning: A comparison of teaching and learning in upper elementary classrooms equipped with shared carts of laptops and permanent 1:1 laptops. *Journal of Educational Computing Research*, 30(4), 313-330.
- Schraer, W.D., & Stoltze, H.J. (1995). *Biology: The study of life*. Englewood Cliffs, NJ: Prentice Hall.
- Stefansdottir, L. (1993). The Icelandic educational network—Ismennt. In G. Davies & B. Samways (Eds.), *Teleteaching—Proceedings of the IFIP TC3 Third Teleteaching Conference* (pp. 829-835). Amsterdam: Elsevier Science Publishers.
- Stevens, K.J. (1994). Australian developments in distance education and their implications for rural schools. *Journal of Research in Rural Education*, 10(1), 78-83.
- Stevens, K.J. (1995a). Geographic isolation and technological change: A new vision of teaching and learning in rural schools in New Zealand. *The Journal of Distance Learning*, 1(1) 32-38.
- Stevens, K.J. (1995b). The technological challenge to the notion of rurality in New Zealand Education—Repositioning the small school. In I. Livingstone (Ed.), *New Zealand Annual Review of Education*, 5, 93-102.
- Stevens, K. (1998). *The Vista Digital Intranet: Initial observations on the teaching of Advanced Placement biology, chemistry, mathematics and physics* (Report 1 to the Vista School District Intranet Advisory Committee, p. 10).
- Stevens, K. (1999). *The Vista Digital Intranet—A model for the organization of virtual classes* (Final Report on the Vista Digital Intranet). Presented to the Information Highways Applications Branch, Industry Canada, Ottawa.
- Stevens, K. (2000). Télé-enseignement et éducation en milieu rural en Nouvelle Zélande et à Terre Neuve. (Telelearning and the education of rural students in New Foundland and New Zealand). *Géocarrefour -Revue de Geographie de Lyon -Espaces Ruraux et Technologies de L'Information*, 75(1), 87-92.
- Stevens, K. (2001). The development of digital Intranets for the enhancement of education in rural communities. *Journal of Interactive Instruction Development*, 13(3), 19-24.
- Stevens, K., Piper, T., & Power, D. (1998). *From closed to open classes—TeleLearning and the management of isolation in Newfoundland and Labrador*. Presented to the TeleLearning Network of Centres of Excellence (TL.NCE) Vancouver, British Columbia, Canada.
- Stevens, K., Power, D., & Barry, M. (1999). *State of the art in K-12: Research advances in teaching and learning science in rural Newfoundland schools*. Presented to the TeleLearning Network

of Centres of Excellence (TL.NCE), Montreal, Quebec.

Stevens, K.J., & Stewart, D. (2005). *Cyber-cells—Learning in actual and virtual groups*. Melbourne: Thompson-Dunmore.

Van Manen, M. (2002). The pedagogical task of teaching. *Teaching and Teacher Education*, 18(2), 135-138.

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 221-239, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 4.2

ICTs for Intercultural Dialogue (ICT4ID)

Victor Giner Minana

UNESCO ICT4ID Programme, Spain

This case study will focus on UNESCO's cross-disciplinary programme spanning the sectors of communication and culture, "Information and Communication Technologies for Intercultural Dialogue: Developing Communication Capacities of Indigenous Peoples (ICT4ID)." It will show a general overview of the five ongoing pilot projects. This programme aims at preserving indigenous peoples' cultural resources by fostering access to ICT. These are the expected results:

- Indigenous community representatives trained in media content production and ICT use.
- Indigenous cultural content produced for television, radio and news media.
- Awareness raised at an international level of indigenous creativity.
- Advocacy made for the importance of cultural diversity and its expression through ICTs.
- Reinforcement of intercultural dialogue through the inclusion of indigenous peoples'

cultural expressions in mainstream knowledge societies.

In order to achieve these objectives, the programme has begun to implement five pilot projects worldwide. These five projects can be divided into two groups: the first group of projects focusing on the audiovisual and the second group consisting of two projects related to multimedia.

AUDIOVISUAL PROJECTS

The projects of the first group (audiovisual) are being implemented in Peru, Bolivia and Gabon. These projects have three phases: training, production and broadcasting. During the first phase, indigenous representatives are trained in audiovisual techniques. The training also includes classes in indigenous culture, focusing on topics such as history, artistic expression and narrative skill. In the second phase the participants film documentaries which allow them to express their

view of the world through the audiovisual tool. Afterwards, during the third phase, this work is broadcasted nationally and internationally. This phase is very important because its objective is to show other social groups the tasks carried out by the indigenous populations and therefore, by doing so, achieving an intercultural dialogue.

These three projects have all concluded the first phase. A first survey has been carried out among the trainees who participated in the project in Peru. This project takes place in Villa El Salvador, a district in Lima inhabited by the Quechua population which began to migrate in the forties from the Sierra to the capital. The target group of the project is the second generation of Quechuas living in Villa El Salvador — children of the migrants who have grown up in an environment consisting of two cultures and two worlds.

The training has been highly appreciated by the 14 students who took part. They have emphasized the importance of the classes of Quechua culture (they had never studied it before) and the fact that the work that they will film in the second phase of the project will be seen abroad. Even if most of them had no prior experience in audiovisual techniques, they have easily learnt the basic audiovisual language. Nevertheless they are aware of the high price of the audiovisual equipment, which hinders them from feeling comfortable using it.

MULTIMEDIA PROJECTS

In the second group (related to multimedia) there are two projects. The first one takes place in Namibia and its target population is the Himba people. The second one takes place in South Africa and its beneficiaries are the San people. There is a close collaboration between both project managers.

The “Kaoko Local Knowledge Living Archive project” (Namibia) aims to revive the oral history of the Himbas through several activities. They are:

- The production of the documentary “Katjira’s Dream: Memory, Land and Ancestors in the Land of Kaoko” by Doxa Productions.
- Setting up of an ICT centre in Kaoko, which will also be a base station for the mapping and recording of the oral history of the Kaoko people. Along with this, the centre and its ICT facilities will provide information in areas such as education, political representation, HIV, cattle diseases and tourism. Cornelius Tijuma, a Himba who has worked with Doxa Productions in the last few years, has been trained in order to be able to train other Himbas in ICT and to manage the ICT centre.
- The production of an interactive DVD-ROM by a multidisciplinary team consisting of anthropologists, filmmakers and DVD designers who will work together to create a living archive of the Himba oral culture which will be made accessible to them.

The “San Interactive Archive, Training and Heritage Management” project aims to train and enable the San people to manage their cultural heritage and express their own cultural contents through audiovisual media and multimedia. As a first step, the San representatives were trained in cultural management. As a second step, the community will produce a DVD on the San people dealing with the loss of their land in 1935. In the long run, by making use of all the audiovisual archives that the project coordinators have gathered during the last years of fieldwork, it will be possible to organise and conceptualise all these audiovisual and multimedia materials into inter-linked interactive archival packages which could be used to create local-content productions, such as documentaries, short narratives, animations and DVDs in collaboration with the representatives of the San communities.

In this paper the five ongoing pilot projects of ICT4ID have been presented. The programme is currently at the midpoint, so it is too early to as-

ICTs for Intercultural Dialogue (ICT4ID)

sess its results, even if the first outcome has been successfully achieved. It is likely that UNESCO will decide to extend this programme which would allow the implementation of more projects taking advantage of the lessons learnt during the implementation of these five projects.

This work was previously published in Information Technology and Indigenous People, edited by L. E. Dyson, pp. 52-54, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 4.3

Information and Communication Technologies Provision to Rural Communities: The Case of Gutu World Links Telecenter in Zimbabwe

Shirley Chikowore-Kabwato

International Association of Physicians in AIDS Care, South Africa

Isola Ajiferuke

University of Western Ontario, Canada

ABSTRACT

This chapter introduces information and communication technologies as having the potential of aiding the sustainable development of rural communities through distance education, telemedicine, and the provision of timely information on agriculture and the environment. It argues that telecenters offer practical and community-oriented ways to bring information and communication technologies services to the rural people. Furthermore, based on the outcome of an evaluation of a telecenter in Zimbabwe, it is suggested that in order for a telecenter to offer effective, efficient and sustainable services, local needs assessment would need to be conducted, the telecenter located

at a central place, and an awareness-building campaign targeted at potential users.

INTRODUCTION

Advances in information and communication technologies (ICTs) have aided the social and economic transformations of many industrialized nations (Mansell & Wehn, 1998). However, these technologies also have enormous potential for developing countries in their quest for sustainable development (Jensen, 1998). Though the applications of ICTs have potential impacts in both urban and rural areas of developing countries, rural communities stand to benefit more as they

face extreme pressure due to poverty, illiteracy, environmental degradation and remoteness.

Agricultural production can be improved through the gathering of useful information from the Internet by community information centers and farmers' organizations, and subsequent dissemination to farmers via local radio stations and other local information-sharing networks (e.g., cooperatives, local stores, transportation hubs, agricultural supply outlets and social gathering points) and tools (Richardson, 1998). Health care problems can also be improved through the practice of telemedicine, which permits the transfer of patients' records from the rural areas to urban areas for better diagnosis as well as the provision of medical advice/training to the health care staff in remote areas. For example, HealthNet provides free medical advice and information to community health workers, doctors and hospitals in 15 African countries through the use of low orbit satellites. Distance learning through the Internet can broaden the educational opportunities available to the people in the rural areas. These opportunities range from elementary education to the university (e.g., African Virtual University) and these can aid in the reduction of illiteracy, which is a major obstacle to the development of rural areas. Also, telecommunications can be used for effective communication between the various levels of government and the rural populace to ensure safety, security and good governance (Barr, 1998).

One of the major constraints to the realization of the potential of ICTs in rural areas is lack of access (Adam & Wood, 1999) and the most popular solution to this problem is the establishment of telecenters (Graham, 1997; Whyte, 1998; Gomez & Hunt, 1999). Telecenters offer practical and community-oriented ways to bring new information and communication technologies to the rural people without incurring large set-up costs. The normal telecenters (often referred to as "phone shops" or "public call offices") offer basic telecommunications services, while the advanced

telecenters (often referred to as multipurpose community telecenters) may include facilities such as libraries and seminar rooms, and provide Internet services, videoconferencing, distance education, and training in ICTs, telemedicine and e-commerce (Oestmann & Dymond, 2001).

Telecenter projects have been initiated in many developing countries, including the African countries of Benin Republic, Egypt, Ghana, Mali, Mozambique, Senegal, South Africa, Tanzania, and Uganda. For example, Nakaseke Multipurpose Community Telecenter has proved useful in providing telemedicine services for the Mulago and Nakaseke hospitals, enabling health workers to consult with each other by phone, fax and e-mail (Mayanja, 2001). It has also been shown that a Web site set up by the Timbuktu Multipurpose Community Telecenter for artisans' handcrafts has proved very useful to tour agents organizing visits to Timbuktu, and as a result boosted the sales of the handcrafts (Benjamin, 2000).

In Zimbabwe, the first rural community telecenter was established in Gutu by the World Links for Development Program, an international donor agency, in 1999. Since then, 11 other pilot telecenters have been established in other rural communities by the international donor agency. However, just as is the case in most developing countries, while a lot of efforts and resources have been devoted to setting up these pilot telecenters, little or no effort has been made to evaluate their services. An evaluation of the services would assist in understanding the uses of these centers as well as in the determination of their impact on the communities they serve (Gomez, Hunt, & Lamoureux, 1999). Also, the outcome of such an exercise would assist in improving the services being provided at these telecenters as well as serve as a guide in the establishment of similar projects in the future.

Hence, the goal of this chapter is to evaluate the services of the first rural telecenter in Zimbabwe with the hope that the exercise would illustrate: (i) the problems being encountered in the establish-

ment of telecenters in rural communities; (ii) how well telecenters are meeting the needs of rural communities; and (iii) ways in which ICTs can be better utilized to improve the quality of lives of people in the rural areas.

BACKGROUND

Zimbabwe, which attained its independence in 1980, has an estimated population of 12 million people, with about 1.6 million people living in Harare, the capital city, while the majority (70%) are living in the rural areas. Agriculture is the mainstay of Zimbabwe's economy, and the principal crops are tobacco, cotton, and sugarcane.

Gutu rural village is located about 280km from Harare, and about 40km from Masvingo town, one of Zimbabwe's several small towns. It has a population of about 245,000 people and covers an area of 700,000 hectares. It lies in a highland area which receives adequate rainfall and has fairly fertile agricultural land. Gutu has been installed with electricity and telecommunications infrastructures such as telephone lines.

Gutu World Links Telecenter (GWLT) is located at a growth point, a central location that the government has targeted for its rural development program. Gutu growth point comprises small business enterprises, community banks, postal agencies, clinic, hospital, local council, and primary and secondary schools. A few government offices, such as the ministries of health, education, veterinary services and agriculture, are also located in the area. GWLT was built closer to the community library in order to ensure that both facilities complement each other.

Questionnaires, interviews and observation were the main methods used in the evaluation of the services of GWLT. First of all, questionnaires containing both closed and open-ended questions were used to gather data from users and non-users of GWLT. The questionnaire for the users asked questions related to their experience in using

the telecenter while the one for the non-users solicited reasons for non-usage of the telecenter services. From the preliminary discussions with the GWLT coordinator, it was established that the telecenter normally gets about 30 to 40 users a week. Hence, every user that visited the center during a four-week period was given a questionnaire to complete. Some users completed the questionnaire immediately, while others took the questionnaire away and returned it later. In all, 120 users completed the questionnaire within the four-week period. Non-users of the telecenter were approached at the local library, schools, local district council, local clinic, local government council, business/community center and the village, and after a period of about three weeks, 105 non-users had completed the questionnaire.

The personal interview method was used to gather data from the telecenter coordinator, national coordinator of World Links for Development Program, and a few users and non-users. Interviews were necessary in order to supplement the responses from the questionnaires. Also, in order to obtain a clear picture of the activities of the telecenter, some time was spent in observing some people making use of the telecenter's facilities.

AN EVALUATION OF THE GUTU WORLD LINKS TELECENTER

Objectives and Functions of the GWLT

GWLT was established by the World Bank as part of its World Links for Development Program. Based on the interview with the national coordinator of World Links for Development Program-Zimbabwe, we gathered that the program's main objective was to provide ICT services to those members of society who do not have access to them.

GWLT was set up in collaboration with the Ministry of Education, Sport and Culture, Computer Society of Zimbabwe, I*Earn, Alliance for Global Learning, US Peace Corps and Voluntary Service Overseas, among others. The telecenter receives funding from the World Link for Development Program but it has also embarked on a program where users pay for the services provided. In this way, the telecenter hopes to become self-sustainable in the near future. In fact, the responsibilities for the telecenter's recurrent expenditure (e.g., phone and electricity charges) are soon to be assumed by the telecenter.

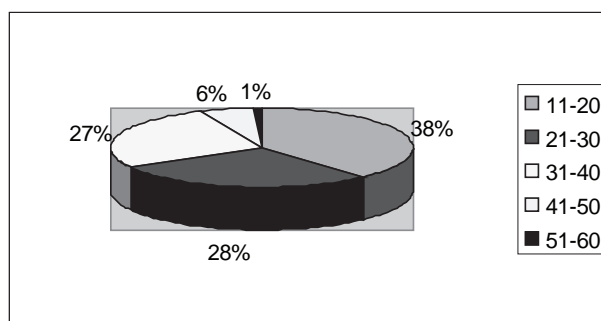
GWLT has 10 networked computers, server (running Windows NT software), printer, modem and Internet dial-up connection for its operations. The center is managed by only one staff member who has a Diploma in Education (Computers) and is known as the coordinator. According to him, GWLT provides Internet services, computer literacy programs (these include introduction to computers, word processing, Internet and e-mail basics and WWW search), telephone services, e-mail, and basic computing services. The telecenter receives between 30 to 40 people per week and the number of users is increasing almost on a monthly basis, especially from students, professionals and the unemployed. GWLT has already trained many people who knew nothing about computer technology but with some of them later

securing employment requiring computer literacy. The telecenter has, however, faced a number of problems that were beyond the coordinator's control. For instance, since its establishment, the center has been experiencing problems of inadequate electricity supply (especially because of continuous disruptions) and lack of proper telecommunications infrastructure. These problems are similar to the ones being experienced by some other telecenters in developing countries (Gaster, 2001; Mayanju, 2001). Also, the telecenter lacks facilities such as fax and photocopying machines, and it is also under-staffed, as one person has to manage all the activities of the telecenter single-handedly despite the continuous increase in the number of users.

Demographic Characteristics of GWLT Users

Seventy-seven (64%) of the users were male while 43 (36%) were female. This is not surprising, as it corroborates Richardson's (1997) assertion that overall there are more male ICT users than female. GWLT users come from various age groups but the majority are teenagers or young adults (see Figure 1). In fact, only about 6% are older than 40 years. The popularity of GWLT with young people supports Rolinson et al.'s (1995) "computer mythology", which states that "younger people

Figure 1. Age distribution of GWLT users



are happier using computers than older people.” This also corroborates the results of a study carried out by Teo et al. (1997), which revealed that Internet users in Singapore generally comprised teenagers and young adults.

Figure 2 shows that the majority of GWLT users (62.5%) have had secondary school education. Secondary education includes Zimbabwe Junior Certificate (ZJC), ‘O’ level, or ‘A’ level education. Thirty-one (25.8%) of respondents indicated post-secondary as their highest qualification, while 13 (10.8%) respondents indicated primary education as their highest qualification. The large number of literates among the respondents might mean that GWLT’s services do not cater to the needs of the illiterates, as only one (0.8%) respondent indicated having no formal education.

The major patrons of GWLT are students, administrators, unemployed, and teachers (see

Table 1). The administrators included clerks and managers in both the government and private sectors, while the unemployed comprised mainly school leavers, that is, those who had just completed their secondary education. GWLT also has a few users who are businessmen, communal farmers or health workers.

Sources of Awareness of GWLT

The coordinator of the GWLT indicated that the telecenter publicized its services through brochures, posters, meetings/workshops and newspapers. In order to determine the effectiveness of these publicity media, the users were asked how they came to know of GWLT’s existence and its services. Fifty-four (45%) of the respondents knew of GWLT through brochures, 43 (35.8%) through friends, 11 (9.2%) through meetings/workshops,

Figure 2. Highest educational level for users

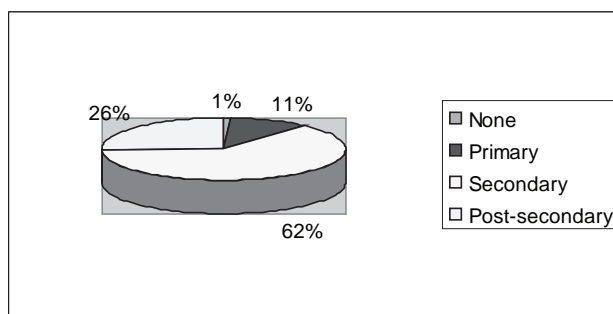


Table 1. Occupation of users

| Occupation | Number of respondents N=120 |
|------------------------|--------------------------------|
| <i>Unemployed</i> | 21 (17.5%) |
| <i>Teacher</i> | 15 (12.5%) |
| <i>Health worker</i> | 3 (2.5%) |
| <i>Communal farmer</i> | 4 (3.3%) |
| <i>Student</i> | 36 (30.0%) |
| <i>Businessman</i> | 6 (5.0%) |
| <i>Administrator</i> | 31 (25.8%) |
| <i>Other</i> | 4 (3.3%) |

10 (8.3%) through newspapers, and two (1.7%) through the Internet (see Figure 3).

The above scenario indicates that many of the respondents got to know of GWLT and its services through the distribution of brochures. This probably means that brochures are effective tools for publicizing GWLT and should be the main medium of publicizing the telecenter's services. Many of the respondents also got to know about GWLT through friends. Word of mouth is a powerful tool and if GWLT continues to provide good services, it should be able to count on satisfied users publicizing its services. Few respondents became aware of GWLT through meetings/workshops and newspapers, partly because of the frequency of meetings and cost of newspapers. However, the two media can be used occasionally to supplement the use of brochures to publicize the telecenter's services.

ICT Use at GWLT

Forty-five (37.5%) and 38 (31.7%) of the respondents had to travel about one and two km respectively to use the facilities at the telecenter (see Figure 4). Also, 25 (20.8%) lived three to four km away from the telecenter while only 12 (10%) of the respondents who lived five to 10 km away visited the telecenter during the period of this research. The fact that significantly fewer respondents who had to travel distances covering three km or more visited the telecenter as compared to those who lived within the one to two km vicinity indicate that distance might be limiting the number of people who patronize the telecenter.

Eighty-three (69.2%) of the respondents claimed to have used basic computer systems at the telecenter, 60 (50%) had used the telephone, 36 (30%) had used the Internet, and 30 (25%) had

Figure 3. Source of awareness of GWLT

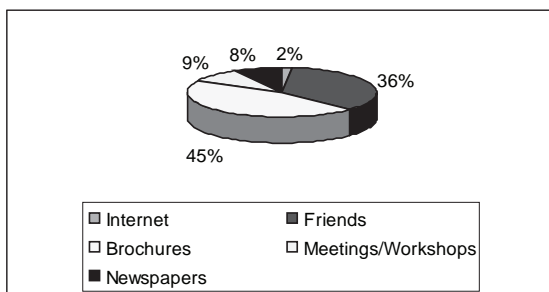
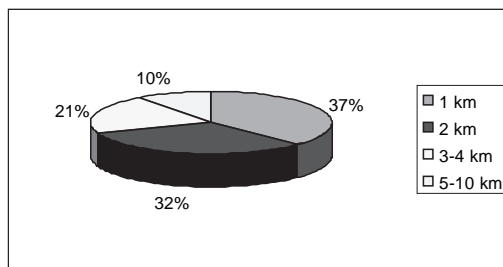


Figure 4. Distance traveled by users to telecenter



been to the telecenter to use the e-mail facility (see Figure 5). The basic computer systems were used mainly for word-processing and computer literacy programs, which shows that the rural people are becoming aware of the benefits of being computer literate.

The majority of the Internet users claimed to use it to search for educational information, while a few used it to search for agricultural, health or business information. Telephone and e-mail services were used mainly for personal and business communications. A few of the respondents also claimed to have used e-mail to exchange ideas for both personal development and career advancement.

In terms of frequency of ICT use, about 38% of the respondents claimed to use ICT at the telecenter about one to three times a month while about 27% use it less than once a month (see Figure 6). The remaining 45% use ICT at the telecenter at

least once a week. It would appear that a majority of the users do not visit the telecenter frequently, probably due to the distance from the telecenter, work or school commitments, or dissatisfaction with the services at the telecenter.

Evaluation of ICT Services at GWLT

Most of the respondents found the ICT services at GWLT very useful and some expressed their satisfaction at being able to access information easily and quickly. Some other respondents expressed appreciation at being able to share large amount of information as well as exchange ideas locally and abroad. Some of the respondents also claimed to have benefited a lot from the computer literacy programs and word processing services offered by the telecenter. However, the majority of respondents (65.8%) said the ICT services were inadequate. Some of the reasons stated for

Figure 5. ICT use at GWLT

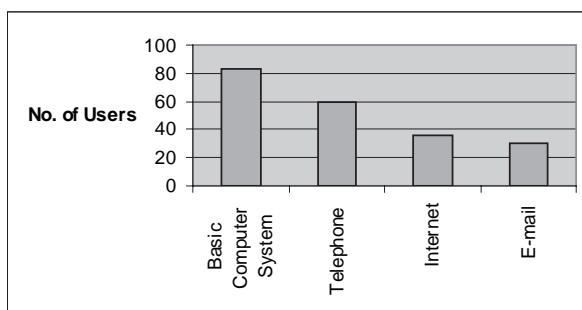
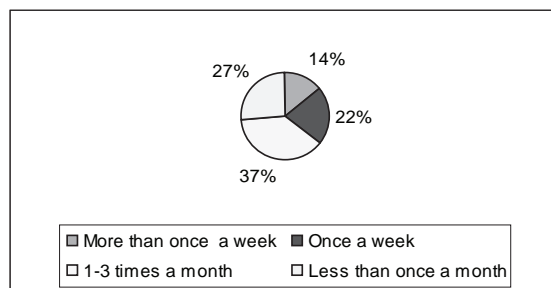


Figure 6. Frequency of use of ICT at GWLT



their dissatisfaction with the services include the continuous breakdown of the computer systems, slow access to the Internet and e-mail facilities, and insufficient number of computer systems. Respondents also expressed disappointment at the fact that there was only one staff member (the coordinator) at the telecenter. Respondents felt that the coordinator had too many responsibilities and this left him with little time to attend to their individual needs.

In order to improve its ICT services, the respondents would like the telecenter to increase the speed of its e-mail and Internet services as well as increase the number of computer systems. They would also like the telecenter to introduce fax, telex and photocopying services.

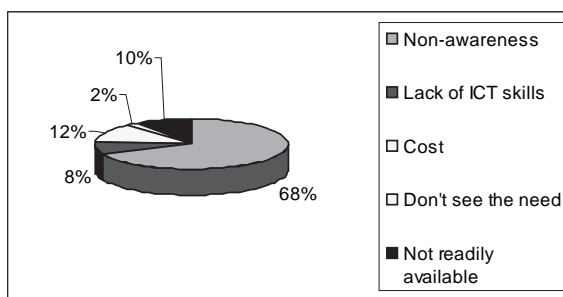
Reasons for Non-Use of GWLT Services

The 105 non-users that were included in the survey varied in gender, age, educational qualification, and occupation. The group included: males and females; teenagers, young adults, adults, and seniors; from those with no educational qualification to those with post-secondary qualification; and unemployed, teachers, housewives, health workers, communal farmers, students, businessmen, and administrators.

The major reason for non-use of the GWLT services was the lack of awareness, as 72 (68.6%) claimed not to be aware of GWLT and its services (see Figure 7). This indicates that there seems to be a lack of effective publicity and promotional programs. This result corroborates the coordinator's views, who acknowledged that despite an increase in the use of ICT services at the telecenter, the level of general public awareness of ICT and its services was low. The coordinator felt that there is still need for more publicity and promotion programs to be done by the telecenter to let the expected beneficiaries or users be aware of GMTC and the benefits they would get by utilizing the services offered.

Thirteen (39.4%) of the respondents indicated that the cost of the services prohibited them from using the telecenter, as they did not have enough money, while 10 (30.3%) of the respondents said they did not use GWLT services due to the fact that they were not readily available to them. Distance could have been a contributing factor to the non-availability of GWLT services to this group of non-users. Eight (24.2%) of the respondents stated that they did not have enough computer skills to use ICT. This group of people seemed not to know that GWLT offered computer literacy programs. Two (6.1%) of the respondents said they did not use GWLT because they did not see the need for use.

Figure 7. Reasons for non-use of GWLT



CONCLUSIONS

The study has revealed that the users of GWLT have been making use of telephone, e-mail, Internet, and basic computing services at the telecenter. The basic computer systems were used for word processing and computer literacy programs. Acquiring basic computer skills will definitely enhance the job prospects of the unemployed youth in Gutu. E-mail and telephone services were used for business and personal communications while the Internet was used for searching for information. Some of the users searched the Internet for health, business, agricultural and community development information (though on a small scale) which, according to Richardson (1998) may lead to economic development for farmers, expansion of community development programs, and promotion of small business enterprises.

Users rated the GWLT services as useful but requested additional services. These include fax, telex and photocopying services. In order to identify other ICT and related needs, it may be necessary for World Links for Development Program to conduct a needs assessment survey of the people of Gutu. Also, to ensure that rural people have access to adequate information, GWLT should consider working hand in hand with institutions and extension officers. Intermediary organizations such as extension field offices, rural NGOs, health clinics, government offices, and church organizations, together with small businesses can offer benefits to their rural client groups in numerous ways. These groups can use ICT services, especially the Internet, at the telecenter to access information and pass it on to the rural people, especially the illiterate, who are likely to benefit more from oral provision of information (Leach, 1999).

GWLT publicized its services through brochures, newspapers, meetings/workshops, and posters. However, it seems as if the publicity is not enough, as the majority of non-users were not aware of its services. Community sensitization and

awareness-building is required, with the technologies and their capabilities being explained to all. Local media resources such as popular theatre, town meetings, radio, television, video and films should be used in educating the rural people on the objectives of GWLT and ICT services and the benefits it would provide to the community.

Distance was also found to be an access barrier to GWLT and its services. This problem could probably be solved by introducing ICT mobile vans. Rural Libraries and Resource Development Program (RLRDP) in Bulawayo is also planning on introducing ICT on its mobile donkey cart and making it accessible to the rural masses (SADC, 1997). RLRDP has already started developing the use of solar powered televisions and video plays in its donkey cart. The government and district councils should also upgrade roads in Gutu to ensure easy accessibility to some rural villages in Gutu.

The telecenter coordinator expressed concern at the lack of manpower at GWLT. It was observed that the telecenter has only one staff despite the fact that the number of users is increasing. For example, the coordinator indicated that in most cases he had very little time for publicity activities and also had little time to attend to individual problems of users. GWLT should lobby for funds from the private sector, NGOs, government and individuals so as to be able to hire additional staff as well as make its services affordable to most people in the community. Also, GWLT should establish close working relationships with local community groups who may then be asked to provide volunteers to assist at the telecenter.

Constraints such as poor telecommunications infrastructure (e.g., low Internet bandwidth) and unreliable power supply have seriously affected the effectiveness of ICT services at GWLT. The telecommunications problems have limited access to the Internet and e-mail facilities at GWLT. GWLT should lobby the Post and Telecommunications Corporation (PTC) to provide high quality, reliable telephone lines. Otherwise,

serious consideration should be given to the use of alternative means of connecting to the Internet such as radio links and satellite technology (Smith, 2000). GWLT should also lobby the Zimbabwe Electricity Supply Authority to stabilize power supply or install stand-alone generators. More importantly, the government of Zimbabwe should aim at improving the general telecommunications infrastructures in the country.

Finally, despite the teething problems being encountered in the establishment and operations of telecenters in rural communities in Africa, such telecenters have the potentials to transform the rural communities. Hence, it would be desirable if developmental and non-governmental agencies continue to establish more telecenters in rural communities in Africa while efforts are being made to improve the effectiveness of such centers.

FUTURE TRENDS

The evaluation of Gutu World Links Telecenter suggests that in order to ensure effective, efficient and sustainable services, any agency setting up such a center should: (i) conduct needs assessment in order to tailor the technological services to the needs of the rural populace; (ii) locate the telecenter at a central place where it would easily be accessible by the rural populace; and (iii) target awareness-building campaigns at potential users of the telecenter, as information and communication technologies are new to many people in the rural areas (Anderson, Van Crowder, Dion & Truelove, 1998).

The kind of evaluation done in this study and similar ones done by Benjamin (2001), Gaster (2001) and Mayanja (2001) is referred to as 'formative evaluation' by Hudson (2001). However, only very few studies have attempted to go beyond the formative evaluation to determine the socio-economic impact assessment of the telecenters (Oestmann & Dymond, 2001). One such study

was conducted by the International Development Center (IDRC) on Acacia telecenter projects (IDRC, 2000). The study compared community data from 59 communities with telecenters (40 in South Africa, 14 in Senegal, two in Mozambique and three in Uganda) with those from approximately 50 communities without telecenters (almost all in South Africa). The study revealed that the telecenters are successful in ensuring access to ICTs, leading to community development, and also that communities with telecenters are more empowered with knowledge than those without. It is hoped that there will be more of such studies in the future that will seek to determine the contributions of the telecenters to the socio-economic development of the rural communities in which they are located.

REFERENCES

- Adam, L. & Wood, F. (1999). An investigation of the impact of information and communication technologies in sub-Saharan Africa. *Journal of Information Science*, 25(4), 307-318.
- Anderson, J., Van Crowder, L., Dion, D., & Truelove, W. (1998). Applying the lessons of participatory communication and training to rural telecenters. In Richardson, D. & Paisley, L. (Eds.), *The First Mile of Connectivity: Advancing Telecommunications for Rural Development through a Participatory Communications Approach*. Rome: FAO.
- Barr, D.F. (1998). Integrated rural development through telecommunications. In Richardson, D. & Paisley, L. (Eds.), *The First Mile of Connectivity: Advancing Telecommunications for Rural Development through a Participatory Communications Approach*. Rome: FAO.
- Benjamin, P. (2000). *Telecenters – the key to wider Internet access?* Retrieved September 18, 2000 from: <http://old.healthnet.org/afro-nets/afro-nets-hma/afro-nets.200009/msg00067.html>

- Benjamin, P. (2001). The Gaseleka telecenter, Northern Province, South Africa. In Latchem, C. & Walker, D. (Eds.), *Telecenters: Case Studies and Key Issues*. Retrieved July 15, 2001 from The Commonwealth of Learning, Burnaby, Canada Web site: <http://www.col.org/telecenters>
- Gaster, P. (2001). A pilot telecenters project in Mozambique. In Latchem, C. & Walker, D. (Eds.), *Telecenters: Case Studies and Key Issues*. Retrieved July 15, 2001 from The Commonwealth of Learning, Burnaby, Canada Web site: <http://www.col.org/telecenters>
- Gómez, R. & Hunt, P. (1999). Telecenter Evaluation : A global perspective. Retrieved July 15, 2001 from International Development Research Center (IDRC), Ottawa Web site: http://www.idrc.ca/telecenter/evaluation/html/06_Tel.html
- Graham, M. (1997). *Use of information and communication technologies in IDRC projects: Lessons learned*. Retrieved September 8, 1999 from International Development Research Center (IDRC), Ottawa Web site: <http://www.idrc.ca/acacia/outputs/op-eval.htm>
- Hudson, H.E. (2001). Telecenter evaluation: Issues and strategies. In Latchem, C. & Walker, D. (Eds.), *Telecenters: Case Studies and Key Issues*. Retrieved July 15, 2001 from The Commonwealth of Learning, Burnaby, Canada Web site: <http://www.col.org/telecenters>
- IDRC. (2000). *Telecenter impact: Methodology study 04066-Acacia*. Retrieved February 14, 2000 from International Development Research Center (IDRC), Ottawa Web site: <http://www.idrc.ca/Pan/tele/04066.html>
- Jensen, M. (1998). *The role of multipurpose community telecenters in fostering universal access and rural development*. Retrieved August 8, 2001 from: <http://www.itu.int?ITU-D-UniversalAccess/seminar/buda/papers/mj/mikej-abstract.htm>
- Leach, A. (1999). The provision of information to adults in rural Kwazulu-Natal, South Africa by non-governmental organizations. *Libri*, 49(2), 71-89.
- Mansell, R. & When, U. (ed.) (1998). *Knowledge societies: Information technology for sustainable development*. Oxford: Oxford University Press.
- Mayanja, M. (1999). *Telecenters in action: Nakaseke Community Multipurpose Telecenter pilot project: Uganda a case study presentation*. Retrieved February 15, 2000 from: <http://www.bica99.org/Meddie%20Mayanja.htm>
- Mayanja, M. (2001). The Nakaseke Multipurpose Community Telecenter in Uganda. In Latchem, C. & Walker, D. (Eds.), *Telecenters: Case Studies and Key Issues*. Retrieved July 15, 2001 from The Commonwealth of Learning, Burnaby, Canada Web site: <http://www.col.org/telecenters>
- Oestmann, S. & Dymond, A. C. (2001). Telecenters-experiences, lessons and trends. In Latchem, C. & Walker, D. (Eds.), *Telecenters: Case Studies and Key Issues*. Retrieved July 15, 2001 from The Commonwealth of Learning, Burnaby, Canada Web site: <http://www.col.org/telecenters>
- Richardson, D. (1997). *The Internet and rural development: An integrated approach*. Rome: FAO.
- Richardson, D. (1998). The Internet and rural development. In Richardson, D. & Paisley, L. (Eds.), *The First Mile of Connectivity: Advancing Telecommunications for Rural Development through a Participatory Communications Approach*. Rome: FAO.
- Rolinson, J., Meadows, A.J., & Smith, H. (1995). Use of ICT by biology researchers. *Journal of Information Science*, 21(2), 133-139.
- SADC Center for Communication and Development. (1997). *Report on the Workshop to Promote Food Security through Rural Connectivity and the Internet*. Held in Harare (February 18-20).

Retrieved September 14, 1999 from International Development Research Center (IDRC), Ottawa Web site: <http://www.idrc.ca/acacia/outputs/op-sadc.htm>

Smith, R. (2000). Overcoming regulatory and technological challenges to bring Internet access to a sparsely populated, remote area. *First Monday*, 5(10). Retrieved July 15, 2001 from: http://firstmonday.org/issues/issue5_10/smith/index.html

Teo, T., Lim, V.K.J., & Lai, R.Y.C. (1997). User and uses of the Internet: The case of Singapore.

International Journal of Information Management, 17(5), 325-336.

Whyte, A. (1998). *Telecenter research framework for Acacia*. Retrieved September 28, 1999 from International Development Research Center (IDRC), Ottawa Web site: http://www.idrc.ca/acacia/04066/whyte_8.html

World Bank. (1998). *Zimbabwe – World links for development programs feasibility mission aide-memoire*. Harare: World Bank.

This work was previously published in Using Community Informatics to Transform Regions, edited by S. Marshall, W. Taylor & X. Yu, pp. 100-114, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 4.4

Indigenous Peoples and the Cultural Construction of Information and Communication Technology (ICT) in Latin America

Juan Francisco Salazar

University of Western Sydney, Australia

ABSTRACT

Indigenous media have become an intensely debated subject in discussions of cultural diversity and access to information and communication technologies (ICTs). In many circles, the question of the equitable and affordable access to communication and information has begun to be conceptualized as integral to human rights and as an essential element in the foundation of a knowledge and/or information society. The purpose of the chapter is to analyse current approaches to indigenous ICT practices in Latin America by examining several case studies that explore, enliven and criticize the often ethnocentric discussions of the digital divide. The analysis

is placed in the context of the rise of coordinated indigenous movements in Latin America, the wave of media privatisation in the region and the impact of IT policy and reform. It argues that, beyond consideration of the social impact of ICT on indigenous cultures, it is also relevant to consider the cultural construction of new technologies of information and communication in order to better understand the ways in which indigenous peoples adopt and make use of new digital technologies according to traditional knowledge and systems of law. The chapter concludes by supporting the need for self-identification of local practices and knowledge within the communities in order to design adequate strategies to gain benefit from the use of ICTs.

INTRODUCTION

Today, halfway through the first decade of the twenty first century, it is outstanding to see that a large number of indigenous organizations, collectives, groups, tribes and nations worldwide have been able to set up their presence on the World Wide Web. Moreover, several indigenous organizations actively use various information technologies for different purposes on an everyday basis, ranging from political advocacy to electronic commerce, film and television marketing or biodiversity research. Nevertheless, despite increasing access to information and communication technologies, indigenous peoples worldwide have made it clear that the promotion of the Internet by governments and non-governmental organizations alike may constitute yet another exercise in control and coercion. If digital division is cultural exclusion, digital inclusion has not necessarily meant cultural inclusion. In this regard, the dynamics of visibility/invisibility of indigenous peoples in the information society remain as complex an issue as ever before.

An important example of this is the inclusion of indigenous peoples in discussions on the information society, like the ones that took place as part of the World Summit on the Information Society (WSIS) in Geneva in 2003 where a Declaration of Indigenous Peoples and the Information Society and a Programme of Action were articulated. On that occasion it was made clear that indigenous peoples do not seek inclusion in the information society at the expense of their civil rights, cultural identities, ancestral territories or bio-resources. Moreover, it must be indigenous peoples themselves who decide on how and when they access and use new technologies.

Keeping these broad issues in mind, this chapter examines current literature and proposals on the topic, particularly those calling for new frames for action regarding the technological, cultural and policy use of ICTs by indigenous peoples

in Latin America and the Caribbean. While we may celebrate the possibilities for developing new social literacy, political alliances and independent cultural production, at the same time we must understand that indigenous peoples are still faced and confronted with a paradox of media power and control, particularized by the fact that technology may be disruptive of traditional knowledge if exerted as an imposed gadget.

In the following pages it is argued that the indigenising of digital information and communication technologies is a clear example of what might be called the cultural construction of information technology. Culture is not only shaped by technology, but also determines its use and value. The increasing appropriation of ICTs by indigenous organizations and individuals in Latin America in the past decade can only be grounded in new processes of ethnic resurgence sweeping the region, and has to do with finding efficient ways for intra-communal communication and ways to communicate and inform the broader societies within which indigenous nations live. More importantly for the Latin American case, ICTs have been constructed as useful technologies for the formation of a new “pan-indigenous discourse” (Bengoa, 2000, p.138) and also an incipient pan-American indigenous public sphere. What is striking in the international indigenous movement in recent years is that the indigenous demands of today have moved from mere complaint to compound proposals. In other words, they have stepped forward from complaint and objection to the proposal for a world of decentralised but coordinated autonomies (Lara, 1999). For this reason, to consider the impact of ICT on indigenous peoples is certainly a critical issue, yet we should not overlook the impact of culture on technology and the implications of the indigenising of IT. Therefore, I propose to consider indigenous media as a socio-technical system of relations where technology becomes a cultural construction appropriated according to relevant cultural codes and social relations.

In the following pages I have summarized some of the critical issues in Latin America today in relation to indigenous peoples and the information society. In examining a range of literature on the topic, I refer to broader questions of, first, how indigenous peoples feel incorporated into the information society, and second, up to what point ICTs offer fresh possibilities for empowerment to indigenous peoples. Both have direct relation to more complex concerns of ethnic citizenship and political autonomy.

INDIGENOUS PEOPLES, ICT, AND RESEARCH

Much of the emphasis of the existing literature that explores indigenous peoples and information technology has dealt with the negative or positive impacts of ICTs on indigenous peoples. Little work has been done to understand the cultural constructions of technology or what the “cultural impact” of indigenous knowledge on IT may be in the near future. Recent literature examining indigenous peoples and ICTs in Latin America and the Caribbean has been important in defining those aspects of the “information paradigm” that have helped promote indigenous marginalisation in regard to what some called the “digital revolution” (Hernandez & Calcagno, 2003; Monasterios, 2003; Forte, 2002; Delgado, 2003; Becker & Delgado, 1998; Pilco, 2000; Salazar, 2002). The expansion of digital capitalism has often resulted in the commodification of indigenous identities, which are pushed to overcome issues such as lack of electricity in remote areas, geographical isolation, lack of technical know-how, absence of regulatory legal frameworks or low degree of connectivity in some areas.

The question of digitalisation of knowledge is particularly critical as new digital information and communication technologies offer alternative possibilities — from cultural recuperation, revival

and political mobilisation, to questions of cultural autonomy and indigenous rights to artistic and intellectual property. In many cases, information technology has proven to be a useful tool beyond a symbolic field of struggle to become, in certain cases, an option for the construction of alternative spheres of public debate, or what Fraser (1993) has called “counter public spheres” in reference to the limitations of the original concept of public sphere put forward by Jurgen Habermas. The latter may not be appropriate to understand the way “ethnic citizenship” has been absent in most constructions of the public sphere in modern states.

The first academic references to indigenous peoples and the Internet in Latin America began coming out in the late 1990s, mostly analysing the impact of the Zapatistas use of the medium after the uprising of 1994 as part of their political and cultural program against the expansionism of the Mexican State (Froehling, 1997; Knudson, 1998; Cleaver, 1998; Becker & Delgado, 1998; Barnhardt-Park, 2000; Villarreal & Gil, 2001). These were primarily academic examinations of a new phenomenon, written in English and targeting mainly a small section of politically aware English-speaking academics.

Since then, several other documents have been published in several languages including indigenous languages. One of the first was written by Sami Pilco, an indigenous woman from Ecuador as part of a postgraduate degree at the University of Bergen, Norway. This document written in 2000 may be regarded as one of the first critical analyses from an indigenous perspective of the challenges of IT to indigenous peoples in Latin America. What is interesting in Pilco’s early analysis is her critical problematization of the “democratic” nature of the Internet, the logic of IT towards consumerism and profit and the challenges that ICTs pose to indigenous peoples. This work is definitely the first attempt to systematize different experiences of indigenous appropriation of the Internet in Latin America and

critically analyses the politics of representation (and self-representation) of indigenous peoples in cyberspace. The study concluded that with notable exceptions, most Internet sites with indigenous content were produced by international NGOs as a way of promoting indigenous development and as part of technology transfer programs of European cooperation agencies, but only a few were produced by indigenous peoples themselves. This has changed in recent years as several indigenous organizations have become autonomous in their use of the Internet.

More recently, in what is perhaps the most comprehensive analysis of indigenous peoples' access to IT in Latin America, Hernandez and Calcagno (2003) have written a significant case outlining the opportunities, challenges and possible paths for indigenous peoples' involvement in the information society. The document, elaborated by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) and the Institute for Connectivity in the Americas (ICA), is a serious and respectful attempt to develop a typology of indigenous Internet sites in Latin America, and a summary of the modes that indigenous communications may take within a Latin American "information society."

In their study, Hernandez and Calcagno (2003) distinguish Web sites by the ethnic origin of their creators, by the level of representation of the institutions, by the geographical location of the creators, by the origin of the funding agent, by the language used on the Web site and by the main interests or subject matter of the Web site. In the first instance, the authors include two variants. First, those Web sites developed by non-indigenous peoples, generally intellectuals, foundations, academic institutions, governmental organizations, social science professional associations and NGOs. These have an emphasis on disseminating historical, social, political, linguistic, ecological, ethnic and technical information; legislation; and denouncements against actions

that threaten territories, organizations and people, as well as human and cultural rights. Second, there are Web sites produced by indigenous peoples, as in the case of those developed by local grassroots organizations, NGOs and associations that coordinate the activities of various regional, national and international ethnic organizations. The primary objective of these sites is "to use the Web to display the presence and points of view of the indigenous organizations about topics of interest for the communities: globalization, the economy, indigenous politics, relations with the national society and transnational businesses, cosmology, history, art, native language courses, dictionaries, grammars, etc." (Hernandez & Calcagno, 2003, p. 11).

More importantly, the document promotes a practical framework for action by way of a regional strategy for the reduction of the *information marginalization* of indigenous communities. This regional strategy is put into practice through specific programs for indigenous access to the new information and communication technologies, which in turn are based in the demands of the communities themselves. The study clearly acknowledges that the digital divide has become a new form of indigenous cultural exclusion. However, it moves beyond the critical study of the impacts of ICT to an attempt to incorporate the specific cultural variables of indigenous peoples' appropriation and use of IT.

First, in this regard, the study emphasizes the need for respecting community organizations, social and communal solidarities and indigenous law in the design of consensual policies and actions that correspond to concrete means of reduction of the social phenomenon of information exclusion.

Second, there is the assumption that the principle of self-determination — where a community or nation plays an active role in its own development and is capable of making its own decisions in matters of "national" interest — is

intimately tied to the principle of self-management. Self-management of ICTs refers to the ability “to learn the concrete tasks that require the gradual incorporation of the population and the indigenous communities into the digitalization process” (Hernandez & Calcagno, 2003).

THE POETICS OF INFORMATION AND COMMUNICATION TECHNOLOGIES

In this section of the chapter I put forward some theoretical considerations before going on to look at several case studies of indigenous peoples’ use of IT. I propose an examination of the “poetics” of information technology or, in other words, the process of media *making*. A poetics of ICT is therefore concerned with the way media comes into being and functions in a given community, group or culture through its practice, or poiesis. It is concerned with the way social practices of technology are grounded in cultural politics and social action, generally rooted in local social solidarities. This poiesis, or making of communication technologies, is both a process and product of cultural representation. Therefore, the term ICT should be understood more in a practical way, as a form of action, and not exclusively in a technical way, as the incorporation of material gadgets or tools into indigenous peoples’ lives. By acknowledging that indigenous engagements with digital technologies of information and communication have their own logic, then the structuralization of indigenous information technology in Latin America can be contextualized in broader processes of cultural activism, including the new processes of ethnic resurgence originating primarily since 1992 onwards.

In attempting to decolonize research on indigenous peoples and information technology from the often ethnocentric assumptions of development and technology transfer, it must be assumed

that the appropriation of a new technology is ultimately a process of negotiation between different constituencies and the creation of content is ultimately a social process. Thus, indigenous media production in general and the appropriation of new technology in particular shouldn’t be seen as isolated phenomena, but as inserted in historical conditions and placed in intertextual and intercultural frames of reference, like the struggle of the Mapuche against the logging companies in Chile, the Zapatistas against the Mexican State or the Ashaninka in Peru as a way to defend their biodiversity rights against the onslaught of American transnational companies.

INDIGENOUS PEOPLES AND THE USES OF ICT IN LATIN AMERICA

In 1998, only 0.8% of the population in Latin America had access to the Internet. In 2004, more than 55 million users — or 10% of the total population — had access, marking the single most important increase worldwide. Among these users, 50% are located in urban centres of Brazil, while the previous year Uruguay and Chile had the highest levels of internet penetration in the region, with 34% and 29% respectively. However, despite exponential growth, the average cost of Internet access in most Latin American and Caribbean countries is still much higher than the average connection in the U.S., Canada, Australia, Japan or western European countries. This growth may be partly explained by the strong wave of privatisation of the Latin American telecommunication markets during the early 1990s, leading to an explosion of new technologies, new services and an influx of new market players, including also the move by several states to become part of the “information revolution.”

The wave of privatisations, deregulation and liberalization of the information and telecommunication sectors during the last two decades, to-

gether with a reorientation of foreign cooperation development funding towards programs dealing with new information and communication technologies and a more active role of public policy and state involvement, have paved the way for more innovative implementations of ICT initiatives in indigenous communities, ranging from literacy to political activism and e-commerce. Many initiatives have sprung from indigenous organizations themselves, who have been able to access IT through their own means. Let us look, then, at some important examples of the favourable use of ICTs by indigenous organizations in Latin America.

ICT Access and Literacy

Information technology literacy has become a critical aspect of the incorporation of indigenous cultures into the information society, as shown by a variety of pilot programs in different countries in the region. One of the most notable cases in recent years has been the Telematic Network for Indigenous Populations begun in 2000 simultaneously in Bolivia, Peru, Ecuador and Colombia. The pilot project is funded by the United Nations and coordinated by INKARRI, a non-governmental organization and indigenous documentation centre with headquarters in the Basque country. Since its inception, the project has sought the systematization of mechanisms for the appropriation of telematic technology and computer science by indigenous organizations. The five-year plan (under review in 2005) has aimed at strengthening local capacities through promotion of a more democratic participation, the latter stimulated by shared access to ICTs through public or collective telecenters in rural and peripheral-urban areas. What seems really critical in this initiative is the emphasis on the self-identification of local practices that benefit through the use of the ICTs, which in turn has encouraged the appropriation and use of new

digital, computer-based technologies within the communities.

Another similar initiative began around the same time (1999), the Internet Radio for Ashaninka Aboriginal Communities in Peru, which promotes computer literacy and community access through telecentres for over 60 Ashaninka communities in the Peruvian Sierra. The Ashaninka project — funded by IDRC, the Canadian International Development and Research Centre, through one of its PAN Americas initiatives — has been strongly motivated by new forms of self-management offered by the new technologies and the opportunities for the production of content; this in turn has fostered processes of appropriation and training of indigenous ICT users. Through the use of high frequency Internet radio, over 60 Ashaninka communities, located in a relatively extensive area of the Peruvian Andes, have been able to establish a network of intra-communal information that ranges from cultural revival to protection of native rights to natural resources and traditional medicine. In addition, e-commerce is promoted, whereby the communities are able to sell products — such as coffee — in big urban centres such like Lima. The project has also become an important way for the Ashaninka to fight for traditional knowledge of medicinal plants and the access to their ancestral environment resources, which have been seriously threatened by the activities of large foreign transnational companies.

ICT and E-Commerce

The issue of e-commerce is not unique to the Ashaninka communities of Peru. Otavalo communities in northern Ecuador have established important businesses in Europe, where they market weavings and other crafts. Another example is the pilot project Virtual Bolivian Market, financed by the International Telecommunication Union in 1999. This is an innovative project of indigenous e-commerce that aims to supply indigenous and

peasant communities with e-commerce tools, such as an online purchasing portal that allows visitors to buy various products, including music, handicrafts and food.

The commercial use of IT in indigenous communities is still marginal and, despite these cases, the Internet is yet to become a technology for profit. Up until now, IT has been primarily an instrument of political advocacy and cultural activism, as it has allowed for wide ranging and fast circulation of information.

ICT and Political Advocacy

When looking at the shaping of ICT for political activism and advocacy, it is important to remark the ways in which ICTs have been constructed as fields of symbolic struggle all over the region (Bonilla, 2000). Some of the best known cases of indigenous organizations that have made effective use of ICT for political purposes are the Zapatistas in Chiapas, Mexico and the Confederation of Indigenous Nations of Ecuador (CONAIE). The CONAIE was formed in 1988 and is today one of the strongest indigenous organizations in the world. Computer networking played a pivotal role when the CONAIE was able to coordinate and organize mass mobilizations of indigenous peoples and peasants during the massive protests of 1997 and 2000, both of which led to the ousting of Ecuadorian presidents. Similar events have occurred in Bolivia with the rise of Aymara ethno-nationalism in recent years. In Panama, some Kuna communities have forged institutional partnerships with international environmental NGOs to work towards the preservation of their traditional resources and environment, and, in similar circumstances, indigenous groups in Colombia have made useful exercise of information technology to arrest the offensive of transnational oil companies and the onslaught of both the guerrilla and paramilitary forces. In Bolivia a new project by CIDOB, the Confederation of

Indigenous Peoples of Eastern Bolivia, is creating an information system (database and Web site) to work on claims by Bolivian indigenous groups regarding their land rights. The information is collected through CIDOB's regional offices, and is used to inform the indigenous groups as to the state of their claims and to obtain information in relation to conflicts and negotiations regarding indigenous land.

In this regard, Bolivia is at the forefront of indigenous peoples' use of new technologies. The country has been one of the regional centres for indigenous media production in recent years, for example, hosting the regional office of CLACPI, the Latin American Indigenous Council of Film, Video and Communications. The Bolivian Plan of Indigenous Audiovisual Communications, designed in 1996 after a regional meeting of CLACPI in La Paz, constitutes a concrete outcome of a long process by which several indigenous and peasant organizations in Bolivia established a long-term scheme of audiovisual communication in conjunction with CEFREC, an independent Film Education Centre. Mainly working with video, but recently with new technologies as well, it is interesting to note how indigenous peoples in Bolivia have been able to begin inserting their cultural narratives into broader spheres, based on their ancestral forms of communication and representation. Through this scheme, a varied and thriving indigenous media practice has emerged, establishing the foundation for a series of exchange practices at the national level that allow for the continuation of traditional forms of oral and collective memory. As such, video has come to be conceptualised as a tool for empowerment and as a tactic to elaborate an ambitious strategy for cultural survival, promoting a more democratic and multicultural participation in the mass media.

In Chile, the Mapuche movement has also been active in the use of ICT for creating alternative public spheres of debate. Mapuche organiza-

tions and individuals, both in Chile and abroad, have constructed a remarkable digital network of Web sites and online communication. These organizations have vehemently embraced the Internet as a viable tactic for building a counter-hegemonic discourse that has started to impact the national public sphere. These instances stand out as notable cases of radical indigenous media practices which I argue can be seen as a strong yet incipient indigenous (Mapuche) public sphere. Today there are at least twenty-five distinctive Mapuche Web sites, some hosted in Chile, many others in countries like Sweden, the Netherlands, the United Kingdom, France, Germany, Belgium and Spain. Most of these sites have been used as vehicles of expression for processes of “rebellious communication” (Downing, 2001) as well as mobilisation originating at the community level (see also Salazar, 2003). To support the argument that one of the primordial uses of the Internet for the Mapuche has been to develop an oppositional public sphere, I will focus here only on those cases that I believe have played a key role. In general terms, the Mapuche Web sites have continued to bare witness to the legacies of the military dictatorship, even after fifteen years of democratic administration. Examples of this are the neo-liberal policies impacting negatively on indigenous peoples and the environment, or the infliction of the anti-terrorist law of 1979 — designed under the military dictatorship of General Augusto Pinochet to counter Marxist guerrillas — on Mapuche peasants and activists. The Mapuche Web sites have been crucial in showing images of police abuse, the action of paramilitary groups and the militarisation of rural communities in the south. They have raised fresh claims over the control, production and circulation of images and the ownership of media and communications outlets. In general, the Mapuche online network is a locus without a centre and without vertical control with the potential to host a “free and influential public space, a sphere of social action

not separate but fully linked to and a protagonist in conflicts and antagonisms” (Carlini, 1996, in Bentivegna, 2002, p. 59).

THE FUTURE AHEAD: INDIGENOUS COMMUNICATION RIGHTS

The social impact of ICTs on indigenous populations has been a critical issue in recent years. The chapter has summarized some of the current issues, literature and contexts of use regarding indigenous peoples and ICTs in Latin America. It has been argued that to move beyond the “impact of technology on society” approach, we need to attend to the cultural constructions of technology and the way indigenous groups may use, appropriate, conceive and image technology differently than other populations. Questions of self-determination that have been so important within indigenous movements worldwide need also to apply to communication. Further research on the topic should focus more on examining ways of developing autonomous indigenous communications and self-management. As indigenous communities gain increasing access to ICT in coming years, researchers, advocates and policy makers will also need to put more attention to the design of appropriate regulatory frameworks to ensure indigenous communication rights and to open truly intercultural information spaces. This begins with the design and implementation of programs aimed at reducing computer illiteracy and at promoting favourable attitudes for the incorporation of the ICTs within communities and organizations based on principles of indigenous knowledge and law. The incorporation of indigenous languages within these new frameworks will be of critical importance in deploying a new configuration of indigenous communications.

Moreover, indigenous peoples around the world have a broad range of knowledge with

high potential commercial value for national and transnational corporations. This has been demonstrated through a series of international studies and reports by non-governmental groups and indigenous organizations that have shown the critical importance of implementing intellectual property rights to such knowledge so that local and indigenous communities can have an instrument to fight against “piracy” by foreign companies and researchers. As has been shown in the case studies mentioned in this chapter, ICTs will have critical importance in promoting a more equitable distribution of profits from the commercialization of indigenous knowledge, whether it be of plants with medicinal properties, television programs or alternative farming practices.

REFERENCES

- Barnhart-Park, A. (2000, March). *alt.Indigenous. electronic-(re)sources*. Paper presented at the Annual Meeting of the Latin American Studies Association, Miami.
- Becker, M., & Delgado, G. (1998). Latin America: The Internet and indigenous texts. *Cultural Survival Quarterly* 21(4). Retrieved May 11, 2006, from <http://209.200.101.189/publications/csq/csq-article.cfm?id=1455>
- Bengoa, J. (2000). *La emergencia Indígena en América Latina*. Santiago, Chile: Fondo de Cultura Económica.
- Bentivegna, S. (2002). Politics and new media. In L. Lievrouw & S. Livingstone (Eds.), *Handbook of new media: Social shaping and consequences of ICT* (pp. 50-60). London: Sage.
- Bonilla Urvina, M. (2000). *Investigando las nuevas tecnologías de información y comunicación (NTIC) como campos de lucha simbólica en América Latina y el Caribe*. Quito, Ecuador: Facultad Latinoamericana de Ciencias Sociales (FLACSO).
- Cleaver, H. M. Jr. (1998, Spring). The Zapatista effect: The Internet and the rise of an alternative political fabric. *Journal of International Affairs*, 51(2), 621-640.
- Delgado, G. (2003, March). Solidarity in cyberspace: Indigenous peoples online: Have new electronic technologies fulfilled the promise they once seemed to hold for indigenous peoples? The answers are yes, and no. In NACLA, *Report on the Americas*, 35(5), 49-53.
- Downing, J. D. H. (2001). *Radical media: Rebellious communication and social movements*. London: Sage.
- Forte, M. (2002). “We are not extinct”: The revival of Carib and Taino identities, the Internet, and the transformation of offline Indigenes into online “N-digenes.” In *Sincronia: An Electronic Journal of Cultural Studies*. Department of Letters, University of Guadalajara, Mexico.
- Fraser, N. (1993). Rethinking the public sphere: A contribution to the critique of actually existing democracy. In B. Robbins (Ed.), *The phantom public sphere* (pp. 1-32). Minneapolis: University of Minnesota Press.
- Froehling, O. (1987). The cyberspace “war of ink and Internet” in Chiapas, Mexico. *The Geographical Review*, 87(2), 291-307.
- Hernández, I., & Calcagno, S. (2003). *Indigenous peoples and the information society in Latin America and the Caribbean: A framework for action*. Santiago, Chile: CEPAL.
- Knudson, J. W. (1998). Rebellion in Chiapas: Insurrection by Internet and public relations. *Media, Culture & Society*, 20(3), 507-518.
- Lara, S. (1999). YANAPANAKU: Propuesta de organización y construcción de la red global de solidaridad. Retrieved November 3, 2005, from <http://funredes.org/mistica/castellano/cibero-teca>

Indigenous Peoples and the Cultural Construction of Information and Communication Technology (ICT)

Monasterios, G. (2003). Usos de Internet por organizaciones Indígenas (OI) de Abya Yala: Para una alternativa en políticas comunicacionales. *Revista Comunicación*, 122, 60-69.

Pilco, S. A. (2000). *La red de Internet y los Pueblos Indígenas de América Latina: Experiencias y perspectivas*. Institute for Media Studies, University of Bergen, Norway. Retrieved November 3, 2005, from <http://www.nativeweb.org>

Salazar, J. F. (2002). Activismo Indígena en América Latina: Estrategias para una construcción cultural de tecnologías de información y comunicación. In *Journal of Iberian and Latin*

American Studies, 8(2), 61-79. Melbourne, Australia: La Trobe University.

Salazar, J. F. (2003). Articulating an activist imaginary: Internet as counter public sphere in the Mapuche movement, 1997-2000. In *Media International Australia, incorporating Culture and Policy*, 107, 19-30. Brisbane, Australia: Griffith University.

Villarreal, T. & Gil, G. (2001). Radical Internet use: Two case studies. In J. D. H. Downing (Ed.), *Radical media: Rebellious communication and social movements*. London: Sage.

This work was previously published in Information Technology and Indigenous People, edited by L. E. Dyson, pp. 14-26, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 4.5

Assessing Universal Access to ICT in Ghana

Godfred Frempong

Science and Technology Policy Research Institute, Ghana

Imoro Braimah

Kwame Nkrumah University of Science and Technology, Ghana

INTRODUCTION

Information and Communication Technologies (ICT)¹ have become part of the key factors driving social and economic advancement. They have not only altered the way people live, work, communicate and entertain themselves but also created a new infrastructure for business, scientific advancement and social interaction.

Given the importance of ICT, many countries (developed and developing) have evolved policies that would enable every citizen to participate in the digital revolution. However, access to the ICT is concentrated in few regions, countries and population groups. The result is that there is a deepening gap between the developed and developing countries in the availability and accessibility to ICT services. This is referred to as the digital divide. The digital divide is following and supplementing the prevailing income and economic divides existing between developed and developing countries (Navas-Sabater, Dymond & Juntunen, 2002).

According to Navas-Sabater, Dymond and Juntunen (2002), there are two aspects of the digital divide—poverty and isolation. They defined the two aspects, as disparity between the rich and the poor on one hand, and disparities between urban and rural areas on the other. They argue that although both components are important, isolation poses a greater challenge to the utilisation of the service. Therefore, addressing the internal disparities becomes central to universal access discussions.

The policy objective of developed countries is to ensure equal access to ICT services by all the populace—universal service. The concept of universal service is based on the need for uniform geographical coverage of the service, quality, price, and the service offered on a non-discriminatory basis so that the expected benefits of ICTs would be available to the whole population (Tarjanne, 2000). The concept of universal service has increasingly been narrowed down to the connection of households to the public-switched telephone network. Here, the objective

is to achieve a minimum level of ICT services that must be available to all users regardless of where they are living and at a price which should be affordable to all (Wellenius, 2000).

Developing countries on their part have adopted a policy that emphasises community's access to ICT services—universal access. Efforts to promote universal access to ICT in Africa have been on the agenda of meetings of high-level policymakers since the early 1990s (Etta & Parvyn-Wamahiu, 2003). As a result different criteria such as distance, population size, time, etc., have been used by these countries to define what they mean by universal access. For example, in Ghana, the criterion is a telephone in every locality of 500 people, whilst in Burkina Faso it is a telephone within every 20 km (ITU, 1998).

The objective of this paper is to assess the deployment of ICT to achieve universal access in Ghana. Given the broad definition of ICT, the assessment will cover telecommunication (specifically telephone), the Internet, computer hardware and broadcasting (radio and television). Until 2003, achievement of universal access in Ghana was more related to increased penetration of telephones—fixed line and mobile, therefore, prominence is given to the deployment of telephones.

UNIVERSAL ACCESS POLICIES IN GHANA

For a long time, Ghana had no definite policy on universal access to ICT services. However, references can be made to programmes that gave some indications of government's intentions. The first of such programmes was the Accelerated Development Plan (1994 – 2000) for the telecom sector. The general objective of the Accelerated Development Plan (ADP) was to revamp the telecom sector through the participation of the private sector to meet the increasing social and

economic needs of Ghanaians. This was to enable Ghana to be integrated into the global economy as well as achieving the broad national objective of becoming the “gateway” to West Africa (Atubra & Frempong, 1999).

The government under the ADP adopted the use of pay phones as a way of achieving universal access. The target was to provide every rural community of 500 people with one pay phone. The ADP also had the objective of raising the national teledensity to a level between 1.5 and 2.5 by the year 2000.

The second evidence of government's policy on universal access can be found in the National Communications Regulations of 2003 (Legislative Instrument). Section 2 of the Legislative Instrument emphasised that the services of communication operators should reach the entire geographical areas specified in their licenses, which include rural, remote parts and sparsely populated areas. Therefore, in the issuance of licenses, the National Communications Authority (NCA) had an intrinsic objective of ensuring universal access to ICT services.

The first succinct ICT policy for Ghana was launched in the latter part of 2003. For universal access, the general objective was to promote equal and universal access to ICT services and resources to all communities. The universal access objective is to be achieved through:

- Implementation of community-based national ICT programmes and initiatives including telemedicine, multi-purpose community telecentres, tele-education and schoolnet initiatives.
- Community-based village information and communications infrastructure initiatives.
- Special ICT initiatives targeted at the disadvantaged communities and sections of the Ghanaian society, including the underserved communities and the physically and mentally challenged (Ghana Government, 2003)².

ICT INFRASTRUCTURE

In the early part of the 1990s, Ghana liberalised both telecom services and the airwaves. This liberalisation policy had had profound impact on the development of ICT infrastructure³ in the country. In this section, we provide an overview of the deployment of ICT infrastructure in the country. The overview shall include telecommunication, the Internet, radio and television.

TELECOMMUNICATION SERVICES

Fixed Line Telephones

There has been considerable improvement in the penetration of fixed-line telephones in the country. In 1990, there were a little over 44,000 telephone lines in the country and this increased to 288,500 in 2003.

Ghana has three companies providing fixed line telephone services—Ghana Telecom (GT), Westel and Capital Telecom. In 2003, there were 291,978 telephones in the country of which the incumbent GT had about 98.8% share. The teledensity of the country was 1.42.

Work by Frempong (2004) revealed that the Greater Accra Region, which hosts the national capital has about 67% of the telephone lines in the country. In this sense, availability of the service in the other regions was limited and therefore, has negative implications for achieving universal access to the service (see Figure 1).

The concentration of telephone lines in the Greater Accra does not necessarily mean that there is increased access by residential users. Most of the service is subscribed to by government departments and agencies, and corporate organisations operating in the Accra-Tema Metropolitan Assemblies.

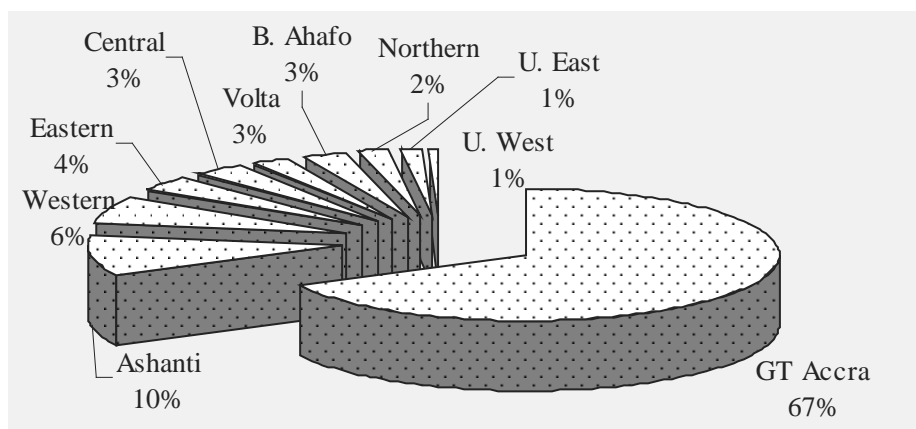
Pay Phones

There has been a considerable improvement in the deployment of the service in the country. There were only 25 pay phones in the country in 1993, but as at 2003, the number had risen to 6,921. The penetration of pay phones per 1,000 people in 2003 was 0.33, while the ratio of pay phones to private main telephones was 1:42. But the penetration level is less than a pay phone for a community of 500 and in this sense the goal set by government with respect to the development in rural areas was not achieved.

Table 1. Basic telecommunications data (ITU [2003] Telecom Indicators and Ghana Telecom [2004])

| Indicators | Number |
|---|-----------|
| Fixed-Line Telephone Networks | 3 |
| Fixed Telephone lines | 291,978 |
| Teledensity (Fixed telephone lines) | 1.42 |
| Waiting list for Fixed Telephones | 183,755 |
| Pay phones | 6,921 |
| Pay phones (per 1000 inhabitants) | 0.33 |
| Ratio of Pay phones to Fixed Telephone Lines | 1:43 |
| Cellular Mobile Telephone Networks | 4 |
| Mobile subscribers | 775,000 |
| Mobile subscribers per 100 inhabitants. | 3.8 |
| Ratio of Fixed Telephone subscribers to Mobile subscriber | 1:2.7 |
| Total No. of Tel. Subscribes (main line + mobile) | 1,066,978 |

Figure 1. Regional distribution of Ghana Telecom fixed line telephones (Source: Ghana Telecom)



Communication Centres

Another source of telephone service is through what is locally called Communication Centres. Communication Centres in Ghana are basically private commercial ventures which re-sell telephone services from a few number of lines obtained largely from Ghana Telecom. They do not include Internet cafés. However, some of the operators have arrangements with some of the Internet Service Providers (ISPs), notably Africa Online to provide points where people can send and receive e-mails. At these Centres, people make and receive calls and this provides an important access to telephone service for the rural population.

In general, there has been appreciable improvement in the access to telephone service including pay phones after the liberalisation of the sector in 1996. This is contrasted with the situation in some African countries where mobile telephone deployment has negatively affected fixed line telephone.⁴

Mobile Telephones

Mobile telephony was introduced into the country in 1992 by Millicom SA. Presently, there are four

mobile telephone companies—Millicom Ghana Limited, Kasapa Telecom, Scancom Ghana Limited and One Touch (a subsidiary of GT)—making Ghana one of the most liberalised mobile telephone markets in Africa as the African average is two mobile operators. The total mobile telephone (i.e., cellular) subscription in 2003 was 775,000 with mobile teledensity of 3.8. The deployment of mobile telephones outpaced the fixed-line telephones in 2002. The ratio of fixed line to cellular mobile telephone was 1:2.7.

Mobile telephony in Ghana started early within the African context. However, subsequent development was not as fast as in many other countries. For example, countries like Senegal, Cote d'Ivoire, Cameroon, Kenya, Tanzania and Uganda have outperformed Ghana (Frempong and Henten, 2004). In 2001, mobile penetration in Ghana was 0.64, while that of Uganda, which introduced the service six years later, was 1.16. Absence of rigorous competition among the operators, especially between 1993-2000 largely contributed to the poor performance of the sector.⁵ Problems of interconnection has also negatively affected the operations of the mobile telephone companies.

INTERNET

Internet penetration in Ghana is very low compared to some African countries, especially the Republic of South Africa and the Maghreb region. In 2003, South Africa had more than 3.1 million Internet users, Egypt had 1.9 million users, while that of Ghana was 170,000 (ITU, 2003). Most users in Ghana have access through shared Internet connections—offices, cyber cafes, friends and to a less extent homes (Ahiabenu II, 2003). The country had 313 Internet hosts in 2003 and users per 10,000 inhabitants were 78.4 (see Table 2) which were below the African average of 123.21.

The Internet cafes are the most important sources of Internet access. In early 2003, there were over 750 Internet cafes in Ghana mostly using dial-ups. About 90% of these cafes are located in Accra, with the rest in the other cities such as Kumasi and Takoradi (Ahiabenu II, 2003).

BROADCASTING

Television

As of September 2003, the NCA had licensed 21 companies to broadcast and/or re-broadcast foreign TV signals in the country. Out of this number, only 10 are operational. Four companies were to provide free on air services of which three were to cover the whole country. However, it is only Ghana Broadcasting Corporation which has nation-wide coverage. The rest provide the service on a “pay as you view” basis largely in Accra-Tema, Kumasi and Takoradi—the major cities in the country.

In 2000, the penetration rate of television sets was 118 per 1,000 persons. In absolute figures, there were about 1.1 million TV sets in the country. However, the number might have improved considerably due to the influx of used TV sets into the country largely from Europe.

Radio

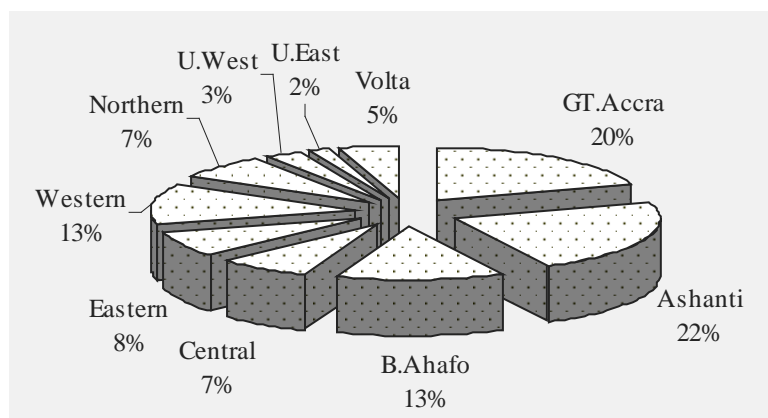
The National Communications Authority in September 2003 had allocated frequencies to 127 companies to operate FM radio stations in the country. However, not all of these companies had utilised their licenses. But a greater number (about 62%) of the companies had commenced business (Brammah and Frempong, 2003). From Figure 1, FM radio stations are available in all the 10 regions of the country. However, the majority (69%) of the stations are located in four regions - namely Greater Accra, Ashanti, Western and Brong Ahafo. The rural-based regions, especially the three in the northern part of the country had less FM stations. Therefore, access to radio services is more pronounced in the urbanised regions of the country.

From Table 2, though the number of TV and radio sets is not significantly high, the communal way of life, especially in the rural areas, increase

Table 2. Other ICT indicators (ITU, Information Technology Data [2003]) and NCA, 2003 Please note: not all service providers have commenced business)

| Category | No. |
|---------------------------------------|-------------|
| Paging Service Providers | 10 |
| Internet Service Providers | 112 |
| VSAT Data Operators | 96 |
| Public/Corporate Data Operators | 57 |
| FM Stations | 127 |
| TV Stations | 21 |
| TV Sets | 1.1 million |
| Total of Personal Computers | 82,000 |
| Personal Computers (per 100 persons) | 0.38 |
| Radio per 1000 persons (in 2000) | 710 |
| TV per 1000 persons (in 2000) | 118 |
| Internet Host | 313 |
| Internet users | 170,000 |
| Internet users per 10,000 inhabitants | 78.43 |

Figure 2. Regional distribution of FM stations as of September 2003 (NCA, 2003)



the accessibility to the two services. People in such areas can watch TV and listen to radio programmes from the homes of friends and relations, and in this case, provide accessibility to the service.

REGIONAL DISTRIBUTION OF ICT COMPANIES IN GHANA

From the survey conducted as part of the Scan-ICT study⁶ in 2002, close to 45% of the ICT companies surveyed were in the Greater Accra region (mostly in Accra, the national capital). Ashanti Region, (mostly in Kumasi, the second largest city in Ghana) had 31% and 10% in the Central Region (see Table 3). Predominantly rural-based regions were not attractive to the ICT companies, due to the smallness of the market in those regions. In this case the vast majority of the people are denied access to the services those companies provide.

The ICT companies surveyed were business houses involved in the sale of ICT equipment, peripherals and services that conform to the International Standard Classification (ISIC) Rev. 3 and Rev. 3.1 of 2002. They include wholesale and retail of electronic and telecom equipment, computers, peripherals, software, television and radio receivers. Others were involved in ancillary

activities such as training, repair, installation of ICT related equipment and peripherals, and wiring of customers' premises.

These companies are important to the achievement of universal access as they enable people to acquire ancillary services, ICT equipment and peripherals, and invariably help increase access to ICT services. Profit being the ulterior motive of every business, these companies concentrate in areas where there are markets for their products and services. Invariably, their concentration in a particular locality (in this case Accra and Kumasi) will help increase the access to ICT services.

Table 3. Regional distributions of ICT companies (INIIT, The Ghana Scan-ICT Study, 2002)

| Region | Percentage |
|-------------------|------------|
| Gt. Accra Region | 45 |
| Ashanti Region | 31 |
| Central Region | 10 |
| Western Region | 4 |
| Eastern Region | 3 |
| Brong Ahafo | 2 |
| Volta Region | 2 |
| Upper West Region | 1 |
| Upper East Region | 1 |
| Northern Region | 1 |

To conclude, there has been considerable improvement in ICT infrastructure in the country. The liberalisation of the telecom and the airwaves provided a springboard for the introduction of many ICT services in the country. However, the objective of achieving universal access is still a mirage. Deployment of ICT infrastructure is skewed to the urban areas. In that case, the majority of the populace who reside in the rural areas have limited access.

CHALLENGES TO ATTAINING UNIVERSAL ACCESS

The discussion has revealed that in spite of the significant improvements in the deployment of fixed line and cellular mobile telephones, universal access is still far from realisation. A number of factors have constrained the attainment of universal access in the country. In this section, we shall look at some of these constraints.

Interconnection

One of the major problems that has mitigated against the achievement of universal access is interconnection between telecom operators. Telephone is the foundation for many of the ICT services. The interdependent nature of the telecom networks make it necessary for all operators to interconnect to provide a seamless network to enable users from different networks to communicate (Melody, 2001). The reform and the subsequent introduction of competition in telecom services have made interconnection a prominent feature of the telecom market.

Interconnection difficulties have adversely affected the deployment of telecom services and also constricted access to the service. Restrictive interconnection agreements had affected the performance of the other operators. For example, interconnection controversies between Westel and

GT delayed the former in launching its services in 1998. Problems of obtaining more EIs⁷ from GT had also constrained the ability of the mobile telephone operators to expand their services as quickly and widely as possible.

The problem of interconnection had also negatively affected the flow of foreign investments into the sector to help in the expansion of the network to improve the accessibility. For example, Westel attributed its inability to attract more investment to expand its service to the initial interconnection problems it encountered with GT. According to Westel, the problem sent a wrong signal to prospective investors and they became apprehensive about investing in the country.

Affordability

Access to the service is not only the physical availability but also the issue of affordability. Affordability depends on the financial strength of customers to pay for the service. In Ghana, accessibility and affordability are critical problems confronting the achievement of universal access.

The increase in the interconnection charge between cellular mobile and fixed line networks from US\$0.06 to US\$0.2 per minute in October of 2003 had serious financial implication on accessibility to telephone service, especially for rural dwellers. The increase in the interconnection call rate meant that callers to the cellular mobile network from fixed-line telephones had to pay more for the service. For example, previously callers to cellular mobile networks from fixed-line networks paid US\$0.1 per minute, however with the new tariffs, they pay US\$0.3 per minute at the communication centres.

The communication centre and Internet café concept provides a better way of ensuring universal access to ICT services in the country. At these cafes and centres, users can make and receive calls, send and receive faxes, check e-

mails and browse the Internet for a fee. Presently, the average cost of browsing the Internet for one hour is US\$0.65. This is increasing accessibility to the service, especially for the young people in the urban areas.

One of the problems affecting Internet penetration is limited access to telephone service and high connection charges. Access to Internet service is mainly through the dial-up system. Therefore one pays the normal telephone charge of US\$0.02 per minute for a dial-up access, in addition to the monthly subscription. The Network Computer System in 2003, charged a one-time connection fee of US\$50.00 and a monthly subscription of US\$35.00 for unlimited Internet service. The charges are considerably high for many potential private subscribers.

Low E-Literacy Level

The idea of e-literacy is based on the premise that people have the skills, awareness and understanding to participate in the e-services such as e-governance and e-mail service. People should be e-literate (individual e-readiness) to make use of these opportunities given by ICT technologies. The ability to become e-literate is strongly linked to being literate (ability to read and write) as ICT services are knowledge-intensive.

However, the low level of literacy in the country is a handicap to many people becoming e-literate to utilise these services. The estimated illiteracy level in Ghana is about 38.1% (Ghana Statistical Service, 2000) and in this case, a sizeable number of Ghanaians cannot use these knowledge-intensive services even if they are available in their communities.

CONCLUSION

It can be concluded that generally there has been improvement in the deployment of ICT infrastructure in the country since the liberalisa-

tion of telecom and the airwaves. However, the achievement of universal access is still far away from reality because much of the improvements in the ICT infrastructures are concentrated in the urban areas. The accessibility to telephone service (presently fixed line) is the first step towards the participation in the digital revolution but the teledensity is greatly skewed towards Accra, the national capital.

It is argued that the use of pay phones as a strategy to achieve universal access has limitations. Pay phones can only support voice communication and if universal access is extended to cover data transfer then pay phones will not be suitable. Therefore, there is the need to adopt a system that can support access to broad range of ICT services.

In terms of the electronic media, its uniqueness presents a better accessibility than telephones. One can easily receive the signal of radio and TV broadcast if one lives within the coverage area. The limiting factors, especially access to TV, are the initial cost of the set and availability of electricity. Notwithstanding, the communal way of life of most Ghanaians, especially those in the rural areas will enable many rural people without TV and radio sets to benefit from others.

REFERENCES

- Ahiabenu II, K. (2003). Ghana—Rapid growth in Internet use despite constraints. *Balancing Act News Update*, 54. Retrieved on 30, 2003, from <http://www.balancingact-africa.com/news>
- Atubra, W.H., & Frempong, G. K. (1999). *The assessment of the telecommunications sector in Ghana*. Working Papers No. 1, University of Ghana/ Centre for Tele-Information, Denmark.
- Etta, F. B., & Parvyn-Wamahiu, S. (2003). *Information and communication technologies for development in Africa: The experience with telecentres* (Vol. 2). Senegal: IDRC & CODES-RIA.

Frempong, G. K. (2004). *Restructuring of the telecom sector in Ghana: Experiences and policy implications* (Draft Ph.D. Thesis). Accra: University of Ghana.

Frempong, G. K., & Braimah, I. (2003). Strengthening information and communication policy in Africa: Governance and equity Issues—the case of Ghana. Nairobi: Draft ATPS Report.

Frempong, G.K., & Henten, A. (2004). *Telecom developments and investments in Ghana*. Copenhagen: WDR Publication (forthcoming).

Ghana Government. (2003). *The ICT for accelerated development (ICT4AD) policy*. Accra: Graphic Communications Group.

INIIT. (2002). *An empirical study of the development, deployment and the exploitation of ICTs in Ghana*. Retrieved on January 20, 2004, from www.web.idrc.ca/uploads/user-s

ITU. (1998). *World telecommunication development report 1998, universal access*. Geneva: ITU Publications.

ITU. (2002). *World telecommunication development report 2002: Reinventing telecoms*. Geneva: ITU Publications.

ITU. (2003). Basic information technology data. Retrieved on February 10, 2004, from www.itu.int/ITU-D/ict/statistics/

Melody, W.H. (2001). Interconnection: Cornerstone of competition. In Melody (Ed.), *Telecom reform: Principles, policies and regulatory practices*. Copenhagen: Den Private Ingeniorfond, TUD.

Navas-Sabater, J., Dymond, A., & Juntunen, N. (2002). *Telecommunications and information services for the poor – towards a strategy for universal access*. Washington DC: World Bank Discussion Paper No. 432.

Statistical Service of Ghana. (2000). *Ghana living standards survey report*. Accra: Statistical Service Publications.

Tarjanne, P. (2000). The limits of national sovereignty: Issues for the governance of international telecom. In W.H. Melody (Ed.), *Telecom reform: Principles, policies and regulatory practices*. Copenhagen: Den Private Ingeniorfond, TUD.

Wellenius, B. (2000). Extending telecommunications beyond the market. Washington DC: Viewpoint 204, World Bank.

KEY TERMS

Communications Centres: Commercial ventures which are reselling telephone services from a few number of telephone lines.

Digital Divide: The disparity in access to ICT services between people of different countries and those of the same country.

EIs: The links used for the physical interconnection between different networks.

ICT Infrastructure: The deployment of telecom (both fixed and mobile), TVs, radio, computers and Internet connections to enable the populace access ICT services.

Internet Cafes: Business units that resell Internet access to people.

Internet Service Providers: Companies that provide Internet access to individuals, groups or corporate organisations through normal telephones, satellites or fibre optics.

Universal Access: Communal access to telephone and other ICT services usually measured by indicators such as distance, population and time.

Universal Service: Widespread access to telephone and other ICT services normally related to household access.

ENDNOTES

- ¹ For the purpose of this study Information and Communication Technology (ICT) includes the production and utilisation of hardware, software and services for the processing, communication and maintenance of information.
- ² Programmes for the implementation of these universal access strategies and programmes are yet to be drawn as the national ICT policy was launched in the latter part of 2003.
- ³ ICT infrastructure as used here refers to the deployment of telecom (both fixed and mobile), TVs, radio, computers and Internet connections to enable the populace to access ICT services.
- ⁴ This was the general observation of the papers presented by the members of Research ICT Africa network meeting held in Cairo on 2nd May, 2004 as part of the Expert Forum on Telecom Regulation organised by World Dialogue on Regulation.
- ⁵ The launch of One Touch mobile service by the incumbent in October 2000, brought some dynamism into the market.
- ⁶ The SCAN-ICT project—an initiative of the International Development Research Centre (IDRC) and the Economic Commission for Africa (ECA) is designed to: build support for the phased development of a comprehensive African capability to collect and manage information on key ICT-related indicators to support the growing investment in ICTs as well as the transition of Africa to an information society.
- ⁷ The EIs are links used for physical interconnection between different networks.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 28-34, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.6

Caribbean Companies and the Information Superhighway

Simon Fraser

The University of the West Indies, Trinidad and Tabago

INTRODUCTION

With the explosion of public awareness of the Internet in the early 1990s, much attention has been focused on ways in which these new technologies can be used in developing nations. Some of the primary proponents of these initiatives include the World Bank, The United Nations Conference on Trade and Development (UNCTAD) and the Inter American Development Bank. The major themes include ways in which the Internet and electronic commerce can be harnessed for development, impediments to rapid diffusion of Internet technologies and success stories in small and medium companies.

Perhaps the most comprehensive review of these themes can be found in the United Nations Conference on Trade and Development's E-Commerce and Development Reports 2001, 2002 and

2003 (UNCTAD, 2001; UNCTAD, 2002; UNCTAD, 2003). Another rich source of information is Development Gateway's very comprehensive Web site, (<http://developmentgateway.org>), with links to hundreds of reports, publications and articles on the use of information and communications technologies in the development process.

Caribbean governments have also recognized the potential of the new technologies in fostering economic development. A search of the Web sites of regional newspapers turns up many stories written over the last decade promoting the Internet and electronic commerce. Once again, the major themes include the promise of electronic commerce for small and medium enterprises and factors precluding the effective utilization of the associated technologies and strategies in the region. (E-normous role in Ja for Net, 2000; Welcome to the Land of Pan, 2000).

Over last decade many Caribbean countries have witnessed massive investments in information and communications technology. Together, telephone companies, public and private corporations, cable television operators and Internet service providers have invested billions of dollars (United States currency) in new plant and equipment. These investments led to the introduction of an impressive array of new information and entertainment services. Simultaneously, many domestic banks introduced local and international credit cards.

These developments have given Caribbean businesses and residents unprecedented access to new information sources via the Internet and cable or satellite television. Their credit card accounts also give them the ability to act on advertisements shown on American television and Web sites. As such, there is a possibility that local companies could find themselves in direct competition with larger, better-financed corporations in more developed economies.

This paper will briefly highlight some salient characteristics of the English speaking Caribbean. The second section will review developments in the information and communications technology arena throughout the Caribbean during the period 1990 to 2002. This will be followed by a brief discussion of the impact that the Internet and its associated technologies can have on buyer search costs and information asymmetry. The fourth section will attempt to show how declines in information asymmetry in the region may translate into lower market shares, prices and in some cases business failure at the regional level. Evidence from U.S. industries will be considered. The section before last will also briefly examine how local retailers may benefit from the Internet and electronic commerce. Finally, the paper closes with a review of avenues for future research that will help close the knowledge gaps at a regional level.

OVERVIEW OF THE ENGLISH SPEAKING CARIBBEAN

The English speaking Caribbean is made up of former and remaining colonies of the United Kingdom. Geographically the region stretches from the Bahamas in the northwest to Guyana, located on the South American mainland. While many Caribbean nations are categorized as developing states, per capita incomes, access to health care, education and technology are significantly greater than the developing regions of Africa, Asia and Latin America. Some of these characteristics are summarized in Table 1.

Another critical characteristic of the English speaking Caribbean is the close proximity of most of the territories to the United States—the leading adopter of electronic commerce technologies and processes. Miami is a major international trade hub for the region. The flying time from Miami to any of the islands ranges between 30 minutes to the Bahamas and 4.5 hours to Guyana. Each country is served by daily flights to the United States. Several shipping lines offer scheduled service between the United States' eastern seaboard and each country.

Selected ICT Developments in the Caribbean (1990-2002)

Telephone Companies

The largest ICT investor in the region is almost certainly Cable & Wireless (C&W) and its regional subsidiaries. C&W subsidiaries have invested billions of US dollars in fiber optic backbones, digital switching technology and cellular networks (C&W Deal Signals New Investments, 1999). Most have joined international consortiums such as the Americas I and II undersea cable projects (TSTT to spend \$540 million on upgrade, 1998).

Caribbean Companies and the Information Superhighway

Table 1. Selected developmental statistics for the Caribbean, Africa, Latin America and South East Asia

| Caribbean | Population (2003) ¹ | GDP Per Capita US\$ ² | Infant Mortality (per 1000) ³ | Gross Enrollment Ratio (Secondary Level) 2001 | Motor Vehicles (per 1000 inhabitants) ⁴ | Telephone Lines ⁵ | Internet Users as % of total population ⁶ |
|--------------------------------|--------------------------------|----------------------------------|--|---|--|------------------------------|--|
| Barbados | 270,000 | 9,486 | 11 | 103.3 | 268 | 48.1 | 5.56% |
| Bahamas | 314,000 | 10476 | 18 | 91.5 | 342 | 40 | 6.75% |
| Guyana | 765,000 | 936 | 51 | 90.5 | 100.8 | 9.2 | 12.42% |
| Jamaica | 2,651,000 | 2,990 | 20 | 83.6 | 74 | 20.5 | 3.77% |
| St. Lucia | 149,000 | 4,994 | 15 | 86 | 172 | 31.7 | 8.72% |
| St. Vincent and The Grenadines | 120,000 | 2,940 | 16 | 72.5 | 117.8 | 22.7 | 4.58% |
| Trinidad and Tobago | 1,303,000 | 7,031 | 14 | 70.4 | 219 | 24 | 10.59% |

| Africa | | | | | | | |
|------------------------------|-------------|-----|-----|------|---------|---------|-------|
| Nigeria | 129,000,000 | 435 | 79 | 32 | .6 | .5 | 0.16% |
| Ghana | 20,922,000 | 265 | 58 | 37.7 | 10.5 | 1.2 | 0.19% |
| Democratic Republic of Congo | 52,771,000 | 91 | 120 | 18.4 | No Data | No Data | 0.01% |
| Mauritania | 2,893,000 | 353 | 97 | 21.7 | 11.2 | 1 | 0.35% |
| Kenya | 31,987,000 | 367 | 69 | 32 | 16.7 | 1 | 1.56% |
| Somalia | 9,890,000 | 110 | 118 | 5.9 | No Data | .3 | 0.10% |

| Latin America | | | | | | | |
|---------------|-------------|---------|----|------|-------|------|--------|
| Brazil | 178,470,000 | \$2,925 | 38 | 107 | 111.9 | 21.8 | 8.01% |
| Argentina | 38,428,000 | \$5,267 | 20 | 99.6 | 197.7 | 22.4 | 10.67% |
| Chile | 15,805,000 | \$4,310 | 12 | 85.5 | 135 | 23.3 | 19.63% |
| Peru | 27,167,000 | \$2,053 | 33 | 81.7 | 50.1 | 7.8 | 7.36% |
| Ecuador | 13,003 | \$1,666 | 41 | 59.2 | 47.1 | 10.4 | 3.87% |
| Venezuela | 25,000,000 | \$3,134 | 19 | 68.6 | 100.2 | 10.9 | 5.08% |

| Asian Counties | | | | | | | |
|----------------|---------------|---------|----|------|-------|------|--------|
| China | 1,300,000,000 | \$918 | 37 | 68.2 | 10.2 | 13.7 | 1.19% |
| Philippines | 80,000,000 | \$925 | 29 | 81.9 | 34.3 | 4.2 | 2.50% |
| Indonesia | 219,883 | \$678 | 42 | 57.9 | 27.6 | 3.5 | 1.82% |
| Malaysia | 24,425,000 | \$3,748 | 10 | 69.6 | 18.8 | 19.8 | 26.61% |
| Thailand | 62,833,000 | \$1,865 | 20 | 82.8 | 126.1 | 9.9 | 7.64% |
| Vietnam | 81,377,000 | \$416 | 34 | 69.7 | .7 | 3.8 | 1.84% |

Cable television companies have also invested heavily in new plants and equipment. Several are positioning themselves to enter the voice market when the telecommunications environment is liberalized. Caribbean consumers also have access to US television programming via DirecTV Latin America.

The Internet

Internet access is now firmly established in the English speaking Caribbean. Consumers can now access the Internet through dial-up connections, cyber cafes, schools, offices and kiosks (Net Kiosks Online, 2000). Most Islands now have at least one local Internet Service Provider, and the bigger territories have up to ten. Competition between the ISPs is fierce and prices have declined rapidly (Net War Heats Up, 2000) in the late-1990s before stabilizing.

Credit Cards

Consumers in the English speaking Caribbean were also able to open local credit card accounts for the first time during the 1990s. Visa International's Web site indicates that, as of March 31, 2004, the company had over 125 million credit card accounts in Latin America and the Caribbean (<http://corporate.visa.com/mc/stats/statistics-cardsissued.shtml>).

LITERATURE REVIEW

Information Asymmetry and Buyer Search Costs

One of the most powerful effects of the Internet is in its ability to reduce information asymmetry by lowering buyer search costs. Information asymmetry is thought to occur when one party to a transaction has more relevant information about

that transaction than the other party (Akerlof, 1970). While Akerlof's initial original article focused on asymmetric knowledge as it relates to quality, we can almost certainly apply his analysis to asymmetric knowledge as it relates to prices in different markets.

Buyer search costs refer to the cost incurred by the buyer to locate potential sellers, product information and pricing. These search costs include expenditure on driving to retail outlets, telephone calls, magazine subscriptions and the opportunity cost of the time spent searching (Bakos, 1997). The premise is that information and communications technology decreases search costs, allowing customers to easily compare prices from various potential suppliers (Bakos, 1991). Thus the reduction in buyer search costs leads to reduced information asymmetry which in turn should lead to more intense price negotiations, and correspondingly lower prices.

Several possible scenarios can be anticipated. First, the Caribbean consumer discovers that a product (called A) sold in a retail outlet in the Caribbean for X can now be purchased online for .3X (inclusive of shipping and handling). Second, the consumer discovers a superior grade of the product (B in this case) not available for sale in Caribbean retail outlets but available online for the same price as A retails for in the nearest shopping center. The consumer is then faced with four possible alternatives. First, she can choose to purchase at the local retailer knowing that she is probably not getting a good price. Second, she can forgo purchasing the item altogether. Third, she can bypass the Caribbean retailer and purchase from an American retailer. Finally, she can negotiate with her local retailer for a better (lower) price or better quality. Options two and three leave the retailer with no sale. Option 4 results in a sale but at a reduced price and perhaps reduced profit margin. Option 1 preserves the status quo, but may leave the consumer dissatisfied.

Recent work in the insurance industry suggests that the Internet has reduced prices (premiums) for term life insurance policies, a fairly homogenous product by 8% to 15% “*and increased consumer surplus by \$115-215 million per year*” (Brown & Goolsbee, 2000).

These studies concentrate on developments in the United States. There is a dearth of literature of similar studies carried out in the developing world in general or the Caribbean in particular. However, it seems reasonable to assume that Caribbean businesses and consumers are using the Internet to search for information relating to planned purchases. Prior to the Internet, the primary source of information on a wide variety of products and services would have come from the local distributors/agents and producers. Finding “off island” sellers and comparing prices would have required expensive long distance phone calls, faxes, and sometimes even site visits.

Some of the primary questions relating to downward pricing pressure include the following:

1. To what extent have prices paid by Caribbean consumers and businesses for various goods and services declined as a result of Internet access?
2. If there have been price declines, are they fairly uniform over industry, or do they vary from industry to industry?
3. Do Caribbean buyers perceive that they now have more power to negotiate lower prices vis-à-vis traditional suppliers, given increased access to information?
4. Are regional firms aware of any downward pricing pressure and, if so, have they attributed this development to reduced information asymmetry in favour of the buyer?

Channel Disintermediation

The threat of disintermediation is another issue facing Caribbean companies. Option 3 above

specifically refers to this threat. Recent business and academic literature has focused on the ability of producers and consumers to conduct transactions directly with each other, thus doing away with intermediaries in the supply chain. The rationale was that as the Internet dramatically lowered transaction and search costs, consumers and producers would now find it economical to do without intermediaries (Gellman, 1996).

Subsequent studies suggest that Gellman’s hypothesis is only partially correct (Brown & Goolsbee, 2002). What seems to be happening is that while some traditional intermediaries become less relevant (Traditional Travel Agents), new intermediaries are springing up in many industries—for example, Expedia.com and Travelocity. Reintermediation is the term applied to the emergence of new intermediaries based on the Internet. What seems to be occurring is that existing business processes and business models are being challenged by more efficient variants. Firms that are able to use the Internet to improve business processes and value systems will prosper. Firms that cannot will disappear over time.

The question then is will Caribbean companies, with limited financial, human and technological resources, be able to evolve quickly enough to adapt to a more competitive environment?

Studies on disintermediation have focused on the United States and other developing countries. A search of the EBSCO Host Business Source Premier and Academic Search Premier databases yielded 219 references to the term “disintermediation” but not one of them referred to developing nations.

However, Coulthard (2000) reported that studies in Australia indicate that while electronic commerce yielded “unequivocal” benefits for 30 out of 57 regions, 24 out of 57 experienced an increase in economic activity, but a decrease in employment. The remaining three experienced declines in economic activity and employment. In trying to explain the differences, Coulthard

cites the study conducted by Australia's National Office of the Information Economy which states that, "*What matters is the composition of the region's underlying economy...regions more dependant on just a few key activities are vulnerable to an overall contraction as a result of greater use of eCommerce*" (Coulthard, 2000, p. 2, italics added).

Coulthard seems to attribute this decline to the disintermediation of companies located in small regional towns in rural Australia. While Australia on the whole is significantly more developed than many Caribbean nations, rural Australia probably shares several traits with the islands of the Caribbean. The most important of these is a reliance on a few industries for employment and earnings—primarily farming, mining and tourism.

Some of the preliminary questions relating to disintermediation include the following:

1. Is disintermediation taking place in the Caribbean?
2. If so, what industries are most vulnerable?
3. What industry attributes raise the risk of disintermediation and what attributes lower the risk?
4. Do local companies perceive that they are losing market share to their suppliers or to larger "hypermediaries"?

Not All Bad

Despite the gloomy scenarios described above, some Caribbean companies will benefit from the diffusion of the Internet throughout the region. There are many success stories on www.developmentgateway.org pointing to individuals and companies throughout the world that have been able to develop export markets through contacts made over the Internet. Like UNCTAD (2001), The United Nations Development Programme in its Human Development Report 2001 highlights the many ways in which the Internet can ben-

efit companies in developing countries (UNDP, 2001).

The United Nations, the World Bank, and many other development agencies focus primarily on export development. However, Caribbean companies who choose to focus on their own domestic markets can also benefit from the Internet. These companies, like consumers, benefit from a reduction in information asymmetry brought about by lower search costs. Consequently, they can source higher quality goods at lower costs and at lower expense. To the extent that selling prices in the domestic market remain stable, these lower costs translate to higher profitability. If regional companies pass these savings onto consumers, as they are likely to do in a competitive environment, then consumer welfare improves.

A key question that arises, however, is that even with these benefits, can Caribbean companies reduce costs, improve assortment and convenience quickly enough to compete with the giants corporations in North America, Europe and Asia?

CONCLUSION

Regional investments in ICT and the diffusion of the Internet in the English speaking Caribbean when considered alongside the literature on the effects of reduced search cost and information asymmetry suggest that there is the potential for negative impacts in the profitability of Caribbean business organizations. However, while the potential for negative side effects are prevalent, the author is not aware of any attempts to study these phenomena in any detail.

Promising areas for future research include:

1. Longitudinal studies on consumer and business attitudes about, and use of the Internet for, pre-purchase research on an island-by-island basis. These studies will show changes over time and regional variations between countries.

2. Comparisons of prices paid by Internet users versus those paid by non-users in selected product and service categories.
3. Longitudinal market share studies in selected product and service categories. These studies will assist in determining if regional businesses are being squeezed out of the value chain.

Without the data provided by these types of studies, economic policy makers and business executives will have an incomplete understanding of the full impact of electronic commerce in the Caribbean.

REFERENCES

- Akerlof, G.A. (1970). The market for 'lemons': Quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 84(3), 488-500.
- Bakos, J.Y. (1991). A strategic analysis of electronic marketplaces. *MIS Quarterly*, 15(3), 295-310.
- Bakos, J.Y. (1997). Reducing buyer search cost: Implications for electronic markets. *Management Science*, 43(12), 1676-1692.
- Brown, J.R., & Goolsbee, A. (2002). Does the Internet make markets more competitive? Evidence in the life insurance industry. *Journal of Political Economy*, 110(3) 481-507.
- C&W Deal Signals New Investments. (1999, October 1). *The Jamaica Gleaner* [Kingston]. Retrieved August 6, 2004, from <http://www.jamaica-gleaner.com/gleaner/19991001/f3.html>
- Coulthard, D. (2001). eCommerce and the region: Not necessarily an unequivocal good, *e-everything: e-Commerce, e-Government, e-Household, e-Democracy: Proceedings of the Fourteenth Bled Electronic Commerce Conference* (pp. 419-431). E-normous role in Ja for Net. (2000, June 28). *The Jamaica Gleaner* 9 [Kingston] Retrieved August 6, 2004, from <http://www.jamaica-gleaner.com/gleaner/20000628/Lead/Lead5.html>
- Gellman, R. (1996). Disintermediation and the Internet. *Government Information Quarterly*, 13(1), 1-8.
- Net Kiosks Online. (2000, April 20). *The Jamaica Gleaner* [Kingston]. Retrieved August 6, 2004, from <http://www.jamaica-gleaner.com/gleaner/20000420/business/b3.html>
- Net War Heats Up. (2000, August 11). *The Jamaica Gleaner* [Kingston]. Retrieved August 6, 2004, from <http://www.jamaica-gleaner.com/gleaner/20000811/Business/Business1.html>
- TSTT to Spend \$540 Million on Upgrade. (1998, July 24). *Trinidad Express* [Port of Spain]. Retrieved January 10, 2003, from <http://209.94.197.2/july/july24/finance.htm>
- United Nations Conference on Trade and Development. (2001). *E-Commerce and Development Report 2001*. Geneva: Electronic Commerce Branch, Division for Services Infrastructure for Development and Trade Efficiency, UNCTAD. Retrieved August 6, 2004, from http://r0.unctad.org/ecommerce/docs/edr01_en.htm
- United Nations Conference on Trade and Development. (2002). *E-Commerce and Development Report 2002*. Geneva: Electronic Commerce Branch, Division for Services Infrastructure for Development and Trade Efficiency, UNCTAD. Retrieved August 6, 2004, from http://r0.unctad.org/ecommerce/ecommerce_en/edr02_en.htm
- United Nations Conference on Trade and Development. (2003). *E-Commerce and Development Report 2003*. Geneva: Electronic Commerce Branch, Division for Services Infrastructure for Development and Trade Efficiency, UNCTAD. Retrieved August 6, 2004, from http://r0.unctad.org/ecommerce/ecommerce_en/edr03_en.htm

United Nations Development Programme. (2001). *Human development report 2001: Making new technologies work for human development*. New York: Oxford University Press.

Welcome to the Land of Pan, Calypso and now the Internet. (2000, January 24). *Trinidad Express* [Port of Spain]. Retrieved January 11 2003, from <http://209.94.197.2/jan00/jan24/finance.htm>

KEY TERMS

Buyer Search Costs: The financial, time and psychic costs incurred by a buyer as he or she searches for any type of information on a prospective purchase. These could include trips to the mall, telephone calls, purchase of reviews, etc.

The Caribbean: Also known as the West Indies, refers to a group of islands that border or are near the Caribbean Sea. This archipelago stretches southeastward from Florida to the north eastern coast of Venezuela. The Bahamas, Turks and Caicos and Guyana, though not geographically adjacent to the Caribbean Sea, are normally considered part of the Caribbean due to shared history, culture, language, etc.

Disintermediation: Disintermediation refers to the removal of intermediaries from the Supply Chain. The possibility of disintermediation is said to occur when there is market transparency and the final buyers become aware of manufacturers' prices intermediaries.

Electronic Commerce: Electronic Commerce refers to the buying, selling and servicing of goods over computer networks. These networks can be either public, such as the Internet, or private, such as the private Electronic Data Interchange (EDI) systems used by large companies.

Information and Communications Technologies: ICT refers to the computing and telecommunications hardware and software used to capture, process, transfer and store data.

Information Asymmetry: A situation where one party to a transaction has more information than another party. In many cases it is the seller who has more and better information about the quality and underlying costs of a product than the buyer.

Internet: A global public network that utilized the TCP/IP protocols to transfer data from one computer to another. The Internet is often referred to as a 'network of networks' as it is made up of thousands of smaller privately owned networks.

Reintermediation: The process of using ICT technologies to identify and exploit new intermediary roles in the supply chain. Reintermediation strategies are often based on providing superior service or convenience to buyers. New intermediaries that have taken advantage of the Internet to build large organizations include Amazon.com, eBay and iTunes.com. Reintermediation is often seen as the opposite of disintermediation.

ENDNOTES

- ¹ Source: Population projections for 2003 were published in *World Population Prospects: The 2000 Revision*.
- ² Source: United Nations, National Accounts Statistics: Analysis of Main Aggregates, 1998-1999, (Series X, United Nations publication, annual) and United Nations, Statistical Yearbook, (Series S, United Nations publication, annual). In order to have comparable coverage for as many countries as possible, the official GDP national currency data are supplemented by estimates prepared by the Statistics Division, using additional data from national and international sources.
- ³ Source: Table A.27 of the United Nations publication *World Population Prospects: The 2002 Revision* (United Nations publication). See also: <http://esa.un.org/unpp>.

- ⁴ Source: United Nations, Statistical Yearbook (Series S, United Nations publication, annual).
Supplementary data obtained from AAMA Motor Vehicle *Facts and Figures 1997* (Detroit, USA) and Auto and Truck International, *1999-2000 World Automotive Market Report* (Illinois, USA).
- ⁵ Source: International Telecommunications Union, *World Telecommunication Development Report 1999-2001*. See also: <http://www.itu.int/ITU-D/ict/statistics>.
- ⁶ Source: International Telecommunication Union, *World Telecommunication Indicators* (Geneva 2002) See also: <http://www.itu.int/ITU-D/ict/statistics/>.
- ⁷ Source: World Bank EdStats, Global Country Data, Summary Educational Profiles (<http://devdata.worldbank.org/edstats/cd1.asp>). Latest Date for 1995.
- ⁸ Source: World Bank EdStats, Global Country Data, Summary Educational Profiles (<http://devdata.worldbank.org/edstats/cd1.asp>). Latest Date for 1995.
- ⁹ Source: World Bank EdStats, Global Country Data, Summary Educational Profiles (<http://devdata.worldbank.org/edstats/cd1.asp>). Latest Date for 2000.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 79-84, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.7

Technology Leapfrogging in Thailand

Louis Sanzogni

Griffith University, Australia

Heather Arthur-Gray

Griffith University, Australia

TECHNOLOGY LEAPFROGGING

The phrase “leapfrogging development” reflects the belief, especially in the 1980’s, among policymakers and theoreticians that information technologies, especially telecommunications, can help developing countries accelerate their pace of development or telescope the stages of growth (Singh, 1999).¹

The telecommunications literature uses the word “leapfrogging” in three ways:

- First, it is meant to imply that telecommunications can help developing countries skip over the stages of development and become members of a post-industrial society.
- Second, leapfrogging is used in “an engine of growth” sense to mean that telecom-

munications can help developing countries accelerate their pace of development².

- Finally, leapfrogging is used in a technical sense to signify skipping over the technological frontier or product cycle³.

Often the word leapfrogging is used interchangeably referring to both technical and economic “leaps”⁴ (Singh, 1999), usually though the two are interdependent. The term “Technology Leapfrogging” is also being used to describe the phenomenon that is being seriously and widely considered in the developing world with countries such as Egypt, Malaysia, Thailand, Canada and Bangladesh having gone or going through the experience at the moment (Davison, Vogel, Harris & Jones, 2000).

PROMISE OF ICT-DRIVEN GROWTH

The possibility of developing countries leapfrogging has come about through the progressively lower cost of technologies and the user friendliness that is allowing the development and implementation of systems that would otherwise be unavailable to them (Weiss, 1994). Further, “economic and social progress has forged in South East Asia (SEA) a perception of growth previously unparalleled in human history” (Lander, 2000). There is an inevitability in SEA that ICT-driven economic expansion will simply occur because of the size of the population, “which is young, well-educated and with rising incomes” (Lander, 2000). It can be further suggested that the expanding market and the use of high-tech devices are interpreted as cultural systems that are used in the construction of modernity and that the economic and social focus of the South East Asian nations is on market corporatism, market socialism and high tech developmentalism” (Boyd, 2002). Asian Tiger countries have been pursuing a number of projects that use Technology Leapfrogging to surge forward in this development and economic race, to rescind the ever-growing gap between the developed and developing countries (Gray & Sanzogni, 2004).

Availability of funds in the South Asian region has attracted \$4.196 billion (2.5% of total FDI) (Saidi & Yared, 2002). However, it is unclear how many countries fully appreciate the need for a coordinated effort across all sectors in terms of the implementation of an ICT-based commerce strategy. Such an implementation represents a considerable challenge requiring integration of technology, law, policy, business processes and skilled people (Keretho & Limstit, 2002). But that’s not all. A major problem facing developing nations is the lack of a sound telecommunication infrastructure which forms part of the basic building block for a modern ICT-based socio-economic infrastructure (Davison et al., 2000).

The close relationship of communication networks and development is one of the reasons that investment in communications has become a priority for so many governments. Only 5% of the population in developing countries has access to the Internet. With the measure of telecommunication access expressed as teledensity, we note that 50/100 people have telephones in the developed world against 1.4/100 in developing world (Tipton, 2002). In Asia the lag in provision of a basic telephone service was starkly illustrated by a report estimating only 10% of the 500 million telephones in the world were in Asia in 1991 (Asia Money, 1991; Larson, 1995). ICT has good potential to create (via communication) social and economic networks leading to advances in development. However, lack of ICT implementation not only runs the risk of an economic divide, but also a political divide with people being potentially cut off from participation in future economic activities beyond regional boundaries.

Further clouding the issue, there is no clear evidence, according to economists, to support the belief that ICT can create growth. There is also indication (Tipton, 2002) that difficulties in measuring success in ICT solutions increase when moving from the private to the public sector as there is lack of a framework of analysis (ultimately the P&L). Other difficulties cited are of a cultural nature, such as the resistance to systems leading to greater transparency and accountability, as in developing countries there are cultures of subterfuge, gifts in exchange of favours, etc.

NATIONAL FRAMEWORKS FOR “TECHNOLOGY LEAPFROGGING” DRIVEN DEVELOPMENT

Ultimately however, governments recognise the need to enhance physical and knowledge infrastructures to improve competitiveness. ICT solutions are seen as a strong central to enabler of these initiatives and successes in some countries in

Technology Leapfrogging in Thailand

the region give an optimistic outlook to leapfrogging implementations. Chalmers Johnson's study of Japan and later Weiss', Evans', and Wade's studies of South Korea, Taiwan and Singapore, all identified models of governments intervention for the fast-paced introduction of ICT (Tipton, 2002). These studies contributed to the identification of "pilot agencies" whose successful drive of ICT implementation stood out as good examples to follow. The respective agencies are Japan's Ministry of International Trade and Industry (MITI), South Korea's Economic Planning Board (EPB), Taiwan's Council for Economic Planning and Development (CEPAD), and Singapore's Economic Planning Board (EPB). Tipton (2002) attributes the ICT implementation successes of these nations to:

institutionalised position and organisational structure. They are elite institutions, attracting high-quality staff, possessing a high degree of cohesiveness and strong sense of commitment to national goals. They are not large bodies, but have adequate staff and independent funding that provides sufficient resources to achieve their mission. They possess powerful capabilities for assembling and analysing data, giving them insight into both current conditions and possible future directions of development. They are 'insulated' from direct contact with industry groups, but they are not 'insular' or isolated from the concerns of their constituents. This can be achieved organisationally by a combination of 'horizontal' departments responsible for overall policy and 'vertical' departments concerned with particular industries, but it depends to a large degree on the acknowledged expertise of the officials and their resulting prestige in dealing with industry groups. They are also insulated from short-term political concerns. They do not depend on politicians for their positions, and they must be able to resist pressure from politicians whose interest may clash with long-term approaches to economic policy.

Pilot agencies traditionally have performed two tasks:

- The provision of advice on policy development.
- Administrative responsibilities for the deployment of funds into specific industries for the introduction of new technologies whose benefits are judged to have the greatest probability of a beneficial spill-over effect into the economy as a whole.

It is important to note that while these agencies played and play a significant role in terms of policy development and technology implementation at the national level some, as in the case of Singapore's EPB, also helped in paving the way for foreign investment and the positioning of local offices of foreign firms with special emphasis on high tech.

We now turn our attention to two particular economies, namely South Korea and Thailand and draw comparisons in terms of leapfrogging success. Both these countries have emerging economies and plans to become leaders in the region by investing heavily in ICT. However we note that one economy is still essentially in reactive mode responding to issues and circumstances as they arise, while the other has adopted strategically-based proactive initiatives in order to promote and retain business investment. Mashelkar (2003) in his address to the Royal Society (10th Zuckerman Lecture) clearly elucidates the difficulties and promises that the introduction of a dynamic economic environment (such as in Singapore) can bring to developing nations.

South Korea

South Korea's successful initiatives leading to the transformation of its communications industries and environment are a great example of technology leapfrogging, which included infrastructure

development, technological progress, growth of its electronics industries, regulatory changes and changes in media culture and habits of the Korean people (Larson, 1995). Larson's (1995) study expounds the processes that South Korea utilised to advance to an information society, indicating teledensity increased faster than any comparable country in the world from 1978 to 1990. This rapid telecommunications network development during the 1980's attracted a great deal of attention because it occurred in a developing country. Accordingly many policy makers and industry experts believe that a modern telephone network is a prerequisite for development (Larson, 1995).

Korea's high level of literacy and high participation in education is seen as a prerequisite for the success rate enjoyed by ITC-based technologies. So much so in fact that today its knowledge and information industry plays a significant role in the nation's economy. Other significant factors in Korea's Internet access growth point to:

- The explicit introduction of Korean content on the Internet (a policy also adopted by Thailand).
- The release of broadband Internet access to facilitate streaming, gaming and e-commerce.
- Fibre-optic backbones across the country.
- Sound international connectivity that stood at 5.2 Gbps as of December 2001.
- The lowest broadband access prices in the world.
- Mobile/Internet numbering integration to facilitate mobile Internet.

Korea is now ready to move from e-readiness to e-nation since implementing a number of e-government projects. In 200 all government agencies and ministerial offices were connected to the Internet via high-speed backbone. About 80% of official documents are in digital form

with a 60% rate of document handling over the Internet. Property titles and owner registration is now handled online, as are births, deaths, marriages and divorces with citizens able to access and alter records online.

Korea's ICT success factors are:

- A National Project Evaluation to allow the government to put achievements into an international perspective, and also the comparison of different government strategies.
- An evaluation system for national IT projects composed of government officials as well as academics and experts from research organisations and industry.
- Research and development in the field of electronics and telecommunication, policy and vision for a knowledge-based society.
- Universal access as a direct challenge to the digital divide with goals to furnish every region in the country with broadband access.
- The distribution and supply of PCs with Internet access to children of low-income families and the availability of Internet access in public places.
- Right environment for ICT implementation and operation with the support of just legislation in the form of cyber laws and a secure operating environment.
- Learning from and sharing with others through a liberal dissemination of reciprocal experiences through conferences, workshops, forums, etc.

From the evidence, Korea's approach to ICT's successful implementation as a technology leapfrog should be seen in terms of a national enabler across all significant sectors and thus (in Korea's case at least) the ICT leapfrog appears to have achieved the status of a leapfrogging technology.

Thailand

In the case of Thailand Information Communication Technology (ICT) developments are divided into two diverse yet related areas (Technology and Telecommunications, respectively), which are fundamental for progressing Thailand into a post-industrial nation. Those technologies more specifically relate to the development of telecommunication and Internet infrastructures within the nation (Gray & Sanzogni, 2004). The National Information Technology Committee (NITC) oversees Thailand's ICT initiatives at the national level through a number of sub-committees.

Historically, in the early-1980s there were two state enterprises managing Thailand's telecommunications, the Telephone Organization of Thailand (TOT) and the Communications Authority of Thailand (CAT), providing a limited service of two telephones per 100 people (Corey, 1995; Weiss, 1994). The Asian Technology Information Program (ATIP) on IT&T in South East Asia conference 1995, reported that "Thailand has critical telecommunications infrastructure needs," indicating Thailand's national plan to add 8 million telecommunications lines by 2001 with a further goal to increase the lines per 100 people from two to 20 early in the new century. They estimated the growth demand at 600,000 lines per year (Corey, 1995). TOT estimated in 1996 that demand would rise to 800,000 (Palasri, Huter & Wenzel, 1999). Projected estimates for telecommunications installations were high in 1999, although this positive progression would have been significantly effected by the economic crash in 1997. These targets have not been met, according to the National Statistical Office of Thailand, which reports in the Thailand Development Indicators Report of 2003 (Ministry of Information and Communication Technology, 2003) that only 9.6 people per 100 people in the population had telephones, with a ratio of only 3.89 per 100 people having mobile phones. These figures are

no longer being distorted, as they are now being reported as separate telecommunications devices. Additionally another high-profile project, the SchoolNet project, seems to have stalled from an initial indication of 5,000 schools having Internet access by the year 2001 to only 4,794 reported as being online as of October 2004, after which there has been no further reporting (Ministry of Transport and Communications, 2001).

In 2000 Thailand's cabinet directed the National IT Committee to study e-ASEAN, a framework established in November 2000 by ASEAN (Association of South East Asian Nations) to facilitate the set up for an information-sharing medium, with a view to make recommendations with particular emphasis on e-services, e-government, and e-trade (<http://www.aseansec.org/11499.htm>). Thailand is pushing strongly for an e-Thailand identity as a forerunner to full participation in the global electronic marketplace. The formulation of Thailand's IT draft policy "IT 2010 (2001-2010)" signals Thailand's intention to move toward a knowledge economy. Within the course of the decade Thailand intends to move from a position of "Dynamic adopter" to "Potential Leader" with fully embraced and mature ICT-based technologies (Tipton, 2002).

To date, it appears that although Thailand had established an aggressive commitment to reform in the 1980's under the guidance of the then Prime Minister Prem Tinsulanonda, lack of recent coherent policy leadership since Prem Tinsulanonda left office in 1988 seems to have left a void where a comprehensive national IT policy is required (Corey, 1998) to aggressively utilise technology leapfrogging and make the significant funds available to develop the telecommunications network throughout Thailand in order to avoid a looming expansion of the digital divide. There is evidence that population reach is not good and far from uniform. Telephone lines per capita are still low, e-government initiatives are lagging behind and the education systems is still struggling to get

online or produce graduates to drive the economy. There is an ongoing need to promote e-commerce as a trading tool, which can be taken as a sign that it has not been taken up (seemingly due to lack of adequate supporting technical infrastructure, although negotiations are occurring in terms of further broadband development) (World IT Report, 2003). The harmonisation of cyber laws across trading partners is still in its infancy and, although on the National's IT committee agenda, quick progress is not expected in terms of an implementation across ASEAN trading partners (Bernama, 2003).

CONCLUSION

In concise terms (given the discussion thus far), the measure of success for an ICT leapfrog should be its pervasiveness throughout the nation's population, with clear, uniform support across its ethnic, social, cultural, economic, religious and political groups, men and women, the rich and poor, and the young and the old. ICT should thus be seen as an enabler of a national and eventually global epistemology model that is emergent, liberating, pluralistic and participatory on the world stage. With this mindset a nation can reap the full benefits of an ICT leapfrog, as ultimately it will have created a firm opportunity for the populous to inform and be informed at will.

Although Thailand is pursuing initiatives that have good potential as both technological (ICT) and economic (e-business, e-government, e-education and e-commerce to name some) drivers, the impetus seems to have stalled somewhat. The culprits seem to be inadequate funding, key committees under political jurisdiction, and a shortage of local experts and professionals (outside the political system) to drive the leapfrog (Tipton, 2002; World IT Report, 2003; ITU, 2003).

REFERENCES

- Anonymous. (1991). Asia: Telecommunications-wired for funds. *Asia Money*, 40-45.
- Bernama. (2003, July 28). *M'sia-Thailand To Set Up Joint Committee for ICT Development*, p. 1.
- Boyd, J. (2002). *e-Commerce in developing nations*. *TCOM*, 640. Retrieved from <http://206.208.128.3/jboyd/tcom640/Papers/jboydecommercein3rdWorld.htm>
- Corey, K. E. (1995). *ATIP95.25 : IT & Telecom in SE Asia*. Tokyo: Asian Technology Information Program (ATIP). Retrieved July 30, 2004, from <http://www.atip.or.jp/public/atip.reports.95/atip95.25r.html>
- Corey, K. E. (1998). *Information technology and telecommunications policies in southeast Asian development: Cases in vision and leadership*. In V. R. K. Savage, and W. Neville (Eds.), *The Naga awakens: Growth and change in southeast Asia* (pp. 145-200). Singapore: Times Academic Press.
- Davison, R. M., Vogel, D. R., Harris, R. W., & Jones, N. (2000). Technology leapfrogging in developing countries-An inevitable luxury? *EJISDC*, 1(5), 1-10. Retrieved from www.ejisd.org
- Gray, H., & Sanzogni, L. (2004). Technology leapfrogging in Thailand: Issues for the support of eCommerce infrastructure. *EJISDC*, 16(3), 1-26. Retrieved from www.ejisd.org
- ITU Report. (2003). *Broadband Korea: Internet case study*, March. Retrieved July 30, 2004, from http://www.itu.int/ITU-D/ict/cs/korea/material/CS_KOR.pdf
- Keretho, S., & Limstitt, P. (2002). *e-Commerce: The way of business in Thailand*. Paper presented at the Workshop on Electronic Commerce Policy and Regional Cooperation, Bangkok, Thailand.

Technology Leapfrogging in Thailand

Retrieved July 30, 2004, from <http://www.ecommerce.or.th/APEC-Workshop2002/ppt/pdf/ecway-businessinThailand.pdf>

Lander, M. (2000). *In China, Malaysia and Singapore, freedom and control dance a digital minuet*. Retrieved April 30, 2004, from <http://webenhanced.lb.cc.edu/ibus30kf/ecommerce>

Larson, J. F. (1995). *The telecommunications revolution in Korea*. Oxford: Oxford University Press.

Mashelkar, R.A. (2003). National building through science & technology: A developed world perspective. 10th Zuckerman Lecture. Royal Society, London. Retrieved July 31, 2004, from <http://www.nifindia.org/events/ZUCKERMANLECTRURE.pdf>

Ministry of Information and Communication Technology. (2003). *Thailand Development Indicators 2003:83* Bangkok: National Statistical Office. Retrieved July 30, 2004, from <http://www.nso.go.th>

Ministry of Transport and Communications. (2001). *Thai Telecommunication Background*. Vol. 2004: ITU (International Telecommunication Union Regional Office for Asia Pacific). Retrieved July 30, 2004, from http://www2.itu.or.th/coe/tm/main_frame_Bgro und. html

Palasri, S., Huter, S., & Wenzel, Z. (1999). *The history of the Internet in Thailand*. University of Oregon Books.

Saidi, N., & Yared, H. (2002). e-Government: Technology for good governance, development and democracy in the MENA countries. Retrieved July 30, 2004, from <http://www.worldbank.org/mdf/mdf4/papers/saidi-yared.pdf>

Singh, J. P. (1999). *Leapfrogging development?: The political economy of telecommunications restructuring* (1st ed.). Albany, NY: State University of New York Press.

Tipon, F. B. (2002, April). Bridging the digital divide in Southeast Asia: Pilot agencies and policy implementation in Thailand, Malaysia, Vietnam, and the Philippines, *ASEAN Economic Bulletin*, 19(1), 83-99.

Weiss, E. (1994). Privatization and growth in Southeast Asia. *Telecommunications*, 28(5), 95-99.

World IT Report. (2003). *Thailand's ICT Minister Calls for eGovt Agency*, p. 1.

KEY TERMS

ASEAN: Association of Southeast Asian Countries.

ATIP: Asian Technology Information Program.

CAT: Communications Authority of Thailand.

E-ASEAN: A concept capturing the essence of the intent to establish electronic links at all levels between ASEAN countries.

E-Business: A concept capturing the essence of conducting business by electronic means in addition to or as a substitute for a physical location (bricks and mortar). E-business (electronic business) is, in its simplest form, the conduct of business on the Internet. It is a more generic term than e-commerce because it refers to not only buying and selling but also servicing customers and collaborating with business partners.

E-Commerce: A concept capturing the essence of carrying out commerce by electronic means. E-commerce (electronic commerce) refers to the buying and selling of goods and services on the Internet, especially the World Wide Web. In practice, this term and a newer term, e-business, are often used interchangeably.

E-Education: A concept capturing the essence of carrying out education by electronic means.

E-Government: A concept capturing the essence of carrying out the business of government by electronic means including the delivery of public services, and voting (in some instances).

P&L: Profit and Loss statement.

SEA: South East Asia.

TOT: Telephone Organization of Thailand.

ENDNOTES

- ¹ Stages of growth argument go back to Rowstow (1960), who postulated that economies go through specific stages from the feudal to the industrial age with a short “take-off” stage lasting two to three decades propelling developing societies into industrialization. For its use in the leapfrogging sense (see Karunarante, 1982, p. 212, Singh, 1999) *Leapfrogging Development: The Political*

Economy of Telecommunications Restructuring (1st ed.). Albany, NY: State University of New York Press.

- ² The idea of accelerating the pace of development through newer technologies and state-led mechanisms goes back to Gerschenkron (1962). For its application in telecommunication literature (see Bruce, 1989, p. 45). Singh, J. P. (1999). Leapfrogging Development?: *The political economy of telecommunications restructuring* (1st ed.). Albany, NY: State University of New York Press.
- ³ See Nutly (1989 p. 10); Fredebeul-Krein and Freytag (1997 p. 478). Singh, J. P. (1999). Leapfrogging development? *The political economy of telecommunications restructuring* (1st ed.). Albany: State University of New York Press.
- ⁴ Soete (1985). Singh, J. P. (1999). Leapfrogging development: *The political economy of telecommunications restructuring* (1st ed.). Albany, NY: State University of New York Press.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 671-676, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.8

An ICT Enabled “Community” in Rural Nigeria and the UK

Pamela McLean

Cawdnet (CAWD)¹ and Dada McLean Ltd.², UK

INTRODUCTION

Development initiatives in Nigeria tend to be delivered down through layers of administration, from federal government, to state government, to local government, before they get implemented. Often developments are concentrated in urban areas rather than rural communities.

CawdNet¹ aims to link top-down research and development initiatives with people at the rural grassroots, not just through NGOs working with the “grassroots” community, but also by opening up existing communication channels amongst farmers, women, teachers, health workers, and young people, and integrating them into the communication channels of the connected community (McLean & Johnson, 2004). CawdNet³ has worked across the digital divide in its internal organisation, since 2001. Increasingly CawdNet is looking outwards and as a result members of the rural communities and members of various “connected communities” are becoming directly involved in these information flows.

THE CONTEXT OF CAWDNET: THE WORK AND WORKERS

CawdNet is an informal group, a “community,” whose existence has been enabled through Information and Communication Technology (ICT). The core members of CawdNet collaborate on work concerned with farmers, women, micro-credit, livelihoods, youth, health, education and other aspects of community development. The CawdNet core members are from Oke-Ogun Community Development Network (OCDN), Fantsuam Foundation (FF) Rural Searchlight (RUSEL) and CAWD volunteers. Although most of the core members are in local community development organisations in rural Nigeria, there are two CAWD volunteers in the UK, who act as a (proactive) link between the Internet and CawdNet in Nigeria. All CawdNet core members in Nigeria have some kind of e-mail link with CAWD volunteers, even if their access to e-mail can only happen infrequently because of difficult journeys to a cyber cafe.

There are very few paid "CawdNet workers."⁴ Most work with their CawdNet organisations happens "as and when" that work can be fitted in around other responsibilities and "day jobs." All CawdNet workers, except for the CAWD volunteers, are active in rural Nigeria.

"CawdNet friends" are comprised of individuals, groups or organisations that are helping (or have helped) to forward CawdNet's work in some way. Friends may have a formal or informal relationship with CawdNet, or with one or more of the organisations it represents. Many CawdNet friends are engaged in some kind of information exchange, free of charge, which enhances CawdNet's work. Free information exchange can range from someone sending occasional e-mails, with advice or information, to a graduate student working with the project for weeks or months at a time. Some friends help in cash or in kind. Voluntary Service Overseas (VSO) has been a much-valued friend in this way, but information is a more usual form of help. Most, but not all, of the CawdNet friends who give information are involved in some aspect of development in a professional full-time way. Some are exploring ways to collaborate on various planned projects.

Acquaintances of CawdNet are those we know less well, familiar names from discussion lists, or contacts at face-to-face meetings, people we have exchanged ideas with in a public way, who have helped to influence our thinking, but not in the personal, specifically "CawdNet directed" way of friends.

CawdNet, ICT AND COMMUNICATION

CawdNet's initial existence and subsequent development is totally an outcome of ICT. It is not a traditional organisation or group where communication, and the relationship to information, is simply enhanced by ICT. Without e-mail CawdNet could not have come into being. Without the In-

ternet, CawdNet could not have learnt so much about the "development world" of which it is a part. Without mailing lists and discussion groups CawdNet could not have started to make a place for itself within the wider context of the "development world." It could not have established many of the relationships that it values highly. Without those relationships, and the opportunities afforded by e-mail, it would not be exploring the various collaborative projects on community development that are currently under consideration.

CawdNet uses e-mail for internal communication. This is not desk-to-desk office e-mail communication. CawdNet workers typically have to travel to cyber cafes to send e-mails. This is necessary because their community work is based beyond the reach of the telecommunications infrastructure. VSAT links are making e-mail increasingly available. This means that access is gradually improving, regarding distances travelled, but expense is still a great barrier. As e-mails become easier for more people to send, there is a gradual increase in information exchange in the CAWDNET network. Also with increased access, more CawdNet workers, beyond the CawdNet core members, are communicating with CAWD volunteers. This improves the quality and quantity of information exchanged between the rural areas and the connected community.

The CAWD volunteers in the UK began their work through links of friendship with Peter Adetunji Oyawale, not through prior knowledge of the development initiatives. Hence there was a need for extensive effort to learn about the Nigerian development issues using e-mail and the Internet, which is supplemented by "on the ground" understanding in Nigeria. For most CawdNet workers in Nigeria, surfing the Net is excruciatingly slow and prohibitively expensive. Therefore, the CAWD volunteers undertake Internet work for other CawdNet workers and the communities they serve. The resulting information is forwarded by e-mails and on CD-Roms. Using such processes volunteers are often able to

find out about free material that can be supplied to them and which they would not otherwise have known about if they had relied upon traditional government services.

The e-mails to CAWD volunteers from the community are currently both short and few in number, but this traffic is increasing as access, knowledge and trust increase. It is important to understand that to the volunteers every e-mail is significant not just for what it says, but also for what it represents. The two following examples give some context to this:

1. The farmer society of Ago-Are are progressing and we are preparing for harvesting of yam and maize. Mr. Oyawale also said you should help him greet the Oyawale's family over there. Bye.

To the volunteers a personal greeting such as this plus a sentence about the harvest represents the very first report from the Farmers' SIG (Special Interest Group). It is evidence that the representatives of this group are trying to keep in touch. There is communication across the digital divide. Most of the people in the Ago-Are farmers group are illiterate and struggling in poverty, yet representatives of this group are making the effort to send traffic along the information “footpath” (it is far from being an “information highway” yet).

2. Dr E.Akioya:-“pls lorain can i get any free cd rom on HIV/AIDS,and polio. i was directed by pam.I am a medical doctor in nigeria.pls also keep me posted on other available health cds.”

An e-mail from a doctor, requesting specific information, is evidence that the Health SIG is beginning to “pull” information, where previously the information had been “pushed” by the volunteers.

Discussion lists, virtual conferences and other interactive exchanges on the Internet have two important functions for CawdNet. First there is

a lot to be learnt from acquaintances in this way. Secondly, some of these acquaintances develop into friends. Fantsuam Foundation and CAWD volunteers were Internet acquaintances long before they started working closely and the name CawdNet was adopted. Most of CawdNet's friends began as acquaintances on the Internet. This is even true of friends based in Nigeria, including some who are in fact geographically close to CawdNet core members.

In the connected community, CawdNet has friends and acquaintances from many parts of the globe, including Nigeria, and from many sectors: academia, development organisations, the Diaspora, alternative technology groups, ICT professionals, Open Source groups, research and development people, publishers, health professionals, social entrepreneurs, and others, each with their own particular area of interest which relates in some way to rural development. Most of these contacts have come through the work of Fantsuam Foundation and CAWD volunteers, actively reaching out to the connected community. Others have come unexpectedly, through people finding CawdNet through the Internet, via the Web sites of FF, or CAWD, or through the e-newsletter.

There are many virtual communities. What makes the small CawdNet community unusual is the boundaries that it crosses, by working both in the connected communities and in rural Nigerian communities. CawdNet has links, through personal networks, beyond the telecommunications infrastructure. Someone in the connected community who links with CawdNet, links with the formal and informal networks of rural Nigeria. OCDN, FF and RUSEL are grassroots organisations, led by people deeply embedded in their communities. They are networking with the poorest and most un-empowered members of their communities—subsistence farmers (men and women), petty traders, and unemployed youths—as well as knowing the elites, the highly educated, the professionals, business people, traditional rul-

ers, chiefs, politicians, administrators, religious leaders and community committees.

Another unusual feature of CawdNet is that the roots of its work are with the poor. RUSEL and FF both began as micro-credit organisations. CAWD was started by Peter Adetunji Oyawale, who was the son of a poor and illiterate farmer. Peter started the work in Oke-Ogun (now led by Oke-Ogun Community Development Network) because he wanted to help people like his parents and his friends from primary school to have a better future, and he believed that ICTs had a part to play. It was Peter who had the vision, and who made the initial links across the digital divide, from which CawdNet developed.

LOOKING FORWARD

CawdNet is a developing network so its form and its function are evolving. It is influenced by the ideas and examples of social entrepreneurs (Bornstein, 2004). Social entrepreneurs fit somewhere between the conventional models of “a charity” and “a business.” CawdNet sees itself becoming increasingly involved in a mixture of new enterprises:

- Some charitable (such as subsidising education and training opportunities).
- Some sustainable businesses (perhaps related to alternative technologies; some perhaps providing an umbrella/franchise arrangement for small businesses, in enterprises that are more ambitious than the present micro-credit enabled opportunities; some others. Various ideas are emerging).
- Some hybrids of charity/business.

The businesses that CawdNet sees itself supporting tend to be small scale, in harmony with “Small is Beautiful” ideas of economic development (Schumacher, 1973).

CawdNet hopes the way forward will be one of increasing collaboration, of a situation where people who have knowledge of development (in whatever way), or a desire to support it financially, will join with people who know the realities of rural Nigeria (because it is the life they lead). This is already happening, but we hope it will greatly increase. CawdNet does not see its rural communities as passive potential recipients of development aid, but as partners and potential “rural consultants.” Together with development workers they can try things out. In addition to being involved in the normal grant making and investment programmes, they could work within cross-cultural teams for a practical research and development, “R and D,” approach to development (along the lines of what educators might term “project-based learning”). Such collaborations could lead to genuine problem solving on various issues of sustainable development and the Millennium Development Goals.

REFERENCES

- Bornstein, D. (2004). *How to change the world: Social entrepreneurs and the power of new ideas*. Oxford: Oxford University Press.
- McLean, P., & Johnson, S. (2004). How Oke-Ogun crosses the digital divide: Study of a rural Nigerian development Project. *Journal of Digital Information (JoDI)* (special issue: Social Aspects of Digital Information in Perspective). Retrieved October 20, 2004, from <http://jodi.ecs.soton.ac.uk/>
- Schumacher, E.F. (1989). *Small is beautiful: Economics as if people mattered*. New York: HarperCollins. First published in 1973 by Blond and Briggs Ltd.

ENDNOTES

¹ CawdNet is not a formal organisation. The inclusive group term “CawdNet” was adopted because the people involved needed to be able to say “we.” The name came about because one of the benefits of working together is an increased ability to network—hence the “Net.” CawdNet traces its roots back to the vision of the late Peter Adetunji Oyawale and his original “CAWD” the Committee for African Welfare and Development—hence CawdNet. The name CAWD lives on through CAWD (Charity for African Welfare and Development, registration no 1104228) which was set up in June 2004 to fundraise.

² Dada McLean Ltd —Knowledge Brokers (UK registered company active in UK and Nigeria) is a key sponsor of CAWD. Web site www.dadamclean.com

³ Additional information can be found through the Web sites of CawdNet <http://www.cawd.net>, Fantsuam Foundation <http://www.fantsuam.org/> and CAWD www.cawd.info. Up to date information is available by subscribing to the oocd2000plus e-newsletter (named after Oke-Ogun Community Development Agenda 2000 Plus) <http://lists.kabissa.org/mailman/listinfo/oocd2000plus>

⁴ “CawdNet worker” is an informal term used to describe anyone who is working with one of the projects represented in CawdNet.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 367-369, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.9

ICT in Medical Education in Trinidad and Tobago

Marilyn Lewis

The University of the West Indies, Trinidad and Tobago

INTRODUCTION AND BACKGROUND

Information and communication technology (ICT) allows users to access information without taking geographic position into account. These users are also unconstrained by time, volume, or format of the information. ICT applications have enormous potential as a tool for aiding development in countries such as Trinidad and Tobago. Telemedicine, which can provide medical services to persons in isolated places, in emergencies, to the homebound, or the physically challenged, is but one example. Mansell and Wehn de Montalvo (1998) noted that “ICT applications facilitate telemedicine” (p. 85), and that “economic development can be fostered by tele-working and tele-services in some developing countries” (p. 83).

The twin-island nation of Trinidad and Tobago lies at the southern end of the Caribbean chain of islands, approximately seven miles off the northeast coast of Venezuela. The area covers 1,864 square miles (5,128 sq. km.), with a population of approximately 1.5 million. The economy of this small nation state is based mainly on petroleum and gas-based industries, but there is a growing service sector. PAHO figures (2002a, b) show a highly literate population with an overall adult literacy rate of 98.5% (males at 99.1% and females at 97.9%).

Transshipment and telecommunications facilities contribute to this country’s position as the most industrialized in the Caribbean. The country’s technical capacity and access to information have grown enormously in recent years. Telecommunication tools extend to the

vast majority of the population. Per capita GDP stands at US\$8,500.

There is a shortage of medical staff in general, with the ratio of doctors to inhabitants at 7.5 per 10,000. Shortages in primary health care are more acute than in other areas and have resulted in the employment of retired nurses and the recruitment of professional staff from other countries, particularly from Nigeria, India, and more recently, from Cuba. Trinidad and Tobago therefore stands poised to benefit from further development by fully embracing ICT, especially in the areas of education and medicine.

MEDICAL EDUCATION IN TRINIDAD AND TOBAGO

Medical education in Trinidad and Tobago engenders self-directed, lifelong learning through the use of the problem-based learning (PBL) method of teaching. The Faculty of Medical Sciences (FMS) of the University of the West Indies opened in St. Augustine, Trinidad and Tobago, in 1989, and has utilized PBL from its inception. Students' relative independence has been noted (Donner & Bickley, 1993) in students following PBL programs. Donner and Bickley noted that "they differ markedly from those following traditional medical programmes... [becoming] more skilled at an eclectic style of learning" (p. 297). These students show particular personal characteristics that encourage them to take a proactive role in their own learning, making them lifelong learners.

Research has also shown that PBL students make maximum use of library resources and that librarians taught the use of technology as a means of accessing, organizing, and managing information (Marshall, 1993). Library instruction is therefore a required part of the curriculum. Librarians become not just providers of books and other materials but also instructors in the

use of modern technology. The library, therefore, prepares medical students for wider use of other applications and technologies to support their future information needs. This has implications for how these students will operate when faced with adverse conditions such as rural health offices and hospitals with limited resources, and for development in the community generally; these students in their homes, in their practices, and in the wider community will generate a multiplier effect.

INSTRUCTIONS IN THE USE OF MODERN TECHNOLOGIES IN THE MSL

From its inception, the Medical Sciences Library (MSL) has embarked on a program of information literacy for undergraduates and other categories of users. From as early as 1993, topics such as "MEDLINE: basic and advanced"; "International Pharmaceutical Abstracts (IPA)"; "MedCarib—health literature for the Caribbean"; "ProCite"; "Introduction to Computers"; and later, "EPI Info"; "Introduction to the Internet" and "PubMed" have been taught. In facilitating this training, the library equips its clientele with survival skills for the 21st century.

The Trinidad and Tobago Ministry of Health also recognized a need for retraining, because new demands were being placed on practitioners by health care transition, health care reforms, increased public and patient expectations, and advances in medical sciences and technology. The Ministry found that medical practitioners required additional skills. This was part of the rationale for the introduction in 2000 of a new postgraduate diploma in Primary Care and Family Medicine being offered by dual mode, face-to-face initially, and thereafter, through distance education.

The library component of this course focused on skills such as "Locating and evaluating health

information”; “Skills base for managing health information resources”; “Innovations in health information practice”; “Effective search and retrieval principles”; “MEDLINE on the Internet”; “Finding biomedical information on the Internet”; “Evaluating information resources”; and “Managing bibliographic references”. Assessment tasks included:

- Joining and leaving an electronic discussion group
- Subscribing and unsubscribing to a mailing list
- Posting to a discussion group
- Locating an electronic serial and printing an article or abstract
- Executing a search on MEDLINE or PubMed and printing the results
- Creating a small database and generating a bibliography

Each session represented distinct skills requirements and supported the utilization of applications to manage the efficient exchange of information among health professionals.

ICT IN EDUCATION: PRIMARY, SECONDARY, AND TERTIARY

Primary and secondary schools in Trinidad and Tobago are also embracing the technology. Many secondary schools have computer science as a subject on the curriculum and typically have computer laboratories. More than 35% of the 78 primary and 120 secondary schools listed in the telephone directory for 2003–2004 have computers with Internet access facilitated by Telecommunication Services of Trinidad and Tobago (TSTT), the only telephone company on the twin islands. Additionally, there are 22 Internet cafes listed in the yellow pages of this directory. Some of these Internet cafes are located in rural areas such as Enterprise, in Central Trinidad, and Penal in the

south of the island. Eighteen Internet Service Providers are listed as well.

Other initiatives to produce a computer literate society in Trinidad and Tobago include the government making computer loans available to all public servants. In 2002, the government also launched an initiative, the National Information and Communications Technology Plan (2004), that aims “to connect people, communities, business, government and educational institutions through an integrated technology network. It will also examine the policy, financial and skills development requirements that will be necessary to ensure sustainability and to ensure that the benefits of connectivity continue to grow, and accelerate, as new technologies, innovation and thinking emerge.”

A survey (NIHERST, 2002) designed to provide empirical data on the penetration of ICT in private households reflects the varying penetration of ICT in private homes of varying socioeconomic status. Data were collected from a representative sample of 2,812 households throughout Trinidad and Tobago. Thirteen percent (13%) of the households in Trinidad and Tobago (approximately 44,600 households based on national statistics for 2000) had a home computer as of June 2001. By comparison, more than 30% of the households in a number of Organisation for Economic Cooperation and Development (OECD) countries were equipped with computers in 1997, and more than half (54%) of the households in Australia had computers in May 2000. Other important findings of the survey were that affordability was the major constraint in 56% of all households without computers; ranging from 43.9% in the City of Port of Spain to 78% in the Borough of Point Fortin. Also, 53% of households purchased computers from private savings; 13% accessed government loans. Households (20%) with gross monthly incomes of \$6,000–\$7,999 had the largest proportion of home computers, followed by 15% of households with incomes of \$4,000–\$5,999. Only

5% of households with monthly incomes of less than \$2,000 had computers. In 2000, 27% of the computers were acquired compared with 6.7% in 1997. Almost three out of four persons (73%) in each household used the computer. The proportion of male (51%) to female (49%) computer users was generally similar. Approximately 16.6% of computer users were between 15 and 19 years of age, 16.3% between 30 and 39 years and 14.5% between 40 and 49 years. Of computer users, 50% had acquired secondary level education, and only 3.8% had a university level education in computer studies. Approximately 50% of computer users were employed and self-employed, and 39% were students. In private enterprises, 59.8% of employees used the computer compared with 29.7% in government. Windows 98 and 95 were the main operating systems in 74.4% of households. Most households (70.8%) used the computer daily between two and five or more hours. Only 11.8% of households were engaged in software development, and 20.2% accessed distance learning/education compared with other activities such as games (78.4%), Microsoft Office (66%), e-mail (62.4%), and Web searches (61.5%).

Apart from the Faculty of Medical Sciences, the university as a whole is also involved in programs to implement ICT applications. The UWI, St. Augustine, in its latest strategic plan (2003–2007) identified student-centeredness as one of its strategic objectives. The campus libraries, of which the MSL is a branch, determined that promoting the use of ICT in delivery of service and products was one way of meeting this objective. Additionally, an increasingly complex print and digital environment was emerging, and people began to expect certain services without coming to the library. Facilitated by the technology, the libraries were able to accomplish one of their main missions by launching a valuable new campus-wide online course, “Foundations of Information Literacy” on March 2, 2004. It is a modular course covering the following seven topics:

1. Basic computer literacy
2. Basic research skills
3. Using the OPAC (online public access catalogue)
4. The Internet as a research tool
5. West Indiana and Special Collections
6. Online databases
7. Managing references

There were tutorials on how to use each of the databases to which the libraries subscribe, as well as a quiz and online feedback, discussion board, and on-campus WebCT server.

In its quest to keep abreast of technology, the St. Augustine campus libraries is looking at further ways to implement applications in ICT in its ongoing program of work. Initiatives such as a digital reference service are also being considered. This project aims to answer students’ reference queries in real time and will enable persons needing live human assistance while using the Web to immediately get the help they need from librarians who can quickly provide the answers. Speed and responsiveness are critical to this initiative, which will radically change the way we serve and support our clientele.

A TOOL FOR COMMUNITY DEVELOPMENT

Based on our epidemiological circumstances, where the Caribbean is second only to Southern Africa in the proliferation of HIV/AIDS and other STDs, ICT can indeed be seen as an effective tool for development. The toll of HIV/AIDS is heaviest on young persons between the ages of 18 and 45, who form the majority of the workforce. CAREC figures indicate that in Trinidad and Tobago, 5,000 persons have died of AIDS since 1985. The nature of the response to these diseases has to do with preventive education, capacity building, and treatment, care, and support.

ICT can play a role in the way people connect with information. Through ICT, people in remote areas can have access to the same information as many of the people in developed countries. With an infusion of ICT learning, people in underdeveloped countries such as Trinidad and Tobago can access and share critical health information that can help in the fight against HIV and AIDS, and its related morbidity and mortality. Ideally, health education should begin in primary schools. When this occurs, the transformative nature of ICT on the epidemiological status of affected countries can become visible.

CONCLUSION

The type of medical education available in Trinidad and Tobago, the campus libraries' program of instruction in the use of ICT, the government's initiatives to make computers available to public servants, the provision of computers in primary and secondary schools, the burgeoning economy, and the developing infrastructure all signal that this country is capable of embracing fully ICT applications that can enhance community development. Additionally, the postgraduate course has been viewed as an investment in the health care of Trinidad and Tobago nationals, in terms of an enhanced quality of health care that will be rendered by the practitioners involved. Healthy individuals contribute to a more productive economy. The course is ongoing, therefore, there will need to be an increment to those receiving training, as well as those receiving enhanced care. Three further cycles of the postgraduate course have been held, resulting in at least 60 primary care physicians who have already been exposed to and benefited from the postgraduate training provided by the MSL.

By teaching the core competencies of information literacy, identifying the information needs, accessing information, and understanding the legal and other issues in the use of information,

the St. Augustine campus libraries aim first to increase the competitiveness of the student. However, not only have the libraries supported the academic enterprise, but they have also made available resources for knowledge creation and capacity building. At the Medical Sciences Library, we assisted in the retraining of primary care physicians to make them comfortable with the new technologies. This has resulted in more effective, efficient high-quality health care for the national community and has contributed to development.

Today's information consumer wants seamless access whenever and wherever they want it. They are comfortable with Web-based information. In this complex and rapidly changing, increasingly interconnected environment, ICT can be an effective tool for community development.

REFERENCES

- Donner, R. S., & Bickley, H. (1993). Problem-based learning in American medical education: An overview. *Bulletin of the Medical Library Association*, 81(3), 294-298.
- FOLDOC. (2004). Free online dictionary of computing. Retrieved September 27, 2004, from <http://foldoc.doc.ic.ac.uk/foldoc/index.html>
- Mansell, R., & Wehn de Montalvo, U. (1998). *Knowledge societies information technology for sustainable development*. Oxford: United Nations Commission on Science and Technology for Development/Oxford UP.
- Marshall, J. G., Fitzgerald, D., Busby, L., & Heaton, G. (1993). A study of library use in problem-based and traditional medical curricula. *Bulletin of the Medical Library Association*, 81(3), 299-305.
- National Institute of Higher Education Research Science and Technology. (2002). *Utilisation of*

information technology by households, 2001. NIHERST: Port of Spain.

Pan American Health Organization. (2002a). Country health profiles. Retrieved September 25, 2004, from http://www.google.tt/search?q=cac he:YxVT NV_AD20J: www.paho.org/english/HIA1998/Trinidad.pdf+ trinidad+ and+tobago+doctor+p atient+ratio&hl=en

Pan American Health Organization. (2002b). Promoting health in the Americas. Retrieved September 22, 2004, from http://www.paho.org/english/dd/ais/cp_780.htm

[Trinidad and Tobago] Ministry of Public Administration and Information [home page]. (2004). *National Information and Communication Technology Plan*. Retrieved September 27, 2004, from <http://www.nict.gov.tt/plan/documents/summary.asp>

KEY TERMS

Digital Reference Service: A human-mediated, Internet-based service in which users' queries are answered in real time.

Discussion Group: Any system that supports group messaging, e.g., a shared mailbox, Usenet, bulletin board system, or possibly a mailing list, used to publish messages on some particular topic (FOLDOC, 2004).

Information Communications Technology (ICT): The study of the technology used to handle information and aid communication. The phrase was coined by Stevenson in his 1997 report to the UK government and promoted by the new National Curriculum documents for the UK in 2000 (FOLDOC, 2004).

Listserv: An automatic mailing list server, initially written to run under IBM's VM operating system by Eric Thomas. Listserv is a user name on some computers on BITNET/EARN which processes e-mail requests for addition to or deletion from mailing lists. Examples are listserv@ucsd.edu, listserver@nysernet.org. Some listservs provide other facilities such as retrieving files from archives and searching databases. Full details of available services can usually be obtained by sending a message with the word HELP in the subject and body to the listserv address. Eric Thomas has recently formed an international corporation, L-Soft, and has ported Listserv to a number of other platforms including Unix. Listserv has simultaneously been enhanced to use both the Internet and BITNET. Two other major mailing list processors, both of which run under Unix, are Majordomo, a freeware system, and Listproc, currently owned and developed by BITNET (FOLDOC, 2004).

MedCarib: A database of the health literature of the Caribbean.

MEDLINE: A CD-ROM database of medical literature in journals produced by the National Library of Medicine, United States.

Problem-Based Learning (PBL): A concept in which students focus from the beginning of their course on a series of real professional issues, where the knowledge of the various academic disciplines that relate to these issues is integrated.

PubMed: An online database of over 14 million citations of biomedical articles from 1950 to the present time. This database is available free over the Internet.

WebCT: Software that provides electronic learning in a flexible integrated environment.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 382-386, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.10

Clustering Dynamics of the ICT Sector in South Africa

Sagren Moodley

Human Sciences Research Council (HSRC), South Africa

INTRODUCTION

Both the production and use of ICT are unevenly distributed across countries and regions. While this is typical of emerging and fast evolving technologies, there are particularly significant spatial differences in the patterns of ICT production. Traditional explanations for these differences include distinct factor endowments, technologies and policies. Regions with originally similar characteristics may develop in very different directions. Hence, the *locational patterns* of ICT cannot be explained in terms of factor endowments and policy regimes only (Barrow, 2001).

The tendency of knowledge-driven industries in particular (such as the ICT sector) to cluster geographically has been recognised in policy-making (Lall, Shalizi, & Deichmann, 2004). Proximity to university laboratories and other research centres provides ICT-related firms located in innovative clusters with easier access to scientific expertise and research results, thus, facilitating transfer of research into commercial applications (Acs, Audretsch, & Feldman, 1992, 1994; Jaffe, 1989). Furthermore, firms located

in a science park benefit from agglomeration economies, due to the fact that numerous high technology enterprises are clustered in a relatively small area, especially if they operate in the same sector, or in closely connected sectors (Palmai, 2004). The networking opportunities of tenant firms are also widened, basically for the same reason. Finally, the park acts as a bridging institution providing tenant firms with suitable accommodation on flexible terms and technical and business services which are particularly valuable to new high-growth enterprises (Durao, Sarmiento, Varela, & Maltez, 2004).

This article looks at the clustering dynamics of the ICT sector in South Africa. The article focuses on two regional (i.e. Western Cape and Gauteng Provinces) ICT cluster case studies which illustrate a clear and intensifying concentration tendency of ICT-related production and R&D, viz. the Bandwidth Barn (a flagship project of the Cape IT Initiative [CITI]) and the Innovation Hub (a component of the Blue IQ project). Finally, the author draws a number of generalisable issues from the case studies which have wider applicability for developing countries.

THE INNOVATION HUB

In March 2001, in a bold bid to position Gauteng (which is South Africa's wealthiest province) as South Africa's "Smart Province", the Gauteng Provincial Government launched an initiative called Blue IQ. The Innovation Hub is part of the Gauteng Government's ZAR 1.7 billion Blue IQ project, under the auspices of the Strategic Economic Infrastructure Investment Programme (SEIIP). Blue IQ is Gauteng Province's high-tech industrial promotion agency. The Innovation Hub's vision is to "create a unique space where high-tech entrepreneurs, businesses, education, research and venture capital can meet, network and prosper" (Innovation Hub, 2003, n.p.). The 11 Blue IQ projects focused on three sectors:

- **Smart industries:** i.e., the Innovation Hub and Gautrain Rapid Rail Link;
- **High value-added manufacturing:** i.e., Gauteng Automotive Cluster; Wadeville Alrode Industrial Corridor; Johannesburg International Airport (JIA) Freezone; and City Deep Terminal; and
- **Tourism:** i.e., Cradle of Humankind World Heritage Site; Constitution Hill; Newtown; Dinokeng; and Kliptown.

The Blue IQ initiative aimed to: (1) create an environment in which smart industries in the ICT and bio-medical sectors can thrive; (2) shift Gauteng's manufacturing sector away from traditional heavy industry into more sophisticated, high value-added production; and (3) develop business tourism in order to capitalise on Gauteng's status as South Africa's commercial and financial hub.

The Innovation Hub became a full member of the International Association of Science Parks (IASP); the only full member in Africa. Furthermore, the Business Incubator at the Hub became a member of the National Business Incubators Association (NBIA) in the United States, which

seeks to provide professionals worldwide with information, education, advocacy and networking resources for early-stage companies. The Innovation Hub consists of:

- A high-tech incubator;
- An entrepreneur/innovator development programme, including Coach Lab where postgraduate students are mentored to work on industry projects;
- Initiatives targeting empowerment; and
- Alliances with world-class academic and research institutions.

The Innovation Hub was developed to:

- Establish a high-tech hub in Gauteng;
- Develop infrastructure to implement and stimulate high-tech business in a conducive and mutually beneficial environment; and
- House other essential components such as incubators, venture capital funders and professional service suppliers, to form the basis for a world-class 'innovation corridor' in the province.

The Innovation Hub was South Africa's first science park and a joint initiative between the Gauteng provincial government and the Southern Education and Research Alliance (SERA), an alliance between the University of Pretoria and the Council for Scientific and Industrial Research (CSIR). Construction started in October 2003 (and is expected to be finished in late 2004/early 2005) with the objective of creating South Africa's own 'Silicon Valley'. The ZAR 300 million Hub, located in Pretoria, was being built around the concept of technological convergence. The sectors that were being targeted include biosciences and biotechnology, ICT, electronics, aerospace, advanced materials, and advanced manufacturing sectors such as automotive, defence and defence spin-offs. The Hub was positioned adjacent to

the University of Pretoria and directly to the east of the Hub—just across the N1 highway—lies the CSIR. Hence the Innovation Hub, situated on a “knowledge axis”, was therefore deemed to be at the centre of knowledge and information. Pretoria is only 60km by freeway from South Africa’s commercial capital, Johannesburg. Furthermore, the Gautrain Rapid Rail Link, another Blue IQ project, is set to link Pretoria, Johannesburg and Johannesburg International Airport by 2006.

The provincial government saw the hub as: (1) creating a unique location in Gauteng Province where high-tech industry, academia and entrepreneurs will be able to meet and work together; (2) better positioning the province as a globally-competitive knowledge economy; (3) a catalyst to enhance the innovative and growth capacity of high-tech companies and to improve productivity and technology; 4) an incubator for high-tech start-ups; and (5) promoting black economic empowerment by acting as an incubator for innovative black start-up companies.

Processes and outputs of the Innovation Hub are benchmarked on a continual basis, against international best practice. The objectives of the incubator are:

- To facilitate the accelerated growth and sustainable development of technologically innovative start-up companies;
- To position the Innovation Hub incubator as the prime location for technologically innovative start-up companies; and
- To be a leader in South African best practice incubation.

Facilities and services offered by the incubator include:

- Flexible leases and a variety of office sizes;
- Reception and secretarial support;

- Sophisticated ICT infrastructure for the guaranteed supply of unlimited connectivity and high bandwidth;
- Management advisory and mentoring services, including structured training programmes focused at the developmental needs of the new venture;
- Business support services (financial, legal, administrative);
- Access to business networks and markets;
- Assistance in finding suitable black economic empowerment partners;
- Assistance with obtaining venture capital or financing;
- Assistance in accessing technical expertise;
- Entrepreneurship development and education;
- Participation in a high-tech cluster with access to like-minded people, i.e., being part of an entrepreneurial, innovative community;
- Being part of an established brand, viz: the Innovation Hub;
- Market visibility by means of corporate advertising (marketing support);
- A research interface; and
- Technological support.

The incubation programme is made up of three phases: (1) *pre-incubation phase* which was designed to last for about six months and to make sure that the start-up had a good business plan and tested the market with its product; (2) the *incubation phase* designed to last for between three to four years; and (3) the *associate stage* was designed as the final phase of the programme, as a year-long “after care” stage. The incubation programme produced early success stories such as Expertron, a start-up which invented a new information security solution product. Expertron concluded a 30% shareholding deal with Grintek early in the process, and was granted a lucrative

contract for the product by the ERP.com group. Another start-up Naledi3d Factory, successfully established an interactive virtual reality development facility in Uganda.

THE BANDWIDTH BARN

The Bandwidth Barn was the pioneer project of the Cape Information Technology Initiative (CITI), a not-for-profit promotion agency for the ICT industry in the Western Cape. The Cape IT Initiative (CITI) was established as a non-profit public-private partnership funded by the Western Cape Province and City of Cape Town governments, as well as more than 40 corporate members including UUNET, Microsoft, Telkom and other national, regional and local businesses. CITI aimed to promote the development of the Knowledge Economy in the Western Cape Province of South Africa and to act as the marketing agency for the Western Cape ICT sector. CITI's intention is to grow the Western Cape into an international ICT hub, creating jobs and building the regional economy. The Bandwidth Barn offers entrepreneurs the facilities, bandwidth, mentorship, support and networking required to grow young businesses and foster innovation. The overall aim of the Bandwidth Barn is to facilitate the creation of jobs (social goal) and wealth (economic goal) through ICT, and to make the region more attractive for direct foreign investment (economic goal).

The Barn was financed by a million Rand sponsorship from the Department of Trade and Industry's Sector Partnership Fund (SPF) and it received a multi-million Rand sponsorship from UUNET SA, the largest carrier of Internet traffic in Africa. The Barn is located in Cape Town's central business district, in close proximity to three major universities, i.e., University of Cape Town, Stellenbosch University and the University of the Western Cape—all of which graduate computer engineers. The objectives of the Barn are to:

- Serve as a focus point for ICT entrepreneurship in the Western Cape and to bring the benefits of 'clustering' to the budding ICT sector in Cape Town;
- Provide fast 24/7 Internet connectivity (ADSL) to high-tech start-ups;
- Provide small ICT businesses with affordable office rentals, shared office facilities to reduce overhead costs for services like Internet connectivity, telephone and reception;
- Provide incubation for start-up ICT entrepreneurs in the Western Cape;
- Provide a supportive networked community to create synergies; and
- Create a network of strongly interdependent firms and specialised suppliers, knowledge producing agents (education institutions, research bodies, engineering companies), bridging institutions (brokers, consultants) and customers, and to link together in a value-adding production chain.

The Barn is a unique incubation model where the stability of anchor tenants is coupled with a dynamic and evolving set of small companies. The Barn aims to remove the barriers that impede small start-ups, i.e.:

- The cost of high quality Internet access;
- The difficulty of finding premises and the requirement to sign long-term leases;
- The cost of reception and PBX services; and
- The isolation of operating on one's own.

One Barn success story is the black empowerment company, *Liquid Thought*, which is an e-business consulting service. The company is three years old, employs 10 people and its turnover is likely to exceed ZAR 10 million by the end of the 2003 financial year. Zulfiq Isaacs, the MD of Liquid Thought, had this to say:

The Barn was critical to our success. Clustering enables you to reduce overheads by sharing the cost of Internet access and other infrastructure, it quickly raised our profile in the marketplace and created networking opportunities. Most importantly, we were able to partner other companies with different skills to create joint projects. (CITI, 2003, n.p.)

CITI has formed the “Cape Lab” initiative to help teach entrepreneurs about international markets and to forge links with peer organisations like *Enterprise Island* in the UK and *Enterprise Ireland* in the Republic of Ireland to help address this issue. CITI envisions the Western Cape duplicating India’s success in attracting offshore software development projects and international software support centres. Further, the Bandwidth Barn has been actively involved in local and provincial ICT initiatives (e.g. the Cape Online e-Government Strategy) and in policy-making organisations such as the Internet Service Providers Association (ISPA), the Internet Society of South Africa (ISOC SA), ICANN, etc.

DISCUSSION

The geographical structure of the Bandwidth Barn and the Innovation Hub are concentrated, with a multitude of linkages between core firms, their spin-offs and local subcontractors, world-class universities and research centres, and local/regional authorities. Some key common features characterising this specific production model can be identified, namely:

- The geographical proximity of small and medium sized firms;
- A spatial development where the interface of research with commerce and industry is encouraged for the better exploitation of technology;

- A dense network of inter-firm relationships, in which the firms cooperate and compete at the same time;
- A dense network of social relationships, based mainly on face-to-face contact, which is inter-connected with the system of economic relationships;
- The presence within the area of complementary competencies and skills;
- Facilitating the creation and growth of innovation-based companies through incubation and spin-off processes, and provide other value-added services together with high quality space and facilities;
- Creating a culture of innovation where the physical infrastructure stimulates the cross-fertilisation of ideas and the flow of knowledge and technology to create the “buzz” that comes with shared exploits, innovation and dynamic social interaction; and
- A high degree of specialisation of both the firms and the workforce.

Both the Barn and the Innovation Hub are not-for-profit incubators and the owners do not hold equity in their tenants. They have close links to each other and often network and share resources. CITI and the Innovation Hub have strengthened existing ties through an informal partnership that is aimed at consolidating the activities of both parties for the greater benefit of the ICT sector nationally. This includes sharing knowledge resources, such as ICT guest speakers and information on high-profile international delegations to South Africa.

The two case studies clearly underline the importance of local and regional policies in promoting ICT clustering dynamics. Focusing merely on national policies is insufficient. Further, the close proximity to centres of teaching and research is particularly favourable for the creation and growth of knowledge-based businesses. Both the Bandwidth Barn and the Innovation Hub are innovative ICT clusters which (1) have formal

operational links with centres of knowledge creation, such as universities and research centres; (2) are designed to encourage the formation and growth of innovative businesses; and (3) have a management function which is actively engaged in the transfer of technology and business skills to “on-park” located small high-tech firms. Moreover, the objectives of the two technology incubator programmes are to: (1) provide a mechanism for the commercialisation and transfer of technology; (2) promote the concept of growth through innovation and application of technology; (3) support economic development strategies for small business development; and (4) encourage growth from within local economies.

GENERALIZABLE ISSUES

Entrepreneurship is at the heart of sustainable, organic growth for most developed, as well as transition and developing economies, and high-tech incubators have often served as catalysts and even accelerators of entrepreneurial cluster formation and growth (Harwit, 2002; Link & Link, 2003). This may be more so in less developed economies where incubators can help bridge knowledge, digital, socio-political and even cultural divides and help increase the availability, awareness, accessibility and affordability of financial, human, intellectual, and even social capital, the key ingredients of entrepreneurial success. Incubation has recently experienced increased attention as a model of start-up facilitation in the ICT sector (Molnar, Grimes, & Edelstein, 2001). Venture capitalists see incubators as a means to diversify risky investment portfolios, while would-be entrepreneurs approach incubators for start-up support. Incubators are thus faced with the challenge and the opportunity of managing both investment risks, as well as entrepreneurial risks.

There is value in establishing innovation hubs or clusters as an appropriate vehicle to help

promote and facilitate the development of ICT firms within incubation programmes in developing countries. However, it is evident that science parks and incubators take place in different environmental and institutional contexts, which are also dynamic. This points to the need for a structural contingency perspective that relates the different types of science parks and incubators to different institutional contexts and objectives. Furthermore, the needs of tenant incubators at different stages of development are varied. Hence, if the purpose is to assess whether or not a particular incubator programme is of value to tenant incubators at different stages of business development, the comparative evaluative approach should be modified so that the effects on technology firms throughout the venture development path could be captured. For cluster formation in the ICT sector to be successful, the innovation hub should: (1) be sustainable; (2) have operational links with universities, R&D centres and/or other institutions of higher education; (3) encourage and support the start-up and incubation of innovative, high-growth and technology-based companies; and (4) stimulate the transfer of technology, know-how and innovation.

CONCLUSION

Despite the fact that the cost of transmitting information has declined tremendously and has become largely invariant of distance, the importance of location to innovation and production remains. The primary reasons for this are benefits that the proximity of others generates to the firms in the area, i.e. Marshallian externalities (Marshall, 1920). ICT companies located in the area of a specialised cluster of firms may benefit from knowledge spillovers: information concerning new applications or other innovative practices may spread faster among the firms that are located geographically closer to each other. As the two

case studies have revealed, there are other factors fostering spatial agglomeration such as the availability of skilled labour, good infrastructure, and supporting institutions, e.g. universities and research centres.

Both the Innovation Hub and Bandwidth Barn are examples of innovation being driven in an institutional way. Castells and Hall's (1994) concept of technopoles aptly describe the Blue IQ and CITI initiatives, viz. "deliberate attempts to plan and promote within one concentrated area, technologically innovative, industrial-related production" (Castells & Hall, 1994, p. 8). However, both of these clusters are still at a very early stage of development, therefore it is difficult to critically assess their success. That said, international experience suggests that few incubators succeed, and those that do are driven by experienced, hard-core entrepreneurs (Colombo & Delmastro, 2002, p. 1103). Ultimately, the success of the Innovation Hub and the Bandwidth Barn will be determined by how much venture capital experience and business experience that the people running them have. Finally, ICT-based innovative clusters in the Third World must be strategic, properly managed and implemented, without becoming bogged down in politics and bureaucracy.

REFERENCES

- Acs, Z.J., Audretsch, D.B., & Feldman, M.P. (1992). Real effects of academic research: Comment. *American Economic Review*, 81, 363-367.
- Acs, Z.J., Audretsch, D.B., & Feldman, M.P. (1994). R&D spillovers and innovative activity. *Managerial and Decision Economics*, 15, 131-138.
- Barrow, C. (2001). *Incubators*. Chichester, UK: Wiley.
- Castells, M., & Hall, P. (1994). *Technopoles of the world: The making of 21st century industrial complexes*. London: Routledge.
- CITI. (2003). *Annual Report*. Cape Town: Cape IT Initiative.
- Colombo, M.G., & Delmastro, M. (2002). How effective are technology incubators? Evidence from Italy. *Research Policy*, 31, 1103-1122.
- Durao, D., Sarmiento, M., Varela, V., & Maltez, L. (2004). Virtual and real-estate science and technology parks: A case study of Taguspark. *Technovation*. Forthcoming.
- Harwit, E. (2002). High-technology incubators: Fuel for China's new entrepreneurship? *China Business Review*, 29, 26-29.
- Innovation Hub*. (2003). Annual Report. Pretoria: Innovation Hub.
- Jaffe, A.B. (1989). Real effects of academic research. *American Economic Review*, 79, 957-970.
- Lall, S.V., Shalizi, Z., & Deichmann, U. (2004). Agglomeration economies and productivity in Indian industry. *Journal of Development Economics*, 73, 643-673.
- Link, A.N., & Link, K.R. (2003). On the growth of U.S. science parks. *Journal of Technology Transfer*, 28, 81-85.
- Marshall, A. (1920). *Principles of economics*. London: Macmillan.
- Molnar, L., Grimes, D., & Edelstein, J. (2001). *Business incubation works*. OH: NBIA Publications.
- Palmai, Z. (2004). An innovation park in Hungary: INNOTECH of the Budapest University of technology and economics. *Technovation*, 24, 421-432.

KEY TERMS

Agglomeration Economies: Refers to the spatial concentration of economic activities. For example, a firm that is located in close proximity to other firms in the same industry can take advantage of localisation economies. These intra-industry benefits include access to specialised know-how (i.e., knowledge diffusion), the presence of buyer-supplier networks and opportunities for efficient subcontracting. Employees with industry-specific skills will be attracted to such clusters giving firms access to a larger specialised labour pool. Another case of agglomeration economies external to the firm relates to benefits that accrue from being located in close proximity to firms in other industries, i.e., urbanisation economies. These inter-industry benefits include easier access to complementary services (publishing, advertising, banking), availability of a large labour pool with multiple specialisation, inter-industry information transfers and the availability of less costly general infrastructure.

Business Incubators: Business Incubators are property-based organisations with identifiable administrative centres focused on the mission of business acceleration through knowledge agglomeration and resource sharing. The main role of the incubator is to assist entrepreneurs with business start-ups and development.

Clustering: This occurs when high-tech firms of similar characteristics and within the same value chain are attracted to co-locate and gradually emerge as a strong allied group complementary to each other. An innovation-driven cluster aims to encourage and facilitate the formation and growth of ICT-based businesses by providing access to structural elements, e.g. infrastructure and supporting facilities, and generating mutual synergies.

ICT Sector: The ICT Sector can be defined as a combination of manufacturing and services industries that capture, transmit and display data and information electronically.

Information and Communication Technologies (ICT): The term “Information and Communication Technologies (ICT)” reflects the technological convergence between digital computing, telecommunications and broadcasting. Whereas computers were largely focused on the processing of information, ICT undertake both processing and communication of information.

Innovation Hubs: Are designed to encourage the formation and growth of knowledge-based enterprises or high value-added tertiary firms. Innovation hubs generally aim at promoting and catalysing innovation and entrepreneurship within an innovative milieu.

Knowledge Economy: The knowledge economy is a state of economic being and a process of economic becoming that leverages, both intensively and extensively, knowledge assets and competences, as well as economic learning to catalyse and accelerate sustainable and robust economic growth.

Science Park: A Science Park is a business support initiative whose main aim is to encourage and support the start-up and incubation of innovative, high-growth, technology-based businesses through the provision of infrastructure and support services, including: (1) collaborative links with economic development agencies; (2) formal and operational links with centres of excellence such as universities, higher education institutions and research establishments; and (3) management support actively engaged in the transfer of technology and business skills to small- and medium-sized enterprises.

Chapter 4.11

ICT and the Tourism Information Marketplace in Australia

Andrew Taylor

Southern Cross University, Australia

INTRODUCTION

In November 2003, the Australian Government released the Tourism White Paper, a medium- to long-term strategy for the Australian tourism industry. The Paper provides for funding to improve the availability of high-quality information for the development of tourism in regional areas of Australia. More than \$21 million, a historically large amount, has been identified for "...extending the provision of quality research and statistics" (Prime Minister John Howard, Media Release, November 20, 2003).

A growing body of literature about systems of innovation (SOI) supports the notion that secondary information is a vital input to the evolutionary processes of innovation (see, for example, Edquist & McKelvey, 2000, p. 4). The efficient production and distribution of knowledge, of which information is a precursor, is widely discussed as a prerequisite for innovation in economic systems.

There is a long history of relatively poor access to and application of strategic business intelligence in the Australian tourism industry, particularly by those in regional areas. Examples of coordinated

and sustained efforts to engender a research-based ethic among tourism enterprises, organizations, and other institutions have been, at best, sporadic (Hunt & Prosser, 1998).

ICT systems are increasingly seen as primary enablers in the dissemination of information to regional economic systems. Online technologies can reduce dissemination costs for suppliers and consumers of strategic business intelligence. ICT systems assist by encouraging the formation and growth of regional- and sector-based networks and cooperatives, facilitating interactions in the global economy, encouraging wider use and application of information, and bridging the information divide between cities and regional areas.

Several tourism information systems have been developed worldwide to help address technological and capacity issues in the industry. Examples exist in Australia, Spain, Austria, Canada, and New Zealand.

The availability of quality research and data for the tourism industry is one side of the information equation and has been the focus of most discussions on the topic (Scott, 1999). However, supply-side issues are not the sole impediments

to more widespread procurement and application of tourism research in Australia.

This paper introduces the concept of the Tourism Information Marketplace (TICM) to demonstrate that the historically poor dissemination and application of strategic tourism information in RTS is, in part, the result of barriers to its efficient procurement on the demand side. Previous analyses of this issue have identified weaknesses that exist in the current delivery systems for regional tourism information. These relate to administration of data collections, the knowledge management capacity of small firms and local tourism associations, quality and availability of data, and the technologies that are used in its distribution. This research augments these findings by identifying the barriers to the efficient exchange and procurement of tourism information commodities.

THE IMPORTANCE OF STRATEGIC INFORMATION COMMODITIES TO REGIONAL TOURISM SYSTEMS

There is voluminous representation in the literature of the growth in the size and importance of the global information, or knowledge-based, economy (see, for example, Levine & Lippman, 1995; Nelson, 2000; Shipario & Varian, 1999). Most acknowledge the emergent role of knowledge as an enabler of wealth creation and economic growth. Indeed, some argue that the modern economy is tending toward the application of knowledge for the sake of knowledge itself (Johnston, 1999).

The concept of Systems of Innovation (SOI) is being increasingly described in the literature. SOI are networks of firms, organizations, and other parties who apply knowledge and innovations through interactive learning processes to generate favourable economic outcomes (for a review, see Edquist & McKelvey, 2000). An SOI may exist at any geographic level and may be sector-specific, as in the case of tourism.

Regional tourism in Australia is also characterised by networks and interactions between tourism product suppliers, public-sector organisations, community organisations, other intermediaries, and the legislative and political regimes that influence the region. The systemic nature of these interactions points to the existence of RTSs, which are focused largely around regional destinations (Carson et al., 2003).

There has been some past research on the information needs of key agents in Australia's RTS. The Centre for Regional Tourism Research (Prosser, 2000) conducted a national research roadshow in 1999 that included participation from over 500 regional tourism operators and association managers. In 2001, the Australian Regional Tourism Convention in Port Macquarie (Kelly, 2001) included a national forum that identified the broad information needs of regional and local tourism associations. The results of these two initiatives were supplemented by a series of focus groups in 2002 and 2003 to determine the current data or information needs in regional tourism, and the perceived barriers to obtaining and using this information.

All three investigations highlighted the difficulty organisations (particularly small businesses and local tourism associations) have in articulating their data and information needs and in procuring information to address these.

THE ROLE OF THE TOURISM INFORMATION MARKETPLACE

Externally sourced, or secondary, knowledge and information is important to innovation at the enterprise level and, consequently, to the RTS. For entities engaged in the Australian tourism industry, the potential for secondary information to contribute to innovation is growing in line with global trends (Scott, 1999, p. 14). Secondary information can help to establish a competitive advantage in a globalised, competitive, and de-

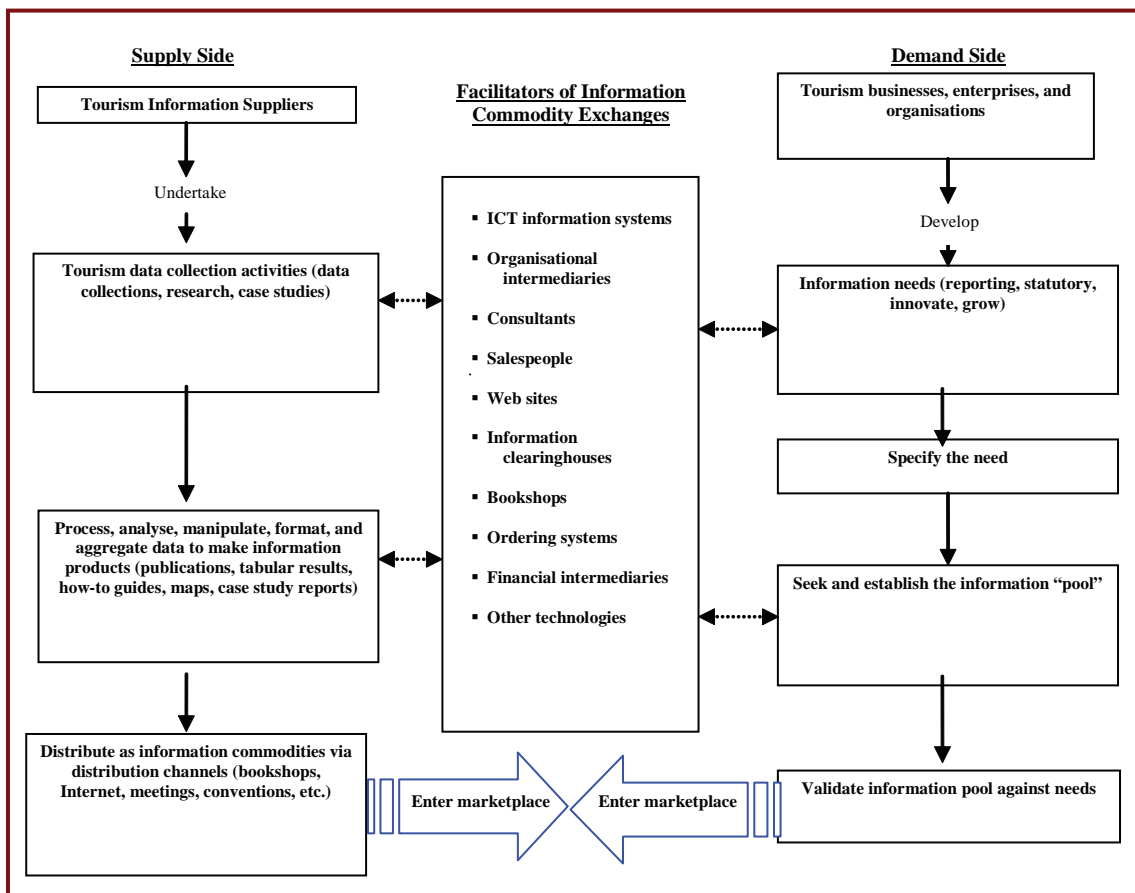
mand-elastic industry; benchmark against other regions or competitors; promote evidenced-based approaches to management and reporting; develop or diversify products or services; and guide future decision pathways. The effective procurement and application of secondary information relies on an efficient marketplace that facilitates its exchange. The TICM is a conceptual model depicting the processes involved in the exchange of tourism information commodities.

At a broad level, the TICM (see Figure 1) is similar in structure to other commodity marketplaces. Suppliers offer information commodities in the forms of publications, tabular data, research products, and case studies. Demand for these is generated by the information needs of tourism

businesses, research bodies, and other organisations. The exchange of information commodities is facilitated by intermediaries such as technology-based systems (for example, online bookshops) and organizationally based facilitators (such as regional tourism organisations).

Neoclassical economic theories on marketplaces focus on how marginal price changes affect the demand and supply for commodities. A marketplace is said to be operating efficiently when all the commodities offered to the market are cleared. The price at which this occurs is the equilibrium price (Mansfield, 1985). These rudimentary economic theories rely on several assumptions, including that suppliers and consumers have perfect information available on

Figure 1. A conceptual model of the TIM



which to base their decisions, and consumers are rational to the extent that they consistently seek to maximise their marginal utility.

Even with such assumptions in place, marketplaces in which the commodity is information are inherently different (Shipario & Varian, 1999). Reasons for this include that information is an “experience good” that must be consumed before you realise its value; the price of information tends to move toward the marginal cost that can be close to zero for some information commodities; and many suppliers of information commodities do not engage in the marketplace with the intention of profit maximisation (Edquist, 1997).

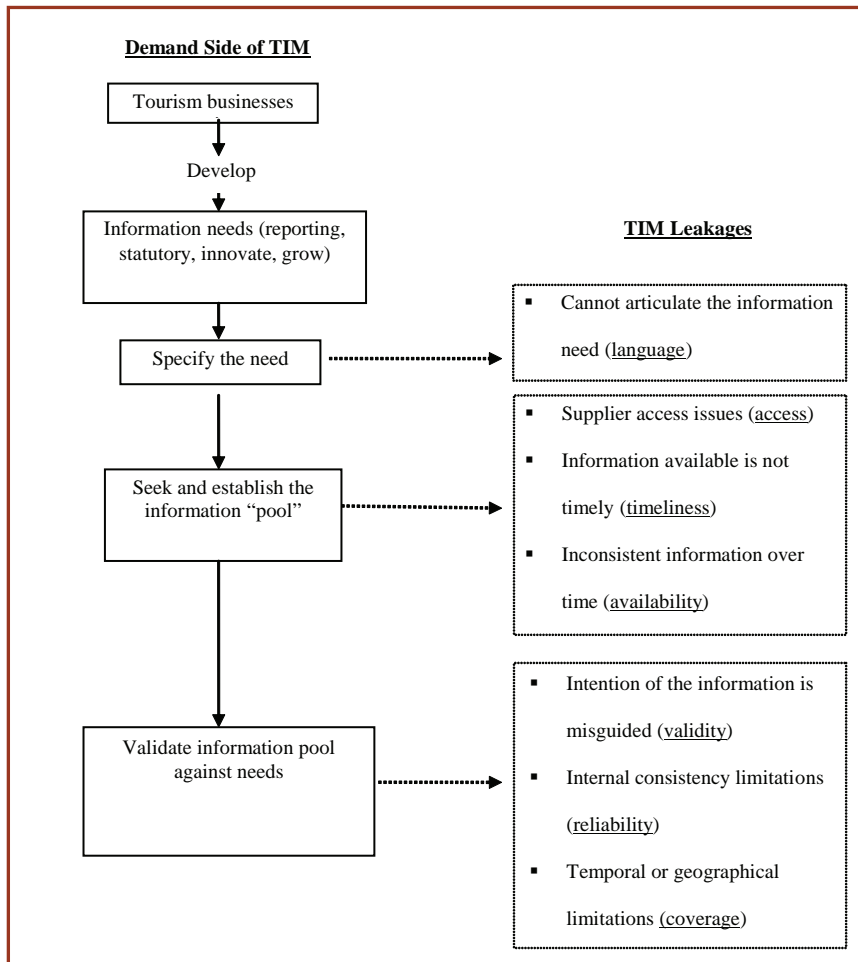
The uniqueness of information as a commodity means that the efficiency of the marketplace in which it is exchanged cannot be ascertained in terms of its ability to reach a state of equilibrium. An alternative approach is to assess whether information can be procured in the marketplace efficiently. If this was the case, tourism enterprises, after identifying their information needs, would be able to specify them to suppliers in a common language; readily assess the pool of information commodities available to address their needs; and apply relevant knowledge and skills to validate each information commodity to determine its appropriateness and relevance. Price impacts on the behaviour of the marketplace (especially consumers) become subservient to procurement activities, which are outlined in the model.

A closer examination of the Australian TICM and supporting literature reveals that the steps toward information commodity procurement are not efficient. Demand-side leakages are evident, masking the true demand for tourism information commodities. Leakages cause demand “drop out” on the demand side of the model. They are evident in each of the “specify,” “seek,” and “validate” phases (see Figure 2).

Causes of TICM leakages are identified in brackets in Figure 2 as follows:

- **Language (specify stages):** Carson and Sharma (2001) note that the supply of tourism information commodities in Australia is not bounded by a standard data model. Several attempts to produce standard classifications of tourism information have, nevertheless, been made. These include the Framework for Australian Tourism Statistics (Australian Bureau of Statistics, 2003), the National Tourism Information Model (Carson & Sharma, 2002), and the work of Scott (2000). The National Tourism Information Model, in particular, has recognised the importance of a “universe of discourse,” or common language, for the efficient distribution of tourism information.
- **Access (seek stages):** Efficient procurement of tourism information requires well-organised and defined access points to supplier commodities. After identifying and specifying their information needs, consumers must seek relevant information commodities from suppliers. Access to key information about the set of appropriate commodities can be obtained from intermediaries or directly elicited from suppliers. Degrees of access vary, ranging from direct access to information experts to no means of access at all. To highlight the magnitude of the access issue, the Decipher project in Australia currently provides a single point of access to information commodities from more than 150 suppliers (www.decipher.biz, April 2004).
- **TICMeliness (seek stages):** Timeliness describes the temporal lag between data collection and the public release of the data in the form of information commodities. The importance of timeliness to the tourism industry is underlined by the impacts of recent geopolitical shocks. These have underscored the high elasticity of demand for international tourism products. To respond effectively, tourism businesses require

Figure 2. Leakages in the tourism information marketplace



information on current and likely future implications. Until recently, lags of 12 to 18 months were not unusual for national-tourism-specific data sets. This situation is improving with advances in technology and increased experience in data management.

- **Availability (seek stages):** Relates to the assurance that information commodities are based on data that will continue to be collected and made consistently available. Recent funding cutbacks to public-sector suppliers have restricted their capacity to continue to deliver some knowledge commodities.

- **Validity (validate stages):** Validity describes the degree to which information consumers can ascertain the value of the information commodities relative to the current information needs. Information not produced specifically for tourism may still be highly valid where it contains generic “lessons.” Prominent suppliers usually provide guidance on the validity of their products through metadata.
- **Reliability (validate stages):** In terms of statistical reliability, technical considerations include sample size, sampling procedure, benchmarking processes (if used), and is-

sues of bias in data collection. A range of technical skills at the user end is required to assess reliability issues. This may be further complicated by the intended application for the information. For example, sample sizes may determine a data set to be reliable at the national level but not at the regional level. Tourism firms and organisations have been found to be lacking in their understanding of the impacts of reliability issues (Scott, 1999, p. 21).

- **Coverage (validate stages):** Relates to both the geographic scope and temporal scope of the information. National and state data sets are usually established for purposes of national- and state-level analysis, and coverage at regional levels suffers as a result. Some knowledge products contain generic, or globally, relevant content. Temporal coverage involves the time frame of reference for the data collection. This can be particularly important in tourism analysis because of seasonality effects.

THE POTENTIAL FOR ICT TO FACILITATE EFFICIENT TOURISM INFORMATION COMMODITY EXCHANGE

Coupled with the global shift to knowledge-based economies, there has been growth in the trade of information. Where previously, in capitalist-based economic systems, knowledge was an input to the development of industrial assets (such as machinery), knowledge in the information economy is the tool of specialist workers. Such workers seek, procure, and apply knowledge to wealth-creation processes, such as developing new production techniques and organisational structures and establishing competitive advantage. Processes that facilitate these outcomes can be described as innovative processes. This approach represents a major paradigm shift insofar as knowledge

and innovation are no longer exogenous to core economic processes.

Technologies such as online ICT systems have led to a proliferation in the availability of information by reducing storage, transfer, and handling costs. The World Wide Web is an obvious functional example. While information may still be relatively expensive to produce, it is cheap to reproduce (Shipario & Varian, 1999, p. 3). At the enterprise and organisational levels, information may be sourced from within the organisation as tacit or “prior related” knowledge (Brockman & Morgan, 2003) or from outside as secondary information.

A small suite of online tourism information systems has been developed around the world. Each system offers the capacity for technology-based solutions to the challenge of placing appropriate business intelligence in the hands of tourism enterprises and organisations. As a group, these systems demonstrate the capacity for ICT to address or minimise leakages in the TICM. Table 1 summarizes these and briefly indicates their main features. Table 2 summarises the potential contributions of the systems identified above to reducing marketplace inefficiencies the TIM.

CONCLUSION: AN ASSESSMENT OF THE IMPLEMENTATION POTENTIAL OF TOURISM ICT SYSTEMS

“Implementation potential” can be described as the likelihood that a particular innovation will be adopted in the system for which it was intended and in a way that is similar to its intended purpose. A closer examination of the Decipher ICT system in Australia substantiates that systemic barriers to implementation potential may reduce the capacity of ICT systems to be diffused in systems. Consequently, the innovative potential of such systems is diminished.

Table 1. Summary of existing online tourism information systems

| ICT System | Features and Strengths |
|--|---|
| Decipher (Australia) (www.decipher.biz) | Information from over 150 suppliers |
| | Delivered in context through intelligent user pathways |
| | Dynamic report-building and resource-tracking functionalities |
| Tourism Studies Austria (http://www.studien.at) | Database containing studies, research reports, and conference reports |
| | Searchable in multiple languages on title, keywords, summary, date of completion, etc. |
| Canadian Tourism Exchange (http://www.canadatourism.com/en/ctc/ctx/ctx-ind_watch/tourism_stats/index.cfm) | Business-to-business network for the Canadian tourism industry |
| | Access to a series of applications offering significant added value to its members |
| | Access to a series of html reports, statistical tables, publications, online professional development courses, and events calendars |
| Tourism Research Liaison Group of the United Kingdom—StarUK (http://www.staruk.org.uk/) | Delivers research reports and statistics in pdf and html formats |
| Tourism Studies Institute Spain (www.iet.tourspain.es) | Users can search for tables and pdf reports |
| | Sophisticated tools for manipulating tables |
| Tourism Research Council New Zealand (http://www.trcnz.govt.nz/) | Delivers publications and standard tables in html, pdf, and Citrix database format |
| | Index of research and publications from other sources |
| | Resources organized according to topic areas |

Table 2. Potential of ICT systems to resolve TIM issues

| Tourism Information Dissemination and Application Barriers | Potential ICT System Solutions |
|--|--|
| Language | Common discourse (e.g., NTIM) used to execute standard functionality (searches, retrieval of resources, etc) |
| Access | Single location access to resources from multiple suppliers |
| | Ability to facilitate and broker supplier–consumer interactions |
| Timeliness | Encourages suppliers to release soft-copy information commodities |
| | Facilitate “on time” public availability through automated delivery channels |
| Availability | Ability to deliver related resources where availability is poor |
| | Access to previous versions and trends (e.g., time-series data) |
| Validity | Potential to restrict the application of resources with poor validity |
| | Contextualization of validity issues to tasks |
| Reliability | Provision of metadata to assist with validation |
| | Access to related resources where reliability is poor |
| | Potential for automated warnings about reliability |
| Coverage | Provision to “push” resources with generic and extra-regional relevance |
| | Potential to build industry knowledge on seasonal impacts |

The Decipher ICT system meets a regional tourism need that has been consistently identified as a high priority (see, for example, Department of Industry Science and Resources, 2003; Prosser, 2000). From the neoclassical viewpoint, this market demand and product superiority would be considered sufficient for the technology to be widely diffused and adopted in the system. However, the tendency has been for developers of online tourism initiatives to encounter difficulties in achieving widespread uptake, despite the market need. To a degree, this is illustrative of the complexity inherent in RTS and the inability of the system to facilitate diffusion of technology for innovation (Daniele, Mistilis, & Ward, 2000; Sharma, DeLacy, & Carson, 2000).

Based on the Decipher experience, Table 3 details some of the impediments to more widespread diffusion and application of online information innovations in a systemic context.

Two main conclusions can be drawn from these discussions. First, the analysis of the TICM construct illustrates that a focus on increasing the production of information commodities without addressing the barriers to efficient exchange, uptake, and application may represent an imprudent investment of resources. This brings into question the policy of growing the stock of tourism information as purported in the White Paper. It also provides a generic lesson for developers of ICT systems insofar as information dissemination technologies can only be considered to be successful if they recognise the uniqueness of information as a commodity and address the barriers to exchange.

Second, as the Decipher case indicates, there is no guarantee that ICT systems will achieve their implementation potential. Developers must consider the capacity of the system to adopt, use, and apply the technology according to the purpose

Table 3. RTS impediments to the implementation potential of ICT systems (derived from Carson et al., 2003)

| Regional Tourism System Characteristic | Factors Impacting on Implementation Potential |
|---|--|
| Commercial imperatives | Most ICT projects require (at least) a part-return on investment; there is a poor history of users (especially small firms and local tourism associations) purchasing research and business intelligence |
| Information rich vs. knowledge poor | Inability of tourism information consumers to muddle through the leakages in the TIM and to apply skill sets to develop knowledge and learning |
| Regional dispersion | A key barrier to all ICT uptake in regional tourism (see Sharma & Carson, 2002; Carson, Sharma, & Waller, 2002); affects marketing, training, and the cumulative uptake of technologies |
| Structure of the tourism industry | Large numbers of small firms with generally poor ICT skills |
| | Low levels of contact between ICT system proponents and users |
| Sourcing of innovation champions | Reluctance among user groups to provide a lead-user role in the diffusion of innovative technologies |
| | Low levels of risk-taking behaviour associated with high elasticity of demand for tourism products |
| “Technophobia” | Inability to achieve a critical mass of users because of a poor understanding of the potential for technology-driven innovation |
| Tourism institutional stagnation | While imperatives for innovation are recognised in policy circles (Department of Industry Science and Resources, 1999), institutions focus on ICT development to facilitate product marketing and bookings |

for which it was designed. In RTS in Australia, the problems may be particularly acute. Addressing these may require coordinated strategies from policy makers, peak industry groups, and key tourism organisations. While ICT systems can demonstrate the need for such responses, their ability to progress the system toward this is beyond the influence of ICT developers.

REFERENCES

- Australian Bureau of Statistics. (2004). *Business use of information technology (Catalogue Number 8129.0)*. Canberra: Commonwealth of Australia.
- Breschi, S., & Malerba, F. (1997). Sectoral innovation systems: Technological regimes, Schumpeterian dynamics, and spatial boundaries. In C. Edquist (Ed.), *Systems of innovation: Technologies, institutions and organisations* (pp. 130-156). London: Pinter.
- Brockman, B., & Morgan, R. (Eds.). (2003). *The role of existing knowledge in new product innovativeness and performance* (Vol. 34).
- Carson, D., & Sharma, P. (2002). *A model of Australian tourism information: Implications for information systems*. Paper presented at the International Conference of Information Technology and Travel and Tourism.
- Carson, D., Sharma, P., & Waller, I. (2002, August 27-29). *Regional tourism and the Internet: Ebusiness structures for regional tourism organisations*. Paper presented at the Information Technologies in Regional Australia (ITiRA).
- Carson, D., Taylor, A., & Richards, F. (2003). *Delivering business intelligence for regional tourism in Australia: Analysis of the Decipher technological innovation*. Paper presented at the 5th International Conference of IT in Regional Areas, Caloundra.
- Daniele, R., Mistilis, N., & Ward, L. (2000). Partnership Australia's national tourism data warehouse: Preliminary assessment of a destination marketing system. In D. R. Fesenmaier, S. Klein, & D. Buhalis (Eds.), *Information and communication technologies in tourism 2000* (pp. 353-364). New York: Springer.
- Department of Industry Science and Resources. (1999). *Measuring the knowledge-based economy: How does Australia compare?* Canberra: Commonwealth of Australia.
- Department of Industry Science and Resources. (2003). *Tourism White Paper*. Canberra: Commonwealth of Australia.
- Edquist, C. (1997). Systems of innovation approaches: Their emergence and characteristics. In C. Edquist (Ed.), *Systems of innovation: Technologies, institutions and organisations* (pp. 1-35). London: Pinter.
- Edquist, C., & McKelvey, M. (2000). *Systems of innovation: Growth, competitiveness and employment* (Vol. 1). Cheltenham: Edward Elgar Publishing Limited.
- Frew, A. J. (2000). Information and communications technology research in the travel and tourism domain: Perspective and direction. *Journal of Travel Research*, 39(2), 136-145.
- Hunt, S., & Prosser, G. (1998). *Regional tourism statistics in Australia*. Lismore: Centre for Regional Tourism Research.
- Hutchinson, J. (1997). *Tourism: Getting it right for the next millennium, Report to the Minister for Industry, Science and Tourism*. Canberra.
- Johnston, R. (1999). *Australia's information future—Innovation and knowledge management for the 21st century*. Paper presented at the Australia's Information Future, Australian National University, Canberra.

Kelly, I. (2001). *Australian regional tourism handbook: Industry solutions*. Gold Coast: Cooperative Research Centre for Sustainable Tourism.

Lester, M. (2001). Innovation and knowledge management: The long view. *Innovation and Knowledge Management*, 10(3), 165–176.

Levine, D., & Lippman, S. (1995). *The economics of information* (Vol. 1). Aldershot: Edward Elgar.

Mansfield, E. (1985). *Micro-economics: Theory and applications*. New York: W.W. Norton.

Nelson, R. (2000). Knowledge and innovation systems. In Organisation for Economic Co-operation and Development (Ed.), *Innovation in small and medium firms: Background reports*. Paris: Organisation for Economic Co-operation and Development.

Prosser, G. (2000). *Regional tourism research: A scoping study*. Lismore: Centre for Regional Tourism Research.

Scott, N. (1999). *Tourism research in Australia*. Gold Coast: CRC for Sustainable Tourism Pty Ltd.

Sharma, P., DeLacy, T., & Carson, D. (2000). National online tourism policy initiatives for Australia. *Journal of Travel Research*, 39(November), 157–162.

Shipario, C., & Varian, H. (1999). *Information rules: A strategic guide to the network economy*. Cambridge, MA: Harvard Business School Press.

KEY TERMS

Information: Contextualised data that can be analysed and applied to decision-making circumstances.

Innovation Implementation Potential: The likelihood that a particular innovation will be adopted in the system it was intended for in a way similar to its intended purpose.

Knowledge: The outcome of the application of skills and resources to transform what were contextualised facts (information) into resources for learning.

Marginal Utility: The relative satisfaction gained from consuming additional units of a commodity. For many commodities, marginal utility diminishes (for example, a cream bun).

Metadata: Data or information that is about data. For example, a table of standard errors, a definition, and a library classification system are all examples of metadata.

Regional Tourism Systems (RTSs): RTSs in the Australian context are sectoral networks of organisations and institutions that interact or are interdependent, where the hub of such interactions is located outside of major cities.

System of Innovation: A conceptual framework in which networks of firms, organizations, and other parties apply tacit and secondary knowledge to interactive learning processes to generate favourable economic outcomes.

Tourism Information Marketplace (TICM): A conceptual model depicting the entities that participate and interact in the processes that facilitate the exchange of tourism information commodities.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 360-366, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.12

Potential Challenges of ICT Implementations in Sri Lanka

Kennedy D. Gunawardana

University of Sri Jayewardenepura, Sri Lanka

ABSTRACT

This chapter offers a state-of-the-art review of the implementation of ICTs strategies in a developing country with special reference to Sri Lanka as a case study. This chapter is based on primary and secondary sources (books, articles, Web sites, white papers, and grey literature). It also brings in a small number of empirical studies that serve to illustrate the practical use of the ICT to support arguments. Traditionally, access to ICTs and information has not been viewed as basic a need. However, if needs are interpreted as being dynamic and changing over time and culture (Max-Neef, 1986), access to information and knowledge could be treated as a basic need.

Information and knowledge have become increasingly important in the contemporary globalized economy, as advancement in ICTs has enabled larger amounts of information to circulate at a much higher speed and at lower cost. This is partly due to the balance between knowledge and natural resources, but with regard to being the most important factor in determining the standard of living in a country, it is said to have shifted in favor of knowledge. This has led many authors to claim that the people are now living in an information society or a knowledge-based economy (Drucker, 1993). Nowadays, it is a country's ability to assimilate, use, and diffuse knowledge that will essentially determine its chances of uplift in the new economy.

EMERGING ICT ISSUES IN SRI LANKA

Sri Lanka's ICT industry is thriving but faces significant problems, such as lack of transparency in government acquisitions (the largest prospective client); lack of moderately priced international bandwidth; lack of trained ICT professionals and classes knowledgeable about ICT; and a tax structure that does not reward local sales. In recent years, USAID has funded a number of projects aimed at increasing the competitiveness of various industries in Sri Lanka, and ICT is one of their prime foci. Their ICT sector studies have been well-performed, and their recommendations, if followed, will help guide the industry. However there is some danger that they may widen their scope to include the application of ICT in peripheral areas and, as a result, dilute their resources to no longer focus on their original crucial targets.

In general, the use of ICT in the commercial sector is irregular. Often, computers only seem to be found in managers' offices; they are rarely integrated throughout all levels of an organization. Some financial institutions have invested heavily in ICT, and as a result they are country leaders in the use of technology. Other sectors are far behind and their use of ICT is not visible. Even those companies that have invested in ICT often do so in restricted ways that are poorly integrated into their businesses. The same is true in case of the use of the Internet. In part, this is a small percentage (less than 10% of their total revenue) of Sri Lankan's access to the Internet, but the prime reason is, no doubt, the low level of managerial knowledge about the ICT capabilities in their business area.

At all levels of aggregation, statistics about any aspect of ICT in Sri Lanka are highly misleading and can be deceptive when used for policy purposes. Virtually all ICT activity is centered in Colombo, with small pockets in the Galle and Kandy areas (100 kilometers away from Colombo

city). There is clearly a desire to spread ICT development over a wider geographic area than just in Colombo, but it appears that it is not going to be an easy task.

The regions outside the urban areas are particularly poorly served with respect to electricity and telecommunications. Total consumption of the western province is 3,699 Gwh in 2003, compared to the rural sector's consumption with an average of 340 gwh. Moreover, the rural areas do not provide the level of comforts and conveniences often expected by people with the high-end technical and managerial skills needed to drive this sector. Lastly, the supply of lower level technical skills is substantially lower in these regions.

The telecenter movement is in its infancy in Sri Lanka. In many countries, telecenters have become the focal point for introducing technology into rural areas, and in fact to disadvantaged groups in urban settings. The concept shows up in many reports and plans, but despite this, there are a very few active telecenters. Of more concern is that the groups that are developing telecentre plans are doing this in isolation from each other, and from the worldwide community that has a rich knowledge on what works and what does not.

Underlying most issues in Sri Lanka is the 19-year civil unrest and conflict between the Government of Sri Lanka and the Liberation Tigers of Tamil Eelam (LTTE), which has controlled territories in the northern and eastern parts of the island and been the source of disruptions in the south. There are 362,000 (both Tamils and non-Tamils displaced due to Tamil conflict) who have been killed by the war.

When it comes to socioeconomic development and the uses of technology, Sri Lanka is a country of achievements and contrasts. It has achieved high levels of life expectancy, education, and health at par with countries having a Gross Domestic Product (GDP) per capita more than twice than Sri Lanka. Sri Lanka's per capita income was US\$1,000 in 2005.

Albeit all these constraints, the country has achieved a United Nations Development Program Human Development Index that is impressive relative to its GDP per capita. Its healthcare system includes the latest technologies: open-heart surgery, CT, and MRI scans (although access to some of these in public hospitals is limited). The southwest and the Colombo area in particular, have fiberoptic networks running along roads where carts are pulled by bullocks. Universities teach not only advanced computer science programs, but also the entire administration of the university, including students' academic records that was based on paper and manual operations, is being computerized.

BACKGROUND

The speed of global technological and economic transformation demands urgent action to turn the present digital divide into digital opportunities for all. A discussion about the allocation of resources is imminent if looked at the connectivity of the Internet in developing countries. One way to measure the digital divide is to monitor the penetration of telephone subscribers and Internet users, as well as literacy rates in developing countries. Poor access to the Internet in Sri Lanka is widely acknowledged.

A few of the ICT parameters have been discussed here to illustrate the current scenario of ICT in Sri Lanka.

Telecommunications

Over the years, with the advances in the telecommunications field, Sri Lanka Telecom Corporation (SLT) has taken steps to upgrade and strengthen the telecommunications infrastructure in the country. Strategies such as expanding the optical fiber network and applying new digital technologies have contributed to greater reliability and

efficiency. According to 2003 data, there were 822,992 telephones in Sri Lanka. It had 85,500 Internet customers by 2003. The services provided include PSTN dial-up at 56 kbps, ISDN dial-up at 64 kbps and 128 kbps, Internet Leased Line services at 64 kbps, 128 kbps, 256 kbps, 512 kbps, and 2Mbps, client mail server installations and Web hosting.

Other than SLT, there are a number of private telecommunications service providers, cellular mobile telephones, pay phones, trunk telecommunications networks, radio paging service, and trunk radio networks. Mobile cellular phone services, which started in 1989 (a first among South Asian countries), continue to grow very rapidly. The number of cellular connections, which stood at 1,800 in 1991, increased to 2.5 million in 2005. Phone charges per minute are comparatively high. The price \$0.25 per minute for local calls and \$0.40 for International. Domestic phone rates continually increase, and vary from zone to zone, while IDD rates have decreased slightly in recent years. Cellular phone rates are also high, but have declined gradually due to intense competition. Restructuring of telecom services started in 1995, and since then steps have been taken to privatize SLT in stages, opening for foreign investment and with the intention of making the services more efficient.

Internet and Computer Networks

Lanka Internet Services initiated commercial operations in 1995 and SLT started its Internet service facility in 1996. At present there are over 20 Internet Service Providers (ISPs), including SLT and private companies. The services of ISPs cover a wide geographical area, and Internet connectivity and e-mail software are readily available. Despite this fact, the cost is high and it costs around \$0.45 per hour. Currently, most of the Internet usage is in the commercial sector.

Potential Challenges of ICT Implementations in Sri Lanka

In 2003, there were 85,500 Internet users in Sri Lanka. According to the Telecommunications Regulatory Commission of Sri Lanka (TRCSL), the total number of Internet accounts was 121,532 (0.02% of total population of Sri Lanka) in 2005.

Although government initiatives have attempted to provide Internet facilities and access in schools and other educational institutions such as the National Colleges of Education, its use is minimal due to prohibitive cost. The Lanka Educational Academic and Research Network (LEARN) is a facility that interconnects educational and research and development institutions throughout the country. Initiated in 1990 as a project by the Department of Computer Science and Engineering (CSE) at the University of Moratuwa, it provided LEARN mail, the first e-mail service in Sri Lanka. Now administered by the Institute of Computer Technology at the University of Colombo, with technical operations being carried out by the CSE at the University of Moratuwa, it provides e-mail, dial-up, and dedicated Internet connections to its members.

IT in Primary and Secondary Education

Since 1983, the Ministry of Education and Higher Education has taken steps to familiarize and encourage school children in the use of IT. Computers were provided to some schools in 1984. In 1994, Computer Resource Centers (CRCs) were set up in a number of schools with the assistance of the Asian Development Bank. The main objective of setting up CRCs was to provide basic computer literacy to students during their vacations or after they had left school. In 1999 and 2002, a small number of computers were supplied to selected schools in all provinces. This was done with the intention of implementing the “activity room” concept, where students of junior secondary level (Grades 6-9) were to be familiarized with com-

puter use. Despite all these attempts, IT was not integrated into the formal school curriculum. The major emphasis seemed to be on hardware supply for schools rather than on IT education.

Realizing this shortcoming, the IT unit of the Ministry of Education and Higher Education initiated a National Policy on Information Technology in School Education (NAPITSE). It has implemented a number of strategies to improve the situation. This policy includes a six-year strategic plan from 2002 to 2007, which is divided into three stages. Focusing on two main aspects—use of IT in education (learning and teaching) and use of IT in management of the education system—the strategic plan is being implemented under four major themes: curriculum development, human resource development, physical/infrastructure development, and support initiatives development. As a result of NAPITSE, syllabi on General Information Technology (GIT) and Computer Assisted Learning (CAL) courses for GCE A-Level and GCE O-Level classes have been developed, and GIT for GCE A-Level has already been implemented. About 700 A-Level teachers have been trained up to now and 5,000 teachers will be trained next.

IT in Higher Education

The National Policy on IT made several recommendations to enhance IT in university education. These included providing IT awareness to all undergraduates, establishing campus-wide networks in all 14 universities, providing Internet access to all, and introducing computer science courses. Open University of Sri Lanka (OUSL) offers six programs of study including IT courses, ranging from certificate level to master’s degrees. All registered students at OUSL are provided with the opportunity to undergo a basic computer awareness course, and to use the computer facilities available at the elementary computer laboratories at the Colombo Regional Centre

and other regional centers. Internet facility is also provided to students free of charge at these labs and in the main library. The campuswide computer network integrates resources such as the library and IT division.

Initiatives to integrate e-learning with the existing courses are currently being implemented. The staff development center of OUSL conducts multimedia training sessions for its staff, as well as staff from other universities. The IT division also conducts IT training sessions for staff. The Institute of Computer Technology, an independent institution established within the University of Colombo, with modern facilities, is well-recognized by the University grant commission in Sri Lanka.

Providing IT training for students at universities, it is also involved in software development and research in IT (ICT, 2001). The Sri Lanka Institute of Information Technology (SLIIT) was also recently established by the Government of Sri Lanka to train IT professionals. At this institution, courses are offered in IT, development of software, and research and development in IT. The SLIIT conducts a program of study leading to a Bachelor of Science degree in Information Technology (SLIIT, 2004).

The Sri Lankan educational environment is undergoing a phase of rapid transformation with adoption of information technology at various levels. Teacher training on various educational media such as online resources has been identified as one of the key approaches to integrating ICT in the classroom. At the same time, efforts to develop learning materials indigenously are ongoing at various educational institutions.

Before proceeding to the next section, author would like to detail out a comprehensive ICT based educational plan of the Sri Lankan government for national capacity development that will assist to face the challenges of the ICT implementations.

The National Policy on Information Technology in School Education (NAPITSE) affirms the

commitment of the government towards providing the state of the art knowledge in IT to Sri Lanka's younger generation, preparing them to face the challenges in the 21st century. This policy will provide a clear vision and direction in making this a reality, followed by an action plan as a six-year strategic plan from 2002 to 2007. This six year project period is divided into three stages:

- Stage 1: 2002-2003
- Stage 2: 2004-2005
- Stage 3: 2006-2007

The NAPITSE will be implemented via an action plan titled, "National Policy on Information Technology in School Education, Action Plan, and Operational Strategies." It will be in the form of a rolling plan, undergoing periodic changes with necessary academic and professional inputs being incorporated as and when necessary.

The action plan will focus on:

- Use of IT in education (Learning and Teaching)
- Use of IT in management of the education system

Vision:

- A new generation of Sri Lankans empowered with Information and Communication Technology
- To facilitate the planning, implementation, and sustenance of Information Technology education in schools to enhance student's learning and quality of teaching

Goals

The NAPITSE will have the following overarching goals:

Potential Challenges of ICT Implementations in Sri Lanka

- Envisage and foresee the future global challenges in IT education and lay the foundation for appropriate human resource development to meet such challenges
- Create conditions enabling the effective use of IT as a tool in learning and teaching at all levels in the general school education
- Provide “information literacy” for all school leavers
- Create conditions for effective involvement of school system in lifelong education
- Create an information literate population of teachers/educators

Objectives and Strategic Themes

In order to reach the goals, the following objectives would be achieved under four major strategic themes:

- **Curriculum Development**
 - To introduce, sustain, and enhance IT involvement into general education in schools and create opportunities for IT based learning and teaching
 - To introduce IT into pre-service and in-service teacher development and training programs, and create opportunities for system-wide professional development of teachers
- **Human Resource Development**
 - To provide necessary education and training to all teachers in government schools and making them competent in using IT for teaching purposes
 - To upgrade officers in the education system to handle IT related activities competently and with ease
 - To create opportunities for out of school population to utilize resources in school based IT resource centers, thus creating an environment for community learning
- **Physical/Infrastructure Development**
 - To allocate and distribute optimal resources in an equitable manner to meet the learning needs of students and learning/teaching requirements of teachers
 - To set up an Information Technology Education Resource Center (ITERC) at the national level, provincial level and zonal level ITERCs for teacher training/development
 - To establish an IT education laboratory at the National Institute of Education (NIE) to improve curriculum development
 - To establish an ITERC at the Center for Professional Development of Management of Education
 - To dedicate a National College of Education (NCOE) for development of IT teachers under pre-service teacher training
 - To provide innovative means of training through activities, such as mobile training laboratories
 - To set up a Multimedia Education Software and Web Development Center
- **Support Initiatives Development**
 - To establish IT school clubs
 - To encourage preparation of Web sites for schools
 - To encourage teachers to own personal computers
 - To design, develop, and maintain a Web site for the Ministry of Education and Higher Education to assist the school system in e-learning and information management
 - To convene appropriately time-framed IT education research and development conferences/colloquia
 - To facilitate the setting up of a professional body for those who are involved in IT education in schools

- To establish a fund to support innovative approaches and creative initiatives for school IT education development
- To initiate an award scheme to encourage educators for promoting innovative IT in education
- To forge strategic partnerships with other government institutions, Sri Lankan Missions abroad, foreign missions in Sri Lanka and national and international NGOs and the private sector to extend the coverage of IT education, promote, and enhance the quality of IT education in the school system

In the new millennium, nations are judged by the well-being of their citizens; level of education is one of the major determinants. Computer literacy of a nation in the future will be a yardstick to measure the level of education. Sri Lanka's success in achieving high levels of basic literacy and numeracy can be capitalized on by pursuing a well thought-out strategy on achieving high quality IT education in the general school system.

Under various foreign-funded projects, the Ministry of Education is currently taking several measures to enhance IT facilities in schools. For instance, under the World Bank funded General Education Project II, planning is underway to provide 400 schools island-wide with ICT centers, equipped with 10 computers each and other accessories, as well as Internet facilities. The pilot project, in which ICT centers were established in 80 schools, was implemented in 2001 and was evaluated in 2003. The initiative was found to be providing the opportunity for students and teachers to develop basic competencies in the use of IT in education; and, despite various constraints, all schools are attempting to make the best possible use of the centers (Karunanayaka, Kularatne, & Udugama, 2003). The Secondary Education Modernization Project currently being implemented with the support of the Asian Development Bank

intends to develop computer literacy and narrow the digital divide. During 2001-2006, about 2,300 schools will receive 10-20 computers; and the project envisages improving access for an additional 5,000 poor students annually, by upgrading 1,000 existing schools (Reddi & Sinha, 2003).

THE CHALLENGES

A few parameters will be discussed here that may be treated as potential challenges for ICT implementations in Sri Lanka.

Lack of Skilled ICT Professionals

The lack of sufficient, trained ICT professionals has been a recurring focus in ICT studies and reports in Sri Lanka. There seems to be four main drivers for this shortage:

- Sri Lanka produces only a small number of ICT-trained university graduates (albeit high quality) each year. The number of positions in the state-funded universities is severely limited. This is part of a bigger problem. Sri Lanka has a good record for primary and secondary education but admits to university only about 6% of successful secondary school leavers (16,000 out of 200,000).
- Sri Lanka has about 30 state-supported, commercial and quasi-private technical training institutes. However, the quality of training at these institutes is highly variable.
- Sri Lanka loses many ICT graduates soon after graduating. Their ICT skills demand far higher salaries abroad. An IT-qualified graduate earns per month US\$800 to \$1,000 locally.
- Sri Lanka faces a serious shortage of experienced ICT professionals. Senior people with 6-10 years experience are lacking in software design, project management, and network design and management. This short-

Potential Challenges of ICT Implementations in Sri Lanka

age is felt both in industry and education. Sri Lanka has only 10 IT graduates out of 500 graduates.

The problem of insufficient ICT graduates has several dimensions, some of which are addressed below:

- All 14 state-funded universities provide some form of ICT education. However, in the majority of them, it is just computer science or information management courses within a general BS degree.
- Several fee-levying institutes (arms of foreign universities) offer computer science programs, but the prices tend to be above what most of the population can afford. It costs around US\$10,000 for a 3-year program and normally recruits 120 students per batch.
- Though in state-funded universities ICT training is being increased (a recent example being the new Faculty of Information Technology at the University of Moratuwa), this effort is tightly constrained by the lack of senior instructors.
- The University of Colombo has recently begun an innovative 3-year program called the External Degree of Bachelor of Information Technology (BIT). Under this program, the university sets the curriculum and the exams. Student can prepare for examinations through self-study, or they can go to one of about 40 fee-for-service institutes that provide training and/or tutoring. To promote the quality of such sources of training, the university will publish on its Web site student success rates by institution attended. The BIT program is designed to allow students to stop with a Certificate of Information Technology after year one, an Advanced Certificate of Information Technology after year two, or a full Degree Certificate after

completion of year three and other degree requirements. This strategy produces three levels of ICT skills.

For the application of ICT across the non-ICT sectors of Sri Lanka (government, health, primary/secondary education, small and medium enterprise (SME), and the rural sector) more people will need to be computer literate and computer trained. There are many user training programs in place, but as in the case of more technical training, the quality of the training programs remains uneven and erratic. The institution providing the Computer Driver's License may be effective in helping to manage and measure the growth in computer literacy, and offer employers a measure of confidence in hiring staff.

Two skills retention strategies that seem to be underdeveloped in Sri Lanka are the virtual repatriation of the skills of expatriates, and the retention of ICT professionals by linking them online to education, research, and work abroad. Some Latin American countries, for example, resort to the Internet to repatriate the skills of overseas nationals, for use in education, research and development, industry, and for civil society activities. Such efforts are low cost and in many cases the expatriates themselves organize them. Other countries, Ghana for example, have used the Internet to retain local skills, by linking local medical researchers to overseas research networks.

Basic ICT Skill Development

The twin problems of how to increase both the supply and the quality of training, across a number of skill areas and skill levels, should be addressed in collaboration across the relevant stakeholders, including the training institutes. Sri Lanka is not in a position to simply institute various levels of formal certification of ICT training facilities. There can be schemes such as the University of Colombo external BIT plan that certify skills.

Furthermore, publishing students' performance by training institute will allow students, and their families, to identify quality, and influence training quality. Publishing statistics on how many graduates obtain employment utilizing their new skills will also provide a measure of success, but one must be careful that these statistics are honestly presented.

There are discussions going on at a number of levels to institute formal certification of ICT professionals. Certification not only labels the prospective employee, but the type of certification will provide guidance to employers who do not themselves have the skills to identify good employees. The relevant stakeholders, including the training institutes, should consider a mix of *guard dog* and *guide dog* strategies to improve ICT skills and the performance of ICT training institutes. The objective is to expand the supply of quality ICT skills, not to restrict supply just to those that currently produce quality ICT skills.

Weak Strategies for Retaining ICT Professionals

There remains a serious obstacle to a rapid ramp up of ICT activity in the software sector, and the large-scale application of ICT to organizations. While it is possible to quickly expand the supply of entry-level ICT personnel, it is not possible to immediately produce high-level professionals, especially when that includes 6-10 years of proven experience in software design, project/implementation management, and network management. Some of this demand could be met by the virtual repatriation of the senior skills of expatriate Sri Lankans abroad. Again, an end to the civil unrest will also help, both in the potential for full-time repatriation of ICT skills, and for the short term return work stints of expatriates whose ICT skills are being repatriated online the rest of the time. It remains to be seen as to who might organize such efforts.

One interesting and successful way to circumvent this problem is to subcontract high-end tasks to the Computing Services Center (CSC), a group within the Institute of Computer Technology (ICT) of the University of Colombo. ICT is one of the few really concentrated centers of technological expertise in the country, and the CSC has been involved in many successful projects. These have included feasibility studies, project specification and design, tender evaluation, network design and implementation, as well as overall system development. This group has been involved in some of the most strategic projects involving both government and private enterprise. As a side-benefit, this also serves to give staff members an additional source of income, partially alleviating the low academic salaries. The salary of the university senior professor is around US\$600 per month.

OVERCOMING THE CHALLENGES

The author proposes a few strategies to overcome the challenges and uplift the human capacity of Sri Lanka.

Computer Literacy in the General Population

As information and communication technologies (ICTs) become a part of everyday life, it will be increasingly necessary for all citizens to have some basic familiarity with computers. Technology revolutions are complete when such skills are taken for granted and the technology seems to have disappeared into the background. It is necessary to (a) be clear as to what the actual goals are, (b) have an evidence-supported strategy for getting there, and (c) engage in a planning process in which both stakeholders and champions are brought on same side. It is essential to convert strategy into resources, or Sri Lanka will run the risk of reproducing the shortcomings of similar efforts elsewhere.

The main shortcoming is the tendency to substitute the provision of technology with implementation strategy. It is better to deploy one-half, or one-quarter of it, rather than engaging in a technology-intense strategy. One such strategy is helping donor agencies understand the issues, in terms of providing computers in the school and computers in the community.

A method that has been successful elsewhere is to provide technology to a school if there is a local champion and the school management is committed to the success of the project. A champion could be a staff member at the school, or a local company that will provide help and guidance. The essential characteristic of champions is that they passionately care for the computers' better use, and will do whatever is necessary to ensure that outcome. A success in a school with a local champion tends to spread to nearby schools with a ripple effect.

It is also noteworthy that, to date, the technology has not been used in support of other educational goals, specifically those related to English and other language training. It has been found that exposure to the still largely English-dominated computer and Internet world does wonders to increase functional English language skills. And the poor quality of English language education, particularly in rural areas, was highlighted as a major problem by several interviewees. There are 196,597 teachers in 2003 and English teachers who can teach English as a subject in schools are only 10% out of this number.

Improved Internet Access

There are six ISPs in Sri Lanka, with Sri Lanka Telecom (SLT) being the largest. Most of these players are quite small. SLT has 50,000 subscribers out of 19 million of the total population. SLT provides simple dial-up, dedicated to broadband Internet services through its Internet Service Provider (ISP) SLTNet. SLT has points-of-pres-

ence (POPs) across the country and this allows its subscribers to access the Internet for the cost of a local call through a single number (150) using SLT's unmatched superior quality backbone bandwidth of 90 Mbps.

SLT currently offers Internet-leased lines at 64 kbps, 512 kbps, and 2 Mbps, mail server services, Web and Domain Name Server (DNS) hosting are other value added products for business customers. SLT also provides Internet services to most of the other ISPs. All ISPs (or their downstream supplier) interconnect at the Sri Lanka Domestic Interchange, so that, intra-country traffic will never go offshore. SLT provides domestic leased circuits under the name of SLT Data. It offers data circuits of capacities ranging from 64 kbps up to 2 Mbps and in multiples of 2 Mbps. Our services include domestic and International Private Leased Circuits (IPLCs), Frame Relay (FR) circuits, Internet Leased Lines (ILLs), Direct Inward Dialling (DID) and Direct Outward Dialling (DOD) connections.

The cost of Internet ISP access is comparable to similar services elsewhere in the world. Many non-SLT providers only offer 28.8/33.6 kbps dial service, and access from many non-SLT local loops is limited to 28.8 (presumably due to the use of compressed 32kb voice services). A typical cost (from SLT) is US\$11 per month for 150 hours. But, the actual per minute cost of dialup Internet access is normally high because of the additional per-minute cost of voice service. The base cost of a telephone line is low (about US\$3-4 per month). However, the cost per minute, particularly during weekday daylight hours, is abnormally high (for SLT it is US\$1.80 per hour after the first 8 hours).

Incorporate New Technologies

Virtual Private Networks (VPNs) have emerged as a modern solution for meeting the challenge of integrating data, voice and video traffic in an

easily manageable, scalable, and flexible network. VPNs provide economical, efficient, and secure solutions for modern businesses.

SLT has launched its IP-VPN service in 2003 and built a Managed Private Leased Circuit (MPLC) based IP-VPN network covering almost all commercial locations in the Western Province (including Katunayake and Kandy). SLT now offers IP-VPN services to virtually any location within Sri Lanka by providing access through leased lines, frame relay or Digital Subscriber Lines (DSL).

The Managed Private Leased Circuit (MPLC) protocol has emerged as the preferred protocol. It combines the security and performance of Frame Relay Services with the flexibility and cost-effectiveness of IP.

Deregulation of ICT Policies

The telecommunications sector in Sri Lanka was at first a state-owned department. The department was converted to a corporation and regulation was introduced in 1991. The Sri Lanka Telecommunications Authority (SLTA) was created by an Act of Parliament in 1991. It was converted to a commission in 1996. The dominant operator Sri Lanka Telecom (SLT) was privatized in 1997 with the government of Sri Lanka disposing of 35% of the share to the NTT Corporation of Japan. Licenses were issued to two operators for fixed

access telephone services using WLL technology to compete with SLT. At present there are also four cellular operators, six facility based international data transmission providers, twenty-two licensed ISPs and two licensed pay phone operators. To show the current status of ICT, a few parameters are given in Table 1.

The new National Telecom Policy recommends the support for the establishment and promotion of the Sri Lanka information infrastructure and includes focus on new ICTs such as the Internet and e-commerce. In order to develop information technology, the Council for Information Technology (CINTEC) was established under an act of parliament. CINTEC has been involved in the development of e-commerce in Sri Lanka. It has several subcommittees and one of them is on law and computers.

This institution came under the purview of the Ministry of Telecommunications and Information Technology in October 2001. The growth of the telecommunications sector has given the foundation for developing the e-commerce industry in Sri Lanka. Within this improvement, e-commerce has received the attention of consumers, business persons, journalists, private and government organizations during the last few years. It brings a new trend in the policy agenda of Sri Lanka. With the development of technology and Internet applications, the e-commerce operations are becoming very fast, cheap, and simple.

Table 1. A few ICT parameters of Sri Lanka Source: Sri Lanka Telecom LTD 2004 (NA-Not available)

| Item | 2000 | 2001 | 2002 | 2003 | 2004 |
|--------------------------------|---------|---------|---------|-----------|-----------|
| Wireless local loop telephones | 11,4267 | 12,1082 | 11,4488 | 11,6021 | N/A |
| Cellular mobile tele-phones | 430,202 | 667,662 | 931,580 | 1,393,403 | 2,211,000 |
| Radio paging | 7,009 | 6,535 | 5,516 | 2,851 | 3,679 |
| Public pay-phones | 8,222 | 7,281 | 6,681 | 6,440 | N/A |

Better Utilization of the Internet

As mentioned above, various industries in Sri Lanka are making use of e-mail and the Web. However, it is notable that virtually none of them have truly integrated them into their business. It was difficult to find examples where the use of either e-mail or the web was a crucial link to business success.

The attitude of communities is changing with the introduction of Internet at all levels. It is now used extensively in schools, universities, private and government organizations, banks, journalists, and business organizations. This is a very important aspect for the development of e-commerce in Sri Lanka. The business community of the country started to gradually experience applications such as online merchandising, stock trading, and banking and information database. These applications promote the e-business culture locally. A limited number of the organizations are using e-commerce for their international business activities.

Sri Lanka is also in the process of establishing an Electronic Data Interchange Network, which would link up all key public organizations. This development will help to the penetration of an e-business environment in Sri Lanka.

The SMEs use the Internet extensively for trade research. As in any other country, Sri Lankans use the maximum potential of the Internet to absorb the technical know-how from the outside world. Almost 100% of the SMEs who used the Internet at the time of our survey reported that they were using the Net for at least one of the following:

- Free downloading of device drivers from the OEMs
- Free evaluation software downloads
- Obtaining technical documentation/research papers
- User manuals and sales catalogues
- Getting competitor information
- Getting trade know-how and new ideas

Sampath Bank (one of the leading IT introduced local banks from inception) and HSBC Bank are the main bankers used by the Sri Lankan SMEs for Internet banking. The reasons for using them were convenience, proven security, fewer conflicts (words from a respondent), economical operation, and so forth. The normal Internet banking operations were balance verification, requesting statements, transferring funds between accounts, paying bills, requesting check books, and so forth. The length of period of use averaged to about one year. Almost all respondents agreed that Internet banking once implemented with proper security precautions would benefit the customer providing state-of-the-art technology at a touch of a button. The major advantage being the rapid response and dynamic operation without having to waste time in the traffic jams.

Wireless Application Protocol (WAP) Implementations

The mobile phone companies have been promoting WAP applications for quite sometime now. The available applications include exchange rates, cricket scores, horoscopes, stock market, flight information, and so forth.

However, the business volumes on WAP implementations are low due to the lack of proper equipment, lack of customer awareness, and attitude, and so forth. At the same time, the phone companies see that high promotional and operational costs are main barriers to enhance this service.

Improved Policy Initiations

The rapid developments of ICTs in Sri Lanka have significantly affected the current legal system. Many privacy experts in Sri Lanka have shown that there is a need for new laws to adequately regulate new technologies.

The absence of a data protection law and a data protection authority in Sri Lanka is a real threat

to the recently introduced e-Sri Lanka program. The e-Sri Lanka program aims at computerizing all governmental departments in the country and facilitating electronic documentary service, as opposed to the traditional government service that still processes everything manually.

In 2003, the Parliament passed the ICT Act No. 27 for the establishment of a national policy on information and communication technology and for the preparation of an action plan. Under this Act, the Information and Communication Technology Agency (ICTA) has given the responsibility to implement the national policy in both the public and the private sectors. The agency functions as the single highest body involved in ICT policy in the nation. It also assumes the role of implementing the e-Sri Lanka initiative.

The Computer Crime Bill of 2003 has also been approved by the Cabinet of Ministers and established by the Parliament. This act aims at combating computer crime in Sri Lanka. The Electronic Transaction bill Act has been established for providing the legal recognition of electronic transaction and other transactions carried out by means of electronic communications commonly referred to as “electronic commerce.” This act is based on the UNCITRAL Model Law on E-Commerce 1996 and the 2001 UNCITRAL Model law on Electronic signatures.

Enhanced Governance

The e-government index of Sri Lanka is 0.92 which is below the global mean e-government index of 1.62 and it indicates that present e-government capacity of Sri Lanka is poor. A research on the Web survey of government institutes revealed that 30% of ministries in the country do not have Web sites or may not be access able since they are inactive. 38 of the ministries are still in the early stage and information available in Web pages in terms of content is not rich. Only about 17% of ministries offer interactive Web content, where users have access to regularly updated informa-

tion and can communicate through e-mail and download government documents through the Internet. 15% of the ministries provide some online services to the citizens. In same study a sample e-mail was sent and the time taken to reply was recorded. It was found that 99% of e-mails were not responded to by the Web masters (E-government survey, 2004).

The State Accounts Department (part of the Ministry of Finance) is leading a government-wide effort to progressively adopt International Public Sector Accounting Standards (IPSAS) for the reporting of government accounts (revenue and expenditure). The financial statements (i.e., accounts) for 2002 were prepared for the first time in accordance with the IPSAS cash accounting formats and have received a clean audit opinion from the Auditor General (except for a historical reconciliation issue). The previous 198-page dense financial report has been drastically reduced to just nine pages of well laid-out information (a one-page consolidated statement of cash receipts and payments with eight pages of supporting notes) designed to be read and understood by non-accountants.

The technical assistance project funded by the Asian Development Bank has provided the international good practice functional expertise to guide the adoption of the IPSAS cash accounting format. This assistance was grant funded at no cost to the Government of Sri Lanka. The cost of developing the overall information systems that underlie this project has been significant—recent costs for consultancy inputs, training, and overall Web site construction alone (excluding hardware costs and earlier construction of information systems) totals around US\$150,000. However, construction cost of the financial statements and directly-related Web outputs has been reduced to a few thousands of U.S. dollars.

The improved quality and accessibility of accounts have a positive knock-on for transparency and accountability. Expected gains in this regard include but are not limited to informed

parliamentary debate, media coverage based on financial facts, and increased reliance on government financial reports by international investors. Such non-quantifiable benefits will take some time to accrue and perhaps the greatest benefit in quantifiable terms might be the willingness of the international financing institutions to commit additional aid funds on the basis of increased transparency and accountability in government financial management.

Support Outsourcing in Software

Sri Lanka has a small emerging software development industry concentrating on exports, which ran at about \$50 million in 2000 with a high percentage on a subcontract basis. Most of the industry consists of small firms founded by computer professionals, some returning from the U.S. to start their own companies. The industry faces constraints from shortage of skilled professionals, lack of venture capital, and narrow telecommunication bandwidth. Sri Lanka has not been able to take advantage of its high literacy rate to promote the IT industry. Local IT entrepreneurs, however, remain guardedly optimistic that Sri Lanka can carve a niche for itself in the high value-added software product development rather than the low value-added IT services which gravitate to India because of its large English-literate population and low wages.

The recent expansion of the software development industry has resulted largely from outsourcing for American, Middle Eastern, and European clients in Internet-based software development and business applications. Only a handful of companies are engaged in internationally recognized product development. In offshore services sector, local programmers produce software for overseas clients based on their designs and specifications. Some companies providing outsourcing services have dedicated support service centers abroad as well. John Keells Computer Services (JKCS), a subsidiary of Sri Lanka's leading conglomerate

John Keells Holdings (JKH) and one of the leaders in software services in Sri Lanka, employs nearly 2,000 programmers in 2003, and after they recruit every year, 50 qualified people go to their companies. Another major player in software outsourcing is eRunway. eRunway, headquartered in Boston, has an Internet software development center in Colombo employing over 300 software engineers.

Millennium Information Technologies (MIT), founded by a local computer professional, is the most successful company in product development. Valued at over \$100 million, MIT hopes to list on NASDAQ. MIT has built an international reputation for capital market and telecommunication industry software. Its state of the art stock exchange suites are used in stock exchanges in Malaysia (MESDAQ), Croatia, Mauritius, and Sri Lanka. The Colombo Stock Exchange (CSE) is one of the world's most technologically advanced stock exchanges. The catalyst for this change was a systems integration contract from the Colombo Stock Exchange, which was reinterpreted as an opportunity to design and install a straight-through processing system which actually worked. The CSE solution became the basis for Millennium IT's suite of capital markets software products.

Various programs are underway to develop the software development industry in Sri Lanka. The government has recently created a separate Ministry for Information Technology and Higher Education. Despite government's precarious fiscal position leaves little room for investment in related infrastructure, the government believes that due to the high literacy rate, Sri Lanka can be converted to an information technology savvy nation by 2010. Bureaucratic barriers have prevented setting up of a regional Java Training Center in Sri Lanka by SunMicro systems. The software industry, according to industry leaders, will continue to develop more on individual company efforts. For instance, some software developers have set up their own training institutes to meet the human resources shortage.

Elevated E-Readiness

Sri Lanka is ranked 54th out of 82 developed and developing countries in the Networked Readiness Index published in the Global Information Technology Report (2002/2003). The report, the collaborative effort of leading academics worldwide, seeks to benchmark and monitor the progress of nations in different dimensions in the field of ICT.

The report highlights the networked readiness of the three major stakeholder's viz. individuals, businesses and governments within a country's economic and political context. The variables used to measure the Networked Readiness Index are grouped into three broad categories, particularly environment, networked readiness, and network usage. Each component index is composed of three subindexes with the computation of the final Networked Readiness Index being based on the 64 variables included in 9 subindexes.

The final index captures the critical factors relating to the environment, readiness, and usage of ICT by the three stakeholders. The rankings relating to both the component index and subindex, help in identifying the relative strengths and weaknesses in specific areas of competence. The Index therefore provides a useful measure of benchmarking the progress in networked readiness across a wide spectrum of nations worldwide.

Sri Lanka, with a score of 4.66 in the sub-category government readiness, is ranked 25th a high rank in comparison to its overall position of 54. This is a firm indication of the top priority and the thrust provided by the government to ICT in Sri Lanka.

Workforce Strengths

The key to any successful development initiative is the development of its stakeholders. Sri Lanka's labor is reputed for its precision, quality of its work, and productivity. English is widely spoken and understood throughout the island. The World Bank reports have indicated that Sri Lanka has one of the highest literacy rates (92%) among designated low-income countries; a population of 19.2 million has a workforce of approximately 6.7 million. There is a steady pool of manpower resources for both existing and new industries. The government provides free education from kindergarten to university. Sri Lanka is also ranked high on the Human Development Index and compares well with developed countries. Table 2 shows the Human Development Indices of Sri Lanka in comparison to the global or regional context.

Table 2. Human development indices of Sri Lanka and other regions. Source: UNDP (2003) Human Development Report

| Country or Group | HDI Value |
|---|-----------|
| Countries with high human development | 0.908 |
| Sri Lanka | 0.730 |
| World (Average) | 0.722 |
| Countries with medium human development | 0.691 |
| Developing Countries | 0.655 |
| South Asia | 0.582 |

FUTURE ISSUES

Sri Lanka has the highest literacy rate in the South Asian region and has a large pool of educated persons with skills in computer programming. At the higher end of the skill spectrum, qualified software engineers offer levels of supervisory skill that is among the best in the world. The country's IT leaders believe that software development, outsourcing, systems integration, and a vast range of IT related services are the passport to the future.

The Sri Lankan Government has actively encouraged the spread of computer literacy by providing duty concessions on hardware imports. This environment is further enhanced by modern data transmission systems and complementary hardware. Low cost offshore data entry operations have also thrived in Sri Lanka since the early 1980s. Sri Lanka already serves as the headquarters of one of the largest software development houses in South East Asia.

It has to be remembered that in Sri Lanka, data communication facilities are limited within Colombo and its peripheries, the western province and the major provincial towns such as Kandy, Galle, Batticaloa, Ratnapura (about 100KM from Colombo main Capital city), and so forth. Individual usage and, to a great extent, access in the workplace is tied heavily to social class and income. Internet access remains unaffordable for the majority of the people, and cyber cafes, though increasingly spreading, are still limited to urban areas. However, there are a few pilot projects currently being implemented to achieve island-wide coverage through VSAT technology.

In recent years, the growth in ICTs in Sri Lanka has been rapidly increased. At present, the number of websites that cater to the Sri Lankan diasporas as well as to the Sri Lankan public is on the rise with an emphasis on Sri Lankan content either in Sinhalese, Tamil, or English (main languages used by Sri Lankan citizens).

E-mail and Internet reached Sri Lanka at the end of the 1980s making it one of the first countries in Asia to use the Internet, though the potential of the Internet for conflict transformation and resolution remains largely untapped in Sri Lanka, with a few notable exceptions. Sri Lanka still believes that the mere creation of Web sites engenders the use of the Internet, and does not place an onus of educating the masses on how to best use the Internet. However, given these limitations, some NGOs are taking the lead in the creation of interactive Web site that provoke and stimulate online discussion and sharing of viewpoints as an underpinning of classic conflict transformation.

The importance of ICT cannot be ignored by government, civil society, and NGOs in Sri Lanka. ICT by itself is an impotent tool. What animates it is a culture in which stakeholders use ICT to buttress and build confidence between communities, engender discussion, and help in the dissemination of information regarding state-of-the-art conflict resolution techniques and events. Though there are no easy solutions for the peaceful settlement of protracted ethnic, a realization of the power of ICT can help efforts on the ground to bring a negotiated and justified solution to war in Sri Lanka.

CONCLUSION

Sri Lanka's greatest weakness is the poor telecommunication infrastructure. Complete lack of telephone connections to some areas of the country is evidence of this. While Internet connections and e-mail software is now readily available, the pricing puts them beyond the reach of a greater majority of the population. In 2004, the telecommunication sector, in terms of subscriber network, expanded by 36 percent. The external gateway operation, which was the monopoly of Sri Lanka Telecom (SLT), was opened for com-

petition in 2003 with 32 licenses being granted by the end of 2005.

The Government of Sri Lanka has initiated the e Sri Lanka plan which, aims to electronically connect and service the entire country. The labor force is being enhanced with education, skills training and a focus on productivity. Hoping to use trade to spur growth, Sri Lanka is emphasizing its central position in the region and key shipping lanes, Free Trade Agreements with its neighbors and its relatively friendly business climate to grow into a regional hub for manufacturing, commerce, and transport. The private sector also has responded to the peaceful environment with increased business activity and investment. Sri Lanka's economy expanded by 5.6% in 2005, and further progress was made on macroeconomic stabilization.

The government has committed itself to reduce corruption, but problems remain. Tender procedures are opaque, decision making is slow, enforcement of intellectual property rights (IPRs) is uneven, and bureaucracy, caused by a large public sector, hinders efficiency. However, the progress largely depends on the continuation of the peace process, policy adjustments, private sector development and structural reforms. Though still faced with substantial economic, social, and political challenges, Sri Lanka accomplished much in 2005, a fact recognized by the international community.

On 26 December 2004, an undersea earth quake registering 9.3 on the richter scale struck in the Indian Ocean, off the Western coast of Northern Sumatra, Indonesia. Sri Lanka was seriously affected by the tsunamis. They caused extensive damage along more than two thirds of over 1,000 km of the coastline extending from the northern coast, through the eastern and southern coasts to the western coast. The total damage is estimated to be around US\$1 billion (4.9% of the GDP) and the reconstruction, which is likely to spread over a period of about three years, is estimated to cost around US\$1.8 billion (8.9% of the GDP). It is

expected that this will create new coping strategies and a natural disasters plan, in addition to developing new IT culture in the country.

REFERENCES

Adams, C.W. (1992). *Implementing computer-based communication services in Sri Lanka*. Paper presented at the 12th National Computer Conference (Vol. 1), University of Colombo.

Akpan, P. (2000, May). Africa and the new ICTs: Implications for development. In *Proceedings of International Federation for Information Processing Conference*, Cape Town, South Africa.

Alfonso, M. (2003). The digital divide: The need for a global e-inclusion movement. *Technology Analysis and Strategic Management*, 15(1), 137-151.

Avgerou, C. (1998). How can IT enable economic growth in developing countries? *Information Technology for Development*, 8(1), 15-29.

Baro, R.J. (1997). *The determinants of economic growth*. Cambridge, MA: MIT Press.

Bera, M. (2003) Information communications technology and local development. *Telematics and Informatics*, 20(3), 215-234.

Bolou, F. (2005) *Ten years of technical progress in telecommunications in the Ivory Coast: An analysis of total factor productivity in Ivorian ICT Sector 1993-2002*. (IRTMOL Working Paper 2005-8-164).

Bolou, F. (2006). ICT infrastructure expansion in Sub-Saharan Africa: An analysis of six West African countries from 1995-2002. *Communications and Strategies: The Economic Journal on Telecom, IT and Media*, 59, 1.

Broadcast in Sri Lanka: Potential and performance. Centre for Media and Policy Studies,

Potential Challenges of ICT Implementations in Sri Lanka

- Braga, C.A., Kenny, C., Qiang, C., Crisafuli, D., Di Martino, D., Eskinazi, R., Schware R., & Ker-Smith, W. (2000). *The Networking revolution: Opportunities and challenges for developing countries*. Washington, DC: World Bank Group.
- Central Bank of Sri Lanka. (2002). *Annual report for 2001*. Sri Lanka Council for Information Technology (CINTEC) (1998).
- Chen, Y., & Zhu, J. (2004). Measuring information technology's indirect impact on firm performance. *Information Technology & Management Journal*, 5(1-2), 9-22.
- Crafts, N. (2003). *Quantifying the contribution of technological change to economic growth in different eras: A review of the evidence*. London: The London School of Economics, Department of Economic History.
- Davison, R.M., Vogel, D.R., Haris, R.W., & Jones, N. (2000) Technological leapfrogging in developing countries: An inevitable luxury? *Electronic Journal of Information Systems in Developing Countries*, 1(5), 1-10.
- Deliktas., E., & Kok, R. (2003). *Efficiency convergence in transition economies: 1991-2002. A nonparametric frontier approach*. Ege University, Department of Economics.
- Depotis, D. (2005). Measuring human development via data envelopment analysis: The case of Asia and the Pacific. *Omega: International Journal of Management Science*, 33(5), 385-390.
- Desai, M. (1991) Human development: Concepts and measurement. *European Economical Review*, 35(2-3), 350-357.
- Dey, A. (2002). *A brief note on ICT and economic development*. University of California Berkley.
- Drucker, P.F. (1993). *Post-Capitalist Society*. Harper Business, Inc.
- Eggleston, K., Jensem, R., & Zeckhauser, R. (2002). *Information and communication technologies, markets and economic development* (Discussion Papers Series). Department of Economics, Tufts University 0203.
- Fielding, D. (2002). Health and wealth: A structural model of social and economic Development. *Review of Development Economics*, 6, 393-414.
- Gholami, R., Lee, S., & Yong, T.Y. (2005). Time series analysis in the assessment of ICT impact at the aggregate level—lessons and implications for the new economy. *Information & Management*, 42(7), 1009-1022.
- Gilhooly, D., & Ocampo, J. (2005). *Creating an enabling environment: Toward the millennium development goals*. New York: The United Nations Information and Communication Technologies Task Force.
- Government of Sri Lanka. Department of Census and Statistics. (2002). The government of Sri Lanka national policy on information technology in school education. In *ICT Policy and Strategy: Sri Lanka*. Colombo: Government Printing Office.
- Gylfason, T. (2001). Natural resources, education and economic development. *European Economic Review*, 45(4-6), 847-859.
- Hardy, A. (1980). The role of the telephone in economic development. *Telecommunications Policy*, 4(4), 278-286.
- Hicks, N., & Streeten, P. (1979). Indicators of development: The search for a basic needs yardstick. *World Development*, 7(6), 567-580.
- Hoekman, B.M., Maskus, K.E., & Saggi, K. (2005). Transfer of technology to developing countries: Unilateral and multilateral policy options. *World Development*, 33(10), 1587-1602.
- Isurupaya, B. (2004). *Education Publications Department*, (pp. 1-7).

- ITU. (2003). *World summit on the information society: Declaration of principles*. Geneva: International Telecommunications Union and United Nations. Retrieved June 26, 2006, from <http://www.itu.int/wsis/docs/geneva/oficial/dop.html>
- ITU. (2003). *World telecommunication development report 2003: Access indicators for the information society*. International Telecommunications Union. Retrieved June 26, 2006, from http://www.itu.int/ITU-D/ict/publications/wtdr_03/index.html
- Iyigun, M., & Owen, A.L. (forthcoming). Experiencing change and the evolution of adaptive skills: Implications for economic growth. *European Economic Review*.
- Jalavaa, J., & Pohjolab, M. (2002). Economic growth in the new economy: Evidence from advanced economies. *Information Economics and Policy*, 14(2), 189-210.
- Joseph, K. (2002). *Growth of ICT and ICT for development: Realities of the myths of the Indian experience* (Discussion Paper No. 2002/78). United Nations University.WIDER, Helsinki. Retrieved June 26, 2006, from <http://www.unu.wider.edu>
- Karunanayaka, S.P., Kularatne, N.G., & Udugama, L.S.K. (2003). *Process evaluation of the ICT centres established under the General Education Project II* (Report of an evaluation commissioned by the Sri Lanka Ministry of Human Resource Development, Education and Cultural Affairs). Colombo: National Education Commission.
- Kenny, C. (1995). The missing link: Information. *Information Technology for Development*, 6(1), 33-38.
- Kenny, C. (2000). Expanding internet access to the rural poor in Africa. *Information Technology for Development*, 9(1), 25-31.
- Mahlberg, B., & Obersteiner, M. (2001). *Remeasuring the HDI by data envelopment analysis* (IASA Interim Report IR-01-069). Luxemburg.
- Max-Neef, M. (1986). Human scale economics: The challenges ahead. In P. Ekins (Ed.), *The living economy* (pp. 198-206). MCB UP Ltd.
- Mbarika, V.W.A., Okoli, C., Byrd, T., & Data, P.(2005). The neglected continent of IS research: A research agenda for Sub-Saharan Africa. *Journal of the Association for Information Systems*, 6(5), 130-170.
- Molina, A. (2003). The digital divide: The need for a global e-inclusion movement. *Technology Analysis and Strategic Management*, 15(1), 137-151.
- Mwesige, P.G. (2004). Cyber elites: A survey of Internet café users in Uganda. *Telematics and Informatics*, 21(1), 83-101.
- National Policy on Information Technology* (NAPITSE). (2001). The Council for Information Technology, Sri Lanka. Government of Sri Lanka.
- Neumayer, E. (2001) The human development index: A constructive proposal. *Ecological Economics*, 39(1), 101-114.
- Ngwenyama, O., Bolou, F., & Morawczynski, O. (2006, forthcoming). A DEA investigation of the contribution of ICT to development in five African countries. In *Operations research in Africa*. United Nation University Press.
- Noorbakhsh, F. A modified human development index. *World Development*, 26(3), 517-528.
- Noris, P. (2000). *The worldwide digital divide: Information poverty, the Internet and development*. John F. Kennedy School of Management, Harvard University.
- Open University of Sri Lanka (OUSL)*. (2003). Retrieved June 26, 2006, from <http://www.ou.ac.lk>

Potential Challenges of ICT Implementations in Sri Lanka

Pohjola, M. (2001). *Information technology, productivity, and economic growth: International evidence and implications for economic development*. Oxford University Press.

Reddi, Dharni P. Sinha (2003). *Utilization of scarce resources: An analysis of government health*. Ashok Kumar and Hari Haran. Viva Books.

Reddi, U.V., & Sinha, V. (2003). *Sri Lanka: ICT use in education*.

Reforms in General Education—Sri Lanka. Government Publications, Colombo. National Education Commission (1999). *Reforms in Primary Education—Sri Lanka*. Government Publications, Colombo.

Presidential Task Force on General Education. (2000). The general education reforms and primary education. In A. Little (Ed.), *Primary education reforms in Sri Lanka*.

Sri Lanka Institute of Information Technology (SLIIT). (2001). Retrieved June 26, 2006, from <http://www.sliit.lk>

Sri Lanka Telecom (SLT). (2001). *Annual report*. Retrieved June 26, 2006, from http://www.slt.lk/inpages/aboutus_pages/slt_annual2001/slt_full_report.pdf

Telecom Act of Sri Lanka. (1996). Retrieved June 26, 2006, from <http://www.trc.gov.lk/telecom1.html>

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 259-281, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 4.13

The E–Pabelan National ICT4PR Pilot Project: Experiences and Challenges of Implementation in an Indonesian Context

Alex Robinson

University of Huddersfield, UK

ABSTRACT

The chapter presents a case study of an ICT-based attempt to reduce poverty (ICT4PR) in a rural Indonesian community. Differences between the theoretical approaches adopted by the implementing agencies and the difficulties inherent in achieving these aims in practice are outlined. The chapter is particularly concerned with how issues relating to implementation impact on efforts to move toward greater beneficiary inclusion in socioeconomic networks. Crucially, the chapter stresses the ongoing need in practice to move away from a homogenising digital-divide-style approach to ICT4PR, and to better engage with localised realities and contexts.

INTRODUCTION

We have plenty of information. We visit other farmers, talk...listen to the radio, watch television... read books! ~Farmer and local official, male, nonpoor, December 4, 2004

Maybe the telecentre is only for rich people [orang mampu]....Information [in Pabelan] does not flow evenly [tidak merata]—it is only for certain people. So poor people, like me, often do not in fact receive information. ~Occasional child minder, female, poor, February 29, 2005

In recent years, there have been increasing interest, speculation, and debate regarding the

potential of information communication technologies to facilitate and contribute toward a process of development (ICT for development, ICT4D). This interest has been accompanied by a plethora of activities seeking to harness the potential of ICTs to a correspondingly varied array of development ends. This chapter focuses on an attempt to utilise ICTs for poverty reduction (ICT4PR) in a rural Indonesian community. Research informing this chapter was conducted at the e-Pabelan national ICT4PR pilot project in the village of Pabelan between October 2004 and August 2005.¹ e-Pabelan (<http://e-pabelan.myserver.org/portal>) is the initial pilot of the Partnerships for e-Prosperity for the Poor (PePP) programme (<http://www.ict4pr.org>) of the National Development Planning Agency (Badan Perencanaan Pembangunan Nasional, BAPPENAS) and the United Nations Development Programme (UNDP).

e-Pabelan became operational in May 2004. The project takes the form of a telecentre that was established with five computers providing dial-up access to the Internet, plus ancillary equipment including a scanner, printer, and digital projector.² More established ICTs such as a telephone or facsimile machine were not provided. The equipment was provided by BAPPENAS/UNDP as was payment for the Internet connection for the first year, some educational materials, and limited training for some staff and members of the community. The chosen local partner was the Islamic boarding school Pondok Pesantren Pabelan acting through its community development wing Balai Pengkajian dan Pengembang Masyarakata (BPPM). The pesantren is a coeducational secondary (equivalent) school, which, alongside the emphasis on Islamic teachings and proper conduct, follows the Indonesian national curriculum. Additional emphasis is placed on the teaching of languages, including English, and science classes, as well as a range of extracurricular activities. The pesantren is highly regarded nationally and has attracted students from across

the archipelago and from abroad. In its capacity as a local partner, the pesantren provided the use of the BPPM building and payment for electricity. Staff, acting on a volunteer basis at the telecentre, were appointed from within the BPPM as well as some senior students from the pesantren (all male). Usage of the Internet at the telecentre was free for the first year, although there were some complaints that individuals from outside the pesantren had been asked to pay in the early months. The project was, somewhat optimistically, expected to be financially independent after the first year.

The chapter proceeds through presenting a case study of the e-Pabelan project rather than a more theoretical analysis of ICT4PR, and limits itself to issues arising from the implementation and development of e-Pabelan over the project's first year. Enthusiasm for ICT4PR is first briefly situated against a broader backdrop. e-Pabelan is then placed in its local context. The chapter emphasises that such contextualisation is critical. Experiences from the three different stakeholder levels are then outlined: from the implementing agencies, the local partner, and from the intended beneficiary level. Differences in expectations and conceptualisations from these groups urge the need for reflection and realism within ICT4PR. The chapter stresses the need for acknowledging continuities and for approaching ICT4PR as an ongoing development process. In closing, an alternative approach is presented that emphasises the need to better engage with existing networks within communities prior to, and in conjunction with, the establishing of access to external networks mediated via ICTs.

Before proceeding, it is necessary to clarify a number of points. With regard to ICTs, the chapter accepts that ICTs are "electronic means of capturing, processing, storing and communicating information" (Heeks, 1999, p. 3), and is mindful of the fact that ICTs "handle information in digital format. That's all" (Heeks, 2002, p. 2). Within a poverty-alleviation context, the importance

of more established forms of communicating and receiving information beyond the digital is acknowledged (Hewitt de Alcántara, 2001). The concept of poverty is similarly viewed in multidimensional terms. It is accepted that ICTs may be used to facilitate improvements in the related spheres of empowerment, opportunities, and security (World Bank, 2000).

The stated aim of e-Pabelan, and PePP, is to reduce rural poverty with a particular reference to the agricultural sector. Project documentation states that this aim is to be realised through a pro-poor process and by “empower[ing] and mobilis[ing] poor communities for economic activities and accessing social services through better access to information and communication” (documentation courtesy BAPPENAS/UNDP, September 2004). Reference is also made to accessing market prices and to the exploitative role of middlemen in agricultural market networks along with the need for the provision of basic information. It is also noted by the implementing agencies that the provision of information alone is not enough and that the pilot project will be “tightly focused,” localised,” and include capacity-building activities (ibid). On paper, therefore, e-Pabelan reflects widely accepted approaches to ICT4PR and community-oriented rural development. The implementing agencies, however, do not proffer a precise working definition of poverty, although under PePP, at least 30% of the beneficiary community must fall below national poverty lines. It is thus assumed that ICT4PR at Pabelan is targeted at this segment of the local population. In this context, ICT4PR is viewed as the direct introduction of ICTs within a community to bolster flows of communication and information to and within that community in order to improve opportunities, empowerment, and security for the poor.

SUMMARISING THE POTENTIAL AND LIMITATIONS OF ICT4PR

The related concepts of an information age and information society have spurred increasing interest in the role of both information and technology in development.³ For the proponents of ICTs, the future is conceived as boundless in a vision of unfettered and immediate access to digitally communicated information (Cairncross, 1997). However, as this book explores, such a situation can lead to both opportunities and costs. The information age and its associated technologies present a double-edged sword that could potentially cut a swathe, for better or for worse, through the development sphere. Increasing interest in ICTs in development circles may be summarised, to a degree, by drawing on the words of the foremost commentator on the information age, Manuel Castells (1999), and through what he sees as the emergence of a “fourth world”: “This fourth world of social exclusion, beyond poverty, exists everywhere, albeit in different proportions, from South Bronx to Mantes-la-Jolie, from Kamagasaki to Meseta de Orcasitas, and from the favelas of Rio to the shanties of Jakarta. There is ... a systemic relationship between the rise of informational, global capitalism, under current conditions, and the extraordinary growth of social exclusion and human despair” (Castells, 1999, p. 10).

If we accept that the emergence of new digital technologies is a critical factor behind such increases in exclusion, the significance of ICTs in and for development becomes clearer; it is increasing disparities between the digitally networked and the marginalised other. At the same time, the emergence of more affordable and flexible ICTs presents new opportunities for inclusion and for empowerment. Such concerns are reflected in calls to bridge the so-called digital divide. The need to bridge this divide has been widely used to leverage access to ICTs as a development priority as the link between poverty and a lack of access

to ICTs is “indisputable” (Flor, 2001), one argument follows. Issues of inclusion are undoubtedly central to attempts to alleviate poverty, but there is also the danger that the adoption of such an approach can lead to an overemphasis on technically oriented fixes in practice.

A more cautious view maintains that the notion of a digital divide is misleading. Prioritising a link between ICTs and poverty confuses cause and effect and pays scant attention to the complexities and underlying causes of poverty and social exclusion (Marker, McNamara, & Wallace, 2002; McNamara, 2003). Viewed in such light, the provision of access to ICTs can be construed as little more than a flirtatious diversion from more deep-rooted concerns. There is also the need to ask what the provision of access to ICTs actually means and on whose terms such access is promoted and established (Gurstein, 2003). An overemphasis on technical access, it has also been suggested, reflects, somewhat ironically, a return to the values of modernisation theory in development thinking (Schech, 2002). Modernisation theory was similarly concerned with imparting knowledge and the transfer of technology from “us” to “them.” Modernisation theory may be considered the antithesis of community-based or alternative approaches to development. Although different development paradigms coexist within ICT4D (Houston & Jackson, 2003), at the beneficiary level, alternative understandings and realities need to be better acknowledged (Avgerou, 2000).

With reference to poverty alleviation, we may summarise that enthusiasm for ICTs can obscure complexity and prioritise the dominance of particular values and norms. Such an approach raises issues regarding power, representation, and voice and cannot, therefore, be construed as constituting inclusion in its own right. For the marginalised, there is the risk that without due care, ICT4PR may well mean more of the same. The danger of ICT4PR, as both discipline and practice, is that by prioritising universal approaches and fixes, the

realities and actual needs of the poor can be de-emphasised. This is not just a point of theoretical concern, but one that can have very real implications in practice. As this case study illustrates, there is a need for fuller engagement with local contexts within ICT4PR. One size does not fit all. In stressing the need for contextualisation, the context in which e-Pabelan was established needs to be outlined.

E-PABELAN IN CONTEXT

The village of Pabelan lies roughly 30 km to the north of Yogyakarta near the Buddhist temple complex and world-heritage site of Borobudur. Pabelan borders the market town of Muntilan and straddles central Java’s main transport artery. The village is not, therefore, isolated in a broader communicative sense. Within Pabelan, poor individuals also utilise various ICTs. Within the village and immediate vicinity, there are 12 public telephone kiosks (wartel). The telecentre cannot, therefore, be considered to be filling a void in access to basic communication technologies. Clustered around the main road there are also businesses offering photocopying services, two computer rental businesses offering off-line applications by the hour, and more recently, kiosks selling mobile telephones and accessories have begun to multiply. Poor households within the village also reported owning radios (76%), televisions (64%), and at least one mobile telephone (13%). No poor households reported having a fixed-line telephone.⁴ A lack of ownership of ICTs, however, does not necessarily equate to a lack of access.

Official statistics place the population of Pabelan at 6,955 within 1,839 households (Badan Pusat Statistik, 2005). Broadly speaking, the majority of livelihoods within the village may be said to be centred on agriculture and related activities, including the home-based production

of foodstuffs and small-scale trading. The latter two are particularly important livelihood options for women. There is also a significant handicraft industry producing wood, bamboo, and stone products. However, livelihoods within the village are best viewed in terms of diversity and range from salaried government employees to occasional labourers. Importantly, and contrary to popular opinions, households that own land and make a living solely from farming no longer represent the majority. The inheritance of smaller parcels of land through the generations and a lack of alternative local employment opportunities have resulted in a significant number of villagers seeking work in other areas of Indonesia and as far afield as Saudi Arabia. In some subunits (*dusun*), villagers complain that youth unemployment runs as high as 70%. Poverty estimates vary but suggest that between 30% and 50% of the population are living in poverty.⁵ Pabelan livelihood options and limitations are varied and reflect changing patterns of land ownership and wider structural changes within the Indonesian economy.

THE PROJECT

While it may appear unrealistic for e-Pabelan to have had a notable impact on poverty by the end of its first year, the project could not be said to have made significant progress toward achieving that end. During the year, the number of farmers, being the primary target group, recorded as visiting the telecentre (rather than using the Internet *per se*) amounted to 12. This figure showed little change since early training at the telecentre, and the overall profile of users remained consistent throughout the year. The typical user was male (65%), young (mean 19 years), and educated (73% currently in education). In order to account for poor participation by target groups at e-Pabelan, it is necessary to relate the project's implementation to the local context.

Implementing a Vision

As noted, the implementing agencies stress that e-Pabelan is a pro-poor community-based development project and moves were made to establish local ownership through partnering with the *pesantren*. Nevertheless, ensuring wider community involvement became increasingly difficult to realise as the project progressed. In practice, the social, political, and structural *contexts* into which e-Pabelan was introduced had a considerable bearing on the project.

Initial difficulties arose from differing understandings between the implementing agencies and the local partners. Establishing a partnership with the *pesantren* was based on two principle notions. First, the BPPM had active community-development activities, and second, the *pesantren* was a regular source of information for the community. Both of these assumptions were, to varying degrees, misplaced. While it is true that the BPPM was active in the past, this has not been the case for some time.⁶ The heyday of the BPPM was from 1986 to 1990. It is the case, however, that the *pesantren* is a source of religious information (mostly) for some members of the community. For others, the *pesantren*'s relationship to the wider community is seen as increasingly distant. This is primarily due to changes within the *pesantren*'s leadership since the death of the reportedly charismatic founder in 1993. A change of village heads (*kepala desa*) has also been significant.⁷ The current *kepala desa* (1989 onward) is regarded by many as being less active within the wider community than the former. Both the current and former *kepala desa* occupied positions in the BPPM. While the status of the BPPM was not checked by the implementing agencies, neither was it clarified by the local partners. One member of the BPPM was later to speculate, with no obvious irony, that "perhaps they [the implementing agencies] got that information from the Web?" (male, March 15, 2005)

Regardless, the memorandum of understanding (MoU) was signed, and the broad aims of poverty reduction and community development sealed. Concurrently, the telecentre was implemented through what may be described as established political channels and institutional structures.

Within Indonesia, there is a clearly defined political hierarchy extending from the national level to, and within, the village. Under the New Order regime of President Suharto, these channels proved effective in disseminating information to the level of neighbours (*rumah tangah*) if needed. Equally, this structure facilitated both paternalism and repression up to Suharto's fall in May 1998 (Schwarz, 2004). Although moves toward decentralisation have been established, e-Pabelan was implemented through essentially the same political structure.⁸ However, political and social changes within Indonesia since 1998 have also opened new opportunities for both agency and resistance (Bebbington, Dharmawan, Fahmi, & Guggenheim, 2004). Individuals, therefore, are far more able, and increasingly willing, to question the motives behind, and value of, externally driven interventions.

The implementation of e-Pabelan reflected established top-down approaches to development and stands in contrast to the project's stated participatory and community-based aims. The project was directed from the national level down, opened by the mayor (*bupati*), and initial open public meetings were dominated by invited officials, village leaders, and selected (some villagers claimed) members of the community. All, naturally, showed their support. The result was that the intended beneficiaries were, or perceived themselves as being, excluded from the process. The paradigm (community-based development) adopted in theory did not materialise at the local level. As one villager offered by way of explanation, the political structure both within and beyond the village serves to maintain the status quo: "The political trick is that there is already

an arrangement into levels, from the national level down, in Indonesia...[and] Pabelan is like a mini Indonesia" (handicrafts, male, January 31, 2005). From the beneficiary level, attempts to subsequently market the project to the community appeared as little more than an afterthought. Ten months after the signing of the MoU, it was found that less than 50% of poor households surveyed knew of the existence of the telecentre. Those that did know had, in the main, found out from friends or family or from simply passing the BPPM building. Information regarding the project did not flow to the intended beneficiaries, and what information did reach members of the wider community was partial and superficial. As one farmer tellingly noted, "I've never been told about the project...maybe, that's because it's not for me" (sharecropper, male, February 28, 2005).

The utilisation of related institutional structures was mirrored in the initial trainings (June-July 2004). Early training focused on staff at the *pesantren* and formal community groups (*kelompok*). These trainings sought to disseminate both awareness of the telecentre and information from the Internet to the wider community. However, formal *kelompok* membership by poor households in Pabelan is currently low. The notable exception is the women's group Pendidikan Kesjahteraan Keluarga (PKK) Village level women's welfare and educational group. Addressing the specific target group of farmers, 52% of poor households surveyed had employment in agriculture; however, only seven households reported a family member attending a farmers' *kelompok*. Poorer farmers, in particular, often complained these meetings were merely formalities for the better off and politically connected. One official (female, August 23, 2005) explained that the reason *kelompok* in Pabelan are not as active as they once were is precisely because individuals now have better access to information through alternative channels, television and radio in particular. Higher attendance at the PKK meetings can be accounted for by the incorporation

of a rotary savings scheme (arisan). The arisan is both a social occasion and an important source of independent capital for many women. The critical point about the early trainings, however, is as one of the telecentre staff (male, November 30, 2004) reflected: "They did not come back."

The community trainings were not always completed and quickly came to an end. Any early impetus was rapidly lost. By September 2004, recorded visitors to the telecentre had dropped to 16 from 273 for the previous month. This fall was also attributable to an array of technical problems that the local partners were ill equipped to deal with alongside falling enthusiasm from some local staff. The elite bias (Chambers, 1997) within the implementation was not without its implications.

LOCAL PARTNERS, POLITICS, AND RESPONSES

From a local-partner perspective, it is not difficult to imagine the attraction of a telecentre and the trappings of modernity it implies. Nevertheless, this does not mean that local partners will be equipped to envisage what such a project may entail in practice. Neither does it imply that they will have the necessary will and resources to respond to difficulties that, inevitably, will arise. Within Pabelan, they did not. Although initial trainings for staff at the telecentre were conducted by some external partners, the trainings were limited in both scope and reach. Difficulties at the local level were exacerbated by the lack of coherent systems for monitoring and evaluation, resulting in sluggish responses as problems emerged. Neither were there clear mechanisms for providing essential support to the local partners initially established. Furthermore, confusion persisted at the local level over how exactly the telecentre, and the Internet in particular, was to help in reducing poverty and bring material (primarily)

benefits to the community. As a result, interest quickly waned.

The fall in enthusiasm also reflects a more specific agenda on the part of the local partners. Interest in the project by the local partners was based on the potential of the telecentre to reconnect the activities of the pesantren to the wider community. That the pesantren is perceived as not having the same links to the community as it once had is not something that local officials are blind to. It is also a situation they wish to change. The telecentre was seen as a potential vehicle to do just this and to rejuvenate (*menghidupkan*) the activities of the BPPM. However, lacking the BPPM's previous expertise, community links, and external support, the local partners were not well placed to achieve this aim. Difficulties were further compounded by the lack of a clear mechanism for achieving the broad aim of poverty reduction. For the BPPM, it became clear that the telecentre was of limited use unless it was tied to more concrete development goals. As one member of the telecentre team reflected, "they [BAPPENAS/UNDP] just gave us the equipment; the telecentre was placed in a vacuum" (male, March 15, 2005). Despite the theoretical considerations of the implementing agencies, in practice, e-Pabelan was established as if the project would and could in some way have a direct impact on poverty; it was left up to the local partner to join up the dots. Although, the implementing agencies stress that the project was not just about the Internet, at the local level the project very much was.

The local partner's response to difficulties was to reorganise the management structure of the telecentre (January 2005) in order to better incorporate the telecentre into the BPPM and its future activities. The initial focus of the BPPM was to be on education and not on poverty reduction per se. Considering the expertise of the pesantren, the user base of the telecentre, and the value placed on children's education by many poor households, this seemed a wholly reasonable response. At the

end of the first year, however, any such plans were very much still in the process. Coinciding with the BPPM's response to difficulties, the implementing agencies' hand was forced and a number of interventions were funded. In March 2005, a local technical administrator was appointed for a period of 1 year. The individual was supported, primarily online, by a BAPPENAS technician in Jakarta. Although the telecentre continued to face technical problems, particularly regarding the erratic Telkomnet Instan dial-up service, this was a significant improvement.

In January 2005, the implementing agencies also agreed to fund a dedicated manager for 1 year. By way of compromise with the local partner, a new management team was finally appointed on a job-share basis in May 2005. The management team (two female, one male) were proposed by, and have previous connections to, the pesantren and the BPPM. Continuity, to a degree, with the BPPM's earlier plans was thus assured. Whilst this was an important development, the choice of management team did not, needless to say, directly increase involvement in the running of the project by the intended beneficiaries.⁹ A related development (January 2005) was the starting of a 10-month English-language course and computer-skills course for nonelite youths.¹⁰ The English course significantly helped to boost attendance at the telecentre, reaching a peak of 726 recorded visits in May 2005. However, the English course did not change the overall profile of users. The choice of students for the course was problematic. Members of the community complained that the course was dominated (approximately two thirds) by students from the pesantren and from outside of the community. For older members of the community, the perception reinforced was that the telecentre was not for them. Any sense that the project might be for the poor community within Pabelan was further eroded as the news of free Internet access spread, attracting young people from neighbouring areas. That the English course

should inadvertently cement such perceptions is unfortunate. However, the point of concern is that the situation persisted.

In summary, the choice of local partners presented little more than a facade of local ownership. Local ownership in the sense of ownership by the intended beneficiaries themselves was neither achieved nor moved toward. The officials initially consulted by the implementing agencies seldom visited the telecentre and were yet to use the Internet. For these individuals, the telecentre presented its own opportunity. In contrast to the stated inclusive approach, the development of the project continued to reflect the local political structure and to prioritise the interests of elite institutions within the village. Furthermore, interventions at Pabelan meant that the implementing agencies were forced to extend their financial commitment significantly beyond the project's first year as originally planned. It is highly improbable that the telecentre will be able to employ the additional staff after their contracts end. As the new managers are working toward what they see as a more realistic 3-year time frame, this is somewhat troublesome. Although a business plan was implemented for the telecentre in July 2005, the figures had yet to add up. Considering the current status of e-Pabelan, it is unlikely that the telecentre will be able to cover the costs of the current Internet connection alone.¹¹ In the absence of significant change, e-Pabelan faces a highly uncertain future.

BENEFICIARY CONTEXTS AND EXPERIENCES

Usage of the telecentre was dominated by the young (primarily students from the pesantren), reflecting both the location of the telecentre and the attraction of the Internet for this particular group. The majority of these users were in education, and a large number had previous computer experience.

It should be noted, however, that the majority of young individuals from within the village itself have not visited the telecentre. Older educated individuals also seldom visited the centre. Some individuals with previous computer experience, and local computer owners, had also yet to visit. This casts doubts on suggestions that one of the major obstacles to accessing the Internet at Pabelan by poor households is illiteracy and low educational attainment. Within Pabelan, this is not the case, and such arguments reflect taking the head of the household as the point of reference. Within the household, educational attainment has steadily risen with a few poor household members educated to degree level (S1). The situation at Pabelan is testament to overall increases in educational attainment within Indonesia over recent decades (Moertiningsih Adioetomo, 2005). Attainment by gender is also evenly matched, but this is not to imply that all things are equal. At times, circumstances dictate they are not:

Every year the cost of schooling goes up. If a farmer has other work, it's not a problem, but if you don't have other work like me, it's very difficult. Before we had children the income from farming was enough, but that was before school. After you have children it's not enough... Our son [14 years] goes to school in Magelang; it has computers and the facilities are good, so it's expensive.
(husband)

...Our daughter [11 years] goes to school in Borobudur [lower school fees]. She has registered, but she hasn't started yet because we haven't been able to pay the fees.
(wife)

...Of course, we want both of them to go to a progressive school (sekolah maju)...but it's just too expensive.
(husband)

(farming household, July 22, 2005, shortly after new school year began)

Naturally, things could always be improved, but within Indonesia, relatively high levels of educational attainment should, in theory at least, be conducive to the adoption of ICTs. While the rising cost of education is a major concern for poor households and represents the major household expenditure for many, it is a cost that families, and particularly women, go to lengths to bear.¹²

It is also not the case, as the experience of trainings at Pabelan demonstrates, that after individuals have been introduced to the Internet they will automatically see its worth:

I attended the basic training...No, I didn't go back. I don't see the benefit [manfaat] of the telecentre; also I have a young child and don't have the time. Also, the PKK has new leaders and is not as active as it was before...The PKK did find lots of information about KIA [mother and child health] and recipes, for example...but this was the usual information...that we can already find everywhere...also the health clinic [bidan] is next door to the telecentre...They would have been happier if they had found new information [for example] if it was possible to find information that could raise the income of a family...After the training, the women were still ill at ease [masih canggung] and scared [of the Internet]...they need continuous training.
(housewife, April 29, 2005)

The above illustrates that trainees were taught to access the Internet. This is not the same as accessing previously identified and processed information that is conveyed in a manner appropriate to particular needs.¹³ An emphasis on technical access can blur this crucial distinction. Furthermore, the utility of any information accessed did little to impress and did not sustain interest. Not all information is equal, and individuals within the wider community had more pressing concerns. Furthermore, it is evident that training was not ongoing and that the importance of such activities for building capacity and nurturing de-

The E-Pabelan National ICT4PR Pilot Project

mand within the community was not sufficiently acknowledged in practice. The choice of local partners was also decisive in shaping intended beneficiaries' perceptions:

I want to look for information about [business] capital, training for hairdressing, but I'm scared [to go to the telecentre] because it is owned by the Pondok and is only for the Pondok... We don't know what the aims [of the project] are and people don't know about it... Pabelan [i.e., Pabelan IV] receives lots of help, but it never reaches Batikan or Jagalan.¹⁴ ... The information does not reach here... The village head has projects, such as the orchid growing [World Bank funded training] and telecentre project, and there are socialisation programmes for the community, but the issue is that they have yet to ever reach here... The poor community are afraid to speak out against this. (hairdresser, female, March 1, 2005)

Furthermore, e-Pabelan also had to compete with the established demand for existing technologies, and the Internet does not always have an obvious comparative advantage in terms of either communication or information:

People in the community, especially women staying at home, don't have the motivation to use the Internet... you have to walk to the telecentre, write an e-mail and then wait for a reply. It's more convenient to use a mobile phone [i.e., short messaging service]. (health worker, female, March 17, 2005)

Similarly, existing technologies (television and radio) already provide access to specialised local programming for groups such as farmers. Needless to say, individuals also access information from an array of formal and informal sources. Whether individuals actually do act, or are able to act, on this information is another point entirely, but it is evidently not the case that the poor in

Pabelan need access to basic information. To emphasise that they do is overtly paternalistic and homogenising. The information individuals require is specific to particular needs and situations. Such needs are in turn dependent on gender, age, occupation, social status, and the various combinations of these factors.

At Pabelan, any assumed link between accessing the Internet and increasing the security of livelihoods has yet to be demonstrated. At the risk of oversimplification, the fundamental reasons for low participation boil down to some simple home truths. For the poor and nonpoor alike, the utility and relevance of the telecentre, and particularly the Internet, remained far from clear. The community voted with their feet; the majority walked straight past the telecentre, and the few intended beneficiaries who did enter left and did not return. All the same, at the intended beneficiary level, this does not imply that there is no need for information. Equally, it should not be inferred that the abstract notion of information is viewed as a priority by the poor. The importance of information is regularly acknowledged, but its immediate relevance remains unclear in the face of efforts to secure daily needs. However, it is the case that a working knowledge of computers and the Internet are seen as important for the future of the community's children, particularly in the face of limited employment opportunities for the young. That the selection of participants for the English course was not more beneficiary focused was an opportunity missed. Again, the intended beneficiaries, along with their aspirations, were passed by:

I feel disappointed [that nobody ever told me about the telecentre] because my children want to learn how to use a computer... and I don't clearly know what the procedure is for using [the telecentre]. (laundry service, female, February 28, 2005)

In contrast to its stated aims, e-Pabelan has not been inclusive. The project has merely accentuated differences and reconfirmed preexisting relations of power. While intentions may have been well placed, e-Pabelan is, in effect, something that “we” have done to “them.” The implementation and ensuing development of e-Pabelan over its first year cannot be considered pro-poor. Furthermore, it is unlikely that the Internet will ever entirely replace a visit to the health clinic or a hands-on demonstration by an agricultural extension worker. As elsewhere, sociability is valued highly, information is tested, and trust is accrued through the attainment of tangible results.

From the beneficiary viewpoint, the challenge that ICT4PR faces at Pabelan is how to utilise ICTs to increase employment opportunities (particularly for the young), raise incomes (particularly for women), and improve entitlements (Sen, 1981) to and command over resources. ICT4PR must also engage with widening participation and inclusion in localised networks. In this sense, information clearly has a role to play. However, a blanket approach to poverty that ignores complexity and prioritises the technical will achieves little. The wider lesson from e-Pabelan for ICT4PR is that it is essential that the provision of information does not become subordinated to the mechanisms of information delivery within a project’s design. e-Pabelan provides access to the Internet for a minority; it has yet to provide access to beneficial information for the majority. As such, the project finds itself lumbering awkwardly somewhere between promise and utility. There has been no information revolution in Pabelan.

PRIORITISING AND ENGAGING WITH LOCALISED NETWORKS

The experience of e-Pabelan illustrates the importance of accounting for, and responding to, local contexts. The danger of a digital-divide

approach to ICT4PR is that local contexts can become subordinated to the provision of technical access. The Internet is all too readily perceived as a reified artefact (Hand & Sandywell, 2002) of universal benefit and worth to all. Correspondingly, the poor are glossed as an amorphous mass ready to gratefully receive. Individuals’ agency and realities are ignored. The approach also reflects a view that conceptualises information as a “public good” (Olson, 1971). While such an approach may well be worth aiming for, this is not the reality of the poor. Within Pabelan, existing flows of information exclude. The structural and political realities of the poor, therefore, need to be actively engaged within ICT4PR. Outside enthusiasm for ICTs needs to be situated against insiders’ realities and perspectives.

It is clear that access to ICTs does not automatically result in accessing relevant information. Also, both the economic and social means to enable individuals to act on any information received (Duncombe & Heeks, 2001) needs to be incorporated into the project design. ICT4PR is not an event addressing problems that are merely and conveniently to be bridged *à la* the digital divide; it is a process. Policy makers, therefore, need to be clear in what it is that they wish and are realistically able to achieve. A project aimed toward providing access to either the Internet or information is not synonymous with a project directed toward poverty alleviation. The latter is far more likely to be achieved by establishing clearly defined development programmes and targets. The role for ICTs in this sense is one of facilitation. In practice, ICTs and poverty remain uneasy bedfellows. For ICT4PR to be effective, it is suggested that the emphasis needs to be placed back on information. It is yet to be conclusively shown that the provision of access to ICTs alone will directly raise the incomes of the poor, although, as e-Pabelan illustrates, projects continue to be implemented as if they may. In a poverty-alleviation context, ICT4PR’s potential

lies first and foremost in increasing inclusion and empowerment. Somewhat ironically, this is what efforts to bridge the digital divide imply, but for ICT4PR, to attempt to empower and to include requires the acknowledgement that sociopolitical relations matter. It also requires that the approach adopted in practice is active, ongoing, and context specific. A more fruitful point of departure may be found through focusing on more locally oriented networks.

The Importance of Horizontally Oriented Networks

Within ICT4D as a whole, there is a tendency to prioritise the accessing of external networks. Examples from e-Pabelan include the provision of access to externally produced information and the claim that poor farmers can, irrelevant of capacity and resources, and are willing to, irrespective of established market relations, access distant markets. These external networks are hierarchical in nature. As such, these vertically oriented linkages remain socially, culturally, and economically distant. In short, they are of questionable immediate relevance and utility to the poor. Consequently, ICT4PR needs to become more locally and horizontally focused.

Exclusion from localised networks and institutions is commonplace for the poor. During the initial implementation stage of ICT4PR, an alternative approach would be to prioritise the widening of access to information within the community. The initial focus should not be on the deployment of ICTs per se. It is overtly unrealistic to expect individuals to access external and untested networks from a starting point of exclusion. Empowerment and the building of capacity, therefore, need to be prioritised. In order to achieve empowerment, fuller participation within the design and implementation of the project by the intended beneficiaries is required. The concept of participation is not, of course,

without its problems. If the answer has already been decided, for example, in the form of a telecentre, participation can become little more than coercion. However, as e-Pabelan indicates, participation remains critical. ICT4PR needs to draw on wider development experiences, and increasing participation should be (re)approached as a politically empowering act (Parfitt, 2004; Williams, 2004). Without empowering individuals to better participate and engage with local political processes and socioeconomic networks, the potential of ICT4PR is severely curtailed.

A further step in establishing the prerequisite environment for a later introduction of ICTs is the identification of beneficiaries' needs. However, while information needs are often emphasised in ICT4PR, it is the identification of development needs that remains critical. It is also the latter that poor individuals are more likely to relate to and be better placed to discuss and convey. ICTs offer the flexibility to be adapted to the development needs of a community. The community should not be expected to bend and conform to a predetermined outside agenda. As e-Pabelan illustrates, the community will, in all likelihood, not. It may well prove to be ICT4PR in both outlook and practice that requires some adjustment. An initial emphasis on participation and empowerment within a community also provides a foundation from which a project can work outward.

From a localised point of departure, networks should be extended laterally. Although hierarchical relationships (as networks remain prone to differing relations of power) can not be totally avoided, they should be minimised. Partnerships with individuals and institutions with locally relevant expertise and experience should be sought. While partnerships for e-Pabelan were established, these partnerships were high level and again vertically orientated. In practice, these high-level stakeholders had limited community involvement at best. Through extending local

networks, a sustainable and accessible network of support for the project can be established. Furthermore, such a network can be drawn on to widen access to alternative sources of information, create critical local content, and provide potential sources of community trainings. Such trainings are again a prerequisite to the introduction of ICTs and should be development focused. Examples of trainings relevant to Pabelan would include locally oriented marketing for microenterprises and farmers, and information relating to child psychology for young mothers from poor households—the point being that the information required is specific and is more likely to be better conveyed through personal interaction. Both of these examples require a degree of trust, and individuals need to be able to actively engage with and question the information received. By starting within the target groups and building networks outward, the utility of ICTs is more likely to be apparent on introduction.

Crucially, the introduction of ICTs should be governed by the prevailing communicative environment. In the case of Pabelan, the utilisation of community-based radio may well have proved more effective in disseminating locally relevant information. A staged introduction of differing ICTs should be considered depending on the needs, receptiveness of the beneficiaries, and the intended development goals. Within a more horizontally focused approach to ICT4PR, it may well be that communities of shared experiences have the information that is required; however, they are unlikely to have access to the Internet. The Internet is, of course, subject to network effects, and without relevant information or a trusted source of information at some other node, it is of no use at all.

The challenge that ICT4PR faces in practice is how to shift the emphasis from being an externally driven, supply-led venture to one that begins with the beneficiaries themselves. For the poor to benefit, ICT4PR needs to shed its neutral

apolitical stance and universalising approach, and better engage in establishing a process of empowerment and inclusion for the poor. With regard to the Internet, this is problematic as it is currently hard to envisage a situation where access to the Internet for the poor is not mediated in some shape or form. ICT4PR, therefore, needs to tread with caution, strive for inclusion, and engage with and continually reflect upon local contexts throughout the project process. Despite the simplistic allure of the digital divide, policy makers must be mindful of the fact that ICT4PR offers no quick fixes. To continue to act as though it does shows little understanding of the realities of the poor.

CONCLUSION

e-Pabelan proved to be far harder to implement in practice than anticipated. Despite acknowledgements of social factors, community engagement, and a pro-poor process, in practice, the project reflected an attempt to bridge the digital divide. e-Pabelan was implemented as if it was an event and was subsequently forced, by necessity, to try to become a development process. ICT4PR needs to be viewed as a coherent and targeted process of development from the outset. This requires both a significant commitment and, perhaps, a shift of emphasis. A way forward may be found through moving away from an emphasis on the external to better engaging with networks and relations of power within communities. Contrary to digital-divide-based promises, e-Pabelan has yet to increase inclusion in either external or internal networks for the poor.

Within ICT4PR, there can be a temptation to focus on the tangible rather than the intangible. While the bricks and mortar of a telecentre are a highly visible use of funding, the fact remains that it is information that lies at the heart of ICT4PR. Needless to say, information alone does not have

the same immediate appeal to donors as buildings, hardware, and RAM. It may well not have the same appeal for potential local partners also. However, the experience of e-Pabelan demonstrates that the utility of ICT4PR ultimately rests on the socioeconomic and political environment into which such projects are introduced. ICT4PR is also heavily dependent on the linkages through which such projects are implemented, and the socioeconomic and political networks they seek to influence. Due attention must be paid to these issues if fuller inclusion is to be achieved. An approach that emphasises universally beneficial technical access obscures such critical factors. A start toward increasing the goal of inclusion may be obtained through emphasising horizontal rather than vertical linkages. The danger of ICT4PR is that enthusiasm for the technical can, if left unchecked, lead to ICT4PR riding rough shod over many development fundamentals already accrued. The continuation of such an approach will do few favours for ICT4PR or the individuals and communities that ICT4PR seeks to empower.

REFERENCES

- Avgerou, C. (2000). Recognising alternative rationalities in the deployment of information systems. *The Electronic Journal of Information Systems in Developing Countries*, 3(7), 1-15. Retrieved January 10, 2005, from <http://www.ejisdc.org>
- Badan Pusat Statistik. (2005). *Kecamatan mungkid, kabupaten magelang dalam angka tahun 2004*. Magelang, Central Java: Author.
- Balai Kepala Desa (Village Head's Office). (2004, 2005). *Unpublished local poverty figures for 2004 and 2005* [accessed 2005]. Pabelan: Village Head's Office.
- Bebbington, A., Dharmawan, L., Fahmi, E., & Guggenheim, S. (2004). Village politics, culture and community-driven development: Insights from Indonesia. *Progress in Development Studies*, 4(3), 187-205.
- Cairncross, F. (1997). *The death of distance: How the telecommunications revolution will change our world*. London: Orion.
- Castells, M. (1999). *Information technology, globalization and social development* (Discussion Paper 114). Geneva, Switzerland: United Nations Research Institute for Social Development.
- Chambers, R. (1997). *Whose reality counts? Putting the first last*. London: Intermediate Technology Publications.
- Duff, A. S. (2000). *Information society studies*. London: Routledge.
- Duncombe, R., & Heeks, R. (2001). *Information, technology and small enterprise in Africa: Lessons from Botswana*. Manchester, United Kingdom: University of Manchester, Institute for Development Policy and Management. Retrieved February 10, 2005, from <http://www.sed.manchester.ac.uk/idpm/research/is/ictsme/full/>
- Flor, A. G. (2001, August). *ICTs and poverty: The indisputable link*. Paper presented at the Third Asia Development Forum on Regional Economic Cooperation in Asia and the Pacific, Bangkok, Thailand. Retrieved August 7, 2005, from <http://www.worldbank.org/html/extdr/of-frep/eap/eapprem/infoalexan.pdf>
- Gurstein, M. (2003). Effective use: A community informatics strategy beyond the digital divide. *First Monday*, 8(12). Retrieved August 7, 2005, from http://firstmonday.org/issues/issue8_12/gurstein/index.html
- Hand, M., & Sandywell, B. (2002). E-topia as cosmopolis or citadel: On the democratising and de-democratising logics of the Internet, or, toward a critique of the new technological fetishism. *Theory, Culture & Society*, 19(1-2), 197-225.

- Heeks, R. (1999). *Information and communication technologies, poverty and development* (Development Informatics Working Paper 5). Manchester, United Kingdom: University of Manchester, Institute for Development Policy and Management. Retrieved February 10, 2004, from http://idpm.man.ac.uk/publications/wp/di/di_wp05.pdf
- Heeks, R. (2002). I-development not e-development: Special issue on ICTs and development. *Journal of International Development*, 14, 1-11.
- Hewitt de Alcántara, C. (2001). *The development divide in a digital age: An issues paper* (Technology, Business, and Society Programme Paper 4). Geneva, Switzerland: United Nations Research Institute for Social Development. Retrieved August 7, 2005, from [http://www.unrisd.org/unrisd/website/document.nsf/d2a23ad2d50cb2a280256eb300385855/19b0b342a4f1cf5b80256b5e0036d99f/\\$FILE/hewitt.pdf](http://www.unrisd.org/unrisd/website/document.nsf/d2a23ad2d50cb2a280256eb300385855/19b0b342a4f1cf5b80256b5e0036d99f/$FILE/hewitt.pdf)
- Houston, R., & Jackson, M. H. (2003). Technology and context within research on international development programs: Positioning an integrationist perspective. *Communication Theory*, 13(1), 57-77.
- Marker, P., McNamara, K. S., & Wallace, L. (2002). *The significance of information and communication technologies for reducing poverty*. Department for International Development. Retrieved February 10, 2004, from http://www.dfid.gov.uk/Pubs/files/ict_poverty.htm
- McNamara, K. S. (2003, December). *Information and communication technologies, poverty and development: Learning from experience*. Paper presented at the infoDev Annual Symposium, Geneva, Switzerland. Retrieved August 5, 2005, from <http://www.eldis.org/fulltext/sidaictpoverty.pdf>
- Moertiningsih Adioetomo, S. (2005). Reshaping populations. In T. H. Hull (Ed.), *People, population, and policy in Indonesia* (pp. 125-168). Jakarta, Indonesia: Equinox.
- Olson, M. (1971). *The logic of collective action: Public goods and the theory of groups*. Cambridge, MA: Harvard University Press.
- Parfitt, T. (2004). The ambiguity of participation: A qualified defence of participatory development. *Third World Quarterly*, 25(3), 537-556.
- PT Risadata Utama. (2004). *Report survey and statistical analysis on the baseline survey for e-pabelan for [sic] National Development Planning Agency of the Republic of Indonesia (BAPPENAS)*. Jakarta, Indonesia: Author.
- Schech, S. (2002). Wired for change: The links between ICTs and development discourses. *Journal of International Development*, 14, 13-23.
- Schwarz, A. (2004). *A nation in waiting: Indonesia's search for stability*. Singapore: Talisman.
- Sen, A. (1981). *Poverty and famines: An essay on entitlements and deprivation*. Oxford, United Kingdom: Oxford University Press.
- Webster, F. (with Blom, R., Karvonen, E., Melin, H., Nordenstreng, K., & Puoskari, E.) (Ed.). (2004). *The information society reader*. London: Routledge.
- Williams, G. (2004). Evaluating participatory development: Tyranny, power and (re)politicisation. *Third World Quarterly*, 25(3), 557-578.
- World Bank. (2000). *World development report 2000/1: Attacking poverty. Opportunity, empowerment and security*. Oxford, United Kingdom: Oxford University Press. Retrieved August 5, 2005, from <http://siteresources.worldbank.org/INT/POVERTY/Resources/WDR/overview.pdf>

ENDNOTES

- ¹ The research project combined both qualitative and quantitative methods including direct and participant observation, open-ended interviews, questionnaire surveys, and rural appraisals. The statistics referred to on participation are based on data from the telecentre logbook from July 2004 to June 2005 and include repeat visits. Other statistics referred to in this chapter are based on a randomly sampled survey of 216 poor households in five village subunits conducted at the 95% confidence level. Included supporting statements are indicative of commonly voiced concerns within Pabelan. However, it should be noted that throughout the research period, awareness of and interest in the telecentre (and the project's aims) remained low within the community. For the vast majority, life carried on as before. This chapter focuses on the intended beneficiaries' conceptualisations and not the minority (predominantly students) who utilised the telecentre. To focus on the latter would require distinguishing what the actual difference is in practice between e-Pabelan, being a poverty-reduction project, and a privately run Internet café (warnet). This remained a troublesome issue, and space does not permit a fuller analysis here.
- ² The term telecentre is used in this chapter as this is the term often used at the implementing-agency level and exclusively at the local level (alongside TC or tele). It is also a more apt descriptor in this context than, for example, multipurpose community centre.
- ³ Whether an information society or age actually exists, and in what form, remains the subject of debate. For an overview, see Webster (2004). The term information society probably first emerged from Japan in the late 1960s (Duff, 2000).
- ⁴ The most used, and most overlooked, communication technology within Pabelan is the motorcycle. Within Pabelan, there were 375 motorcycles in 2004 (Badan Pusat Statistik, 2005) and growing.
- ⁵ Poverty figures courtesy of *PT Risadata Utama* (2004) and local figures from *Kepala Desa* (2004, 2005). Local figures reflect income- or consumption-based approaches to measuring poverty. The external source utilised a somewhat broader composite approach.
- ⁶ Two projects originally established by the BPPM are currently running. They are a telephone kiosk and a health clinic near the pesantren. Both now run independently of the BPPM. The current health worker at the clinic was not aware of any links with the BPPM itself, although she started work there in 2000.
- ⁷ The local political context is further complicated in that the current village head is the spouse of the leader (pimpinan) of the pesantren.
- ⁸ Regional autonomy (Otonomi Daerah) resulting in increased powers at the level of the provinces in Indonesia came into being January 1, 2001.
- ⁹ An "infomobiliser" with no previous links to the pesantren was also appointed. Toward the end of the research period, this individual was in the process of conducting appraisals with a view to introducing newly formed learning groups (kelompok belajar) to information from the telecentre and then to the telecentre itself at a later date. Although, at the time of writing, it was too early to gauge the effectiveness of this initiative, it should be regarded as a potentially significant development.
- ¹⁰ The English course was established in association with a Jakarta-based nongovernmental organisation and funded by the Regional English Language Office (RELO) of the United States embassy, Jakarta.

- ¹¹ In August 2005, the implementing agencies agreed to extend payment for the Internet connection for a further 6 months. Charges for using the telecentre were introduced August 1, 2005.
- ¹² Married women often reported receiving the sum of 10,000Rp (just over \$1) per day (but not every day) from their husbands. This is to pay for expenses, including food, bills, clothing, and education for children. While some women have independent income sources, others are dependent solely on such money and informal sources of credit.
- ¹³ The contrast with utilising radio for development is striking. No one would expect an individual to benefit from accessing a radio station that was devoid of preprepared relevant content.
- ¹⁴ Pabelan is comprised of 10 dusun. The pesantren and telecentre is located in Pabelan IV, which may be considered the political hub of the village. Correspondingly, the telecentre is not located in one of the poorest parts of the village.

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, & M. Acevedo-Ruiz, pp. 138-155, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 4.14

Determining Whether ICT Improves Social Interactions

Raj Gururajan

The University of Southern Queensland, Australia

INTRODUCTION

Previous innovations, such as telephones allowed individuals to communicate on a one-to-one basis, or for powerful, central institutions to speak one-way to the masses (Burrows, 2000). New technologies such as the Internet are revolutionizing communications as a positive force, improving the efficiency and accountability of local government, and strengthening communities. This requires a vision in order to be able to actively *use* technology rather than passively reacting to change. Any advancement which is able to significantly empower people, also threatens to entrench the division between haves and have-nots—both as organizations and as individuals (Burrows, 2000). In the current climate, local government agencies are beginning to use these new technologies to open up the process of communication between governments and the citizens.

Essential to the technological challenges is the balance between three major elements—social capital, Quality of Life (QoL) and the technology itself. For instance, social capital is realized

when the public perception that technological changes implemented in societies would enable advancements in daily routines of the public. These advancements, then, would contribute to better QoL. The link between the daily routines and the advancements is provided by technology. For example, using the Internet technology, public can order their groceries and this is seen as advancement as there may be considerable time savings, resulting in quality time spent with family. Therefore, local government agencies introduce technologies in their communities with the anticipation that the social fabric can be strengthened via these technologies.

Over the last five years social capital has become a main topic on the public agenda. Social capital is realized *between people who establish networks, norms, social trust and facilitate co-ordination and co-operation for mutual benefit and there is* increasing evidence to suggest that social capital is an essential ingredient in civil society, economic development, the health of people in communities and community development (Stone, 2001; UNCTD, 2002). Thus in communities

where social capital is strongly rooted, people will feel that they are part of the community, useful and be able to make a real contribution to the community, will participate in local community networks and organizations, work together for the common good in times of distress, and valued for who they are (Chamber, 2002). This is shown in Figure 1, where the “ME” component is centered upon the family, work, friends and relatives, and the immediate neighborhood.

Quality of Life (QoL) is defined in various forms in the literature. For example, QoL is defined as subjective well-being by the Global Development Research Centre. QoL reflects the difference, the gap between the hopes and expectations of a person and their present experience. Earle and Fopp (1999) asserted that technology is a major social and occupational determinant in QoL and indicated that technology has reduced the need for direct interaction. As a consequence, communities are culturally experiencing a change. Others found that technology itself (e.g., Internet access) ultimately plays little role in determining individuals’ quality of life as maturity and life experience replace the need for any dependence on an artificial support system (e.g., Granzin & Haggard, 2000). Therefore, while technology plays a crucial role in the social determination, how it

is implemented is essential in order to ascertain the reach of this technology on the public. If the technology is properly implemented, then it may be possible to realize a better social capital.

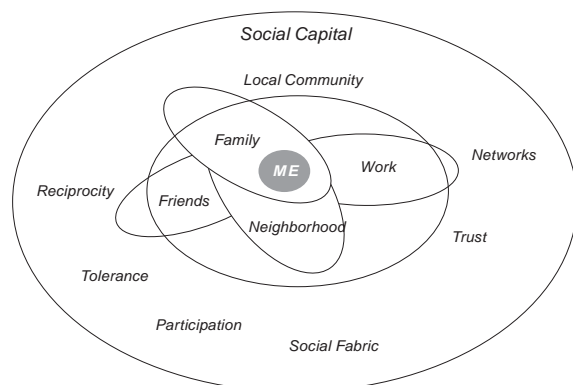
NETWORK NEIGHBORHOOD

Network Neighborhood (NN) is about using online technologies in order for people to communicate with each other when they want to, and develop strong communities of interest to keep them involved and interested in their neighborhood, so they have a sense of belonging (Gill, 2003). NN is a program designed to enhance the economic, cultural, social and environmental development and deliver better quality of life. Its main aim is to deliver a social dividend while increasing the reach and relevance of government and significantly cut the cost of government service delivery (Gill, 2003). Picton Waters Network Neighborhood project is one such NN project developed by an Internet-based software application in Western Australia to see if the Internet can help make stronger communities and better neighborhoods.

A growing body of literature has confirmed that social capital is correlated with positive individual and collective outcomes in areas such as better health, lower crime, better educational outcomes, economic development and good government (Carroll, 2002, p. 647). According to Bullen and Onyx (1999), it is possible to measure social capital in network neighborhood as there is a general social capital factor available in many forms such as participation in local community. In a neighborhood context, indicators help to evaluate whether local actions are having the effects desired.

Therefore, the main aim of this study is to test the claim that the NN would improve the QoL of the neighborhood community.

Figure 1. Social capital (Adopted from Bullen & Onyx, 1999)



METHODOLOGY

This study used a mixed methodology. Initially, an interview method was employed in this study to identify indicators for measurement. This was then followed by a survey method. A QoL survey relies on the respondent's subjective rating of perception about QoL. Typically the spheres measured are primarily based around finances, health, family, friends and work (Ventegodt, 1996). Zehner (1996) measured QoL in terms of economic security, physical environment, family life, contentment, well-being, personal relationships and values, job-satisfaction, social relationships (non-family), leisure activities, health, religious values, parenting and housing and found housing, community, physical environment, social environment, and work, transportation and living costs to be significant factors. Shookner (2000) suggested that indicators such as social, health, economic and environmental should also be included in the QoL Index. This study used those social indicators identified by Zehner (1996) with consideration to the concerns raised by Earle and Fopp (1999) who found that technology has reduced the need for direct interaction, and, as a consequence, communities are experiencing a change in the way their members interact with each other using online technologies.

The vital component of this project is to evaluate the effectiveness of NN in terms of whether the use of the online technologies improves the QoL of the community. It is hard to determine the most optimal or most suitable indicators to measure QoL in the context of ICT as the proposition that "the use of ICT in a community would improve (or worsen) the QoL" is quite new. It appears that there is limited research conducted to measure that impact of ICT on QoL (Keyes & Bancroft, 2002, p. iii).

Selection of Indicators

The QoL indicators have been selected following interviews with key personnel in the Department of Premier and the Cabinet in Western Australia.

The interviews yielded specific characteristics appropriate to the indicators. They are timeliness of the indicators, reliability and stability, understandability, relevancy, usefulness, simplicity and honesty. Based on this, an initial theme for the indicators was developed from Kingsley (1999) and elaborated during informal, open interviews. The theme includes depression, stress, social isolation, safety, trust, opportunities, and equality. The themes were further studied resulting in a set of hypotheses.

Discussion of Hypotheses

Social support helps give people the emotional and practical resources they need. Belonging to a social network of communication and mutual obligation makes people feel cared for, loved, esteemed and valued. According to the World Health Organization Regional Office for Europe, this has a powerful protective effect on health. Through the use of NN, the members of the community can interact with each other through mail or being part of the various communities that are available through the network site. The NN helps in bringing the physical proximity of family and friends together, and one needs to measure the degree to which a person is socially integrated, or if there is any availability of social support networks being developed through the use of NN for the overall social well-being of the community member. Social well-being here is defined as including interactions among the members of the Picton Waters neighborhood community.

The hypotheses developed for this study covers areas such as depression, social isolation, safety, trust, opportunities and equality. These factors appear to have an impact on social isolation, and it is believed that by using ICT, it may be possible to alleviate the adverse impact of these factors. For instance, depression is a major medical disorder, just like high blood pressure or heart disease, and influences people day after day, affecting thoughts, feelings, physical health

and behavior (Cleveland Clinic, 2001). These concepts are tested in the following hypotheses: s tested in the following hypotheses:

Hypothesis 1a: The use of the NN technology helps in the decrease of depression through the increased use of making friends and allies through chatting and e-mail.

Hypothesis 1b: The use of the NN technology helps in the decrease of stress levels through the increased use of making friends and allies through chatting and e-mail.

Hypothesis 1c: The use of the NN technology helps in the decrease of social isolation of a community member through the increased use of making friends and allies through chatting and e-mail.

Hypothesis 2: The use of the technology of NN helps in the feeling of mental and physical security when in crisis and hence creates a sense of safety.

Hypothesis 3: The prolonged use the NN helps in developing and building trust between members of the neighborhood community.

Hypothesis 4: The use of NN helps local small businesses with increased opportunities to exchange skills, goods and services.

Hypothesis 5: The use of NN site promotes a sense of equality among members.

Data Collection

The data collection involved the use of the survey as a vehicle for measuring social capital in family and community life. Questions in the survey are measured on the basis of the Likert scale, with respondents ranking their responses to a set of items on a range of numbers, from 1-5. The Likert scale has been used basically to ascertain the correlation between the positive and negative halves of the answer to the question. The Likert has been selected because it is easy to construct, tends to high reliability, is flexible and is the best in scaling people on attitudes, perceptions,

personality characteristic and for the assessment of multidimensional constructs.

The questions compiled for this study were checked by the staff of the Department of Premier and Cabinet at Western Australia to ascertain the suitability and appropriateness. The questionnaire was then pilot tested by students and staff of a university in Western Australia. The pilot testing revealed that some questions were ambiguous and these questions were considered for refinement. Further, some other questions were re-worded for appropriateness. The Western Australian Government administered the questionnaire to the residents of Picton Water Community. The questionnaire was sent to a total of 39 households and the total valid responses received were from the 39 households. The responses were entered into a spreadsheet by two data entry operators and tested for any typographical errors. Any mismatch identified was corrected by using a file comparator method. Once the data entry was complete, the data was transformed into an SPSS software file.

Data Analysis

Participant demographics indicated that the majority of the respondents have been living in the neighborhood for a period of 3-10 years (33.3%). The majority of the respondents were in the age group 30-36 years (15.4%). The majority of the respondents had a tertiary qualification (51.3%) and was currently employed (74.4%). The entire respondents used the Internet (100%). And the average number of people in the household was four people. The data on location of Internet usage and intention for use had missing values and could not be thus quantified.

The data was initially analyzed for standard statistics such as mean and standard deviation. A normal curve was plotted on the descriptive to identify any "outliers" as responses sometimes may end up in extreme boundary values of the scale used. Any such outliers were eliminated from the

Determining Whether ICT Improves Social Interactions

data as these may cause bias. In this study, of the 39 questionnaires distributed, all responses have been considered valid and were considered for analysis. The data was then checked for “normality” and ensured that this feature was obtained. Further reliability tests were performed on the data and the reliability factor was ensured (over 0.73). Once this basic quality checking was accomplished, the data were tested for correlation.

The data were tested using the Pearson’s correlation method. It was found that the correlation varied between 0.327 and 0.667 in many cases, with significance level under 0.05. This indicated that the questionnaire was an appropriate instrument, and the questions were measuring what was intended to be measured. Most of the questions were correlating positively with other questions either at 99% or 95% level of confidence. Exceptions to this were questions 16 and 12 and questions 14 and 3. Questions 12 and 16 measured community participation and making new friends and found to be negatively correlated. Questions 3 and 14 measured attendance in community events and the resulting social interaction and found to be negatively correlated.

DISCUSSION

The survey clearly indicated that people in the Picton Water community lead their lives mainly within their own household. They do not know the name of their immediate neighbours and rarely socialize with friends who live within a close distance of their home. They rarely talked to the people in the neighborhood. However, a surprising factor that emerged was that if there is a community or service group activity in the neighborhood, the majority of the respondents participated in the event. The respondents also indicated that they attended events in the nearby areas. The results of these interactions indicate that they are capable of making friends. While this study was not able to conclude whether the

network technology facilitates the same level of interactions, it is believed that community members can increase their interactions using this technology. The “decrease in stress” level factor resulting from these interactions is not conclusive.

In terms of the second hypothesis, where “safety” factor was measured, the respondents indicated that a majority of them felt that if they socialize more and involved in more community work together they may get to know each other. Further, a majority of them are confident of making new friends/acquaintances if through various social events. The results also demonstrated that the majority of respondents do not meet outside these local events. The survey also indicated that the majority of the respondents felt a general feeling of safety in the neighborhood. The survey indicated that the “safety” factor was better at night time as well. This feeling of safety has been strong because a majority of respondents felt people in the community have a respect for their community and each other. Further, they participated in local events even if they are not personally asked or invited to do so and are not afraid to participate even if they do not know anyone or won’t be accepted. Therefore, it is concluded that using the network technology, it is possible to build “safety” in communities.

Hypothesis 3 dealt with “prolonged” use of technology and its effect on trust. As it was not possible to collect longitudinal data in time for this publication, it is not possible to provide comments on this hypothesis.

There is clear evidence to indicate that socialization and interactions in community events is limited only to these events. The results also show that the majority of respondents do not have sense of belonging to their neighborhood and this can be attributed to the fact of they do not know their neighbors personally and do not socialize with people close to their home. Further, due to lack of data on their use of technology for online transactions, it is not possible to ascertain whether

there are opportunities for exchange of goods and services using this technology. While the indications are that there are possibilities, due to lack of strong numerical evidence, hypothesis 4 is rejected.

The fifth hypothesis, equality among members, is accepted as the data clearly indicates that members in the community felt that they have equal opportunities in event participation. Further, when this aspect is combined with the safety data, it is evident that the perception of equality is valid. Therefore, this hypothesis is accepted.

CONCLUSION

This research has made a number of findings about the social behavior of people of Picton Waters and has documented a number of issues in the use of NNs. In terms of project completion at the preliminary stage, the objective of accessing the social behavior (through the measurement of the social indicators identified) of the people in Picton Waters through the introduction survey was successfully completed.

The second objective, a longitudinal survey based on continual use of technology was not completed on time due to some unanticipated problems in administering the survey to the same set of respondents. Therefore, the results of the same were not available in time to prepare this report. Hence, the hypothesis with the use of NN technology could not be measured as planned initially.

In conclusion, it can be said that there are indications that the NN technology could help in improving the QoL of the people in the Picton Waters community as it could be an excellent way of improving the social interactions between the community members.

REFERENCES

- Bullen, P., & Onyx, J. (1999). *Social capital: Family support services and neighborhood and community centers in NSW*. Retrieved March 29, 2003, from <http://www.mapl.com.au/A12.htm>
- Burrows, J. (2000). *Community information networking - An overview*. Retrieved March 29, 2003, from <http://www.rhizomatics.demon.co.uk/locgov/cominfo.html>
- Canadian Research Policy Network (2001). *Indicators of quality of life in Canada: A citizen's prototype* (online). Retrieved March 20, 2003, from <http://www.cprn.org>
- Carroll, J. (2002). *Human computer interaction in the new millennium*. New York: ACM Press.
- Chamber, R. (2002). *Measuring customer satisfaction*. Philadelphia: Plaint Graphic.
- Cleveland Clinic. (2001). *Explaining anxiety disorders: Anxiety and depression*. Retrieved on March 29, 2003, from <http://www.clevelandclinic.org/quality/08-06/08-06a.htm>
- Earle, L. & Fopp, R. (1999). *Introduction to Australian society, A sociological overview*. Harcourt Brace & Company. Australia.
- Gill, J. (2003). *Network neighborhoods: Overview*.
- The Global Development Research Center (2003). *Notes on "quality of life"* (online). Retrieved March 21, 2003, from <http://www.gdrc.org/uem/gol-define.html>
- Granzin, K.L. & Haggard, L.M. (2000). An integrative explanations for quality of life. In E. Diener & D.R. Rahtz (Eds.), *Advances in quality of life theory and research* (pp. 31-63). The Netherlands: Kluwer Academic Publishers.
- Institute for Social Research Swinburne University of Technology. (2000). *Social benchmarks and indicators for Victoria*. Consultants' Report for the Department of Premier and Cabinet, Victoria. Retrieved on April 29, 2003, from <http://www.nexus.edu.au/TeachStud/arera/news/ms2appen1.pdf>

Keyes, D., & Bancroft, E. (2002). *Information technology indicators for a healthy community* [Online]. Retrieved March 19, 2003 from <http://www.cityofseattle.net/tech/indicators>

Kingsley, G. (1999). *Building and operating neighborhood indicator systems: A guidebook*. National Neighborhood Indicators Partnership, The Urban Institute. Retrieved March 29, 2003, from <http://www.urban.org/nnip/pdf/guidebk.pdf>

Resnick, P. (2002). Beyond bowling together: Socio-technical capital. In J.M. Carroll (Ed.), *Human computer interaction in the new millennium* (pp. 647-672). NJ: Addison-Wesley.

Shookner, M. (2000, June). *The quality of life in Ontario Spring 2000*. Retrieved March 29, 2003, from <http://www.qli-ont.org/spring2000/qlispring2000.html>

Stone, W. (2001, February). *Measuring social capital: Towards a theoretically informed measurement framework for researching social capital in family and community life*. Research paper No. 24. Retrieved March 29, 2003, from <http://www.aifs.gov.au/institute/pubs/RP24.html>

The United Nation Conference on Trade and Development. (UNCTD). (2002). *The number of Internet user worldwide* [Online]. Retrieved April 11, 2003, from <http://www.nua.com.au>

University of Toronto (2003). *QOL concepts: The quality of life model* (online). Retrieved March 21, 2003, from <http://www.utoronto.ca/qol/concepts.htm>

Ventegodt, S. (1996). *Measuring the quality of life, from theory to practice*. Denmark: Forskningscentrets Forlag.

Zehner, R. (1996). *Indicators of the quality of life in new communities*. Ballinger Publishing Company. USA.

KEY TERMS

Identity: Identity results from interplay of three related factors: “whether one considers oneself part of the group, whether other group members treat one as a member, and whether people outside the group do” (Resnick, 2002, p. 654).

Quality of Life (QoL): QoL may be defined as subjective well-being. Recognising the subjectivity of QOL is a key to understanding this construct. QoL reflects the difference, the gap, between the hopes and expectations of a person and their present experience. Human adaptation is such that life expectations are usually adjusted so as to lie within the realm of what the individual perceives to be possible. This enables people who have difficult life circumstances to maintain a reasonable QoL (The Global Development Research Centre, 2003).

Social Interaction: Social Interaction/Belonging includes links with social environments and includes the sense of acceptance by intimate others, family, friends, co-workers, and neighborhood and community (University of Toronto, 2003).

Sustainable Communities: A sustainable community (like NN) offers its members a greater sense of security which leads to less reliance on the health and welfare systems as replacements for social activity, and crime decreases as individuals feel a greater sense of inclusion and are not disenfranchised (Gill, 2003, p. 7). In addition to that, a greater sense of security would also mean “greater sense of personal safety in the community” (Canadian Policy Research Network, 2001). Therefore, greater sense of security would lead to higher QoL, with less worry and more freedom (greater feeling of being safe).

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, X. Yu, pp. 159-163, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.15

Formation of a Knowledge-Based Society through Utilization of Information Networking

Hakikur Rahman
SDNP Bangladesh, Bangladesh

THE CONTEXT OF THE INFORMATION SOCIETY FOR BANGLADESH

“Information society,” “knowledge network” and “digital divide” are terms becoming increasingly common in many parts of the world over recent years. The key element in these concepts is that of “information,” and its fluidity in the modern world. Information can be viewed as the foundation stone of this new phenomenon and is the collation of raw and un-processed data into meaningful dialogue. Many societies and communities in developed and developing situation have settled on the term “information,” to describe the new economy and be the basis of development in the new millennium.

The Information Society is created by information, in a similar way that the industrial society area was created by manufacturing. This new Informa-

tion Society is therefore a society being produced by a reliance on information as the most significant factor in the means of production. Hence, it relies on the information economy to produce products, services, employment, wealth and life style on which the community depends. It is believed that ultimately the whole community of a country can benefit from the optimum utilization of information in each and every corner of society.

Knowledge, on the other hand, is dynamic and capable of creating dynamism in a similar way to capital and labor. Money, work and information are catalysts, while knowledge, capital and labor are concepts containing stored endurance and cultural interpretation. Given the right incubation, they are capable of creating fruitful outcomes. Building a knowledge network molded by information can accelerate the pace of development.

In Bangladesh, efforts have been allocated to accommodate propositions on developing a nation wide information network using the existing

information backbones. As a result, a centrally driven content repository may eventually be established.

INTRODUCTION

The Information Age is challenging the role of the expert in society and, therefore, the relationship between expert and amateur (Handy, 1997). The WWW (World Wide Web) has created new opportunities for self-learning in a wide range of expertise previously dominated by specialists. Specialists and professionals in all aspects of human life are benefiting through this expert support. Thus, knowledge is evolving as the result of information acquisition melded with experience where many amateurs can develop to act as effectively as experts.

Knowledge management incorporates huge data storage facilities, contents in distributed databases and an effective retrieval system. It means planning for research, linking ideas to generate information and conceptualizing the notion of a knowledge society. The knowledge society can bring more ability and options to the stakeholders through methodologies like self-paced learning, forming common communities through mass networking and by maintaining maximum flexibility in learning sequences.

Mass networking is one of the prerequisites to form a homogenous, multidimensional, dynamically developed and research-potent knowledge-based society. Academics, institutes, research organizations, civil society, government and non-governmental agencies, and other partners/stakeholders of the community should be able to interact with each other through a common horizontal platform.

In response to the challenges of globalization and the information society, each country needs to set out its own strategic objective for the coming decade, and to become the most competitive and dynamic knowledge-based economy in the global

market, capable of sustainable economic growth with better jobs and greater social cohesion.

Bangladesh is a country of 133.4 million people. With a minimal GDP of 357USD, 33% of the population lives under the national poverty line. More than 80% of the population resides in difficult accessible rural regions, where information infrastructure is very thin and formation of a common information backbone still remains an open challenge to the society.

In order to address the issues faced by much of Bangladesh, detailed programmes and action plans on the future of education and training systems need to be prepared. The policies need to be implemented using “open coordination concept” among all the partner organizations.

STRATEGIES

In addressing the obvious needs of Bangladesh in the Information Age, strategic plans need to be initiated at the national level and incorporate flexibility in each stage of the development and action, to deliver optimum resource utilization and to maximize benefits. The new strategy requires an indigenous method, an open coordination concept, a realistic measure:

- identifying and defining common objectives; and
- stimulating the quality and relevance of locally based capacity enhancement programmes.

In discussing information and knowledge, it is useful to start by observing that both are human creations (or social constructs). They are designed to explain and meet some of the challenges that individuals or groups face at a particular time and place. No one fully understands the meaning of knowledge and information without recognizing that they can both be “double-edged swords.” They can be used to empower individuals and

groups. They can also be used to continue and reinforce relations of power and control. When a ruling group uses information and knowledge to control (dominate) people, those people are led to despair, powerlessness, and unsustainable life styles (Mchombu, 2002).

Several aspects of the emerging framework for the Information Age in Bangladesh that are essential for bringing communities to a common platform by raising their capacity through the utilization of ICT techniques are now discussed.

Policy Initiation

To increase socio-economic development, government must undertake broad-based action plans. The inclusion of the following section in the ICT Policy of Bangladesh, is a positive step in this respect:

Socio-economic development can be accelerated if more people can have access to information. Teledensity is important in this respect and it will be increased to broaden the coverage, which will improve the socio-economic condition of the people through ICT-related activities in line with experience of developed countries. (ICT Policy, 2002)

Secondly, ICT Policy accommodates steps towards capacity development of the general population:

Widespread introduction of ICT education in public and private educational institutions is a prerequisite for producing skilled ICT manpower. (ICT Policy, 2002)

Finally, the ICT Policy needs to recognize that the information infrastructure needs to be upgraded to allow the formulation of a national data bank to assist the development of millennium initiatives:

A central depository for collection and dissemination of ICT information and research findings will be developed. This will be done under a network, connecting all university libraries and research organizations to this central depository, which in turn will be connected to the Internet. (ICT Policy, 2002)

Education

Education is by necessity a primary concern in all countries. Although the structures of education systems differ considerably, both within and amongst different countries, a mass literacy campaign should be given the first preference in a country's education system. Bangladesh, with 38% of the population being illiterate, needs to upgrade its education programmes to raise literacy. The government is keenly interested to make the country 100% literate by 2006.

Predictions about the economic and social impact of Information and Communication Technologies (ICT) abound in the literature and the economic and social behavior of society. The technological trends are extrapolated to illustrate potential benefits and by adopting a visionary perspective, resulting in predictions of "revolutionary changes" in the global knowledge society. Advances in ICT have been particularly striking in the areas of digital computing and communication networks (Carlos et al., 2003). Superimposed on these factors, education systems no longer remain removed from the basic societal aggregations. Scholars, researchers, and educators are striving hard in Bangladesh to produce quality education systems using the benefits of ICT. Educational networks have become a prime urgency in Bangladesh. In this context the interaction between technological development and new approaches to education become increasingly important in previously unserved situations.

The Semantic Web is expected by many to open new opportunities to manage information

while allowing for new Web functionalities with significant storage potential. Artificial intelligence and expert systems are expected by many to gain a novel power and utility as standards for distributed computing and grid systems spread around the world. New technology-based infrastructure developments open new possibilities for regions with low-bandwidth connectivity to leapfrog stages of development by entering the “broadband” phase via wireless solutions. The Wi-Fi phenomenon is a good example of the “law of unintended consequences” in action as a technology originally designed to support wireless local area networks is beginning to pave the way to establish of low-cost broadband telecommunication systems at the outset (Rahman, 2003a).

Lifelong Learning

Another core element of the Bangladesh ICT strategy is the concept of lifelong learning, which is central not only to competitiveness and employability but also to social inclusion, active citizenship and personal development (EU, 2002).

Lifelong learning has become the guideline principle for the development of education and training policy. Following this path the learning of new technologies has become a priority in an ever-changing society.

Although the area of corporate distance education is new, a study by the International Data Corporation (IDC) reported an annual growth rate of 63.5% for distance learning from 1992 to 1997 (EXEN Partners, 1998).

Learning is dependent on the use and application of information and in how information is contextualized to become knowledge. That such a process is socially mediated and is dependent on social interaction is evident (Freund, 2003). Developing a learning organization is a huge challenge. Developing a learning partnership is an even greater challenge. It hinges very much on a willingness to learn from each other (Chetley, 1998).

Networking

Increased networking among education institutes, research organizations, and eventually government and non-governmental agencies to establish interactive information exchange platform, by sharing knowledge and expertise in formulating effective governance, knowledge networking and mass information dissemination at the grassroots level would enhance the development processes.

Proficient utilization of network resources in disseminating knowledge-based information in online and off-line environments formulates a concrete platform of a collaborative research base and collaborative learning sequences (Rahman, 2003b).

Transborder data flow (TDF), or the transfer of information across borders, is becoming commonplace due to developments in electronic communications. Amongst developed countries in the Western world, TDF has been happening for years with the facsimile machine being the first major tool for easy information transfer. But developing and transitional countries are lacking the basic infrastructure to allow them to carry out TDF, leading to gaps in their knowledge base and creating information impoverished societies (Allen, 1999).

Today, developed countries show that access to the Internet can, and has, dramatically transformed every aspect of the society and economic activity that rely on access to information. For developing countries, large-scale access to the Internet still remains to be fully addressed, leading to an ever-increasing digital divide with developed countries. Recent studies by the World Bank show that Internet access, based on telecommunication infrastructure (fixed networks, mobile or satellites), constitutes the fastest growing technology within the ICT sector. There is, therefore, a need to accelerate the on-going Internet penetration efforts (especially in developing countries), by deploying technology that is both scalable and

affordable to end-users. High prices charged by few service providers, and poor (or at times a lack of) terrestrial connectivity to majority of the population in rural areas may inhibit large-scale Internet access in developing countries (Koyabe, 1999).

Virtual Networking

Networking can be divided into two forms: Physical networking and Virtual networking. Physical networking is infrastructure independent, while Virtual networking is being superimposed over the available infrastructure. Virtual networking should adopt low cost or open-source software utilities to form a common platform of communication among geographically distributed locations. Based on this concept, educators are availing the facilities to form groups and dissemination hubs through e-mail, e-groups, BBS (Bulletin Board Service), virtual seminars and moderated discussions.

Available technologies can be integrated to form low cost information provider. Utilizing interactive distance education techniques, educators and learners can be brought together in a common collaborative platform to make the system cheaper and easily available to remote users.

Virtual learning involves the use of some form of electronic media to enhance the learning processes. Sometimes confused with distance learning (a broader delivery medium that would include text-based learning and courses conducted via written correspondence), courses are delivered via “e-learning” when technology is used to bridge both an instructional and a geographical gap. Accommodating a range of activities, from effective use of digital resources and learning technologies in the classroom, to a personal learning experience enabled through individual access at home or elsewhere, virtual learning is essentially the facilitation of teaching and learning via the use of some electronic medium.

Knowledge Management

As the term “knowledge management” slips easily into the vocabulary of libraries, we are in danger of understanding the power and extent of the paradigm we invoke. It is not just that industries based on knowledge are developing. It is not just that information, like machinery, becomes essential to any business or enterprise. If we consider what infrastructure—networks, organization, bodies of research, commentary, jobs, regulation, legislation—is in place to support the constructs of labor and capital in our society, we begin to glimpse what might be in store for the “knowledge” concept in an information society (Dellit, 1998).

Knowledge management is not a precise enclosure of means that professionals can easily learn and just apply in specific situations. Knowledge management is a complex web of ideology, values, dependencies, power relationships, learning, maneuvering, social and economic analysis, the essence of knowledge, behavior and techniques.

The European Union (EU) is a forum for the exchange of ideas and good practice. It does not have a common education policy, however. On the contrary, its role is to create a system of genuine cooperation between the Member States by preserving the rights of each Member State in terms of the content and organization of its education and training systems (EU, 2002).

Information Networking

Information networking is not a new concept in this globalized society. Utilizing the information backbone and Internet, educators, society leaders, researchers, policy initiators and other development partners are acting around the globe for promoting sustainable development and alleviating poverty. Awareness raising, promotion of literacy, agricultural extension, disaster management, and many other important aspects

of the current society are taking benefits of the communication networking.

There exist several networks in Bangladesh, in discrete and isolated forms. Bangladesh Open University with 12 Regional Resource Centres spread over the country through a dial-up network (<http://www.sdnbd.org/sdnbd/maps/pic6.htm>) is used mainly for administrative purposes. Similarly, another secluded network, the Bangladesh Education and Research Network (BERNET), is maintained by the University Grants Commission (UGC) (<http://www.ugc.org>).

BERNET included 128Kbps radio link connectivity with a private ISP and this link has been distributed to the Bangladesh University of Engineering and Technology (BUET) (64Kbps) and the Dhaka University (64Kbps). Some of the other state-run universities are connected to UGC server by dial-in connection. Among them, the Shahjalal University of Engineering and Technology in Sylhet has its own VSAT linked network connected to the Internet.

Recently, a few other universities are establishing their own network using VSAT connectivity. Government organizations, like, the Ministry of Health, Ministry of Education and Ministry of Agriculture are extending their networks down to their district town outlets, using mainly dial-up. The state-owned telco, the Bangladesh Telegraph and Telephone Board (BTTB), is also trying to connect each district town through several types of connectivity (Fiber, Digital Data Network and Dial-up).

Sustainable Development Networking Programme (SDNP) of Bangladesh (<http://www.sdnbd.org/sdnbd/maps/pic4.htm>), a UNDP-funded project, under the Ministry of Environment and Forest (MoEF) and implemented by the premier socio-economic research institute, Bangladesh Institute of Development Studies (BIDS), is maintaining a network comprised of radio links, ADSL and dial-up. One of its regional setups has been running successfully for about a year in the Bangladesh Agricultural University

(BAU) in Mymensingh at a distance of 120Km away from the Dhaka city (<http://www.sdnbd.org/sdnbd/maps/pic3.htm>, http://www.sdnbd.org/sdnbd/tech_support/4.gif). Recently, SDNP has extended its network along the coastal belt of the country using VSAT connectivity (http://www.sdnbd.org/sdnbd/maps/radio_station.htm, <http://www.sdnbd.org/sdnbd/maps/mcpc.htm>). This project aims to capitalize on this information network to create an appropriate IT-based mechanism for facilitating the exchange of information/knowledge among policy makers, the civil society, academia and development partners, locally, nationally and internationally, to support initiatives and processes of sustainable development in Bangladesh.

Among others, schoolnet (http://www.sdnbd.org/sdnbd/maps/school_pro.htm), online blood bank (<http://www.sdnbd.org/sandhani>), virtual library information system (<http://www.sdnbd.org/cgi-bin/books.cgi>), sustainable development information data bank (<http://203.76.110.35/sdi/home.jsp>) are other initiatives towards formation of a knowledge-based society in the country for sustainable development. However, the project should accommodate the deprived southwestern part of the country, where an infrastructure backbone is almost missing. SDNP has been proposing (<http://www.sdnbd.org/sdnbd/maps/pic2.htm>) for alternate funding to accomplish this task.

Coordinating the majority of the above-mentioned networks, a nation-wide information backbone has been established to act as an advanced research network (Bangladesh Advanced Education, Research and Information Network, BAERIN) (<http://www.baerin.net>) in the country. With little initiative and effort, this network may emerge as the national repository of information and provide enormous opportunities in information networking and knowledge management.

CONCLUSION

With open discussions and public input, also including education researchers, the integration of a scientifically based research network for education and research may be developed on the back of existing individual efforts. This will necessitate regular interaction and a highly developed spirit of cooperation through a core work group under a National Steering Committee. It is encouraging to note that already the government has initiated some changes in the ICT policy as a result of input and scrutiny from the education and research community.

To become critical users of information and knowledge, community members will want to analyze critically both the knowledge that comes from outside the community, and their own inherited knowledge. The community will want to study, for example, how cultural and elitist definitions of gender, race, tribe, class, poverty, are developed as both historical and social constructs. In most cases, these definitions should be questioned and critiqued so that value is added to achieve more transformative knowledge and information for the community (Mchombu, 2002).

The nation-wide distributed network should give emphasis to the accumulation of local content directly beneficial to the community and localized global content fitted to suit the capacity of the participant. Integrating modular learning patterns in different platforms of the society, overall capacity can be raised at a functional level.

REFERENCES

- Allen, G. (1999). *Transborder information flow*. UK Foreign and Commonwealth Office.
- Carlos, A., Braga, P., Daly, J.A., & Sareen, B. (2003). The Future of information and communication technologies for development. Presented at the ICT Development Forum, Germany, May 21, 2003. Retrieved from <http://www.developmentgateway.org/node/133831/sdm/docview?docid=492330>
- Chetley, A. (1998). Working with overseas partners. Presentation to IIS Seminar on Information and Developing/Emerging/Transitional Countries, June 10.
- Dellit, J. (2003). All knowing: Creating the knowledge society from the information economy. *EdNA Online*, Education Network, Australia, September 1998.
- EU. (2002). Education, training, youth: Introduction. Activities of the *European Union Summaries of legislation*, November 13.
- EXEN Partners. (1998). EXEN partners with one touch systems and connects America's business schools to companies across the nation. *Telcon's Show Daily*, October.
- Freund, R.J. (2003). Mass customization and personalization in education and training. *ElearnChina 2003*, Edinburgh, July 21-23.
- Handy, C. (1997). *The Hungry Spirit*. London: Random House.
- ICT Policy. (2002). The government of the people's republic of Bangladesh. *ICT Policy*, October.
- Koyabe, M.W. (1999). *Large-scale multicast Internet access via satellite: Benefits and challenges in developing countries*.
- Mchombu, K.J. (2002). Sharing knowledge for community development and transformation: A Handbook. *DLR International in Canada for the Oxfam Horn of Africa Capacity Building Programme*, with support of the Canadian International Development Agency (CIDA), October.
- Rahman, H. (2003a). Distributed learning sequences for the future generation, a conference proceedings of *Closing Gaps in the Digital Divide Regional Conference on Digital GMS*, Asian

Institute of Technology, Bangkok, Thailand, February 26-28.

Rahman, H. (2003b). Virtual networking: An essence of future learners, a conference proceedings of *International Summer Meeting of the Laboratoire de Modelisation et Simulation Numerique en Mecanique*, Marseille, France, July 7-9.

World Bank Development Gateway. (2003). Retrieved from <http://www.developmentgateway.org/node/133831/sdm/docview?docid=627584>

KEY TERMS

Digital Divide: “Digital divide” is a term used to describe the gap between the technology “haves” and “have-nots.” It is a gap in opportunities experienced by those with limited accessibility to technology.

Information Society: A society in which economic and cultural life is integrated by complex communication networks, and critically dependent on information and communications technologies.

Knowledge Management: “Knowledge management” is a concept in which an enter-

prise gathers, organizes, shares, and analyzes its knowledge in terms of resources, documents, and people skills. It involves capturing, warehousing, transforming, and disseminating data/information within an organization to leverage knowledge for competitiveness enhancement.

Knowledge Network: Knowledge is information with guidance for action based upon insight and experience. A network is the connection of two or more entities so that they can share resources. A knowledge network is an interconnected resource entity to improve the results of perception and learning, and reasoning.

Lifelong Learning: A process of acquiring knowledge or skills throughout one’s lifetime via education, training, work and general experiences. It is a concept of continuous personal development through personal learning with an emphasis on independent study determined by contextual personal needs.

Virtual Network: A form of network that refers to the appearance of a single, seamless network system. This type of network provides virtual circuits established through a real network.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, X. Yu, pp. 310-315, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.16

Transforming the K–12 Classroom with ICT: Recognizing and Engaging New Configurations of Student Learning

Colin Baskin

James Cook University, Australia

ABSTRACT

This chapter begins with four very public examples of how K-12 education providers across Australia are attempting to assimilate new teaching and learning technologies into existing teaching and learning structures. The transition as predicted is not altogether smooth, and questions are raised as to where and how the discourses of literacy, education, and technology converge in the information and communication technology classroom. The discussion presents a layered case study that brings together the practical discourse of the teacher, the new discourses of literacy, teaching and learning confronting our students, and the challenge these provide to the management discourse of school administrators. In doing so, it points conclusively to the fact that new configurations of learning are at work in our online classrooms.

INTRODUCTION

Using a convenience sample of middle school SOSE students, the discussion draws on quantitative as well as qualitative methods to explore and document the educational, social and information literacy outcomes of students (and their teacher) in their first experience of online learning. The emerging community of practice is the crucial node at which technology-in and technology-and education is aligned, and its members organised and merged. This situated account describes how this merging is taking place, and how allegiance to the practice of learning both reengineers and re-orientes the very roles, relationships, and distributed knowledge of the school community. In particular, the chapter offers a *gendered* account of how students mediate online learning, how new literacies are appropriated in learning exchange, and how ICT-enhanced teaching challenged one teacher's classroom practice. The chapter urges

that before we discount the transformative values of ICTs in teaching and learning, we need to consider the case for a new definition of student learning that focuses on “the demands of the new world environment” (Blasi & Heinecke, 2000, p. 5).

NEW LEARNING TECHNOLOGIES AND EDUCATIONAL REFORM: TRANSFORMING LEARNING

This discussion is framed by the unique and very public circumstances facing schools and school communities across Australia as they endeavour to get up to speed with new learning technologies. In a recent edition of the *Sydney Morning Herald*, an article ambitiously entitled “Experience the Power of E-Learning” (Wilson, 2002) described how the “horse and buggy days of education” were numbered. It went on to announce the transformation of an entire educational system as part of a “learning revolution” capable of “turning education on its head.” Educational reform born of new configurations of learning is walking steadily towards our schools along the information superhighway. Such bold expectations reflect a deeper belief that technology will improve learning, but as yet there remains some gap between the pervasiveness of this discourse and the actual progress of information and communication technologies (ICTs) in adding value to teaching and learning efforts. The following scenarios capture something of this impasse.

Scenario One

Under Australian political structures, the constitutional responsibility for public as distinct to private education provision falls to each of the six state and two territory governments. In 2001, the New South Wales (NSW) State Treasurer announced a State Government plan to commit \$21 million over four years to provide an e-mail account for

every teacher and student in NSW. In doing so, he proclaimed that, “In years to come, I believe people will look back on this as the year we began a revolution in NSW schools.” The Treasurer continued to state that creation of such e-mail accounts “would transform how children learn” (*Sydney Morning Herald*, 2001). Later, when asked to elaborate on how such lofty outcomes could be realised through e-mail provision, he passed the question to the Minister for Education for a more judicious response. A follow-up article reported somewhat tongue-in-cheek:

It turned out [the Treasurer] had little idea how e-learning accounts would work or how they differ from the Internet and extensive education intranets and free e-mail accounts that exist. Instead, he kept insisting the media should ask the... Minister for Education. ‘I’m one of those people who still writes his Budget speech with a pen in hand and a piece of paper so I think I will leave the details to John Aquilina’s people’ Mr. Egan said modestly. And, er, no he doesn’t have an e-mail account at home himself. (Hewett, 2001)

Scenario Two

In one of our Southern states, Victoria, the Federal Member for Murray, Dr. Sharman Stone, has publicly criticised the State Labour Government for its lack of action in addressing rising Internet costs to state educational providers in the rural regions of Victoria. This criticism was delivered against a backdrop where the state government had just awarded 50 state secondary schools across Victoria a \$5,000 share of state grants to foster the further development of information and communication technology skills.

Scenario Three

The New South Wales State Government has been publicly applauded by parent groups for providing free e-mail services to students across the state

(see Scenario One above). The same political administration is simultaneously lauded by local school administrators for providing a quota of only one ISDN line per school, making widespread use of the e-mail system both impossible and impractical (Parker, 2002).

Scenario Four

In Queensland, State Education Minister Anna Bligh has reacted strongly to the recently discovered knowledge that the targeted ‘critical mass’ of teachers with information technology skills has not emerged with the political velocity she would have liked. Teachers in our Northern most state have been slow to embrace technology in the classroom. As a result the minister is examining the value of withholding funding for technology-based projects within “recalcitrant” schools (Johnstone & Fynes-Clinton, 2002).

RECOGNISING NEW CONFIGURATIONS OF LEARNING BEFORE YOU KILL IT!

This discussion raises the possibility that ICTs in teaching and learning can be both rewarding and confronting for all parties involved—school administrators, policymakers, educators, school communities, and their students. The scenarios presented above suggest a widespread belief (at least in political circles) that ICTs will enhance student learning in the K-12 schooling sector. Yet in each scenario (above), as we race to meet this learning revolution, our school administrators create a new casualty on the information superhighway. These same scenarios are indicative of the gap between the pervasiveness of the school reform mantra and the inchoateness with which people address the very real question of how learning will be improved by incorporating ICTs into school curriculum.

What do we mean when we talk about how ICTs might improve learning and teaching? Does, for example, improved learning in terms of ICTs act as a proxy for a known outcome statement? Should this be expressed in terms of higher test scores, or pedagogically as models of *deeper* compared to *shallower* learning? Or, as with the field of Information Literacy, should we document ‘learning’ against the standardised observations common in ICT effectiveness studies that code, measure, and compare observations against sets of industry standards?

A recent U.S. report demonstrates the failure of ICTs to achieve these kinds of results. The National Assessment of Educational Progress test scores for 1999 showed no significant change between 1994 and 1999 in reading, mathematics, or science for any of three age groups: 9-year-olds, 13-year-olds, and 17-year-olds (Campbell, Hombo, & Mazzeo, 2000). Technology has transformed many social practices, but the millions of new computers in schools have delivered no real improvement in aggregated literacy, numeracy, and science benchmark scores in this U.S. study.

An alternate approach might suggest there is something to be gained in pursuing the new literacies, new knowledges path, where “improved learning” is interrogated as a process wherein new learning dynamics, processes, and outcome states are currently in the act of production. If what-counts-as-learning is taken as already existing and known, then “improved learning” can only mean higher steps on the existing ladder of learning outcomes; learning that is more of the same, but incrementally better than the same. If on the other hand new forms of learning are emerging, then “improved learning” describes a form of learning that is different to what has gone before. This discussion posits that recognition of this different learning in an ICT setting poses problems for classroom practitioners in the K-12 setting and beyond.

For example, it is unlikely in Scenario One that even the then NSW Education Minister

could give an adequate response to the question of how and where ICTs are transforming ‘horse and buggy’ schools, because there is very little documented evidence to date to suggest that educational technologies are being used to transform aggregated learning in any meaningful way. Certainly a few resourced schools are able to publicise stories about their use of laptops across the curriculum, document expensive hardware provision, and project this to host communities as self-promotion. Yet, this is not the same as broad scale curriculum innovation that draws on rich constructivist learning sites with embedded rich media. Nor does it deliver, as Scenario Four suggests, the critical mass of ICT skilled teachers required to sustain the ‘learning revolution’ within our schools. Stiles (2000) in his UK-based study of the implementation of ICTs for learning, concluded that failure in the use of technology in learning was based on several factors:

- the failure of ICT-enhanced curricula to engage the learner in authentic learning tasks;
- the propensity of ICT instructors to mistake “interactivity” for engagement;
- the bias in ICT-enhanced teaching and learning towards focusing on content rather than outcomes;
- the futile attempts of teachers in ICT-enhanced settings to mirror traditional pedagogical approaches onto new learning technologies; and
- an across-the-board failure to recognise the social nature of learning.

Stiles’ (2000) fourth point is particularly relevant here. In general, ICT uptake in schools has to date focused primarily on trying to overlay new technologies on traditional forms of teaching, without making substantive changes to the character of teaching (Campbell et al., 2000). As each of Scenarios One, Two, Three, and Four suggest, there exists an attitude that computers

remain separate from, rather than integral to established educational process. School communities are ambitious about technology-and education, but are less adept when it comes to technology-in education.

It is conceivable therefore that many teachers will not take full advantage of computer technology in their classrooms (evident in Scenario Four) as many teachers know and understand that the greatest benefits of ICT-mediated learning cannot wallpaper traditional modes of schooling. For here, the teacher rather than the learner remains in control of learning and predetermines many aspects of computer (class) interactions, how the machines will fit into the overall learning agenda, what the surrogate computer will teach and what the teacher will teach, and how much class time will be allocated to computer activities. This is not a unique view. A parallel U.S. study concludes that despite considerable rhetoric to the contrary, new technologies were hardly being used at all in schools (Cuban, 2001) with Fiske (1998, p. 11) arguing that “the only significant technological innovations of the 20th century to find a secure place in schools are the loudspeaker, the overhead projector, and the copy machine.” To suggest that local Scenarios One, Two, Three, and Four (presented above) are out of context with general trends in the schooling sector would be incorrect. Clearly, the trends repeat in Australia; it is only the setting that varies.

When we consider the more qualitative questions of how and why actual ICT uptake in schools fails to match the uptake of the ICT hype of politicians, perhaps this ‘trend’ is symptomatic of the dwindling capacity of state educational providers and administrators to meet and greet the information age head on. At the heart of Scenarios One, Two, Three, and Four lays a central and important question—how do we as an educational community transform classroom practice using new technologies? In doing so, how do we develop pedagogy and curriculum that engages the interests and (prior) experiences

of the student, whilst opening access to future learning options to them? As early as 1993, Seymour Papert urged the academic community to re-examine how the relationship between children and computers affects the traditional learning culture of schools. In some ways, the attempts of Australian policymakers nationwide reflect this engagement, with technology now a designated 'key learning area' in all state curricula. Computer competence amongst teachers is also articulated in policy; in our Northern most state Queensland, the Education minister has developed teacher competency measures and a performance continua to include benchmarks that feature changing a printer cartridge, word processing operations, and knowledge of e-mail and the World Wide Web (Johnstone & Fynes-Clinton, 2002). Policy rhetoric, though at times inconsistent with current examples of practice, clearly underlies a reformist move towards integrated information literacy, technology, and education. New learning technologies (ICTs) aim to facilitate "rich curriculum tasks," but as yet stop short of umbrella status as pedagogy in their own right (Lankshear & Knobel, 1995), and remain on the periphery of classroom practice. From the limits-to-technology-growth argument's annotated list of critics, Perelman's (1992, p. 23) key point is that schools are "no longer the primary modellers of information processing and knowledge transmission." This position is elaborated somewhat by the Queensland Minister of Education, Anna Bligh, in her affirmation that schools will now have to "prove their teachers can use IT equipment" before they receive it (Johnstone & Fynes-Clinton, 2002).

DIVERGENT DISCOURSES: CONVERGING PRACTICES

Clearly, there is a widespread climate of expectation about the new technological era. Schools and school systems are grappling with these expectations and competing as to what they try

to put in place. It is a period when many people (from parents to bureaucrats) really want to know what is meant by improved schooling and therefore what constitutes good educational practice. Some indication of what this may be is provided in the Queensland School Reform Longitudinal Study (QSRLS), located within the literature on effective schools, and which has wide appeal for policymakers, administrators, and parents alike. It attempts to identify pedagogies, school contexts, and external conditions that are linked to improved student outcomes (Lingard, Hayes, & Mills, 2002; Newmann & Associates, 1996). Potentially, 'improved learning' under such a model sees schools, teachers, and students using ICTs in ways that are intellectually demanding, in learning environments that are socially supportive, that value difference, and that have connections beyond the immediate confines of the classroom.

At a very instrumental level, Scenarios One, Two, Three, and Four offer a rough consensus to the technology/education problem. If school reform is stalling as each of these scenarios imply, and if ICTs are not the umbrella answer to improved learning as the lack of teacher uptake (Scenario Four) reflects, then the question becomes one of convergence. At what point (if any) do the discourses of information literacy, education, and technology converge and reconcile? How does this intersection better align the practical discourse of the teacher and the management discourse of school administrators such that it opens space for navigating new educational, social, and technological outcomes? The community of practice that comes to occupy this emerging space is the crucial node at which technology-in and technology-and education is aligned and its peoples (students, teachers, parents, administrators, and policymakers) implicated and merged.

"Rich description" is the tool of analysis commonly used to examine these types of connections. Recent research debates have made clear that "we do not so much *describe* as *inscribe in*

discourse” (Lather, 1991, p. 90). What we see and how we name things is shaped by the conceptions and agendas we bring to it. There is a difference providing rich descriptions from familiar guiding agendas (disadvantage, words and what they construct, explicit and inexplicit pedagogical devices), and ones where, to some extent, it is not clear what aspects of the ICT-enhanced classroom we should even be considering. The next part of this discussion brings to life a situated account of how the merging of ‘technology-in and technology-and’ education is taking place within a local North Queensland school, and of how allegiance to the practice of learning has reengineered and re-oriented the very roles, relationships, and distributed knowledge of the classroom. It begins with a quantitative analysis of student learning behaviours in their maiden online experience, and uses their teacher’s qualitative account of the online classroom as a tool to help guide reflections on changing classroom practices. In this case, the crucial node at which technology and learning align is in an early high school Studies of Society and Environment (SOSE) classroom; it is also the site at which emerging learning identities are formed.

IF YOU GO DOWN TO THE WOODS: A MIDDLE SCHOOL STUDY OF RAINFORESTS ONLINE

The essential impact of learner engagement with online learning environments is an emerging sense of learner control over the learning experience (Baskin, 2001). To the teacher in a K-12 setting, this represents substantive curriculum change, but not merely in terms of teaching and delivery. Resource-based learning and the shift from teacher-centred to learner-centred environments require that teachers rethink the fundamentals of their teaching role. To effectively weave usage of new information literacies, resources, and ICTs into the curriculum and culture of an early

secondary school classroom requires improved understandings of learning theory. This may involve a questioning of:

- What are the essential characteristics of the classroom environment in terms of stimulating learning? Can these be replicated online?
- Furthermore, what is meant (for example) by a ‘learner-centred approach’ to an early high school SOSE program?

The Blackboard® Learning Management System (LMS) was the e-learning platform featured in this classroom. The sample presented here is a Year 8 early high school class, engaged in a semester-length integrated SOSE classroom. The unit of study featured in this analysis was intended to occupy a timetabled block of five weeks; its focus was on local, national, and global rainforest issues. This unit was chosen to be developed and taught online as it contained pre-existing:

- peer-to-peer learning activities (paired and group collaborations);
- cross-disciplinary collaborative interactions (science, technology, health sciences, commerce, sociology, and administration);
- situated problem solving (task and interpersonal components); and
- stimulus for learners to engage with a variety of new literacies (learning objects, databases, e-paedias, virtual tours, and resource repositories).

The aim of offering the subject online was to extend the borders of the classroom to enable learners to have increased access to information resources for simulations, group work, and problem solving. A second focus of the online delivery of the Rainforests Unit was to enable interactions that promote a sense of belonging to a wider and *richer* learning environment than the traditional classroom. To achieve these dual aims, a heavy

reliance was placed on the communication and collaboration suites embedded in the host learning management system (Blackboard®) to extend student learning into new spaces and places.

CHALLENGING EXISTING TEXTUALITIES

One feature of current educational practice in the SOSE field is the codifying of knowledge into existing subject matter, for example the diversity of topics woven into a representative Year 8 SOSE textbook and course of study. The resultant package is an anthropological and theory-laden textual construct, what Callon (1986) calls “obligatory” passage points of discourse around what “counts as social education.” Its treatment of the Rainforests Unit warrants mention. Its textual device attempts to enrol students in “established” understandings of rainforest problems, while at the same time convincing them of the indispensability of existing (and at times ideological) solutions to rainforest issues. This kind of textual engagement at some level obviates the need for the student to participate in the search for active solutions, perhaps to the extent that “knowledge is lifted out of practice” (Wenger, 1998, p. 265). In this light, the teaching of Rainforests Unit does not necessarily cause learning about rainforest issues.

To the extent that teaching and learning are linked in practice, the linkage is not one of cause and effect, but more of resources and negotiation. Unlike a traditional K-12 classroom where everyone is learning the same thing, participants in an online setting contribute in a variety of interdependent ways to the learning of the class and to engaging with others around that purpose. The online setting becomes a way of organising learning, while providing the technology context in which learning can be demonstrated through active participation. The role of information literacy in the online setting lies in its capacity to enable teaching and learning about rainforests to interact so that each becomes

a structuring resource for the other. Perhaps the sharing of some observations may illuminate this point in more detail.

Something Different Happened: Time Zones in a Rainforest

Data presented here is a summary of the learning experiences of 33 Year 8 students ($n = 17$ female, $n = 16$ males) and their teacher. These participants were drawn together as a convenience sample, surveyed and interviewed after completing a five-week online unit on “*Rainforests*” as part of their Year 8 SOSE program. The first sign that something different had happened in the ICT classroom was that the planned five-week unit was much shorter than anticipated. In fact the teacher completed it in two weeks, most of the student groups in three, and one group of boys failed to complete it in the five allocated weeks. The class was both divided and together in its online experience of learning about rainforests. Not only did the online setting separate student/teacher and student/student in learning *time and space*, but the online medium also showed that learning time does not align with teaching time, and that learner perceptions of both are a powerful influencer on learning experience and outcomes. When the traditional stop signs of the classroom—the bells and timetabled periods—gave way to 24/7 orientations to learning in an “already there” online setting, students began to adopt individual and self-paced approaches to learning by freely accessing learning materials. This increasingly happened outside timetabled classroom activities; the teacher’s original reaction was one of dismay: “What about my lesson plans?”

LEARNING DESIGN AND LEARNING ARCHITECTURE

The Rainforests host subject site is heavily constructivist, and the aim of its design is to

stimulate candidate membership by recruiting learners *vis-a-vis* Wenger's (1998, p. 270) three-component design infrastructure of "engagement, imagination, and alignment." For many students, the option to work online was not just a curriculum delivery experience, but also an opportunity to connect, relate, and have serious fun through an established learning resource. The learning architecture (LMS) supports the pervasiveness of Wenger's (1998) mantra of engagement, imagination, and alignment by providing opportunities for access to:

- **Communication suites/tools/places to promote and expand asynchronous engagement:** This involved group architecture that featured small learning groups each comprising six students, as well as class-level discussion boards, file exchange, and e-mail facilities.
- **Web-mounted materials and experiences (i.e., Virtual Amazon tour):** These enable students to negotiate and construct an image of themselves in their world that is not timetable nor teacher-centric, and which is not reliant on *right-answerism* for its confirmation.
- **Simulations and interactions to practice and form practices about how to critically interact with the rainforest:** These include, but are not limited to, embedded learning resources, featured Web sites, and online threaded discussions. Peer review and collaboration was also a feature of the rainforests learnscape, in so far as student's were asked to act as both reviewers and producers of texts.

For the learner, the lure of technology is both obvious and profound; the short-run rewards in supporting the teaching and learning process and its management are significant. Information and communication technologies open pathways to the creation of learning environments that are

able to support the diverse needs of learners whilst widening traditional access to learning opportunities. Despite the novelty of the subject site and method, the degree to which students appropriated online learning behaviours varied incredibly. Some students identified strongly with new learning approaches; others did not at first. Some reacted to the online environment with suspicion, some with resistance. Some saw it an opportunity to participate, whilst others saw it as an invitation for peripheral lurking.

Teacher appropriation was similarly varied. The LMS offers a variety of features and new literacy tools to enhance the delivery of subject content materials and activities. These include a conferencing system, online chat, student progress tracking, group work organisers, student self-evaluation, grade maintenance, access control, navigation tools, auto-marked quizzes, e-mail, course calendar, student homepages, digital drop boxes, and embedded search engines. The choice for uptake by the classroom teacher is comprehensive and the technologies broad. Initially the magnitude of the pedagogical divide confronted the host teacher.

...we used to spend a week on this or a week on that and now they (students) are all over the place...I worry that they don't spend enough time on the important bits, and I'm buggered if I know how to test them? (Teacher)

The teacher, like his students, reported that the traditional teaching pyramid had "been inverted" and felt at times at the "bottom of the technological totem pole." Despite initial feelings of inadequacy, by the end of the Rainforests Unit, learning relations had significantly reformed, as teacher and students began to engage in new ways of learning through the online learning resources. A new set of learning relations slowly began to evolve.

We learned a lot...even about Rainforests, but mostly about how to learn. I would like to say we

Figure 1. Rainforests online



met on a level playing field, but the kids were way ahead of me. But (we) swapped ideas and traded skills and before long I was in about 12 discussion groups, and was able to start pointing and linking these together. The silence in the classroom was deafening...the noise in the discussion boards was huge. It was like unleashing a monster...I wondered how these things stop but then remembered we still have the bell, thank God! (Teacher)

A METHODOLOGY FOR CAPTURING STUDENT FEEDBACK

When a classroom teacher states that we “learned a lot...but mostly about how to learn,” I am intrigued to know more about the nature of this learning, how it is (re)distributed within this particular classroom, and what kind of learning improvements or costs accrue. In keeping with the online setting, an authenticated Web survey featuring 20 items (a CGI form) was generated and posted to the host subject Web site. Raw data from the survey was treated by placing the data (ranked 1-5 in nominal format) into a frequency distribution to view comparative differences of median scores across and between participating students. There were 33 out of 58 valid

learner responses, valid in so far as they contained completed student data sets.

Additionally, factor and multiple regression analyses were conducted to locate and measure the learning behaviours students identified as the most ‘relevant’ to their learning in an online environment. The data collection process ensured anonymity for all participants. The aggregated data confirmed that the online setting facilitated an authentic learning context for the study of rainforests by opening access to relevant forms of learner participation. The subject design and architecture emphasised active, learner-centred learning paradigms based on constructivist principles (Beatty, Hodgson, Mann, & McConnell, 2002), including the need for peer interaction and collaboration (Ramsey, 2002). The data set shows that the online environment was able to enrich student learning, and led to a more informed teacher perspective about what-counts-as-learning in a Year 8 SOSE classroom.

Learning-In and Learning-Through Technology

As previously stated, a feature of the Rainforests Unit was the host course management (LMS)

software, which provided opportunities for embedding and networking collaborative learning groups. Learning group activities conducted over (a planned) five weeks featured student collaborations in solving situated problems related to understanding rainforests and rainforest management. Online student meetings consisted of sharing information, dissecting course materials, environmental site analyses, collecting project data, collating project data, interpreting data, as well as publishing results from virtual field trips and projects (e.g., virtual Amazon). The summative assessment for the unit involved students

designing, developing, and testing their own board game simulation entitled “*Rainforests.*” Formative assessment involved a range of progressive online quizzes (using the LMS quiz generator) that often directed students to the archived and published work of other students as a point of reference and debate. The tabled results of the CGI form survey (Table 1) indicate that students endorse the online environment as an appropriate and fun (91%) forum for learning.

The survey questions attempt to capture the what (quantitative) as well as the why (qualitative) factors underlying student feedback about

Table 1. Summary statistics—student perspectives online learning

| Individual perspective | Agree | | Disagree | | Unsure/DK | |
|---|-------|------|----------|------|-----------|------|
| | No. | (%) | No. | (%) | No. | (%) |
| Learnt a lot about Rainforests | 28 | [85] | 2 | [6] | 3 | [9] |
| Made new friends & connections | 24 | [73] | 2 | [6] | 7 | [21] |
| Improved my computer skills | 28 | [85] | 0 | [0] | 5 | [15] |
| Felt at risk at first | 15 | [45] | 7 | [21] | 11 | [34] |
| Found it easier to speak on-line in a group | 26 | [79] | 5 | [15] | 2 | [6] |
| Learned a lot through the experiential exercises | 28 | [85] | 0 | [0] | 5 | [15] |
| Learnt to have confidence in other students | 24 | [73] | 4 | [12] | 5 | [15] |
| Learnt to use on-line communications | 29 | [88] | 1 | [3] | 3 | [9] |
| I took control of my own learning | 27 | [82] | 3 | [9] | 3 | [9] |
| I was able to relate materials to real world issues | 25 | [77] | 5 | [15] | 3 | [9] |
| I felt comfortable giving/receiving feedback | 18 | [54] | 9 | [28] | 6 | [18] |
| Group perspective | | | | | | |
| Showed up immature students | 16 | [49] | 10 | [30] | 7 | [21] |
| Saw how my behaviour affects others | 24 | [73] | 3 | [9] | 6 | [18] |
| Fun | 30 | [91] | 1 | [3] | 2 | [6] |
| Learnt to include quiet people | 24 | [73] | 3 | [9] | 6 | [18] |
| The Rainforests Project | | | | | | |
| Unorthodox/unusual way of learning | 17 | [52] | 12 | [36] | 4 | [12] |
| Learnt to manage learning | 27 | [82] | 4 | [12] | 2 | [6] |
| Learnt to manage myself | 27 | [82] | 1 | [3] | 5 | [15] |
| Learnt to manage others in group work | | | 22 | [67] | 8 | [24] |
| Forced me to manage my time | 25 | [76] | 4 | [12] | 4 | [12] |

online learning at the individual, collaborative, as well as curriculum levels. Reported learning transfer is high (85%), as is the reported increase in computer (85%) and communication tool skills (88%) and software applications. Completion of the online learning activities clearly required learners to apply new literacy and communication tools as a means of actively negotiating learning resources. Learner responses also reflect a high level of acceptance of (and a corresponding shift to) self-directed learning (82%), and increased self- (82%) as well as time-management (76%) opportunities. Some 90% of the survey cohort accessed the learning resources outside of scheduled class time, indicating a readiness to extend (and in some ways challenge) the limitations of the timetabled classroom. This is strong evidence of engagement with and acceptance of a new learning context, one that supports learners to take learning beyond the pedagogical intentions of the traditional classroom setting.

A climate of active learning exchange (73%) was evident as students moved between formative assessments using subject discussion boards. Learners were able to apply information literacy to form connections between ideas (association), create meaningful patterns of ideas (integration), test consistency between new patterns and old ones (validation), and own new information in a way that allows it to inform their practice (appropriation) as resource managers. Students valued the opportunity for learning to learn through both global and local materials and activities (77%), for the inbuilt modelling of learning behaviours (85%) and self-reflection and feedback (54%).

Students also reported a sense of engagement in realistic challenges that mediated their study of the environment, their interactions with peer group members, and the available ICT learning resources. Learning was not just confined to learning about technology, but encompassed learning-in and learning-through technology. Feedback on aspects of member participation

indicate an increased awareness of how “my behaviour affected others” (73%), of the need to manage group processes (67%), and how to include and accommodate others (73%) in collaborative learning tasks. The online environment was clearly able to stimulate authentic experiential and interpersonal challenges for students in a Year 8 SOSE course of study. In the words of one female student: “The boys aren’t nearly as loathsome online” (Georgie).

The ‘identities of participation’ that emerge through these classroom interactions point to a learning community that is closely connected by knowledge resources, whose membership is locally differentiated (by skill, computer orientations, exposure, preferences, proximity), yet one that remains locally connected through learning. This is more significant given the steady drift (over five weeks) away from ‘timetabled’ classes as a critical factor in determining when learning about rainforests would take place. In terms of induction to literacy in technology, some students saw the concept of online learning as somewhat unorthodox (52%) at first, with nearly half the students reporting that they initially felt at risk (45%) in what was an unfamiliar environment. Beyond the initial difference in perceptions, a virtual learning environment does pose a unique set of challenges for the novice user. It immediately enlists the learner in a process of having to decide where to go within the site, what counts-as-learning, and which territories of knowledge need to be claimed and labelled. The traditional classroom setting demands less immediacy from the learner; the initial contrast is the shrinkage of response time, wherein new relations and forms of learner membership are negotiated, owned, and enacted. The feedback from students about their maiden experience of online learning is indeed glowing, and assigns a significant potential to ICT and resource-based learning in SOSE classrooms of the future.

What or Who Helped Me to Learn?

If, as the survey data suggests, ICT delivery can improve learning effort, questions of “when, where, and how” this value adding takes place become important. In order to identify “what-or-who-helped-me-to-learn,” a principal components factor analysis with *varimax* rotation was conducted to examine which (if any) structure of variables (see Table 1) students attribute to “better learning experiences.” Six principle factors with *eigenvalues* greater than one were extracted using SPSS. In other words, a good online learning experience boils down to patterns of learner participation (at a range of levels) within the learning community (Wenger, 1998). In particular, the emerging factors included

1. how learners manage themselves,
2. how learners manage their learning,
3. how they use communication tools and processes,
4. how they organise online collaborations,
5. the degree to which learners seek and incorporate teacher feedback and evaluation, and
6. the gender of the learner.

From these results, a multiple regression analysis was used to examine associations between these six factors (e.g., which, if any, factors above can be used to explain or account for student learning outcomes). The regression analysis showed a strong association ($r^2=.802$) between *learner attitude and approach, learner self-management, learner’s use of Blackboard communication tools, gender, and collaborative learning relationships, with teacher feedback and evaluation* held constant as the dependent variable. In all, 80% of all variance (that is what-or-who-helped-me-to-learn) has been accounted for by these five independent variables.

For the teaching practitioner, this is very good news indeed. What-counts-as-improved-teaching

in the traditional classroom still counts as much (if not more) in the online setting. Teaching with ICTs still requires an ability to generate enough excitement, energy, relevance, and value to attract and engage learners, and to communicate this through feedback and evaluation. What is needed to make the transition to online teaching successful is a translational pedagogy that is able to situate the teacher and their students within more contemporary (read ICT-enhanced) learning systems. As stated previously:

- *The first goal of the “Rainforests subject site is to articulate the internal direction, character, and energy of the classroom. This already is in the classroom; hence the online classroom is built on pre-existing personal networks and clear curriculum statements.*
- *A second goal of the subject site is to open a dialogue between insider and outsider perspectives, whilst making space for different levels of learner participation. Learning is not always direct and declarative.*

These goals advocate greater learner control over the learning experience. The learner control afforded to users of the subject site is best evidenced in its space labelling properties.

- GroupWare enabled easy transition between private and public spaces (subject-wide and small group spaces), shifting the learning focus from the macro (class) level to the micro (small learning group) level through the simple selection of a navigation icon.
- E-mail provided a conduit for one-on-one networking for the sharing of information with limited clusters of people, and back channel group discussion pages (small group pages) helped orchestrate the public space before students go public with publishing their work and/or ideas.

- ICTs were therefore able to add value to learning by raising individual awareness, and in the longer term developing a systematic body (memory or archive) of knowledge that can be easily accessed by each learner within the classroom. This is a powerful characteristic of new literacies.

As the Rainforests Unit progressed, students settled into a pattern of Web site use built around the functionalities of the site. The mix of idea-sharing forums and tool-building projects fostered both casual classroom connections as well as facilitated learner outcomes. The combination of whole class, as well as small learner group gatherings created a balance between the familiarity of teacher-centred interactions, and the buzz students describe from working and playing in a distributed learning environment.

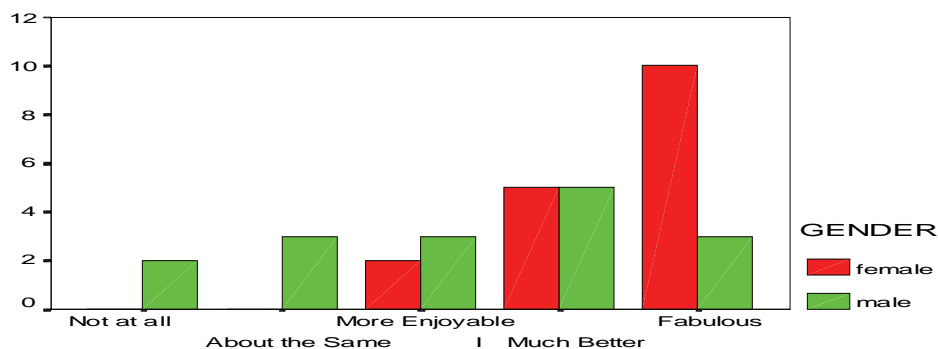
My cyber-identity was Baby Spice, but all the kids christened me Mrs. Doubtfire. I thought I could trick them and just merge into the group but it was not that easy...they were on to me as much online as they were in the classroom. What was different was that they started a discussion thread called ask Mrs. Doubtfire and I suddenly realised how ridiculous Baby Spice seemed. (Teacher)

The Relevance of Gender

The very fact that we have a middle-aged male teacher using ICTs to adopt the *cyberidentity* of Baby Spice is evidence that something different in learning is at work here. Here is evidence that subjectivities and relationships are mediated by literacy in technology, and are associated with shifts in power relationships. There is a long literature on inequalities and schooling, with some longstanding stabilities (class or SES) and some changing forms (gender), and each has been an ongoing issue of interest in relation to the organisation of schools and school systems. The introduction of expensive technology and possibly new forms of literacy, competence, skill, and knowledge display potentially change some existing relationships with which education is instrumentally familiar.

Harding (1997) points to the fact that technology is “gendered space” within the school curriculum. Although it is “dominated” by males, this dominance is not based on competency or learning outcomes (Kirkpatrick & Cuban, 1998; Durnell, Glissov, & Siann, 1995; Cockburn & Arnold, 1985). Girls and women are very pragmatic and confident users of computers. To some degree, this is represented in the higher relative weighting females assign to communication tools as a component of the rainforests learning environment (see Figure 2).

Figure 2. Use of communication tools



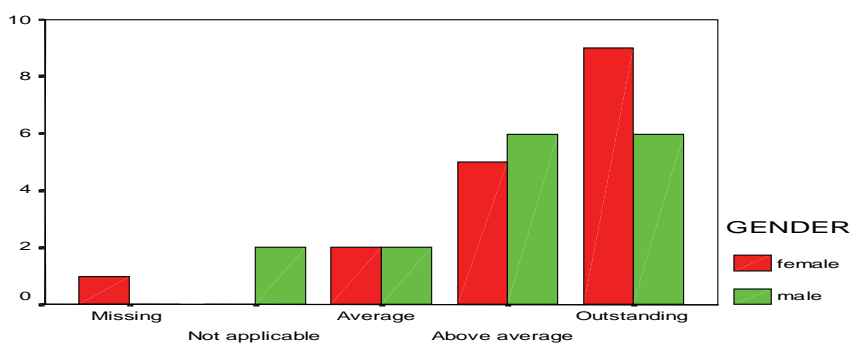
The uptake of communication and learning technologies by female students is evidence that learning is changing and that what counts as knowledge is changing. What is more important however is the issue of what the fundamental knowledge, both content *and* competencies, is that learners now need for vocational success (read access), to new worker identities and opportunities. Gee, for example, argues that the new economy calls up a “shape shifting portfolio person,” and that skills in design and collaboration therefore warrant and acquire new significance (Gee, 1999).

Given the outcomes in Figure 2, it is no surprise that female respondents report a higher level of enjoyment of the online learning experience than their male counterparts (see Figure 3). In fact, all female students reported enjoying the online learning experience more than they did their recent unit of study in the traditional chalk-and-talk SOSE classroom. The pragmatic adoption of online communication processes by female students also signalled a change in the nature of learning relationships within the online classroom. Short, Williams, and Christie (1976) hypothesised that users of communication media are in some sense aware of the degree of social presence of each medium and tend to avoid using particular interactions in particular media.

Specifically, users avoid interactions requiring a higher sense of social presence in media which lack such capacity. Social presence, they contend, varies among different media; it affects the nature of the interaction and it interacts with the purpose of the interaction to influence the medium chosen by the individual who wishes to communicate. In this context, a gendered pattern of ICT uptake is emerging through the data; subjectivities and relationships are mediated by technology in so far as female students are transforming their online learning experience by transforming the role of technology to enhance what Stiles (2000) termed the “social” aspect of learning.

In any learning context, knowledge construction hinges mainly on an *understanding* of the *relationships* between different components of knowledge; understanding is demonstrated in the ability to interpret, integrate, and create new knowledge (Resnick, 1987) actively, purposefully, effectively, and strategically. When mediating learning, from a constructivist viewpoint the learner has to do the thinking, relating, constructing, integrating, and interpretation. Knowledge is, after all, personally constructed (Toohey, 1999, p. 56). However, in any teaching context, the teacher needs to make the learning platform available; they must explicate its dimensions and processes, and provide the scaffolding for writing, thinking,

Figure 3. Enjoyed online learning



and constructing to take place purposefully and effectively. Teaching and learning thus have a context of practice.

To this end, Anderson (1995) describes different types of knowledge, each of which can be linked to rainforests. Declarative (also known as representational or propositional) knowledge (Anderson, 1995) is knowledge about facts, beliefs, things, and events usually expressed as theories, principles, rules, and frameworks (knowing what). When this theoretical knowledge is converted into action, it becomes procedural knowledge (Anderson, 1995), realised as the skills and techniques related to knowing how to perform cognitive tasks. When both the theoretical (propositional) and practical (procedural) knowledge are enacted, it becomes conditional knowledge—that is *knowing* when, where, and how cognitive tasks are to be performed and applied. When the theoretical (propositional), practical (procedural), and applied (conditional) knowledge are used as deliberate learning strategies, strategic knowledge comes into being, meaning the learner is negotiating the when, where, how, and why of learning. There is clear (directional) taxonomy between these four categories of knowledge and evidence within this case study that new improved forms of social learning are emerging among female students.

Most student responses identified that traditional teaching and learning relationships and

roles had changed in an ICT-enhanced classroom (see Figure 4).

Female students seemed more aware and indicated a stronger desire for supported online learning than did male students—all female respondents deemed additional peer and teacher support as helpful, important, or necessary (see Figure 5) as a strategy for consolidating learning by balancing information literacy competence with the rhythm of the ICT classroom.

Female students reported enjoying the opportunities for self-directed learning, and in turn using these opportunities to orchestrate and structure whole community and small community communications to support their learning. For all participants, the mix of idea-sharing forums and tool-building projects enabled informal (as well as formal) learning channels to develop in a way that supported interpersonal development. Its culture promoted an increased sense of responsibility for learning, for self- and time-management as a learner, and was able to create dialogue between the learning materials and the context of the learner. The data presented here also suggests that the online classroom is less extreme in its representations of ‘real-world’ classroom identities and dysfunction, and also points to evidence that learning misbehaviour is more transparent when embedded in ICTs. The ICT framework also laid the groundwork for a more explicit examination of

Figure 4. Changed teacher role

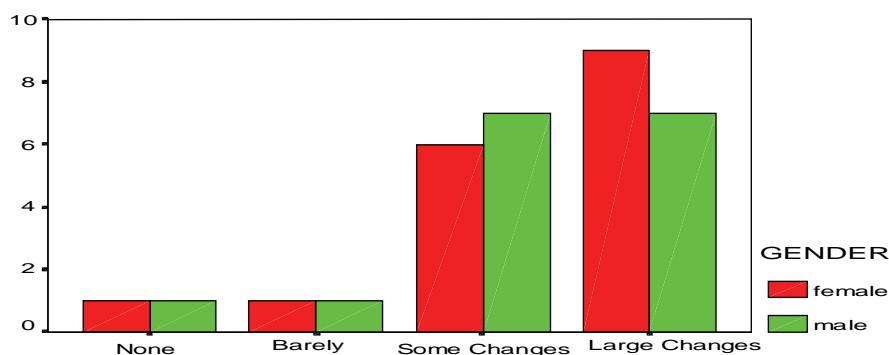
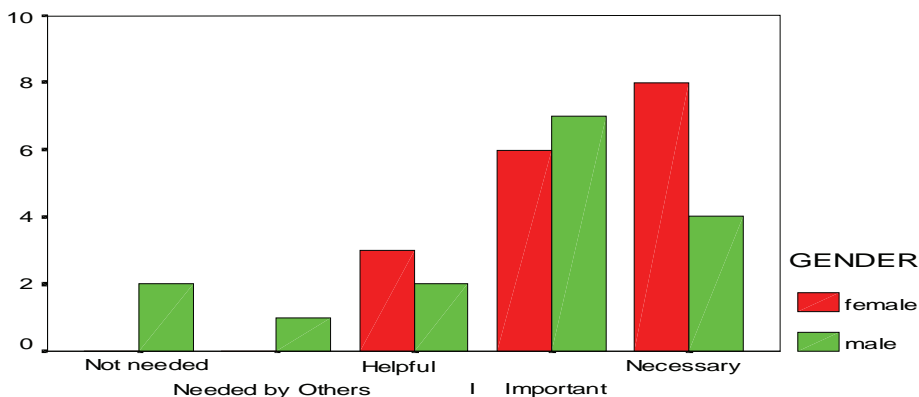


Figure 5. Need for learner support



what the traditional classroom enacts as (hidden) largely tacit forms of classroom organisation. Data presented here suggests that ICTs help teachers and learners explicitly declare:

- *who is the authority, and who is expected to listen and is enabled to speak;*
- *how activities, groupings, and transitions are determined;*
- *who judges performance, and how this is done;*
- *what counts as knowledge; what constitutes performance;*
- *what links are made across the curriculum; which have currency beyond it;*
- *where control is located;*
- *where knowledge is produced;*
- *when communication is enabled and for what purpose; and ultimately*
- *why computers are used.*

THE TEACHER'S PERSPECTIVE

As educators we are traditionally encouraged to focus on creating structures, systems, and roles within our classrooms that achieve relatively fixed (sometimes banded, sometimes hierarchi-

cal) goals that enable our students to fit well into other school-based or systemic structures and processes. To most teachers this challenge presents itself in the form of strategies and techniques for classroom management. The interview data presented here brings to a focus the challenges facing teachers and students when interfacing between two textually mediated delivery or classroom management contexts. The teacher in this study reports a range of challenges in a variety of areas: technology, literacy, logistics, organisation, and delivery (Dabbagh, 2001). What emerged from his observations was a sense of dissonance, a fragmentation of teaching practice across two conflicting platforms.

Two roles ... on the one hand me, the constructivist, the facilitator moving in and around the knowledge construction processes of the student. They expect me to be their peer, their mentor ... I am supposed to contribute equally to the subjective and unstructured as well as the structured discussion within the class. On the other hand a different me ... the assignment marker ... bringing the lower end of the class closer to the top end ... the expert who will ultimately be expected to pass judgement on the rigor of student work in the most objective way possible. This conflict means the roles have to be

performed independently—this results in a huge increase in my workload. (Teacher)

After analysing the activity within the subject-wide discussion forum, over half the discussion threads were generated by the teacher, and more than 50% of the total responses were directly attributable to the teacher. Most of the teacher's discussion threads were attempts to "set (discipline) the collaborative agenda" for the class, including setting up activities, assigning groups, and indicating useful resources. As the Rainforests Unit progressed, more and more of the teacher's online time was spent on 'weaving' the student discussions towards an outcome. In the words of the contributing teacher, this was "heavy reflective work," the "very stuff" of good teaching.

One task had students using e-mail to prepare and submit a summary report of their board game...(you know) the final assessment piece for the unit. This created huge response pressures. Even the suggestion of "e-mail contact" raises the expectation that I am permanently on tap for feedback, and that feedback will be needed yesterday rather than today. Great!...so one Monday I lose my spare period when I would normally send out e-mails and for the rest of the week I am apologising to kids for my tardiness. They got very clever... "Hey Mr: _____, I can't do this assignment until you have approved my concept." The system had turned on me...it was (like) trial by media...make that multi-media (hah). And then...yes there is a then...you (interviewer) told me to use the technology to work for me, you remember...to copy and paste responses in e-mail rather than type it all. So the kids start to compare my feedback comments...and what do you know...they accuse me of sending out the same rotten e-mail. I have never felt more under the microscope. (Teacher)

The conflict between face-to-face and online literacy and learning processes was marked. In

the teacher's words, "It is normal bread and butter practice to close (a lesson) by pulling together the key themes of a lesson." However, the demands of new literacies and their synchronous and asynchronous properties shift the responsibility for mediating discussions (read closure) to the facilitator. As the same teacher concludes, "Closing an online discussion helped me to demonstrate effective modelling and synthesising strategies, but it took me far too long (time) to achieve this."

At the administrative level, the organisational and logistical aspects of online learning seemed also to challenge the response capacity as well as the mindset of school administrators. It was difficult to "get a working computer lab," and even more difficult to "mediate the tribal practices of the IT and multimedia teachers" to secure server access and "some form of ongoing help." Assessment also appeared problematic in an online environment. The teacher felt compelled to be able to 'feedback' to students and parents about the quality of each student's participation, but felt he lacked the 'repertoire' (read time and means) to determine:

...which student contributions actually enhanced the debates; who was original and who was responsive in discussions; how to deal with "lurkers" and non-participation, and how to educate about attribution of ideas and resources. In short...I felt the collective was engaged seriously in learning but I found it hard to say the same for each individual.

As to the degree to which technology added value to the classroom practices of this particular teacher, we must borrow from "Tina's" experiences.

Tina _____ just talks a lot. She is incessant. In class I would speak to her all day everyday if she had her way. I added up all the words I had typed to her over the last four weeks...about 1,800 words. Stay with me...I have a point. Now,

if I speak at...say 160 to 170 words a minute this means that in four weeks I have spoken to Tina for the equivalent of about 10-12 minutes. You tell me...is that enough?

The risk in over-focusing on the ICT experiences of one teacher is that we may tend to over-identify with a very singular and idiosyncratic episode of teaching, vis-a-vis a sample of one. If we ask, looking through the wide-angle lens, “What does literacy in technology do?” a surprisingly focused answer comes back. It recaptures the expressivity of youth cultures which school texts and teacher-generated learning materials exclude. This creates a different sense of self and society: literacy allows us to access human society in the formal terms denied to an oral culture that just narrates its ongoing drama. New literacies enable both sets of rules to speak with equal voice and equal authority. ICTs in this way are transformative tools; the fact remains that this online classroom had an intrinsic quality that led to questioning (both productive and less than productive) about the dual modes of teaching delivery. Despite the glowing response from students to the new forms of literacy and learning, two enduring principles of the ‘trial by multimedia’ exist for our more circumspect teacher.

- online teaching leads to an increase in teacher workload, and
- it can also lead to dissatisfaction (at least ambiguity) with the quality of the teaching experience.

ENGAGING NEW CONFIGURATIONS OF LEARNING

Education has always had at its core the desire and the requirement to prepare students for the world in which they live. Much has been written before this chapter about the challenge of shifting educational practice to reflect the demands of

contemporary society, resulting in suggestions of new skills and new understandings of how such education can be achieved. A growing number of researchers and educationalists (individuals and groups) describe variations on a common range of desirable attributes. Students need to be able to motivate and direct their own learning, engage in creative, productive activities that are relevant beyond the classroom. They need to be well equipped to think critically, make decisions, and be sensitive to multiple cultural and world views. Invariably the ability to creatively and responsibly use information and communication technologies appears as a requirement.

The findings of this project suggest that a learner’s digital literacy skills will emerge in ways that reflect his/her local circumstances; in a Year 8 classroom, this means how they manage themselves, their learning, how they use online communication tools, how they form networks of collaboration, how they appropriate teacher feedback, and how they challenge aspects of gendered practice. The findings also highlight issues impacting social, school, and assessment policy and practice. Revitalised schools are something many of us strive for: staff, students, and communities alike. One problem facing the ICTs in schools movement at the enterprise level is that staff, students, and administrators in our schools experience technology differently. This is reflected in all four opening scenarios, and captured within the student and staff data presented in the body of this chapter.

Because experiences of new learning technologies are different, so too will be the range of outcomes. Technology transforms by inclusion as this project shows: the transition to a better social and learning opportunity for the individual (and for groups) depends largely on where and how you are positioned in relation to information literacy access. If you are a mid-career teacher, a disenfranchised male high school student in a Year 8 SOSE class, or a teacher in a school that for social, cultural, or economic reasons does

not meet the IT state benchmarks, then the social pact of ICT-enhanced education offers at best diminishing marginal returns.

The failure of ICTs in K-12 schooling is that we ask existing teachers to scaffold new learning processes in a new generational context, using old generation theories, approaches, and concepts. This impasse provides the case for a new definition of student learning that focuses on “the demands of the new world environment” (Blasi & Heinecke, 2000, p. 5). The challenge presented here is to find better ways to respond to a clear identification of the need for more relevant and meaningful standards or new definitions of student achievement.

Parallel to this are significant methodological issues for how we might channel ICTs into a study of current K-12 learning practices, and how this could build upon existing research models. Current ICT effectiveness studies are designed to code, measure, and compare observations against sets of standards to draw common classroom observations about improvements in student learning. A more productive outcome might be to place the pedagogical practices of teachers under scrutiny as this project has done, to question what technology is used for, how learning is assessed, and what performances are valued. A new research emphasis on learning recognises that not all learning may be observed by changes in behaviour, and that some learning may well be unplanned and therefore unanticipated (Wenger, 1998). It is the latter, that which Wenger (1998) terms “emergent learning,” that holds much promise for ICTs in education, for here new configurations of learning are at work within our classrooms. That this happens despite our accidental attempts to ‘kill’ them off is a profound statement of their pedagogical potential and productivity.

REFERENCES

Anderson, J. R. (1995). *Cognitive psychology and its implications* (4th ed.). New York: W. H. Freeman and Co.

Baskin, C. (2001). The Titanic, Volkswagens, and collaborative group work: Remaking old favourites with new learning technologies. *Australian Journal of Educational Technology*, 17(Spring).

Beaty, E., Hodgson, V., Mann, S., & McConnell, D. (2002). *Towards e-quality in networked e-learning in higher education*. Retrieved from <http://www.csalt.lancs.ac.uk/esrc/manifesto.htm>

Blasi, L., & Heinecke, W. F. (2000). From rhetoric to technology: A transformation from citizens to consumers. In R. A. Cole (Ed.), *Issues in Web-based pedagogy: A critical primer*. London: Greenwood Press.

Callon, M. (1986). Some elements of a sociology of translation. In J. Law (Ed.), *Sociological review*. London: Routledge & Keegan Paul.

Campbell, R., Hombro, C., & Mazzeo, J. (2000). *NAEP 1999 trends in academic progress: Three decades of student performance* (NCES Publication No. 2000-469). Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics. Retrieved January 23, 2001, from <http://nces.ed.gov/nationsreportcard/pdf/main1999/2000469.pdf>

Cockburn, T., & Arnold, E. (1985). *Machinery of dominance: Women, men and technical knowledge*. Boston: Boston University Press.

Cuban, L. (1998). High-tech schools and low-tech teaching: A commentary. *Journal of Computers in Teacher Education*, 14(2), 6-7.

Dabbagh, N. (2001). The challenges of interfacing between face-to-face and online instruction. *Tech-Trends*, 44(6).

Transforming the K-12 Classroom with ICT

- Durnell, A., Glissov, P., & Siann, G. (1995). Gender and computing: Persisting differences. *Educational Research, 37*(21).
- Fiske, E. R. (1998). Computers at the crossroads. *Technos, 7*(1), 11-13.
- Gee, J. P. (1999). New people in new worlds: Networks, the new capitalism and schools. In B. Cope & M. Kalantzis (Eds.), *Multiliteracies: Literacy learning and the design of social futures*. London: Routledge.
- Harding, J. (1997). Gender and design in technology education. *The Journal of Design and Technology Education, 2*(1).
- Hewett, J. (2001). Pen and paper treasurer who can't dot com the I's. *Sydney Morning Herald*, (May 30), 1.
- Johnstone, C., & Fynes-Clinton, M. (2002). Teachers face the tech test. *Courier Mail*, (April 3, North Queensland Edition), 1.
- Kirkpatrick, H., & Cuban, L. (1998). Should we be worried? What the research says about gender differences in access, use, attitudes and achievement with computers. *Educational Technology*, (July-August).
- Lankshear, C., & Knobel, M. (1995). Literacies, text and difference in the electronic age. *Critical Forum, 4*(2).
- Lather, P. (1991). *Getting smart: Feminist research and pedagogy with/in the postmodern*. New York: Routledge.
- Lingard, B., Hayes, D., & Mills, M. (2002). Developments in school-based management: The specific case of Queensland, Australia. *Journal of Educational Administration, 40*(1).
- Newmann, F. & Associates. (1996). *Authentic achievement: Restructuring schools for intellectual quality*. San Francisco: Jossey Bass.
- Papert, S. (1993). *The children's machine: Rethinking school in the age of the computer*. New York: Basic Books.
- Parker, M. (2002). Parents' fears cast a wide net. *Daily Telegraph*, (February 27), 23.
- Perelman, L. (1992). *School's out: The radical new formula for the revitalization of America's educational system*. New York. Avon Books.
- Ramsey, C. (2002, April 8-10). Using virtual learning environments to facilitate new learning relationships. *Proceedings of the BEST 2002 Annual Conference*, Edinburgh. Retrieved from www.business.ltsn.ac.uk/events/BEST%202002/Papers/c_ramsey.PDF
- Resnick, L. B. (1987). *Education and learning to think*. Washington, DC: National Academy Press.
- Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. London: John Wiley & Sons.
- Stiles, M. (2000a). Developing tacit and codified knowledge and subject culture within a virtual learning environment. *IJEEE, 37*(1), 13-25.
- Toohy, S. (1999). *Designing courses for higher education*. Buckingham, UK: The Society for Research into High Education and Open University.
- Wenger, E. (1998). *Communities of practice: Learning, meaning and identity*. Cambridge: Cambridge University Press.
- Wilson, E. (2002). Experience the power of e-learning. *The Sydney Morning Herald*, (April 23), 11.

This work was previously published in Handbook of Research on Literacy in Technology at the K-12 Level, edited by L. Tan and R. Subramaniam, pp. 195-216, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.17

Strategies for the Cooperation of Higher Education Institutions in ICT

Juha Kettunen

Turku Polytechnic, Finland

ABSTRACT

This study analyzes the strategic planning of the ICT center, which is a joint venture of three higher education institutions. The strategies of focus and operations excellence are natural choices to define the strategic outlines for the center, which aims to increase the economic growth of the region. The selected strategies are described in this study using the balanced scorecard approach. It allows the network of organizations to articulate and communicate their strategy to their employees and stakeholders. The concept of the strategy map is used to describe the strategy. The decentralized efforts of separate organizational units would most likely fail without the network strategy and cooperation.

INTRODUCTION

Higher education institutions (HEIs) try to focus their activities to specific fields of education and

the needs of their geographical area. Each HEI has its historical background and strengths. The educational institutions try to reinforce their strengths and improve their quality by focusing their resources on specific activities. Strategic choices are typically made to focus on the specific segments of knowledge creation and delivery.

Another strategy of HEIs emphasizes the operations excellence theme. Institutions try to reduce their costs and improve quality by doing operations more efficiently. The HEIs can achieve their desired objectives in ways other than traditional pure operational excellence. This study shows how the interests of various HEIs can converge in research and education in information and communication technology (ICT). The close cooperation of institutions has led to a partnership to build a joint ICT center, which produces better labor force and enhances the competitive advantage of the ICT companies in the region.

The various strategic approaches aim to move educational institutions from their present position to a desirable future position (Davies & Ellison,

2003; Fidler, 2002; West-Burnham, 1994; Wheale, 1991). The strategy of focus aims to direct activities to specific customer segments. This also leads to operations excellence and overall cost efficiency. These two strategies are essentially the competitive strategies by Porter (1990, 1996) applied to educational institutions.

The purpose of this study is to show that the balanced scorecard approach and the concept of the strategy map developed by Kaplan and Norton (2001, 2004) can successfully be used to describe and communicate the network strategy of the ICT center, which is a joint venture of HEIs. The communication of strategic objectives is important especially in a network project. The stakeholders have diverse backgrounds which increase the need for enhanced communication. The decentralized efforts of separate organizational units would most likely fail without the network strategy and cooperation. The approach helps to create a shared understanding about the planning and operation of the center. The balanced scorecard translates the center's strategy into tangible objectives and balances them into four different perspectives: customer, finance, internal processes, and learning.

The strategies typically reflect the structure of the organization for which the strategy has been planned. In such cases the implementation of the strategy is straightforward, because the strategies of different administrative units can be aligned with one another to obtain an effective plan for the whole organization. This study presents strategies which are not congruent with the structure of an existing organization but with the network of independent institutions. The strategies favor the cooperation of the institutions in an ICT center in order to increase their external impact.

In many regions there are typically several HEIs, which have their own unique strengths but much in common. In these regions no single HEI is solely responsible for the regional development nor is in complete control of it. Their

strategies can, however, be aligned and linked in order to strengthen their external impact on the local community. This study uses the balanced scorecard approach to plan strategies for virtual organizations to achieve commitment to a common strategy. Thus, the strategy for a virtual organization involves multiple autonomous operators with their own activities.

The ICT center is a joint venture of the University of Turku, Åbo Akademi University, Turku Polytechnic and the Turku Science Park Ltd. As the owner of Turku Polytechnic and Turku Science Park Ltd, the City of Turku has had an active role in establishing the center. The ICT center was planned according to the educational policy outlined by the Ministry of Education in order to increase the external impact of HEIs in Finland.

This is a qualitative study based on the concepts of strategic planning and the balanced scorecard approach. The focus of the study is on the interpretation of how the participants make sense of the planning concepts. The focus is not in the numerical exactness, which is typically the strength of the quantitative research. When a qualitative study is conducted, qualitative data are used to clarify and illustrate the meaning of findings. Typically one case or a small number of cases are studied preserving the individuality of the analyzes.

This study is organized as follows: The next section presents the operational environment of the ICT center. The third section presents the strategic planning and the cooperation of educational institutions. The fourth section presents the balanced scorecard approach and the strategy maps, which are used to describe and communicate the strategy. It also presents the strategic initiative to build the ICT center. The results of the study are summarized and discussed in the concluding section.

THE OPERATIONAL ENVIRONMENT OF THE ICT CENTER

Economic Development of the Region

The strategic location of the ICT center is at the Turku Region situated in the county of Southwest Finland. The Turku Region is one of the largest growth areas of Finland and is the second largest growth area on the southern coast of Finland after the Helsinki metropolitan area. Turku has an excellent location right at the heart of an area comprising the Scandinavian countries, the Baltic countries and St. Petersburg. Turku has only 175,000 inhabitants, but about 30 million people live within an easy reach of Turku. This offers the business in Turku a clear potential for continuous economic growth.

The main clusters in Southwest Finland include ICT, biotechnology, and metal and maritime technology. These clusters are based on high technology, but they mix with low technology, manufacturing, and services. Porter (1998) defines clusters as geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries and associated institutions in particular fields that compete but also cooperate. Recent growth has particularly boosted the ICT and biotechnology. The traditional metal and maritime cluster provide the basis for new products in pharmaceuticals, functional foods and life sciences, transport as well as printing technology and media.

The growth of industrial production in Southwest Finland has been particularly fast compared to the average development of the whole country. The value of production of electro-technical industry in Southwest Finland has increased more than tenfold during the last decade, while the growth rate of other industries has been 15%. Also many other industrial and service industries began to grow faster during the late 1990s. Particularly rapid growth is expected to continue

in transport and storage services, data communication, construction, and services provided for business life.

The fast growth of the electro-technical industry can also be seen in the production structure of the industry. The share of electro-technical industry has reached an all-time high in Southwest Finland. It accounted for 25% of all industrial production in Finland after being only less than 7% in 1990. The share of electro-technical production is the highest among the industries of Finland. The structural change has particularly affected the production in Southwest Finland.

The advantages of clusters involve location-specific factors and public goods. The clusters are supported by the public sector including educational institutions. The advantages of clusters include physical proximity, close cooperation, and access to information. Public investment in knowledge and specialized infrastructure benefit these clusters and increase their competitive advantage. HEIs located within clusters are able to more clearly and rapidly perceive new educational needs (Pfeffer, 1997).

The traditional universities and Turku Polytechnic are closely situated in the same district of Turku Science Park. The City of Turku established a holding and development company Turku Science Park Ltd. to develop the area. Turku Science Park comprises a five square kilometer area in Turku including properties for cluster-specific innovation activities. There are also three cluster-specific development companies ICT Turku Ltd., Bio Valley Ltd. and Turku Technology Center Ltd., which also operate in cooperation with education institutions, companies and other stakeholders.

Turku Science Park links together public and private investments, major construction companies and the companies of the Turku Region. It combines four HEIs, 13,500 employees, 25,000 students, 400 professors and 300 companies in a single location. It combines research, development, education and production involving public and private operators. Turku Science Park breeds

the future products of digital mobile communication, biotechnology and bioinformatics, process engineering and transport technology.

The ICT center will increase the cooperation of HEIs and increase competitive advantage of ICT companies through the research and development and the quality of learning. The center is common ground for research, development and education of multinational telecommunication companies such as Nokia, Siemens, Eriksson, and TeliaSonera. The improved competitive advantage of the companies increases the economic growth of the region and provides employment opportunities for graduates.

Turku Polytechnic

Turku Polytechnic is located in Southwest Finland, which is the second largest economic area after the capital of Finland. Education, culture, and technology are engaged in Southwest Finland in mutually beneficial cooperation with commerce and industry. Regional development is one of the main objectives of Turku Polytechnic. The interaction is close with its operational environment. The purpose of the institution is to react to the changes in its environment in a flexible way. Turku Polytechnic was the first HEI which committed to build the ICT center.

Higher education is fragmented in Turku. There are three traditional universities, the main premises and activities of Turku Polytechnic, and three branch offices of three other smaller polytechnics. The universities include the University of Turku, Åbo Akademi University, and the Turku School of Economics and Business Administration. Åbo Akademi University provides education for the Swedish speaking population. Turku Polytechnic is the largest polytechnic in Finland. The smaller polytechnics Diaconia Polytechnic, Humanities Polytechnic, and the Sydväst Polytechnic have only a relatively small amount of students in Turku. There are plenty of

good examples of cooperation between the higher education institutions in Turku.

Turku Polytechnic is a multidisciplinary higher education institution founded in 1992. The City of Turku owns the Polytechnic, which has 750 full time employees. Turku Polytechnic has seven fields of education and a Continuing Education Center. Technology, communication and transport, healthcare and social services, and business and administration are the largest fields of education. The Continuing Education Center has 6,000 participants in a year. The Polytechnic operates in six municipalities in Southwest Finland.

Turku Polytechnic has 8,300 students in 36 Bachelor's and Master's degree programs, and among them five programmes are taught in English. Internationalization is one of the focus areas of the institution. The objective is to improve the students' ability to work in global environment. Turku Polytechnic has a plenty of cooperating higher education institutions in Europe, Asia, and Americas.

STRATEGIC PLANNING

Strategic Outlines for the Cooperation

The purpose of strategic management is to achieve the desired objectives in the future. The strategic management also involves the development of the organization and its present activities to achieve the objectives set in the strategic plan (Davies & Ellison, 2003; Fidler, 2002). According to Peters (1988), the strategy is used to create organizational capabilities to react to the changing environment. Educational institutions typically develop their internal processes and structures to meet the needs of the changing educational policy, society, and local community.

The competitive strategies were selected for the ICT center on the basis of the strategic outlines. These strategies presented by Porter (1990, 1996)

were originally planned for business companies, but they are also applicable to educational institutions (Kettunen, 2002; Treacy & Wiersma, 1995). The strategy of focus was combined with the strategy of cost-efficiency and applied to the center.

The strategy of focus means that an organization selects a market segment and creates bonds with its customers. It knows the customer organizations and can plan the products and services to meet the needs of customers. The focus may also be on a geographical region, occupational group, and organizational level. The functional policy is to serve the selected market segments particularly well. The focus strategy enables the HEIs to enhance their knowledge in their respective areas.

The strategy of cost efficiency means that the institutions deliver a combination of costs and quality that creates competitive advantage. Typically HEIs have unit-priced funding. They emphasize efficient internal processes and try to achieve high quality in their activities. The strategy of cost efficiency also makes it possible to eliminate overlapping activities and achieve cost reductions. The ICT center use shared premises and support activities to reduce costs.

Even though the focus strategy does not primarily aim to achieve low costs, it does also achieve cost efficiency. The HEIs can eliminate the overlapping activities, focus them, and direct the resources to improve their quality. Cost efficiency is a natural choice for the strategy of educational institutions, which typically have set annual budgets.

Strategic Themes Create Success

The balanced scorecard developed by Kaplan and Norton (1992, 1993) is a general framework for describing and implementing strategy. It can be used to describe a holistic model of the strategy linked to the vision of the future. The balanced scorecard translates the strategy into

linked cause-and-effect objectives and measures, which can be used to communicate the strategy to organizational subunits and workers (Kettunen & Kantola, 2005). It helps to create a shared understanding about the efforts and needed steps for the change.

Balanced scorecards have been developed for business companies, but they are also applicable in public organizations. The balanced scorecards of HEIs look remarkably similar to those developed for profit-seeking corporations. They do not pay as much attention to the financial perspective, but emphasize more on the role of students and employees. Given that the financial result is not the primary objective for most of the non-profit organizations in the public sector, it is reasonable to place the recipient at the top of the hierarchy.

Measurement managed companies tend to have better teamwork at the top, better communication throughout the organization and better self-management at the bottom level (Lingle & Shieman, 1996). The results of the study by Frigio and Krumwiede (1999) show that the performance management systems which used balanced scorecard were significantly more effective compared to other systems.

The general strategic statement is that “the ICT center will strengthen the expertise of HEIs and increases the competitive advantage of the companies in the global markets.” The improved competitive advantage of local companies increases economic growth, expands the employment opportunities of graduates and generates prosperity in the region. The success of the local company Nokia Mobile Phones Ltd. creates expectations for a wider range of flourishing companies.

Strategic themes describe what management believes must be done to succeed and achieve the desired outcomes (Kaplan & Norton, 2001). They describe the strategy of an organization in a concise way. Each organization has a unique set of strategic themes for creating value for customers. The strategy typically emerges from local initiatives and also within the organiza-

tions (Kettunen, 2003, 2004; Minzberg, 1987). Usually, the strategic themes are tailored to a specific case and cannot necessarily be replicated in other regions.

The first strategic theme of the ICT center emphasizes that the HEIs have to focus their activities on their strengths in order to improve the quality of their activities. Each institution has its specific interest areas and strengths. The first theme describes the customer-oriented strategy to create distinct value for the ICT companies, students, and region.

The second strategic theme is to increase the cooperation of HEIs in order to improve cost-efficiency. The center aims to take advantage of the cooperation of HEIs in order to achieve cost-effective and high-quality operation. These themes reflect the generic competitive strategies which are applicable in many types of organizations. The strategy of focus is combined in this case with the strategy of overall cost efficiency.

The strategy of the ICT center can be written as follows:

- The ICT center will strengthen the expertise of HEIs and increase the competitive advantage of the companies in the global markets.
- Each HEI will focus on its strengths to serve its customers better.
- The increased cooperation of HEIs will enable cost-effective and high-quality activities.

The strategy for the joint ICT center describes the activities required in the center. Each HEI is then able to define its own strategic plan, where the overall network strategy is taken into account.

The first theme is a vertical strategic theme that accommodates the underlying drivers in the learning perspective that will lead to the desired strategic outcome in the customer perspective placed at the top of the hierarchy. It emphasizes the development of the existing strengths of each

HEI. The focus on the strengths helps the HEIs to use their resources efficiently and improve the quality of their services. The efficient and high-quality services help the HEIs to serve their customers better.

The other theme is a horizontal strategic theme, which describes the activities in the internal processes perspective. It describes the cooperation of HEIs enabling cost-effective and high-quality activities. Reinforcing strengths and avoiding overlapping operations makes it possible to direct the resources to improved quality in research, development and education and provide regional development and customers with better service. For students this strategy means wider opportunities and higher quality of learning.

Porter (1996) emphasizes that the essence of the strategy is in the activities. The strategy is about selecting the set of activities in which an organization will excel to create a sustainable difference in the marketplace (Kaplan & Norton, 2004). The strategy requires an organizational theory of value creation. The first strategic theme is clearly linked to the activities and describes the value proposition for the customers. The second strategic theme describes the cooperation of different organizational units. The internal processes perspective actually describes the innovation chain, where each institution develops its strengths and cooperates with the others.

Cooperation of Educational Institutions

The University of Turku has a strong and internationally distinguished position as a multi-disciplinary scientific university having 17,000 students. Åbo Akademi University offers the Swedish speaking population in Finland higher education in their mother tongue. It has 7,600 students. The Turku School of Economics and Business Administration provides research and higher education in the field of business science. It has 4,200 students. Turku Polytechnic is the

largest polytechnic in Finland, having 8,300 students. All these HEIs are participating in the ICT center.

Table 1 presents the number of cooperation projects between HEIs in Turku. According to the results of the survey by Puustelli (2002) most cooperation is in teaching, where 72 examples are found. There are 37 projects of cooperation in research and development. In addition, there are 25 projects in other activities, which include mainly cooperation among support units. However, there are only a few examples of cooperation between the polytechnics. This can be largely explained by the fact that the units of The Sydväst Polytechnic, The Diaconia Polytechnic, and The Humanities Polytechnic are small.

The three universities have a joint network, the Turku Center for Computer Science (TUCS), which was started in 1994 to coordinate research and education in the field of information technology. Education is coordinated entirely by the departments up to the bachelor's level. The educational workgroups of the TUCS coordinate the master's level and postgraduate education.

Table 2 describes the education and research at the ICT center. The cooperation between the HEIs was strengthened starting in the 1990s when TUCS started the joint master's and postgraduate programmes. That also enabled the expansion of the cooperation in research and development. The ICT provides a joint and up-to-date learning environment for the institutions to expand their cooperation.

Table 1. The number of cooperation projects between higher education institutions

| | Teaching | Research and development | Other activities |
|---------------------------------------|----------|--------------------------|------------------|
| Between universities | 39 | 31 | 16 |
| Between polytechnics | 4 | 1 | 4 |
| Between universities and polytechnics | 29 | 5 | 5 |
| Total | 72 | 37 | 25 |

Table 2. Activities at the ICT center

| Partners of the ICT center: | | | |
|-----------------------------|--|--|---|
| Focus: | University of Turku | Åbo Akademi University | Turku Polytechnic |
| Research and development | Basic and applied research at research laboratories | Basic and applied research at research laboratories | Applied research and development Entrepreneurship |
| Educational programmes | Master's programme in information technology Graduate programme at TUCS Graduate School | Master's programme in software engineering Master's programme in electronic and mobile commerce Graduate programme at TUCS Graduate School | Degree programme in information technology (bachelor's degree) Degree programme in electronics (bachelor's degree) |

The traditional functions of the HEIs are to create new knowledge and deliver it. Research and development serves education, providing new contents and improving the quality of education. It also provides development projects, which can be combined with education. The University of Turku and Åbo Akademi University have basic and applied research laboratories within TUCS. Turku Polytechnic has applied research and development facilities. The development includes, for example, projects that develop entrepreneurship.

It has been observed that the cooperation between the HEIs is more active in information and communication technology than in other fields of study. An important reason that facilitates this cooperation is that the same subject is represented in all three universities and Turku Polytechnic. Another reason is that the HEIs are operating in the same district of Turku. The cooperation includes, for example, the consortium of digital media, exchange of students and teachers, international education, Master's program in software engineering in Salo, Center of Software Engineering, TUCS and data networks.

All the HEIs have different profiles in their degree programs. The universities have graduate programs at the TUCS Graduate School. The University of Turku has focused on information technology. Åbo Akademi University provides education for the Swedish-speaking population. It has focused on software development, electronic, and mobile commerce. Turku Polytechnic has two degree programmes in information technology and electronics.

THE BALANCED SCORECARD DESCRIBES THE STRATEGY

Perspectives of the Balanced Scorecard

Strategies are typically planned for the whole organization and also for its subunits. The plans

reflect the structure of the organization for which they have been tailored. This study shows that the balanced scorecard provides an approach where strategies have not been planned for a single organization or administrative unit, but the strategies can be shared to achieve the synergy of autonomous HEIs.

The planning of strategies for virtual organizations or networks of independent operators is notably different from that of other strategies, because there is no single organization which owns and implements the strategy or is evaluated against it. On their own the decentralized and overlapping efforts of HEIs would likely have a smaller effect on the economic growth of the region.

If the strategy cannot be described and communicated, it cannot be implemented. Here, the balanced scorecard can be used to translate the vision and strategy into tangible objectives and measures that can be communicated to the personnel and external stakeholders. Hence, a good measurement system should have a balanced mix of objectives and measures in the different perspectives to indicate the strategy.

The objectives and measures have to be defined for each of the four perspectives:

1. **Customer:** The customer perspective describes the value created for customers by the internal processes. The customer perspective also includes regional development.
2. **Finance:** The financial perspective describes the funding from central government and external funding, which are aligned with the cost-efficient internal processes.
3. **Internal processes:** The internal processes perspective describes the strategic priorities for internal processes and how value is created for customers.
4. **Learning:** The learning perspective describes the drivers for future performance and the learning which is required for the internal processes.

These perspectives have been found to be necessary and sufficient across a wide variety of organizations (Kaplan & Norton, 1996, 2001).

The customer-oriented process begins in a top-down fashion, defining the objectives of the customer perspective. It starts by asking, "Who are the target customers and how do we measure our success with them?" Then the process continues, "What funding is required?" and "What has to be done in the internal processes?" Finally the process asks, "What skill and knowledge is needed in the internal processes?"

The customers of HEIs include students, employers, and the local community. The Ministry of Education in June 2002 imposed a requirement that the Finnish HEIs should intensify their cooperation in order to increase their external impact. The first regional strategies were planned by the end of 2002 and updated in 2005. The Ministry of Education hopes that the HEIs will offer better integrated activities for the students and employers in the region. The Ministry hopes also that the increased cooperation enhances the cost efficiency of the institutions.

The ICT center can create synergies across the diverse HEIs by providing students with a broad set of courses and services. It is often reasonable to share the lecturers on basic courses and take advantage of scale effectiveness. This enables the concentrations of expertise in a broader set of specific high-quality courses, which offer students wider perspectives. The cooperation of the HEIs depends largely on the activeness of the professors and other members of the personnel. The purpose is also to improve the competitiveness of the ICT companies. The needs of the companies are collected from the employers' advisory boards.

Education is financed by central government. The Ministry of Education also finances the joint development projects of HEIs that have a positive impact on regional development. The additional project-based funding for the ICT center expands the degree of cooperation, removes overlapping activities and increases the external impact of the

HEIs. This study supports the findings by Tolbert (1985) and Gumpert and Sporn (1999) that the activities and organizational structures follow the funding sources.

The additional financial support from the City of Turku maintained sufficient coherence and ensured that the needed decisions for the investment were taken. The meetings organized by the Mayor of Turku stimulated an intense management dialogue, which helped the partners to define their strategic outlines for the ICT center. The extra funding enabled them to share common premises and facilities. The value of the total investment is more than 50 million euros.

The internal processes of the ICT center include many different administrative units. Chandler (1990) describes how synergies across organizations and the economies of scale can be used to achieve cost-efficiency in the operations of smaller and focused organizations. The strategies of different organizational units should be aligned and linked to achieve cost-efficiency. The strategy provides the insight and direction to guide them to increase their strengths, eliminate the overlapping activities and improve the quality of activities.

The ICT center creates synergies across the separate HEIs that aim to increase economic growth and welfare in the local community. The departments of autonomous institutions have intensive interactions with each other. The degree programs of the HEIs benefit from synergies through the sharing of students and staff. They also share libraries, data networks and other facilities which reduce costs and enables higher quality.

The learning of knowledge and skills is the driver of an organization's success (Collis & Montgomery, 1995). Rucci, Kirn, and Quinn (1998) studied the drivers of the future performance of business companies. Their analysis reveals how improvements in training and employees' understanding of the business led to better outcomes. It has also been found that awareness of strategic objectives is one of the key driving forces.

The knowledge-based synergies among the different units enable the whole ICT center to be more valuable than the sum of its parts (Collis & Montgomery, 1995; Goold, Campbell & Alexander, 1994). Typically the strategies of various educational departments are rather similar so that they can be aggregated into larger entities. In this case the different ICT departments have their historical backgrounds and strengths. Their strategies can be combined into the cooperative network strategy of the ICT center.

The importance of cooperation was evaluated in a survey from the different perspectives of the balanced scorecard on the scale 1-5, where 1 is low and 5 is high (Kettunen, 2004; Puustelli, 2002). According to the perceptions of the respondents from the HEIs the cooperation is most important from the perspective of regional development (mean 4.4), customer (mean 3.9) and learning (mean 4.1). Joint ventures, data networks, problem-based activities, and science parks are the most important forms of cooperation from the perspective of regional development. The perspective of customer underlines the subject-related activities. Also the joint ventures and joint support units are evaluated to notably increase the customer value. A pleasing result is that learning is an important motivating factor for cooperation. The finance and internal processes perspective have the lowest importance for cooperation according to the respondents (means 3.9). There are clear financial benefits only in data networks and research schools. These results are obvious, because the HEIs are able to benefit from economies of scale.

Strategy Maps Describe the Way to the Future

The strategy map is a visual representation of the cause and effect relationships among the components of an organization's strategy and a great insight to executives and stakeholders in understanding the strategy (Kaplan & Norton,

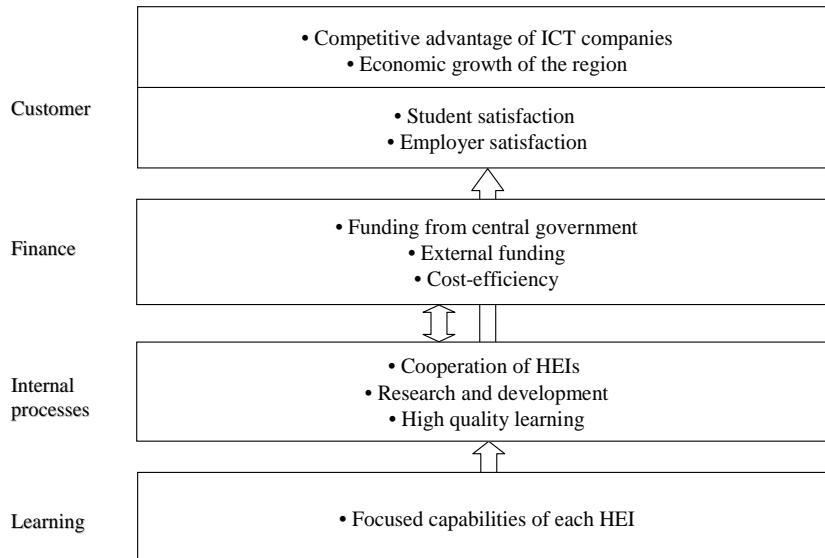
2001, 2004). It has been used in thousands of companies and other organizations. Strategy is a way to a better future described by the organization's vision. The strategy map is simply a graphical representation of the strategy. Strategy maps describe the essential characteristics of the strategy like a road map, but omit all the minor details. They help the employees and stakeholders of the organization to understand why the objectives of the organization have been set and how they can be achieved.

Strategy maps provide tools to describe the strategic themes and help the management of the organization to define the objectives in the different perspectives. Strategy maps describe the causal linkages between the objectives. They provide a comprehensive description of the functioning of an organization and provide an organizational theory, which communicates the organization's desired outcomes and how these outcomes can be achieved. The balanced scorecard approach was selected for the City of Turku and HEIs to provide them a common and understandable framework of indicators. The approach is used in many other cities and educational institutions in Finland.

Figure 1 presents the strategy map of the ICT center, which includes customer, finance, internal processes, and learning perspectives. The perspectives include objectives that have to be achieved in order that the final outcomes in the customer perspectives can be achieved. The objectives in the perspectives and the linkages between the objectives help to understand the strategy, which is necessary for the efficient implementation of the strategic plan. Cost efficiency and improved learning are obvious reasons for the cooperation, but it is difficult to quantify them.

The customer perspective contains two blocks describing the regional development and customer satisfaction. The objectives of the regional development are the competitive advantage of ICT companies and the economic growth of the region. The objectives of customer satisfaction include

Figure 1. The strategy map of the ICT center



student satisfaction and employer satisfaction. High quality learning and employment opportunities are sources of student satisfaction. Employers are satisfied with skilled labor. Customer satisfaction provides feedback on how the ICT center is doing. The objectives in the financial, internal processes, and learning perspectives have to be achieved to achieve the desired outcome in the customer perspective.

The financial perspective includes the objectives of funding from central government, external funding and cost-efficiency. An important objective of the ICT center is to increase the cost efficient activities so that the HEIs can improve the quality and provide better service for companies. The external funding is primarily used to finance research and development. The funding from central government is used to finance education. The funding is a prerequisite for the internal processes but, on the other hand, the cost effective processes ensure sufficient funding.

The internal processes perspective includes the objective cooperation of HEIs. It also includes the

sequential process of research and development and high quality learning. Each HEI identifies and develops its strengths. Overlapping activities are avoided and cooperation between the HEIs is carried out. The cost efficient organization of education makes it possible to increase the resources used in research and development.

The learning perspective includes the objective focused capabilities of each HEI. Each HEI has its own historical background. The ICT center provides shared premises, which afford better possibilities to develop and intensify the cooperation between the HEIs. The strengthening of the capabilities of the personnel is the driver for the objectives in the internal processes perspective.

The strategy map was used in a press conference by the representative of Turku Polytechnic. It helped the journalists to understand the objectives of the ICT center. The analytical presentation got plenty of publicity in the media (e.g., Karvonen, 2004; KunnallisSuomi, 2005). The strategy map was also used in many meetings arranged during the construction of the new ICT building.

It helped the persons involved in the project to create a shared knowledge and joint understanding of the efforts and steps needed to reach the strategic objectives.

STRATEGIC INITIATIVES TO IMPLEMENT THE STRATEGY

Managers typically specify short-term milestones along the strategic path. Once targets for measures have been set, it is possible to assess whether the short or medium-term targets can be achieved by challenging resources in annual budgets to achieve them. If the managers conclude that by solving local problems for continuous improvement of the internal processes, the targets cannot be achieved, then there is a need for long-term development.

In order to satisfy customer needs and improve the competitive advantage of customers, the goal for the strategic initiative should focus on substantial cost reductions and quality improvements. In the longer run, managers should develop or reengineer processes that could be critical to the organization's strategic success, rather than merely applying process redesign where minor gains might be obtained. The managers should link the investment decisions to their strategic plans and long-term priorities. They should be committed to achieving the objectives and at the same time accountable for achieving the organizational vision by directing significant resources.

Strategic initiatives can be planned in a balanced way to effectively implement the strategy. All the necessary objects of the different perspectives must be taken into account. The essence of the strategic initiative is to develop the internal processes to achieve the desired strategic objectives and value for customers. However, sufficient funding is needed to develop internal processes. In addition, sufficient coherence and learning are needed to maintain strategic awareness and capabilities for the change.

The first plans to establish the center were made at the end of the 1990s in order to increase the competitive advantage of the ICT companies and economic growth in the region. The measures were planned in numerous meetings, where specific targets were described and agreed. Precise steps were gradually taken, and a timetable was planned and responsibilities were assigned to named groups and individuals.

Turku Polytechnic was the first institution to commit to the investment in 2002. Shortly after that the University of Turku and Åbo Akademi University made their decisions gradually so that the construction of the new building of more than 30,000 square meters of floor space could be started in 2004. A property developer, Kiinteistö Oy ICT, was established in 2004 to own the building and rent the premises to the HEIs. The construction work will be completed soon and the cooperation can be started from 2006.

CONCLUSION

For several years the various organizational units had a long planning process, which led to mutual understanding about the need to invest in the ICT center. The City of Turku played an active role in the planning of the ICT center to the area of the Turku Science Park, where the educational institutions are located. Each educational institution, however, made their own plans separately and took their own investment decisions following the mutual understanding and commitment to build the ICT center.

The strategy of cost-effectiveness combined with the strategy of focus is the basis for the overall strategy of the ICT center. According to the general strategic statement the center strengthens the expertise of HEIs and increases the competitive advantage of companies in the global markets, so that each HEI develops its strengths to better serve its customers and the increased cooperation

of HEIs enables cost-effective and high-quality operations.

In this case, the balanced scorecard approach is a useful tool to describe and communicate the strategy. It can also be used to accomplish its strategic themes, objectives and measures for the partnership projects. It turns out that the balanced scorecard can also help the institutions to plan a common strategy for the several departments operating in the same center. It assists the senior executive teams of the educational institutions in specifying objectives and allocating resources to achieve the objectives.

The strategy map is a useful tool to translate the strategic statement and strategic themes into a graphic representation which clearly describes the objectives in the different perspectives of the balanced scorecard. Furthermore, the strategy map describes the linkages between the objectives and helps the personnel and external stakeholders to understand why the ICT center has been established and specific objectives have been set and how these can be achieved.

This study shows that the planning period of an investment may last for several years, but in this case it took only 4-5 years. However, sufficient time is needed to describe and quantify the different needs of educational institutions. It is paradoxical that the construction takes much less time than the planning. Unfortunately the balanced scorecard approach was found only at the very end of the planning period. The experiences of this study show that rigorous planning methodology is needed to shorten the planning period and fulfill the various needs of the cooperative partners.

REFERENCES

- Chandler, A. D. (1990). *Scale and scope: The dynamics of industrial capitalism*. Cambridge, MA: Belknap Press.
- Collis, D. J., & Montgomery, C. A. (1995, July-August). Competing on resources: Strategy in the 1990's. *Harvard Business Review*, pp. 118-128.
- Davies, B., & Ellison, L. (2003). *The new strategic direction and development of the school*. London: RoutledgeFalmer.
- Fidler, B. (2002). *Strategic management for school development*. London: Paul Chapman Publishing.
- Frigio, M. L., & Krumwiede, K. (1999, February-March). Balanced scorecard: A rising trend in strategic performance measurement, *Journal of Strategic Performance Measurement*, pp. 42-48.
- Goold, M., Campbell, A., & Alexander, M. (1994). *Corporate-level strategy: Creating value in the multibusiness company*. New York: John Wiley & Sons.
- Gumport, P. J., & Sporn, B. (1999). Institutional adaption: Demands for management reform and university administration. In J. C. Smart (Series Ed.), *Higher education: Handbook of theory and research, Vol. XIV* (pp. 103-145). New York: Agathon Press.
- Kaplan, R., & Norton, D. (1992, January-February). The balanced scorecard: Measures that drive performance. *Harvard Business Review*, pp. 71-79.
- Kaplan, R., & Norton, D. (1993, September-October). Putting the balanced scorecard to work. *Harvard Business Review*, pp. 134-147.
- Kaplan, R., & Norton, D. (1996). *The balanced scorecard*. Boston: Harvard Business School Press.
- Kaplan, R., & Norton, D. (2001). *The strategy-focused organization*. Boston: Harvard Business School Press.
- Kaplan, R., & Norton, D. (2004). *Strategy maps*. Boston: Harvard Business School Press.

- Karvonen, T. (2004, October 15). ICT-talokokooalan opetuksen ja tutkimuksen Turussa, *Talous Sanomat, IT viikko*, p. 1.
- Kettunen, J. (2002). Competitive strategies in higher education. *Journal of Institutional Research, 11*(2), 38-47.
- Kettunen, J. (2003). Strategic evaluation of institutions by students in higher education. *Perspectives: Policy and Practice in Higher Education, 7*(1), 14-18.
- Kettunen, J. (2004). The strategic evaluation of regional development. *Assessment and Evaluation in Higher Education, 29*(3), 357-368.
- Kettunen, J., & Kantola, I. (2005). Management information system based on the balanced scorecard. *Campus-Wide Information Systems, 22*(5), 263-274.
- KunnallisSuomi*. (2005, January). Informaatioteknologia leimaa nykyaikaista oppimisympäristöä (Information technology characterized the modern learning environment), p. 20.
- Lingle, J. H., & Shieman, W. A. (1996, March). From balanced scorecards to strategic gauges: Is measurement worth it? *Management Review*, pp. 56-62.
- Minzberg, H. (1987, July-August). Crafting strategy. *Harvard Business Review*, pp. 66-75.
- Peters, T. (1988). *Thriving on chaos: A handbook for management revolution*. London: Macmillan.
- Pfeffer, J. (1997). *New directions for organizational theory*. New York: Oxford University Press.
- Porter, M. (1990). *The competitive advantage of nations*. London: Macmillan.
- Porter, M. (1996, November-December). What is strategy? *Harvard Business Review*, pp. 61-78.
- Porter, M. (1998). *On competition*. Boston: Harvard Business School Press.
- Puustelli, P. (2002). *Synergiällä alueellista vaikuttavuutta, Selvitys Turun yliopistojen ja ammattikorkeakoulujen välisestä yhteistyöstä*, (Synergy creates external regional impact, A study about the cooperation of the universities and polytechnics in Turku) (University of Turku, Publications of the Rector's Office)2/2002. Turku: University of Turku.
- Rucci, A. J., Kirn, S. P., & Quinn, R. T. (1998, January-February). The employee-customer-profit chain at Sears. *Harvard Business Review*, pp. 82-97.
- Tolbert, P. S. (1985). Institutional environments and resource dependence: Sources of administrative structure in institutions of higher education. *Administrative Science Quarterly, 30*(1), 1-13.
- Treacy, M., & Wiersema, F. (1995). *The discipline of market leaders: Choose your customers, narrow your focus, dominate your market*. Reading, MA: Addison-Wesley.
- West-Burnham, J. (1994). Strategy, policy, and planning. In T. Bush & J. West-Burnham (Eds.), *The principles of educational management* (pp. 77-99). Harlow: Longman.
- Wheale, J. (1991). *Generating income for educational institutions: A business planning approach*. London: Kogan Page.

Chapter 4.18

Integrating ICT in Universities: Some Actual Problems and Solutions

Vassilios Dagdilelis

University of Macedonia in Thessaloniki, Greece

ABSTRACT

Universities adopt the most progressive, technologically speaking, methods of research and education. Nevertheless, the adoption of ICTs (Information and Communication Technologies) appears to be necessarily accompanied by a deep shift in the organization of work, and this adoption must to be included in a wider teaching and learning strategy. We present some of the problems arising when ICT systems are integrated in universities and some suggestions to deal with these problems.

INTRODUCTION

Computers and more generally speaking, ICTs (Information and Communication Technologies), have penetrated substantially into every area of human activity: from research to entertainment and from medicine to business management, ICTs have revolutionized the methods used by humans up to now. The field of education is no exception

where ICTs have had a strong impact, perhaps the greatest since the invention of printing. Thus, ICTs seem to be advancing at great speed, and generally are being accepted and adopted by educational institutions, especially universities.

Universities and other similar organizations of higher education constitute socially recognized institutions assigned mainly to research, education, and services. By their very own nature, universities adopt the most progressive, technologically speaking, methods of research and education. Under these conditions, it is expected that they will thus adopt the most contemporary instructional technologies, especially ICTs. In addition, universities are obliged to adopt ICTs, not only because of their nature, but also due to the strong economic, political, and social pressures from external sources — and in actual fact, pressures which often appear for the first time. ICTs offer the possibility of expanding the student body, making available a more flexible schedule, as well as the improvement of teaching methods through the creation of teaching environments with multiple possibilities. Nevertheless, the adoption of ICTs

appears to be necessarily accompanied by a deep shift in the organization of work, and this adoption must be included in a wider teaching and learning strategy (Bates, 2000). Further, ICTs are also the means through which institutions of higher education will be able to respond to the new economic and social demands.

Instructional Systems Design methodologies, such as ADDIE, constitute a generally accepted tool for the design of instructional applications. It has been applied successfully in many cases in the design and the development of modern educational applications. Unfortunately, however, ADDIE cannot be applied to the university instructional systems without some additional work and consideration. Furthermore, it must be added that the design of a new instructional system for the university must take into account the fact that the designed system will function within a larger system, the university itself.

Universities have their own structure and by consequence, new systems like an instructional system destined to function within them must be integrated. Moreover, universities and other similar institutions are also part of a system of larger institutions, with society itself as the largest one. Each one of these institutions, as a kind of homocentric cycle, includes the institutions of the “lower” level and is included in the “higher” one. Universities, for example, are part of institutions of higher education, which is part of the educational system and so on. An analogy is that of live organisms living in a specific environment. Their environment (e.g., a lake) is a part of the regional environment, which is part of a larger ecosystem. Thus, in order to study the function of one organism, we must take into consideration its own internal structure, its parts and their interrelatedness, and also the ecological conditions that govern its interaction with the environment.

Returning to the issue of universities, it is argued that the understanding of their function must be based on the study of their internal structure

and of their “ecology,” i.e., their interaction with the other institutions. Institutions of higher education are influenced both by local as well as general trends which prevail in the economic, political, and social fields. However, it must be kept in mind that the institutions, in turn, also influence these trends (Marginson & Rhoades, 2002).

All the factors, which are included in this interaction, have not been adequately analyzed nor validated — even though many attempts have been made at an international level to create a theoretical framework that would allow for their analysis (Marginson & Rhoades, 2002).

The strong interaction between institutions and the integration of universities into larger institutions creates some complex problems not easily dealt with when tools like ADDIE are used. Traditional ADDIE methodologies are meaningful when applied to a stable environment with known variables. New technologies, besides introducing novel ideas, also change the environment. For this reason, ADDIE does not seem to be a sufficient tool, able to integrate these elements in the construction of a new educational system. In some way, using ADDIE leads to a paradox, because the more a tool like ADDIE is needed, the more insufficient it becomes, as it cannot take into account the consequences of a radical change.

Below, are some of the problems arising and some of the affecting conditions when ICT systems are integrated in universities, and some suggestions to deal with these problems.

SOME IMPLICATIONS FOR ICT IN UNIVERSITIES

As already referred to in the introduction, it is the actual nature of universities that leads them to adopt the most advanced technological systems. However, in the case of ICTs, external factors are applying pressure to the universities more than at any other period in time. Universities are knowledge-driven organizations and thus it is only to be

expected that they will be influenced by progress in ICTs, especially since universities themselves were one of the pioneers in this progress.

First of all, ICTs have had an influence on a fundamental activity carried out by universities, namely that of research (Duderstadt, 1998). The influence has been so deep that nowadays it is absolutely inconceivable to conduct research without the use of ICT: from the actual research procedure which may be based on simulations or huge calculations to the communication among the researchers, all stages of the research appear to need ICTs.

Apart from research, ICTs are used to a large extent by university administration and recently they are also being used in teaching. A basic benefit of ICTs in teaching is their ability to create rich learning environments, which at least theoretically, contribute to the development of more successful teaching methods. In other words, their basic benefit, that which most affects the running of teaching institutions, is that they offer new ways of communication. The new technological possibilities that — thanks to ICT — have been opened up today, allow educational services to be delivered to anyone at any place and at any time, without the limitations of space and/or time (Bates, 2000; Duderstadt, 1998; Langlois, 1997). It is estimated that the effect of ICTs will become even greater — given that no other technological invention in the past, neither the radio nor television, influenced educational institutions so intensely and in such a short period of time (Bates, 2000; Duderstadt, 1998; Langlois, 1997).

The network of relationships in institutions of higher education with the other social institutions, of course, includes the interaction of the institutions among themselves. The institutions are not only interacting when they belong to the same administrative area — State or Nation — but also when they are in the same categories: for example the institutions involved with molecular biology obviously are in constant contact with each other and influence one another. This interaction, as a

rule, has a number of general characteristics: institutions all over the world, more and more, look alike. Institutions of higher education, for instance, tend to be almost homogeneous. Although this procedure is rather complex, it can be explained, due to two types of mechanisms.

The first type is classical: the same reasons cause analogous results, thus, while globalization tends to equate the economic and cultural environments in which universities function, it also causes similar reactions on their part. The second type of mechanism, connected to the first, is that which can be described as the “snakelike procession of academic drift” (Morphew, 2000). This is the idea that as the snake’s tail “follows” the same route as the head, in the same way the least successful academic institutions will follow the most prestigious ones. However, the image of the “snakelike procession” is not fully accurate because the less well-known institutions do not actually follow the same route as the successful ones but just *mimic* them. For example, if a prestigious university adopts a successful strategy after a trial period, then the other institutions will also adopt this same strategy, but without necessarily passing through all the intermediary trial stages. For this reason the process of homogeneity develops faster. If this hypothesis of homogeneity is correct, then strategies adopted by one category of institutions, in this example the most technologically advanced, will in the long run also be adopted by the other institutions all over the world.

An obvious example is the Greek Open University (www.eap.gr), which was established in 1993 and which adopted the successful strategies of other Open Universities around the world. This tendency to be homogeneous comprises a powerful factor that influences the formation of modern universities. Thus, when the large and prestigious universities adopt ICTs, this becomes an indirect factor for the small universities to also adopt them.

SOCIAL AND ECONOMIC FACTORS

However, the most important factors affecting the integration of ICTs in universities are those of an economic and social nature. There is a series of interacting factors which more than anything else not only define the strategy of universities toward ICTs but also, more generally, determine indirectly many of the changes universities make. The study of such complex factors is based on a series of ascertainments or developments. The first development is that the number of students has been increasing much faster over the last 30 years. This increase includes not only the number of “typical” students, i.e., those who go to institutions of higher education straight out of secondary education (18- to 20-year-old high school graduates), but also the number of the mature-aged students who come from a variety of socioeconomic backgrounds. The latter have particular characteristics: they are, as a rule, already employed and have specific training needs that are required in order for them to remain competitive in the employment market. Therefore, neither the regular university schedule nor their presence on campus, nor the typical curriculum of institutions of higher education, meets the needs of these mature students. Their social importance, nevertheless, as well as their economic power makes them as important or even more so than the typical students. Universities are thus called on to readjust in order to cope with the new demands. Mature-aged students have very specific needs, which are directly linked to their type of work. For example, nowadays, production requires the use of a workforce that is computer literate and prepared to undergo independent lifelong learning. Universities are to a degree obligated to readjust under these social pressures.

As is natural, the increased demand for education creates a similar increase in the running costs of universities. The university expenses, however, for research, education, and the rendering of services, have increased at even greater

speed: universities function because of the highly trained staff and the facilities and special equipment, which are all very expensive. Universities are driven by an ever-expanding knowledge base; access and exploitation of this knowledge, likewise, have a very high cost.

At the same time as the cost of the running of universities is constantly increasing, government and other funding sources are drastically being reduced (Katz & Associates, 1999; Bates, 2000; Duderstadt, 1998; Langlois, 1997): “Not only in the USA and in the EU, but internationally has public support for higher education flattened and then declined over the past two decades.” In the USA, this downward trend is obvious at all levels — for example, the aid toward students in the form of grants has been replaced with help in the form of loans. This reaction, on the part of universities, is analogous to the local conditions.

In the USA, there appears to have been an increase in tuition fees that is much higher than the Consumer Price Index. This fact has provoked public interest as to the profitability of investment (public and private), which is made in institutions of higher education. In the EU, the programs are geared all the more toward the direct needs of the economy. Therefore, universities are obliged to readjust to the new social and economic situation.

INFORMATION AS A COMMODITY AND A BUSINESS

Additionally, the great demand in teaching services has an indirect result: information and knowledge, more than at any other time, have become an economic good — and their use appears to be regulated more by the market forces and less by the current governing policy. This means that universities now face external competition. It appears that they are losing, to an extent, their formerly exclusive production of new knowledge, and the power and authority to educate and certify knowledge and skills. Today, large organizations

and businesses are establishing their own educational departments, which offer “just-in-time” and “just-in-case” extra training to their employees. Also, new businesses are appearing, whose only activity is to offer educational and training services. Virtual Universities and “learning-ware” providers are entering the marketplace to compete with traditional institutions (Duderstadt, 1998). It is thus clear that the universities are experiencing multiple external pressures and need to readjust. Clearly, this readjustment is directly connected to ICTs. The use of ICTs in no way decreases the overall functioning costs of a university since its costs are initially high and the equipment used is very quickly outdated. Nevertheless, under the right circumstances, ICTs can lead to improved cost-effectiveness by enabling new target groups to be reached and new, higher quality learning outcomes to be gained at a lower marginal cost per student than through conventional classroom methods (Bates, 2000).

Universities are also undergoing internal pressure, from their own nature and function. The necessity of adopting new technologies because universities have as a basic aim the adoption of modern methods has already been mentioned. To this must be added the fact that university students, who are not simply computer literate, but are actually the so-called “Plug’n’Play generation,” expect the institutions at which they are studying to make extensive use of ICTs — and especially now, since ICTs have been integrated into all levels of human activity such as work and entertainment. Very often, universities are in a position of competition among themselves and their technological infrastructure is an important factor in attracting more and better students.

Finally, the actual members of the academic community who are involved with ICTs also apply a type of pressure either toward the direction of the market for new equipment or toward the direction of employing even more staff for research and teaching that will use ICTs for the institution.

THE UNIVERSITY ECOSYSTEM TODAY

Studying institutions of post-secondary education, within the nexus of their relationships with other institutions, allows for a more complete understanding and interpretation of the problems which arise. In fact, we support the position that the internal and external pressures force universities and in general all higher educational institutions to adopt ICTs and at the same time to alter their own status. This change is so deep-rooted that many believe that universities and institutions of higher education generally will cease to exist in the way that they have been known until now. There are two very important changes: (1) changes in the economic funding of these institutions, especially of universities; and (2) changes in the actual functioning, not only at an internal level of organization, but also the types of services they will provide.

Diversity is a good example. In many countries, diversity has become an important issue in higher education policies. Diversity can be seen as an answer to the continual expansion of universities. It is comparable to the differentiation of studies and services offered by the academic institutions (form, duration, direction) but also in the differentiation between the actual institutions themselves (size, location, type of institution). However, even though diversity has as a general aim the satisfaction of social needs, a number of researchers observe that diversity can and should be analyzed within the framework of a purely economic analysis (Dill & Teixeira, 2000), and believe that diversity and the related concept of innovation are economic concepts and as such they should be analyzed. Considering these concepts from an economic point of view raises a specific *problématique*: “From this point of view, an academic innovation would be considered as a way to better satisfy universities’ customers or to create a clear benefit for the innovating Higher Education institution” (Dill & Teixeira, 2000).

Apart from diversity, a second example is the economies of scope, i.e., the fact that complementary products, which are available simultaneously, function successfully. Thus, some researchers include both doctoral and contract research in this category of complementary products (Dill & Teixeira, 2000).

THE UNIVERSITY AS A BUSINESS

The overall activities, therefore, of a higher educational institution can be put to an economic analysis. Universities and other institutions of higher education in general seem to be progressively losing their academic characteristics and acquiring those of a *business*. For many economic researchers, the only plausible response to the pressures that universities are under is based on a conceptual change: universities, from non-profit organizations functioning on the basis of government subsidies, will be considered as “for-profit firms” (Jongbloed, 2002). In this situation, the influence of the general environment on the functioning of universities will be even stronger, since, for example, the most significant factor for the adoption of innovations will be the wider structure of the market (Dill & Teixeira, 2000). These phenomena, i.e., the obligatory restructuring of universities, can be explained by the fact that the economy itself is being transformed in its entirety from a manufacturing economy into a network economy (Jongbloed, 2002).

It is common to refer to the principal aims of the university in terms of teaching, research, and service. But these roles can be regarded as simply the 20th century manifestations of the more fundamental roles of creating, preserving, integrating, transmitting, and applying knowledge (Jongbloed, 2002). Universities perform a basic function in “creating, preserving, integrating, transmitting, and applying knowledge” (Duderstadt, 1998). In the 20th century, this function was realized in a particular way and thus, universities organized

themselves accordingly so as to produce new knowledge, to transmit this knowledge, and to offer services in accordance with social, as well as other needs of the century. In the 21st century, universities will therefore function more as a type of knowledge server rather than in the way they are operating today. If the more contemporary language of computer networks were to be used, the university might be regarded as a “knowledge server,” providing knowledge services (i.e., creating, preserving, transmitting, and applying knowledge) in whatever form needed by contemporary society.

From this more abstract viewpoint, it is clear that while these fundamental roles of the university do not change over time, the particular realization of these roles *does* change — and in fact, quite fast.

PROBLEMS IN ADOPTING ICTS AT UNIVERSITIES

This whole trend of adopting ICTs and the gradual restructuring of the universities is not without obstacles nor is it unconditional. The main obstacle in the adoption of ICTs comes from the actual nature of the universities, which is basically conservative. For certain academic circles, the use of ICTs could be rather dangerous: “many readers...may think of higher education’s relationship with information technology as a dance with the devil...many of us in higher education now wish that we could push the information technology genie back into the bottle” (Katz & Associates, 1999). Universities have long produced and disseminated knowledge in an old-fashioned way. Traditionally, universities have functioned in a specific location and cater to mainly a specific age group (late teens — early twenties). In addition, the produced and transmitted knowledge is directed toward a relatively limited local group of students. Nevertheless, the new trend reverses this situation and there is a type of inertia at universi-

ties, which is being called on to change a number of their rather strong functioning stereotypes.

What we consider as a major problem in the design and use of ICTs for educational purposes is directly related with the importance of ICTs. As has been stated, integrating ICTs implies a major change for any organization. By their own nature, universities are well-structured institutions, and unavoidably the integration of ICTs leads to a radical change in their function and the balance of “forces” within the system. These changes arise at many different levels: changes in allowing resources for the technological infrastructure and the restructuring of the courses, in order to exploit the new possibilities offered by ICT, constitute typical examples of profound changes which finally influence the whole structure as well as the function of universities.

Experience shows that the adoption of ICTs, even by the most dynamic institutions of higher education, takes place gradually and at a very slow pace. The internal rivalries of researchers, who have dissenting views, are a common phenomenon. A significant factor in this situation is the fact that the university staff is not always acquainted with ICTs. It is not, in other words, computer literate. Naturally, the use of ICTs and the reorientation of a university’s activities require not simply computer literacy but rather a much deeper knowledge of ICTs. This deeper knowledge is many times lacking in the staff members, especially those in fields which are not based on technology, like the Humanities.

At the other end of the spectrum, many obstacles can be found for courses delivered via the Internet. In order to deliver courses via networks, the existence of a fast, robust, reliable, and cheap network (in some places mostly telephone lines) is necessary. Often, for many countries or regions, not even telephone lines are reliable or cheap. It is also necessary that the potential students have the fundamental skills needed in order to be able to follow these courses. The increase in the power and functionality of ICTs, as well as the falling

prices, have contributed to ICT adoption and use in developed and newly industrialized countries — but this remains untrue for large sections of the population within these countries that include a large number of other nations.

In some cases another problem arises, that of *institutional recognition* of the courses delivered from a distance. The low cost of these courses, coupled with the increased demand for new ones, has led to a general tendency for the creation of even more new courses. Their institutional status, however, can remain undefined and a large sector of the educational system refuses to accept the total equivalence of these courses to traditional ones delivered only by recognized institutions.

The consideration of institutions of higher education institutions on economic terms is naturally a choice. Viewing universities as a business is contrary to their academic character, not only generally and ideologically, but also in terms of specific strategic choices. A characteristic feature is the example of appropriability. Appropriability is an important factor in the adoption of innovations. If the diffusion of an innovation is too simple, then not only the business that devised the innovation and which was burdened with the costs of this invention will benefit, but also will its competitors. For this reason, there are fewer incentives for the adoption of innovations (Dill & Teixeira, 2000). However, this principle is in total contrast to academic ideology, which believes in the dissemination of new knowledge without rules and restrictions. Thus, universities will most likely ignore this principle. For example, MIT’s recent decision to make its courses available on the Internet is an expression of MIT’s choice for openness. Cited in Vest (2001): “We have built a system of higher education that is the envy of all the world, and we have developed the Internet as a universal medium for rapidly distributing and accessing information. These forces must now combine to raise educational opportunity throughout the world.”

A second example is the strategic response from universities to the increasing pressure of internationalization, i.e., “the integration of an international dimension into the teaching, research, and service function of higher education” (Van der Wende, 2001). The Anglo-Saxon countries have chosen a categorically stated and at times aggressive — competitive policy, whereas the European countries seem to prefer a more cooperative policy (Van der Wende, 2001).

Universities, therefore, as social institutions must adapt or they will disappear. “Thirty years from now the big university campuses will be relics. Universities will not survive. It is as large a change as when we first got the printed book” (Lenzner & Johnson, 1997). Their readjustment does not mean merely the adoption of ICTs and a few new programs. Universities and institutions of higher education in general must reorganize from their foundations and most importantly redefine their business concept (Jongbloed, 2002).

The views expressed above are most likely exaggerated. However, even if the situation is not as stated, the problem remains open, even on a different scale.

THE STATE OF INSTRUCTIONAL DESIGN TODAY

Up to this point an attempt has been made to explain that the constant pressures, both internal and external, on the universities to integrate ICTs are accompanied by strong pressure for restructuring, which allow them to keep their initial role, but which make them, most probably, operate on a different basis.

Within this framework, it would seem that the traditional methodologies for instructional design are non-existent because they do not seem to take into account all the new parameters, which must now be included.

Many models have been proposed as a more general consideration of the new factors, such as

ACTIONS (Bates, 2000). Khan (1999) proposes a model for the analysis of Web-based courses, which includes many more options than traditional tools. Linguistic themes, cultural considerations and motivations, institutional influences, cost analysis, and so on need to be considered during design. Despite all the proposed analytical tools, none of them seems to be generally accepted. It is, however, very clear that the traditional methods of lesson planning are seriously insufficient at the level of instructional analysis.

The new methods of teaching educational content present many new elements which are not integrated in ADDIE — which presupposes the existence of a class of students with known characteristics, face-to-face teaching, and so on. These basic suppositions, however, do not apply to the new educational frameworks in which distance learning takes place. In fact, the new educational environments are based on a rapidly expanding technology, little researched and little understood (Philson, 1998). Furthermore, up to now, research into the quality of Open and Distance Learning (ODL) has been technology-driven rather than pedagogy-driven (Langlois, 1997).

One important problem arising in Web-based and other technology-based courses is related to their (instructional) efficiency — or inefficiency, as the case may be. Even though potentially ICTs can play a very positive role in teaching, this still remains a strong hypothesis and many researchers have emphasized the absence of a specific pedagogy. To be more precise, the exact conditions necessary to construct a pedagogically efficient course are not known. This seems to be especially true in cases where teaching consists of practical exercises. If one agrees with the constructivist hypothesis, which nowadays is widely accepted, knowledge, either in a procedural or a declarative form, is constructed through a process of interaction between the learner and their environment. In most cases, however, the interaction between them in distance learning courses is very poor, and thus the efficiency of

delivered courses is rather questionable in some cases. For example, one of the most promising computing products is that of the so-called open microworlds such as the language LOGO, the physics environments such as Interactive Physics, the Dynamic Geometry environments such as Cabri-Geometer or Geometer Sketchpad. The most contemporary software of this type consists of simple, open environments, but which also integrates possibilities of dynamic variation and direct use of objects. However, to a large extent, nowadays we are not aware of what might be the most successful use of these environments (see, for example, Jonassen, 2000). ICTs are supposed to be able to improve the quality of teaching, but generally we do not know the methodology to achieve this. The ADDIE methodologies, as a rule, are functional in the analysis and creation of lessons in succession and at specific levels of teaching—whereas the possibilities being opened up by the new educational environments allows that lessons be organized on different bases.

In addition, the new educational environments include not only “local” microworlds in which students can conduct experiments, trials, measurements, and generally develop a variety of activities, but they also offer a variety of communication possibilities inside and outside the classroom. Thus, thanks to ICTs, a new type of organization of the classroom is created and often the teacher within this framework is called on to play a new role. Nevertheless, ADDIE methodologies do not have, as a rule, the possibility to integrate and analyze these new didactic situations and remain at that level.

ICTs’ strongest influence, however, in institutions of higher education appears to be related to the provision of distance learning lessons and mainly to asynchronous teaching. This is because in essence, these types of lessons will allow the institutions to have a significant cost reduction resulting in a reduced cost of teaching per student.

A difficulty in the design of online lessons is the extreme diversity of the public to whom they are geared. Subjects intended for an international public are especially difficult, requiring a more complex procedure since factors of language, and culture and teaching problems that may arise, all have to be taken into account, as these lessons are available to “anyone.”

A second level of difficulty is related to the teaching theory usually implemented with online lessons. Online lessons, in their current form, are most times rather simplistic from the point of view of teaching, and it cannot be sure that they can replace live lessons. As is well known, in a traditional classroom situation, there is a very strong interaction between teacher and students. This interaction is not merely typical; it is not only based on words but on the entire context of the situation. The teacher, for instance, is able to either emphasize or dismiss a student’s answer with gestures of the hands, the expression on the face, and in many other ways. This process is neither marginal nor insignificant, but rather it is very important since it consists of a very significant aspect of the teaching process. The lack of this type of communication in distance education is obviously a disadvantage, and it is not known how it can be overcome. It is the same for the very strong interaction between students, which in distance learning is either totally missing or is replaced by communication through the Net. The lack of direct interaction between those taking part, as is the case with those of a traditional classroom, is thus a disadvantage for distance learning, at least in the way that it exists today. This disadvantage naturally increases in the cases when practical application and the learning of practical skills are required on the part of students.

Up to now, online lessons have been designed with low teaching specifications: they are in fact e-books with very little interaction with the student and have closed-type exercises. Especially in the situations where new concepts are intro-

duced — and particularly where these concepts do not conform to the intuition and experience of students — the understanding of these concepts requires, as a rule, rich teaching environments, and the online environment, as has been shown, is relatively insufficient.

From their experience, teachers gain a whole range of knowledge, which enables them to recognize not only the mistakes but also why those mistakes were made, i.e., students' misconceptions. In this way, a mistake made on reasoning, a question apparently without meaning, and generally students' actions are gauges for the teachers who do not intervene in the mistake itself, but rather in the reason for the mistake. If, for example, students insist that a lighter weight body falls slower than a heavy one, the teacher is able to understand that the students have not simply made a mistake, but obviously have not understood the concept of gravity, and thus the teaching involved will not simply be to correct the mistake, but rather to correct the misconception.

Nevertheless, the methods for expressing in a typical manner the teacher's informal and empirical knowledge are still not known (except for commonplace situations such as the above) and thus we are not yet able to "implement" this knowledge within a system of teaching. The teaching systems, which exist at present, do not have the diagnostic abilities an experienced teacher has.

These problems are usually dealt with empirically, according to each case. And in this case, the methodologies of ADDIE are not sufficiently analytical, in order to allow for the creation of successful educational online lessons.

SOME SUGGESTIONS

The problems mentioned above have a common point. They are all related, directly or indirectly, with the profound, radical transformation in the educational process occurring when ICTs

are used. In most cases, tools for the design of new educational systems or courses do not take into account the implications of these systems in the organization where the systems must be integrated.

In addition, these tools cannot integrate the new and to a large extent unknown possibilities which are opened up — as well as their limits and any possible weaknesses. ADDIE enables the design of different educational applications, but within an educational system that remains stable and in teaching environments with typical parameters. It is possible that in the current situation, we are not in a position to expand systems like ADDIE in order to include new elements such as the ones mentioned above, because data collected from experience and research are not sufficient to deal with these complex phenomena. However, the elaboration of this expansion is considered a necessity, and research in this area must be encouraged.

Is there, at present, a technology, which enables a very successful design to be created? Possibly not. As Vest (2001, p. 4) states, "There is not one grand solution. Indeed, I believe that it is too early to declare comprehensive positions and strategies. Rather, it is a time for substantial experimentation and calculated risks that will help us to sort out opportunities and find effective paths." Thus, research seems to be the only channel for the accumulated experience to be expressed within the framework of a new methodology.

Along with experimentation, which is an acceptable, although time-consuming scientific procedure, there is a pressing need for the adoption of strategies for ICTs on the part of universities.

The experience up till now allows certain practical rules to be formulated on the use of ICTs (see for example Langlois, 1997):

- Recognition of the systemic variables and conditions affecting the design, development, and implementation of online courses needs to be incorporated into the instructional systems design process.

- A cooperative policy is a basic choice that universities have. It should systematically cultivate the elaboration of subjects at all levels. At an internal level, cooperation among students, faculty, and technical staff should be cultivated, and at an external level, cooperation with related institutions who also adopt ICTs is advisable both to better understand ICTs and their functioning, as well as to facilitate shared decision-making at all relevant levels.
- Promote and support the development of course material using ICTs. That means not only to promote and financially support the research on methods of teaching with ICTs, but also an open collaboration policy with other agents involved, such as computer firms, software developers, and enterprises designing educational delivery systems. Nevertheless, this progress must not be made at the expense of lessons, which must follow the accepted quality standards.
- Develop a systematic training for faculty members in order for them to be able to use more effectively ICTs in teaching. This training must be based not only on formal courses, but also in collaboration with the technical staff.
- Develop an infrastructure that will support new technologies not only within the confines of the university, but also between universities and generally as widely as possible. Within the framework of this infrastructure, a system should also be developed which makes accessing the lessons easy for all students, either on or off campus.
- Simultaneously support the development of library technology, hand-in-hand with instructional technology.

All these rules are obviously not sufficient to determine in an analytical way the strategy of universities toward ICTs. They do, however, consist of a summary of tried directions, and in

combination with systematic experimental and related research could be used to formulate a more general policy.

REFERENCES

- Bates, W. (2000). *Managing Technological Change*. Jossey-Bass.
- Daniel, J.S. (1996). *Mega-Universities & Knowledge Media*. Kogan Page.
- Dill, D.D. & Teixeira, P. (2000). Program diversity in higher education: An economic perspective. *Higher Education Policy*, 13(1), 99-117.
- Duderstadt, J.J. (1998). Transforming the university to serve the Digital Age. *CAUSE/EFFECT*, 20(4), 21-32.
- Evans, T. & Nation, D. (2000). *Changing University Teaching*. Kogan Page.
- Hanna, D.E. & Associates. (2000). *Higher Education in an Era of Digital Competition*. Atwood Publishing.
- Jonassen, D.H. (2000). *Computers as Mindtools for Schools*. Merrill, Prentice-Hall.
- Jongbloed, B. (2002). Lifelong learning: Implications for Institutions. *Higher Education*, 44, 423-431.
- Katz, R.N. & Associates. (1999). *Dancing with the Devil, Information Technology and the New Competition in Higher Education*. Jossey-Bass.
- Langlois, C. (1997) *Universities and New Information and Communication Technologies: Issues and Strategies*. International Association of Universities.
- Lenzner, R. & Johnson, S.S. (1997). Seeing things as they really are. *Forbes*, 10(March).
- Marginson, S. & Rhoades, G. (2002) Beyond

Integrating ICT in Universities

national states, markets, and systems of higher education: A Glocanal agency heuristic. *Higher Education*, 43, 281-309.

Morphew, C.C. (2000). Institutional diversity, program acquisition and faculty members: Examining academic drift at a new level. *Higher Education Policy*, 13(1), 55-77.

Philson, R.M. (1998). Curriculum by bytes—Using technology to enhance international education. In Mestenhauser, J.A. & Ellingboe, B.J. (Eds.),

Reforming the Higher Education Curriculum. American Council of Education, Oryx Press.

van der Wende, M.C. (2001). Internationalization policies: About new trends and contrasting paradigms. *Higher Education Policy*, 14(3), 249-259.

Vest, C.M. (2001). *Disturbing the Educational Universe: Universities in the Digital Age—Dinosaurs or Prometheans?* Report of the President, MIT, Year 2000-2001.

This work was previously published in Instructional Design in the Real World: A View from the Trenches, edited by A.-M. Armstrong, pp. 201-217, copyright 2004 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.19

Diffusion of Educational Technology and Education Reform: Examining Perceptual Barriers to Technology Integration

LeAnne K. Robinson
Western Washington University, USA

ABSTRACT

This study examines educators' perceived barriers to technology integration and the relationship to education reform. Educators and administrators from four elementary schools in Washington state were interviewed in their classrooms during a 3-month period. The schools differed in size, location and social economic status, and reported variances in their Washington Assessment of Student Learning (WASL) scores. While all of the schools reported similar barriers to the use of educational technology, distinct differences appeared between those schools that had done long-range planning during the reform process and those that had not. Specifically, staff in the two schools that coordinated curricula, performance standards and a variety of assessment tools while simultaneously allowing teachers the flexibility

to alter the curricula were more likely to state personal responsibility for student learning, and they were also more likely to have overcome barriers to the use of technology.

BACKGROUND

In a recent campaign commercial, a candidate spoke of the need to improve education and to create quality schools. Lined up along a white wall behind him were rows of computers with elementary students quietly absorbed in the computer screens. The message to the public was clear: Computers and computing technology are not only necessary for quality schools, but are indicative of good teaching and student learning. If the state was to have youth who would eventually be competitive in a global economy, technology

would need to be at the forefront of funding and government support.

Computing technology has been marketed as the current solution to education's problems (Rockman, 2000), and the quest for technologically equipped schools has grown dramatically. In 2000, the number of computers in schools numbered more than 10 million (Becker, 2000). By 2003, nearly 100% of all public schools had Internet access, and more than 93% of all instructional classrooms were wired for access. The mean average of computers per school was nearly 136 (NCES, 2004). The estimated cost of technology per pupil in the United States (US) was \$103 per pupil in 2005 alone (Education Week, 2005).

PURPOSE

Research in the integration and institutionalization of educational technology was limited in scope in 1994 (Seels & Richey, 1994), and although educational technology is now available, it is not integrated into classrooms today (Becker, 2000; NCES, 2000). Only 43% of elementary classrooms surveyed used computers on more than 20 occasions during the school year (Becker, 2000). Nationwide, school districts are grappling with education reform and accountability while simultaneously attempting to financially support computing technology and encourage integration by classroom teachers. Currently, there is no clear rationale that explains the apparent difficulty with incorporating the use of educational technology and whether or not there is a relationship between the level of technology integration and the pressure teachers experience as a result of education reform efforts. The purpose of this study was to examine how educators in several schools in a Northwestern state were responding to the pressure to integrate technology while simultaneously being accountable for student achievement.

REVIEW OF THE LITERATURE

In January 2002, President Bush reauthorized the Elementary and Secondary Education Act. This bill contained an even larger allotment of money and support for technology from the federal government than previous education bills (Fletcher, 2002). Currently, 48 states have adopted or are developing assessments that align with standards-based reform efforts (Stecher & Chun, 2001). Reform and standards have impacted classroom practice, and schools and teachers have responded in multiple ways (Adcock & Patton, 2001). Often, technology reform and education reform have paralleled each other as opposed to being incorporated (Peters, 2000), meaning that in many instances the purchasing of computing tools and related technology, as well as a plan for staff development, were not coordinated with a building's reorganization and examination of the curriculum and instructional processes. When both education reform and technology integration have been fully combined with curriculum reform, which includes examining pedagogy, positive results have been found for students (Bain & Smith, 2000).

Barriers to Technology Use

In spite of significant pressure to integrate the use of technology into the curriculum, the presence and accessibility of computers in the schools has not shown that the technology is being used by educators or that students actually can or do use it (Cuban, Kirkpatrick, & Peck, 2002; Kalkowski, 2001). Although they are accessible, computers have not transformed the practices of a majority of teachers (Becker, 2000; Labbo & Reinking, 1999) and Willis, Thompson, and Sadera (1999) have pointed out that integration of computers into the classroom actually has been a slow process.

Defining Barriers

In initial efforts to understand why teachers have failed to integrate technology, barriers have been defined as being 'primary' and 'secondary' (Judson & Sawada, 2000; Prater, 2001; Ertmer, Addison, Lane, Ross, & Woods, 1999). Both primary and secondary barriers are explained as being intrinsic and extrinsic (Ertmer, Addison, Lane, Ross, & Woods, 1999). Primary barriers include: lack of access to computers and software, insufficient time to plan instruction, and inadequate technical and administrative support. Secondary barriers include: beliefs about teaching, beliefs about computers, established classroom practices and unwillingness to change.

Diffusion of Innovations and Educational Technology

In addition to defining barriers, researchers have sought to understand why some specific technologies are adopted. The diffusion of innovations is the study of the process by which the use of a perceived new idea, practice or object is adopted within a given social system (Rogers, 1995). The study of the diffusion of innovations is present in many research traditions, including anthropology, marketing, geography, communication and education. Within the overall research arena, fewer than 10% of the studies of innovations have been conducted in education (Rogers, 1995). While Rogers (1995) provides a generic model of the process of the adoption of an innovation, case studies are showing that alternative models may be more applicable to school systems. These models specifically identify educational technology as the innovation being studied, thus the phrase 'diffusion of educational technology' is often used in place of 'diffusion of innovations.'

The diffusion of educational technology models that have been recently presented are non-

linear, implying that many factors are involved in the adoption (or lack of adoption) of educational technology (Dooley, 1999; James, Lamb, Bailey, & Householder, 2000; Rogers, 2000; Sherry, Billig, Tavalin, & Gibson, 2000). These models vary from the commonly cited model posed by Everett Rogers (1995), as they focus solely on educational technology and attempt to identify more specifically those factors that will lead to the adoption of an innovation in a school setting. All of the models have been developed using a limited number of schools, and none of the models clearly indicate why technology integration has been a slow process.

PILOT STUDY ON MEDIA SELECTION

In spring 2001, the researcher conducted a pilot study at a K-6 elementary school to determine how teachers in this particular setting made decisions regarding media selection. While the majority of staff verbally supported the use of computing tools, few used educational technology and instead tended to blame others or cite circumstances they felt were out of their control for a lack of use. The common theme that emerged from the interviews was that regardless of the reason for failing to integrate technology, the teachers in the building were making the majority of decisions based on a highly structured reading program that had been adopted during a school reform process. All related the lack of technology use to some aspect of the school's focus on educational reform and to their concerns related to teacher accountability and a state-required assessment. The results of the pilot study provided an additional foundation for further examination of the relationship between education reform, educational technology and educators' perceived barriers to technology integration.

METHODOLOGY

Theoretical Underpinnings

Authentic technologies (Clark & Estes, 1999) are “educational solutions resulting from systematic analysis that identifies the problem being solved, selects and translates appropriate, well-designed research and applies it to design culturally appropriate educational solutions” (p. 243). A four-stage model proposed by Clark and Estes (1999) for conducting research in the development of authentic technologies provided the theoretical underpinnings for this study. Authentic technologies can include teaching strategies and processes, not merely computing tools. This research is based in the first, or Descriptive Scientific Research Stage, where the defining of constructs and hypotheses generation are the key goals.

Two research questions guided the study:

1. What are teachers’ perceptions of barriers to the use of educational technology/technology integration, and how do the barriers connect to education reform?

2. What are the connections between perceived barriers to the responsibility for computing technology?

Site Selection

Four separate sites from the same Educational Service District in a Northwestern state were purposely selected. A stratified sample was used (Patton, 1990), meaning that the four sites represented four different subgroups for comparison. Two of the schools were located in rural settings and reported variances between their WASL scores (demographics are reported in Table 1 and Table 2). Access was granted through a key individual at each site, and snowball sampling (Patton, 1990) was used. Semi-structured questions were asked and observations were made of the classroom setup and equipment available.

Data Collection

Twenty individuals were interviewed between March and May, 2002. Interviewees included: three administrators, one administrative intern, three reading specialists, 13 classroom teachers,

Table 1. Demographics of selected sites, 2001

| School | Location | Enrollment | % of Free and Reduced Lunch |
|--------------|----------|------------|-----------------------------|
| Wrangle | Urban | 370 K-6 | 56.8 |
| Sandal Creek | Suburb | 444 K-4 | 10.3 |
| East Lake | Rural | 263 K-6 | 34.4 |
| Woodland | Rural | 304 K-6 | 44.4 |

Table 2. WASL scores for selected sites, 2001

| School | % Passing Reading WASL (66.1 state) | % Passing Math WASL (43.9 state) | % Passing Writing WASL (43.5 state) | % Passing Listening WASL (72.4 state) |
|--------------|-------------------------------------|----------------------------------|-------------------------------------|---------------------------------------|
| Wrangle | 48.8 | 23.3 | 27.9 | 58.1 |
| Sandal Creek | 52.7 | 28 | 43 | 71 |
| East Lake | 55.8 | 30.2 | 23.3 | 72.1 |
| Woodland | 73.2 | 39 | 43.9 | 80.5 |

a counselor and a physical education (PE) teacher. Each interview lasted between 45 and 90 minutes. All of the interviews occurred within the individual teacher's classroom or the administrator's office. Following the transcriptions of the interviews and during the analysis, the initial contact person at each school remained available to answer specific questions via phone and e-mail.

The International Society for Technology in Education (ISTE) has developed frameworks that provide progressive descriptions, ranging from teachers who do not integrate technology to teachers that fully integrate technology (ISTE Homepage, 1999). These frameworks were converted into a survey and each teacher was asked to identify his or her current level of technology integration. Notes were taken during the interviews, and observations and comparisons were made between the information gathered during the interview and the teacher's reported level of integration.

Data Analysis

Each interview was read multiple times and the researcher looked for themes within each broad category. A list of themes was generated and selective sections of the interviews that corresponded to the potential themes were labeled. For the teachers, the following themes were identified: primary barriers, secondary barriers, school climate, favorite parts of teaching, frustration/needs, teaching practices, accountability and technology-specific responses.

Interviews were coded and sorted in several ways. The responses of those who had high integration scores on the technology integration survey and those that scored lower were separated for comparison. In addition, responses to both primary and secondary barriers were separated into two groups: those who saw an identified bar-

rier as an obstacle that they could not or would not overcome; and those that were attempting to, or had overcome, the identified barrier. Patterns within and between schools were identified, including those who rated themselves high on the integration survey and those who rated themselves lower. Individual profiles for each school were developed and used to confirm the researcher's initial findings from the organizational charts.

INTERPRETATION

After reviewing the analysis, several distinct differences and similarities appeared between the schools. Remarkably similar were the hindrances to technology integration. All barriers cited in the literature were mentioned at every school. These included: inappropriate training or in-service (Kay, 1996; Maor, 1999); collegial jealousy or pre-defined roles (Sherry & Billig, 2002; Reinking & Watkins, 2000; Wood, 2000); lack of appropriate or relevant software instruction (Becker, 2000; Rockman, 2000; Rogers, 2000; Ruberg, 1993; Sia, 1992); teachers failing to find the relevance of technology use or applications to classroom practices (Maor, 1999; Sherry, Billig, Tavalin, & Gibson, 2000; Rogers, 2000); as well as teachers having a lack of space and time within the curriculum (Cuban, Kirkpatrick, & Peck, 2001; James, Lamb, Bailey, & Householder, 2000).

What differed were the role of curricula within the school reform process, the types and uses of assessments and teachers' statements of personal responsibility for both the use of technology and for student learning. Although all of the schools had participated in school reform efforts, the connection between curricula, assessment and instruction varied. These connections and teacher statements of responsibility at the four elementary schools will be highlighted in the following section.

**Curriculum, Assessment,
Instruction and Teacher
Responsibility for Student
Learning: Looking at a
Disconnect:
Sandal Creek and Wrangle**

A disconnect between curriculum, assessment and instruction existed in two of the four schools: Sandal Creek and Wrangle. At Wrangle, teachers were using the structured curriculum as the primary means of addressing problems with student achievement in reading. Teachers were not the decision makers when it came to reading instruction. Instead, representatives from the adopted reading program and a reading coordinator reviewed scores on a regular basis and directed adjustments. The adjustments were not generally instructional, but related to group placement. Teachers felt that they had little say in what and how to teach and were frustrated. In addition, this highly structured curriculum impacted all other school decisions.

I wish I had more time in the day to teach what we are being expected to teach, for one thing. I wish I could veer from the hard and fast philosophy we are living with now. ... I would like to branch out and be a little more creative. It is the way I used to teach. Now we have to stay with the party line. It is boring for me and it is boring for the kids. (Sixth grade teacher, Wrangle, March 28, 2002)

At the other end of the spectrum was Sandal Creek, where very little structured curricula existed. Like Wrangle, teachers at Sandal Creek were also frustrated, but because of a lack of structure.

Actually, I am sitting on a committee right now that is trying to purchase a curriculum. We are

all frustrated with the hodgepodge. (Third grade teacher, Sandal Creek, May 8, 2002)

For new teachers [the reading program] is really hard. The program itself is really hard to follow, because the way it is set up, and there are two different books. It is just hard logistically because the materials that come with it, well, there aren't any ... philosophically [the teachers] like it, but it is not helpful as far as providing resources. (Reading teacher and administrative intern, Sandal Creek, May 8, 2002)

Sandal Creek had virtually no structure or connection between curriculum, assessment and classroom instruction. No curriculum existed, just frameworks. Wrangle teachers were not the decision makers, but were directed by adopted curriculum. Neither of these two schools had teachers who commented on being responsible for the actual learning of the students.

"I know there needs to be some sort of accountability ... but I wish they were less centered on the teachers ... and that the politicians who actually came up with this stuff would point their finger where the real issue is, which is in the home. (Sixth grade teacher, Wrangle, March 28, 2002)

**Making a Connection:
East Lake and Woodland**

At the two other elementary schools, East Lake and Woodland, teachers discussed multiple types of assessments and multiple purposes for assessment. WASL scores were reviewed, but the results from this assessment were not the only measure of student success. District and classroom assessments were used to adjust instruction and determine individual student needs. Both formal and informal assessments were combined to assist in curricular decisions and teachers were expected to make decisions based on their own professional judgment.

Table 3. The role of curricula between Wrangle, Woodland, East Lake and Sandal Creek; comparison of assessments, curricula, instruction and responsibility

| | Schools | | | |
|--|---------|-----------|--------------|----------|
| | Wrangle | East Lake | Sandal Creek | Woodland |
| Primary Assessments | | | | |
| Classroom | | X | X | X |
| School | X | | X | X |
| District | | | X | X |
| State | X | X | X | X |
| Role of Curricula | | | | |
| Highly Structured | X | | X | X |
| Adopted Curricula and District Frameworks with Flexibility to Adjust | | | X | X |
| No Adopted Curricula and District Frameworks | | X | | |
| Teachers State Responsibility for Student Learning | | | X | X |
| Teachers State Responsibility for Technology Integration | X* | | X | X |
| Teachers State Plans for Overcoming Barriers | X* | | X | X |

* Indicates a single teacher

Like I said, in major areas [the District does] have priorities where you can teach. Now the way you get there, obviously, is up to the teacher and up to your classroom. There are other teachers in our district, in our school, that don't stick closely to the adopted reading curriculum, but they do hit the major component parts of it. (Sixth grade teacher, East Lake, May 6, 2002)

... and if all [the curriculum process] has been done, the curriculum is critical; how it's adjusted and adapted and delivered to the students is totally a professional obligation and responsibility of that classroom teacher, but they need to be able to know the curriculum well enough to [know] how to adapt it. I would encourage all teachers the first year to use the curriculum closely ... They are going to have to do some adapting and they'll probably have to work with the special education teachers. We check every day on how they are doing. (Principal, Woodland, May 10, 2002)

I don't feel really badly if we don't make the [state test] because it is a different cohort. There are other conditions that apply. Certainly it is a goal for us to look at, and it certainly is one measurement, but I am more interested in looking at individual students over time. If I see that kids aren't making adequate progress in our classroom assessment, then we have to do something different, and that's going to adjust our school plan, which ultimately should result in the [state test] improvement. (Principal, East Lake, March 28, 2002)

Assertion 1. Comparing the four schools, it appeared that when education reform efforts included the integration of curriculum, assessment and classroom instruction, such as at Woodland and East Lake, teachers were more likely to take personal responsibility for student learning. At East Lake and Woodland, curriculum, assessment and classroom instruction seemed closely connected. There was a clear understanding of

both formal and informal assessments. It was only at these two schools that teachers commented on being responsible for student learning, being accountable to themselves. As one teacher stated, “It’s the teacher’s responsibility.”

Integrating Technology with Reform and Teacher Responsibility

At Sandal Creek and Wrangle, technology remained separate from the rest of the school happenings. For example, a technology plan was being developed for Sandal Creek at the district level, as opposed to the school staff formulating the plan. Staff at both schools rarely cited efforts to overcome barriers. They blamed others for the existing barriers and individuals, and made no problem solving references to how to personally overcome an obstacle or influence policy and practice related to technology integration.

... because people aren't telling us what the research base is, so I'm just finding whatever's there and that's what I will use, but I'm not using it to teach kids with. I'm using it as like a reward for having completed whatever things they've done in the classroom, so I'm not thinking of it in terms of curriculum. It is more like ... it is not part of our curriculum, it is something extra for kids who are finished and need an extension of whatever. (Second grade teacher, Wrangle, May 7, 2002)

At both Woodland and East Lake, teachers were more likely to have mentioned having overcome obstacles to technology use. Technology use was seen as part of the total overall piece of instruction, not as something that was separate from or in addition to the existing curriculum. There had been both long-range planning and the integration of assessment with instruction. Technology had been used as a part of the process; both districts had adopted software that committees felt had supported the curriculum and classroom instruction.

I think [technology] is supportive of the curriculum, it just depends on what you're going to use it for. (Fifth grade teacher, Woodland, May 10, 2002)

Technology is a tool. It is not to be, I mean it is not the goal, the technology is not the goal, it is the means to the end and the is ... we model this for kids ... we don't have time in the day to do those free-standing things that aren't tied directly to goals we have for student learning. (Principal, Woodland, May 10, 2002)

Assertion 2. Teachers took more responsibility for technology use when technology integration was not separate from curricula and/or reform efforts. Even if a teacher had not fully integrated technology, teachers at East Lake and Woodland made statements of personal responsibility for technology use:

It is definitely not what we have now; you know, last year I could have said we don't have great computers. But I think it is just a comfort level for me and I think I need to get in and experiment to how to use it myself and then be able to expect my kids do that, so I think it is something that will happen, maybe next year. (Third grade teacher, Woodland, May 10, 2002)

Access to Technology

The concept of homophily (Rogers, 1995) suggests that the adoption of a new technology is more likely to occur if someone similar, such as an equal colleague, introduces it or is successful at using the new technology. It was interesting to note that Wrangle was one of the schools with a disconnect between curriculum, assessment and instruction, yet had more computers per student than any of the other schools. Three of the teachers had received a total of four large grants and every teacher had at least one computer in his or her classroom. Of all of those interviewed, Wrangle also had a teacher that scored higher than any other

on the integration survey. However, Wrangle had less technology use as measured by the Technology Integration Scale. The large grants received by one specific teacher seemed to have isolated her. The technology provided by the grant stayed within the individual classrooms, although the grant recipients did collaborate with each other. On the other hand, Woodland had received a large grant where the technology moved with the students. Following the initial grant year, the student took the technology, in this case portable word processors, with them to the next grade. The new teachers then began utilizing the technology because the students were accustomed to it and it was still available to them.

Wood (2000) found that teachers who were next to one grant recipient often were jealous and those with the technology were often discouraged from sharing, isolating them from their peers. This was seen at Wrangle. Teachers were often angered by the technology grant recipients who, every year, collaborated in the creation of a play. Two classrooms were involved in the development of the play and the integration of technology throughout was apparent; brochures, advertising, film editing, lights and music were all developed. One of the teachers who was interviewed and had observed the play asked the researcher to figure out, "How, exactly, does that fit with curriculum?"

Assertion 3. For technology to be used in a school, access to technology needs to be made for all. It should be noted that the literature suggests that access to technology does not guarantee that teachers will utilize it (Cuban, Kirkpatrick & Peck, 2001). At Woodland, where the lab provided ample access, some teachers still hadn't used the lab. However, even though the teachers were hesitant, they were not unwilling to try or had future plans to increase use. Once access is provided, addressing individual perceptual barriers and actual needs may be the next step. In schools where there is no access or access is restricted to

specific classrooms, it seems unlikely that other teachers will seek to integrate technology.

DISCUSSION

Schools cannot be centered solely on technology, or just assessment or curricula. Schools that become too focused on one area can neglect the others. To better understand how technology use can be supported, the school processes need to be viewed from the perspective of student learning first. What are the factors that directly influence and impact student learning? Such things as the relationship of curricula, assessment, accountability, leadership style, resources and the individual needs of the teacher need to be examined in a global context. Technology integration fits into many of the categories, but technology alone will not guarantee student learning. It is simply one factor that may contribute towards meeting student learning goals.

Two models of the diffusion of educational technology have identified that the point of rejection of a new technology occurred when teachers failed to see relevance for the learner (Sherry, Bilig, Tavalin & Gibson, 2000; Rogers, 2000). On completion of this study, it seems necessary to further define the diffusion of educational technology models so that they encompass more than one technology and provide direction related to the overall process of technology integration. Technology integration within schools must exceed the adoption or use of a single technological device or application. Most of the models of adoption take a technology-centered view. Even a holistic model presented by Dooley (2000), where internal and external factors of integration are viewed in the context of the school along with types of change facilitators, presents technology as the central focus.

CONCLUSION

Re-Conceptualizing the Role of Technology

The integration of technology into today's classroom needs to be viewed as an integral component of a more comprehensive package of education reform. Although the literature often uses the phrase "integrate technology" to imply that technology is to be part of multiple areas of education, including curriculum, assessment and instruction, it is often presented as the focal point or treated as a separate component. Student learning is truly at the center of education. Perhaps a more appropriate phrase would be to, "Enhance teaching and learning through the effective use of technology." Performance standards or frameworks are in place in almost every state. Curriculum and assessment should be used to inform instruction. Technology and best practices need to be examined within the context of each area of the educational system, and technology integration needs to be re-conceptualized and presented within the context of an entire school system (Figure 1).

For teachers to overcome barriers to technology integration, teachers need to feel in control both of the classroom and the available technology,

be able to take responsibility and have a sense of accomplishment. These three areas can be applied to the use of a single technological innovation, but can and should be applied to the broader context of a school system. Too many schools are taking away the ability for teachers to be responsible. Teachers are being given scripted curricula and are told what to teach and which assessments must be given, as opposed to being given the freedom to make appropriate choices about instruction and appropriate assessment.

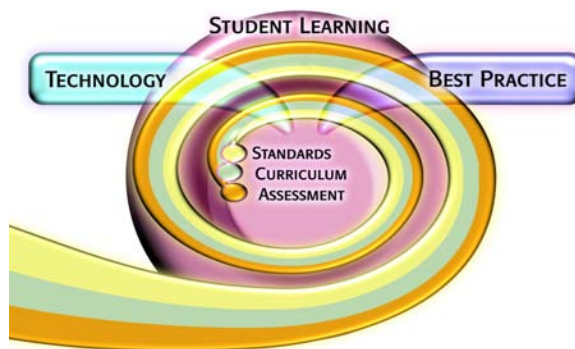
Recommendations for School Improvement

Several recommendations can be made for school improvement and restructuring.

First, combine technology with other reform efforts. Make the connection between the uses of certain technologies or best practice with continued student achievement. This can take many forms; projects for increasing student learning, specific software applications for student use, appropriate assessment and continued classroom management. Isolating technology, or any other component of reform, such as curricula, creates frustrations and limits vision.

Second, schools need to have the ability to overcome multiple primary barriers. Focusing on

Figure 1. Conceptualization of the role of technology



one barrier, such as access, neglects the others. Teachers are unique, have differing skills, and need different opportunities for growth. Meeting one need does not guarantee integration; other barriers will arise and the ability to address them needs to be available for all. This includes not limiting materials and resources provided by a grant to a single classroom. This can isolate a teacher from his or her peers and create potential school climate issues. If a teacher does receive a grant, plans for future growth for other teachers within the building need to be thought through. This is the same for the students. What about those students who spend a year in a technology-rich classroom, followed by several years in a technology-poor classroom, or those students at the same grade, because of placement in a certain classroom are then denied access to computing tools? Solutions to the one technology classroom may include team teaching, or cross-age projects.

Third, long-range planning needs to be done for all school restructuring. School goals need to be created within a holistic context that include the close scrutiny of curriculum, assessment practices, how teachers are matching classroom practices with established frameworks and how teachers are implementing best practices in instruction. Building goals should be developed followed with the examination of individual teacher needs. It simply is not enough to set goals without taking into consideration different barriers that individual teachers may face. Teachers need to be active participants in the decision-making process. Student needs are more likely to be met when teachers are able to make active decisions regarding curriculum, assessment, instruction and the use of technology.

REFERENCES

- Adcock, S. G., & Patton, M. M. (2001). Views of effective early childhood educators regarding systemic constraints that affect their teaching. *Journal of Research in Childhood Education, 15*(2), 194-208.
- Bain, A., & Smith, D. (2000). Technology enabling school reform. *Technological Horizons in Education Journal, 28*(3), 90-97.
- Becker, H. J. (2000). Findings from the teaching, learning, and computing survey: Is Larry Cuban right? *Education Policy Analysis Archives, 8*(51).
- Clark, R. E., & Estes, F. (1999). New directions: How to develop "authentic technologies." In R.E. Clark (Ed.), *Learning from media: Arguments, analysis, and evidence* (pp. 241-262). Greenwich: Information Age Publishing.
- Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal, 38*(4), 813-834.
- Dooley, K. E. (1999). Towards a holistic model for the diffusion of educational technologies: An integrative review of educational innovation studies. *Educational Technology and Society, 2*(4). Retrieved October 17, 2001, from http://ifets.ieee.org/periodical/vol_4_99/kim_dooley.html
- Education Week. (2005). *Technology counts 2005, 8th annual report*. Retrieved January 6, 2006, from <http://edweek.org>
- Ertmer, R. A., Addison, P., Lane, M., Ross, E., & Woods, D. (1999). Examining teachers' beliefs about the role of technology in the elementary classroom. *Journal of Research on Computing in Education, 32*(1), 54-62.
- Fletcher, G. (2002). Education act sets stage for technology reform. *Technological Horizons in Education Journal, 29*(7), 56.
- ISTE (2000). *National educational technology standards for teachers*. United States and Canada.

Eugene, OR: International Society for Technology in Education.

ISTE Home Page. (1999). Online supplement: Levels of technology implementation framework. *Learning and Leading with Technology*, 26(8). Retrieved April 16, 2002, from www.iste.org/L&L/archive/vol26/no8/supplements/morsch/table2.html

James, R. K., Lamb, C. E., Bailey, M. A., & Householder, D. L. (2000). Integrating science, mathematics, and technology in middle school technology-rich environments: A study of implementation and change. *School Science and Mathematics*, 100(1), 27-35.

Judson, E., & Sawada, D. (2000). Examining the effects of a reformed junior high school science class on students' math achievement. *School Science and Mathematics*, 100(8), 419-425.

Kalkowski, M. A. (2001). Focus on learning and technology. *Communication: Journalism Education Today*, 34(4), 19-22, 25, 27.

Kay, A. (1996). Revealing the elephant: The use and misuse of computers in education. *Educom Review*, 31(4). Retrieved November 5, 2001, from www.educause.edu/pub/er/reviewArticles/31422.htm

Labbo, L. D., & Reinking, D. (1999). Negotiating the multiple realities of technology in literacy research and instruction. *Reading Research Quarterly*, 34(4), 478-492.

Maor, D. (1999). Teachers-as-learners: The role of multimedia professional development program in changing classroom practice. *Australian Science Teachers Journal*, 45(3), 45-50.

NCES (2000). *The condition of education 2000. Quality elementary and secondary educational environments*. Retrieved October 17, 2001, from <http://nces.ed.gov/pubs2000/coe2000/section4/indicators45.html>

NCES (2004). Libraries and educational technology. *Digest of Educational Statistics*. Retrieved January 6, 2006, from http://nces.ed.gov/programs/digest/d04/ch_7.asp

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Newbury Park: Sage Publications.

Peters, L. (2000). Joining forces: A third millennial challenge: Harness the power of educational technology to advance the standards movement. *Technology Horizons in Education Journal*, 28(2), 94-102.

Reinking, D., & Watkins, J. (2000). A formative experiment investigating the use of multimedia book reviews to increase elementary students' independent reading. *Reading Research Quarterly*, 35(3), 384-419.

Rogers, E. (1995). *Diffusion of innovations* (4th ed.). New York: The Free Press.

Rogers, P. L. (2000). Barriers to adopting emerging technologies in education. *Journal of Educational Computing Research*, 22(4), 455-472.

Ruberg, L. (1993). The impact of digital technologies on the elementary school classroom. In *Virtual literacy in the digital age: Selected readings from the Annual Conference of the International Visual Literacy Association* (ERIC Document Reproduction Services No. ED370566).

Schneiderman, B. (1998). *Designing the user interface* (3rd ed.). Reading: Addison Wesley Longman.

Sia, A. (1992, February). *Enhancing instruction through software infusion*. Paper presented at the American Technology Education Conference, Orlando, FL.

Seels, B. B., & Richey, R. C. (1994) *Instructional technology: The definition and domains of the field*. Washington, D.C.: Association for Educational Communications and Technology.

Sherry, L., & Billig, S. H. (2002). Redefining a "virtual community of learners." *Tech Trends*, 46(1), 48-51.

Sherry, L., Billig, S., Tavalin, F., & Gibson, D. (2000). *New insights on technology adoption in communities of learners*. Proceedings of the Society for Information Technology & Teacher Education International Conference, San Diego, CA (ERIC Document Reproduction Services No. ED 444 565).

Stecher, B., & Chun, L. (2001). *School and classroom practices during two years of educa-*

tion reform in Washington state. Los Angeles: University of California.

Willis, J., Thompson, A., & Sadera, W. (1999). Research on technology and teacher education: Current status and future directions. *Educational Technology Research and Development*, 47(4), 29-45.

Wood, J. M. (2000). *Innovative teachers hindered by the green-eyed monster*. Retrieved March 3, 2002, from www.edletter.org/past/issues/2000-ja/innovative.html

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 272-288, copyright 2007 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.20

Evaluating the Learning Effectiveness of Using Web-Based Instruction: An Individual Differences Approach

Sherry Y. Chen
Brunel University, UK

ABSTRACT

The use of Web-based instruction is becoming widespread in higher education; however, much remains to be learned about how different learners react to such instructional programs. The study presented in this article evaluates students' learning performance and their perceptions in a Web-based instructional program, which was applied to teach students how to use HTML in Brunel University's Department of Information Systems and Computing. Sixty-one master's students participated in this study. A number of interesting interactions were found. Students' task achievements were affected by the levels of their previous system experience. On the other hand, the post-test and gain scores were positively influenced by their perceptions and attitudes toward the Web-based instructional program. The implications of these findings are discussed.

INTRODUCTION

Due to the popularity of the World Wide Web (Web), there has been a considerable growth in the use of Web-based instruction. Bonk et al. (2001) stated that no technology has so rapidly become prominent in educational settings as the Web-based instruction. From educational insights, Web-based instruction seems to provide answers to problems confronted by traditional teaching in higher education, such as large class (Freeman, 1997), and students from disperse locations (Dede, 1996). However, the drawback is that Web-based instruction employs hypermedia techniques to present information in a non-linear format. On the one hand, non-linear interaction provides learners some control over the instruction. On the other hand, the responsibility for designing learning paths becomes that of the students. Learners have to decide in what order the topics will be accessed (Sweany et al., 1996).

If learners lack such a skill, their performance may be hindered; in turn, they may have more negative attitudes toward using Web-based instruction programs (Dringus, 2000). It suggests that the use of the Web-based instruction may not improve learning effectiveness (Cummings, Bonk & Jacobs, 2002), and individual differences are critical factors for the successful use of Web-based instruction programs (Chen, 2002). However, there is little empirical evidence of the learning effectiveness of Web-based instruction (Bork, 2001). Therefore, many more empirical studies are needed, because such evaluation can provide concrete prescriptions for improving the design of Web-based instruction. In this vein, the study reported in this article aims to investigate how individual differences influence students' learning effectiveness within a Web-based instruction program.

The article begins by building a theoretical framework to present the relationships between Web-based instructional programs and individual differences. It then progresses to describe an empirical study of students' learning experiences in a Web-based instructional program. Subsequently, the design implications are discussed based on the findings of this empirical study.

THEORETICAL FRAMEWORK

Web-Based Instruction

Web-based instruction provides a revolutionary educational environment (Brooks, 1997), and it is increasingly being used to deliver course content in higher education (Nachmias & Segev, 2003). Perhaps the most obvious advantages perceived by the students are dynamic interaction and flexible schedule. In terms of dynamic interaction, the Web-based instruction presents an enormous amount of information through various interconnections that offer students a rich exploration environment. The development of Web-based

instruction provides learners with many opportunities to explore, discover, and learn in theory according to their own individual needs. Students can create individualized learning paths to reach the desired goals, move at their own speed and retrieve additional information as needed (Hui & Cheung, 1999). There is a shift away from didactic instruction to discovery of information (Smaldino, 1999). This approach is in line with the constructivist philosophy of learning where the learner is encouraged to interact with the environment to construct individual knowledge structure (MacDonald et al., 2001).

With regard to flexible schedule, Web-based instruction allows learners to read course content through a computer network at any time and at different places (Chang et al., 1998). Burton and Goldsmith (2002) found that such flexible schedule makes Web-based instruction appealing to the students, including the convenience of not having to be on campus during the week, ease of arranging personal commitments, and ability to take courses around work schedules. This type of learning may be particularly beneficial to individuals who live in remote places (Daugherty, 1998). The individuals living in remote areas can have access to the same course content as those living in big cities. This is the reason why many educators have tried to develop a distance-learning program on the Web. As pointed by Clark and Lyon (1999), the Web-based instruction has been predicted to be the future of all types of distance learning programs.

However, these advantages may come with a price. Power and Roth (1999) reported that the Web-based instruction is more dynamic and flexible than other learning material, but it creates new challenges related to the effect on learners' comprehension. Ng and Gunstrone (2002) indicated that although students had positive perceptions to self-based learning provided by Web-based instruction, the unstructured nature of the Web made some of the students need more time to search information. Quintana (1996) stated that

while students gained the advantage of flexibility in time, pace, and distance with Web-based instruction, many students, on the other hand, felt isolated, experienced lack of motivation, or lack of support and feedback, and consequently to dropped out of the course. Hedberg, Harper, and Corrent-Agostinho (1998) indicated that some students are still working to come to grips with a new and difficult way of learning. They exemplify the concern by asking for more incentive, more time, more structure, and more guidance.

These studies provide evidence that not all types of students appreciate being given freedom in their learning processes. In particular, students who need more guidance through the learning process may meet an increased number of problems in using the Web-based instructional programs. To address this limitation, the Web-based instruction should be developed to support the unique needs of each individual learner (Carter, 2002). Only when their needs are identified can developers of programs effectively enhance functionality and increase learners' satisfaction (Ke, Kwakkelaar, Taic & Chen, 2002). Therefore, understanding of learners' individual differences arguably becomes an important consideration in the development of Web-based instruction programs.

Individual Differences

Individual differences play an important role in learning. Individuals differ in traits such as skills, aptitudes and preferences for processing information, constructing meaning from information and applying it to real-world situations (Jonassen & Grabowski, 1993). The effects of users' individual differences on task performance in a computer-based learning environment have been one of the growing research areas (Wang & Jonassen, 1993). According to Egan, there are at least two reasons why system designers should pay attention to the differences among the users:

“First, individual differences usually play a major role in determining whether humans can use a computer to perform a task effectively. Second, our understanding and technology have reached the point where it is possible to accommodate more user differences.” (Egan, 1988, p. 544)

Individual differences variables that have been found to be influential factors accounting for learning performance include gender differences (Ford & Chen, 2000; Ford & Miller, 1996), domain knowledge (Lawless & Kulikowich, 1998), and system experience (Chen & Ford, 1998; Reed & Oughton, 1997). In terms of gender differences, previous research indicates that gender differences influence users' navigation strategies in Web-based instruction. Schwarz (2001) found that females and males request different kinds of support when locating particular information. Male users need a larger frame of reference while female users ask procedural directions.

With respect to domain knowledge, research suggests that less knowledgeable users experienced more disorientation problems in Web-based instruction (Last et al., 2001). This may be due to the fact that they are unfamiliar with the subject matter of the text, so they cannot rely on prior knowledge to help them structure the text. On the other hand, more knowledgeable users may experience fewer navigation problems because their greater grasp of the conceptual structure of the subject matter can enable them to impose structure on the Web (McDonald & Stevenson, 1998). In regard to system experience, novices and experts demonstrate different attitudes toward the use of Web-based instruction. Liaw (2002) found students' experience using the Internet to be a good predictor of their computer and Web attitudes. Furthermore, Torkzadeh and Van Dyke (2002) found the transition from low experience to high experience could improve Internet self-efficacy.

Results from these studies suggest that individual differences play an important role in the

use of Web-based instruction programs. These studies also indicate that further empirical works are needed to identify the learners' different preferences, and their results may help to guide the development and evaluation of Web-based instructional programs. This article presents such a study, which aims to examine how individual differences influence students' learning effectiveness within a Web-based instructional program.

RESEARCH DESIGN

Web-Based Instruction Program

The Web-based instructional program that was used to host the HTML tutorial began by introducing the learning objectives and explaining the available navigation approaches provided in the instructional program. The contents were divided into three sections: (1) What is HTML? (2) Working with HTML, and (3) Relations with SGML and WWW. Section 2 is the key element of the Web-based instructional program that covers 12 sub-topics of HTML authoring. Each sub-topic was further split into five parts comprising (a) overview, (b) detailed techniques, (c) examples, (d) related skills, and (e) references. Information

was presented in texts, tables, index, and maps.

The tutorial screen was divided using frames. In the top frame, there was a title bar showing the section name being viewed and the other available section buttons. In the left frame were the Main Menu, Index, Map, and Quit buttons. The right frame displayed the main content for each section, including topic buttons and text-based hypertext links.

In terms of navigation control, the Web-based instruction program took advantage of the features of non-linear learning and provided students with freedom of navigation. Topics and sub-topics could be studied in any order. In other words, students were allowed to decide their own navigational routes through the subject matter. Three types of navigation control were available in this tutorial as shown in Table 1.

Pre-Test & Post-Test

Examining student learning outcome in theoretical knowledge was conducted by using a pre-test and a post-test methodology. The students were evaluated with the pre-test to examine their levels of prior HTML knowledge and with the post-test to assess learning achievement. Both tests were presented in paper-based formats and included

Table 1: Illustration of the Three Types of Navigation Control

| Control | Purposes | Tools |
|-------------------------|--|---|
| <i>Sequence Control</i> | To allow students to decide the sequence of subjects to be learn | <ul style="list-style-type: none"> • <i>Subject Maps</i>: to show all topics and sub-topics in a hierarchical way; • <i>Keyword Index</i>: to list keywords in an alphabetical way; • <i>Back/Forward</i>: to see the page previously visited; |
| <i>Content Control</i> | To allow students to control the selection of the contents they wish to learn | <ul style="list-style-type: none"> • <i>Section Buttons</i>: to choose three sections of the main content; • <i>Main Menu</i>: to present main topics; • <i>Hypertext Links</i>: to connect relevant concepts; |
| <i>Display Control</i> | To allow students to choose one of several display options that cover the same concept | <ul style="list-style-type: none"> • <i>Display Options</i>: to include overview, examples, detailed techniques, and so forth. |

20 multiple-choice questions with only one right answer. The formats of the questions were similar, with only the specific subject of the question modified. The questions covered all three sections of the Web-based instruction program from basic concepts to advanced topics.

Students were allotted 20 minutes to answer each test and were not allowed to examine the content presented in the program at the same time. Student learning outcome was assessed by:

- *Post-Test Score*: each student's score on the post-test, ranging from 0 to 20, in order to identify general learning performance;
- *Gain Score*: score difference between the pre-test and post-test in order to measure improved learning performance by taking the HTML tutorial.

Task Sheet

Students were assigned to do a practical task that involved constructing a Web page using Notepad in order to measure skill-based learning outcomes. The practical task entailed 10 key areas (e.g., creating hypertext links, changing background colors, formatting text, etc.). A printed task sheet describing the detailed features of the Web page to be completed was given to the students, who were allowed to decide the order in which they attempted to complete the task activities on the sheet. They were also allowed to look at the content of the HTML tutorial simultaneously. One and a half hours were allocated to complete the task. The starting time and the end time for each student were recorded. Student task achievement was evaluated by:

- *Task Score*: a score consisting of summing items successfully completed, on a 0-10 scale;
- *Task Time*: the total time spent for completing the tasks.

Exit Questionnaire

The questionnaire was divided into two parts. The first sought information regarding biographical data relating to the student and her/his experience of using computers, the Internet, and HTML. The second, which was the main focus, consisted of three open-ended questions and 47 closed statements to collect student responses to the Web-based instructional program. It took students approximately 20 minutes to respond to all of the questions.

The open-ended questions were related to student opinions about the strengths and weaknesses of the HTML tutorial and the barriers that they met. Students were requested to express their opinions in their own words. Enough space was provided for them to write their opinions. The closed statements were designed to collect information about student comprehension, preferences, and satisfaction or dissatisfaction with the Web-based instructional program. It included five sections: (A) level of understanding; (B) content presentation; (C) interaction styles; (D) functionality and usability; and (E) difficulties and problems.

Each closed statement could be classified as either in favor or not in favor of the program. The number of "favored" statements was almost equal to the "not-favored" statements (20 favored statements and 27 not-favored statements), in an attempt to reduce bias in the questionnaire. All statements used a five-point Likert scale consisting of: "strongly agree," "agree," "neutral," "disagree," and "strongly disagree". Students were required to indicate agreement or disagreement with each statement by placing a check mark at the response alternative that most closely reflected their opinion. Their perceptions and attitudes were measured by:

- *Positive Perceptions*: the total score for all favored statements of the exit questionnaire with the same Likert scale;

- *Negative Attitudes*: the total score for all not-favored statements of the exit questionnaire with the same Likert scale.

Procedure

All participants took part in the study in the same room at the same time and interacted with the Web-based instructional program using Microsoft's Internet Explorer. The participants were asked to do the following activities:

1. Complete the pre-test to ascertain levels of prior knowledge of HTML
2. Interact with the Web-based instructional program (i.e., HTML Tutorial)
3. Complete a practical task, which involved constructing a Web page using HTML
4. Complete the post-test to identify their learning performance
5. Complete a paper-based exit questionnaire to describe their personal details and to reflect on their opinions of the Web-based instructional program.

Data Analyses

To investigate how individual differences influence student learning in the Web-based instructional program, the data obtained from pre- and post tests, practical tasks, and exit questionnaire were used to conduct statistical analyses to identify student learning experiences. Pearson's r was applied to find the correlations between individual student differences (i.e., gender differences and prior knowledge) and their learning experience (i.e., learning performance and perceptions). The Pearson correlation test reveals the nature and extent of association between two variables and is appropriate for the analyses of binary data and interval data (Stephen & Hornby, 1997). A significance level of $p < .05$ was adopted for the study. In addition, the mean scores are employed to describe the learning outcome for each individual group.

FINDINGS

Overall Results

The participants ($N=61$) consisted of Master's students at Brunel University's Department of Information Systems and Computing. Despite the fact that the participants volunteered to take part in the experiment, the sample was evenly distributed in terms of gender and system experience. They were 32 males and 29 females. The computer experience and Internet experience reported by the participants ranged from average to excellent on a five-point scale. Their familiarity with the subject content, *HTML authoring*, ranged from none to good. There was similar proportion of computer and Internet experience and HTML authoring in both male and female groups. In terms of the perceptions and attitudes, a majority of the students (78%) felt that the Web-based instruction program was useful and they liked the Web treatment of the content.

Tasks vs. Tests

As indicated earlier, students needed to be assessed by both practical task and paper-based tests. It is important to note that both task and tests were markedly different; distinctions similar to those between open-book examination and closed-book examination were noted. The practical task was completed in open-book examination style, with students building Web pages guided by the task sheet. The practical task could be completed successfully without recourse to memory by applying knowledge read from the screen at the particular time it was needed. On the other hand, the post-test, which was a multiple choice factual test, entailed recalling knowledge from memory, and completed after learning using the Web-based instructional program, looked like a closed-book examination. These differences can also be associated with those between *procedural knowledge* and *declarative knowledge*.

Derry (1990) distinguishes between these two. Procedural refers to knowledge of how to do things, while declarative refers to knowledge about the world and its properties (McGilly, 1994). Practical tasks refer to procedure knowledge of how to use HTML, while paper-based tests refer to declarative knowledge about the properties of HTML.

Pearson's correlations found that student task scores were affected by the levels of their previous Internet experience ($r=.44$) and HTML authoring ($r=.35$). On the other hand, the post-test and gain scores were positively influenced by student perceptions and attitudes toward the Web-based instructional program. In other words, the students who had more positive perceptions toward the Web-based instructional program ($r=.40$) could obtain better post-test and gain scores than those who had more negative attitudes ($r=.46$) toward the program.

The findings of the study implied that performance on the practical task of applying procedural knowledge could be promoted by prior system experience in using the Internet and HTML authoring, but it would not be affected by the matching or mismatching of instruction with the student preferences. Conversely, the ability to recall declarative knowledge appears to have been mainly facilitated by matching instructional presentation with learners' preferences, but it is not influenced by prior system experience of using the Internet and HTML authoring.

Gender Differences

There were interesting correlations between student learning performance and gender differences. Female students performed better than male students in the post-test. Conversely, the male students outperformed the female students in the practical task ($r=.39$). The differences between the post-test and practical task can be related with those between declarative knowledge and procedural knowledge. It implies that female students

are better at acquiring declarative knowledge rather than procedural knowledge. Conversely, male students are skilled at gaining procedural knowledge instead of declarative knowledge.

For learning attitudes, male students were patient in completing the task. On the other hand, female students felt nervous doing the tasks, and some of them ($N = 10$) gave up doing the tasks within 15 minutes. In addition, female students needed more guidance than male students did. Female students tended to ask for instruction from the tutor instead of trying to correct errors by themselves. These findings are in line with some previous studies that found males showed more interest in using and learning about computers while females reported fear of using computers and feeling helpless around them (Koch, 1994; Shashaani, 1994). For this phenomenon, educators should help female students build their confidence in facing the challenge of using computers instead of giving too detailed instructions. In addition, educational settings should ensure that instructional programs developed should not place any students at a disadvantage due to their gender differences (Owen & Liles, 1998).

Prior Knowledge

Through analyzing student prior knowledge, one thing seems evident. For doing practical tasks, students who had greater experience using the Internet ($r=.27$) or HTML authoring ($r=.28$) seemed able to look for relevant information in an efficient way. Conversely, students who were lacking prior knowledge of the subject content needed more time to decide the learning paths for completing the task. It seemed that students' existing knowledge did influence their interaction with the Web-based instructional program. These findings arguably supported results from previous studies (Gay, 1986; Shih & Gamon, 1999) that found a positive relationship between learner control and prior knowledge.

Expert learners who had an adequate amount of prior knowledge of the subject felt familiar with the interface and the contents of the Web-based instructional program. They were confident about being more active when navigating the Web-based instructional system. On the other hand, novice learners might not be aware of the best order to read the material or recognize the most important information. Therefore, it is important to provide novice learners with an initial phase of orientation relating to both interface and domain contents (Linard & Zeillger, 1995). One of the ways is to provide visual paths that can be displayed by means of cues to indicate how far students are along a path or by giving some conceptual description for the possible sequences. The alternative way is to provide good labels for the pages. Labels that clearly indicate the role of a particular page may help novices successfully decide on the appropriate coherent path (Lewis & Polson, 1990).

Learning by Doing

In this Web-based instruction program, students were asked to do a practical task (i.e., design a Web page with HTML). A significant number of students (44%) reported that doing the task was a useful way of helping them to set a focus in the Web-based instructional program. From these 44% of students, 52% of them could obtain the post-test scores above the average (= 10.4) and 63% of them demonstrated more positive perceptions of the Web-based instructional program. These results implied that “learning by doing” could assist some students to set their effective learning strategies. As indicated by Smith and Parks (1997), tasks serve to simulate “goal directed” browsing in such a way that learning performance can be enhanced.

On the other hand, a few students (30%) reported that doing the task hindered their learning. They found that they lost other important information that they needed to learn because

they were concentrating on doing the task. From these 30% of students, 58% of them obtained the post-test scores below the average and 54% of them showed more negative attitudes toward the Web-based instructional program. This raises some interesting questions for further studies to consider (a) whether task activities can facilitate promoting student learning performance in a Web-based instructional program; and (b) what the relationships are between student attitudes and their learning patterns as reflected in a Web-based instructional program with/without setting tasks.

CONCLUSIONS

The aforementioned findings provide evidence that Web-based instructional programs may not be suitable for all learners as an instructional methodology. Instructors must be aware of individual differences such as gender and levels of prior knowledge possessed. Some learners, for example novice learners, may need greater support and guidance from the instructors, while others may be able to follow Web-based instructional programs relatively independently. Thus, instructors should not assume that every student would benefit equally from Web-based instructional programs in educational settings. There remains the need for guidance to ensure that all learners attain their learning potential.

Implementing Web-based instructional programs is a complex process composed of interactions among students, instructional content, and the features of Web-based instructional programs. It is important for educational settings to have a good plan in advance. Instructors should remain cautious about making a sweeping decision to convert entire curricula into Web-based instructional programs. The goals of such a process should be weighed against the potential problems (e.g., alienating certain learners). To avoid alienating a certain group, instructors should continue to

incorporate a number of different teaching strategies into their lectures. In addition, this transition requires time for the student and time in the classroom to acquaint the students with Web-based instructional programs. This is especially the case for students who have difficulties in independent learning; there is a need to let them have more time for this shift. With this issue in mind, such innovation in teaching and learning will be more meaningful and valuable.

This study has shown the importance of understanding individual differences in the development of Web-based instructional programs, but it was only a small-scale study. Further studies need to be undertaken with a larger sample to provide additional evidence. The other limitation is that this study adopted a self-developed pre-test and post-test, so the reliability and validity of these tests are questionable. Therefore, testing and modification of the tests are needed in the future. There is a need to conduct future research that would examine the impact of other individual differences such as cognitive styles, cultural background, or domain knowledge. Such research should also be conducted within a more sophisticated multimedia Web-based instructional program, including the presentation of animation and video. It would be interesting to see how individual differences influence student learning in multimedia Web-based instructional programs. The findings of such studies could be integrated to build robust user models for the development of personalized Web-based instructional programs that can accommodate individual differences.

ACKNOWLEDGMENT

This study has been performed as part of the project "Human Factors in the Design of Adaptive Hypermedia Systems: A Cognitive Style Approach" funded by the UK Engineering and Physical Sciences Research Council (EPSRC Grant References: GR/R57737/01).

EDITOR'S NOTE

The author has generously offered an expanded discussion of the research design as well as the survey instruments and assessment tools explored in this article. For copies of this supplementary information, please contact the author via e-mail.

REFERENCES

- Bonk, C.J., Kirkley, J., Hara, N., & Dennen, V.P. (2001). Finding the instructor in post-secondary online learning: Pedagogical, social, managerial and technological locations. In J. Stephenson (Ed.), *Teaching & learning online: Pedagogies for new technologies*. London: Kogan Page.
- Bork, A. (2001). What is needed for effective learning on the Internet? *Educational Technology & Society*, 4(3). Retrieved October 10, 2002 from: http://ifets.ieee.org/periodical/vol_3_2001/bork.html
- Brooks, D.W. (1997). *Web-teaching: A guide to designing interactive teaching for the World Wide Web*. New York: Plenum.
- Burton, L., & Goldsmith, D. (2002). *Students' experience in online course: A study using asynchronous online focus groups*. Connecticut Distance Learning Consortium, CT.
- Carter, E.W. (2002). Doing the best you can with what you have: Lessons learned from outcomes assessment. *Journal of Academic Librarianship*, 28, 36-41.
- Chang, H.H., Henriquez, A., Honey, M., Light, D., Moeller, B., & Ross, N. (1998). *The Union City story: Education reform and technology students' performance on standardized tests*. New York: Center for Children and Technology.
- Chen, S.Y. (2002, December 10-13). The relationships between individual differences and the quality of learning outcomes in Web-based instruction. *Proceedings of the ICEB 2nd International Conference on Electronic Business* (pp. 345-351). Taipei, Taiwan.

- Chen, S.Y., & Ford, N.J. (1998). Modeling user navigation behaviours in a hypermedia-based learning system: An individual differences approach. *International Journal of Knowledge Organization*, 25(3), 67-78.
- Clark, R., & Lyons, C. (1999). Using Web-based training wisely. *Training*, 36(7), 51-61.
- Cummings, J.A., Bonk, C.J., & Jacobs, F.R. (2002). Twenty-first century college syllabi options for online communication and interactivity. *The Internet and Higher Education*, 5(1), 1-19.
- Daugherty, M., & Funke, B.L. (1998). University faculty and student perceptions of Web-based instruction. *Journal of Distance Education*, 13(1), 21-39.
- Dede, C. (1996). Emerging technologies in distance education for business. *Journal of Education for Business*, 71(4), 197-204.
- Derry, S.J. (1990). Learning strategies for acquiring useful knowledge. In B.F. Jones & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 347-379). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Dringus, L.P. (2000). Towards active online learning: A dramatic shift in perspective for learners. *The Internet and Higher Education*, 2(4), 189-195.
- Egan, D. (1988). Individual differences in human-computer interaction. In M. Helander (Ed.), *Handbook of human-computer interaction* (pp. 543-568). North-Holland: Elsevier.
- Ford, N., & Chen, S.Y. (2000). Individual differences, hypermedia navigation and learning: An empirical study. *Journal of Educational Multimedia and Hypermedia*, 9(4), 281-312.
- Ford, N., & Miller, D. (1996). Gender differences in Internet perceptions and use. *Aslib Proceedings*, 48, 183-92.
- Freeman, M. (1997). Flexibility in access, interaction and assessment: The case for Web-based teaching programs. *Australian Journal of Educational Technology*, 13(1), 23-39.
- Gay, G. (1986). Interaction of learner control and prior understanding in computer-assisted video instruction. *Journal of Educational Psychology*, 78(3), 225-227.
- Hedberg, J.G., & Corrent-Agostinho, S. (2000). Creating a postgraduate virtual community: Assessment drives learning. *Educational Media International*, 37(2), 83-90.
- Hui, S., & Cheung, K.P. (1999). Developing a Web-based learning environment for building energy efficiency and solar design in Hong Kong. *Solar Energy*, 67(1-3), 151-159.
- Jonassen, D.H., & Grabowski, B.L. (1993). *Handbook of individual differences, learning, and instruction*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Ke, H., Kwakkelaar, R., Taic, Y., & Chenc, L. (2002). Exploring behavior of e-journal users in science and technology: Transaction log analysis of Elsevier's ScienceDirect OnSite in Taiwan. *Library & Information Science Research*, 24(3), 265-291.
- Koch, M. (1994). No girls allowed! *Technos*, 3, 14-19.
- Lawless, K.A., & Kulikowich, J.M. (1998). Domain knowledge, interest and navigation: A study of individual differences. *Journal of Educational Multimedia and Hypermedia*, 7, 51-69.
- Lewis, C., & Polson, P.G. (1990). Theory-based design for easily learned interfaces. *HCI*, 5, 191-220.
- Liaw, S.-S. (2002). An Internet survey for perceptions of computers and the World Wide Web: Relationship, prediction, and difference. *Computers in Human Behavior*, 18, 17-35.
- Linard, M., & Zeillger, G. (1995). Designing navigational support for educational software. *Proceedings of Human Computer Interactions* (pp. 63-78).
- McDonald, C.J., Stodel, E.J., Farres, L.G., Breithaupt, K., & Gabriel, M.A. (2001). The demand-driven learn-

Evaluating the Learning Effectiveness of Using Web-Based Instruction

- ing model: A framework for Web-based learning. *The Internet and Higher Education*, 4(1), 9-30.
- McGilly, K. (1994). *Classroom lesson: Integrating cognitive theory and classroom practice*. Cambridge, MA: MIT.
- Ng, W., & Gunstone, R. (2002). Students' perceptions of the effectiveness of the World Wide Web as a research and teaching tool in science learning. *Research in Science Education*, 32(4), 489-510.
- Owen, M.B., & Liles, R. (1998). *Factors contributing to the use of Internet by educators*. Available: <http://outreach.missouri.edu/netc98/manuscripts/owen-liles.html>
- Power, D.J., & Roth, R.M. (1999). Issues in designing and using Web-based teaching cases. *Proceedings of the 5th Americas Conference on Information System (AMCIS 1999)* (pp. 936-938).
- Quintana, Y. (1996). *Evaluating the value and effectiveness of Internet-based learning*. http://www.crim.ca/inet96/papers/c1/c1_4.htm
- Rafi Nachmias, R., & Segev, L. (2003). Students' use of content in Web-supported academic courses. *The Internet and Higher Education*, 6(2), 145-157.
- Reed, W.M., & Oughton, J.M. (1997). Computer experience and interval-based hypermedia navigation. *Journal of Research on Computing in Education*, 30, 38-52.
- Schwarz, J. (2001). *Lost in virtual space: Gender differences are magnified*. Retrieved October 15, 2002 from: <http://www.washington.edu/newsroom/news/2001archive/06-01archive/k061301.html>
- Shashaani, L. (1994). Gender differences in computer experience and its influence on computer attitudes. *Journal of Educational Computing Research*, 11(4), 347-367.
- Shih, C., & Gamon, J. (1999). *Student learning styles, motivation, learning strategies, and achievement in Web-based courses*. Available: <http://iccel.wfu.edu/publications/journals/jcel/jcel990305/ccshih.htm>
- Smaldino, S. (1999). Instructional design for distance education. *Techtrends*, 43(5), 9-13.
- Smith and Parks. (1997). *Virtual hierarchies and virtual networks: Some lessons from hypermedia usability research applied to the World Wide Web*. Retrieved December 4, 1998 from: <http://ijhcs.open.ac.uk/smith/smith-nf.html>
- Stephen, P., & Hornby, S. (1997). *Simple statistics for library and information professionals*. London: Library Association.
- Sweany, N.D., McManus, T.F., Williams, D.C., & Tothoro, K.D. (1996). *The use of cognitive and metacognitive strategies in a hypermedia environment*. Poster presented at World Educational Media Conference, Boston, MA.
- Torkzadeh, G., & Van Dyke, T.P. (2002). Effects of training on Internet self-efficacy and computer user attitudes. *Computers in Human Behavior*, 18, 479-494.
- Wang, S.R., & Jonassen, D.H. (1993). *Investigating the effects of individual differences on performance in cognitive flexibility hypertexts*. Annual Meeting of the American Educational Research Association, Atlanta, GA.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 1, No. 1, edited by L. Tomei, pp. 69-82, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 4.21

Quality of Online Learning Applications: Impact on Student Enjoyment, Motivation, and Anxiety

Leping Liu

University of Nevada, USA

ABSTRACT

The purpose of this study was to explore the influence of the design-quality of current online K-12 learning applications on student learning via three learning-related variables (student enjoyment, motivation and anxiety level when using those online applications). Nine hundred online K-12 applications (WebQuests, online drills, games, tests and other applications) were evaluated in terms of four design factors (quality of information, design of information, quality of technology use and design of technology use) in relation to the three learning-related variables. Three prediction models were generated and tested in this study. An intermediate effect was found between the design of online application and student learning, which may provide some insights for teachers when they integrate online applications into teaching and learning. The target audience of this chapter may be school teachers, designers or professionals who use online applications for educational purposes.

INTRODUCTION

The Internet has been used in many ways to promote teaching and learning (Aviv & Golan, 1998; Barnard, 1997; Berge, 1997; Coombs & Rodd, 2001; Lengel & Lengel, 2006; Thorsen, 2006), from the use of Web-based resource to the employment of Web-based instruction (Berge, Collins, & Dougherty, 2000; Bonk, Cummings, Hara, Fischler, & Lee, 2000; Cunningham & Billingsley, 2006; Fishman, 1997; Miller & Miller, 2000; Riel, 1992; Trentin, 2001). In the literature, one common use of the Web in K-12 teaching and learning appeared to be the utilization of existing online learning applications, such as tutorials, drills, games or video products developed and posted onto the Web by other educators or designers (Clark & Jorde, 2004; Glazer, 2004; Hillman & Moore, 2004; Liu, 2001; Lombard, 2004; Murphy, 2004; Perkins & McKnight, 2005; Shelly, Cashman, Gunter, & Gunter, 2003; Stvan, 2005). It is hard to imagine and estimate the num-

ber of learning applications available on the Web today: A Google search on “math game” resulted in 691,735 items; and a random exploration on 10 links found that on average, 25 to 35 online math games were under each link.

Unfortunately, the effectiveness of using those online learning applications on student learning achievement was ambiguous (Maddux, Ewing-Taylor, & Johnson, 2002). In a study that consisted of 102 technology integration cases, Johnson and Liu (2000) found that the use of existing Web activity did not significantly contribute to either the success of the technology integration or student learning outcome. The issue is that if the use of those online applications could not effectively improve learning, such tremendous amount of resources would be a huge waste, and sometimes may cause confusion.

Many studies have explored the possible causes of such unsatisfied use of the Web, and suggested that a lack of design was one common weakness in educational applications, such as online communication, online course and online instructional content or activity (Liu & Maddux, 2003; Liu, 2003; Schweizer, Whipp, & Hayslett, 2002; Boer & Collis, 2001). The purpose of this study is to explore the influence of the design quality of current K-12 online learning applications on student learning.

In this chapter, first, the definitions and major types of K-12 online learning applications are introduced. Next, variables examined in this study are identified, including four design-related variables that are derived from a technology integration model (Liu & Velasques-Bryant, 2003; Liu & Johnson, 2003a, 2003b), and three learning-related variables that have been found to have direct impact on learning achievement (Liu & Johnson, 1998; Liu, Maddux, & Johnson, 2004). The four design-related variables are then used to evaluate the quality of 900 online K-12 learning applications in relation to the three learning-related variables. At the end, a set of quality-

related models that illustrate the relationships are generated and tested.

LITERATURE REVIEW

Online Learning Applications

In the context of current study, the term *online learning application* can be defined as *any entity of instructional contents or activities delivered through the Web* that has the following features:

1. It intends to teach a focused concept
2. It meets specific learning objectives
3. It provides a learner-centered context
4. It is an individual piece that can be used and reused.

The concept of *learning application* in this chapter is very much similar to that of a widely discussed term—*learning object*, besides that a learning object is an object-oriented application (Barker, Winterstein & Wright, 2004; Murphy, 2004; Doderer, Aedo, & Diaz, 2002). The author carefully chose not to use the term *learning object*, because some learning applications examined in this study were not object-oriented, and could not concisely fit the definition of a learning object.

Types of Online Learning Applications

A learning application can present learning content, provide learning activity, contain simulation or allow for student assessment. Generally, types of online learning applications can be sorted by format and function.

Two major formats of online learning application are: (a) hypertext-format, and (b) hypermedia-format. Hypertext-format learning applications are developed with HyperText Markup Language (HTML) or other hypertext editors. Examples

include WebQuests, online lecture notes, reading materials or other text-based instructional materials. There are two types of hypermedia-format learning applications: One type includes applications developed directly with scripting language, such as HTML, DHTML, XHTML or JAVA; incorporating with multimedia products, such as graphics, animations, video or audio clips. The other type includes those initially developed with multimedia authoring software, such as Flash, Director, Authorware, ToolBook or HyperStudio. They are converted to a Web run-version, and then published onto the Internet. Examples can be online games, drills, tests or video products.

Two major functions of current online learning applications are: (1) providing information, and (2) providing interactions. Some applications are developed to provide content information or guidelines to learning activities, most of which are hypertext format. Some dynamic Web activities or those pre-designed multimedia instructional programs are developed to carry out interactions, which enable users to interact with the learning application directly from the Web. Currently, more and more online learning applications tend to have both functions.

To select an appropriate online learning application for students, teachers may want to consider whether its format and function fit the learning objectives, content structures, the nature of activities or the grade level of the students. The selection is usually based on the design-related quality of the application.

DESIGN OF THE STUDY

Design-Related Variables

According to a design model Liu and Velasques-Bryant (2003) summarized from a review of 20 years' research and practice in the field of technology integration, successful design of a technology-based instructional application

should reflect the *merging* of three components: information, technology and instructional design. Based on this model, four variables are identified to measure the design-related quality of an online learning application:

1. **Quality of information:** Evaluates the quality of content information (e.g., the accuracy, clarity, currency or verifiability of the contents).
2. **Design of information:** Measures the extent to which instructional design components are integrated into the content (e.g., audience analysis, content analysis, assignment design and delivery, assessment implementation, or the match between the required thinking skill and the developmental stage of the targeted audience).
3. **Quality of technology-use:** Measures the quality of technology applied in the learning application (e.g., screen design, orientation, navigation or interactions).
4. **Design of technology-use:** Examines the extent to which instructional design principles are integrated into the use of technology (e.g., the match between content information and the media use or delivery methods, or the match between required technology skill and the grade level of targeted audience).

All online learning applications in this study were evaluated with these four design-related variables in relation to three learning-related variables.

Learning-Related Variables

Research findings suggest that student learning achievement is influenced by three variables: enjoyment, motivation and anxiety (Liu, Maddux & Johnson, 2004; Liu, 1999; Liu & Johnson, 1998). Students tend to have better performances and higher achievement scores when they enjoy learning (Temple & Lips, 1989; King & Bond,

1996), are motivated to learn (Kellenberfer, 1996; Clariana, 1993; Keller, 1983) or feel less anxious to learn (Liu, 1997; Ayersman, 1996). This study examined these three learning-related variables in terms of how students feel about using an online learning application:

1. **Enjoyment:** Measures the degree to which a student enjoys learning with an online application
2. **Motivation:** Measures the extent to which a student is motivated to learn with an online application
3. **Freedom from anxiety:** Measures the anxiety level of a student when he or she learns with an online application.

According to the purpose of this study, the three learning-related variables were examined to determine an *intermediate effect*, as described in the following logic procedures.

Underlying Logic of the Study

This study was designed to explore the relationships among: A) the design-quality of an online learning application, B) learning-related variables, and C) student learning achievement. The underlying logic of current study follows the three steps:

1. We have known that B influences on C (from literature)
2. If we can determine that A influences B (to be determined), then
3. We can conclude that A can influence C via B (conclusion).

Based on this conclusion, we say that B is the intermediate *variable* between A and C; and the influence “transferred” via B between A and C is the *intermediate effect*. In other words, knowing that learning-related variables influence learning achievement, if the quality of learning applications

influences the learning-related variables, we can conclude that the quality of the learning applications influence learning achievement indirectly, and therefore, an *intermediate effect* exists. This is a method known as *detecting intermediate variable or effect* in educational research (Liu, Maddux & Johnson, 2004). In this study, only the second step was examined.

RESEARCH QUESTIONS

The research questions for this study were:

1. Can *enjoyment* (the degree to which a student enjoys learning with an online application) be predicted by any of the four design variables?
2. Can *motivation* (the extent to which a student is motivated to learn with an online application) be predicted by any of the four design variables?
3. Can *freedom from anxiety* (the anxiety level of a student when he or she learns with an online application) be predicted by any of the four design variables?

METHODOLOGY

Samples

The sample of this study was 900 online K-12 learning applications on the subject areas of arithmetic, algebra, geometry, reading, writing, science, Spanish, history, geography and social science. They were WebQuests, instructional materials, drills, games, tests and instructional video clips. More than 92% of the WebQuests and instructional materials were hypertext information; and more than 86% of the drills, games and tests were hypermedia applications with online interactions.

Of the 900 online learning applications, 375 (see Table 1) were selected by 75 graduate teacher education students, from six classes of an introductory technology course in a western state university from 2002 to 2004. The other 525 applications (see Table 2) were selected by 105 graduate teacher education students, from four classes of an introductory technology course and four classes of a design course in an eastern state university from 1999 to 2002. The distribution of the subject areas and the types of applications are shown in Tables 1 and 2.

Procedures

The author was the instructor of all three courses in the two universities. In the introductory information technology course, students learned basic computing skills and the strategies of technology integration. In the design course, students learned theory and design of computer-based instruction, and created multimedia instructional segments using authoring tools such as Director or ToolBook.

Data were obtained from a technology integration project required for all three courses. In completing this project, each student (referred to as a *mentor*) first located a K-12 student at any

Table 1. Online learning applications evaluated at the Western site

| | | Types of Learning Application | | | | | | | |
|---------------|--------------|-------------------------------|-------------------------|--------|-------|-------|--------|------------------|-------|
| | | WebQuests | Instructional Materials | Drills | Games | Tests | Videos | Other Activities | Total |
| Subject Areas | Arithmetic | 12 | | 14 | 16 | 10 | | | 52 |
| | Algebra | 10 | | 12 | 13 | 3 | | | 38 |
| | Geometry | 8 | 1 | 6 | 12 | 2 | | 1 | 30 |
| | Reading | 14 | 8 | 5 | 5 | 9 | 1 | 1 | 43 |
| | Writing | 5 | 2 | 15 | 15 | 5 | 4 | 1 | 47 |
| | Science | 6 | 3 | 11 | 18 | 6 | 4 | | 48 |
| | Spanish | 10 | 2 | 15 | 3 | 8 | 1 | | 39 |
| | History | 5 | 5 | 12 | 4 | 2 | 4 | | 32 |
| | Geography | 4 | | 5 | 8 | 3 | 1 | | 21 |
| | Social Study | 5 | 5 | 7 | 6 | 2 | | | 25 |
| Total | | 79 | 26 | 102 | 100 | 50 | 15 | 3 | 375 |

Table 2. Online learning applications evaluated at the Eastern site

| | | Types of Learning Applications | | | | | | | |
|---------------|--------------|--------------------------------|-------------------------|--------|-------|-------|--------|------------------|-------|
| | | WebQuests | Instructional Materials | Drills | Games | Tests | Videos | Other Activities | Total |
| Subject Areas | Arithmetic | 24 | 5 | 8 | 18 | 10 | | 1 | 66 |
| | Algebra | 10 | 2 | 8 | 8 | 7 | | | 35 |
| | Geometry | 8 | 1 | 16 | 10 | 5 | | | 40 |
| | Reading | 21 | 4 | 18 | 11 | 8 | 2 | 1 | 65 |
| | Writing | 19 | 3 | 16 | 12 | 10 | 2 | | 62 |
| | Science | 10 | 4 | 15 | 16 | 12 | 1 | | 58 |
| | Spanish | 20 | 5 | 11 | 10 | 8 | 2 | 1 | 57 |
| | History | 12 | 3 | 12 | 9 | 10 | 1 | 1 | 48 |
| | Geography | 9 | 6 | 11 | 10 | 8 | | | 44 |
| | Social Study | 23 | 5 | 7 | 9 | 6 | | | 50 |
| Total | | 156 | 38 | 122 | 113 | 84 | 8 | 4 | 525 |

grade level (referred to as a *protégé*). Together, they then determined five learning objectives in one to two subject areas.

After the objectives were determined, the mentor needed to select five online learning applications. He or she was required to do a thorough search on the Web, evaluate seven or more K-12 online learning applications using the design-quality instrument (Appendix A), and determine five applications consistent with the learning objectives.

The mentor then developed five lesson plans. He or she was required to create five learner-centered activities with the use of the five online applications. The instructor provided an instructional worksheet for the mentor to design those learning procedures and activities, which ensured that the major components and procedures of instructional design were included.

The protégé followed the lesson plans, interacted with the five online applications, performed the five activities and completed the assigned learning tasks. Simultaneously, the mentor observed the learning process, and scored the performances in terms of the protégé's enjoyment, motivation and anxiety level toward each online application (using the instrument in Appendix B).

By the time the technology integration project was completed, each mentor had evaluated five online applications and observed the protégé's performances on five learning activities. Therefore, he or she had collected 10 sets of data: five sets of quality evaluation scores on the online learning applications, and five sets of observation scores on the three learning-related variables.

The same procedures were repeated in all classes involved in this study from the two universities. All data were coded and saved for data analysis.

Instruments, Measurements and Scoring

As described above, two instruments were used in this study: The four design-related variables (*quality of information, design of information, quality of technology-use* and *design of technology-use*) were measured by a Likert-Style instrument (Appendix A) consisting of 32 positive statements sorted into four categories, with eight statements in each category. The eight statements in each category measured one design-related variable. Each statement was scored from 1 (strongly disagree) to 5 (strongly agree). The score for each variable was the sum of eight statements, and the highest possible score was 40. Higher scores represented better qualities of a learning application. The reliability coefficient alpha for this instrument was 0.826 from current study.

The three learning-related variables (*enjoyment, motivation and freedom from anxiety*) were measured by another Likert-Style instrument (Appendix B) consisting of 18 statements sorted into three categories, with three positive statements and three negative statements in each category. The six statements in each category measured one variable. The answer for each statement must be chosen from: strongly disagree (SD), disagree (D), undecided (U), agree (A) or strongly agree (SA). For the positive statements, the score for answer SA was the highest (5 points) and for SD was the lowest (1 point); for negative statements, reversely, the score for answer SD was the highest (5 points) and for SA was the lowest (1 point). The score for each variable was the sum of the six statements, and the highest possible score was 30. Higher scores indicate a more positive approach toward the use of an online learning application. The reliability coefficient alpha for this instrument was 0.832 from current study.

The seven variables were qualitative variables. In this study, they were measured quantitatively with the scoring method described above. The Likert scaling implied that each of the items had

the same “level of difficulty.” That is, respondents found them equally easy or difficult to endorse. The reliability coefficient alpha values (0.825 and 0.832) indicated that each instrument did reliably measure each variable, and the scores were “reasonably reliable for respondents like those in this study” (Green & Salkind, 2003, p. 315).

DATA ANALYSIS AND RESULTS

Data analysis was performed in two phases. In the first phase, the *western-data* (data from the western state university, $N = 375$) were used to perform multiple regression analyses in developing the prediction models. In the second phase, the *eastern-data* (data from the eastern state university, $N = 525$) were used to test the prediction models with paired t tests.

Data exploration plots showed that the assumptions of normality and equal variance were not violated, and no extreme outliers were found in the two sets of data.

Phase One: Model Development and Results

The *western-data* ($N = 375$) was used in three multiple regression analyses to develop the prediction models in correspondence with the three research questions. The four design-related variables were treated as predictor variables, and regressed to each of the three learning-related variables.

Results from the First Regression Analysis. In the first regression analysis, the predictor variables were the four design variables: *quality of information* (QI), *design of information* (DI), *quality of technology use* (QT) and *design of technology use* (DT); and the response variable was *Enjoyment* (E).

In the first run that included the four predictor variables, linear model was found significant ($F_{(4, 374)} = 96.373, p < 0.0001$), but one predictor variable—QI—was found not significant to the

model ($t = 0.664, p < 0.507$). Therefore, the next run only included the other three variables: DI, QT and DT. The results showed as the following

The linear regression trend was significant ($F_{(3, 374)} = 128.546, p < 0.0001$). The F ratio indicated that the linear model was the desired model that represented the data better than other regression models. The t statistic for each predictor variable was significant: *DI* ($t = 2.296, p < 0.022$), *QT* ($t = 5.491, p < 0.001$) and *DT* ($t = 5.339, p < 0.0001$), indicating that all three variables significantly contributed to the variation of the response variable *E*. R-Square of the model ($R^2 = 0.510$) indicated that around 51% of the variation of the response variable *E* could be explained by this model, or by the variation in the three design-related variables.

The regression analysis generated a set of coefficients that were used to formulate the *Regression Equation 1*:

$$E = -3.088 + 0.335(DI) + 0.105 (QT) + 0.342(DT)$$

According to this equation, a one-unit increase in DI, for example, would increase 0.335 units on the *E* score.

Results from the Second Regression Analysis. In the second regression analysis, the predictor variables were the same three design variables: DI, QT and DT, because QI was, again, found not significant to the model ($t = 0.222, p < 0.825$). The response variable was *Motivation* (*M*). The results showed as the following:

The linear model was significant ($F_{(3, 374)} = 128.546, p < 0.0001$), and the three predictor variables significantly influenced the response variable *M*, because the t statistics for all three variables were significant: *DI* ($t = 6.241, p < 0.010$), *QT* ($t = 2.259, p < 0.010$) and *DT* ($t = 5.179, p < 0.0001$). R-Square of the model ($R^2 = 0.539$) indicated that around 54% of the variation of the response variable *M* could be explained by this model, or by the variation in the three design-re-

lated variables. The regression analysis generated a set of coefficients that were used to formulate the *Regression Equation 2*:

$$M = -4.098 + 0.398(DI) + 0.123 (QT) + 0.324(DT)$$

According to this equation, a one-unit increase in QT, for example, would increase 0.123 units on the *M* score.

Results from the Third Regression Analysis.

In the third regression analysis, only two predictor variables were included: DI and DT, because *QI* ($t = 1.413, p < 0.153$) and *QT* ($t = 0.071, p < 0.944$) were found not significant to the model. The response variable was *Freedom from Anxiety (FA)*. The results showed as the following.

The linear model was significant ($F_{(2, 374)} = 174.435, p < 0.0001$), and the two predictor variables significantly influenced the response variable *FA*, because the *t* statistics for both variables were significant: *DI* ($t = 3.689, p < 0.010$) and *DT* ($t = 8.056, p < 0.0001$). Around 48% ($R^2 = 0.483$) of the variation of the response variable *FA* could be explained by this model, or by the variation in the three design-related variables. The regression analysis generated a set of coefficients that were used to formulate the *Regression Equation 3*:

$$FA = -3.299 + 0.259(DI) + 0.531(DT)$$

According to this equation, a one-unit increase in DT, for example, would increase 0.531 units on the score of *FA*.

The data analyses generated three prediction models, illustrated by equations 1, 2 and 3. The three models were then tested in the next phase.

Phase Two: Model Testing and Results

The *eastern-data* ($N = 525$) were used to test the three prediction models; that is, to examine whether the three models and the relationships

developed from *western-data* ($N=375$) could be used to predict the relationships in the *eastern-data*.

To test the first model (Enjoyment), for example, first we calculated the predicted values of *E* using *Regression Equation 1* (generated from the *western-data*) with the raw data in the *eastern-data*, through four steps:

1. Opening the *eastern-data* file from Excel
2. Creating a new column named “predicted enjoyment scores” next to the column that coded the original raw scores of *E*
3. Adding a calculation function on to this new column according to *Regression Equation 1*: $E = -3.088 + 0.335(DI) + 0.105 (QT) + 0.342(DT)$. In the calculation function, exact column names for the three predictor variables (DI, QT and DT) were used correspondingly. For example, in the datasheet, if the three variables were in columns C, D and E, then the function added into the first cell of the new column should be “=-3.088 + 0.335*C1 + 0.105*D1 + 0.342*E1”
4. Copying this function onto all the cells in the new column. All the calculated values then appeared in this new column, which were the predicted *E* scores.

Second, we tested the enjoyment model (expressed in *Regression Equation 1*) by examining whether there was any difference between the *predicted* values and the original *observed* values of the variable *Et*. If there was no difference, this model developed from the *western-data* had successfully predicted the relationships in the *eastern-data*.

Using this model testing method, we calculated the predicted values of the three response variables: *E*, *M* and *FA*. In addition, three paired *t* tests were conducted to compare the predicted values and observed values of each variable. Results showed that there was no difference between the predicted values and the observed values for each

of the three variables: E ($t_{(524)} = 0.108, p < 0.914$), M ($t_{(524)} = 0.403, p < 0.687$) and FA ($t_{(524)} = 0.011, p < 0.991$). The results indicated that these models could reliably predict the relationships between the quality of online application design and how students feel about using the applications.

The three prediction models have been tested and confirmed, and they can be summarized into the three model functions:

$$E = f [\text{DI}, \text{QT}, \text{DT}] \quad (1)$$

$$M = f [\text{DI}, \text{QT}, \text{DT}] \quad (2)$$

$$FA = f [\text{DI}, \text{DI}] \quad (3)$$

$f []$ indicates a significant linear relationship (“a linear function of ...”)

Function 1 reads “The extent to which students enjoy using the online learning applications is a linear function of the three design-related variables-- *design of information*, *quality of technology-use* and *design of technology-use*.” Functions 2 and 3 can have the similar interpretation.

CONCLUSION AND DISCUSSIONS

In summary, the three research questions have been answered, and three prediction models have been generated, tested and summarized into three model functions. Following the underlying logic of the research design, we may conclude that an *intermediate effect* has been found: the design-quality of online learning applications may have impact on student learning via its influence on students’ enjoyment, motivation and anxiety.

Specifically, when the content materials of the applications were accurate, easy to understand, consistent with the grade level, designed in a learner-centered approach to engage critical thinking and closely related to the learning tasks; and when the application provided a clear layout, interesting interface, easy navigation, convenient assistance information, active interaction and

bug-free running time, the learners would feel more delighted, inspired and less nervous to learn with the online applications. Therefore, they could have better performance and higher learning achievement.

According to the three prediction models, a learner’s *enjoyment* and *motivation* were influenced by the *design of information*, *quality of technology-use* and *design of technology-use*; and his or her *anxiety* level was influenced by the *design of information* and *design of technology-use*. The variable *quality of information* was not significant to any of the three learning-related variables. This does not mean that the variable *quality of information* is not important. One possible cause to the insignificance of this variable may be that all the mentors may have chosen applications with high quality of information presentation and, hence, the variation within this variable was not large enough to make any difference among the scores of the response variable.

The author believed that the sampling of the online applications and the methods of model development had strengthened the study. The 900 learning applications were on the Web over the past 5 years and covered a variety of subject areas, formats and functions. They were evaluated and selected by mentors from two geographical areas in the United States. They should reflect the current trends of online applications. The model development involved two sets of data. The models were generated from one set of data and then tested in the other, which demonstrated the reliability of the models.

LIMITATIONS OF THE STUDY

The author also realized some limitations of the study. First, this study aimed at the overall quality of online learning application design. The author did not conduct in-depth analyses to compare the quality of specific types of learning applications, analyze the quality of specific items under each

design-related variable or examine the quality of the applications by different designers. All the information had been collected, and further analyses will be conducted to explore those details.

Second, the first step in detecting the intermediate effect was based on the literature. In this study, the author did not analyze learning outcomes of the protégés in relation to the three learning-related variables (enjoyment, motivation and anxiety level). To provide a complete picture of the intermediate effect, the impact of the learning-related variables on student learning achievement will be examined with first-hand data in further studies.

Third, the mentors were students from the classes that the author taught over the past 5 years, and the protégés were chosen by the mentors. Although a total of 180 mentors and 180 protégés were not a small sample, they were not randomly selected from the two states. This may influence the generalization of the findings. Therefore, a careful statement may be made that the results and findings best explained the situation within the context of this study, and they may be used as references by other educators and researchers.

Fourth, the measurements for motivation, enjoyment and anxiety were based on the mentor's observations and interactions with the protégé, not responses directly from the protégé him or herself, which may raise a potential issue whether these scores accurately reflected the protégé's feelings. The study was designed to have the mentor score the three variables because, most of the time, teachers were the ones who selected learning applications for their students. They should see how their students interacted with the applications and what kind of applications was appropriate for the students. Analyses based on the teachers' observation would be a meaningful reference for other educators' teaching practice.

This chapter has taken an initial step in developing those models. The author hopes that other educators and researchers could apply or test these models in their practice, and conduct

further studies to revise the models with their new findings.

REFERENCES

- Aviv, R., & Golan, G. (1998). Pedagogic communication patterns in collaborative telelearning. *Journal of Education Technology Systems, 26*(3), 201-201.
- Ayersman, D.J. (1996). Effects of computer instruction, learning style, gender, and experience on computer anxiety. *Computers in the Schools, 12*(4), 15-30.
- Barker, S., Winterstein, A. P., & Wright, K.E. (2004). Tools for creating e-learning: Learning objects. *Athletic Therapy Today, 9*(1), 10-15.
- Barnard, J. (1997). The World Wide Web and higher education: The promise of virtual universities and online libraries. *Educational Technology, 37*(3), 30-35.
- Berge, Z. (1997). Computer conferencing and the online classroom. *International Journal of Educational Telecommunications, 3*(1), 3-21.
- Berge, Z.L., Collins, M., & Dougherty, K. (2000). Design guidelines for Web-based courses. In A. Beverly (Ed.), *Instructional and cognitive impacts of Web-based education* (pp. 32-40). Hershey, PA: Idea Group Publishing.
- Boer, W. D., & Collis, B. (2001). Implementation and adaptation experiences with a WWW-based course management system. *Computer in the Schools, 17*(3/4), 127-146.
- Bonk, C. J., Cummings, J. A., Hara, N., Fischler, R. B., & Lee, S. M. (2000). A ten-level Web integration continuum for higher education. In A. Beverly (Ed.), *Instructional and cognitive impacts of Web-based education* (pp. 56-77). Hershey: Idea Group Publishing.

- Clariana, T. B. (1993). The motivational effect of advisement on attendance and achievement in computer-based instruction. *Journal of Research on Computing in Education*, 20(2), 47-51.
- Clark, D., & Jorde, D. (2004). Helping students revise disruptive experientially-supported ideas about thermodynamics: Computer visualizations and tactile models. *Journal of Research in Science Teaching*, 41(1), 1-23.
- Coombs, S.J., & Rodd, J. (2001). Using the Internet to deliver higher education: A cautionary tale about achieving good practice. *Computers in the Schools*, 17(3/4), 67-90.
- Cunningham, C. A., & Billingsley, M. (2006). *Curriculum Webs: Weaving the Web into teaching and learning* (2nd ed.). Boston: Allyn and Bacon.
- Dodero, J. M., Aedo, I., & Diaz, P. (2002). Participative knowledge production of learning objects for e-books. *The Electronic Library*, 20(4), 296-305.
- Fishman, B. J. (1997, March). *Student traits and the use of computer-mediated communication tools: What matters and why?* Proceedings of the Annual Meeting of the American Educational Research Association, Chicago.
- Glazer, E. (2004). K-12 mathematics and the Web. *Computers in the Schools*, 21(3/4), 37-44.
- Green, S.B., & Salkind, N.J. (2003, 3rd Ed.). *Using SPSS for Windows and Macintosh: Analyzing and understanding data*. Upper Saddle River: Prentice Hall.
- Hillman, M., & Moore, T.J. (2004). The Web and early literacy. *Computers in the Schools*, 21(3/4), 15-22.
- Johnson, D. L., & Liu, L. (2000). First steps toward a statistically generated information technology integration model. *Computers in the Schools*, 16(2), 3-12.
- Kellenberger, D. W. (1996). Preservice teachers' perceived computer self-efficacy based on achievement and value beliefs within a motivational framework. *Journal of Research on Computing in Education*, 29(2), 124-140.
- Keller, J. M. (1983). Motivational design of instruction. In C.M. Reigeluth (Ed.), *Instructional design theories and models: An overview of their current status* (pp. 384-434). Hillsdale: Lawrence Erlbaum Associates.
- King, J., & Bond, T. (1996). A rash analysis of a measure of computer anxiety. *Journal of Educational Computing Research*, 14(1), 49-65.
- Lengel, J. G., & Lengel, K. M. (2006). *Integrating technology: A practical guide*. Boston: Allyn and Bacon.
- Liu, L. (1997, October 22-24). *Repeated measures analysis on preservice teachers' attitudes towards the subjects taught in school*. Proceedings of the Western Users of SAS Software Conference, Los Angeles, CA.
- Liu, L. (1999). The influence of different teaching methods on student attitudes toward technology. *Technology and Teacher Education Annual 1999* (pp. 1400-1405). Charlottesville: AACE.
- Liu, L. (2001). Online delivery of multimedia courseware: Issues and effects. In J.D. Price, D.A. Willis, N. Davis, & J. Willis (Eds.), *Technology & teacher education annual 2001* (pp. 1126-1131). Charlottesville: AACE.
- Liu, L. (2003). Communication design for online courses: Effects of a multi-layer approach. In G. Marks & A. Rodssett (Eds.), *E-learn in corporate, government, healthcare and higher education annual 2003* (pp. 1699-1702). Charlottesville: AACE.
- Liu, L., & Johnson, D. L. (2002). Assessing student learning in instructional technology courses within the dimensions of learning model: Static vs.

- dynamic assessment. *Computers in the Schools*, 18(2/3), 79-95.
- Liu, L., & Johnson, L. (1998). A computer achievement model: Computer attitude and computer achievement. *Computers in the Schools*, 14(3-4), 33-54.
- Liu, L., & Johnson, L. (2003a). A new approach of design: Technology integration as information system development. In C. Crawford, N. Davis, J. Price, R. Weber, & D.A. Willis (Eds.), *Technology & teacher education annual 2000* (pp. 1010-1016). Charlottesville: AACE.
- Liu, L., & Johnson, L. (2003b). A technology integration model and weak areas. In W. Pearman, M. Mallott, E. Oshiro, R. Stiller, E. Flower, T. Gregson, & D. Yang (Eds.), *Hawaii International Conference on Education: Conference Proceedings* (p. 5) Honolulu: HICE.
- Liu, L., & Maddux, C. (2003). Online course design and research. In G. Marks & A. Rodsett (Eds.), *E-learn in corporate, government, healthcare and higher education annual 2003* (pp. 1078-1081). Charlottesville: AACE.
- Liu, L., Maddux, C., & Johnson, L. (2004). Computer attitude and achievement: Is time an intermediate variable? *Journal of Technology and Teacher Education*, 12(4), 593-607.
- Liu, L., & Velasques-Bryant, N.J. (2003). An information technology integration system and its life cycle: What is missing? *Computers in the Schools*, 20(1/2), p. 93-106.
- Lombard, R.H. (2004). Social studies and the Web today. *Computers in the Schools*, 21(3/4), 45-52.
- Maddux, C.D., Ewing-Taylor, J., & Johnson, D.L. (2002). The light and dark sides of distance education. *Computers in the Schools*, 19(3/4), 1-7.
- Miller, S.M., & Miller, K.L. (2000). Theoretical and practical considerations in the design of Web-based instruction. In A. Beverly (Ed.), *Instructional and cognitive impacts of Web-based education* (pp. 156-177). Hershey, PA: Idea Group Publishing.
- Murphy, E. (2004). Moving from theory to practice in the design of Web-based learning using a learning object approach. *E-Journal of Instructional Science and Technology*, 7(1). Retrieved March 10, 2004, from www.usq.edu/electpub/e-jist/
- Orme, M. P., & Monroe, E. E. (2005). The nature of discourse as students collaborate on a mathematics WebQuest. *Computers in the Schools*, 22(1/2), 135-146.
- Perkins, R., & McKnight M. L. (2005). Teachers' attitudes toward WebQuest as a method of teaching. *Computers in the Schools*, 22(1/2), 123-134.
- Riel, M. (1992). A functional analysis of education telecomputing: A case study of learning circles. *Interactive Learning Environments*, 2(1), 15-29.
- Schweizer, H., Whipp, J., & Hayslett, C. (2002). Quality control in online courses: Using a social constructivist framework. *Computers in the Schools*, 19(3/4), 143-158.
- Shelly, G.B., Cashman, T. J., Gunter, R. E., & Gunter, G. A. (2003). *Teacher discovering computers: Integrating technology in the classroom* (3rd ed.). Boston: Course Technology.
- Stvan, L. S. (2005). Inferring new vocabulary using online text. *Computers in the Schools*, 22(1/2), 85-96.
- Temple, L., & Lips, H. M. (1989). Reliability and generalizability of the Collis attitudes toward computers survey. *Educational Research Quarterly*, 13(4), 6-9.
- Thorsen, C. (2006). *TechTacTics: Technology for teachers* (2nd ed.). Boston: Allyn and Bacon.
- Trentin, G. (2001). Designing online education courses. *Computers in the Schools*, 17(3/4), 47-66.

APPENDIX A: EVALUATION CRITERIA FOR ONLINE LEARNING APPLICATIONS DESIGN

Information:

1. Language is accurate.
2. Language is easy to understand.
3. Language is error free.
4. Language and materials are at the identified grade level.
5. Resources are sufficient.
6. Resources are updated.
7. Materials and resources are verifiable.
8. Designer's information is included.

Design of Information:

9. Activity goals/objectives are clearly presented.
10. Task and processes are designed to achieve the goals/objectives.
11. Task and processes are designed for learners at the identified grade level.
12. Higher-level thinking is engaged.
13. Processes are designed in a learner-oriented approach.
14. Resources are closely related to the task/activities.
15. Assignments/exercise requirements reflect the knowledge/skills that match objectives.
16. Evaluation criteria match the activity processes and objectives.

Technology:

17. Screen layout is balanced, and graphics are positioned appropriately.
18. It is easy to find where you are in the program.
19. It is easy to find where you want to go within program.
20. Users can stop and find a way to exit when they need.
21. All resource links work well.
22. Help or assistance instructions are provided and easy to access.
23. Instruction materials can be downloaded or printed out in a clear layout.
24. Interactions between user and the program are user-friendly.

Design of Technology-Use:

25. Web is appropriate for performing this activity.
26. Technology skills needed for the activity match learners' developmental level.
27. Interface design is appropriate to the grade level and the topic/subject area.
28. Organization of resource links matches the activity processes.
29. Use of (multi-)media matches the objectives of the activity.
30. Design approach (linear or non-linear) matches task processes and objectives.

Quality of Online Learning Applications

31. The interactions are designed to meet the learning objectives.
32. Mapping of the contents and activities is available.

APPENDIX B: MEASUREMENTS OF ENJOYMENT, MOTIVATION, AND ANXIETY

Enjoyment:

1. This program is not very interesting to my students.
2. My students enjoy learning about this concept with this program.
3. My students do not like learning about this concept with this program.
4. Learning about and working with this program is enjoyable and stimulating to my students.
5. This program is dull and boring.
6. My students like trying to solve new problems with this program.

Motivation:

7. My students want to develop their knowledge and skills and study more with this program.
8. My students do not want to work any more on this program than they have to.
9. My students are interested in acquiring further knowledge with this kind of program and activities.
10. My students are not willing to work more on this kind of activities.
11. My students like to work on as many activities like this as they can during their studies.
12. My students are motivated to work very hard on this kind of program or activities.

Freedom from Anxiety:

13. Working on this kind of program or activities make my students feel nervous and uncomfortable.
14. My students are very calm when learning with these activities.
15. This kind of activities and content make my students feel uneasy and confused.
16. Trying to understand this concept with this program does not make my students anxious.
17. Working on online activities is one of the most dreaded subjects for my students.
18. My students did not get upset when studying with this program.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L.Tomei, pp. 327-346, copyright 2007 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 4.22

Virtual Reality & Immersive Technology in Education

Patrick E. Connolly
Purdue University, USA

ABSTRACT

Virtual reality, also known as VR, is an exciting but ill-defined field of discovery. The question of how technological advances in this field will impact education is difficult to answer at present with any degree of certainty, but is one that must be considered by educational researchers, teachers, and administrators. This position paper presents the foundational definitions and positions of several investigators in this realm, along with thoughts on difficulties and complex issues that currently hinder the application of virtual reality in educational settings. It is recommended that the excitement that VR generates be leveraged into applications research in order to validate both the effectiveness of VR in education and encourage further development of the technology.

INTRODUCTION

Virtual reality (VR) is a phrase that is frequently used in discussions of technological advance-

ments in the science, computer, and entertainment fields, among others. However, VR is a very broad and multifaceted term that means different things depending on its source and application. Furthermore, is it a technology that has value for the fields of education and training? In this article, the author will attempt to define one aspect of virtual reality and gauge its potential for the instructional environment.

CONCEPTUAL FRAMEWORK

As might be expected, the definition of what virtual reality is differs from field to field depending on focus and usage. Generally VR can be defined as the use of computers and related technology to produce an artificial environment that simulates a targeted one. Senovsky and Kodym (1999) state that VR depends on the design and manipulation of 3D models, and may or may not require the use of other peripheral devices to simulate sensory input. They further claim that there are four key components to a VR program: (1) all events must

happen in real time, (2) the artificial environment must be three dimensional, (3) the user is able to enter into the environment and move in it freely, and (4) the environment is not static but can be manipulated by the user. Several authors (Javidi, 1999; Macedonia & Rosenbloom, 2000; Taxén & Naeve, 2001) emphasize that VR must place the user inside the artificial environment to be truly considered as virtual reality. This capability, known as immersive virtual reality, provides the opportunity for full sensory simulation. Billinghurst (2002) uses a continuum of reality to differentiate “augmented” reality (partial immersion) from total immersion based on the amount of the user’s world that is produced by computer. These differences in definition have generated some confusion regarding the actual nature of VR and its application in education. This article will focus on immersive VR and its potential in future educational settings.

There is little question that this technology will be critical in future learning environments. Jacobs and Dempsey (2002) claim that the high level goals of education in the future will only be able to be accomplished through the use of artificial intelligence in virtual settings. Taxén and Naeve (2001) point out the significant advantages that VR offers by placing students in discovery and experiential environments that would be impossible in real life. They note that applications have been developed for teaching in the areas of science, math, art, and history, although not always in the fully immersive environment. Interestingly, they predict that too much reality in immersive settings may actually be distracting to students and prevent focus on the desired learning objective. De Moraes, Machado, Gnecco, and Cabral (2002) show an effective use of “Cave” immersive environments in the teaching of statistical interpretation and data analysis. Javidi (1999) suggests that immersive learning is very constructivist and that the level of discovery and experiential learning that the technology provides

will drive education more in that philosophical direction in the future.

The important role that immersive VR will play in the future of education in many technical areas cannot be understated. Beier (2004) points out that any three-dimensional environment can be simulated in VR, including such a variety as “buildings, landscapes, underwater shipwrecks, spacecrafts, archaeological excavation sites, human anatomy, sculptures, crime scene reconstructions, solar systems, and so on.” Pantelidis (2000) describes situations when using VR technologies would be beneficial to educators. She explains that any teaching or training experience in an actual environment that is too dangerous, difficult, inconvenient, expensive, or impossible is a prime candidate for virtual reality scenarios. Kalawsky (1998) states that VR capabilities will aid the educator in simulating complex systems, magnification or reduction of environments, and accelerating or decelerating time passage. Current examples of such educational applications in VR include: architectural design (Donath & Regenbrecht, 1999), ergonomic design (Cerney, Duncan & Vance, 2002), molecular nanotechnology (Stevens & Judson, 2004), and oceanographic and meteorological studies (Moore, 2002). Finally, Kalawsky (1998) lists many potential educational areas for VR application, such as: civil engineering, aerospace engineering, architecture, automotive engineering, chemistry, design, finance, geographical information systems (GIS), historical scenarios, manufacturing, medical, and sports science. Clearly the future use of immersive VR in educational and training settings will only be limited by the imagination (and resources) of the instructor.

In an article by Diana Walczak (2002), several problem areas are described that explain why immersive VR can be useful in education. She states that current teaching practices are directed at the average student, often ignoring the needs of faster and slower learners. One advantage of VR technology would be customizing the learning process

to fit the individual learner's needs. Secondly, she points out the ability of immersive environments to utilize more of the senses, allowing for more experiential learning. Finally, she feels that the use of VR will provide students the opportunity to become curious about their learning, and result in more individual ownership of the learning experience. Realistically, she mentions that there are significant challenges in developing "a more customized and far less simplistic education system" (p. 3). Roussou (2000) also concentrates on issues that must be met for interactive immersive technologies to assist in the educational process. She notes that the technology should not be expected to be stand-alone, but that it must be partnered with the environment, the students, and the learning context and issues. Secondly, the technology must seamlessly fit within the instruction, being non-obtrusive and non-distracting. She also states that VR must provide immediate feedback and long-term engagement for the instruction to be effective. Lastly, Roussou strongly supports proper instructional design methods to ensure valid content, ensuring that the novelty of the technology will not displace the instruction. Barnes (2000) also highlights the need for good instructional design practices to make immersive technology viable in education. He also shows that for VR to be fully effective, the learner must have control of the environment and that the environment must be authentic, simulating the real-world experience as much as possible. Barnes also states that the development and application of such VR scenarios is difficult, and "places much higher demands on the ingenuity, time and patience of course developers" (p. 3). All of the authors mentioned see the compelling need for immersive instruction as a way to truly simulate the real-world nature of issues and problems.

There is little doubt that immersive VR technology will become more prevalent in future educational environments. Although presently expensive, somewhat unstructured, and difficult to implement, the potential advantages will cause

more empirical studies, continuous technological development, and lessening costs that will promote this capability into many instructional and training situations. Neumann and Kyriakakis (2002) optimistically predict:

These new remote immersion systems will bring interactive and stimulating classroom experiences to all student populations—regardless of location. Classroom boundaries will fade as students and teachers are brought together by high-resolution video and immersive 3D shared environments that allow natural discussion, collaboration, and interaction among physically distant participants. With remote immersion, students and teachers will investigate, play, explore, and learn together in an environment that dynamically adapts to the content—from a biology laboratory to a visit to the aquarium. (p. 2)

Both Hinrichs (2003) and Javidi (1999) mention that the effective use of immersive VR in education will impact the role of the instructor. Hinrichs states that the teacher's role will become that of mentor and not be as involved in the direct instruction of the learner. Javidi points out the difficulty the teacher will experience in monitoring a significant number of students if they are immersed in separate virtual learning experiences. He also notes that assessment of learning might prove difficult in virtual environments.

POTENTIAL IMPACT OF THE POSITION

Immersive virtual reality is an educational tool that is still in its infancy. No doubt there will be many technological and pedagogical developments over the next decade that will promote the growth and application of VR in many training and instructional settings. However, for this technology to truly become an integral part of the normal educational environment, many changes

and adaptations will need to occur. Obviously, the technology must continue to mature, become supported by more scientific studies, and become much more affordable to educational institutions. Careful attention will need to be given to instructional design methods and environments to successfully utilize the immersive and experiential nature of the technology. Significantly, the role of teachers would change drastically in a fully immersive, totally virtual environment. While some predict such massive changes in our future, it is more likely that immersive VR technology will be implemented as a complementary strategy to other teaching/learning methods. This more realistic view of the future of VR in education would still require a major shift of the role of the teacher, but would probably be more palatable to educators than many of the more dramatic scenarios envisioned by some authors in this field.

REFERENCES

- Barnes, C. (2000). Building immersive environments using Quicktime VR: Lessons from the real world and virtual realities. Retrieved August 1, 2003: http://auc.uow.edu.au/conf/conf00/papers/AUC2000_Barnes.pdf
- Beier, K.P. (2004). Virtual reality: A short introduction. Retrieved June 2, 2004: <http://www-vrl.umich.edu/intro/>
- Billinghurst, M. (2002). Augmented reality in education. Retrieved August 1, 2003: <http://www.newhorizons.org/strategies/technology/billinghurst.htm>
- Cerney, M.M., Duncan, J.R., & Vance, J.M. (2002). Using population data and immersive virtual reality for ergonomic design of operator workstations. Retrieved June 2, 2004: <http://www.vrac.iastate.edu/~mecerney/Cerney-DHMC-2002.PDF>
- de Moraes, R.M., Machado, L. , Gnecco, B.B., & Cabral, M.C. (2002). Immersive visualization to help image classification education. Retrieved August 1, 2003: <http://www.asee.org/international/INTERTECH2002/612.pdf>
- Donath, D., & Regenbrecht, H. (1999). Using immersive virtual reality systems for spatial design in architecture. Retrieved August 4, 2003: http://infar.architektur.uni-weimar.de/infar/deu/forschung/public/downloads/avoocad_1999_using_final.pdf
- Hinrichs, R. (2003). A vision for life long learning. Retrieved August 1, 2003: <http://www.microsoft.com/education/DOWNLOADS/Vision/Vision-lifeLongLearning.doc>
- Jacobs, J.W., & Dempsey, J.V. (2002). Emerging instructional technologies: The near future. In R.A. Reiser & J.V. Dempsey (Eds.), *Trends and Issues in Instructional Design and Technology* (pp. 319-332). Upper Saddle River, NJ: Pearson Education, Inc.
- Javidi, G. (1999). Virtual reality and education. Retrieved August 1, 2003: <http://www.coedu.usf.edu/itphdsem/eme7938/gj899.pdf>
- Kalawsky, R.S. (1998). Exploiting virtual reality techniques in education and training: Technological issues. Retrieved May 21, 2004: <http://www.ago.cg.ac.uk/reports/virtual/vrtech/toc.htm>
- Macedonia, M.R., & Rosenbloom, P.S. (2000). Entertainment technology and environments for training and education. Retrieved August 1, 2003: <http://www.educause.edu/ir/library/pdf/ff-piu0005.pdf>
- Moore, C. (2002). Using virtual reality: New machines to visualize data. Retrieved June 2, 2004: http://www.noaatech2002.noaa.gov/abstract_50.html
- Neumann, U., & Kyriakakis, C. (2002). 2020 classroom. Retrieved August 1, 2003: http://imsc.usc.edu/news/pdfs/imsc_section.pdf

Pantelidis, V.S. (2000). Suggestions on when to use and when not to use virtual reality in education. Retrieved May 21, 2004: <http://www.coe.edu.edu/vr/sug.html>

Roussou, M. (2000). Immersive interactive virtual reality and informal education. Retrieved August 1, 2003: <http://ui4all.ics.forth.gr/i3SD2000/Roussou.PDF>

Senovsky, M., & Kodym, O. (1999). Virtual reality in education. Retrieved August 1, 2003: <http://www.fs.vsb.cz/akce/1999/icee99/Proceedings/papers/365/365.htm>

Stevens, R., & Judson, I.R. (2004). Using immersive virtual reality for visualizing and modeling of molecular nanosystems. Retrieved June 2, 2004: <http://www foresight.org/Conferences/MNT05/Abstracts/Stvlabst.html>

Taxén, G., & Naeve, A. (2001). A system for exploring open issues in VR-based education. Retrieved August 1, 2003: <http://cid.nada.kth.se/pdf/CID-137.pdf>

Walczak, D. (2002). Encompassing education. Retrieved August 1, 2003: <http://www.kurzweilai.net/articles/art0519.html?printable=1>

SUGGESTED READINGS

Allison, D. (1998). The virtual gorilla exhibit project: Using virtual reality to enhance educa-

tional experiences. Retrieved August 1, 2003, from <http://www.cc.gatech.edu/grads/a/Don.Allison/gorilla/gorilla.html>

Beier, K. et al. (2000) An immersive virtual reality platform for medical education: Introduction to the Medical Readiness trainer. Retrieved August 1, 2003, from <http://www.computer.org/proceedings/hicss/0493/04935/04935025.pdf>

Jonassen, D.H. (Ed.). (2001). Introduction to virtual reality applications in education and training. *Handbook of Research for Educational Communications and Technology*. Retrieved August 4, 2003, from <https://www.aect.org/intranet/Publications/edtech/15/15-04.html>

Pantelidis, V.S. (2002). Virtual reality and education: Information sources; A bibliography. Retrieved August 1, 2003, from <http://www.coe.edu.edu/vr/vpbib.html> (Contains hundreds of VR/Education sources)

Shaffer, J. (2002). Virtual reality in education. Retrieved August 1, 2003, from: <http://www.coe.edu.edu/vr/vrits/3-1Young.htm>

Song, W., & Ou, S. (2000). Using virtual reality modelling to improve training techniques. Retrieved August 4, 2003, from <http://www.ifip.or.at/con2000/iceut2000/iceut12-09.pdf>

Youngblut, C. (1997). Educational uses of virtual reality technology. Retrieved August 4, 2003: <http://www.coe.edu.edu/vr/vrits/3-1Young.htm>

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 1, No. 1, edited by L. Tomei, pp. 12-18, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 4.23

E–Learning: An Investigation into Students’ Reactions to Investment into IT at Tertiary Institutions

Solitaire Maherry-Lubbe

Dolphin Coast Enterprises, South Africa

ABSTRACT

Constructivist theories and modern pedagogical concepts emphasize that an activation of students is one of the most influential factors for learning effectiveness. The implementation of those educational concepts in e-learning, especially in distance learning contexts, is a rather difficult challenge. Systems that assist lectures in this intention are required. In this study, a student’s reaction towards e-learning is observed. The focus is on student’s demographics in order to analyze their reaction towards e-learning. Solving tasks and observing and critiquing this solution process, instead of merely assessing the end product of e-learning processes. A sample of 105 students from the University was drawn and the findings suggest that e-learning investment can help address a need for this type of support.

INTRODUCTION

Technology is developing at a high speed and it has an impact on people’s lives, especially the way one shops or does banking online. Gone are those days when one had to stand in long lines to cash money or pay transactions. Students need to study and work at the same time and the answer for that is e-learning. e-learning involves the use of a computer or electronic device (e.g., a mobile phone) in some way to provide training, educational, or learning material. e-learning can involve a greater variety of equipment than online training or education, for as the name implies, “online” involves using the Internet or an Intranet. CD-ROM and DVD can be used to provide learning materials.

The value of this research lies in the fact that it emphasises the importance of technology in teaching. It was therefore with this in mind that the

researcher investigated why people need to invest into IT for teaching purposes. The researcher used Google and EBSCO host to look for articles, using the keywords e-learning, investment into IT and digital teaching as basis for searches for relevant literature. This chapter introduces the reader to the study focusing on the establishment of e-learning at a University in South Africa.

LITERATURE REVIEW

Much of the focus in e-learning today—from analysts, industry observers, consultants, and technologists—is on e-learning in the corporate world. But the biggest impact and opportunity for e-learning may be in education. Governments want to raise the skills and education level of its population, but to date e-learning has had little impact in this area.

e-learning can potentially transform education at every level. It can make high-quality educational experiences available to those whose location, economic, and personal constraints have prevented them from pursuing their educational goals. These learners also represent a wider student market for universities and other education establishments (Mkhize et al., 2005).

Much of the focus in e-learning today from analysts, industry observers, consultants, and technologists is on e-learning in the corporate world. But the biggest impact and opportunity for e-learning may ultimately be in education. Governments want to raise the skills and education level of its population, but to date e-learning has had little impact in this area. e-learning can potentially transform education at every level. It can make high-quality educational experiences available to those whose location, economic, and personal constraints have prevented them from pursuing their educational goals. These learners also represent a wider student market for universities and other education establishments.

Callaghan (2001) notes that much of the literature on the subject of e-learning extols the potential of the technologies for enhancing the

learning experience. As has been mentioned, however, there is little evidence regarding learners' attitude to online learning, their responses to online as opposed to traditional classroom learning, their future use of online learning in their lives and the particular elements in online learning which learners find useful. Much of the literature also notes that traditional educators for their slow take-up of online learning elements in their teaching. Most commentators attribute this to teachers' lack of ability and enthusiasm for incorporating e-learning into the traditional classroom experience. Many of the dot.com e-learning ventures stress the importance of incorporating a wide range of communicative elements within the e-learning environment without producing the empirical evidence for their usefulness for learners (Callaghan, 2001).

Problems, Plagiarism, and Access

University Resistance

One issue is that universities don't see themselves merely as educational "content providers." Universities have a proud tradition of combining learning, research, teaching, and professional development. If one looks at higher education as a whole, it's not obvious how to implement e-learning. A second reason higher education resists e-learning is the absence of many of the technical skills needed as well as the experience in marketing and customer service necessary to support and develop this new market. Many universities are attempting e-learning initiatives, but on a limited scale. To have a chance of expanding the programs, they recognize the need for the right base of skills. Funding for such initiatives at the university level is another challenge.

A number of private ventures, especially in the United States, are attempting to tap into this potentially lucrative market. To date, these ventures have focused on the specific skills and technical capabilities needed. Where they fall short is in the area of access and sponsorship

E-Learning

from universities, which resist giving up control, perceived or real. The result, again, is limited success. The organization needed a great deal of time and resources to become sustainable.

The government has to play a role in e-learning education. It has only recently entered this dialog, and initial results are promising. Governments show an interest in leveraging e-learning to create more widespread and cost-effective delivery of education from most levels, such as literacy training, all the way up to postgraduate degrees. The benefit of governmental support is that it can provide sponsorship and commitment. Universities need a development model that provides a common capability backed by government, allowing universities and other educational bodies to exploit e-learning and focus on content and teaching.

A model has emerged in the United Kingdom where the department for education and skills launched an initiative in 2001 called UK Universities. It was organized as a separate commercial enterprise that was expected to become self-funding and profitable over the next few years. With this organization, universities benefit because they can continue to focus on and own the content on the educational side, while UK Universities provides the capabilities and skills in marketing, sales, learning design, content development, and platform operation and support. All parties shared benefits and costs.

Salopek (2001) notes that accessibility is a buzzword that's been on the lips of people involved with e-learning for many months now. Optavia Corporation defines it as "the ability to use the Internet even when functioning under constraints." Those constraints can be of two types: functional limitations, also known as disabilities, and situational limitations, constraints caused by the devices a user is attempting to use. Salopek notes that one can expand Optavia's definition to embrace not only the Internet but all electronic and IT, as indeed the U.S. government has done.

Smart Force e-learning complied with new government standards for accessibility. Adkins

cited by Salopek (2001) states that Smart Force's goal is to provide user experience to all users and they are making investments to integrate accessibility across [its] entire product line (Salopek, 2001). Smulders (2003) states that people can increase the learning potential of Web courses by following simple principles. Instructors and course developers are well versed in the art of instructional design. Despite this expertise and experience, many Web-based courses suffer from weak Web design and poor usability. Often, learners can't take advantage of good instructional design because the Web environment is too problematic: content is difficult to find, course tools don't work, and navigation is inconsistent.

Plagiarism

Major (2002) argues that universities have vowed to clamp down on businesses offering forged degree certificates. It came to light that a Liverpool based businessman is flouting the law and continuing to sell fake degrees over the Internet. Fakedegrees.co.uk claims to be the largest degree template library available in the world and sells degree certificates for £135. The site offers degree certificates that appear to come from universities based in the UK, USA, Australia, and New Zealand. The site is produced by Peter Leon Quinn, who calls himself a designer of impressive authentic looking certificates. Universities obtained a court injunction stopping.

New measures to help detect cheating students are being demonstrated at a conference in Newcastle. A survey of around 350 undergraduates found nearly 25% had copied text from another source at least once. A service that can scan 4.5 billion Web pages is now online so that lecturers can check the originality of the work submitted by students. The software was demonstrated at a meeting of the Plagiarism Advisory Service at North Umbria University (Major, 2002).

Hi-Tech Answer to Student Cheats

The Plagiarism Advisory Service notes that cheating is not a new phenomenon but the Internet has led to concerns within the academic community that the problem is set to increase dramatically. Service manager Fiona Duggan said:

The software has four databases that it checks students' work against and produces an originality report, which highlights where it has found matches. It demonstrates where the student has lifted text from, and it also takes you to the source where the match was found.

The software has been developed in the USA and the Plagiarism Advisory Service hopes it will go some way to stamping out the practice. Ms. Duggan noted that there are other things that can be done, like the way you set assignments so each student has something individual to put into the assignment so it is not so easy to copy (BBC News, 2002).

Accessing IT Education

Wood (2003) notes that people from ethnic minorities use their computers for education more than their richer neighbours, according to a DfES-commissioned survey into deprived areas of the UK. The study—which surveyed more than 1,500 people in deprived areas showed more than three-quarters of whom were from an ethnic minority—showed that, while 8 in 10 people in such areas recognised that IT skills were essential for their children, nearly two-thirds had beginner-level skills or none at all. Respondents were significantly less likely to own a PC or use the Internet than others in their communities, they found. Just 31% of blacks owned a PC, compared to 37% of whites, 42% of south Asians, and 44% from Chinese and other backgrounds. Some 40% of black people had used the Internet, compared to 38% of South Asians, 45% of whites, and 54% of Chinese and other respondents.

Literacy in English was a problem for South Asian people, with one quarter who did not use a computer citing language problems as the main factor preventing them from using a PC. There were also indications in interviews that gender may also act as a barrier for some Muslim women. South Asian people were less likely than other groups to use public facilities than other groups. Six in ten white non-users cited a lack of interest or need for computers, compared to only a third from black, South Asian, and mixed groups. The DfES welcomed the report. They note that they have a good understanding of the barriers that different groups face. Access to ICT, and the skills for using it, is critical to individuals' learning and employability (Wood, 2002). The Commission for Racial Equality said:

Public authorities need to be alert to the differences between ethnic groups in methods of learning and access to IT and the Internet in terms of messages and information they want to disseminate.

A total of 1,182 black and ethnic minority and 391 white households were surveyed in inner and outer London, Birmingham, Leeds and Bradford, Cardiff and Glasgow.

Wood (2003) argues that the following need to be looked at when preparing ecosystems:

1. **Environment:** Students need a certain environment (PC, connection, software) and some preparation needs to be done to make sure that the student has that.
2. **Technical skills:** Students need to know something about how to use whatever learning system exists. There has to be a way to impart this knowledge.
3. **Subject matter skills:** Students need to have some pre-requisite knowledge in the discipline to take the course.
4. **Study skills:** Students need to have the discipline and learning skills to benefit from the course.

E-Learning

5. **Support:** When students run into problems with any of these there has to be a mechanism to (a) find out and (b) help them through it.
 6. **Content:** Designed for interaction—to keep students engaged—page clicking won't necessarily motivate students.
 7. **Learner:** Disciplined, motivated to learn, has a need for learning, self-directed.
 8. **Instructor:** Aware of students needs/concerns and involvement levels, attempts to draw students in to discussions early, organized schedule, provides resources for learners in need of additional learning (remedial).
 9. **Technology:** Should play a servant role. Tools should be selected that involve learners and help them to connect with each other/content/instructor (e.g., chat, discussion questions, voice over IP are useful for connecting students and can be seen as student-cantered technologies).
 10. **Organization:** Focused on learning, time, and resources made available, learners supported (through help desks etc.).
- Service quality sufficient for voice, fax, and data
 - Rates based on community of interest (i.e., flat rate plans such as extended area service)
 - Universal enhanced 911 (emergency services)
 - Access to optional information services (local or toll-free calls for gateways to e-mail and databases in rural and remote areas)
 - Mobile services

Many of these areas are outside of the instructors influence, but still need to be considered or if an area is weak (i.e., limited organizational support), other areas may have to play a more prominent role to ensure learners are prepared and succeed.

Rural and Urban Access

Conventionally, providing access has been defined as ensuring that rural communities can be wired up. For instance, Hudson (1994) advocates that the following be made available in rural and remote regions, to ensure equitable access:

- Universal single-party touchtone service (digital switching)
1. **Language barrier:** The World's population speaks several thousand different languages. Teaching and learning at the K-12 level can hardly be performed in any other language but in the children's native one. They must reflect social and cultural specifics so it can

Just as salient, however, is ensuring that urban environments, where a majority of the new, visible, and minority immigrants tend to congregate, are able to get connected. A 1995 report by the U.S. Office of Technology Assessment (OTA) concerned the complex problems faced by urban cores with the increasing digitization of our knowledge sector. Given that much of the technological growth is taking place in the outer suburbs, edge cities, and high-tech parks, where there are often tax incentives, and a congruence of higher amenities, central and inner city urban areas are facing population losses and a lack of serviceable amenities (OTA, 1995).

Hvorecky (2004) argues that one of big expectations tied to e-learning speaks about its ability to introduce equal education to everyone. He claims that the possibility of e-courses to reach any corner of our planet will lead to the opportunity of delivering same high-quality education everywhere. The biggest optimists have a vision of top-ranking universities acting over the Internet using ready-made courses for huge amounts of students in third world countries. In accordance to well-known practices of e-learning, the students would study on their own pace by self-learning.

hardly cover more than the particular region. Consequently, most of materials have to be produced locally. Such geographical limitations minimize chances for applications of e-learning.

2. **Absence of prerequisites:** At all education levels in countries behind the digital divide, the total absence of qualified teachers is much bigger problem than the distance from them. There are not enough human resources for preparing appropriate courses in any form, regardless whether on-ground or online.
3. **Technology hurdles:** Some teaching materials can be exploited as they do not require any knowledge of the foreign language or can be understood using limited language abilities. Broadband connection, high-resolution screens, and other course producers' expectations are often difficult to achieve in many countries. Slovakia for example belongs to OECD--the commonwealth of 30 of the worlds's most developed nations.
4. **Difficulties with translation:** Evidently, performing the entire K-12 educational process in a foreign language is almost impossible. Very few courses do not intensive textual support. The last choice is translation of the courses.

Thus, one can only expect wider applications of e-learning at the higher educational levels when the taught material is general enough and student's foreign language skills are adequate. At the same time, high schools and universities in all countries are better equipped by powerful technology. Seemingly, there is a much higher chance to overcome the above obstacles. In this paper we demonstrate another reason why delivering successful and well-designed courses is unlikely even in this cases. Crossing the digital divide is equal to crossing an economic barrier.

Security Problems

Korba (2003) states that security examines ways and means for implementing data integrity and protection policies for organizations involved with e-learning. He recommends that security in e-learning need to be taken serious, security have to-date been largely ignored. At best, they have been accommodated in an ad-hoc, patch-work fashion.

Gender, Race, and Age

Tanner (1981) notes that sexual selection in the hominid divergence also could have increased the capacity of males for relaxed social interaction. What may have been selected for among the transitional hominid males was the capacity to be extremely social but yet sufficiently aggressive when required and an ability to make fine discriminations as to situational necessity. Thus, the males of the transitional population would come to more closely resemble the females than had the males of the ancestral population. Much of the selection pressure engendered by female choice of sexual partners was directed toward male social and communicatory behaviour, reinforcing the potential and capacity for sociability, social learning, and intelligence.

Morris (2004) states that research from the National Statistics Omnibus Survey 2003 estimates that 54% of adults in Britain had used e-learning in the past three months. This represents a 5% point increase in April 2002. Over the period January to March 2003, an estimated 11.7 million households in the UK (47%) can now access the Internet from home.

The statistics claim:

- 85% of adults had used the Internet to e-mail.
- 80% to find information on goods and services.

E-Learning

Table 1. Spread of age of respondents

| | |
|----------|-----|
| 16 to 24 | 78% |
| 24 to 44 | 72% |
| 45 to 54 | 59% |
| 55 to 64 | 41% |
| 65+ | 16% |

- 69% to search for information about travel and accommodation.

Research for adults using the Internet, for personal and private use, shows the most popular purchases were travel, accommodation or holidays (54%), tickets for events (41%), books, magazines, e-learning, or training material (40%) and music or CDs (38%). However, younger adults use the Internet far more. Seventy eight percent of people aged 16-24 to only 16% for adults aged 65 and over.

There were nearly 60% of men in the sample. This was not by intention but because the sample was by assembled by chance.

Advantage and Disadvantages of E-Learning

There are many advantages to online and computer-based learning when compared to traditional face-to-face courses and lectures.

- Class work can be scheduled around work and family.
- Reduces travel time and travel costs for off-campus students.
- Students can study anywhere they have access to a computer and Internet connection.
- Self-paced learning modules allow students to work at their own pace.

- Instructors and students both report e-learning fosters more interaction among students and instructors than in large lecture courses.
- Develops knowledge of the Internet and computers skills that will help learners throughout their lives and careers.
- Successfully completing online or computer-based courses builds self-knowledge and self-confidence and encourages students to take responsibility for their learning.

Advantages of Web-Based Learning

Kruse (2001) notes that the general benefits of Web-based training when compared to traditional *instructor-led training* include all those shared by other types of technology-based training. When compared to *CD-ROM training*, the benefits of Web-based training stem from the fact that access to the content is easy and requires no distribution of physical materials. This means that Web-based training yields additional benefits, among them:

- Access is available anytime, anywhere, around the globe.
- Per-student equipment costs are affordable.
- Student tracking is made easy.
- Possible “learning object” architecture supports on demand, personalized learning.
- Content is easily updated (Kruse, 2001).

Disadvantages of Online or Computer-Based Learning

Kruse (2001) lists some of the disadvantages of e-learning as follows:

- Learners with low motivation or bad study habits may fall behind.
- Without the routine structures of a traditional class, students may get lost or confused about course activities and deadlines.
- Instructor may not always be available when students are studying or need help.
- Slow Internet connections or older computers may make accessing course materials frustrating.

CONCLUSION

E-learning is gaining a foothold in school districts across South Africa. Most universities are responding to new technologies, e-learning. Universities have a proud tradition of combining learning, research, teaching, and professional development. Although e-learning is growing fast it still has many problems in South Africa one of them being the fact that in South Africa most of the population are poor they can't even afford basic education. The next section will discuss the research methodology.

WHY THIS RESEARCH STUDY IS IMPORTANT

Most institutions are looking at investing into ICT as a tool for e-learning as a method of providing learning and research. Although some South African universities may have resisted some e-learning, they are all turning to e-learning. Interest in the area has grown over the last couple of years. It is clear from previous research, El-

Khatib (2003), who stated that the major benefits of online distance education are an improved quality of learning, an improved productivity of learning, an improved access to learning, and an improved student attitude to learning. Another advantage of the new online distance education model is the opportunity available for students to interact with others internationally and gain a more sophisticated and global understanding of complex international political issues, while gaining information technology literacy in the process.

Online delivery, if designed correctly, will improve distance education in the way that it will allow an increased level of interaction between students and teachers. The Internet has therefore provided many ways in which students can communicate in real time, which had previously missing from distance education courses. Students of online distance education need to be more motivated in order to keep on track and this will lead to a better level of education for all involved.

The survey was drafted after the first phase of literature review and interviews, which formed the scope and direction of the survey, as well as supporting questions. The population were Information Systems and technology students from the University of KwaZulu Natal (Westville campus) and the sample were 105 students.

The instrument is compiled in such a way it will help answer the research questions:

- Q1-Q5 race, age, gender, and year of study
- Q7-Q14 online services and computer literacy
- Q15-Q 19 e-learning and securities

Students will be given questions with option of choosing the answer from supplied answers. One of the main disadvantages of surveys, according to Dunn (2003), is finding a representative sample of respondents. Items that were covered include:

E-Learning

- What is e-learning?
- Race, age, and gender of students?
- Can e-learning be supportive?
- When should you use e-learning and when should you not use it?
- What competition or risk will the institution put itself in if they get involved in e-learning?
- How do you select the right tool? How do these tools work?
- How do student feel about e-learning?
- Is e-learning real?
- Securities in e-learning?
- How do you prove that the right candidate is doing the assignment?
- What are the best-practices for rapid development processes and rapid instructional design?
- How do you organize your team for e-learning?
- How can you avoid “rapid development” of poor content?
- How do you build instructional templates for reuse and efficiency?

The data was collated on a spreadsheet, and imported into SPSS for processing.

PRESENTATION AND DISCUSSION OF RESULT

Gender

From a sample of 105 students, 52% were females and 48% were male. One of the reasons of having more females than males is because females were more willing to answer questionnaires than males, who complained about lack of time. The aim of this question was to see whether there is a difference in student reaction to e-learning based on gender. Tanner (1981) argues that female cooperation is essential for the maintenance of special

relationships and they thus present an opportunity for females to exercise choice. If female choice is involved, it is of interest to note that the selection criteria appear to be social and care should be taken to obtain the abilities of the males and not their dominance status into account.

Racial Composition

The question on race was aimed at determining whether there is a difference in the way students view e-learning based on race. The questionnaires stated that the purpose of stating race was for research purposes. This was to ease the sensitivity in students when asked to specify their race. The race listed in questionnaires covered all races found in South Africa and the rest of the world with an option of other if you did not belong to any of the race listed in the questionnaires. The racial composition of the research is 58% were African, Indian (35%), coloured (6%), and other (1%). Also, racism requires real or imagined differences and might affect e-learning applications.

Age

Age is important in research as different age groups react different to situations. The aim of this questionnaire was to see if different age groups have differing views about e-learning as it can be seen as follows.

Age does have influence on e-learning if one compare the age group of 24 and above, which are older people ready to start their own families and they are matured enough to know what they want, they turn to like e-learning. This can be a result of many influences they can be under pressure to

Table 1. Respondents' gender

| | |
|--------|----|
| Male | 50 |
| Female | 55 |

Table 2. Age of students

| Age | No. of Students |
|-------|-----------------|
| 16-19 | 44 |
| 20-23 | 44 |
| 24+ | 7 |

Table 3. Composition of age and reaction to e-learning

| Age | How they feel about e-learning | No. of Students |
|-------|--------------------------------|-----------------|
| 16-19 | excited | 22 |
| | will not mind | 21 |
| | uncomfortable | 1 |
| 20-23 | excited | 15 |
| | will not mind | 15 |
| | uncomfortable | 14 |
| 24+ | excited | 17 |

support their families. It can be that they want to work and study at the same time so e-learning will enable them to do both at the same time.

If one takes the age group of 16 to 19 years, you will see that out of 44 students, only one student is not comfortable with e-learning. This can be because many young people like to experience new things without knowing the outcome of it. Another factor can be that if the students grow up playing computer games, they can be influenced by this and turn to technology-based learning.

From the 20 to 23 age group, 15 students will like to see UKZN engaging in e-learning, while 15 will not mind whether they are involved in e-learning or not. The other 14 don't support the idea of e-learning. Some of their reasons for not supporting e-learning was that they enjoy being around campus and they believe in traditional ways of learning

Morris (2004) states that research from the National Statistics Omnibus Survey 2003 estimates that 54% of adults had used e-learning in the past three months. This represents a 5% point increase on April 2002. However, younger adults use the Internet far more.

Composition of Student View About E-Learning

The aim of the questionnaire was to see if student from different geographical areas have different views on e-learning. Table 4 compares students and their views about e-learning.

From the table, it can be seen that students from the suburbs would like to use e-learning, as 17 of them will like to use e-learning and the other five would not mind e-learning. This can be a result of those students from suburbs or developed places using technology so they are unlikely to reject technology-based form of education.

There were 34 respondents from urban areas, 20 of them will like to use e-learning, while six would not mind e-learning, and the other six will feel uncomfortable if they were to use e-learning for their study purposes. More than 30 (36) respondents from township answered questionnaires, where 17 will love to study through e-learning, 18 will not mind, and one will feel uncomfortable. Fifteen respondents from rural areas were given the questionnaires (seven of them will not mind to study through e-learning and eight will feel

Table 4. How students feel about e-learning

| | |
|------------|----|
| townships | 17 |
| urban | 20 |
| suburb | 17 |
| townships | 18 |
| urban | 6 |
| rural area | 7 |
| suburb | 5 |
| townships | 1 |
| urban | 6 |
| rural area | 8 |

uncomfortable if UKZN were to offer courses through e-learning). The reason may be because many students from rural areas are technological disadvantaged when they come to the university. A lot of them have never used a computer before, so it can be difficult for them to support e-learning as they have to adjust to this technology base form of education while they are used to traditional based education. For one to be involved or study through e-learning, one needs to learn the programs and software being used.

It can be concluded that students from rural area are less computer literate compared to students from other places. Though all the students who answered the questionnaire were from the information systems and technology department, some of them can not print while others can't use Microsoft Excel, so they ended up failing the computer literacy test. Many of the students from rural areas who are not computer literate have deregistered IS&T course. They said it gave them problems as they did not know how to use a computer before or during the time they attended the IS&T course, they were not given time to adjust, and they were taken as if they know how to operate a computer. They have decided to reregister the course next year.

Hudson (1994) advocates that the following be made available in rural and remote regions to ensure equitable access:

- Universal single-party touchtone service (digital switching)
- Service quality sufficient for voice, fax, and data
- Rates based on community of interest (i.e., flat rate plans such as extended area service)
- Universal enhanced 911 (emergency services)
- Access to optional information services (local or toll-free calls for gateways to e-mail and databases in rural and remote areas)
- Mobile services

Just as salient, however, is ensuring that urban environments where a majority of the new, visible, and minority immigrants tend to congregate, are able to get connected. A 1995 report by the U.S. Office of Technology Assessment (OTA) discussed the complex problems faced by urban cores with the increasing digitization of our knowledge sector. Given that much of the technological growth is taking place in the outer suburbs, edge cities, and high-tech parks, where there are often tax incentives and a congruence of higher amenities, central and inner city urban areas are facing population losses and a lack of serviceable amenities.

Online Information

The 105 respondents noted as follows: (1) 55 students use online information more often, (2) 43 sometimes depending on the need, and (3) seven students don't use online information. It can be concluded that IS&T students have the capability of adjusting to e-learning as they are used in using online information, accounts, and libraries. From a sample of 105 students, 28 students would not mind if the course was to be offered online only, while 35 students would love to see their course being 100% online, and 42 in total disagree with the course being 100% online. There are many advantages to online and computer-based learn-

ing when compared to traditional face-to-face courses and lectures. There are a few disadvantages as well.

Advantages and Disadvantages of E-Learning

As noted in a previous section, some advantages of online or computer-based learning are:

- Class work can be scheduled around work and family.
- Travel time and travel costs are reduced for off-campus students.
- Students may have the option to select learning materials that meets their level of knowledge and interest.
- Students can study anywhere they have access to a computer and Internet connection.
- Self-paced learning modules allow students to work at their own pace.
- There is flexibility to join discussions in the bulletin board threaded discussion areas at any hour, or visit with classmates and instructors remotely in chat rooms.
- Instructors and students both report e-learning fosters more interaction among students and instructors than in large lecture courses.
- E-learning can accommodate different learning styles and facilitate learning through a variety of activities.
- Knowledge of the Internet and computers skills are developed that will help learners throughout their lives and careers.
- Learners can test out of or skim over materials already mastered and concentrate efforts in mastering areas containing new information and/or skills.

The disadvantages of e-learning are:

- Learners with low motivation or bad study habits may fall behind.
- Students may feel isolated from the instructor and classmates.
- Instructors may not always be available when students are studying or need help.
- Slow Internet connections or older computers may make accessing course materials frustrating.
- Hands-on or lab work is difficult to simulate in a virtual classroom (Iowa State University).

STUDENTS IMPRESSION OF E-LEARNING

Fifty-six students think UKZN has the right resources to offer e-learning, students believe that the institution does not have what it take to offer e-learning, while 35 students were not sure. Some students think that e-learning degrees are not such good value as classroom learning or traditional learning. Seventy-seven respondents believe that e-learning can be supportive and 28 students believe e-learning can not be supportive

Hvorecky (2004) argues that one of the big expectations tied to e-learning speaks about its ability to introduce equal education to everyone. Authors of this claim assert that the possibility of e-courses to reach any corner of our planet will lead to the opportunity of delivering the same high-quality education everywhere. The biggest optimists have a vision of top-ranking universities acting over the Internet using ready-made courses for huge amounts of students in third world countries. In accordance to well-known practices of e-learning, the students would study on their own pace by self-learning. Despite the author's conviction that that e-learning has this potential, it is not difficult to express several counterarguments against such overoptimistic conclusions (Hvorecky, 2004):

1. **Language barrier:** The world’s population speaks several thousand different languages. Teaching and learning must reflect social and cultural specifics so it can hardly cover more than the particular region. Consequently, most of materials have to be produced locally. Such geographical limitations minimize chances for applications of e-learning.
2. **Absence of prerequisites:** At all education levels in countries behind the digital divide, the total absence of qualified teachers is a much bigger problem than the distance from them. There are not enough human resources for preparing appropriate courses in any form—regardless whether on-ground or online. For that reasons, student’s lack “standard volume of knowledge” requested for university enrolment and might struggle with problems during their study.
3. **Technology hurdles:** Some teaching materials can be exploited as they do not require any knowledge of the foreign language or can be understood using limited language abilities. Another question arises: Is if there is technology capable of presenting them in a relevant form and quality? Broadband connection, high-resolution screens, and other course producers’ expectations are

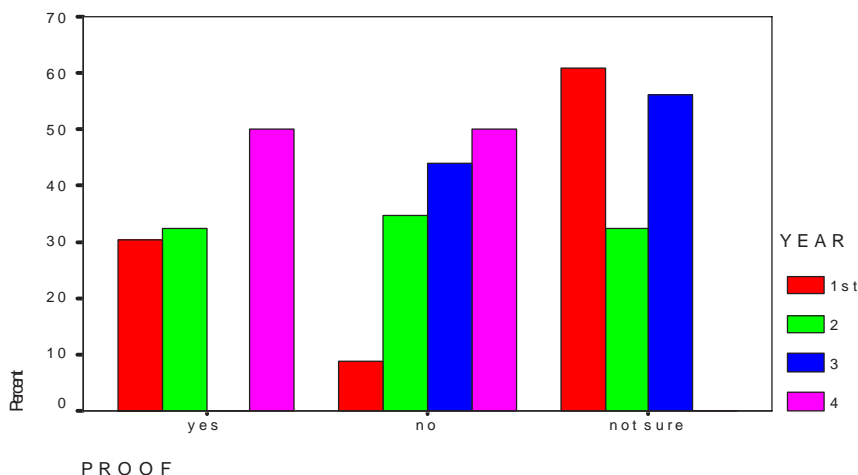
often difficult to achieve in many countries. Slovakia for example belongs to OECD—the commonwealth of 30 of the world’s most developed nations. Yet, a few days ago, who have watched a physician working with a 386 machine in one of the biggest Bratislava hospitals. What can one expect in remote cities of less developed countries?

Thus, one can only expect wider applications of e-learning at the higher educational levels when the taught material is general enough and student’s foreign language skills are adequate. At the same time, high schools and universities in all countries are better equipped by powerful technology. Seemingly, there is a much higher chance to overcome the above obstacles. In this paper we demonstrate another reason why delivering successful and well-designed courses is unlikely even in this cases. Crossing the digital divide is equal to crossing an economic barrier (Hvorecky, 2004)

PLAGIARISM AND E-LEARNING

In Figure 1, respondents were asked whether you can prove in e-learning that the right student is

Figure 1. Plagiarism



doing the work and does plagiarism occur in e-learning. From Figure 1, 28 respondents believe that you can prove who is doing the work, 35 think you cannot prove, and 42 are not sure.

HI-TECH ANSWER TO STUDENT CHEATS

Measures to help detect cheating students are being demonstrated at a conference in Newcastle. A survey of around 350 undergraduates found nearly 25% had copied text from another source at least once. A service that can scan 4.5 billion Web pages is now online so that lecturers can check the originality of the work submitted by students. The software is being demonstrated at a Plagiarism Advisory Service conference at St James's Park (BBC News, 2002). Student Tom Lenham said of the statistics: That's a pretty modest interpretation of the situation at the moment. "From my own experience and that of fellow students, it's a lot higher than that because it is not drummed into the heads from the start. Only more recently one has been told how to use the Internet for referencing. The Plagiarism Advisory Service note that cheating is not a new phenomenon but the Internet has led to concerns within the academic community that the problem

is set to increase dramatically. Service manager Fiona Duggan said:

The software has four databases that it checks students' work against and produces an originality report, which highlights where it has found matches. It demonstrates where the student has lifted text from, and it also takes you to the source where the match was found.

The software has been developed in the USA and the Plagiarism Advisory Service hopes it will go some way to stamping out the practice. Ms. Duggan said:

There are other things that can be done, like the way you set assignments so each student has something individual to put into the assignment so it is not so easy to copy. (BBC News, 2002)

OWNERSHIP OF PERSONAL COMPUTER

Table 5 shows that 59 respondents own a computer or can have access to a computer at any time they want to use it, 46 respondents do not own one and have limited access to a computer. From Table 5, it can be concluded that the geographic place where a student comes from does not have any influence for a student to own a computer. Thirty-nine respondents have full access to the Internet

Table 5. Students that have access to a PC

| townships | | urban | | rural area | | suburb | |
|-----------|----|-------|----|------------|----|--------|----|
| yes | no | yes | no | yes | no | yes | no |
| 19 | 17 | 16 | 16 | 9 | 6 | 15 | 7 |

Table 6. Student access to the Net by race

| | yes | no | sometimes |
|----------|-----|----|-----------|
| African | 19 | 1 | 41 |
| coloured | 4 | | 2 |
| Indian | 16 | 3 | 18 |
| other | | | 1 |

E-Learning

at any time, 62 can access the Internet at any time when there is a need, and only four students have difficulty to access the net.

From Table 6 it can be concluded that all UKZN IS&T students have equal access to the Internet.

COMPUTER LITERACY AND PLACE WHERE STUDENTS COME FROM

The researcher correlated computer literacy and the place where students are from. The purpose was to find out how strong the relationship is between computer literacy and the geographic place where a student comes from. In Table 8, the researcher observed that there is a weak correlation between the place a student comes from and computer literacy. In Table 7, it appears that students from townships, urban and suburbs, are more computer literate than students that come from rural areas. The study also shows that there are more than 50% of the respondents from rural areas are computer

literacy. The correlation is weak which suggest that there might not be causality.

CORRELATION BETWEEN RACE AND ACCESSING THE INTERNET

Table 9 shows that race does not have affect on ones accessing the Internet as all 105 respondents have access to the Internet. Some of them can access the Internet at any time they want and others have limited access to the Internet. There is no student that does not have access to the Internet. Table 10 shows that there is a weak negative correlation between the two variables of -.143.

Accessing the Internet and Places Where Students Live

Table 11 shows that a negative relationship between accessing the Internet and the place where student live.

Table 7. Computer literacy and place

| yes | | | | no |
|-----------|-------|------------|--------|------------|
| townships | urban | rural area | suburb | rural area |
| 36 | 32 | 8 | 22 | 7 |

Table 8. Correlation table between computer literacy and place

| | | PLACE | LITERACY |
|----------|---------------------|-------|----------|
| PLACE | Pearson Correlation | 1 | .185 |
| | Sig. (2-tailed) | . | .059 |
| | N | 105 | 105 |
| LITERACY | Pearson Correlation | .185 | 1 |
| | Sig. (2-tailed) | .059 | . |
| | N | 105 | 105 |

Table 9. Race and accessing the Internet

| African | | Coloured | | Indian | | other |
|---------|-----------|----------|-----------|--------|-----------|-----------|
| yes | sometimes | yes | sometimes | yes | sometimes | sometimes |
| 29 | 32 | 5 | 1 | 21 | 16 | 1 |

Table 10. Correlation table between race and accessing the Internet

| | RACE | ACCESS the Internet |
|---------------------|-------|---------------------|
| Pearson Correlation | 1 | -.143 |
| Sig. (2-tailed) | . | .146 |
| N | 105 | 105 |
| Pearson Correlation | -.143 | 1 |
| Sig. (2-tailed) | .146 | . |
| N | 105 | 105 |

Table 11. Place and accessing the Internet

| | | |
|------------|-----------|----|
| townships | yes | 10 |
| | sometimes | 26 |
| urban | yes | 9 |
| | no | 3 |
| | sometimes | 20 |
| rural area | yes | 6 |
| | no | 1 |
| | sometimes | 8 |
| suburb | yes | 14 |
| | sometimes | 8 |

Table 12. Correlation table between place and accessing the Internet

| | PLACE | ACCESSIN |
|---------------------|---------|----------|
| Pearson Correlation | 1 | -.274** |
| Sig. (2-tailed) | . | .005 |
| N | 105 | 105 |
| Pearson Correlation | -.274** | 1 |
| Sig. (2-tailed) | .005 | . |
| N | 105 | 105 |

Table 13. Online and age

| | | |
|-------|--------------------|----|
| 16-19 | you will not mind | 14 |
| | you will be exited | 21 |
| | total disagree | 9 |
| 20-23 | you will not mind | 14 |
| | you will be exited | 7 |
| | total disagree | 23 |
| 24+ | you will be exited | 7 |
| | total disagree | 10 |

Note: ** Correlation is significant at the 0.01 level (2-tailed).

Table 14. Correlation table between online and age

| | FULONLIN | AGE |
|---------------------|----------|--------|
| Pearson Correlation | 1 | .306** |
| Sig. (2-tailed) | . | .001 |
| N | 105 | 105 |
| Pearson Correlation | .306** | 1 |
| Sig. (2-tailed) | .001 | . |
| N | 105 | 105 |

Note: ** Correlation is significant at the 0.01 level (2-tailed)

Table 15. Year of study and e-learning

| | | |
|-----------------|--------------------|----|
| 1 st | you will not mind | 7 |
| | you will be exited | 7 |
| | total disagree | 9 |
| 2 | you will not mind | 14 |
| | you will be exited | 14 |
| | total disagree | 15 |
| 3 | you will not mind | 7 |
| | you will be exited | 7 |
| | total disagree | 11 |
| 4 | you will be exited | 7 |
| | total disagree | 7 |

Table 16. Year of study

| | YEAR | FULONLIN |
|---------------------|------|----------|
| Pearson Correlation | 1 | .149 |
| Sig. (2-tailed) | . | .130 |
| N | 105 | 105 |
| Pearson Correlation | .149 | 1 |
| Sig. (2-tailed) | .130 | . |
| N | 105 | 105 |

There is a strong positive relationship between age and the way students will feel if their course was 100% online. From Table 13, one can see that most of the young people (age 16 to 19) want to do their course online. This can be a result of the fact that most young people want to experience new things and that during their days, most of the things are done technological. From turning a TV on to playing computer games and one of the reason that might cause old people to reject e-learning is that old people are not flexible in terms of adjusting for new things they tend to prefer traditional class room compared to e-learning.

Year of Study and E-Learning

There is a weak positive relationship between year of study students are in and the reaction towards e-learning meaning there is no causality.

RECOMMENDATIONS AND CONCLUSION

In this section, the researcher will draw recommendations and conclusion based on the findings. The research questions, which were designed previously, will be answered and recommendations for future studies will be made. It can be argued that e-learning can potentially transform education at every level. It can make high-quality educational experiences available to those whose location, economic, and personal constraints have prevented them from pursuing their educational

goals. These learners also represent a wider student market for universities and other education establishments.

Recommendations

Privacy

The researcher recommended that keeping information privacy in e-learning is very important. If your information is not private, someone else may steal your work and submit it before you do and when you submit it later, you may be charged for plagiarism. One way of ensuring privacy in e-learning is encryption. Universities are resorting to e-learning to provide instruction online. While many advances have been made in the mechanics of providing online instruction, the needs for privacy and security have to-date been largely ignored. At best, they have been accommodated in an ad-hoc, patchwork fashion. Privacy can be described as a learner's ability to maintain a "personal space" within which the learner can control the conditions under which personal information is shared with others.

Security examines ways and means for implementing data integrity and protection policies for organizations involved with e-learning. This chapter examines privacy and security issues associated with e-learning. It presents the basic principles behind privacy practices and legislation. It investigates the more popular e-learning standards to determine their provisions and limitations for privacy and security. Privacy requirements for e-learning systems are explored with respect to the "Privacy Principles." The capabilities of a number of existing privacy enhancing technologies, including methods for network privacy, policy-based privacy/security management, and trust systems, are reviewed and assessed.

Student Training

The researcher suggested that students must be taught about e-learning benefits and disadvantages

so that they can decide whether to study using e-learning or use classroom learning. Further more, universities and the government should introduce projects that will teach students in primary and secondary school about this technological ways of studying so that when they reach tertiary they already know about this things.

Securing E-Learning

El-Khatib (2003) states that security examines ways and means for implementing data integrity and protection policies for organizations involved with e-learning. The researcher recommended that security in e-learning be taken serious. At best, they have been accommodated in an ad-hoc, patchwork fashion.

Infrastructure

The researcher suggests that for a university to offer e-learning it has to upgrades its resources.

Verification

The researcher recommends that universities need to come up with special tools and techniques that can ensure user verification. So that one can be sure that the right candidates is doing the work. In the case where it is not possible to verify whether the right candidate is doing the work, Universities can set exams centres around the country to ensure that the right candidates is writing the exams.

User Accounts and Passwords

The study show that many students they use the same passwords for different accounts, the password they were given by the university for their log in at the university they also use it in other accounts.

Government Involvement

The government must set rules, standards, and policies that institutions must meet before they can be allowed to offer e-learning.

RESEARCH QUESTIONS

How Will Students Benefit from E-Learning?

Students leave universities with degrees but with no working experience, these leads to a high percentage of unemployed graduates. With e-learning students can study and work at the same time so by the time they have finished studying they will be having work experience and qualification. There are many other ways students can benefit from e-learning and they are listed next:

- Class work can be scheduled around work and family.
- Travel time and travel costs are reduced for off-campus students.
- Students may have the option to select learning materials that meets their level of knowledge and interest.
- Students can study anywhere they have access to a computer and Internet connection.
- Self-paced learning modules allow students to work at their own pace.
- There is flexibility to join discussions in the bulletin board threaded discussion areas at any hour, or visit with classmates and instructors remotely in chat rooms.
- Instructors and students both report e-learning fosters more interaction among students and instructors than in large lecture courses.

E-Learning

- E-learning can accommodate different learning styles and facilitate learning through a variety of activities.
- Knowledge of the Internet and computers skills are developed that will help learners throughout their lives and careers.

What can be Done to Make Students Feel Comfortable with E-Learning?

According to the findings of this study student from technological disadvantaged places turn to reject e-learning. They prefer traditional way of learning one of the reasons that make student to reject e-learning is that they come to universities with out any computer skills yet e-learning require one to have certain computer skills. Secondary schools need to teach computer courses so that student can .

Is Government Involvement Necessary in the Implementation of E-Learning?

The government can play an important role in e-learning by setting rules, standards, and policies universities need to follow before they can engage in e-learning. This will improve the standard of e-learning as universities will have to meet certain standards before they can be allowed to offer e-learning.

CONCLUSION

Context may be the most important element that can help one to determine the success of an e-learning initiative. An in-depth analysis of the context should be the departure point of every e-learning design effort. To consider the context, take into account learner characteristics, including:

- **Physical features:** Age, gender, disabilities
- **Education:** Fields of study, degrees earned, computer literacy

- **Cultural background:** Language, place of origin, traditions, sensitive subjects
- **Employment background:** Experience, time in current job, relationships with other participants
- **Expectations:** Reasons for attending the course, expected results

More than 85% of students will love to see UKZN (Westville campus) engaging in e-learning. Sixty percent of the students will love to see their course being 100% online. From the previous information, one can conclude that there is a need for e-learning at the University of KwaZulu-Natal (Westville campus) in the department of information systems and technology.

REFERENCES

Callaghan, G. (2001). *Collections of work on e-learning*. Retrieved September 25, 2004, from <http://www.gocallaghan.com>

Dunn, S. (2003). *Return to SENDA? Implementing accessibility for disabled students in virtual learning environments in UK further and higher education*. Retrieved September 25, 2004, from <http://www.saradunn.net/VLEreport/index.html>

El-Khatib, K. (2003). *International Journal of Distance Education, 1*. Retrieved June 30, 2004, from <http://iit-iti.nrc.gc.ca>

Hudson, H. E. (1994). *Universal service: The rural challenge—changing requirements and policy options*. Benton Foundation Communications Policy Working Paper #2. Washington DC: Benton Foundation.

Hvorecky, D. (2004). *Can e-learning break the digital divide?* Retrieved August 20, 2004, from www.eurodl.org/materials/contrib/2004/hvorecky.htm

Kruse, O. (2001). *Beyond Kirkpatrick*. Retrieved October 24, 2004, from http://www.elearning.com/articles/art5_1.htm

Iowa State University. (2004). Press release. Retrieved August 15, 2004, from <http://www.dso.iastate.edu/dept/asc/elearner/advantage/html>

Major, J. (2002). *Plagiarism*. Retrieved June 25, 2004, from <http://education.guardian.co.uk>

Morris, D. (2004). *Help is at hand*. Retrieved June 15, 2004, from www.helpisathand.gov.uk/news

Tanner, N. (1981). *On becoming human*. Cambridge: Cambridge University Press.

The survey system. (2004). *Correlation*. Retrieved June 15, 2004, from www.surveysystem.com/correlation.htm

Wood, R. (2003). *Minorities more likely to use IT for education*. Retrieved June 15, 2004, from <http://education.guardian.co.uk>

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 277-306, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 4.24

Guiding Our Way: Needs and Motivations of Teachers in Online Learning Modeling Responsive Course Design

Kathleen P. King

Fordham University, USA

Frank J. Melia

Fordham University, USA

Marlene D. Dunham

Howard Everson & Associates, USA

ABSTRACT

Increased accountability for student outcomes among teachers led to an examination of the needs and motivations of 324 K-12 educators who participated in 6-week online professional development (PD) modules of study. This research was conducted through focus groups and an online survey. The most telling findings indicate four themes regarding teacher online PD: learner expectations, learner support and access, incentives and content. This project illuminates issues

that arise in formal education online learning environments as we continue to discover how to best serve educators' learning needs. This two-step study uses surveys and focus groups to empirically identify critical factors in instructional design and implementation. It benefits from large samples and the application of knowledge derived from Group A experiences to Group B. Follow-up research of 944 participants at year four of the project provides additional insight into technology use and motivation.

INTRODUCTION

Accountability means teachers must implement standards-based instruction and raise student achievement. The Anytime Anywhere Learning PD School (AALPDS) partnership developed a distance learning PD model to address this problem as it was emerging on the United States (U.S.) national educational horizon in the year 2000. Today, in 2006, it is clear how this need extends to the classroom, as teachers and schools, faculty and educational institutions face increased and incessant demands to integrate technology into teaching and learning, raise student test scores, and meet or exceed academic and content-area standards. This robust distance learning development, training and research project spans the years 2000-2005 and explores how online PD can offer a valuable vehicle for convenient, 24 hours-a-day/7-days-a-week access to a PD community and content that can address these challenges. Timing for the field of education to learn how online learning and hybrid learning can help advance these needs is at a critical stage.

AALPDS is an extensive online course delivery system of multiple 6-week courses. Each course passes through stages of development, implementation, evaluation and revision in a cycle of continual improvement. This distance learning project was funded by a U.S. Department of Education Fund for the Improvement of Postsecondary Education (FIPSE) Learning Anytime Anywhere Partnership (LAAP) grant.

The project set out to (1) design a system of PD that applies current national standards of PD, (2) adapt PD courses to local standards of learning, and (3) increase the capacity of local educators to implement and evaluate their own school-based PD programs. The strategy was to use emerging distance learning technologies to scale up the PD efforts required by standards-based accountability demands. By using Web-enabled technologies, the AALPDS project sought to relieve participating school districts from the burden of creating the PD

courses, managing the technology—the networks and systems—needed to deliver the instruction. The earliest phase was directed at organizational alignment and restructuring, and was followed by a more extended period of course development and online implementation. The project created AALPDS, which served educators in 32 states even as the project evolved.

This project is distinctive because of its focus on the needs of teachers as adult learners, the development of local and distant learning communities, and unique content in the areas of standards-based teaching, online learning, adult learning and high-performance classrooms. The online courses consist of instructor-guided, interactive, asynchronous formats that present in-depth material, promote the application of technology-based learning in teachers' classrooms and facilitate teachers' critical reflection and collaboration in online threaded discussions and group projects. The project sought to assist experienced as well as new teachers in the implementation of high-quality, standards-based instructional programs in a climate of increased national, state and local demands for improvement and accountability.

Since the project's inception in 2000, and going live with its first class in March 2001, we have experienced many changes in partnerships and a significant formative reorientation of our direction and implementation.

While the primary goals of the PD school have remained the same, the path of implementation has shifted based on formative evaluation data collected through online surveys and focus groups. For example, the survey data showed that the 8-week duration of the first series of online modules was too long to sustain learner participation. Online learners stated a preference for shorter modules as evidenced by the higher completion rates with the 6-week format. With the collaboration of the entire project team, all of the modules were revised into 6 weeks, leading in turn to subsequent revisions in plans for additional courses and content. It is from this

perspective that this chapter offers a discussion of two especially important research questions: What characterizes the strength of this distinctive online learning format? and What needs do teacher education and PD face within online learning environments?

LITERATURE REVIEW

In considering the needs of educators in online PD, two areas of the literature in particular inform our discussion: PD from an adult learning perspective and distance education. The project built on a unique framework and depth of understanding that adult learners would respond to; a system that recognized PD is a valuable opportunity for building reflective perspectives and practice.

PD

In considering the needs of educators in their ongoing PD, one salient perspective is to recognize them as adult learners (Cranton, 1996; King, 2002a, 2005; Lawler & King, 2000). The growing literature in this area brings to the forefront characteristics of adult learners that are especially meaningful in cultivating a climate of respect, building on prior experience, learning for application, encouraging active participation, using collaborative learning and empowering participants (Lawler & King, 2000). These broad principles are then interpreted for and applied to the PD context more specifically.

Rather than focusing on “skills” and “methods,” the approach envisioned learning opportunities that evaluates the past, looks at new possibilities and carefully develops approaches to teaching and learning that incorporate new learning and perspectives. Online learning formats were designed with this perspective and incorporated Web-based bulletin boards and online journals as tools for in-depth individual contemplation and group dialog about teaching,

learning, philosophy and practice (Beyerbach & Walsh, 2001; Hawkes, 2001; King, 2001, 2002c; Paloff & Pratt, 2001; Twigg, 2001).

The climate in which educators work is critical in forming perspectives of teaching and learning. When educators work within an environment in which they are highly valued and in which they are addressed as professionals, they can develop responsibility for and invest time in their PD. Intrinsic motivation is a stronger determinant of success than extrinsic rewards, and can be communicated through the organization, individual relationships and the manner in which PD is planned and delivered.

Similarly, building on prior experience enables educators to scaffold their learning and advance in thought and practice while validating their expertise (Lawler & King, 2000). This approach emphasizes transfer of learning and immediate application while also encouraging reflective practice.

Such learning is well received when educators interact with the content and one another through multiple instructional strategies (King, 2002b). Collaborative learning offers one way to cultivate this interaction with experience, content and application and build opportunities for reflection, application and dialog, which can become increasingly “transformative learning opportunities” (King, 2005). Online learning is increasingly used to foster collaborative discussions and can be used to explore and develop ideas and application (Simonson, Smaldino, Albright, & Zvacek, 2003).

Ultimately, these adult learning strategies can move PD initiatives towards empowerment of educators. Rather than PD stopping when an in-service program ends, educators have the opportunity to continue learning both individually and together when their organization supports and validates their learning, experience and collaboration.

Several authors build on this view of educators as adult learners to recognize that PD is a valuable

opportunity for building reflective perspectives and practice (Brookfield, 1995; Cranton, 1996; King 2002a). Rather than focusing on “skills” and “methods,” the approach envisioned learning opportunities that evaluate the past, look at new possibilities and carefully develop approaches to teaching and learning that incorporate new learning and perspectives.

Online learning formats were designed that incorporated this perspective and included Web-based bulletin boards and online journals as tools for in-depth individual contemplation and group dialog about teaching, learning and philosophy, and practice (Beyerbach & Walsh, 2001; Hawkes, 2001; King, 2001, 2002c; Palloff & Pratt, 2001; Twigg, 2001).

Distance Education

With the advent of online learning via Internet, and specifically the World Wide Web in the early 1990s, a new wave of possibilities emerged for distance education (Eastmond, 1995; Palloff & Pratt, 2001; Simonson et al., 2003). Instructional design concerns took new capabilities of user-friendliness, and interactivity emerged. The Web’s graphical interface, increased options for Internet connections and decreased costs of Internet-ready computers played important parts in building a base of users who could engage in online learning.

Building on the view of educators as adult learners, critical issues that emerge in this literature are climate, expectation, experience and interactivity. The widespread adoption of the Web as a major source of information, news and entertainment has brought the use of the Internet into the mainstream. This culture and climate of online dependency is critical in introducing and sustaining the viability of online learning. In the corporate sector, a large portion of PD is being moved to distance modalities and, more specifically, online (Berge, 1998). Online learning

platforms are likely to foster such collaborative discussion and can be used readily to facilitate further exploration and development of ideas and application (Hawkes, 2001; King 2002c, Simonson et al., 2003). The emerging instructional technology of online platforms held out the promise of fostering positive climates for learning, raising teachers’ expectations of themselves and their students, and providing an environment for richer interactive learning experiences (Alexander & Boud, 2001).

These dynamics create expectations within organizations and among individuals that need to be addressed in online learning programs. The literature has shown that online learning usually takes considerably more time than learners expect and, despite their experience with using online resources for other purposes, until they engage in online learning, learners do not fully comprehend the dynamics, possibilities and responsibilities (Palloff & Pratt, 2001).

Additionally, experience and interactivity can be incorporated successfully in online learning. These issues necessitate careful planning that considers a variety of online instructional strategies, pedagogical issues, learner needs and program/course objectives (Palloff & Pratt, 2001). Online learning offers opportunities to draw out learner experience in not only instructor-learner dialog, but also peer-to-peer dialog (King, 2002b). Indeed, these limits and interactivity can be extended so far that educators and learners alike may need to set boundaries for their own participation (Palloff & Pratt, 2001).

All of these dynamic possibilities have continued to develop a challenging pathway for online learning and workplace training as the possibilities and limitations of this multifaceted, still evolving delivery mode is experienced, pressed to new limits and tested under new changing educational, economic, technological, sociological and political conditions. This discussion serves as a brief representation of the wide base of support

for this research as it approaches online learning from adult learning principles, online technology, distance learning and PD.

Methodology

This research integrates two modes of data collection—focus groups and online surveys—within a mixed, quantitative and qualitative design (Creswell, 2003). This mixed design allows researchers to include a broad base of participants, as in the online survey (N=324), and also to explore a greater depth of experience through qualitative methods, such as questioning techniques in focus groups (N= 13, 8). Findings that are particularly relevant to faculty teaching, evaluation and development are presented here. This research and development project consisted of two phases over its first 2 years, according to the method and type of information collected.

During Phase One, the first 8 months, findings were discussed informally and frequently, and adapted as appropriate into project design. Phase Two began in the 9th month, as data collection became more routine and project management shifted from a development phase to a schedule of project coordination and monitoring. In Phase One, focus group findings were based on participant experience with one course offered at the earliest part of the project. During Phase Two, data were gathered through focus group findings and the online survey.

Online Survey. The more quantitative study consisted of an online survey. The 128-item online survey was voluntarily completed by learners within the 4th-6th weeks of their online course. Learners were notified when and how to access the survey by course facilitators. Respondent identity is kept confidential through passwords devised by each participant through a set formula that utilizes their user name. Then, one program administrator who does not have access to the responses of participants forwards those passwords to the evaluator, who accesses the responses without

knowing who the participants are. The survey is a combination of multiple choice, Likert items, and free responses that cover nine broad topics: demographics (7), satisfaction (4), motivation (23), course and course impact (45), online learning (23), technology experience (2), access (12), barriers (5) and contacts (7). This chapter focuses on the data collected from 34 items concerning demographics, satisfaction and motivation.

We instituted a Web-based survey that enabled us to utilize learner feedback to modify and adjust the program of courses to better meet the needs of teacher learners. The survey was developed by the external evaluation team, with a review and revision process that included input from program directors and course content specialists. Pilot testing of survey questions were distributed to the first focus group in person and via e-mail. A survey response rate of 33% (N=324) was achieved from among those who completed the courses.

Participants. All participants were enrolled in the project courses. Contact with the largest group of participants was primarily through the Web-based online survey, because courses are available to any educators in participating districts or who are members of Classroom Connect's total learner community (80,000 Web visitors annually). All courses were delivered exclusively online.

Survey. Among the 324 participants, 287 were female and 35 male. Regarding background, 279 were self-identified as White, 13 as African American, 8 as Hispanic and 5 multiethnic. Teaching experience of the participants ranged from 0 to 16 years and more: 100 had 16 or more years, 149 had 6 to 15 years, 65 had 1 to 5 years; and 2 had no teaching experience. For 102 (31.5%) respondents, this was their first online course.

Based on responses to descriptors in the survey, participants identified themselves as follows: 158 (48.8%) early adopters—first to try something new; 152 (46.9%) like to try technology after it's been tried by others; 7 (2.1%) resist using technology; and 7 (2.1%) no response. Additional findings includes 207 (63.9%) who describe themselves

as advanced technology users; 85 (26.2%) with some experience; and 25 (7.7%) as beginners. Furthermore, 32 (9.9%) were enrolled in a degree program and 11 (3.4%) indicated that the course was part of the requirements for that program.

The majority of survey respondents were female (88.6%) and non-minority (86.1%). The majority also lived in suburban communities 168 (52%); 65 (20.1%) had more than 21 years of professional educational experience, and nearly two-thirds, 201 (62%), held a master's degree. Less than one-fourth of the respondents, 77 (23.8%), lived in rural areas and less than one-fourth lived in an urban location 71 (21.9%). Studies indicate that there is a large economic and racial gap between users and non-users of the Internet, and our respondent demographics appear to confirm this gap for our online learners (Burdenski, 2001).

Focus Groups. Two focus groups were conducted by the project evaluation team at two critical points in the project: (1) at the initial implementation phase, and 2) when the project had been underway for 9 months. These on-site focus groups were conducted in the learners' school communities and included refreshments. Major differences between the two sessions were evident at these different points in time: first, the format of the session; and second, the availability of course offerings (as a result of maturation/development of project). The first focus group of 13 teachers occurred when they had been exposed to the first online course available (1 month after the project began in March, 2001). The 2-hour afternoon session consisted of a presentation by the project director, followed by an open question-and-answer session. The project evaluator was present and distributed written surveys at the close of the session. Data were gathered through observation and notes by evaluator and journal notes of the project director. The session was held at a local community college, in a major urban area.

The second focus group of eight learners occurred in the evening at the district office in a large suburban district. Over 3 hours, discussion

revolved around 15 questions developed by the district coordinators of the program. Discussion was audiotaped. The project evaluator recorded the discussion by question and tabulated responses.

Focus Group One. Thirteen participants (all female) attended the first focus group, among which 10 were African American, 1 Hispanic and 2 white. Eleven had taught for 16 or more years. Although they were all "technology" teachers, all had far less technology experience than teaching experience. Most had less than 5 years' experience in technology and rated themselves as "no experience," beginners and limited experience. This course was their first online course. All the teachers had been required by their school or district to participate in the PD activities. All were required, by the district administrator, to come to the focus group.

Focus Group Two. Ten participants, 9 females and 1 male, attended the second focus group. They were invited to the focus group by the district administration, but not required to attend. Ethnic identification was 2 African American and 8 White. The group represented various positions in five district schools and the district office: one was a high school computer teacher; one worked in the high school guidance office, three were elementary teachers, three were experienced media or resource specialists working in two elementary schools, two were district technology coordinators. Their range of technical expertise extended from "needing help with e-mail," resisting using technology to experienced. For half of the group (5), this was their first online course, as they had been selected by their district to participate and were characterized by intrinsic motivation, curiosity and determination.

Analysis. Objective survey responses were tabulated and coded for frequencies, percentages and correlations. Focus groups and discussion board transcripts and survey free responses were coded by constant comparison, as themes were determined from the data and then the data tabulated and grouped within those themes (Cre-

Guiding Our Way

swell, 2003). Gathering data from several sources provided a broad view of the online experience among these educators.

As commonly used in mixed design research, the multiple sources of data provide support for the validity of the data (Creswell, 2003). Survey items consisted of attitude scales and open-ended free-response answers. The focus groups and discussion boards served to validate the survey responses, as these participants had participated in both modes and the responses could be compared to one another. Construct validity of the survey instrument was a priority for the survey designers, as each section had multiple items relating to the construct being used to ensure fit with the purposes of the survey and the population being surveyed. Hypothesized relationships among different sections of the survey instrument were tested with empirical observations in focus groups. Items covered both negative and positive responses; for example, the items about assistance in accessing the computer was balanced by items about barriers to access. Both items had write-in responses, also. The internal consistent reliability of the rating scales were tested using coefficient alpha, showing reliability of .8581. Both validity and reliability were priorities for the instrument designers, and several items were written and some items were not used after pilot results were evaluated. The online survey system prevented redundancy of respondents because individual, unique, single-use passwords had to be developed for each participant each time they took a course, thereby preventing any individual learner “stacking” the responses with multiple entries.

Procedures. All teacher responses in the data collection process are coded and remain anonymous, and responses regarding individual teacher demographics, teaching experience and teacher opinion are kept confidential. Prior to completing the online survey, participants are informed that the project courses are being studied to assist in course development and to learn more about on-

line learning. Learners may decline to participate without negative consequences.

FINDINGS AND DISCUSSION

Four major themes emerged as the data from the focus groups, online surveys and hybrid classes were analyzed. The subjects and topics that occurred repeatedly in each method of data collection were: (1) learner expectations, (2) learner support and access, (3) incentives, and (4) content. Each theme will be discussed within the context that they were gathered.

The focus groups provide the best indication of the effects on the adult learner of district-mandated implementation of online PD programs. The first focus group discussions centered on obstacles to participation and effective implementation in District A, shedding light as to the practicability, usability and efficacy of a district-required, online PD program. The second focus group, District B in the suburbs of a large metropolitan area, provided information after 9 months of implementation. District B’s district technology coordinator facilitated teacher participation, assuring familiarity with school organization and procedures. This embedded familiarity was critical to the pre-implementation stage to correct assumptions about teacher motivation and usage, and was influenced by changes made as a result of District A’s feedback.

Two tables summarize findings from the focus groups. Table 1 captures the differences in both the individual characteristics of focus group participants and the differences in district implementation and support of the online learning courses. Two contrasting district styles as well as two dissimilar groups of learners emerge in Table 2. Although the focus groups are not comparable, the findings help describe characteristics of successful implementation for both the adult learner and the district/school. We need to remember that

these are results for two unique districts and we need to exercise caution in generalizing these themes.

Learner Expectations

Learner expectations prior to and during the courses surfaced repeatedly in the focus groups and were directly influenced by district/school/administrator communication about the program, the learner's level of technical proficiency and lack of experience with online courses. The context raised issues of technology placement and use; the social networks that developed between and among teachers and school leaders; and the time-frames, budgets and incentives governing use of the PD programs in the schools.

In District A, sometimes information was miscommunicated or not communicated, leading to unrealistic expectations for learners. For example, the purpose and expectations of participating in the courses was incorrectly conveyed to the teachers by district administration. Communicating accurate information to learners was difficult for the Web-based course deliverers, whether by the technical team or the course guide/facilitator. Many of the learners were novice technology users whose lack of understanding led them to repeatedly delete e-mails without reading them.

In District B, participating teachers included resource coordinators and teachers from different schools in the district. Communication was handled better and learners felt "honored and privileged" that they were asked to participate. The level of basic technology skills and lack of understanding about online learning was not an issue for most of these teachers. However, sometimes teachers (even those who had taken previous online courses) found the workload to be greater than expected. This mismatch of expectations may be seen in District B, where learners, although highly motivated, sometimes found they could not continue a course.

Learner Support and Online Access

The need for learner support is multifaceted and far-reaching in online PD. The focus groups indicated the need for ongoing district support for adult learners in mandated PD programs, especially when the users are novices in technology and online course-taking. The focus groups revealed the lack of district support in these areas: (1) a clearly articulated initial introduction with explanatory materials, and (2) a continuous PD program that follows up with teachers, troubleshoots and resolves problems. If such a support system had been in place in District A, teachers may not have been deleting e-mail due to lack of training. During focus group, it was the research team (not the district) that was able to determine (from participants) that greater technical expertise was needed among the learners. This valuable information focused our recruitment for participants and further support efforts, but it was too late to prevent the frustration in District A. In District B, training in how to submit online projects might have prevented the loss of a learner's paper and subsequent frustration.

In an online learning system that is not district based, learner support is primarily provided by the technical online course team. A district's support of an online learning program should include initial communication, training and follow-up with participating learners. Even though these courses included online, e-mail and toll-free telephone support, the novice learners still struggled greatly, including problems with the course registration process.

Discussion with teachers from District A revealed that teachers were unaware of the extent of the Web site and the course offerings, even though they are using the system. District A teachers demonstrate the need for ongoing structured and formalized support and training in the basics of how to use the system. When these novice learners were further oriented to the online course

Guiding Our Way

Table 1. The learner in the district

| Implementation in Two Districts: Comparison of Focus Group Learner Characteristics and Support Provided by District | | |
|---|---|---|
| Learner Background | District A | District B |
| Previous online learning experience | None | 50% had previous experience |
| Learner attitude and motivation | Felt imposed, not enough time, already too busy | Privileged, honored, curious, personal growth motivation |
| Technology experience/Proficiency | All were inexperienced | Moderate and advanced experience (50%) |
| Computer access | 50% had computers a home. All had computers at work. | All had computers at home. All had computers at work. |
| Web-based learning style | Not comfortable reading screens; download and print all information | Comfortable reading screens; sets priorities/identifies materials to download |
| District/School Support Provided | | |
| Online learning policy implementation strategy | A district mandate: Teachers required but not enforced | Invited. Level of implementation varied by school |
| Introduction of system, initial and continuing communication to teachers | Severely limited. District level only. | Better at district level; varied by school |
| District support team providing ongoing support to teachers at implementing sites | Inactive and inexperienced | Active and experienced |
| Training to use system | None | None |
| Goals and follow-through | Unclear | Goals and follow-through set by district. |

Table 2. Summary of themes that emerged in the focus groups

| Needs for Successful Implementation of Online Instruction for Adult Learners in the Public School Setting | | |
|--|--|--|
| Learner Expectations | District A | District B |
| Materials and content: relevance to professional work | Perceived as interesting, but not relevant | Perceived as relevant and interesting |
| Perception of time required | Took more time than expected | Courses varied; some took more time than others |
| Reason for not completing course | Time, lack of meaningful incentives, did not know how to use, not relevant | Courses more work than expected; would be easier fit into schedule; too much reading; too much intensity |
| INCENTIVES | | |
| Incentive/Reward for participation | None felt by participants | Identified by participants |
| SUPPORT | | |
| Communication, training and support | Severely limited; teachers on their own | Better, but teachers still on their own |
| Use of support provided: Web, e-mail, toll-free telephone | None used; some deleted pertinent e-mails, not knowing they were about the class | Used support |

environment and Web site, they expressed greater interest in continuing and learning more.

Incentives

The role of incentives emerged as one of the most important needs among educators in this environment. Intrinsic incentives as well as extrinsic incentives need to be included, based on learners' comments. Online learning takes such great a time commitment amidst such overburdened teacher schedules that there has to be great motivation to pursue such efforts.

The most favored extrinsic incentive mentioned in the focus groups was financial, followed by academic credit incentives, such as graduate credit, continuing education units (CEUs) or certification that would result in financial rewards, and public or professional authority recognition for work accomplished. Teachers expressed that they are motivated by a combination of incentives, including personal and professional incentives, such as the desire to use technology and apply learning to their classrooms, and developing the content standards knowledge that would result from course participation.

District A is an example of how incentives affected the direction of the initiative, as the teachers would not gain financially (salary increments). The primary incentives were personal knowledge gain and CEUs. The learners made it very clear that personal knowledge was not sufficient. In District B, all the learners were interested in implementing new technology and saw enrolling and completing the course as a personal goal. The focus groups provide evidence that teachers lacking intrinsic and extrinsic motivation withdrew from participation.

For some teachers, personal satisfaction and learning are enough, but for others, incentives ought to include a combination of indirect or direct financial rewards. In other situations, the learner is a source of his or her own support and motivation. Without district mandates, incentives

and support, teacher perseverance to complete the course was dependent on personality style, time management and learning style. District B's focus group tended to be interested in implementing new technology and they set enrollment and completion as personal goals. District A teachers felt the program was imposed on them as a district goal – not an individual goal-- and combined with their lack of technology skill, they were not able to get as much out of the courses. Personality style and learning style vary, as learners appear to be very individualistic and idiosyncratic. We have more to learn about how variation in learning style impacts course completion.

Content

In online learning, the role of course content is critical, particularly that it is perceived by the learner as interesting and, even more importantly, relevant to the learner's professional work. Content surfaces as a priority because the learning experience relies so heavily on the course itself rather than spontaneous discussion, explanations or sample examples and applications. Both focus groups clearly illustrate that the curriculum content must satisfy the needs of learners or it will lose them.

District A was eager to begin, and enrolled the technology teachers in the first available course, Introduction to Online Learning. However, the learners were not interested enough in the content area, seriously hampering their continued involvement. Consistent with characteristics of other adult learners, these teachers wanted a course that could directly apply and immediately relate to their teaching in the classroom.

In contrast, District B began to participate when the project was almost a year underway and knew the entire scope of courses available. Several teachers in the District B focus group had participated in two or three courses, and were planning to participate in more, as they were quite enthusiastic about the courses with standards con-

tent. As they expressed, it was the first time they were able to see standards information presented in an organized and helpful manner.

Teacher needs and content need to match in a district implementation, as the choice of who is offered participation must match the courses being offered. District A used novice technology teachers instead of teachers who would be directly involved with implementing standards in the classroom. District B selected technology and resource teachers and teachers involved with implementing standards in the classroom. As additional districts have participated, they were informed of the recommendations below as ways to encourage greater participation and course completion.

Teachers and administrators face many demands in our high-stakes assessment climate. Even as many stakeholders remain critical of public education, this model of PD offers opportunities for new and veteran teachers to improve their effectiveness and meet some of these demands. For example, the threaded Web boards of each course enable teacher/learners to share their insights and expertise across the nation as they develop and increase their own knowledge and skills.

SUMMARY

We learned much about personal online experiences and district support systems for online learning from the participants in the focus groups. These adult learners were located in specific district PD implementation projects. Next, we look at the respondents to the Web-based survey, who are adult learners primarily from the larger Connected University (CU) community. They are not connected to a specific district and the primary way of contacting them is via the web.

Online Survey

From the 324 survey respondents, we compiled a profile of the successful learner in these courses. Though respondents comprise a non-diverse group, we are presented with the opportunity to increase the diversity of learners online. Online educators and learning providers should consider addressing the needs that surface in the emerging profile of the potentially successful learner: (1) diverse learner expectations, (2) learner support and online access availability, (3) incentives, and (4) rigorous content. Each of these areas is discussed in depth below.

Learner Expectations

Many potential and participating online learners have false preconceptions of online experiences. The reality is that quality online learning takes a substantial investment of time: Learners spent 140 minutes every time they logged in. Most respondents allocated minutes: 20 minutes reviewing assignments; 10 downloading information; 30 searching the Internet; 30 reading the forum; 15 posting on the forum; 30 working on course project and reading e-mail; and 5 reading public postings. Learners logged onto the course every week and 42.9% (139) said they logged in “once every few days.” Just more than 100 (105, 32.4%) said they logged in every day, and 114 (35.2%) respondents thought the course took more time than they expected. Very few, 13 (4.0%), thought it took less time than they anticipated. As shown in Table 3, survey respondents came to the online format from a wide range of professional experience.

Learner Support and Online Access Availability

We find that the potentially successful online teacher-learner needs to be a self-directed learner,

Table 3. Professional experience of respondents to AALPDS online surveys

| Years of Professional Education Experience | % Total Respondents |
|--|---------------------|
| One to five | 19% |
| Six to ten | 26% |
| 11 to 15 | 20% |
| 16 to 20 | 14% |
| 21 or more | 18% |

Table 4. Experience using computers in the classroom

| Years Using Computers in Classroom | % Total Respondents N=944 |
|------------------------------------|------------------------------|
| 0-2 | 10% |
| 3-5 years | 26% |
| 6 plus years | 62% |

Table 5. Motivating factors (N=944)

| Motivating Factor | % of Total number of respondents |
|---|----------------------------------|
| Topics are of interest to me. | 88% |
| More convenient (time-wise) than attending a college or university. Convenience was a motivating factor, as many of the respondents said they had families and were looking for time-saving learning options. | 83% |
| Thought it would be intellectually challenging. | 83% |
| Thought it would be rewarding to communicate with other professionals across the country. | 71% |
| Thought the course would be fun. | 72% |
| Wanted to meet interesting people in my class. | 38% |
| Required as part of my program/school. | 19% |
| Live in a location where access to PD is difficult. | 22% |

Guiding Our Way

self-disciplined and have minimum technology proficiency of Internet searching, e-mail skills and Internet usage. In our initial survey of 324 teacher-learner participants, almost three-quarters, 237 (73.2%), reported they had had 3 or more years' experience with computers, and almost half of the respondents, 149 (46.0), had 6 or more years' experience. About half of the learners, 158 (48.8%), described themselves as "early adopters who are one of the first to try new programs or software." Only a small percentage, 7 (2.2%), said, "they resist using technology," and when they rated their technology expertise, two-thirds, 207 (63.9%), said they were "intermediate" and just more than one-fourth, 85 (26.2%), rated themselves as "advanced." Less than 10%, 25 (7.7%) said they were "beginners." When self-direction, self-discipline and comfort with technology are not present, numerous problems arise that may become insurmountable and learners may drop out of their course.

In a follow-up survey taken about 1 year later, the base of teacher learner participants expanded to 944. This larger group responded to the same question about classroom-based usage of computers, and the results are shown in Table 2. It is interesting to see that with the passage of time and the increased experience level of those responding, it appears that the more experienced the teachers, the greater the use of computers in the classroom. This also may reflect the increased market penetration of computer technology in schools.

In that same follow-up study of 944 teacher learners, we asked teachers what motivated them to enroll in an online PD course; the responses are summarized in Table 5. Though convenience appeared to play an important role, interest in the topics and the intellectual challenge appear to be almost as important factors. School or program requirements did not motivate more than one-quarter of respondents. It is also interesting to note that the potential remoteness from PD did not draw much more than one-fifth of the learners.

The focus groups indicated that lack of very basic technology proficiency made simple instructions and Web interface daunting. What the developers had defined as "basic skills" was considered intermediate-advanced skills to most of these teachers in 2000-2002. Of course, these definitions are dictated somewhat socio-historically, culturally and geographically and are changing rapidly, so in 2005 our definition of a novice user is different still. The lesson learned is to enumerate the skills needed.

While we do not know the economic status of our learners, we do know that 212 (96.3%) had computers at home, 299 (92.3%) had classroom access and 275 (84.9%) had access to a school computer lab. The most frequent responses regarding barriers that prevented them from accessing the course were: "personal time issues" (241, 74.4%) and "slow computer connections" (119, 36.7%).

Finally, regarding support and access, home computers appear to be the almost universal commonality of all the learners. We suggest it is essential for the successful online learner (Palloff & Pratt, 2001). When we combine these findings with the demographic profiles of our learners, it raises questions about equity and access, including attention to the economic issues of hardware, software and Web connection fees.

Incentives

We learned much about intrinsic incentives from the survey. The third most-frequent response regarding motivation was convenience (269, 83.0%). The most frequent write-in responses were convenience (112/227, 40.4%), freedom (54, 19.5%) and flexibility (46, 16.6%). The most frequent reward for posting in the Web-based asynchronous forum was that online peers were interesting and engaging (306, 94.4%); secondly, it was rewarding to communicate with peers across the country (290, 89.5%); and thirdly, they enjoyed positive feedback (286, 88.3%).

Content

Fourth, substantial and relevant content is needed in developing online courses. Educators and other Internet users look for courses that have new information, perspectives and application. The AALPDS courses are in several areas, including content areas of reading, writing and mathematics at three levels: K-2, grades 3-5 and grades 6-8. Another area is courses about creating high-performance classrooms, and courses were added in science, grades 3-5; social studies grades 6-8; educational technology; and online learning.

Tying back to motivation, educators, like other adult learners (Brookfield, 1995, King, 2002a), look to learn what they can use in their work, their classroom. Most of the respondents (291, 89.9%) were motivated to enroll in the course by intellectual challenge (277, 85.4%) as a secondary motivating factor. Two hundred twelve (65.5%) believe an online course is more current and 175 (54.0%) believe an online course is more interesting compared to other types of PD. About one-third, 109 (33.6%), believe these courses are more rigorous than other types of PD.

These findings demonstrate how online teacher PD confirms the centrality of felt needs and relevance. Focusing online course content can guide online PD efforts and resources. Courses will draw teacher learners if they hold promise for providing rich, interesting and relevant content, as well as offering means of learning that are more easily personalized, flexible and adaptable to learner needs. The findings demonstrate how online teacher PD courses—developed around clear content and taught with rigor—can strengthen the centrality and relevance of PD efforts and investments.

RECOMMENDATIONS

Online PD programs can benefit from building on the strengths of this program. Seven major recommendations are offered here.

1. **Clarity of expectations:** Online developers need to be familiar with district school procedures and expectations to prevent communication issues that may hinder effective implementation.
2. **Intrinsic motivation:** District and teacher motivation are often two separate issues, and mutually agreed-upon goals must be reached for teacher-ownership. For some teachers, personal satisfaction and learning are enough; but for others, this must be combined with either an indirect or direct financial reward. This is especially the case in highly formalized settings in which any activity out of the “contract” may be tied to a demonstrable incentive.
3. **Supports are needed to enhance technology skills:** District initiatives should provide both initial and ongoing opportunities to extend and support teachers with fewer technology skills. An introduction to the use of computer technology may be an appropriate enhancement for novices interested in adapting technology for their learning. Even teachers in the position of “technology teacher” may need more technology expertise.
4. **Using content as a powerful motivator:** Addressing felt needs of teachers in content supports intrinsic motivation by offering a variety of courses, especially courses that directly apply to the classroom.
5. **Exploring collaborative learning further:** To maximize online PD efforts, local support and collaborative groups would be beneficial. Hybrid models support teachers as learners by incorporating face-to-face sessions in support of online components.
6. **Building on the momentum of Leave No Child Behind (NCLB) legislation and initiatives:** This project stands as an example of the benefits of the scalability of delivering high-quality, instructor-led, online courses on the subject of standards-based curriculum and focused on teaching practice.

7. **Teaching, learning, technology and research:** Each decade brings new discoveries, curricular innovations, technological breakthroughs and philosophical favorites; this project, and others like it, demonstrate how teaching, learning, technology and research can be used to assist educators in the future.

REFERENCES

- Alexander, S., & Boud, D. (2001) Learners still learn from experience when online. In J. Stephenson (Ed.), *Teaching and learning online* (pp. 3-15). Sterling: Kogan Page.
- Berge, Z. (1998). *Distance training*. San Francisco: Jossey-Bass.
- Beyerbach, B., & Walsh, C. (2001). From teaching technology to using technology to enhance student learning. *Journal of Technology and Teacher Education*, 9(1), 105-127.
- Brookfield, S. D. (1995). *Becoming a critically reflective teacher*. San Francisco: Jossey-Bass.
- Burdenski, T. K. (2001). Web-based data collection. *The APAGS Newsletter*, 13(2), 19.
- Coomey, M., & Stephenson, J. (2001). Online learning: It is all about dialogue, involvement, support and control – According to the research. In J. Stephenson (Ed.), *Teaching and learning online* (pp. 37-52). Sterling: Kogan Page.
- Cranton, P. (1996). *Professional development as perspective transformation*. San Francisco: Jossey-Bass.
- Creswell, J. W. (2003). *Research design* (2nd ed.). Thousand Oaks: Sage.
- Eastmond, D. (1995). *Alone, but together: Adult distance study through computer conferencing*. Cresskill: Hampton.
- Hawkes, M. (2001). Variables of interest in exploring the reflective outcomes of network-based communication. *Journal of Research on Computing in Education*, 33(3), 299-315.
- King, K. P. (2001). Professors' transforming perspectives of teaching and learning while learning technology. *Journal of Faculty Development*, 18(1), 25-32.
- King, K. P. (2002a). *Keeping pace with technology, Vol. 1: The promise and potential for K-12 educators*. Cresskill: Hampton Press.
- King, K. P. (2002b). Identifying success in online teacher education and PD. *The Internet and Higher Education*, 5(3), 231-246.
- King, K. P. (2005). *Bringing transformative learning to life*. Malabar: Krieger.
- Lawler, P. A., & King, K. P. (2000). *Planning for effective faculty development; using adult learning strategies*. Malabar: Krieger.
- Murphy, D., Walker, R., & Webb, G. (Eds.). (2001). *Online learning and teaching with technology*. Sterling: Kogan Page.
- Palloff, R., & Pratt, K. (2001). *Lessons from the cyberspace classroom*. San Francisco: Jossey-Bass.
- Passig, D. (2001). Future online teachers' scaffolding. *Journal of Technology and Teacher Education*, 9(4), 599-606.
- Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2003). *Teaching and learning at a distance: Foundations of distance education* (2nd ed.). New York: Pearson.
- Stephenson, J. (Ed.). (2001). *Teaching and learning online: Pedagogies for new technologies*. Sterling: Kogan Page.
- Sujo de Montes, L. E. (2000). Been there, done that: Reaching teachers through distance education. *Journal of Technology and Teacher Education*, 8(4), 351-371.

Twigg, C. A. (2001). *Innovations in online learning: Moving beyond a significant difference*. Troy: Center for Academic Transformation.

ENDNOTE

¹ The project has continued to mature after this study was completed. More learners have completed the courses, and additional programmatic results were realized. Revisions to the text reflect these facts with insights regarding (1) needed PD incentives, (2) changes in content, (3) recommendations

that link to current trends in education, and (4) recommendations regarding research and technology innovation.

² This research and development project was a partnership funded by a U.S. Department of Education FIPSE/Learning Anytime Anywhere Partnership (LAAAP) grant to develop and extend innovative capacity for online teacher PD. It began in 2000 and has served more than 2,000 educators across the U.S. as of December 2005. Additional information may be found through Fordham University's Regional Educational Technology Center, www.retc.fordham.edu.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 307-326, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 4.25

Computer–Based Health Information Systems: Projects for Computerization or Health Management? Empirical Experiences from India

Ranjini C. R.

Lancaster University, UK

Sundeep Sahay

University of Oslo, Norway

ABSTRACT

Large investments are being made to reform the health sector in developing countries as the potential of ICTs in achieving health goals is being increasingly recognized. However, there have been various reports that indicate this potential of ICT is not being fully realized on the ground in particular settings. In this chapter, an empirical investigation of the introduction of health information systems in the primary health-care sector in

India is reported. Three cases—the India Health Care Project, Family Health Information Management System, and Integrated Health Information Management Systems—are presented. The authors argue against adopting a technocentric approach during the development of the HIS and suggest that these efforts should be sensitive to the sociotechnical context. Furthermore, a variety of constraints are identified. The chapter concludes with a discussion on the potentials of integration to address some of the identified constraints.

INTRODUCTION: THE CHALLENGES OF HIS IN DEVELOPING COUNTRIES

The plural of datum is not information.
~ Anonymous

Information and communication technologies in primary health-care settings offer a number of opportunities to enhance the efficiency of administration and improve the delivery of health-care services. Health information systems (HISs), geographic information systems (GISs), telemedicine, Web-based initiatives, and the development of health-care databases (see Bodavala, 2002) are examples of a few ICT-based initiatives currently ongoing in the primary health sector in India, and also in other developing countries. Despite the undoubted potential that ICTs provide, obtaining their practical benefits on the ground is a very complex undertaking, and there are various reports of total, partial, sustainability, and replication failures (Heeks, Mundy, & Salazar, 2000). Contributing to this unrealized potential are a number of complex interrelated issues such as inadequacies in both the computer-based infrastructure (for example, Nhampossa, 2004) and physical infrastructure of roads and transportation, which are required for the transmission of reports (Mosse & Nielsen, 2004); that is, there is a lack of proper network infrastructure, the persistent presence of legacy systems embroiled with different institutional interests (Nhampossa), weak human-resource capacities both in numbers and skills (Chilundo, 2004), heavy workload of health staff who need to give priority to providing care over administrative tasks like reporting (Mosse & Sahay, 2003), and a culture of information use that sees periodic reports as primarily fulfilling the needs of the bureaucracy rather than using the information to support action (Quraishy & Gregory, 2005). All these contextual influences make the challenge of

introducing ICTs in the health-care sector a very difficult one in practice (Sahay, 2001).

The critical role that HISs can play in public health has been emphasized since the early 1980s in attempts to integrate data collection, processing, reporting, and use to strengthen management at all levels of health services (Lippeveld, Sauerborn, & Bodart, 2000). HISs in most developing countries have been described by researchers and also policy documents emerging from international agencies as being grossly inadequate (for example, Lippeveld, Foltz, and Mahouri, 1992; World Health Organisation [WHO], 1987). Sauerborn and Lippeveld (2000) argue that this ineffectiveness stems from various reasons including the irrelevance and poor quality of data being gathered, duplication and waste among parallel HISs, lack of timely reporting and feedback, and poor use of information. As a result, what we typically find is HISs that are data led rather than action led (Sandiford, Annett, & Cibulski, 1992); in this sense data is an end in itself rather than a basis for planning, decision making, and evaluating interventions. Institutionally, HISs in developing countries are situated in rather centralized structures (Braa, Heywood, & Shung King, 1997; Braa & Nermukh, 2000; Braa et al., 2001) in which local use of information is not encouraged (Opit, 1987). This has led Sandiford et al. to comment that what is needed is not necessarily more information but more use of information.

While as a part of various health reform efforts, including HIS, ICTs are being actively introduced by international agencies and national and local governments, what is often found is that the focus of such efforts are primarily on the means, computerization, rather than the ends of what needs to be achieved: strengthening information support for health management. Introducing ICTs in the development of HIS is not necessarily the silver bullet that solves the efficiency problem of the health services (Sandiford et al., 1992), and over the years research has emphasized that critical

issues to be addressed in the implementation of IS are social and organisational, not solely technical (Anderson & Aydin, 1997; Walsham, 1993). As Helfenbein et al. (1987) have argued, changing the way information is gathered, processed, and used for decision making implies making changes in the way an organisation operates. They also suggest that producing and utilizing information more effectively will affect the behaviour and motivation of all personnel.

Policy makers (for example, under the sector-wide approach policy) and also researchers (for example, Piotti, Chilundo, & Sahay, 2005) propose that the integration of an HIS provides mechanisms to address some of the existing inefficiencies of HIS and to develop new forms of health data analysis. For example, the management of HIV programmes requires data from various sources such as the mother, child, and HIV-specific programmes. Rather than developing new HISs, it is argued that the existing systems should be effectively integrated. However, integration of HIS is a complex task. In a study on a national STI (sexually transmitted infections)/HIV/AIDS programme in Mozambique, Piotti et al. (2005) analysed the multiple reporting systems that were in place. Systems for the prevention of mother-to-child transmission, volunteers, counseling and testing, blood-transfusion services, AIDS patients under follow-up for the treatment of infections and/or antiretroviral therapy, rural-district AIDS inpatients, and AIDS patients under follow-up for home-based care were among the many reporting systems that they identified. Despite formal instruments to support the reform efforts to integrate the HIV/AIDS HIS, the multiplicity of reporting systems continued to exist, each with its own practices and processes. The integration of the HIS is not merely a technical or social task, but it is sociotechnical in nature.

We argue that taking a technological determinist perspective on HIS development implies a lack of sensitivity to the sociopolitical and institutional context, and contributes significantly to the un-

realized potential of the computerization of HIS in developing countries. There is an urgent need to shift this focus from computerization itself to the question—What is it that we want to achieve through computerization?—in order to strengthen these HIS-focused reform efforts. Analysis of this question helps to develop an argument against the adoption of a technocentric approach to the development of HIS and to instead approach this effort with a focus on integration and sensitivity to the sociotechnical context. Introducing computers does not in itself lead to better handling and use of information, and the challenge is to initiate a parallel informational reform process where information is seen as a resource for action rather than for fulfilling the needs of the bureaucracy.

The present chapter analyzes empirically some of these challenges, drawing upon a study of three specific HIS initiatives introduced in primary health-care settings in Andhra Pradesh (AP; a state in southern India): The India Health Care (IHC) project, the Family Health Information Management System (FHIMS), and Integrated Health Information Management Systems (IHIMS). In the following section, we provide a brief summary of the broad context of the health sector and HIS in India. We next describe the research setting followed by a narrative of the HIS projects. Later, we present our analysis and discuss the challenges and opportunities inherent in shifting the focus of HIS efforts from computerization itself to how it can support health management. Finally, some brief conclusions are presented.

THE INDIAN HEALTH SECTOR CONTEXT

The goal of health policy in India has been stated as supporting universal and free primary health care for all (Gupta & Chen, 1996). A primary health centre was conceived in India as an institutional structure to provide integrated preventive, promotional, curative, and rehabilitative services

for the entire rural population. The primary health sector includes primary health centres (PHCs), subcentres (SCs), community health centres, and upgraded PHCs in some areas. Each PHC is expected to provide health care for a population of about 30,000, whereas in practical terms, this ranges from 20,000 to 70,000. More details on the health sector in Andhra Pradesh are provided later.

The health staff in the PHCs and SCs generate considerable amounts of data about the services that they render, collate them on a weekly or monthly basis, and report them in prescribed formats, sometimes duplicating the same report format to different departments or programme managers. These informational activities take up a considerable amount of the health staff's time. Moreover, frontline health assistants are mere producers of data rather than its users. While the focus on reporting serves to fulfill the needs of the bureaucracy and their dependencies on international aid agencies, and the potential need for epidemiological analysis, information is rarely ever used to guide local action at the level at which the data are collected (Sahay, 2001). There are also quality-related issues that inhibit the active use of data. For example, data collected at every level are aggregated, and by the time these data reach the higher levels of the health system, the specific situations in the peripheral areas are completely masked (Quraishy & Gregory, 2005). The flow of data is largely unidirectional from the lower levels to the higher ones (see Figure 1), with very little constructive feedback being given to the local levels to strengthen their work processes. Instead, often the only feedback is in the form of a reprimand, where health staff are pulled up for not meeting their (rather unrealistic) targets. Mechanisms to facilitate mutual exchange of information are also minimal.

Acknowledging these limitations of the existing HIS during the launch of a new programme named the National Rural Health Mission, the prime minister of India, Dr. Manmohan Singh,

called for reorienting the HIS to support local action (April 12, 2005):

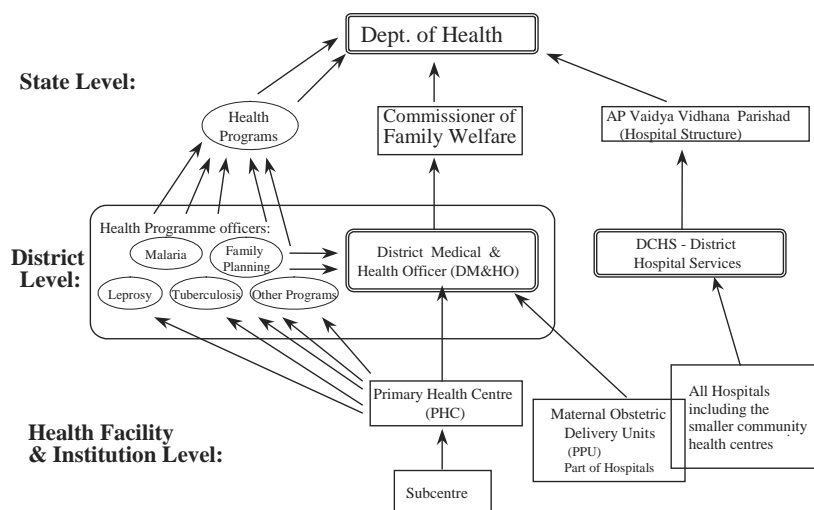
The monitoring systems have to become oriented outward towards the community and not upward towards the bureaucracy. For example, so far the health information we have in our country through the National Family Health Services Reports are seen at State and Central levels and hardly ever at district and below district levels. If information is to lead to action, it should be available and used at the local level. We must reorient the information system to support an accountability-structure by developing district health reports, state health reports and so on.

While the challenges to HIS reform are now being recognized at the policy level, the harder task is to address them on the ground. With this as the backdrop, we now shift to describing the specific research setting and the particular HIS implementation efforts.

The empirical material reported here is derived from a situational analysis of the implementation of three HIS projects in AP, a state with a population of 75.7 million (<http://www.censusindia.net>). Figure 1 provides a broad structure of the health-sector network and an overview of health information flows in Andhra Pradesh.

Subcentres have been established under the PHCs at a rate of one for every 5,000 people in rural areas, and one for every 3,000 people in tribal areas. One or two health assistants (auxiliary nurses and midwives) work at the SCs and are responsible for outreach programmes. They travel from one village to another to provide services such as immunisation, antenatal care, family planning, information and education activities, and school health programmes to the rural population. PHCs serve as the hub for implementing national programmes such as population control, and disease-control programmes like malaria, tuberculosis, leprosy, and gastroenteritis among others. Mainly, however, the PHCs are

Figure 1. Health Information Flow (Source: Sahay & Walsham, 2005, p. 44).



the cornerstone of the maternity and child health programme, now integrated into the reproductive and child health programme.

For example, one district, Chittoor, has a population of about 3.75 million served by 84 PHCs, each theoretically catering to a population of about 30,000. Each PHC has under it about four to seven SCs, each of which in turn is supposed to cater to a population of about 5,000. In practice, the PHC population varies from 25,000 to 40,000, and the SCs from 4,000 to 8,000. The state has about 1,386 PHCs, of which 470 PHCs are expected to provide round-the-clock services for safe deliveries. There will also be 268 hospitals, dispensaries, community health centres, and mobile units, and 10,568 SCs spread across 23 administrative districts, covering an area of about 246,793 sq km. In Andhra Pradesh, there are about 2,848 medical officers, 506 community health officers, 1,686 multipurpose health extension officers, 1,621 female multipurpose health supervisors, 614 public health nurses, about 11,000 multipurpose health assistants (also called auxiliary nurses and midwives), and 500 other administrative staff at

the primary health centre level (family welfare [FW] departmental manual).

RESEARCH SETTINGS: ONGOING HIS INITIATIVES IN ANDHRA PRADESH

Over the last few years, HIS projects have been initiated in the Family Welfare Department (FWD) in AP to help provide electronic support tools to the health staff at different levels of the organisation. These HIS efforts of the state government were initiated with the backdrop of larger good-governance reform policies initiated by the former chief minister Chandrababu Naidu within the framework of SMART governance (Simple, Moral, Accountable, Reliable, and Trustworthy). As a component of this ambitious good-governance policy, the chief minister drew up vision statements for every government department. The government's IT vision states, "Andhra Pradesh will leverage Information Technology to attain a position of leadership and excellence in the

information age and to transform itself into a knowledge society.” The vision document also established ambitious and demanding goals for the health department to be achieved by the year 2020. These goals were, among others, to achieve infant and child mortality rates of 10 per 1,000 (live births) and 20 per 1,000, respectively, a total fertility rate of 1.5 (average number of children per woman), and population growth of 0.8% a year. Good governance and the use of ICTs in public administration were emphasized to help achieve these goals.

In January 2002, the government of Andhra Pradesh brought out a strategy paper on governance and public management that forms the basis for governance reform activities in the state. In the book *Good Governance Initiatives in Andhra Pradesh* (Mohanty, Jones, & Rao, 2004), 28 projects have been documented to disseminate examples of good practices in the field of governance and public-sector reforms. The introductory chapter notes that:

governance involves mechanisms, processes and institutions, through which people articulate their characteristics of good governance to include: rule of law, participation, transparency, responsiveness, consensus, equity and inclusiveness, economy, efficiency and effectiveness, and accountability...The government of Andhra Pradesh has adopted an approach of combining knowledge, technology and citizen-centricity as the key strategy to improve governance in the state. (p. iii)

This focus on good governance to reform public services is indeed welcome. However, there is a need to shift the focus from merely elaborating on the content of reforms to the feasibility of implementing them on the ground. Implementation of these modern and managerial models to support good governance and best practices is complex and problematic (Madon, Sahay, & Sahay, 2004). Given the excessive focus on the

provision of infrastructure rather than on implementation and use, asymmetries exist between macro-level governance policies and the micro-level implementation of particular ICT projects (Madon, Sahay, & Sudan, 2005).

Toward a Computerised Health Database: Vision and Reality

In Andhra Pradesh, toward achieving Vision 2020 and the SMART objectives, the government undertook a number of IT initiatives, some of which have had direct implications for the health initiatives under study. One such initiative was the Multipurpose Household Survey (MPHS).

The MPHS was an ambitious project of the government of Andhra Pradesh to build a massive name-based database of 75.7 million citizens and 76.5 million land records to help provide a social-security identification number for every citizen of the state. The survey was originally compiled in 1995. It was later computerised and the data was hosted on a central server for public access. The citizen's database with about 130 data elements has been installed in 1,125 mandal¹ revenue offices. Although this database was created by the state revenue department for its own purposes, the government passed a directive that MPHS should be used as a standard database by all government departments and other agencies in an attempt to prevent multiplicity of databases. In order to comply with this directive, other departments started to add data from their own databases to the MPHS.

Creating a name-based database with various socioeconomic indicators for a population of 75.7 million is a challenging task. A consultant in the revenue department explained that this database was compiled in 1995 by conducting a household survey, and subsequently between 1998 and 2003 two private companies were given contracts to update these data and also to include other data such as deaths, births, migration, and so forth. Additional data (such as the number of school-go-

ing children and the number of working children in the age group 6 to 14) from another survey called the Human Development Survey (HDS), which was conducted by the planning department, was integrated with the MPHS data in January 2000. Integrating the data from the HDS into the MPHS database had inherent problems because the basic unit for the MPHS was the village and that for the HDS was the habitation.² In the HDS, data were collected on total numbers and not on the details of all individuals in a family. For example, details about a family included the total number of children in the age group of 0 to 5, the number of illiterates above 15 years, and the number of family members above 65 years, while in the MPHS, data were collected about every individual member. There were commissions and omissions because of the migration of people, and also because some people were reluctant to give their details for the survey. There were also quality issues raised about the HDS data as they had been collected by school children. As a result, the database was not accurate, and the quality of data was very poor.

In addition, with regard to our main concern here, the HIS, the PHC as the fundamental unit for the state health department did not match with the fundamental unit of the revenue department (the owners of the MPHS), the village. As a result, many of the health parameters necessary for health services were not included in the MPHS database, and it had to be updated with these data subsequently.

Around the time that the MPHS was being upgraded, in June 2000, Infodev (the Information for Development Programme), an agency of the World Bank, granted \$250,000 in funding for the first of the projects under study here: the IHC project. The key objectives of the IHC were to reduce or eliminate the redundant entry of data prevalent in paper registers, to generate monthly reports automatically for health assistants, and to make data electronically available for further analysis and compilation at higher levels of the

health-care system. The project was eventually implemented in 200 subcentres (spread across 32 PHCs). The larger objective of the initiative was to reduce infant mortality and maternal mortality by improving the quality of antenatal care and child health through improved information management.

The second project under study here, the FHIMS, was an offshoot of the IHC project. One district, Nalgonda, out of the 23 districts in the state was selected to pilot this project. It took off simultaneously in all 67 PHCs in the district in 2002. The information needs at different levels forced the family welfare department to embark on a more elaborate project to have information systems not just at the PHCs, but also in the district offices and the state office. The overall aim of the project was to “computerize the activities of the PHCs as a whole to take care of (a) Family Welfare needs (b) control of communicable diseases and (c) PHC management” (CFW, Office of the Commissioner of Family Welfare, 2003).

As already mentioned, during the initial days of the IHC project, it was decided that MPHS should form the basis for a name-based health registry, and that instead of conducting a new survey, the health staff should update the MPHS. The survey data were crucial for both the projects because they were to be the foundation of the name-based IS. This name-based system (with details such as, for example, who has malaria) was to replace the earlier one in which data were collected based on numbers (for example, how many cases of malaria in a region). In the FWD, the family or household was the basic unit of analysis, and it was expected that the database would maintain this unit of analysis, along data on births, marriages, family planning methods, antenatal and postnatal cases, immunisation of children, deaths, and diseases. It was argued by the proponents of the name-based system that it was necessary to provide targeted health care, especially in following up with antenatal cases, immunising children over a period of time, and in

tracking patients. While the officially stated aim of the FHIMS was to improve patient-specific care, in practice, as one doctor said, the rationale underlying FHIMS was to try and “prevent the manipulation of figures by the health staff, since with names it is easier to track whether or not the right numbers have been filled.”

Apart from these data-related issues, there were also software challenges. A consultant in the revenue department explained:

Quality problems with the software are because each department hires an agency on its own to get the necessary fields from the MPHS. That company may not know the design of the MPHS data completely. They are given a very short time, say a month or so, to deliver the product. Understanding a huge database and to know how to do it takes time. Quality suffered because of this.

Another software programme was developed to download the MPHS and print the MPHS data on habitation in the form of a household register. A software engineer of the IT company that had been involved in the development of the software for the FWD said, “Nobody knows about the accuracy of the data. The survey was initially done for the revenue department. We did not know the software codes because it was done many years back. We cannot assure the accuracy of the data.”

The development of the FHIMS software was contracted to an IT company located in the state capital at a cost of about \$68,500, and the requirements included 17 modules (such as family welfare activities, tuberculosis control, leprosy eradication, budget monitoring, personnel information, etc.). The software was developed on an Oracle back end using Visual Basic. Although the project itself was delayed (because the household survey, which was expected to be completed by December 2003, was still ongoing in March 2004 in many PHCs), the software was expected to be deployed toward the end of 2003. The health department mobilised about \$7.3 million for the project through

a consortium of funding agencies including the World Bank to buy about 1,500 computers and install it in every PHC and district office, and in the state office, and load the computers with Oracle software (with a license fee of about \$200 per computer) and Microsoft software.

The idea of computerization was that the MPHS data would be loaded in the FHIMS software, and using this health survey, data could be entered (based on names). It was soon realized, however, that the MPHS data was unsuitable because of quality issues and the fact that the data did not match the needs of the health department. As already mentioned, this was because the MPHS was conducted by the revenue department and hence did not have all the data that were necessary for the health department.

This process of collecting data for such a massive population, as can be imagined, was a complicated task and involved multiple challenges. When the health staff took the MPHS survey books to their respective habitations, they found them afflicted with many errors. Many health assistants complained that names were missing or inaccurate, ages of family members were wrong, or sometimes data on entire habitations were missing. Sometimes there would be a Muslim name for the head of the household, and the family members would have Hindu names (a quite unlikely possibility!). In another instance, the same name (of a head of the family) was in all the families in a particular habitation. Also, since house numbers were not arranged in an order in many villages, the health assistants had to rely on the names of people to locate their families.

Health assistants were expected to do the survey in addition to their regular work. Some of the health assistants said they were ordered to conduct this survey at their own cost and time. However, higher officials disagreed and said doing such surveys is part of their job. The health assistants would go in the evenings after work to conduct the survey, and had to be accompanied by their husbands because they had to travel after dark.

Also, as the list of names in the forms (printed from the FHIMS database) given to them did not match the people who were physically located in the habitations, they found it easier to buy new books and write the names by pen themselves. However, in the absence of any financial support, the health staff had to buy these books at their own cost. Because of time constraints, and the fact that they had to enter whether a person had (or had not) a list of about nine diseases and particulars of physical disability (six types) in code numbers, the assistants would typically simply enter “no” for all. A project coordinator of the FHIMS explained some of these difficulties experienced by the health assistants while conducting the survey during the pilot phase of the project as follows:

The other big difficulty that our staff faced is that they were given registers...per habitation, per village like that. Each book runs, depending on the size of the habitation, anywhere between 500 and 600 pages. Some habitations are really big and have 10,000 people. Our health assistants have to go to the field with these registers, not knowing on which page the family they have to survey is on because the books do not have any index. Addresses are not printed in a serial order as to how they are located nor are the names listed in an alphabetical order. So the health assistant practically had to turn all the 600 pages or 10,000 pages every time to locate a family. And she couldn't just tear all the pages and arrange it one after the other...She knows perfectly well which house comes next to which... That was also not possible because in one sheet we had two to three families. Later, in replication phase we have made sure we get only one family per page and we now have an index for every bound book...in an alphabetical order.

After the house-to-house survey, the next stage of the project was to enter the data into the computerised database, which was a time-con-

suming and arduous task given the already heavy workload and time constraints of the health assistants. The data entry into the household database, which would then be imported to FHIMS, was outsourced to a private party. This private agency further recruited data-processing operators (data operators; at a salary of about less than \$100 per month) to do the data entry.

During the pilot phase of the FHIMS project involving data entry, there were many omissions because the work of the data operators was not well monitored. While the health assistants were instructed to be present with their registers when data were being entered by the data operators to oversee the process, the health assistants would simply leave their registers with the data operators and go away to fulfill other duties. The data operators, for their part, found it difficult to make out the handwriting of the health assistants and the variety of informal symbols they had made in the registers. A retired district officer, who was appointed as a consultant for the project, explained why this lack of oversight of the data-entry process occurred as follows:

On many occasions health assistants were not present when the data entry was done. If the health assistant sat with the data operator with her register, that would slow down the data operator because his work would be constantly double-checked. On the other hand, work would proceed faster when the health assistant was not present because the data operator would worry less about whether he was entering the records correctly or not. Remember his payment was based on the number of records he entered per day. So naturally, his interest was not whether data he entered was right or wrong, his interest was to enter as many records as possible in a day and collect his money. The health assistants were not able to sit with the data operators, oversee and clarify, because she had so many other priorities. Moreover, that sort of accountability and sense of responsibility was not there among most of

the field staff. So, in effect, the data entry was not done in a systematic manner.

As the project expanded, data entry was moved to the respective PHCs. Now, a new set of problems caused delays in the process. Multiple software bugs, especially due to software incompatibility between the household survey module and the FHIMS database, were some of the problems encountered. The result was that certain data, for instance, data on antenatal women who did not reside in habitation or data on pregnancies leading to abortion or medical termination, could not be entered into the database. In some PHCs, the household survey module could not be linked to FHIMS database, leading to discrepancies between the population figures that were entered and what was actually displayed in FHIMS. In fact, although it was claimed that all the data had been entered, close examination revealed later that data entry was done only for the FWD module and even then for only a portion of it.

The India Health Care Project

The IHC project was started as a pilot in three health centres in the Nalgonda district where health assistants were given personal digital assistants (PDAs) and another health centre was selected to pilot the same application on a desktop computer. Subsequently, PDAs, which are mobile computing devices, were given to about 200 women health assistants. Typically, health assistants spend a considerable amount of time collecting, collating, and reporting health data to different officials. This paperwork is time consuming and cumbersome, and historic data are difficult to manage, retrieve, and use. The health assistants submit several reports of the services they have offered to the supervisors and medical officers at the weekly and monthly meetings, generally organised at the PHCs. At times, they also submit reports on different health programmes to different functionaries and agencies. The stated

objectives of the project were to reduce manual paperwork and eliminate redundant data entry, and thereby free up assistants' time for health-care delivery. The application was also expected to facilitate the generation of schedules with information pertaining to immunization and antenatal services for the health assistants, which would help them to geographically identify antenatal cases to be visited and children to be immunized. The system was also supposed to help the health assistant in tracking the history of the patients and enable her to take preventive measures such as treating high-risk pregnant women or giving timely vaccinations to children. The schedules also highlighted pending cases and those who had been missed by her in previous visits. This was supposed to help the health assistant to prioritise her work so that she could attend to cases that needed immediate attention. The PDAs were expected to eventually replace paper registers. Thus, the use of these mobile computing devices was projected as providing ample opportunities for assisting health staff in their routine work. At the PHC level, it was expected that the data from PDAs would regularly be transferred and uploaded onto desktop computers located at the PHCs and support the routine HIS.

However, the use of the PDAs was largely unsuccessful for a variety of reasons. For one, the memory supplied was insufficient (16MB). There were problems with charging the batteries in the rural areas. Many health assistants said the device was slow, and since using the device while on the job was time consuming, a few health assistants would do the data entry later in the bus on their way back from work or at home. One health assistant said she would ask her children to do the data entry at home. Those health assistants with eye-sight problems complained that they found it difficult to read small letters on the black and white screen, and said that a colour screen would have been better. Also, while standing with the PDAs in the sun made it difficult for the health assistants to see the screen clearly. Since they had

Computer-Based Health Information Systems

to deal with long lines of people waiting to get their attention, they found it troublesome to spend time trying to enter data into the PDAs. Added to the poor quality of the MPHS and the database, there were technical problems during the uploading of data into the database. The PDAs were perceived to be costly, and the health assistants were scared that they might lose them and they would have to pay for it from their pockets. Due to these and other problems, PDA use has now stopped. A health worker shared her experience:

The PDAs which were supplied were low in memory. When we started using PDAs it was taking a lot of time to search the name, or open the screen or save the entry. When we had a long queue of patients, mothers holding their small children waiting for us to give the children immunization shots, if we were operating a PDA which was slow, the patients would be frustrated. If I don't attend to them, they will go away. So, very soon I realised this PDA was not much of use when I was on the job. So I resorted back to writing in my old book. What I did was I would go home and then again enter all the day's entry into the PDA. To tell you frankly, though it has helped me in getting schedules, it has also increased my work load.

A doctor working at a health centre also shared a similar opinion on the reasons for nonuse of the devices:

The health assistants are reluctant to use PDAs because the operating system is such that if the power is discharged or if a health assistant forgets to recharge it, all the data will vanish. She has to come to the PHC and upload the data from the desktop to the PDA. In this division, the reason for reluctance of health assistants to use computers is that we got the PDAs first and desktops later. So whenever data vanished, the software engineers would take the PDAs to Hyderabad

(the state capital) and would feed the data there into the PDA. The second problem was memory. Third problem is when we said the memory is not sufficient, they changed the software so only the target population is there in the PDA. There are many software problems because of this. The health assistants who are really interested even today are not able to use them because some records are not captured properly.

Another doctor who was involved in training and supervising the project said both technical and nontechnical factors contributed to the failure of the PDA project:

The processing capacity of the PDA was slow. The intention of giving PDAs was that the health worker would give immunisation and immediately enter that data in the field. But that did not happen in practice. People won't wait. So they wrote manually in their registers. Once the immunisation session was completed, the health workers would have to again enter the data, come to the health centre and then upload the data (into the desktop). Only after that could they get the schedule. In that schedule few names would be missed because some records would be rejected. So due to all these issues health assistants were not able to use the PDAs comfortably. If these technical problems could have been solved, the percentage (of health assistants using the PDAs) would have been about 70-75%, but not 100%, because you cannot make everyone use that device. Also, battery has to be replaced after every two years or so. All these issues were not taken into consideration.

The reason to do a pilot is to try out a technology on a small scale in order to identify problems and resolve them before making a large investment. However, about 200 PDAs were brought by the IT company all at once. The consultant of the IHC project said:

The irony of it is we started the project in three PHCs initially as a pilot. So they could have procured the PDAs only for those 3 PHCs. When we raised this problem of memory they could have procured higher memory PDAs later. After having gained experience during this pilot phase they could have bought the rest of the PDAs. Anybody would do that. But the software company said they have bought all the PDAs at once. For half of the district, it was 200+ PDAs.

The poor quality of the survey database, recurring software problems, insufficient memory capacity, and the absence of timely and ongoing technical support and maintenance gradually led to nonuse of these devices on the job. The health assistants who were trained and were enthusiastic initially gradually lost interest and reverted back to their earlier manual system of recording health data. The project was neither sustainable nor was it scalable because of the costs involved. Out of 200, only about 9 health assistants were using PDAs in March 2004 during a field visit by one of the authors. During the visit, the health staff took out the PDAs from locked cupboards and showed the researcher blank PDAs that had not been used for months. In some other PHCs, we saw the children of the health assistants playing with these devices.

The aim of the project was to provide support tools that would allow health assistants to reduce the time spent doing paperwork. However, in practice, it actually increased their work. The second aim was to increase the accuracy of the data flowing up from the health assistants; however, this could not be achieved because the quality of the multipurpose survey data itself was poor. The third aim was to provide a means for getting health-care data at the village level into electronic form and generate reports. This was too ambitious to achieve because shifting from a manual to an electronic form was difficult for the reasons cited above. Finally, the project aimed to provide health assistants with information that

allowed them to provide more targeted and effective services to the people. Health assistants need more than just support tools, however, but also support to use those tools. In the absence of this, they were not able to use these devices effectively. As the consultant said, “it works only if the supporting staff trouble-shoot problems promptly and in a reasonable period. But this did not happen, so gradually the health assistants lost interest and developed a negative attitude towards computers.” So when plans to expand the computerisation project to the whole state were being drawn, it was decided not to opt for PDAs because of these problems, and also because it was considered too expensive.

Family Health Information Management System

The FHIMS project was conceived based on the experience of the IHC project. While the IHC project covered only one aspect of the work of the health assistants (family welfare services), it was decided by the FWD that a comprehensive HIS was necessary, and that it should include the different activities of PHCs including family welfare services, various health services (disease control, for example), and administrative aspects (such as budgets and logistics support). The department in its official circular (CFW, 2003) outlined the key objectives of this project as follows:

- To provide a name-based follow-up of family welfare services including antenatal services and immunization, and the early identification and timely referral of high-risk antenatal cases
- To improve the full immunization rates and thereby contribute to the reduction of infant mortality rates and maternal mortality rates
- To facilitate the health assistants to easily get schedules of services to be rendered in each habitation during a month; that is, to

provide schedules on pregnant women and children to be visited by the health assistants in their respective subcentres

- To reduce the burden of manual record keeping by the field staff and all the higher levels
- To contain the spread of communicable diseases and blindness by tracking incidences of diseases
- To improve the functioning of PHCs by facilitating effective service delivery
- To streamline inventory and infrastructure management at the health centres
- To manage career and training issues of field personnel

The project was conceived over the following phases: the pilot at the Nalgonda district (December 2001-November 2002), and the state-wide replication (June 2003-ongoing). We discuss these two phases followed by a summary of the identified implementation challenges.

The Pilot Phase of FHIMS at the Nalgonda District

The pilot phase of the FHIMS project was started in 67 PHCs in December 2001 about a year after the IHC project in the same district. A software engineer who had been involved throughout the design and development of IHC and also FHIMS explained that elaborate consultations were held with health officials at different levels, including health assistants, during the design of the software. However, when we spoke to many doctors, they typically said that the process had been largely top down with limited involvement of PHC-level doctors.

After the software was installed in all the PHCs, the department appointed data-processing operators (data operators) on a temporary basis for a period of 9 months to do the data entry and to train the staff during this transition period.

Although data operators initiated the data-entry process, they did not seem to have the capacity to take on the role of change agents and to motivate the health staff. Although the district administration had instructed every PHC to identify a competent person as a system administrator who could act as a leader and be trained by the data operators from the beginning, this did not happen. Also, the role of systems administrators was not clearly defined, and adequate guidelines were not given to them on how to manage their regular work (for example, as lab assistants) with these additional responsibilities. Additionally, no incentives were provided to concurrently carry on both this task and that of a system administrator. The system administrators also complained that the training that was provided was inadequate and focused primarily on computer awareness with hardly anything on the FHIMS and nothing on health management itself. A coordinator for FHIMS who was involved in conducting training sessions confirmed this exclusion:

Initially, all the cadres were trained in all the modules. That was not really useful. For example, a health assistant need not know about the budget module, or vehicle or personnel module. If she knows about the family welfare module and one or two national health programmes, that should be enough. Similarly, a pharmacist need not know about budget or family welfare modules. If he knows about his stores, inside out, it is more than enough. It won't take more than 2 days. He will be more than happy if he is thoroughly trained for 2 days on his module. But they were called for 5 days and were taught all the modules. By the time they came to their module, they had probably lost interest.

The doctors said they were not fully involved in the project from the beginning and were unaware about the aims of the project. A FHIMS coordinator, who is also a doctor said:

From the beginning, the doctors did not have ownership of the data... since the time the survey started. Training on updating the registers was given only to the health assistants, and the doctors did not know what the training was about. Had the doctors at the PHCs been told about the registers, all about the project, and given guidelines as to how a health assistant has to go about her work, this is where you as a doctor have to guide them...then things would have been different. However, the doctor was bypassed. The data entry was done at a central point (not at PHCs). The doctor lost track there again. That's how they drifted slowly. They could have probably fallen back on track when the software was installed, but that didn't happen due to many reasons. Hence the doctors did not own the project.

Online data transfer took place initially for sometime, but then stopped. The coordinator of FHIMS explained why:

Online data transfer was going on in 50% of the PHCs for sometime. But the thing is, the district administration is still taking only the manual reports. It is not taking the reports generated from FHIMS because all the data are not being entered into FHIMS. So, whatever report you get from that (software), it is not complete. We can generate only one report, Form B from FHIMS. But that had a few errors. And even if you could correct one or two errors with a pen, you need the other data. And where will the other data come from?

In March 2003, the authors visited 12 PHCs, one community health centre, and the district office. The health staff complained that many software- and system-related problems were identified but not addressed. In many PHCs, the health staff did not know the passwords, and did not know how to burn CDs and save the data. At the time of our visits, a majority of the health staff were not using the computerised system, were not

entering and updating the health data regularly, and hence were not generating computerised schedules or reports. The projects in most PHCs had stopped when the data operators left after their temporary tenure.

STATE-WIDE EXPANSION OF FHIMS

State-wide replication of the project involved the extension of the Nalgonda project to all the other 22 districts and 1,319 PHCs. The expansion phase of the project, which started in 2003, involved the computerisation of all the PHCs, district medical and health offices (DM&HOs), and the offices of the Director of Health and the Commissioner of Family Welfare at the state level (Circular I, CFW, 2003, p. 1). The replication involved the conduct of a household survey (to replace the MPHS data as was done in Nalgonda), the installation of computers and the FHIMS, the entering of survey data, training for the health staff, and the initiating of the other activities (such as identifying private agencies for printing MPHS books or team building) necessary for starting the project.

Based on the experience of the pilot, many changes were made during the replication phase. Survey registers were printed with an index and in alphabetical order. A team of 16 people were trained in each district, who in turn trained the health staff at the district level on how to conduct the household survey. Doctors were involved and system administrators were identified. Videoconferencing facilities were used regularly by the commissioner to coordinate and give instructions to health officials in the district, and to obtain status reports on the data-entry process. A number of circulars were sent to every PHC regularly, giving detailed instructions at different stages of implementation.

The computers were introduced in September 2003 in the PHCs, and the initial plan was to start the project by December 2003. In July 2005, one of the authors and his team conducted a situ-

ational analysis of the status of the implementation of FHIMS in 84 PHCs in another district (called Chittoor). This evaluation report, which was provided to the collector of the district, the DM&HOs, and the state-level authorities, identified a number of ongoing problems in the implementation of FHIMS contributing to it being far behind schedule. The evaluation identified that all the PHCs had reported software bugs of varying levels of complexity. Although household data had been entered, service data remained grossly incomplete. None of the PHCs were generating any of the reports that were needed to be sent to the district. This was because, except for one report, other reports could not be generated through the FHIMS. Although in a few cases schedules for health assistants were being printed, the demand for these schedules did not come from the health assistants themselves, but the schedules had been printed by the data operators (before they had left) and given to the health assistants. The study also revealed that on average only three or four people per PHC had received training in computer awareness through the 5-day training programme. No formal training was given to the PHC staff on FHIMS. In some cases, the data operators had provided some basic training to the system administrators. In more than 50% of the PHCs, none of the staff knew the username and password to enter the FHIMS modules after the departure of the data operators.

In summary, various factors have been identified that have impeded the implementation of the HIS initiatives discussed. These complexities are sociotechnical in nature. While some of these problems are expected given the extreme complexity of the projects, some, we believe, can be addressed by providing increased care and attention to the sociotechnical issues. In Table 1, we summarize some of these key challenges, and in the following section, we discuss how they were addressed.

DISCUSSION

One of the key recommendations of WHO (2005) in *Health and the Millennium Development Goals* is to improve the information basis on which health management decisions are made. The report notes, “making available information concerning the location, functioning, and performance of health services should also improve transparency and accountability in the management of the health sector” (p. 79). Accurate information can support better management and enhance the efficiency of health-care delivery. HIS can contribute to human development by supporting health management. Jacucci, Shaw, and Braa (2005) argue that the overall sustainability of a standards-based HIS is dependent on the quality of data and the skillful use of data at the level of collection. Local sustainability of the HIS requires the information to be of relevance not just for the managers, but also at the local level. This requires training health staff not just on the mechanics of using software, but also on public health-related topics of information use, data quality, significance of health indicators, validation, analysis, and interpretation of data, and linking these with interventions on the ground.

The implementation of HIS is not just a matter of introducing technology, but is also dependent on the social, organisational, and political issues that need to be addressed on an ongoing basis. Several authors have emphasized the need to understand and analyse information systems from a sociotechnical perspective (Coakes, Willis, & Lloyd-Jones, 2000; Kling & Lamb, 2000; Walsham, 1993). For example, Kling (1987) and Kling and Scacchi (1982) utilize Web models to take into account the social relations between the set of participants, the infrastructure available for its support, and the previous history of commitments in the organisation around computer-based technologies. Walsham (1993) provides an analytical framework for understanding the mutually shaping linkages that exist between

content, social context, and social processes of IS. Over the years, several authors have both applied Walsham's structural framework and also expanded it by including various facets of the economic, cultural, and political context (e.g., Avgerou & Walsham, 2000; Jarvenpaa & Leidner, 1998; Madon, 1993; Sahay, 2000; Walsham, 2001). Avgerou and Madon (2004) argue "for broadening of the perspective of situated research to make explicit the contextual origins of the meanings, emotional dispositions, and competencies actors bring to bear on the interactions that constitute these processes" (p. 176).

Even though a participatory approach was stated to have been adopted to a certain extent during the design and implementation of the FHIMS, in practice, this did not evolve into effective and sustainable partnerships resulting in end users owning the new system. As an example, the HISP team conducted a situation analysis in the 84 PHCs of the Chittoor district in August 2005 after the contracts of the data-processing operators responsible for the FHIMS implementation were discontinued. The analysis revealed that in about 50 of the 84 PHCs, the FHIMS system had not been used since the departure of the operators because the PHC staff did not even know the password to log into the system, indicative of the absence of a partnership between the implementing team and the end users, and the lack of local ownership of the system. This raises the need to adopt complementary or alternative approaches that can facilitate the creation of local capacity and ownership. This requires the trainers to play multiple roles from building technical capacity to motivating the staff, and facilitating the change processes at multiple levels (Tomasi, Facchini, & Maia, 2004). Building these capacities is a slow and gradual process, but they are crucial and fundamental for the collective ownership of the project. This requires the need to shift the focus from being primarily on technology to the various surrounding processes required to strengthen the informational basis of health management.

Some ways in which these challenges are being addressed in the FHIMS case is now discussed.

Shifting Focus from Technology to Information: Empirical Experiences from IHIMS

In order to address the various implementation challenges, the State Health Department endorsed in July 2005 a project called Integrated Health Information Management System (IHIMS) through a Memorandum of Understanding (MoU) with HISP India³ (a not-for-profit society set up by the University of Oslo). HISP is an ongoing, large-scale action research initiative that operates as a global network across a number of developing countries. HISP was started in India in December 2000, and was operating in some limited areas parallel to the FHIMS project, which had a state mandate. Since FHIMS was the official state project, and HISP was seen primarily as a university research and development project, HISP was always vulnerable to being terminated by the state in favour of FHIMS. As a strategy to protect itself against such an event, the HISP management proposed to the state the IHIMS project, which would integrate the individual capabilities of the FHIMS and HISP projects and develop synergies to contribute to the overall health information management in the state. The integration logic argued by HISP was informational rather than technological. While FHIMS was a name-based software, the District Health Information Software (DHIS), a not-for-profit customised open-source software developed by HISP, was a facility-based system. By linking the two technological systems, it was argued that an integrated informational analysis could be carried out both at the level of individuals and health facilities. Also, since the DHIS was linked to the Web and GISs, the integrated system could provide visual representations of the information on the Web and maps, something not currently possible with FHIMS.

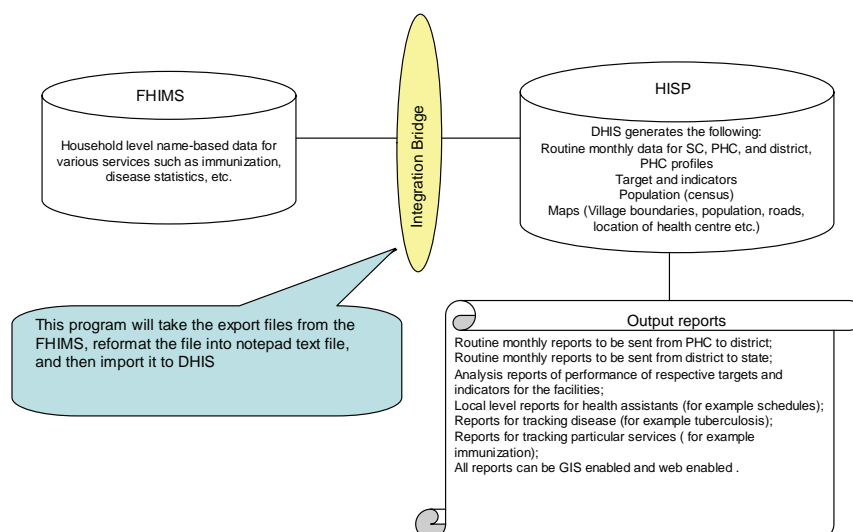
Technically, the integration was developed in the following way. With its focus on name-based data, FHIMS was capable of generating subcentre-based reports and schedules to help the health staff identify which households to visit and when. The name-based household data was entered into the FHIMS, through which the subcentre-based reports were generated. The data were then aggregated and imported into the DHIS by facilities (subcentres) and processed, which resulted in the generation of various analysis reports, including on the GIS and Web. The integration was thus proposed to convert some of the raw (household based) data into useful information through the use of analytical tools, and to improve the representation of the data using GIS-generated maps. In arguing for the integration, the HISP team emphasized that map-based reports would be useful for district- and state-level officials, for example, in resource-allocation decisions (such as opening a new facility or buying an ambulance). The conceptual schema of the integration proposed, and subsequently accepted, through the MoU under the IHIMS project is depicted in Figure 2.

The IHIMS implementation commenced in August 2005, and the first phase of the project

was a situation analysis to try to understand the status of the earlier FHIMS implementation and the underlying challenges. A key problem identified was that the operators who had been working previously in the PHCs under the FHIMS project had operated as independent islands and had not involved the health assistants in the PHCs. As a result, there was little development of local expertise and ownership of the system. As mentioned earlier, in nearly 50 of the 84 PHCs, even the passwords to log on to the system were not known to the staff in clinics there. In contrast to the approach of the operators whose focus was on data entry, the HISP's emphasis was on system facilitation whereby the data entry and report generation was not done by the trainers, but by the health staff themselves, supported and facilitated by the trainers. Also, there was a difference in the focus of the training content, which was not limited to the mechanics of the software, but also to issues of how information can be made useful to support local action.

After the situation analysis in August, the HISP trainers were assigned to a cluster of four to five PHCs and were responsible for providing ongoing support to the staff on site in each of the

Figure 2. The FHIMS-HISP integration



PHCs. This on-site training approach was radically different from the earlier FHIMS training strategy of one large district-level 3- to 5-day training programme followed by literally no support to the staff in the course of their everyday work. From August to November, a key focus of the IHIMS project was on completing the huge amounts of backlog in data entry in the FHIMS database, and trying to change the mindsets of the health staff from FHIMS to IHIMS, which included both DHIS and FHIMS. At the end of November 2005, an evaluation of the IHIMS indicated that 68 of the 84 PHCs had completed the backlog of data entry, and they had generated the Form B, mother and child report, and also the Forms A and C, for communicable diseases and other health services. The way IHIMS worked was that data for the Form B was entered into the FHIMS, and the report accordingly generated. However, the data required to generate Forms A and C were directly entered into the DHIS database, and the reports were generated through the DHIS. The FHIMS technically was not capable of developing the Forms A and C, but through the integration of the two systems, the whole suite of reports could be generated. Another evaluation at the end of December indicated that the number of PHCs that had generated the Forms A, B, and C was now 75, and the remaining 9 had serious structural problems (lack of staff or very large PHCs). Also, some of the PHCs, in addition to the routine reports of Forms A, B, and C, had also started to generate some analysis reports such as those for conducting inter-subcentre comparison. The HISP's training focus in the future was to be increasingly on the analysis reports and the use of information for action.

The relative success of the IHIMS programme can be attributed to three key reasons. First, by linking up the FHIMS and DHIS, the state government gave opportunities for the different people involved to pool their strengths and capacities rather than fight with each other. Second, the

individual capabilities of the two systems could be innovatively combined so that the FHIMS software was used for generating subcentre-based reports while the DHIS provided the facility-specific reports and also incorporated different forms of representation including the Web and GIS. Third, alternative training approaches could be included through the integration. Unlike the FHIMS project, in which training focused primarily on the use of computers, HISP emphasized the use of information, including the generation of reports, the analysis of data, and the use of GIS to make visible spatial correlations in health data. Also, HISP tried to develop the capacity of the health assistants and other staff at the PHC in the local use of information. This effort is part of a larger and long-term process of developing an information culture where data is not just seen as a mindless effort to fulfill the needs of an uncaring bureaucracy, but a resource that can strengthen the everyday local work. This approach is compatible with Sandiford et al.'s (1992) argument:

the ability to analyse and interpret data is indispensable but insufficient to overcome the inertia of the status quo to ensure that the information is translated into decisions and action....The need to tailor the presentation of information to the intended audience must be recognised. (p. 1085)

The analysis capabilities of the DHIS could be emphasized through various preprogrammed tools that provided the user with the ability to make comparisons and present data in the form of graphs, charts, and maps. Similarly, GIS provided particular analytical tools that enabled the mapping of health status and diseases, programme planning, displaying health-care coverage, planning health infrastructure and maintenance, and comparing performance indicators across PHCs (Sauerborn & Karam, 2000).

Prior research in the domains of IS and HIS, both in developed and developing countries, has

emphasized that integrating systems is no easy task as it involves aligning social, technical, and political linkages, and fostering coalitions and building synergies (Chilundo, 2004; Hanseth, Ciborra, & Braa, 2001). We agree with Chilundo, who has argued that the integration of ISs is not only a technical exercise, but involves the creation of a heterogeneous network comprised of various groups of people, technological artefacts, medical practices, and different information systems. While, at one level, integration can be seen as an attempt to reduce some of the heterogeneity in the system arising from a multiplicity of information systems, by adopting a modular approach to integration, heterogeneity can be encouraged rather than neutralized. While both the DHIS and FHIMS were capable of operating independently, in combination they were able to produce the whole set of reports required by the health department. Integration of not only the technical systems also implied bringing together different training approaches and also the pooling of financial and human resources. For example, the system administrators, a post created to support the FHIMS implementation, now were made the focal persons under the IHIMS and became responsible for the generation of the reports from both the DHIS and FHIMS systems.

In summary, we argue that the integration of systems can provide potential opportunities to address some of the implementation challenges discussed earlier. However, the philosophy underlying the integration attempts should not be to neutralize or eliminate one system, but to see how synergies can be created through drawing upon the positive aspects of both the systems and associated resources. For example, through IHIMS, the positive aspects of FHIMS, which were the name-based service schedule and summary reports, and DHIS, which was the facility-based reports, could be meaningfully incorporated toward the broader goals of health management.

CONCLUSION

The case studies presented earlier provide evidence of the importance of adopting a sociotechnical and integrated approach to the development of HIS. Too often, the introduction of ICTs is equated with development as an end in itself rather than as a means for supporting health management, which can in practice support development. These projects end up as largely computerisation projects and unsuccessful ones at that, rather than effective health-management initiatives. The introduction of computers, and the development and implementation of HIS in itself are not sufficient. Rather, the focus should be on how to develop and improve the informational base whereby information comes to be seen as a resource at all levels—at the local, district, state, and national levels—rather than just for bureaucracy.

There is typically an overemphasis on technical aspects during the implementation of HIS, and a relative neglect in addressing problems of information support that is necessary for better health management. The challenge is to move away from this pattern and to adopt a more integrated, holistic, and comprehensive approach to reforming informational and organisational practices. Introducing a HIS, particularly a name-based system, without addressing issues related to information generation, management, and use (analysis, interpretation, and evidence-based decision making) does not solve existing problems of poor quality of data, or the manipulation of figures, because health staff working in the field may have their own logic, stakes, and priorities that might not align with the goals of the promoters. That is, introducing information technology and systems does not in itself necessarily lead to better information practices or better health management. The challenge is not just to have adequate information, but to make better use of it and have a greater ability to act on it.

A grand vision to have a unified system (one-for-all purposes), as in the case of MPHS and FHIMS, may be attractive, but it brings with it numerous problems and is difficult to put effectively in practice. Instead, a more realistic approach should attempt to recognise what exists, what works well, and at what costs new systems are being built. While the name-based approach of the FHIMS is useful at the community level to track patients and provide targeted health care, HISP emphasizes the use of analytical tools for better health management and for capacity building of health staff. Initiating synergies between the FHIMS and DHIS through an integrated approach, as is being empirically attempted, provides opportunities to develop more sustainable health information systems that either of the systems by themselves cannot provide. These opportunities come through increased technical functionalities to serve different needs, a pooling of financial and human resources, and the incorporation of different and complementary training approaches.

ACKNOWLEDGMENTS

The authors would like to thank Professor Lucy Suchman for her helpful comments on previous drafts of this chapter. We would also like to thank the officials at the office of the Commissioner of Family Welfare, Andhra Pradesh, all the health staff and members of HISP India, and the FHIMS team for their support.

REFERENCES

- Anderson, J. G., & Aydin, C. E. (1997). Evaluating the impact of health care information systems. *International Journal of Technology Assessment in Health Care*, 13(2), 380-393.
- Avgerou, C., & Madon, S. (2004). Framing IS studies: Understanding the social context of IS

innovation. In C. Avgerou, C. Ciborra, & F. Land (Eds.), *The social study of information and communication technology: Innovation, actors, and contexts* (pp. 162-182). Oxford, United Kingdom: Oxford University Press.

Avgerou, C., & Walsham, G. (Eds.). (2000). *Information technology in context: Studies from the perspective of developing countries*. Aldershot, United Kingdom: Ashgate.

Bodavala, R. (2002). ICT applications in public healthcare systems in India: A review. *ASCI Journal of Management*, 31(1-2), 56-66.

Braa, J., Heywood, A., & Shung King, M. (1997). District level information systems: Two cases from South Africa. *Methods of Information in Medicine*, 36(2), 115-121.

Braa, J., Monteiro, E., & Sahay, S. (2004). Networks of action: Sustainable health information systems across developing countries. *MIS Quarterly*, 28(3), 337-362.

Braa, J., & Nermukh, C. (2000). Health information systems in Mongolia: A difficult process of change. In C. Avgerou & G. Walsham (Eds.), *Information technology in context: Studies from the perspective of developing countries* (pp. 113-133). Aldershot, United Kingdom: Ashgate.

Braa, J., Macome, E., Mavibe, J. C., Nhampossa, J. L., da Costa, J. L., Manave, A., et al. (2001). A study of the actual and potential usage of information and communication technology at district and provincial levels in Mozambique with a focus on the health sector. *Electronic Journal in Information Systems for Developing Countries*, 5(2), 1-29.

Chilundo, B. (2004). *Integrating information systems of disease-specific health programmes in low income countries: The case study of Mozambique*. Unpublished doctoral dissertation, University of Oslo, Faculty of Medicine, Oslo, Norway.

- Coakes, E., Willis, D., & Lloyd-Jones, R. (2000). Graffiti on the long wall: A sociotechnical conversation. In E. Coakes, D. Willis, & R. Lloyd-Jones (Eds.), *The new sociotech: Graffiti on the long wall* (pp. 3-12). London: Springer-Verlag.
- Gupta, D. M., & Chen, C. L. (1996). Introduction. In D. M. Gupta, C. L. Chen, & T. N. Krishnan (Eds.), *Health, poverty & development in India* (pp. 1-22). Delhi, India: Oxford University Press.
- Hanseth, O., Ciborra, C., & Braa, K. (2001). The control devolution: ERP and the side effects of globalization. *The Data Base for Advances in Information Systems*, 32(4), 34-46.
- Heeks, R., Mundy, D., & Salazar, A. (2000). Understanding success and failure of health-care information systems. In A. Armoni (Ed.), *Healthcare information systems, challenges of the new millennium* (pp. 96-128). Hershey, PA: Idea Group.
- Helfenbein, S., et al. (1987). *Technologies for management information systems in primary health care* (issue paper). Geneva, Switzerland: World Federation of Public Health Associations.
- Jacucci, E., Shaw, V., & Braa, J. (2005). *Standardization of health information systems in South Africa: The challenge of local sustainability*. Proceedings of the Eighth International Working Conference of IFIP WG 9.4: Enhancing Human Resource Development through ICT, Abuja, Nigeria.
- Jarvenpaa, S. L., & Leidner, D. E. (1998). An information company in Mexico: Extending the resource-based view of the firm to a developing country context. *Information Systems Research*, 9(4), 342-361.
- Kling, R. (1987). Defining the boundaries of computing across complex organisation. In R. Boland & R. Hirschheim (Eds.), *Critical issues in information systems research* (pp. 307-362). New York: Wiley.
- Kling, R., & Lamb, R. (2000). IT and organizational change in digital economies: A socio-technical approach. In B. Kahin & E. Brynjolfsson (Eds.), *Understanding the digital economy: Data, tools and research* (pp. 295-324). Cambridge, MA: The MIT Press.
- Kling, R., & Scacchi, W. (1982). The web of computing: Computer technology as social organisations. *Advances in Computing*, 21, 1-90.
- Lippeveld, T., Sauerborn, R., & Bodart, C. (2000). *Design and implementation of health information systems*. Geneva, Switzerland: World Health Organisation.
- Lippeveld, T.J., Foltz, A., & Mahouri, Y. M. (1992). *Transforming health facility-based reporting systems into management information systems: Lessons from the Chad experience* (Development Discussion Papers No. 430). Cambridge, MA: Harvard Institute of International Development.
- Madon, S. (1993). Introducing administrative reform through the application of computer-based information systems: A case study in India. *Public Administration and Development*, 13(1), 37-48.
- Madon, S., Sahay, S., & Sahay, J. (2004). Implementing property tax reforms in Bangalore: An actor-network perspective. *Information and Organization*, 14, 269-295.
- Madon, S., Sahay, S., & Sudan, R. (2005). *E-governance and health care in Andhra Pradesh, India: Reflecting upon the mutual linkages between macro and micro*. Unpublished manuscript.
- Mohanty, P. K., Jones, K., & Rao, S. J. (2004). *Good governance initiatives in Andhra Pradesh 2003*. Hyderabad, India: Centre for Good Governance.
- Mosse, E., & Nielsen, P. (2004). Communication practices as functions, rituals and symbols: Challenges for computerization of paper-based information systems. *The Electronic Journal of*

Information Systems in Developing Countries, 18(3), 1-17.

Mosse, E., & Sahay, S. (2003). Counter networks, communication and health information systems: A case study from Mozambique. In *Proceeding from IFIP TC8 & TC9/WG8.2 Working Conference on Information Systems Perspectives and Challenges in the Context of Globalisation*, pp. 35-51.

Nhampossa, J. L. (2004). Strategies to deal with legacy information systems: A case study from the Mozambican health sector. *Innovations through Information Technology: Proceedings of the 15th Information Resources Management Association International Conference*. Retrieved March 21, 2005, from http://folk.uio.no/leopoldo/Publications/Papers/IRMA_USA.pdf

Nhampossa, J. L., & Sahay, S. (2005). Social construction of software customisation: The case of health information systems from Mozambique and India. In *Proceedings of the Eighth International Working Conference of IFIP WG 9.4: Enhancing Human Resource Development through ICT, Abuja, Nigeria*.

Office of the Commissioner of Family Welfare. (2003, May 13). *Various official circulars. Circular – I* (Rc No. FHIMS/9511/2003). Hyderabad, India.

Opit, L. J. (1987). How should information on healthcare be generated and used? *World Health Forum*, 8, 409-438.

Piotti, B., Chilundo, B., & Sahay, S. (2005). *An institutional perspective on health sector reform and the process of reframing health information systems: Case studies from Mozambique* (Working Paper 9). Retrieved September 14, 2005, from <http://www.ifi.uio.no/forskning/grupper/is/wp/092005.pdf>

Quraishy, Z., & Gregory, J. (2005). Implications of (non) participation of users in implementation of the Health Information System Project (HISP)

in Andhra Pradesh: Practical experiences. In *Proceedings of the Eighth International Working Conference of IFIP WG 9.4: Enhancing Human Resource Development through ICT, Abuja, Nigeria*.

Sahay, S. (1998). Implementing GIS technology in India: Some issues of time and space. *Accounting Management and Information Technologies*, 8, 147-188.

Sahay, S. (2000, May 24-26). *Information flows, local improvisations and work practices*. Paper presented at the IFIP WG 9.4 Conference, Cape Town.

Sahay, S. (2001). Introduction. *The Electronic Journal of Information Systems in Developing Countries*, 5, 1-6.

Sahay, S., & Walsham, G. (2005). *Scaling of health information systems in India: Challenges and approaches*. Proceedings of the Eighth International Working Conference of IFIP WG 9.4: Enhancing Human Resource Development through ICT, Abuja, Nigeria.

Sandiford, P., Annett, H., & Cibulski, R. (1992). What can information systems do for primary health care? An international perspective. *Social Studies and Medicine*, 34(10), 1077-1087.

Sauerborn, R., & Karam, M. (2000). Geographic information systems. In T. Lippeveld, R. Sauerborn, & C. Bodart (Eds.), *Design and implementation of health information systems* (pp. 213-224). Geneva, Switzerland: World Health Organisation.

Sauerborn, R., & Lippeveld, T. (2000). Introduction. In T. Lippeveld, R. Sauerborn, & C. Bodart (Eds.), *Design and implementation of health information systems*. Geneva, Switzerland: World Health Organisation.

Singh, M. (2005). *PM launches National Rural Health Mission*. Retrieved August 31, 2005, from <http://pmindia.nic.in/speech/content.asp?id=101>

Tomasi, E., Facchini, L. A., & Maia, M. F. S. (2004). Health information technology in primary health care in developing countries: A literature review. *Bulletin of the World Health Organization*, 82(11), 867- 869.

Walsham, G. (1993). *Interpreting information systems in organisations*. Cambridge: John Wiley & Sons.

Walsham, G. (2001). *Making a world of difference: IT in a global context*. Chichester, United Kingdom: John Wiley.

World Health Organisation (WHO). (1987). *Report of the interregional meeting on strengthening district health systems based on primary health care* (WHO/SHS/DHS/87.13). Unpublished document.

World Health Organisation (WHO). (2005). *Health and the millennium development goals*. Avenue Appia.

ENDNOTES

- ¹ A mandal is an administrative unit.
- ² A habitation is a group of households in a village. It is also a unit of data for the census.
- ³ For more on HISP activities in India, see Sahay and Walsham (2005) and Braa, Monteiro, and Sahay (2004). ANMs (auxiliary nurses and midwives) and MPHAs (multipurpose health assistants) are synonyms for health assistants.

The quotes that are presented here are not verbatim but with slight alterations to clarify language usage.

GLOSSARY

AP: State of Andhra Pradesh, India

ANMs: Auxiliary Nurses and Midwives or health assistants

CFW: Commissioner of Family Welfare

DMHO: District Medical and Health Office

DHIS: District Health Information System

FHIMS: Family Health Information Management System

FWD: Family Welfare Department

GIS: Geographic Information System

HISP: Health Information System Programme

HIS: Health Information System

IHC: India Health Care Project

IHIMS: Integrated Health Information Management System

MPHS: Multipurpose Household Survey

PDA: Personal Digital Assistant

PHC: Primary Health Centre

SC: Subcentre

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, and M. Acevedo-Ruiz, pp. 1-28, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 4.26

Current and Future State of ICT Deployment and Utilization in Healthcare: An Analysis of Cross-Cultural Ethical Issues

Bernd Carsten Stahl

De Montfort University, UK

Simon Rogerson

De Montfort University, UK

Amin Kashmeery

University of Durham, UK

ABSTRACT

The ever-changing face of ICT can render its deployment rather problematic in sensitive areas of applications, such as healthcare. The ethical implications are multifaceted and have diverse degrees of sensitivity from culture to culture. Our essay attempts to shed light on these interplaying factors in a cross-cultural analysis that takes into account prospective ICT development.

PREAMBLE

Satisfactory provision of healthcare is central to our quality of life. At the same time, healthcare is a central cost factor in our personal as well as public expenditure. Healthcare systems in different countries face different challenges and provide different levels of services. It is probably fair to say that there is no one model that can address or overcome all issues. It is probably also fair to

say that most healthcare systems are trying to use technology in order to address some of the problems they are facing. Among these problems, one can find issues of cost minimization, consistency of care provision, quality control, labor saving, and a variety of others. This chapter will explore the relationship of culture, ethics, and the use of information and communication technology (ICT) in healthcare. As this suggests, we will not be able to do justice to the intersection of these four topics. Instead, the chapter will attempt to identify some dominant issues that are of relevance today.

The main purpose of this chapter is to develop a framework that will allow us to understand how culture can shape the perception of the ethicality of the use of ICT in healthcare. It is meant to provide the foundation upon which we can build valuable empirical research. We are interested specifically in the question whether there are cultural differences with regard to the perception of ICT in healthcare between individuals from cultures in a non-Western setting and those from European, specifically British, culture.

Given the size and complexity of the topic, we will use this chapter to outline some of the relationships among the main concepts and to identify areas worthy of research. Following basic definitions of pertinent concepts, the chapter will start by discussing the relationship between culture and health informatics and then proceed to describe some of the ethical issues of health informatics. These two strands of thought then will be combined to develop the concept of cultural influence on the perception of the ethics and morality of health information systems. We then will describe several scenarios that will render it clear what kind of issues we believe to be likely encountered. Establishing the descriptive and theoretical part of our topic will pave the way for developing methodological considerations that are pertinent to empirical research and to the cultural impact and ethics of ICT use in healthcare.

Ethics and Morality

It long has been established that, for the sake of practicality and application, a distinction should be made between ethics and morality. Morality can be defined as the set of acceptable social rules that are adhered to in a given community. Following this, one can define ethics as the workable scheme for the theory of morality. Ethics then can be used to describe, define, and justify morality. This distinction is not required by the etymology of the concepts, and it is not always used in English language writings on ethics. It is more widely adhered to in continental European philosophy (Stahl, 2004). We nevertheless believe it to be useful because it can help us distinguish between fundamentally different issues. Morality is a social fact and can be observed through the use of established social science methods. For example, we can observe patients in hospitals and find out whether they believe that a certain action is good or bad, whether they believe that a certain use of technology is acceptable or not. This question is fundamentally different from the ethical question of why the use of a technology is good or bad. While most individuals follow a morality of which they are aware, many of us rarely engage in explicit ethical reflection. That means that patients' ethical convictions, while important for their moral attitudes, often are implicit and much harder to determine. This has methodological consequences that will be discussed later.

Another reason the distinction between ethics and morality is important for our project is that it roughly corresponds to the difference between descriptive and normative research. One can undertake purely descriptive research on the social fact of morality, but when it comes to ethical justifications and normative suggestions, one changes the level of analysis. This is important for researchers to reflect on, and the conceptual distinction will make it easier for us to do so.

CULTURE AND INFORMATICS

This section will briefly review the relationship between culture and health informatics. For this purpose, it is useful to state why we are speaking of health informatics rather than information systems, software engineering, or computer science. The reason is that the term *informatics* is more inclusive and aims at use and social context rather than at the technical artefact itself. This is particularly pertinent, given that technology applications in healthcare are never ends in themselves or pure gadgets, but are always there to facilitate the aims of providing care. Such care also is always embedded in situations, cultures, and communities, which must be reflected by the technology. The very term *informatics*, therefore, indicates that we are looking at a wider picture. Interestingly, a large part of academic and practitioner publications dealing with ICT in healthcare use the term. Having thus explained the use of the term *healthcare informatics*, this section now will discuss the concept of culture and its relationship to health informatics.

Culture

Culture is a multifaceted concept that is hard, if not impossible, to define. For our purposes, we can start with an understanding of culture as the totality of shared meanings and interpretations of a given group. This repository of shared understandings and interpretations of the word is represented by emblems whose meanings and interpretations members of the same culture share (Castells, 2000; Galtung, 1998; Ward & Peppard, 1996). The exchange of meanings and the agreement on appropriate interpretations of emblems breed skills of communication, which begin with primitive means but evolve the more the communities develop. Eventually, communities become communication aficionados to the extent that the very existence of the culture depends on it. The nature of the culture will be reflected in

the nature of communication with information or meaning being implicit or explicit. This often is referred to as low context communication and high context communication (Nance & Strohmaier, 1994). This, in turn, underlines the social nature of cultures.

This is a rather wide understanding of culture that requires further specification. It is useful, however, because it allows an understanding of culture as a multiple phenomenon with areas of overlap and frequent change. For example, it facilitates cultures of different reach, such as organizational culture and national culture. Most organizations will have some particularities that are meaningful to their members and that outsiders cannot access easily. This is particularly so within a culture of collectivism (Nance & Strohmaier, 1994). They thus fulfill the definition of culture, and they arguably require a culture in order to facilitate their long-term survival (Robey & Azevedo, 1994). A similar description can be found for national cultures; namely, that they are the collection of things, ideas, and techniques, including institutions, which a society needs to persist (Gehlen, 1997). It should be clear that such a definition of culture will not allow easy delimitations and distinctions. Most individuals will be members of a variety of cultures (e.g., work, sports clubs, ethnic groups, families, nations, and regions). These memberships may be mutually reinforcing, but they also may be contradictory.

An important aspect of culture is that it has a normative function. This means that cultures contain an idea of how things should be and how its members are expected to behave. This means that they are inherently utopian and imply a good state of the world (Bourdil, 1996). There are different ways in which the normative character of cultures is transmitted. One of these ways is what we usually call ethics or morality. These refer to the norms that are accepted in a given culture and the justification of such norms. This also can be translated in terms of values that are

implicit in all cultures. Therefore, one can say that culture is a “value-concept” (Weber, 1994, p. 71). A related and very important aspect is that of tenet. Tenets and creeds constitute what we call meta-ethics. Their essence, usually imposing values and principles on communities that share belief in them, is normative guidance. Some religions are so comprehensive that their creeds and tenets can collectively govern all aspects of life of individuals, including their interactions with other members of the community. To these communities, ethical rules that they would abide by are only those ordained by their religion.

All of this should render it clear that cultures are linked deeply to questions of identity. On an individual level, identity as the answer to the question “Who am I?” is answered by a collection of narratives. These narratives draw on the cultures of which the individual is a member. Despite wide debate of a classification nature between relativists, utilitarianists, teleologists, and deontologists, it remains a fact of life that basic morality in the human species that commands decent conduct (i.e., do not lie; do not steal; do not deceive; etc.) are connate and *natura insitus* and, therefore, for that part universal. Culture, one thus can claim, is a universal ingredient of human existence. Clashes of cultures can evolve when interests conflict and desires intersect. In ramifications of the perplexity of today’s modern life, including those of technological applications, paradigm shifts might redefine postulates. When that happens, some cultures might tend to impose their compromised values on others, thereby leading to contradictory influences on identity and to cognitive dissonance, which can lead to pathological developments.

This point will be addressed in this chapter, since description of distorted cultural values and their influence on the perception of ethics health informatics constitute part of an ongoing debate.

Culture and ICT

The last section indicates that there is a close link between culture and technology. If culture imposes necessary conditions for reproduction, for instance, then it would become clear that reproduction technology and culture will be mutually dependent. By analogy, understanding technology as a rational approach to the environment, which typically uses artifacts for the subordination of nature, we are safe to say that culture is one of the human constants.

The close link of technology and culture extends to different types of technology but, most notably, to the most important and prominent technologies of a given culture. Early agricultural cultures can be characterized by their use of ploughs or other technologies that allowed them to develop agricultural production. Similarly, the cultures we live in today are characterized by their relationship to ICT. Talk of the “information society,” the “global village,” or similar constructs indicates that we are aware of the importance of ICT for our culture. ICT also is linked to the other defining technologies of our age, such as biotechnology and nanotechnology, but also to modern developments of more traditional technologies such as mechanical production technologies.

ICT thus allows the functioning of social institutions in Western societies such as the UK. Public administration and economic activities would look different without it. On the other hand, the social institutions we find in our cultures allow the use and development of ICT. Apart from this high level of interdependency between culture and ICT, there are also links that are less visible but as important. If we go back to the definition of culture as a set of shared meanings, norms, and interpretations, then we will see that culture strongly influences our perception of ICT and of the uses we believe to be acceptable. Again, this is a two-way relationship in which technology also affects the repository of available signs and their

interpretations. For example, we find it normal to speak of humans as information processing machines and to compare our cognitive functions with those of a computer. This indicates that technology has found its way into the set of symbols and metaphors that we believe to be meaningful. The issue becomes more complicated when culture and, consequently, ethics plays on several notes or acts on a multitude of fronts. Ethics of ICT in healthcare demands macro- and micro-analyses of not only the impact of ICT application on societal values but also the product of associated impacts of the combined forces interplaying in the overlapping parts of ICT and healthcare domains.

ETHICS AND HEALTHCARE

Healthcare procedures touch most of us on many different occasions. They are there during the most existential moments of our lives, from birth right across to death. They can affect our well being directly by providing remedies and alleviating pain and indirectly by offering us the certainty that we will be taken care of when needed. In light of the importance of healthcare for our physical and mental well being, it is easy to say that healthcare and ethics are closely related. But, nevertheless, it will be helpful to clarify the concepts used and to indicate some of the areas that we believe to be of relevance to our research.

Value-Based Practice (VBP) vs. Evidence-Based Practice (EBP) in Healthcare

Contemporary applications of ICT expand across the spectrum of healthcare fields. New developments in areas such as ICT are still unfolding and will continue to do so for some time to come. This situation usually creates what could be described as a policy vacuum (Moor, 1985). Applications of

ICT in healthcare systems lead to yet a further step of ambiguity and uncertainty. This is because a policy vacuum breeds an ethics vacuum. In order for action policies to be formulated, a conceptual framework needs to be created through appropriate analysis of the situation in question. This is very much the case in healthcare. In healthcare settings, current and future extensive use of ICT undoubtedly would result in a new state of affairs, which needs to be conceptualized in order for it to be given the legal, moral, and ethical codes that would keep its deployment in an acceptable manner—legally, morally, and ethically.

Over the past five decades, the world has been going through the initial, introductory phase of communication technologies, followed immediately by a boom in information technology applications and then a convergence of computing, communication, and media technologies. We currently are witnessing the new phase, which is still pervading diverse aspects of our lives in an unprecedented interfusion. Thus, this phase merits the title *permeation stage*. The ethical dimensions of healthcare ICT deployment under such circumstances can best be elucidated, if investigations covered areas, where vulnerable groups constitute the matrix. These mainly include neonates and infants, the elderly, palliative care, and mental illness patients. ICT could transform our concepts to the extent that the question is not anymore “Would it enhance healthcare?” but rather “What is healthcare?” When that happens, we then will realize how intangible healthcare has become. It is in such areas that ambiguity is evident as to whether health decision making should be the product of values or facts.

In terms of systematic categorization, recent researchers divide this domain into two distinct major subsections; namely, values-based practice (VBP) and evidence-based practice (EBP). Bill Fulford, one of its prominent advocates, defines VBP as the theory and skills base for effective healthcare decision making, where different (and,

hence, potentially conflicting) values are in play (Fulford, 2004). On the other side of the debate, Ronald Levant, an advocate of EBP, describes their initiative as a movement that strives to achieve accountability in medicine, psychology, education, public policy, and even architecture. He maintains that professionals are required to base their practices to whatever extent possible on evidence (Levant, 2005).

How Relevant is the VBP/EBP Debate to Health Informatics?

Values in a broader sense are “standards of behaviour” (Waite, Hawker, & Soanes, 2001). But this definition falls short of giving even a framework, if values were to be used for applied purposes, such as healthcare practice. In that sense, Sackett, Straus, Scott-Richardson, Rosenberg, and Haynes (2000) maintain that specifically patients’ values mean their unique individual preferences, concerns, and expectations. In practical terms, what these bring to clinical encounters should be integrated for the purpose of making sound, clinical decisions that would serve these patients’ interests. Combining the two definitions, it would appear that standards of behavior can become a function of preferences, concerns, and expectations; in short, the interests of all parties involved. Other definitions go as follows, singling out people’s interests: Value-based practices (VBPs) are practices that are grounded in people-first values, such as choice, growth, personhood, and so forth (Anthony, 2004).

Seedhouse (2005) in his recent work sets out his vision for a democratic future for healthcare decision making in which values of all stakeholders in the healthcare system will be taken into consideration. Values, being a subjective domain, require practice skills and methods of delivery when applied as a tool for healthcare decision making. Interaction between patients and providers is an essential part of the healthcare process. Value-based practice takes such activity

into account and considers its proper application a responsibility that the provider should strive to achieve. Among subheadings relevant to informatics and ICT, *knowledge* and *communication* stand out in this context. These are two terms used for information retrieval, acquisition, and accumulation. Information usually is acquired through first-hand narratives, polls, surveys, and media reports. In order for communication to be effective in terms of value-based practice in healthcare, the human factor is indispensable. Elements, such as attentive listening, empathy, sympathy, and reasoning, are attributes only of human beings. Methods such as Internet polls, postal surveys, and camera surveillance are potential recipes for communication failure, which, by the same token, will impact the value-based assessment and decision making. The knowledge thus acquired might have a wider impact of a negative nature not only on the users (patients) but also on other groups involved in the process, such as managers, social workers, insurers, and so forth (Colombo, Bendelow, Fulford, & William, 2003).

As interests vary from person to person and from group to group, the question as to how conflict is handled becomes inevitable. In fact, this is the paradox of value-based practice in healthcare. Therefore, the term *value* ought to be analyzed further into its micro-dimensions, which constitute a spectrum ranging from the abstract sense of ethics and over self-fulfilment criteria (wishes, desires, needs, etc.) right up to principles and beliefs. Another feature that renders the value concept problematic is the fact that values are not static; they change with time and can be modified under certain circumstances. This situation is exacerbated by the fact that some cultures allow such changes to take place, and others allow that to happen only within a very narrow margin. Also, the attitudes toward such changes can bear different connotations. They can be defined as developments in the positive

sense of the word, but they also can be defined as degradation.

Evidence-based practice, on the other hand, can be executed with the least reliance on the human factor. Artificial intelligence, expert systems, and diagnostic software are vivid examples. When sufficient material for decision-making precursors is at hand, opinions based on facts and evidence come into play. As mentioned above, EBP advocates concentrate their concern on accountability and pursuit of fact and evidence to verify it (Levant, 2005). Others have their own agenda for EBP implementation, which, in their view, should be guided by the recovery-oriented process and its values (Stultz, 2004), a matter that would transform EBP into VBP as well.

It is worthwhile to briefly considering the status of these considerations in terms of ethics and morality as outlined previously. If morality consists of the accepted norms and if ethics are the justifications, then values would seem to be part of both areas. Values are those things that we value and, thus, can be immediate generators of moral norms. On the other hand, values also can be part of the justificatory context of morality. The introduction of the term *value* to the debate also raises another issue: What are we to do if values contradict? As already stated, basing medicine on evidence is an immensely value-laden starting point. It implies assumptions on the nature of reality and of our abilities to access this reality. Evidence-based practice is thus value-based, even if this is not often recognized. Another problem of the concept of values refers to competing and contradictory values. When we speak of value-based medicine, we should realize that there is no single value and no coherent set of values that could guide this. The question thus appears—which values to choose among competing ones? An answer to this question would lead us beyond the current chapter and would have to go back to ethical theory. Very briefly, one solution could be the introduction of a hierarchy of values that would help us to identify

which values we should prefer in case of a value conflict (Stahl, 2003).

Is Ethical Impact Proportional to Technology Sophistication?

In order to answer this question, it would be sensible first to define sophisticated ICT applications in healthcare and what degrees of sophistication are meant. Two broad areas frequently are being identified by prominent bodies such as UNESCO: telehealth and telemedicine. “The former ... [includes] health services, education and research supported by ICT, while the latter refers more specifically to medical care and procedures offered across a geographical distance and involving two or more actors in collaboration, often in interdisciplinary teams” (UNESCO, 2005) As such, both are seen as related to healthcare informatics.

Equity, as a basic concept in all aspects of life, is a value that should be observed by all parties involved in any given setting in which spheres of interests overlap and lines of rights intersect. It is particularly so in healthcare systems. If we consider the situation of healthcare in a third world setting, inhabitants of remote rural areas who hardly have any care at their disposal would find equity a luxury that they cannot afford. ICT can benefit people who inhabit these isolated areas. In terms of observing, for example, the value of equity in healthcare under such circumstances, telemedicine applications are of particular benefit in that they do the following:

- Enhance access to better diagnosis to all people through computerized techniques.
- Enable online consultation with specialists, thereby reducing cost to the benefit of care providers.
- Enable follow-up through easy feedback on the efficiency of the prescribed treatment.
- Allow a chance for local medical professionals to receive training without having to move to more urbanized areas.

- Allow the establishment of databases for easy access to medical records.

Operations such as this could expand to an international level reaching as far as the technology can geographically go, thereby surpassing limits beyond which control becomes increasingly difficult. It is this degree of sophistication that could cause concern. Amidst these vast operations, it would become obvious that values such as confidentiality would be liable to breach with less and less control possibilities. Confidentiality as a personal requirement, however, is being dwarfed in comparison to security at a national or communal level.

An explanation might be that wide-scale research, such as clinical trials, can yield an enormous amount of information. If such information compiled by research conducted on whole communities is of a sensitive nature, such as DNA and genes, the breach of information confidentiality can become alarming. Genes can carry information that reveals traits common in the genetic pool of the whole community to the extent that their very existence could be at risk. Future bio-weapons fall into this category. This is supported by the fact that pharmacogenetics is a reality, which means that certain individuals, groups, or communities are more ready to respond to certain drugs than others, depending on their genetic makeup. This is being vigorously researched under the pharmaceutical domain for enhancing therapeutic and medical treatment. By the same token, however, individuals, groups, or whole communities can be inflicted specifically by disease through certain drugs or chemicals, depending on their genetic makeup. This is very much the case in societies whose building blocks are tribes or clans. We will explore this aspect further later on.

CULTURAL INFLUENCE ON THE ETHICS OF ICT USE IN HEALTHCARE: PARADOXES FROM WESTERN AND NON-WESTERN SETTINGS

In this section, we will have to choose some pertinent characteristics of the cultures that we hold to be representative and contrast them with certain uses of technology. It will end up with a collection of scenarios that will elucidate some issues of concern and shed more focused light on their complexity.

Issues in British Culture

British culture, as a vivid Western example of dynamic liberalism and utilitarianism, can serve the purpose of contrasting Western vs. non-Western settings. The liberal tradition translates into a high regard for the individual and the belief that social phenomena can be reduced to the sum of individual ones. This is important for healthcare, because the individual's rights are considered of primary importance, whereas collective considerations tend to be viewed as secondary. At the same time (and closely related to liberalism), British culture is influenced strongly by utilitarianism. This means that it is a generally accepted ethical principle to sum up all utilities and disutilities of a given act and to make decisions according to the comparison of the aggregate utility of an act. Utilitarianism often is vulgarized into a cost-benefit analysis in which the methodological problem of measuring utilities is replaced by measuring financial costs and benefits. This means that cost-benefits considerations are deemed appropriate in ethically charged situations. It also means that there is an intrinsic contradiction between the two main pillars. While utilitarianism is based on a methodological individualism and,

thus, compatible with liberalism, it is also deeply collectivist, because the rights of the individual can be (morally) overwritten by the overall collective utility.

Another aspect of mainstream British culture is that it is modernist, meaning that it relies on and trusts reason and science. While there is some resistance to this modernist view, it probably is safe to say that in mainstream British discourses, scientists are regarded as reliable and trustworthy, and the results of scientific research are seen as valid. This links to utilitarianism, which can be seen as the attempt to render ethics scientific. Science is justified, because it will help bring about a greater sum of happiness. It also means that there is an intrinsic bias toward evidence-based medicine and by association healthcare, because this is based on the scientific approach. Considerations of value are not seen as equally valid.

Examples of Issues in British Culture

On the basis of liberalism, utilitarianism, and modernism, British culture is fundamentally appreciative of new technologies. This is true for technology in healthcare as well. New healthcare technologies generally are described as positive and benevolent. There is, however, a stream of literature and research that looks at the intrinsic contradictions that grow out of the traditional view of technology in healthcare. Berg, whose work was done in the Netherlands and is transferable to the UK, describes some of these issues. The modernist view of ICT assumes that there is one governing rationale and that technology can be used accordingly to further the well being of patients. Doctors use technology to help and heal patients. This overlooks that modern societies are much more complex. One explicit reason for the use of ICT is thus to support organizational issues (Berg, 1999). Such an approach overlooks that healthcare is a complex system with a multitude of conflicting actors and interests. But even if it works, ICT then can be used to change the

way in which healthcare workers and patients interact. Technology can lead to disliking doctors and nurses. On the other hand, it also can widen the access to health services. Technology, which formally structures processes, also will lead to bureaucracy, which produces costs and, thus, is not always desirable from the utilitarian point of view.

Another interesting problem can be found in the intersection between healthcare, technology, and rationality. The modernist view of linear and individual rationality that objectively can determine desirable solutions (which is also the basis of evidence-based medicine) is not just problematic, because it underestimates the complexity of organizations. It is, to some degree, self-contradictory because it requires the very ad hoc and pragmatic activities to survive that it sets out to replace (Berg, 1997). More importantly, it also can be seen as an ideology that promotes particular interests. Using the case of a new online service, NHS Direct, Hanlon, et al. (2005) argue that “the supposed dominance of this technocratic consciousness hides class, gender and jurisdictional struggles” (p. 156). The Electronic Patient Record is a good example of these issues. Fairweather and Rogerson (2001) argue for a morally appropriate balance between the various moral standards that are in tension in the field of electronic patient records (EPRs). EPRs can facilitate doctor-patient relationships. However, at the same time, they can undermine trust and so harm the doctor-patient relationship. Patients are becoming increasingly reluctant to tell their own doctor everything that is relevant. A number of moral principles and the question of consent to release records need to be considered.

Issues in Non-Western Culture

Social norms differ from one community to another in different parts of the world. What is acceptable and permissible somewhere might not be so somewhere else. Therefore, healthcare

planners and strategists must have a clear vision of what would and what would not trigger sensitivities in the process of healthcare delivery and decision making. For instance, the vital communication element previously mentioned for good value-based practice can become totally defective if carried out, for instance, in a male-to-female setting in which social norms do not accept it. A similar attitude is expected in situations such as vaginal swabbing or artificial insemination, the meta-ethics being tenet-rooted. It is against the social norms and religious codes of many world populations. Muslims, for example, who constitute just over a quarter of the world's population (<http://www.islamicweb.com/begin/results.htm>) have attitudes that are overwhelmingly governed by Shari'a codes of conduct. These ordain many aspects of life, including those that fall within the sphere of healthcare. Questions concerning issues such as permissibility of a male healthcare provider to examine a female patient (or vice versa) are hot debate topics. This will be investigated further in the scenarios given next.

The influence of culture on the perception of health information and communication technologies are issues in a Middle Eastern setting (women, tribal structures, etc.). Further, to points mentioned previously, issues of ethical dimensions can be exacerbated by cultural influences. In the following section, we will try to take the reader through selected scenarios, some hypothetical and others compiled from real life in parts of the world that have entirely different attitudes toward practices seen in Western settings as acceptable—the effect being cultural.

Some Scenarios

Scenario 1: Outcry to the King

Ali takes his wife, who is in labor, to a university teaching hospital. Shocked to learn from the receptionist of the obstetrics and gynecology department that the attending physician is male, not

female, he reluctantly leaves the hospital to send a bitter letter of complaint through the media to the highest authority in the country: the king.

Let us imagine how the situation would be if this scenario were repeated, and the wife had complications and would require consultation and on-air monitoring via telemedicine.

Scenario 2: 30 Years in Pursuit of a Female Orthopedist

Yassir writes on May 18, 2005, to a medical forum asking for help. His mother has been suffering from debilitating orthopedic problems for 30 years and is reluctant to be seen by a male orthopedist; there is no female specialist in the area where they live.

Yassir's mother could not be helped, even by telemedicine intervention, so long as the hands that would touch her were those of a man, as she put it. The patient received numerous messages of support and sympathy.

Scenarios 1 and 2 are in total compliance with the Islamic code of conduct. The Islamic Jurisprudence Council of the Mecca-Based Muslim World League issued in its 14th session, convened in January 1995 in Mecca, its Fatwa (dictum) emphasizing the impermissibility of healthcare professional attending patients of the opposite gender. The Fatwa allowed for a margin of permissibility only under circumstances of absolute necessity. As is the case in all other similar situations, the degree of necessity is left to the individual to evaluate. In our two scenarios, the persons in question did not categorize their situation as absolute necessity and, therefore, abided strictly by the given Fatwa.

Scenario 3: Miss L. and the Monitoring System

Miss L. is admitted to the hospital in the summer of 2003. During her stay in a single room on the surgery ward, a young male in a professional

outfit made frequent visits to her, paving the way for a relationship to develop between the two. Eventually, kissing and hugging took place. Without realizing that the monitoring system was active, she enjoyed it. Soon, another man appeared and showed her photographs of her intimate encounters, threatening to make them public on the World Wide Web, unless she gave in to his demands, which turned out to be sheer sexual blackmail.

Scenario 3 is a typical example of the abuse that technology could undergo as a powerful tool with which opportunistic people might fulfill their desires. The perpetrator knows that Miss L. faces a very difficult situation, as cultural and social values of her society would not approve of her behavior.

Scenario 4: Mr. A.F. and the Monitoring System Again

Mr. A.F. was admitted to the hospital as a private patient and stayed in a private, luxury room for two weeks for pulmonary infection treatment. On one occasion during the convalescence days, his wife, who was visiting him at the time, happened to be with him alone in the room. He locked the door and had a very steamy, intimate encounter with her, without realizing that the monitoring system was active. The hospital management, while reiterating the fact that they were doing their job, soon acknowledged the unfortunate incident, offered an apology, and promised to destroy the film that carried the embarrassment, reminding Mr. A.F. that the essential function of hospital rooms is healthcare and receiving visitors for the purpose of the patient's welfare, but nothing beyond that. Mr. A.F. was adamant in not accepting the apology and insisted on suing the hospital. His argument was based on the conviction that his welfare extended to the activity he performed and that the hospital should have warned him beforehand of the monitoring system and what activities they had in mind for monitoring. He also maintained that

had the monitoring system been run by a human being, he or she would have stopped filming the action immediately. Leaving it up to a machine led to the embarrassment, for which the hospital should be held responsible.

Scenario 5: Genetic Screening and the XL Clan of the LL Tribe

Tribes in Middle Eastern regions and in some other parts of the world constitute the main building blocks of many societies extending across geographical boundaries and trespassing political borders. They share common ancestry and, therefore, a gene pool. The chronicle of this ancestry extends deep in history. Qahtani tribes, for instance, are named after Noah's descendant Qahtan, and Adnani tribes after Adnan, one of the descendants of Ishmael son of Ibrahim. Their branches and subsections are numerous and extend throughout the Arabian peninsula and beyond. For instance, about 70 tribes can now be identified in the UAE alone. Through the tribe and its hierarchy, the individual has the right of protection of the tribe and is obliged to abide by its rules. Disputes among members of the same tribe are dealt with by heads of clans, leaders of the subtribes, or the chief (sheikh) of the tribe. Verdicts and rulings thus formulated are binding to all parties. These stem from traditional tribal conventions and practices (urf), known to everybody. The traditional tribal system even makes a young man's own choice of his bride largely immaterial, as it strongly advocates first and second cousin marriages. The first option is usually the daughter of his paternal uncle. It is, therefore, not surprising that some of these clans who have been living in isolated, remote areas for millennia have an exceedingly high rate of consanguinity and, hence, are expected to have a reasonably distinct genetic makeup (<http://www.al-bab.com/yemen/soc/maneal.htm>).

This is dependent on population frequencies of specific alleles, though not to be taken as race-

specific, as no extensive studies have been made available thus far to define race based on genetics. It also should be made clear that the tribes in question at the writing of this chapter have not been subject to studies within the population genetics domain that clearly point out 1% frequencies of certain alleles, which is by definition a polymorphism.

Under such conditions, culture can put into action factors that are not reckoned with in the West. The sensitivity of information in a healthcare setting, such as patients' records and stigmatization, can form a combination of devastating effects in that culture. Saudi Arabia, for example, recently has introduced nationwide mandatory premarital screening tests, the impact of which on the social level is yet to unfold with a possibility of an unpleasant outcome if the tribal structure of the society is taken into consideration. The positive side of these tests is self-explanatory. In recognition of the high incidence rates of genetic diseases such as sickle cell anemia and thalassaemia in some regions of the country, such measures no doubt would reduce these rates. However, in the long run, with the accumulation of more and more genetically related information, whole clans and tribes could be stigmatized and girls with certain genetic traits victimized (in terms of spinsterhood), if procedures are not properly executed and/or information systems are not efficiently run and managed (Kashmeery, 2004). Our scenario is hypothesized for future projection.

The XL clan extends across the borders of three neighboring countries. Their branch on the western side of the borders had in abundance by genetic screening rules set by their government to consider allowing such tests to be performed on its members. Within a few months, a trend was established from the compiled data that the clan members have a NOTCH4 gene triplet repeat polymorphism. Without realizing the significance of the finding, the medical record facility did not impose tight security measures on the results. An abstract leaked in a bona fide manner to the

local media, which published a layman report on the procedure and praised its underlying policy. In academic circles, the impact was different. This polymorphism was known to have some association with a serious psychological defect: schizophrenia (Wei & Hemmings, 2000). Rumors spread swiftly, blowing the issue out of proportion. The chief on the top hierarchy of the tribe on the eastern side of the border got upset by the news that reached him anecdotally and ordered the XL clan chief not to cooperate with the genetic screening scheme. XL clan, chief, and individuals have their loyalty to the tribe more than to the state. They all decided overwhelmingly to boycott the screening schemes, current and future ones, and thereby came into conflict with local authorities, who stood by their agenda and work plans. The issue assumed national proportions, following confrontations and arrests. Social unrest began to reach police records wherever members of the XL clan were engaged, at work or social activities. XL clan becomes more and more isolated and alienated, with intermarriage rates with other groups of society falling rapidly, leaving stigmatized women haunted by the state of spinsterhood, which is a woman's nightmare in that society. The impact of these developments spilled over the borders to the east and south where other subsections of the same tribe live, and the scenario repeated itself, forcing members of the LL tribe to go through the same ordeal.

Scenario 6: The Bed-Ridden Elderly in the Care of Extended Family

At the age of 82, Mr. S.K. had been bed-ridden for three years due to leg muscular dystrophy. He also was diabetic and hypertensive and, therefore, needed close health and nursing care. Values, culture, and tradition would not allow his family even to discuss the principle of admitting him to a nursing home. The social norms where Mr. S.K. lived demanded that he be looked after by his nearest of kin. To facilitate such a stipula-

tion, members of the extended family usually live together in large premises. Mr. S.K.'s three sons were living with him in such a setting and managed to share the responsibility of his care. They were grown up professionals engaged in diverse occupations ranging from diplomacy and university professorship to high-ranking civil service. None of them was ever heard complaining or expressing the least bit of discontent, except for their admitted lack of expertise in some aspects of the care they were practicing.

Despite their continuous pursuit for knowledge from physician friends of theirs, they have always felt that the scheme would have worked more efficiently had there been a handy, simple software that gave guidelines for executing their tasks in a more professional way.

Their worries always peaked during the night when they were in their rooms and while they all were away at work, for fear of not being there for help, if needed. They used to hypothesize an emergency situation and have always felt that an adequate monitoring system, connecting them simultaneously to the patient's healthcare professionals who could intervene in the right moment, would have perfected the scheme.

These shortcomings were dwarfed in relation to the great advantage of having their father looked after in the comfort of his own home surrounded by members of his own family, who would do anything to please him, reiterating to him time and again that they do that with pleasure and passion.

Of course, he did not know that there are millions of parents in other parts of the world who go through the ordeal of leaving their homes and their loved ones when they desperately need them, and of losing their property in order to cover the expenses of nursing homes, where they might face a fate they frequently read about in the media. He didn't know that. But what he knew very well was that looking after him and preserving his dignity, no matter how demanding that might be,

are ordained by tenet and are a debt carried with pride from generation to generation.

EPILOGUE

Given the review of the literature and the scenarios just elaborated, the reader should have an idea of what sort of issues we expect to find. The reader also will realize that the research we are suggesting is at the crossroads of a number of disciplines and theories. So far, this chapter contains a collection of thoughts that is meant to support the contention that research in the cultural aspects of the ethical properties of ICT in healthcare is desirable. We have refrained from developing a specific theory that will explain the relationship between culture, ethics, and ICT in healthcare. Instead, we intend to investigate these matters from the starting point outlined previously, but we will keep an open mind to issues that have not yet been raised. To some degree, we thus propose to follow a grounded theory approach that aims to develop theory inductively from observation (Glaser & Strauss, 1967).

The purpose of this chapter was to outline an area of research between culture, ethics, and ICT. We hope that the chapter succeeded in persuading the reader that such a project is worthwhile. Given the early stage of the research, we expect the chapter to provoke vigorous debate and hot discussion about this topic—something that will help us to develop these considerations further. It is also a call for other researchers with similar interests to contact us in order to develop collaborative ties.

REFERENCES

Anthony, W. A. (2004). The principle of personhood: The field's transcendent principle. *Psychiatric Rehabilitation Journal*, 27, 205.

- Berg, M. (1997). Problems and promises of the protocol. *Social Science & Medicine*, 44(8), 1081-1088.
- Berg, M. (1999). Patient care information systems and health care work: A sociotechnical approach. *International Journal of Medical Informatics*, 55, 87-101.
- Bourdil, P. (1996). *Le temps*. Paris: Ellipses/Édition Marketing.
- Castells, M. (2000). *The information age: Economy, society, and culture, volume I: The rise of the network society* (2nd ed.). Oxford: Blackwell.
- Colombo, A., Bendelow, G., Fulford, K. W. M., & William, S. (2003). Evaluating the influence of implicit models of mental disorder on processes of shared decision making with community-based multidisciplinary teams. *Social Science & Medicine*, 56, 1557-1570.
- Fairweather, N. B., & Rogerson, S. (2001). A moral approach to electronic patient records. *Medical Informatics and the Internet in Medicine*, 26(3), 219-234.
- Fulford, K. W. M. (2004). Ten principles of values-based medicine. In J. Radden (Ed.), *The philosophy of psychiatry: A companion* (pp. 205-234). New York: Oxford University Press.
- Galtung, J. (1998). *Frieden mit friedlichen Mitteln—Friede und Konflikt, Entwicklung und Kultur*. Opladen: Leske + Budrich.
- Gehlen, A. (1997). *Der Mensch: Seine Natur und seine Stellung in der Welt* (13th ed.). Wiesbaden: UTB.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: de Gruyter.
- Habermas, J. (1981). *Theorie des kommunikativen Handelns* (Band I/II). Frankfurt a. M.: Suhrkamp Verlag.
- Hanlon, G., et al. (2005). Knowledge, technology and nursing: The case of NHS direct. *Human Relations*, 58(2), 147-171.
- Kashmeery, A. (2004). Who owns the human genes? An East-West cross-cultural analysis. *Oxford Research Forum Journal*, 2(1), 81-85.
- Levant, R. F. (2005). Evidence-based practice in psychology. *Monitor on Psychology*, 36(2). Retrieved April 19, 2005, from <http://www.apa.org/monitor/feb05/pc.html>
- Moor, J. H. (1985). What is computer ethics? *Metaphilosophy*, 16(4), 266-275.
- Nance, K. L., & Strohmaier, M. (1994). Ethical accountability in the cyberspace. *Ethics in the Computer Age* (pp 115-118). Gatlinburg, TN: ACM.
- Waite, M., Hawker, S., & Soanes, C. (2001). *Oxford Dictionary, thesaurus and wordpower guide*. Oxford, UK: Oxford University Press.
- Robey, D., & Azevedo, A. (1994). Cultural analysis of the organizational consequences of information technology. *Accounting, Management and Information Technologies*, 4(1), 23-37.
- Sackett, D. L., Straus, S. E., Scott-Richardson, W., Rosenberg, W., & Haynes, R. B. (2000). *Evidence-based medicine: How to practice and teach EBM* (2nd ed.). Edinburgh: Churchill Livingstone.
- Seedhouse, D. (2005). *Values based health care: The fundamentals of ethical decision-making*. Chichester, UK: Wiley & Sons.
- Stahl, B. C. (2003). The moral and business value of information technology: What to do in case of a conflict? In N. Shin (Ed.), *Creating business value with information technology: Challenges and solutions* (pp. 187-202). Hershey, PA: Idea-Group Publishing.
- Stahl, B. C. (2004). *Responsible management of information systems*. Hershey, PA: Idea Group Publishing.

Stultz, T. (2004). Model transformation: From illness management to illness management and recovery. *ACT Center of Indiana*, 3(4), 2.

UNESCO. (2005). Retrieved May 5, 2005 from http://www.unesco.org/webworld/observatory/in_focus/010702_telemedicine.shtml

Ward, J., & Peppard, J. (1996). Reconciling the IT/business relationship: A troubled marriage in need of guidance. *Journal of Strategic Information Systems*, 5, 37-65.

Weber, M. (1994). Objectivity and understanding in economics. In D. M. Hausman (Ed.), *The philosophy of economics: An anthology* (2nd ed.) (pp. 69-82). Cambridge: Cambridge University Press.

Wei, J., & Hemmings, G. P. (2000). The NOTCH4 locus is associated with susceptibility to schizophrenia. *Nature Genetics*, 25, 376-377.

This work was previously published in Information Technology Ethics: Cultural Perspectives, edited by S. Hongladarom, and C. Ess, pp. 169-183, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Section 5

Organizational and Social Implications of Information Communication Technologies

This section includes a wide range of research pertaining to the social and organizational impact of ICT around the world. Chapters introducing this section illustrate the intersection of ICT and culture and the impact this has upon individuals and entire communities. Other contributions discuss ICT's potential for empowerment among disenfranchised individuals and societies as well as the ways in which ICT can transform education and the modern workplace. Particular selections debate the use of ICT for web-based learning, while others discuss how ICT has been utilized in the field of tourism. The debates and inquires presented in this section offer research into the integration of global ICT as well as implementation of ethical considerations for all organizations.

Chapter 5.1

Convergence of ICT and Culture

Matthew Mitchell

WSU Center to Bridge the Digital Divide, USA

INTRODUCTION

Participants in development projects and programs that strategically utilize information communication technologies (ICT) are engaged in activities that have culturally-relevant impacts. At local and regional levels, there may be approaches to implementing ICT-based development projects that are appropriately contextualized for different socio-cultural systems. Such approaches need to look beyond short-term outputs and mid-term outcomes and give adequate focus on long-term impacts. It is possible to analyze the long-term impacts of ICT-based development projects through a number of different lenses, one of which is the concept of “convergence.”

The basic idea of “convergence” is the phenomenon of different states of being becoming one. Certainly the concept of culture converging with technology is not new; however, what is new with the convergence of ICT and culture is the accelerating pace of change on regional and international systems. This article describes diverse perspectives of “convergence” that may help provoke thought about and possibly inform

the successful application of ICT for regional and international sustainable development.

Leveraging ICT to achieve socio-economic development goals is an approach that warrants reflection on the convergence of technologies and cultures. Awareness of the interactive dynamics between culture and technology can enable leaders, researchers, innovators, practitioners, and stakeholders to be more successful in facilitating sustainable “ICT for development” programs. Three views of convergence provide insight on the possible implications of “ICT for development” programs include: structural, technological, and cultural.

STRUCTURAL CONVERGENCE

From a historical perspective, the concept of structural convergence describes the phenomenon where societies in less-developed countries (LDCs) assimilate the processes and practices of more developed countries through technological transfers (Inkeles, 1998). This is often made possible through aid-funded projects in sectors such

as agriculture, education, finance, transportation, and communications. In this perspective, convergence is normally non-reciprocal, meaning that the transfer of technology is unidirectional and only the recipient is impacted. This type of convergence involves the establishment of social and economic structures that are designed by and for developed nations. As evidenced throughout the 1900s, societal structures in LDCs such as finance, agriculture, education, government, and so forth, have become more similar to those structures found in developed countries (Aghion, Howitt, & Mayer-Foulkes, 2004). This structural convergence has a direct result on cultural content. Also seen during the previous century were numerous development projects in LDC's as well as developing countries that failed to produce intended results due to an inadequate consideration of the local environment, political reality, and culture (Howe & Dixon, 1993). Informed by lessons learned by others, current and future ICT-based development projects that affect the processes and practices in developing regions may be able to shape the impact of structural convergence to be more appropriate for a given socio-cultural system and perhaps increase its chance for success (Moore, 1998).

TECHNOLOGICAL CONVERGENCE

Distinct from the structural view, the "technological convergence" perspective describes a phenomenon where technological systems come together to create new systems. A widely recognized example of this type of convergence is the Internet where computers are interlinked using new and existing network infrastructures along with packet switching protocols (OECD, 1996). The World Wide Web (WWW), an aspect of the Internet, is a further example of convergence in that the digitally-mediated GUI environment of cyberspace has been merged with activities normally conducted in specific physical locales

(i.e., shopping, banking, learning, working, etc.). A narrower example of this type of convergence is Voice over Internet Protocol (VoIP), which has the potential to significantly influence the future structure of global telecommunications.

Driven by the acceleration of diverse technologies being synthesized into new technologies, the phenomenon of "convergence of technologies" is pressuring the privatization and liberalization of laws, policies, markets, and economies (Blackman, 1998). Similar to structural convergence, the spread of technology is creating cultural impacts that affect the recipient's culture more than the culture in which the technology was developed. Participants in "ICT for development" programs should be cognizant of this dynamic.

CULTURAL CONVERGENCE

Structural and technological convergences explain aspects of globalization and clearly represent a powerful influence on socio-cultural systems. Perhaps both an influence and an impact to technological convergence, "cultural convergence" is a constantly changing dynamic that serves as an engine for the evolution of broad social domains such as language, values, beliefs, behavior, and artifact. The process of cultural convergence reflects how culture changes through intra- and inter-cultural interactions. Some observers note that the quickening pace of convergence in ICT and the digital tsunami of media content may be detrimental to the integrity of the recipient's culture.

CONVERGENCE OF ICT AND CULTURE

Attempting to understand the convergence of ICT and culture is messy but imperative to the effectiveness and sustainability of development activities. As mentioned earlier, neither the con-

vergence of culture and technology nor awareness of the phenomenon is new. What makes the convergence of ICT and culture notable today is the speed at which these technologies have (and will likely continue to) spread and impact ICT can have on all social systems. The diversity in views of convergence clearly pertains to how ICT is used for development and may account for the difference in how “ICT for development” programs are perceived by stakeholders and “donor” and “recipient” populations.

Given the nature of technological convergence, it might appear as if LDCs are bound to be subjected to cultural change determined by external cultural forces (Huntington, 1993). Indeed, this asymmetric phenomenon can be seen in television programming, WWW content, software licensing, and the establishment of technological standards (Foulger, 2002). Because convergence is complex and causes unintended consequences, some perceive that cultural imperialism is a malignant by-product of development efforts based on technological transfer (James, 2003). However, it may be more than a by-product; it may be a direct result of trends set in motion by historical oppression and subjugation compounded by economic inequities (Senghaas, 2002). It is not exactly a coincidence that most LDCs are former colonies and perhaps understandable why citizens in the post-colonial developing world are much more sensitive to the issue of cultural imperialism than are citizens from more developed countries. Donors, practitioners, and stakeholders in initiatives that leverage ICT for social and economic development are necessarily involved in a process of technological and cultural convergence. This process does not have to include side effects such as hegemony and cultural homogenization. There is some control in the design, organization, degree of inclusion, implementation, and assessments of “ICT for development” programs that can balance the realities of convergence with the imperative of promoting cultural integrity. Due to the converging forces of globalism, there is probably

no way to avoid the impact of ICT on culture; as some say, “the genie is out of the bottle.” However, through adequate awareness of long-term impacts, a degree of control may be possible. For those involved in the design and implementation of ICT-based development projects that are aimed at either local or regional levels, they should take care to find effective ways in shaping the impact of ICT on the recipient social systems to be appropriate and beneficial. Careful implementation of convergence is not only an important condition to sustainable socio-economic development; it is consistent with the fundamental objective of any development activity to help bring about beneficial change while minimizing harm.

REFERENCES

- Aghion, P., Howitt, P., & Mayer-Foulkes, D. (2004). *The effect of financial development on convergence: Theory and evidence*. Cambridge: National Bureau of Economic Research, Inc.
- Blackman, C. (1998). Convergence between telecommunications and other media: How should regulation adapt? *Telecommunications Policy*, 22(33), 163.
- Howe, C., & Dixon, J. (1993). Inefficiencies in water project design and operation in the third world: An economic perspective. *Water Resources Research*, 29(July), 1889-1894.
- Huntington, S. (1993). The clash of civilizations. *Foreign Affairs*, 72(3), 22-28.
- Inkeles, A. (1998). *One world emerging: Convergence and divergence in industrial societies*. Boulder, CO: Westview Press.
- James, J. (2003). *Bridging the digital divide*. Northhampton, MA: Edward Egar.
- Moore, D. (1998). Many World Bank projects haunted by grand delusions. *Forum for Applied Research and Public Policy*, 13(1), 26-31.

Convergence of ICT and Culture

Organization for Economic Co-Operation and Development. (1996). *Information infrastructure convergence and pricing: The Internet*. Paris: OECD.

Senghaas, D. (2002). *The clash within civilizations: Coming to terms with cultural conflicts*. London: Routledge.

KEY TERMS

Convergence: The process of coming together or the state of having come together toward a common point.

Culture: Integrated system of spiritual, material, intellectual and emotional features of society or a social group that encompasses, among other things, art and literature, lifestyles, ways of living together, value systems, traditions and beliefs and artefacts.

ICT-Based Development Projects: Development projects that employ information communication technologies as a strategic tool or approach for achieving desired outcomes.

Information Communication Technology: The technology required for information processing. In particular, the use of electronic computers and computer software to convert, store, process, transmit, and retrieve information.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, & X. Yu, pp. 135-137, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 5.2

Addressing the Cultural Dimensions of E-Learning: Where to Begin?

Andrea L. Edmundson
eWorld Learning, USA

ABSTRACT

In an exploratory study, the researcher examined the effects of cultural dimensions on e-learning outcomes for employees in functionally equivalent jobs in Western and Eastern cultures. Participants from the United States (U.S.) and India completed a Level 1 e-learning course designed in the U.S. In addition, randomly selected completers then reported their interactions with the e-learning course in a survey. Learners from the two cultures achieved equitable learning outcomes, suggesting that characteristics of Level 1 e-learning courses mitigate the effects of culture. In addition, while cultural dimensions did appear to affect learners' preferences for and perceptions of e-learning, both Eastern and Western participants were willing to try new approaches to learning that did not align with their cultural profiles. Based

on these results and practical usage, the revised (v.2) cultural adaptation process (CAP) model is presented as a guideline for adapting e-learning courses for other cultures.

INTRODUCTION

The term *globalization* gained currency in the 1970s as Western corporations rapidly expanded into other parts of the world (Jarvis, 2002), accelerating cultural exchanges (Walker & Dimmock, 2002). Industrial anthropologists have identified *cultural dimensions*—categories of characteristics across which cultures can be compared and contrasted, such as how members of a culture communicate, perceive time or view themselves in relation to the environment. As e-learning options proliferate and globalization continues,

an expanding audience of learners is more likely to encounter courses created by another culture. Most e-learning courses are designed in Western cultures; however, the largest and fastest-growing consumer groups live in Eastern cultures, such as China, Japan and India (Van Dam & Rogers, 2002). “Over the next 20 years, the global market for online learning is estimated to exceed \$215 billion, with rapid growth expected from cross-border delivery of higher education (an institution in one country delivers courses to students in other countries)” (Hezel & Mitchell, 2005, para. 1). Educators thus will be challenged to provide e-learning opportunities that result in equitable learning outcomes for new groups of learners from other cultures.

Learning outcomes were defined by Henderson (1996) as any results that reflect the acquisition of skills and knowledge, the effectiveness of instructional techniques and students’ perceptions or attitudes. Educational practitioners have begun to apply the concepts of cultural dimensions to instructional design, presuming that selecting or adapting courses to suit the cultural profiles of learners will generate equitable learning outcomes. However, empirical research has neither conclusively supported nor disproved them. The purpose of this study was to understand better the effects of cultural dimensions on e-learning in the globalized environment.

The problem is: “Are e-learning courses designed in a Western culture equally effective when used in an Eastern culture?” The research questions used to address this problem were as follows:

1. When taking an e-learning course designed in a Western culture, do participants from Eastern and Western cultures experience *equitable learning outcomes*?
2. Do they have different *preferences for or perceptions of e-learning*?
3. If there *are* strong similarities or significant differences in learning outcomes between

the two cultures, in participants’ use of features or in their preferences or perceptions, are these similarities or differences *related* to the cultural dimensions described in the literature?

Importance

According to a United Nations Development Program report (UNDP, 2001), the most developed, progressive and economically stable countries in the world are those that are technologically advanced. Technological change and the building of human capabilities are interrelated: Each requires the development of the other for success. Thus, the UNDP report (2001) promoted “rethinking educational systems to meet the new challenges of technology” (p. 84) through improved technology and technological education at a global level. Interest in promoting education and technologies continues to be addressed by the U.N. Millennium Development Goals (United Nations, 2005). Domestically, “At a time when many institutions in the U.S. must explore new markets for enrollment growth, other countries face a shortage of higher education campuses and student seats” (Hezel & Mitchell, 2005, para. 3).

From an instructional point of view, incompatibilities between the cultural characteristics of e-learning courses and learners could cause inequitable learning outcomes (Henderson, 1996). For example, members of cultures may prefer to learn in a particular manner (Gardner, 1989; Horton, 1999), or they may have specific approaches to problem solving (Lave, 1988; Soh, 1999) and creativity (Gardner, 1989). Or, a pedagogical paradigm espoused by one culture could alienate or confuse targeted learners (Hall, 1981), as could unintentional cultural biases in instructional design (McLoughlin, 1999). Learning styles may also be influenced by culture. Through their use of research on cultural dimension, practitioners propose that e-learning be designed to match to the cultural profiles of the targeted learners (Marcus & Gould, 2001; Marinetti & Dunn, 2002).

Theoretical Foundations

Hofstede (1984, 1997, 2001), Trompenaars and Hampden-Turner (1998) and Hall (1953, 1981) identified and characterized cultural dimensions at the national level, primarily with respect to corporate business and communication. While they posited the probable effects of many of these dimensions on education, researchers Gardner (1983, 1989), Henderson (1996) and others have explored similar concepts within the discipline of education. Jaju, Kwak, and Zinkhan's (2002) study related learning styles and preferences to cultural dimensions, a step towards confirming a definitive relationship of culture to e-learning and its importance.

Hofstede and Cultural Dimensions at the National Level

Hofstede (1984, 1997) established the practice of using *national cultures* in quantitative studies: Samples of people living and working in the same country are reasonable representations of the national culture. He gathered data from questionnaires administered to 116,000 participants in 50 countries and three regions, identifying five cultural dimensions that he portrayed as continua bounded by polar extremes. He calculated indices of these dimensions for each country, described below, across which cultures could be compared and contrasted.

Power Distance Index (PDI)

The PDI—"the extent to which the less powerful members of institutions and organizations expect and accept that power is distributed unequally" (Hofstede, 1997, p. 27)—has ramifications in educational organizations. In nations with low PDI scores, such as the U.S. (PDI = 40), teachers and students tend to be perceived as equals. Teachers are facilitators of student-centered education rather than authoritative subject matter experts

(SMEs). Students are expected to show initiative, solve problems, build their own knowledge base, question teachers and initiate discussions. In high PDI nations, such as India (PDI = 77), relationships between teachers and students are accepted as inequitable: Teachers are authorities and SMEs; thus, students tend not to question their knowledge (Hofstede, 1997).

Individualism Index (IDV)

Hofstede (1997) defined individualistic societies as those "in which ties between individuals are loose" (1997, p. 51). By contrast, collectivist societies are those "in which people from birth onwards are integrated into strong, cohesive *ingroups*, which throughout people's lifetime continue to protect them in exchange for unquestioned loyalty" (Hofstede, 1997, p. 51).

Members of collectivist societies tend to rely on their *ingroups* to determine social relationships in educational settings, and may even expect differential treatment dependent on their social class. In contrast, students in high-IDV societies expect to be treated as equals among peers and faculty. They prefer to work as individuals and expect recognition for individual merit.

Globally, collectivist societies are predominant (Hofstede, 1997). From the perspective of education, this represents an important consideration. The U.S. and other high-IDV countries produce most instructional artifacts, including e-learning. Characteristics of these courses could significantly conflict with the values of collectivist societies that import them. The U.S. has the highest IDV (91) in Hofstede's study, while India has a much lower IDV of 48 (Hofstede, 1997).

Masculinity Index (MAS)

Hofstede (1984) defined the dimension "masculinity vs. femininity" in terms of how a culture socializes its members to perform gender roles. In a masculine culture, men are expected to be

tough and assertive, while women are perceived as tender and modest. In a feminine culture, men and women are more likely to have similar roles; both are expected to be tender and modest, even if men also express some assertiveness.

Hofstede (1997) contended that, in high-MAS countries, students compete openly, are achievement conscious and are disappointed by failure. An instructor's academic excellence and reputation are important. In a low MAS culture, teachers and students have more relaxed expectations. The U.S. and India yielded similar MAS indices in Hofstede's work (62 and 56, respectively).

Uncertainty Avoidance Index (UAI)

Uncertainty avoidance is "the extent to which the members of the culture feel threatened by uncertain or unknown situations" (Hofstede, 1997, p. 113). Uncertainty avoidance is not risk avoidance; rather, it refers to a pattern of reducing ambiguity.

Hofstede (1997) felt that, in a high-UAI environment, the teacher is an expert and unquestionable authority. Students prefer a structured learning environment, precise objectives, strict timetables, precise answers and rewards for accuracy. In contrast, in low-UAI cultures, teachers act as facilitators of learning. Students are comfortable with vague objectives, loose timetables and multiple solutions to problems, and they seek to be rewarded for originality. The U.S. and India have similar, mid-range UAI scores of 46 and 40, respectively.

Long-Term Orientation (LTO)

Hofstede's fifth cultural dimension, "short-term vs. long-term orientation to time," was theorized after his original 1984 study. In general, Hofstede found that Eastern countries had relatively high LTOs, while Western countries yielded relatively low LTO scores. Hofstede did not propose specific ramifications of the LTO dimension on education, and it was not included in this study.

Trompenaars and Hampden-Turner's Cultural Study

Trompenaars and Hampden-Turner (1998) also researched cultural dimensions at the national level; like Hofstede, they were primarily interested in the effects on business. Their analysis of surveys (more than 30,000 corporate managers from more than 100 countries) identified eight cultural dimensions, some of which were similar to Hofstede's. Each of their dimensions, like Hofstede's, was described as a continuum bounded by two extreme, opposing characteristics. However, in contrast to Hofstede, they held that in practice, cultural groups display both extremes of all dimensions but show a preference or tendency toward one extreme in most situations. Unlike Hofstede, they rarely speculated on the implications of cultural dimensions in education.

In the first category, "relationships and rules," Trompenaars (1998) identified five dimensions across which cultures could be compared and contrasted. *Universalism vs. particularism* relates to the balance between rules and relationships. Universalists tend to adhere to rules. In a particularist society, rules are flexible guidelines over which relationships always take precedence. This dimension is not dissimilar to those delineated by Hofstede; however, attitudes towards relationships and rules could prove to be important in an educational environment. For example, a teacher from a universalist culture conforms to the rules: "You did less than C average work; thus, you have earned the failing grade." However, a teacher from a particularist society might bend the rules to allow the student to pass, acknowledging that the student has put forth effort; or the teacher might be more lenient if he or she is acquainted with the student's family.

The *individualism vs. communitarianism* dimension, similar to Hofstede's IDV index, refers to the tendency to perceive oneself primarily either as an individual or as a member of a group. In an individualistic culture, members value personal achievement and responsibility. The

communitarian society, meanwhile, privileges the achievement of group goals. They frequently make decisions via consensus or defer decisions to an authoritative entity.

Members of *affective vs. neutral* cultures may be, respectively, emotionally expressive or emotionally detached and objective in verbal or non-verbal communication. This dimension is reflected in communication through forms of humor, styles of speaking, tone of voice, frequency and type of touch, amount of eye contact and the ratio of nonverbal (contextual) to verbal (content) communication. Characteristics of this dimension are similar to those described by Hall's (1981) concept of high-context vs. low-context cultures and could, conceivably, affect learning preferences or outcomes.

Specific vs. diffuse relates to "the degree to which we engage others in *specific* areas of life ... or *diffusely* in multiple areas of our lives" (Trompenaars & Hampden-Turner, 1998) and accounts for the degree and level of interaction between people. In *specific* cultures, for example, the "boss" is the authority in the office, but beyond that environment, he or she is no longer granted the same deference. Conversely, in *diffuse* cultures, members confer authority to superiors across most environments. Members of specific cultures tend to use direct and purposeful communication, while diffuse cultures tend to be less direct, often to the point of appearing evasive. Such differences in communication could, conceivably, interfere with learning in a globalized environment.

The *achieved status vs. ascribed status* dimension relates to whether a culture determines status according to accomplishments or according to markers of group membership. In achievement-oriented cultures, according to Trompenaars and Hampden-Turner (1998), authority is tied to one's task or job, whereas in an ascription-oriented culture, titles clarify status. This dimension shares characteristics with Hofstede's PDI.

Trompenaars and Hampden-Turner (1998) also identified two dimensions in the category

"attitude toward time." *Orientation to past, present and future* reflects to how cultures perceive the importance of each of these periods. The dimension *sequential vs. synchronic* is related to whether time is perceived as linear and composed of discrete events or as circular and composed of integrated, overlapping events.

Lastly, Trompenaars and Hampden-Turner (1998) categorized "attitudes toward the environment." Members of *inner-directed* cultures believe they have significant control over the outcome of events, aggressively trying to manage situations; whereas members of *outer-directed* cultures believe they are subject to an external locus of control, and thus are more comfortable and flexible when confronted with change.

Hall's Perspectives of Cultural Differences

In Hall's (1981) words, "culturally based paradigms place obstacles in the path to understanding because culture equips each of us with built-in blinders, hidden and unstated assumptions" (p. 220). Hall envisioned cultural differences as poles on opposite ends of continua that resemble the indices and characteristics, respectively, of Hofstede (1984, 1997) and Trompenaars and Hampden-Turner (1998).

According to Hall (1981), members of *M-time* (monochronic) cultures tend to emphasize schedules, promptness and segmentation of activities. Their communication is low context, depending more on direct language than on subtle signals. In contrast, members of *P-time* (polychronic) cultures engage in multiple activities simultaneously and tend to focus on relationships and the completion of transactions rather than on scheduled events. Their communication is high context, as it is dependent on what they already know about their culture.

According to Hall (1981), American education tends to be linear, compartmentalized and lacking in creativity and problem-solving techniques. As

Addressing the Cultural Dimensions of E-Learning

members of a low-context culture, Americans tend to use sparse communication, especially in technologically driven environments. However, such direct communication may be advantageous in globalized e-learning.

Applications of National Level Cultural Dimensions in Education

Educational researchers and practitioners have begun to incorporate the findings of national-level studies into e-learning. Marcus and Gould (2001), for instance, proposed redesigning the user interface of Web pages to match the known cultural dimensions of the target culture as described by Hofstede (1997).

Marinetti and Dunn (2002) proposed adapting courses of varying complexity to the cultural dimensions of learners as identified in the literature to accommodate the presumed preferences of different groups. Their adaptation strategies are summarized in Table 1. For the purpose of discussion, each level of course complexity has

been assigned a number, ranging from Level 1 to Level 4, also indicating the level of cultural influence on the course design.

For example, based on their table, for Level 1 courses, simple *translation* of content would be adequate as a cultural adaptation technique, because the content and method of presentation is straightforward, indicating little if any cultural impact. Translation could encompass simple conversion to ‘global English’ or to British English, or to full-scale translation to another language. For Level 2 courses, in which content or tasks are more complex but universally familiar, in addition to potential translation, *localization* could ensure that concepts and technical tasks are achievable by the targeted culture.

Localization may be described as “the process of converting material ... into a format that is technically, linguistically and culturally appropriate for countries outside the original market” (Transware, 2002). These superficial changes, called *soft-multiculturalism* by Henderson (1996), include slang, humor, gestures, units

Table 1. Descriptions of course levels 1-4 (Marinette & Dunn, 2002)

| Complexity Level | Level 1 | Level 2 | Level 3 | Level 4 |
|---|--|--|--|---|
| Content Type | Simple information, knowledge, news | Low level, cognitive “hard skills”; simple knowledge and core concepts | Some soft skills; complex knowledge, such as regulatory or financial information; business strategy and most business skills | Mostly “soft skills,” such as attitudes and beliefs; many complex management skills |
| Content Examples | Product knowledge, company procedures | Application software, other electronic skills | Project management, presentation skills, marketing strategy | Negotiation skills, motivation, teamwork, conflict resolution |
| Content Adaptation: What people learn | Translation only; content and context culturally neutral | Translation plus context adaptation, examples as required | Translation plus context adaptation, examples and some modular content | Significant proportion of content and context is unique per culture |
| Instructional Strategy Adaptation: How people learn | None | Minor changes | Required at key points; re-ordering information, representation of concepts, alternative media, etc. | Significant proportion unique per culture; may require alternative course architectures |
| Adaptation Strategies | Translation | Localization | Modularization | Origination |

of measure, law, taboos, etiquette and so forth. For Level 3 courses, Marinetti and Dunn (2002) proposed *modularization*. Modularization entails adapting only those components of the e-learning course that vary between the designing and recipient culture, and that could affect learners' outcomes. These components, referred to as *reusable learning objects* (RLOs), may also be called *cultural learning objects* (CLOs) in this context (Alberta Online Consortium, 2004) or cross-cultural learning objects (XCLOs). Finally, for course content that is complex or culturally differentiated, Marinetti and Dunn recommended *origination*—creating a new course with the full participation of the target culture to meet its very specific needs and preferences.

Any of the above techniques, singularly or in combination, could simplify the adaptation process and reduce the costs of redesign, subsequently improving the cultural compatibility of e-learning courses. However, the presumed need to adapt e-learning courses to the cultural dimensions of targeted learners remains unproven by research. In addition, the possibility that a cultural group could accept or adapt to the dimensions of the culture in which an e-learning artifact originated remains unexplored.

Cultural Dimensions in Education

At a high level, culture influences multiple aspects of education, from the obvious, such as educational structures, governance, delivery systems and teaching styles (Thomas, 1990), to the subliminal, such as values or the purpose of education (Gardner, 1989; Mosa, 1999; Jarvis, 2002).

Gardner (1983) argued that cultures value different types of intelligence and different forms of knowledge. These intelligences are not cultural dimensions per se, but Gardner's theory of multiple intelligences suggests that one culture could prefer one cluster of intelligences to another, and that education could be designed to accommodate those intelligences. In another study (1989), he

found that the Chinese prefer a *mimetic* approach to education: Teachers (and educational materials) are treated as unquestioned repositories of knowledge. In contrast, Americans were moving toward a *transformative* approach to education: Teacher act as coaches, eliciting desired qualities from students.

Henderson (1996) proffered a comprehensive *multiple culture model* (MCM) specifically for investigating cultural characteristics in education, with 14 dimensions represented as continua with polar extremes, reminiscent of those used by Hall (1981), Hofstede (1984, 1997) and Trompenaars and Hampden-Turner (1998). In the model, the course features and characteristics represented on one side reflect the objectivist-instructionist pedagogical paradigm, while those on the other side reflect the constructivist-cognitive paradigm, bearing similarities to the descriptions of Level 1 through Level 4 courses (Marinetti & Dunn, 2002).

STUDY METHODOLOGY

For this study, the 14 dimensions on the MCM were reduced to nine, thereby creating the *simplified multiple cultural model* (SMCM) (Edmundson, 2004):

1. **Pedagogical Paradigm:** *Instructionist/Objectivist – Constructivist/Cognitive*. Four closely related dimensions—*Epistemology, Pedagogical Philosophy, Underlying Psychology* and *Goal Orientation*—were combined to create a singular dimension, Pedagogical Paradigm.
2. **Experiential value:** *Abstract – Concrete*. When instruction has abstract experiential value, learning is removed from reality. Instruction with concrete experiential value integrates the learning process with the learner's world.

3. **Teacher role:** *Didactic – Facilitative*. A didactic exposition of knowledge, such as a lecture, contrasts with facilitative pedagogical techniques that enable exploratory learning without controlling outcomes.
4. **Value of errors:** *Errorless learning–Learning from experience*. Under an errorless learning paradigm, students learn until they generate no mistakes, or the instructional method does not allow for errors. In contrast, the learning from experience approach to instruction uses errors in the educational process.
5. **Motivation:** *Extrinsic–Intrinsic*. Extrinsic motivation originates from factors outside the learner, such as the need for high grades or the presence of engaging materials. Intrinsic motivation comes from an internal desire to learn.
6. **Accommodation of individual differences:** *Non-existent – Multifaceted*. In some contexts, learning and knowledge are structured so that there is no need for accommodation of individual differences. When accommodation of individual differences is existent, on the other hand, knowledge and learning are presented in a variety of ways so that learners can utilize the tools that most suit their preferences.
7. **Learner control:** *Non-existent – Unrestricted*. In this dimension, the student either learns along a predetermined path or by independent discovery.
8. **User activity:** *Mathemagenic–Generative*. A mathemagenic approach permits learners to access the same content in different ways, while a generative approach encourages learners to engage in the process of creating and elaborating content.
9. **Cooperative learning:** *Unsupported – Integral*. In this dimension, learners work independently, or learning is encouraged through cooperative activities.

Certain SMCM dimensions (e.g., cooperative learning) may be manifestations of cultural dimensions at the national level, while others may simply reflect learner preferences or subliminal effects of culture. To date, however, relatively few studies have examined cultural dimensions within e-learning courses. Likewise, few researchers have administered an e-learning course designed by one culture to individuals in another culture with the intention of measuring potential differences in learning outcomes.

THE STUDY

The experimental design best suited to part one of this study was the posttest-only control group design (Campbell & Stanley, 1963; Leedy & Ormrod, 2001; Tuckman, 1978) diagrammed in Figure 1.

Pre-testing was neither desirable nor useful in this study, as the researcher was interested in the differences between learning outcomes caused by the culture, rather than the knowledge or skills generated by the e-learning course.

Seven hundred fifty-seven technology workers in functionally equivalent roles were required by their company to take a western-designed e-learning course. The Software Upgrade Tutorial was designated as a Level 1 course, according to the criteria described by Marinetti and Dunn (2002). From this group, 250 were randomly selected (for a confidence interval of 95%) to participate in the study: 204 from a Western culture (U.S.) and 46 from an Eastern culture (India). Data on learning outcomes were analyzed using students' *t* tests for unequal *n* using StatDisk (Triola, 2001).

In part two of the study, the 250 participants were invited to complete an online post-course questionnaire, which included questions based on the SMCM dimensions, to identify (a) learning outcomes not recorded by the learning management system, and (b) the participants' preferences for and perceptions of e-learning, based on potential

Figure 1. Posttest-only control group design

| | | |
|----|---|----|
| R1 | X | O1 |
| R2 | | O2 |

Note:

- R = randomly selected members of the groups under study
- X = the treatment (i.e., the culture of each of the two groups)
- O = the observations or measurements of differences between the two groups (i.e., tutorial results and questionnaire responses)

cultural differences and their overall experiences with the genre. The students' mean (coded) responses were analyzed using students' *t* tests for unequal *n* using StatDisk (Triola, 2001).

Finally, the researcher explored possible relationships between the learning outcomes and participants' preferences and perceptions to the cultural dimensions described in national-level research.

SUMMARY OF FINDINGS

Members of both groups, completing a Level 1 course, achieved equitable learning outcomes when they took the Software Upgrade Tutorial. There were no significant differences ($\alpha = .05$) between learning outcomes (number of attempts needed to complete the course, scores of each attempt and time needed for each attempt). Responses on the questionnaire provided additional information on how they navigated and used the course and their perceptions of its effectiveness. Both groups needed no more than three attempts to complete the course. An average of 85% of the participants completed the course on the first attempt in an average of 68 minutes, with an average score of 85.5%. While the U.S. participants

felt that the tutorial did not completely meet its objectives, both groups agreed that they had *applied* most of what they had learned to their work. Both groups used the course features, in the form of simple media (demonstrations, handouts and navigation tools), in the same manner, although Americans tended to print more handouts than Indian participants. Both groups acknowledged that they had experienced confusion in the past with language and format in e-learning, which indicated that they had taken e-learning courses more complex than the Level 1 tutorial used in this study.

Participants expressed equal acceptance of the course characteristics manifested in behavioral/objectivist and cognitive/constructivist paradigms. This acceptance may have been related to characteristics of this particular group, but should be considered when working with members of other cultural groups, as well. With respect to those features and characteristics, participants preferred that the instructor/course designer manage the design elements; establishment of course objectives; selection of activities, instructional methods; examples; and determination of the best path to learning. These features are typically selected during the *design process*.

Participants also indicated that they preferred being guided by a facilitator rather than instructed

by an expert, controlling the pace of learning, testing themselves by experimentation, learning from their mistakes, and applying course knowledge and skills to their own activities. In other words, participants expected to control *how they interacted with the course*, although both groups indicated that they would be open to trying other approaches to learning.

Participants' responses indicated that two of the nine dimensions of the SMCM are related to certain cultural dimensions described at the national level. The dimension of *cooperative learning* on the SMCM shares characteristics with Hofstede's IDV dimension, Trompenaars and Hampden-Turner's individualism vs. communitarianism dimension, and Hall's M-time vs. P-time dimension (M-time stressing independence and individualism). The *origin of motivation* on the SMCM shares characteristics with Hofstede's IDV and MAS dimensions (why students chose to participate and achievement consciousness, respectively), as well as to Trompenaars and Hampden-Turner's individualism vs. communitarianism dimension (motivation toward personal achievement or group goals).

Two other SMCM dimensions seem potentially related to those identified at the national level, though not as strongly as *cooperative learning* and *origin of motivation*. *Teacher role* from the SMCM appears to share characteristics with Hofstede's MAS dimension (teacher's status) and with Trompenaars and Hampden-Turner's specific vs. diffuse dimension (the range of authority conferred). *Learner control* on the SMCM appears to share characteristics with Hofstede's PDI (degree of authority or control conferred) and Trompenaars and Hampden-Turner's inner-directed vs. outer-directed dimension (one's need for control over the environment). *Value of errors* on the SMCM seemed weakly related to Trompenaars and Hampden-Turner's universalism vs. particularism, the dimension encompassing the value of rules.

Thus, while this study did not explore statistical correlations between cultural dimensions and learner preferences, there appear to be potential relationships between at least four dimensions of the SMCM and dimensions identified by other researchers. These findings suggest the need for studies of cultural dimensions in Level 1 to 4 courses, as greater course complexity may trigger stronger responses, indicate more cultural preferences or infer more obvious relationships to national-level cultural dimensions.

RESULTS

New Perspectives on E-Learning

The findings in this exploratory study offer five new perspectives on the e-learning environment that could change how instructors/designers create courses, how consumers adapt and/or export Western-designed e-learning courses and how Level 1 e-learning can be used to promote global education and economic development.

First, the features of Level 1 courses appear to create a learning environment conducive to equitable learning outcomes, as their low-context nature introduces the fewest cultural effects: Communication is minimized; interaction is nonexistent; and language is blunt, technical and sparse (Hall, 1981).

Second, learners seem to differentiate between the features of courses generated during the design process (and are thus beyond their control) and those that drive learner interaction with the course, which they prefer to control. This ability to differentiate may be a reflection of a certain level of technical sophistication within these groups of learners; however, knowing this, course developers should expect, at the least, to determine e-learning course goals and objectives, types of learning activities, instructional method(s) and the overall "path" to learning. At the same time,

they should expect that learners would prefer facilitation of learning rather than authoritative instruction, control of the pace of learning, learning from experimentation or mistakes and application of learning to their own needs.

Third, since members of both cultures were amenable to trying course features representing contrasting pedagogical paradigms, there is

potential to introduce an *eclectic paradigm*—a combination of instructivist/objectivist and constructivist/cognitive, as suggested by Henderson (1996)—to other cultures.

Fourth, certain SMCM dimensions appear to affect e-learning preferences and outcomes. The dimensions of cooperative learning and origin

Figure 2. The CAP model, v.2.

| | Level 1 | Level 2 | Level 3 | Level 4 |
|--|---|---|--|---|
| Step 1: Evaluate type of content (see examples.) | Simple information, core knowledge, news or updates, such as product knowledge, company procedures | Low-level, cognitive hard skills; simple knowledge and concepts, such as those used in application software; most computer-related skills | Some soft skills; complex knowledge, such as project management, presentation skills, marketing strategy | Mostly soft skills; attitudes and beliefs, such as negotiation skills, motivation, teamwork, conflict resolution |
| Step 2: Identify media | Lecture, handouts, simple demonstrations (no actual interaction among learners or between instructor and learners) | In this range, several media options are available, but HOW they are used is the important factor. For example, media can provide active or passive access to other learners or to the instructor. Visual Media—Satellite broadcasts, audio conferencing, recordings, television, etc. Text-Based Media—Threaded discussions, list servers, online chat, e-mail, etc. | | Videoconferencing, Web-based training, streaming media and Web conferencing (real time or simulated interactions among learners or between learners and instructor) |
| Step 3: Identify pedagogical paradigm (via instructional methods, etc.) | Instructivist-objectivist, with behavioral objectives and sharply-focused goals; low-context communication; mimetic | More closely related to instructivist-objectivist than constructivist-cognitive paradigm | More closely related to constructivist-cognitive than instructivist-objectivist paradigm | Constructivist-cognitive with cognitive objectives, unfocused goals; high-context communication; transformative |
| Upon review of targeted learners' cultural dimension (Hofstede, Trompenaars & Hampden-Turner, Hall, etc.), relate learners' cultural profiles to <i>critical and assistive</i> characteristics of the course that may support or hinder learners' use or acceptance of course: | | | | |
| Step 3 (a): Identify <i>critical</i> cultural characteristics of course | Unsupported ← | Cooperative Learning | | → Integral |
| | Extrinsic ← | Origin of Motivation | | → Intrinsic |
| | Non-existent ← | Learner Control | | → Unrestricted |
| | Didactic ← | Teacher Role | | → Facilitative |
| | Errorless learning ← | Value of Errors | | → Learning from experience |
| Step 3 (b): Identify <i>assistive</i> cultural characteristics of course | Mathemagenic ← | User Activity | | → Generative |
| | Abstract ← | Experiential Value | | → Concrete |
| | Non-existent ← | Accommodation of Individual Differences | | → Multifaceted |
| Step 4: Integrate current research findings | | | | |
| Step 5: Adaptation strategies Such strategies can consist of design changes to the e-learning course itself, or to the e-learning environment. | | | | |
| Step 5 (a): Design strategies | Translation | + Localization | + Modularization | Origination |
| Step 5 (b): Environmental strategies | | | | |
| Step 6: Action planning and testing | | | | |

of motivation appear to have strong effects on e-learning preferences and, thus, may be characterized as *critical cultural dimensions*. Three dimensions—teacher role, learner control and possibly value of errors—have indeterminate impact, but are likely to matter and, until further research indicates otherwise, could be treated as critical dimensions. The remaining dimensions—user activity, experiential value and accommodation of individual differences—may be described as *assistive cultural dimensions*.

Finally, there appears to be a dichotomy between the cultural *profiles* of learners and their actual preferences. While several of the large-scale trends that define cultural groups may need to be accommodated in e-learning courses above Level 1, a significant number of these dimensions are best viewed as “possible preferences,” rather than as ultimate and final outlooks, and should be explored further. One way in which to do this is to use the cultural adaptation process (CAP) model.

The CAP Model: Version 2

The revised version of the original (Edmundson, 2004) CAP model (v. 2) in Figure 2 is proposed as a guideline for offering culturally appropriate e-learning courses (a) by evaluating existing e-learning courses, (b) by creating cultural profiles of targeted learners, and (c) by guiding testing of e-learning courses. This version is based on a synthesis of findings from this study, but it also incorporates findings on cultural dimensions from research in industrial anthropology (Hofstede, Trompenaars, & Hampden-Turner, Hall, etc.) and education (Henderson, Marinetti, & Dunn, etc.), as well as the practical experiences of the researcher (Edmundson, 2005).

The model provides a matrix in which, from left to right, course complexity is considered, and from top to bottom, the steps in adapting an e-learning course for a targeted culture are presented. Users of the model will need to know

the cultural dimensions of the targeted learners as they relate to cooperative learning, origin of motivation and, most likely, learner control, teacher role and value of errors. They will need to identify the level of the course they expect to use, adapt or create, and then analyze and evaluate the match of course characteristics to the cultural dimensions and preferences of targeted learners. Quantitative evaluations can be conducted to determine if targeted learners can achieve the intended learning outcomes. In addition, their learning preferences should be assessed, using focus groups, surveys or interviews.

Future research may indicate that other dimensions should be included in the model, that certain assistive dimensions should be rated as critical, or that current dimensions classified as critical are more aptly described as assistive.

The CAP model represents a new, but not complete, perspective on the cultural dimensions of e-learning courses and learners. Feedback from the use of the systematic model and further research would help fashion a reliable tool for consumers of e-learning.

Changes Made to the Model

Based on experiences using the original version of the model (Edmundson, 2004), several changes to the model were implemented (Edmundson, 2006). Summarized, those changes include:

1. Incorporate recent research into the model.
2. Conduct qualitative and quantitative evaluations of the effectiveness of the proposed changes using focus groups and pilot tests, as well as surveys to identify learners' preferences for methods and approaches, their use of course features and other relevant variables.
3. Show that adaptation solutions go beyond those proposed in the matrix (e.g., translation, localization, RLOs and origination).

Figure 3. The framework for using the CAP model, v.2.

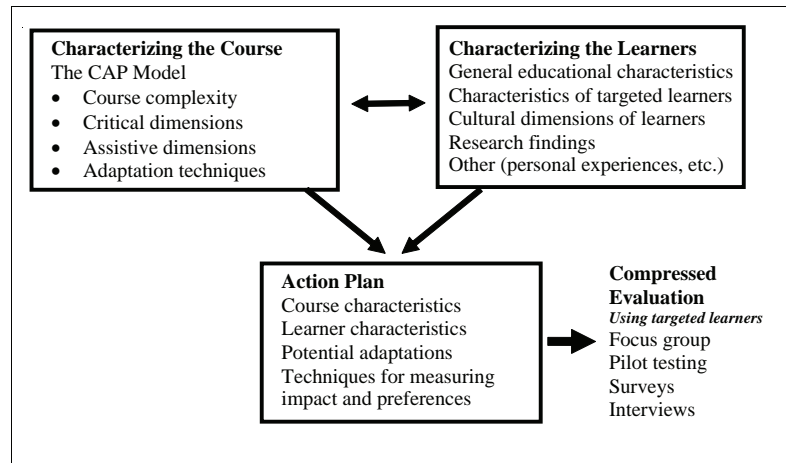


Figure 4. A sampling of potential adaptations to consider (based on a mock example).

| Course characteristics | Learner characteristics | Potential adaptations to consider | How to measure or evaluate impact/preferences |
|---|---|---|--|
| Use of American English | Taught in schools with British English | <ul style="list-style-type: none"> • Change words, idioms, colloquialisms • Provide learners with a glossary • Do nothing | Determine learner familiarity with American English and idioms, and other colloquialisms used in the course. |
| Use of American icons and brand names, such as Harley Davidson motorcycles | Highly educated, work for Americans and are frequently exposed to American culture through mass media, work, colleagues | <ul style="list-style-type: none"> • Replace with those known to Indian learners • Explain differences • Do nothing | Determine learner familiarity with American icons, pop culture and other colloquialisms used in the course via focus group |
| Lacks cooperative activities and group work except through simulations and post-course communications | Prefer cooperative activities and group work | <ul style="list-style-type: none"> • Create RLOs to replace individualistic activities with more cooperative ones • Create and present a supplemental cooperative activity just for the Indian learners • Do nothing; learners may accept and/or adapt to individualistic activities | Pilot test the course for equitable learning outcomes; survey participants about reaction to activities provided |
| Embodies cognitive-constructivist educational paradigm | More accustomed to instructivist-didactic approach to teaching | <ul style="list-style-type: none"> • Create a course based on paradigm to which learners are accustomed • Do nothing; learners accept and/or adapt to different paradigm | Pilot test the course for equitable learning outcomes; survey participants about reaction to activities provided |

Such solutions may include, but are not limited to, presentation options (e.g., how the course is marketed); provision of supplemental materials (e.g., glossaries); and creation of supportive activities (e.g., a cooperative discussion group) (Proposed Changes to the Model section, para. 1).

In version two of the model, all of these changes have been implemented so that the overall process can be envisioned using Figure 3.

Thus, the user of the model would be constantly comparing learner characteristics to characteristics of the e-learning course and, based on identified differences, would generate an 'action plan' (Figure 4) for investigating whether (and to what extent) those differences affected the learners' ability to successfully complete the course. In addition, as alluded to above, the design of the course does not necessarily require adaptation. Instead, as illustrated in Figure 4, the user might identify and consider multiple ways in which to make the e-learning course acceptable to the targeted learners by modifying the environment in which it is presented. Any proposed adaptations would be tested and measured for their effectiveness in a 'compressed evaluation' environment involving representative members of the targeted culture.

CONCLUSION

Based on findings in this study, the researcher proposed new perspectives on e-learning that could represent the means to effectively adapting or creating e-learning courses for use in other cultures. A revised version of the CAP model was provided as a guideline for culturally adapting e-learning. Such actions could increase access to technology education, improve technological literacy, and introduce new technologies across and between cultures, thereby increasing socio-economic development across the ever-expanding e-world.

Many factors point the way to success in global e-learning delivery. Learning those factors—both external market and internal capacity—and how the factors work in different countries will be essential to a sound strategy for international growth of [your] programs. (Hezel & Mitchell, 2005, Conclusion section, para. 1)

REFERENCES

- Alberta Online Consortium. (2004). *Flexible e-content (FLEXEC) project overview*. Retrieved January 24, 2006, from www.ataoc.ca/default.asp?V_DOC_ID=867
- Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Boston: Houghton Mifflin Company.
- Edmundson, A. L. (2004). *The cross-cultural dimensions of globalized e-learning* (unpublished doctoral dissertation). Minneapolis: Walden University.
- Edmundson, A. L. (2005, September 27-30). *Using the cultural adaptation process (CAP) model—Adapting e-learning to the needs of other cultures*. Proceedings of the Advancing the Effectiveness and Sustainability of Open Education Conference, Logan, UT.
- Edmundson, A. L. (2006). Using the cultural adaptation process (CAP) model to match e-learning to the needs of other cultures. In A.L. Edmundson (Ed.), *Globalized e-learning cultural challenges*. Hershey, PA: Idea Group.
- Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.
- Gardner, H. (1989). *To open minds: Chinese clues to the dilemma of contemporary American education*. New York: Basic Books.
- Hall, E. T. (1981). *Beyond culture: Into the cultural unconscious* (1st ed.). Garden City: Anchor Press.

- Henderson, L. (1996). Instructional design of interactive multimedia: A cultural critique. *Educational Technology Research and Development*, 44(4), 85-104.
- Hezel, R. T., & Mitchell, J. (2005). *Developing a global e-learning program: From conceptualization to implementation* (white paper). Syracuse: Hezel Associates.
- Hofstede, G. H. (1984). *Culture's consequences: International differences in work-related values* (Abridged ed., vol. 5). Newbury Park: SAGE Publications.
- Hofstede, G. H. (1997). *Cultures and organizations: Software of the mind* (2nd ed.). London; New York: McGraw-Hill.
- Horton, W. (1999, 2003). *Multicultural multimedia: Teaching and reaching the whole wide world*. Retrieved February 14, 2003, from www.horton.com
- Jaju, A., Kwak, H., & Zinkhan, G.M. (2002). Learning styles of undergraduate business students: A cross-cultural comparison between the U.S., India, and Korea. *Marketing Education Review*, 12(2).
- Jarvis, P. (2002). Globalization, citizenship and the education of adults in contemporary European society. *Compare: A Journal of Comparative Education*, 32(1), 5-19.
- Lave, J. (1988). *Cognition in practice: Mind, mathematics, and culture in everyday life*. Cambridge: Cambridge University Press.
- Leedy, P.D. & Ormrod, J.E. (2001). *Practical research: Planning and design* (7th ed.). Upper Saddle River: Prentice-Hall.
- Marcus, A., & Gould, E.W. (2001). *Cultural dimensions and global Web user-interface design: What? So what? Now what?* Retrieved August 25, 2002, from www.amanda.com
- Marinetti, A., & Dunn, P. (2002). *Cultural adaptation: Necessity for global e-learning*. Retrieved September 24, 2005, from www.linezine.com/7.2/articles/pdamca.htm
- McLoughlin, C. (1999). Culturally responsive technology use: Developing an online community of learners. *British Journal of Educational Technology*, 30(3), 231-245.
- Mosa, A. A. (1999). Culture in education and mass media: Conformation or confrontation. *Educational Media International*, 36(1), 34-41.
- Soh, K.-C. (1999). East-West difference in views on creativity: Is Howard Gardner correct? Yes and no. *Journal of Creative Behavior*, 33(2), 112-125.
- Thomas, R. M. (Ed.). (1990). *International comparative education: Practices, issues & prospects* (1st ed.). Oxford: Pergamon Press.
- Transware, P. (2002, Last update unknown). *What is localization?* Retrieved September 21, 2002, from www.transwareplc.com
- Triola, M. F. (2001). *Elementary statistics* (8th ed.). Boston: Addison-Wesley Longman.
- Trompenaars, A., & Hampden-Turner, C. (1998). *Riding the waves of culture: Understanding cultural diversity in global business* (2nd ed.). New York, London: McGraw Hill.
- Tuckman, B. W. (1978). *Conducting educational research* (2nd ed.). New York: Harcourt Brace Janovich.
- UNDP. (2001). *Human development report 2001: Making new technologies work for human development*. New York: United Nations Development Program.
- United Nations. (2005). *UN Millennium Development Goals*. Retrieved January 1, 2006, from www.un.org/millenniumgoals/#

Addressing the Cultural Dimensions of E-Learning

Van Dam, N., & Rogers, E. (2002). E-learning cultures around the world. *e-Learning*, 3(5), 28-32.

Walker, A., & Dimmock, C. A. J. (Eds.). (2002). *School leadership and administration: Adopting a cultural perspective*. New York: Routledge-Falmer.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 167-187, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 5.3

Group Process and Trust in Group Discussion

Lorna Uden

Staffordshire University, UK

Linda Wojnar

Duquesne University, USA

ABSTRACT

Successful group discussion plays a crucial role in online learning. Teachers normally assume that students automatically transfer their learning of group process from group to group. Our experience found that for group discussion to be effective, it is important that we consider group process and the role of trust within groups. This chapter begins with an introduction to group process and trust, followed by a brief review of the benefits of group discussion for online learning. Then, we describe the role that teachers play in initiating environments that promote trust and group empowerment. Through our experience of the implications of group process and trust, we will discuss how this environment fosters trusting relationships. We will also discuss the value

of reviewing trust in the group process for each class before assigning group work. The chapter concludes with the outcomes of our experience and suggestions for further work.

INTRODUCTION

Students are taught at a very early age about group process, which includes teaching the importance and value of internalizing and distributing roles among group members to maximize the results of the task. Knowing that group process is taught in a specific grade level, succeeding teachers make assumptions that these students will automatically transfer their skills, and the teachers do not first check with the students to learn about what they do remember. Although some groups of students

Group Process and Trust in Group Discussion

may recall and follow the process as they were instructed, our experience showed that most of them do not. More importantly, when most teachers, who are quite experienced in teaching group process, become learners themselves, they, too, do not automatically follow the procedure of assigning roles to group members when working in groups. For group process to work effectively, it is also important to consider trust.

Group Processes

Tasks and activities performed in a group discussion generally can be known as a process. Group process is a crucial part of computer-supported collaborative work (CSCW) concepts that specify the goals and structure of the team, as well as the progress of the cooperation between team members (Borghoff & Schlichter, 2000). According to Borghoff and Schlichter (2000), a group process is the specification of information, activities and characteristics of an electronically supported team, including the context for group interaction. It usually consists of a static part and dynamic part. The static part describes the team and its environment for performing activities, whereas the dynamic part specifies the progress of the group work and its respective state. The static part of the group process consists of: goals, organization, protocols and environment of the group. On the other hand, the dynamic part is made up of shared documents, group activities, the current group state and group sessions (Borghoff & Schlichter, 2000).

Group goals describe the global goals to be achieved by a predefined team. Individual goals can differ from group goals. Group goals have priority over individual goals. Group organization describes team members according to profiles (their skills and competencies) and their position within the team and the organization in which the team is embedded. The role of the team within the group may depend on their roles within the organization. It may also change dynamically

as the group progresses. There are active and dynamic participants within a group discussion. The group protocol describes the way in which the team members cooperate and communicate with each other. Two types of protocols exist: technical and social. A technical protocol is based on hardware or software, while a social protocol is one controlled by team members. It helps to determine how the flow of conversation will occur during a session. Two approaches can determine the flow of the conversation: informal and formal. In the case of an informal approach, each participant can feel free to speak according to predefined rules. In the formal approach, a moderator is appointed. Group environment is determined by the context of the group work, and includes the hardware and software systems, room equipment and room layout.

Group documents belong to the dynamic part of the group process. A meeting session is one example where a group shares information and relates to a group process. Activities taking place during a group process can have temporal or causal dependencies on each other. It must be dynamically adaptable to new situations. Borghoff and Schlichter (2000) suggest that a group session is performed as part of a group activity. It can be both synchronous and asynchronous. Participants may include one or several or all team members. A variety of operations is performed within a group session. According to Borghoff and Schlichter (2000), group process is dynamic and passes through several stages during the group's life. It consists of two main phases: creation and consolidation, which are subdivided into seven phases:

- **Creation phases:**
 1. **Orientation:** This phase represents the beginning of the group process. Team members discuss the overall goals of the group and then ask, Why was the team created? What is the purpose of the team?

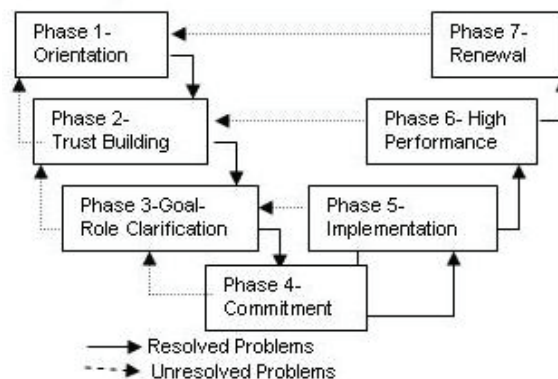
2. **Trust building:** Next, the integration of individual persons into the group process is of interest: What is expected of me? Who are my direct contacts? What amount of work am I expected to do? Trust building is important, because it leads to an open atmosphere and mutual respect. Disorientation or uneasiness of team members requires back-tracking to the previous phase.
 3. **Goal/role clarification:** In this phase, the goals and tasks of a group are defined.
 4. **Commitment:** The procedure for achieving group goals is outlined. Discussions are made with respect to problem structure and the assignment of resources. All team members must agree to support that procedure. Unresolved dependencies and responsibilities may require the group's return to Phase 3.
- **Consolidation phases:**
 5. **Implementation:** Individual tasks are assigned to people after team members have agreed on a problem. Temporal and causal dependencies during task execution must be taken into consideration. Conflicts between tasks and confusion

of team members could result in back-tracking to the goal/role of clarification phase.

6. **High performance:** When methods and procedures are defined, it is no longer necessary for the team to convene to discuss and determine each and every step. Instead, activities occur intuitively and flexibly.
7. **Renewal:** The high performance phase is only of limited duration. Team members become less motivated as time goes on.

The structuring of a group process into phases and interdependencies helps us pinpoint the potential of group work to support the tasks of the individual steps. The first two phases require direct contact (e.g., face to face) between team members. Synchronous conferencing systems or electronic meeting rooms are acceptable alternatives. A mixture of synchronous and asynchronous group work can support activities within the goal/role clarification phase. According to Borghoff and Schlichter (2000), fast communication is indispensable for mutual understanding. During the phases of commitment, implementation and high performance, focus is on the determined and agreed-upon group activities. For the renewal

Figure 1. Group process model of Drexler and Sibbet



phase, direct contact between team members is necessary.

Trust

Another important factor that contributes to the success of group discussion is that of trust. Trust is essential if teamwork is to be successful, especially in online learning, where group members are geographically separated. The level of trust between individuals, organizations and within society as a whole influences the nature of trust in online learning, both in terms of the contributions made by individuals and the productivity of the discussions within the learning environment.

There are different types of trust, depending on the length of time that the team members have known each other. These are (Jarvenpaa & Shaw 1998):

- **Identification-based trust:** The individuals are convinced that they have similar intentions and goals.
- **Deterrence-based trust or calculus-based trust:** Results from a fear of the consequences of behaving in an untrustworthy manner. Calculus process is where a trustor calculates the costs and/or rewards for another party to be opportunistic. In the prediction process, the trustor forecasts another party's behavior from historical data. The individual recognizes the consequences for not doing what he or she said he or she would do.
- **Swift trust:** The time available does not allow trust to be built up in the normal way, and team members simply assume that the other team members embrace similar values to their own.
- **Knowledge-based trust:** The individuals trust each other, as they know each other sufficiently well to be able to predict each other's behavior and have shared experiences. The trustor uses information about how the trustee has carried out tasks in the past to predict future action.
- **Transferred trust:** May occur when the trustor knows and trusts a person or institution that recommends the trustee. This is a form of swift trust.
- **Psychological or behavioral trust:** A predisposition towards having confidence that others will carry through on their obligations (Warrington, Algrab & Caldwell, 2000).
- **Technological trust:** A belief that technologies will perform reliably and will not be used for untoward purposes (Chiravuri & Nazareth, 2001).
- **Organizational trust:** The belief that an organization will carry through on its obligations (Cummings & Bromiley, 1996).
- **Situational trust:** Dependence on cues and clues in the immediate social environment when deciding whether to trust another group, organization or institution (Karake-Shalhoub, 2002).
- **Interpersonal trust:** An expectation that others will behave in a predictable way, and a willingness to be vulnerable during the trust relation (Dibben, 2000).

Shapiro and others (1992) identified three consecutive stages through which trust develops: calculus-based, knowledge-based and identification-based. In the beginning, calculus-based trust exists when neither party is familiar with the other. The knowledge-based stage is entered when information flow increases and behavior becomes more predictable, therefore adding more mutuality to the relationship. Finally, trust develops into the information-based stage. By that time, there should be complete empathy within the relationship and a full understanding of each other's needs, wants and intentions (Ashleigh, Connell & Klein, 2003).

According to Fukuyama (1995), trust is the expectation that arises within a community of regular, honest and cooperative behavior, based on commonly shared norms, on the part of the other members of that community. What is the role of trust in synchronous group discussion? We

believe that knowledge transfer in group discussion is embedded in a social context. Participation in the relevant social context is essential for the successful transfer of learning in productive synchronous group discussion. The very existence of a relationship between participants in productive group discussion exchange requires the presence of trust. The transfer of knowledge through education in group discussion requires trust between the teacher and the student. We also believe that trust, familiarity and mutual understanding, developed in a person's social and cultural contexts, are prerequisites for the successful transfer of learning in group discussions. Trust within and between members of the group can assist the dissemination of knowledge in group discussion. However, it is also important for us to recognize that issues of control and power also shape social interaction and, therefore, influence the processes of learning in group discussion. When a teacher structures the discussions, his or her control has an important impact on the participation and contributions of the learners.

Two types of trust are necessary for knowledge sharing: benevolence-based trust and competence-based trust (Levin, Cross, Abrams, & Lesser, 2002). Benevolence-based trust is one in which an individual will not intentionally harm another when given the opportunity to do so. Competence-based trust describes a relationship in which an individual believes that another person is knowledgeable about a given subject area. Both types of trust were necessary for students to work effectively and share knowledge.

BENEFITS OF ONLINE LEARNING: WITH RESPECT TO GROUP DISCUSSION

There are many benefits to online learning. For learners, benefits include easy access to global resources; learning at a time during the day, evening or night when learning is best for the learners;

learning at the place that is most convenient to the student without the need to travel to universities to attend classes; and learning without any interruptions to their work schedules, appointments or family events. For teachers, information and communications technology (ICT) embraces the design of learning environments that permit deeper learning using multimedia facilities. Teachers have an online location where they can add additional resources to meet the learning needs for all students, who learn through a variety of modalities. Given all the benefits, the heart of online learning is located in the online discussions. Online discussions facilitate learning on a scale not practicable in the past. In residential classrooms, while traversing the room from group to group, teachers can only listen to one group of students at a time. In some online learning systems, teachers have the ability to open and view the chat rooms for all of the groups at the same time, where they may take advantage of 'teachable moments' that occur in synchronous group discussions, to provide explanations when needed or to challenge students to think at higher levels while the discussions are in action. In most learning management systems today, online discussions are automatically archived. A benefit of an archived discussion is that the transcript could be viewed by students who were not able to take part in the discussion. Another benefit is that the chat logs from all of the groups could be posted to a discussion thread, where the entire class could access and learn from them, adding to the richness of the class. Online discussions provide the medium for teachers to observe the level of community building within in each group, within the entire class, and to add more scaffolding to move the community building to higher levels.

We believe that trust and performance are interrelated in online learning. The reason given is that much learning happens through social interaction. According to Sousa (2003), the trust students put in three main components of an online distance learning scenario is the common

Group Process and Trust in Group Discussion

denominator of several related problems, such as motivation, retention and technology difficulties, which normally lead to low academic performance. The three factors identified by Sousa and others (2003) are:

- Students' trust toward the teacher's interaction;
- Students' trust toward the virtual learning environments (VLE); and
- Students' trust toward the technology.

The work by Jarvenpaa and Leider (1998) also pointed to the relationship between trust and performance in online distance learning. They suggested that responses to positive trust building activities have an increasing trust in team members. In the paper *Trust, Safety and Confidence: Building the Foundation for Online Interaction*, Klecka (2003) shows that besides safety and confidence, trust is the basis for interaction in online learning. In her research, Klecka (2003) found that users need to establish trust before they feel confidence to participate in group discussion and sharing.

ONLINE LEARNING AT DUQUESNE

GITED516: Distance Learning Course Design is a graduate course purposefully designed for educators who aspire to teach online. This course was designed to place teachers in the role of a learner so they could experience and gain an appreciation of what it was like to learn online from a learner's perspective. In this blended course, learners meet residentially for a total of four sessions during the 15-week semester: two sessions at the beginning of the course and two sessions at the end of the course.

From the moment the students enter a class, when they meet the teacher and other students for the first time, they develop an intuition about how they feel about the culture of the class. Initial Online Trust (IOT) is the initial stage of a user's

trust in the online learning system. It inherits the essential nature of general trust. IOT is the trust that surfaces when parties first meet or interact. It is based on an individual's disposition to trust or an institutional cue that enables one person to trust another without firsthand knowledge (McKnight & Cummings, 1998). Initial trust is also the trust in an unfamiliar trustee, a relationship in which the actors do not yet have any credible, meaningful information about or affective bonds with each other. We believe it is important to identify the type of knowledge a trustor has before the first interaction. Differentiating users based on their knowledge is the first step to understanding their trust.

Even if students do not verbalize their thoughts, they enter a classroom concerned whether they are enrolled a safe risk-taking course, where they can trust the teacher and the students, where they can take risks, possibly even make mistakes, and still be accepted by others. In this course, during the first face-to-face session, the teacher took the first step in setting the tone of the environment. The teacher and the students briefly introduced themselves to the class, since one of the homework assignments for the first class was for the students to upload their autobiography, adding more details into the Learning Management System (Blackboard) than they shared in class. The bio is an important activity. Students from past courses frequently commented that they referred back to the photos and personal information about their peers several times during the course after they began to read each others' postings. Following the brief introductions, the students performed an activity where they completed an unannounced 1-minute typing test, using an authentic secretarial typing test, to identify their typing speeds. The purpose of this activity was to identify the typing speeds of each student so that the teacher could combine this information along with the knowledge learned from the students' bios, so that the teacher could place them in groups for the next two activities: an unstructured and structured synchronous chat. The ability to communicate can be hindered by

limited typing skills. Clear communication is essential for online teams to function effectively (Larson & La Fasto, 1989). Building trust fosters effective online communication. A synchronous chat is similar to on-ground small-group discussions, which happen in real time. The class was divided into groups consisting of no more than three to four students per group. As other previous GITED 516 classes, the average typing for this class was 30–40 words per minute. Once the groups were formed, the teacher shared this information with the class and then taught the class about the ‘mechanics’ of entering and posting their thoughts into a virtual classroom, called a ‘chat room.’ This is where the students only learned about the tool. Intentionally, information was shared with the students at this time.

The first synchronous activity was called an unstructured chat. In the unstructured chat, the teacher provided no rules of online etiquette (netiquette) and she did not provide any reference to group processes. The purpose of the chat was to observe the interactions of the group members, to witness whether their typing speeds were exchanged without prompting, to check for group organization and productivity, to observe for equal participation of all group members, and particularly to see whether the groups assigned roles. The teacher timed the activity to last 15 minutes. The group was tasked to answer two questions, which the teacher knew they could answer from their past experience. The two questions for this assignment were:

1. Discuss your most favorite teacher and the reason you remember the teacher so well.
2. Discuss what you either heard from others, experienced yourself or perceive about the characteristics and qualities of successful online students.

The teacher assured the students that there were no right or wrong answers to this activity, hoping that the students would be more willing

to express their thoughts in a public forum (but in a password-protected Learning Management System) to their peers they met that evening.

Once the unstructured chat was over, the students were allotted 15 minutes to discuss their unstructured synchronous chat experience. As with other classes, the groups said they felt like they were on a treadmill, where they had difficulty keeping up with reading and typing at the same time. Some students said they stopped participating in the discussion because of their limited typing speeds or because English was not their first language, feeling excluded because the American students used a lot of slang or local terminology they did not know. Following the discussion, the teacher spent the next 15 minutes reviewing the group process, structure, rules of netiquette and the group roles the students would be expected to assign for each succeeding synchronous chat. The five roles communicated to the students were: *Organizer, Communicator, Timekeeper, Recorder and Remediator.*

- **Organizer:** Monitors the group’s progression, keeps the group on task, and checks for accuracy in the posted information.
- **Communicator:** Substantiates that all participants in the group had an equal opportunity to voice their thoughts, opinions and ideas during the discussion and assures that the diversity of thoughts is respected. *Communicators* must know the typing speeds of each member to decrease the pace of the conversation, when necessary, to keep all members participating at an achievable level.
- **Timekeeper:** Monitors and manages the assigned tasks to assure that all questions or assignments have been addressed.
- **Recorder:** Reviews the online chat log following the discussion, summarizes the important points addressed, sends the analysis to all team members to be sure the summary is reflective of everyone’s thoughts, and posts

Group Process and Trust in Group Discussion

the summary to the discussion board for the other groups to read so that everyone in the class has the opportunity to learn from the discussions of all groups.

- **Remediator:** Recaps the group's agenda, tasks or assignments, updates the member briefly of the group's progress, and asks the member for his or her input.

From the author's experience, building trust within a community of learners (Phase 2: Trust in Borghoff and Schlichter's model, 2000) evolves within an eight-step hierarchical model. If teachers want groups to attain their highest levels of trust that leads to sustaining online dialog, the teacher's role must evolve from leading and directing the conversation to a facilitator's role, which becomes supportive and fosters group empowerment, culminating in the facilitator stepping aside, letting the group take the lead, and only intervening in the conversation on occasion and when appropriate. The eight-step hierarchical model to aid in sustaining online discussions and building trust involves:

- **Step 1:** Facilitator learns about the audience and sets everyone up for successful dialog.
- **Step 2:** Facilitator individualizes the setting—links content to the context and culture of the audience.
- **Step 3:** Facilitator sets up a risk-taking environment for the group to respect each others' thoughts.
- **Step 4:** Group depends on the facilitator to raise the comfort level of the group and begin the discussion, rarely taking risks when they speak.
- **Step 5:** Group begins the dialog, but superficially shares their thoughts. The group begins to formulate thoughts about the trustworthiness of the group. Learners are less vulnerable in conversations when they begin their dialog with the word "They."

- **Step 6:** Group leads the dialog, but increases their trust slowly—taking one risk at a time (Trust builds on small successes) and testing the trustworthiness of the group by taking more risks with the more acceptance they receive from the group. Learners are more vulnerable and generally progress from beginning their thoughts with the word "They" to the word "We."
- **Step 7:** Group sustains the dialog and shares deeper thoughts with the group. The group depends on each other to drive the dialog. This is where the learners are most vulnerable, and they generally begin their conversations with the word "I."
- **Step 8:** Group sustains the dialog and the group members speak with a unified voice, understanding each other when they speak. This level demonstrates that the highest levels of trust are evident. The group speaks openly and honestly, and refrains from group think.

Online dialog has the potential for groups to form deeper relationships, because in an online environment learners who do not speak (by typing their responses) are considered absent. Learners cannot remain passive in an online environment or no one will know they are present. The first four steps in the model described above are initiated and implemented by the teacher. The remaining four steps are led by the group members. Building trust evolves over time and is accomplished through a hierarchical approach. For example, when trust is breached, learners may regress at least one or two more steps. Depending on the learner's trust established in prior relationships, the length of time it takes for learners to trust the group members will vary. This factor must be taken into consideration in the group process. Some students will not openly share their thoughts until trust among the group members has been achieved.

One of the homework assignments for the first session was for students to answer a 20-question self-assessment questionnaire related to *Making Informed Decisions About Online Learning*. This survey was another tool that further assisted the teacher in learning more about the students before they worked online and outside of the residential setting. The questions below were selected from the survey because of their direct implication in providing more knowledge about each student's past experiences, which may impact their performance in the group. In the survey, students rated themselves using the metaphor of a traffic light, implicating their answers in a green (benefit), yellow (caution) or red (risk) category. For any markings in the yellow (caution) or red (risk) categories, students were asked to provide an explanation for their answers. Our experience has shown that many students rated themselves more critically than the teacher would have rated them. This survey was used to identify potential and proactive "red flags" that may indicate potential problems the students may experience in the course and group work. The questions most appropriate for this chapter and the students working in groups in general were:

- Rate your leadership skills;
- Rate your history of verbal participation in class;
- Rate your pattern of focusing and answering questions/dialoging on task;
- Rate whether you prefer to work in groups or to work alone;
- Rate your individual productivity completing group work;
- Rate your level of active listening during a conversation;
- Rate your level of comfort sharing your work with others; and
- Rate your ability to read carefully.

THE CASE STUDY

In this section we describe how the group process of Borghoff and Schlichter (2000) is used in our case study for our online learning course at Duquesne.

Phase 1: Orientation

Following the Best Practice Model of Online Teaching and Learning in the article by Wilcox and Wojnar, *Best Practice Goes Online* (2000), getting to know the audience is an important starting point to building trust and individualizing instruction for all learners. In this phase, the teacher and students met in a residential classroom. Meeting their peers in a face-to-face (on-ground) classroom before conducting online discussions in a virtual classroom, where the students were meeting online from various geographical locations, helped the students to feel more at ease with their peers. They were able to connect names with the faces of their peers they remembered from the first session. Online, students will be communicating in text-based synchronous discussions and asynchronous discussions. The instructor guided the students through the unstructured chat, the teaching portion of group process, expectations and netiquette guidelines, and then through the structured chat. For homework, students were tasked to complete a 20-question survey. The orientation aims to prepare the class for a problem-solving synchronous discussion the groups will conduct themselves, without the presence of the teacher, using the content of the *Six Thinking Hats* book by Dr. Edward De Bono in Session/Week 4.

Phase 2: Trust Building

Teachers and students evolve into communities of learners over time. Trust begins on the first day the teacher and students meet. In our model, the teacher facilitates the first four steps toward

Group Process and Trust in Group Discussion

building a community of learners. Steps four through eight focused on the group's role in this process. The goal is to keep increasing the levels of trust within the group so that the discussions will become rich and will be sustained by the group. *Trust is the most fluid and most critical level in the group process to keep learners involved in the learning process.* As long as group members continue trusting each other, by acquiring small successes to what they post and gaining acceptance by their peers, the members will be more willing to share their thoughts in a public forum, which in turn aids the progression of the dialog, where students are comfortable sharing their true thoughts without the fear of rejection. Facilitating and nurturing the process where students depend on each other, rather having them depend on the teacher to provide the knowledge and guidance they need to be successful in online discussions, assists students in taking ownership and responsibility for their own learning.

Phase 3: Goal-Role Clarification

The agenda for the group work is clearly articulated and understood by all group members. Discussions proceed smoother and on-task faster when one person in the group posts the objectives and tasks the group is expected to complete. It is important to review netiquette guidelines and assign roles to each member of the group. Initially, the teacher should assign the roles to the group members. The more clearly the objectives and tasks are articulated and understood at this time, the easier it will be for the group to begin to focus their thinking and move forward in their discussion.

Phase 4: Commitment

The teacher selected the groups. In this assignment, students were provided with a link to an online case study in advance of the discussion.

The entire class read the *Six Thinking Hats* book. The teacher assigned a different colored hat to each student. There were six students per group. Students were expected to lead the discussion when their group requested a response of the thinking of their colored hat to solve a problem. The group was tasked to problem solve a case study using all of the colored hats.

Phase 5: Implementation

The synchronous discussion took place over 1-1½ hours. Our experience has shown that a discussion lasting longer than 1½ hours causes a decline in the students' concentration and reading abilities, because the thinking and concentration of reading text online was so intense.

Phase 6: High Performance

Reports and comments from students have shown that this activity is very meaningful. Most of the students had been involved in work or life situations that required problem-solving skills. In prior situations, students had recognized they generally do their problem solving with some, but not all, of the colored hats. Because students found this activity so interesting and practical, they were able to see how this activity could transfer to problem-solving issues in their workplace. The group's concentration was very intense, but sustainable by the group.

Phase 7: Renewal

Limiting the time frame to conducting the discussion to a manageable time frame (no longer than 1½ hours), the group was able to sustain the momentum of the discussion without getting tired or becoming less motivated. In past classes, when the chat lasted more than 1½ hours, renewal time was required.

THE ROLE OF TRUST IN SYNCHRONOUS GROUP WORKING

How do we facilitate trust?

1. Creating a common understanding of how the online learning course works, we found it important to develop a common context or common understanding among students regarding the nature and goals of the course. Factors that were significant in building benevolence and competence-based trust include: a shared language and goals; and relating to the importance of building a shared view of how learning was accomplished, how it is measured and how it is ultimately rewarded. Creating this common understanding makes it easier to focus on mutually held goals and values. This helps to reduce the time and effort spent on individual issues and motivation.
2. Help build trust-building behavior. As teachers, we can influence the level of trust by modeling and recognizing trust-building behavior, such as receptivity and discretion.

Teacher support is vital to the success of online learning. Teachers should support their students at the start of their learning. What type of support is appropriate? It is our belief that support should include providing information, encouragement and resources to the students. Teachers should respond promptly to students' queries and provide direction to them, acting as an arbitrator and backing decisions of teams.

Until students get to know one another, the benefits of learning through group discussion may require a leap of faith. New online learners will not know whether what they are learning is of value until they fully experience several discussions. The ability to share a high degree of mutual understanding, built on a common appreciation of

a shared social and cultural context, is essential to building trust between individuals.

Trust is widely recognized as a major issue affecting the uptake of online learning. We know that although ICT can be used to facilitate the transfer of knowledge through online learning, it should also be capable of reinforcing trust by providing mechanisms of validation and protection through necessary regulatory and institutional framework. In addition, trust should also depend on the sharing of a set of socially embedded values, cultural institutions and expectations. This may be facilitated through the establishment and maintenance of a strong institutional culture. It is possible with the aid of ICT through the virtual learning environment of the discussion group to build a relationship of trust and mutual understanding.

While mutual goals are necessary, they are not sufficient to gain mutual trust for collaboration (Dodgson, 1993). With mutual trust, participants will reciprocate openness and sharing of information and knowledge over time. Other conditions that impact mutual trust are rivalries and occupational communities. We believe that it is necessary to understand the philosophy of group process with trust built in as part of the process.

It is our belief that cooperation is an essential part of online learning. Borghoff and Schlichter (2000) believe that cooperation in a group is both a repeated alternate between synchronous and asynchronous cooperation and a process during which subgroups constitute themselves for solving individual subprograms. For example, a seminar on a paper can exemplify alternation between the different cooperation modes, as shown in Figure 2 (Borghoff & Schlichter, 2000).

The synchronous environment demonstrates students' ability to demonstrate thinking using both preparatory and impromptu techniques (Wallace & Wojnar, 2002). In our case study, students were assigned a Universal Resource Locator (URL) to locate an article for their case

Group Process and Trust in Group Discussion

study. Students were expected to identify the issues and then to problem solve each issue using all six hats. Since students had time to prepare and formulate or process their thoughts, they used a preparatory technique. As the discussion continued and the group posed questions to each other, students responded to the questions without any prior preparation. This technique is called the impromptu question-and-answering technique. The asynchronous environment is more reflective than the synchronous environment and allows for students who are processors of information to think through and rewrite their original thoughts once they have had ample time to process the information. Incorporating both synchronous and asynchronous discussions in an online course are the closest means to replicating a residential learning environment. Residential classrooms are filled with rich discussions because they include both group and individual work.

During the 15 weeks the course was taught, there were only two synchronous discussions scheduled with each discussion lasting no longer than 1-1½ hours. Too many synchronous discussions during a course defeat the purpose most learners enroll in online classes—flexibility, leading to a fixed course schedule.

Learning is a social process involving teams of people working together. Building relationships for online learning is vital to the effectiveness of the team (DeNigris & Witchel, 2000). This is a positive link between member relations and team performance for both short-term teams and long-term teams (Druskat, 1996; Druskat & Kayes, 2000).

CONCLUSION

Group discussion is a crucial part of online learning. For effective group discussion, it is important that we understand group process and trust in collaborative work. According to Borghoff and Schlichter (2000), a group process is the specifica-

tion of information, activities and characteristics of an electronically supported team, including the context for the group interaction. Included in the group process is the issue of trust. Trust is vital if we want students to be fully active and participate in the group discussion. The outcome of the trust building process in the group discussion leads to a student's ability to learn from other each and from the teacher. Because students began to trust each other and their teacher, they became more open and able to share their thoughts without fear of being rejected. This allows them to learn problem solving from each other that will lead to solving related issues in their workplace. The trust that individual members develop within their team helps them to predict others' behaviors. The initial getting-to-know-you session encompasses sharing of cultural information. These individuals exchange information about shared values, assumptions, opinions and beliefs. There is also a sharing of personal information, such as hobbies, interests, family life, work life, personal expectations of team, equipment, resources and so forth.

Our experience has shown that for online discussions to be productive and goal oriented, teachers should review the group process with students before they assign group work. Students need to know the value and impact they have on making groups functional and high performing. Surveys that could identify past experiences within group work may help to identify "red flags" that may proactively make a difference between student satisfaction and frustration in online discussions. Trust is one of the most fluid yet critical elements that either led groups to share or to hold back their thoughts in any setting. By taking the time to explain the rules of online engagement, teachers will increase the probability that the discussion will be content-rich, productive and on-task, and meets or exceeds the objectives and tasks assigned, rather than being disappointing, non-productive and demonstrating no viable results.

Once students are skilled in the procedure for conducting online discussions, generally with secondary students or adult learners, teachers may empower their groups to monitor and manage a synchronous discussion without their presence. By carefully following the model of Borghoff and Schlichter (2000) from orientation to renewal, higher-quality and more productive discussions that actively engage all learners are possible. Students who have multiple classes together may be more inclined to experience all eight steps in our community building model. We have demonstrated in this chapter how we have utilized both group process and trust in our online course.

FUTURE RESEARCH

We would like to conduct further research in how group process and the issue of trust impacts online learning discussions, the limitations of the current model, the process of identifying the types of audiences that would be most suitable for online group discussion, online chat logs from the course to identify whether groups automatically assign roles to their group members and the group process they follow, and group online productivity through a variety of assignments.

REFERENCES

- Ashleigh, M., Connell, C., & Klein, J.H. (2003, October 23-24). *Trust and knowledge transfer: An explanatory framework for identifying relationships within a community of practice*. Proceedings of the EIASM second workshop on trust within and between organizations, Amsterdam.
- Borghoff, U. M., & Schlichter, J.H. (2000). *Computer-supported cooperative work: Introduction to distributed applications*. Berlin: Springer-Verlag.
- Chiravuri, A., & Nazareth, D. (2001). Consumer trust in electronic commerce: An alternative framework using technology acceptance. *Proceedings of the Seventh Americas conference on information systems* (pp. 781-784).
- Cummings, L. L., & Bromiley, P. (1996). The organizational trust inventory (OTI): Development and validation. In R. M. Kramer & T. R. Tyler (Eds.), *Trust in organizations: Frontiers of theory and research*. Thousand Oaks: Sage Publications.
- De Bono, E. (1999). *Six thinking hats*. Boston: Little, Brown and Company.
- DeNigris, J., & Witchel, A. (2000). *How to teach and train online*. Needham Heights: Pearson Custom Publishing.
- Dibben, M. R. (2000). *Exploring international trust in the entrepreneurial venture*. London: Macmillan.
- Dodgson, M. (1993). Learning, trust and technological collaboration. *Human Relations*, 46(1), 77-96.
- Druskat, V. U. (1996, August 13). *Team-level competencies in superior performing, self managing work teams*. Proceedings of the annual meeting of the Academy of Management, Cincinnati, OH.
- Druskat, V. U., & Kayes, D.C. (2000). Learning versus performance in short-term project teams. *Small Group Research*, 31(3), 328-353.
- Fukuyama, F. (1995). *Trust: The social virtues and the creation of prosperity*. London: Penguin Books.
- Jarvenpaa, S., & Leidner, D. (1998). Communication and trust in global virtual teams. *Journal of Computer-Mediated communication and Organization Science: A Joint Issue*, 3, 1-38.
- Jarvenpaa, S. L., & Shaw, T. R. (1998). Global virtual teams: Integrating models of trust. In P.

Group Process and Trust in Group Discussion

Siober & J. Griese (Eds.), *Organizational virtualness* (pp. 35-51). Bern: Simowa Verlag.

Keckca, C. (2003). *Trust, safety and confidence. Building the foundation for online Interaction.* University of Urbana-Champaign. Retrieved from www.ed.uiuc.edu/meter/Publications/Documents/klecka_Trust_AERA03.pdf

Larson, C., & La Fasto, F. M. (1989). *Teamwork: what must go right/what can go wrong.* Newbury Park: Sage.

Levin, D. Z., Cross, R., Abrams, L. C., & Lesser, E. L. (2002). *Trust and knowledge sharing: A critical combination.* IBM Institute for Knowledge-Based Organizations.

McKnight, D. H., & Cummings, L. (1998). Initial trust formulation in new organizational relationships. *The Academy of Management Review*, 23(3), 473-495.

Shapiro, D., Sheppard, B. H., & Cheraskin, L. (1992). Business on a handshake. *Negotiation Journal*, 8, 365-377.

Sousa, S. (2003). *Trust and performance in online distance learning.* Retrieved from www.pa-linz.ac.at/international/Alert/Tntee/Tntee_publication/ELHEII/sonja.pdf

Wallace, R., & Wojnar, L. (2002, September). How to use chat. *EC & T Journal*, September, 37-38.

Warrington, T. B., Algrab, N. J., & Caldwell, H. M. (2000). Building trust to develop competitive advantage in e-business relationships. *Competitive Review* 10(2), 160-168.

Wilcox, B., & Wojnar, L. (2000, August). Best practice goes online. *Reading Online*, 4(2). Retrieved March 8, 2004, from www.readingonline.org/articles/art_index.asp?HREF=/articles/wilcox/index.htm

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 135-153, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 5.4

Community (Information and Communication) Technology: Policy, Partnership and Practice

Peter Day

University of Brighton, UK & Central Queensland University, Australia

ABSTRACT

This chapter illustrates the significance of developing a shared understanding of community, which is more than an adjective qualifying a certain type of ICT usage in a rapidly developing area of social practice and academic study — Community Informatics. Highlighting the importance of contextualising ICTs within their social environments, the chapter approaches Community Informatics from a human-centered perspective. It introduces a framework of democratic design criteria intended to assist the community planning and implementation processes of community technology initiatives. Examining the significance of community policy, community partnerships and community practice, the author invokes the need for interdisciplinary and cross-sectoral collaboration in Community Informatics and argues that community ICT initiatives should be grounded in the needs of local communities if they are to be utilised successfully as tools of community empowerment.

INTRODUCTION

Communication, in one form or another, has played a central role in developing and sustaining the well-being of geographic communities throughout history. Community Informatics, a fairly recent phenomenon of modern network societies, can be traced to the community communications pioneers of the late 1980s and early 1990s. In Europe, for example, community tele-service centres and community telecottages were being developed in Scandinavia and the UK, whilst in North America, the community networking movement emerged during the same period (Day, 2001). Since these early beginnings the primary purpose of such community technologies has been to utilise information and communications infrastructures, applications and services to empower and sustain the social capital of local communities (the networks, organisations, groups, activities and values underpinning community life). However, developing sustainable and effective community

ICT initiatives can be problematic and present significant challenges across a number of levels (Day & Harris, 1997).

This chapter seeks to address some of these challenges, not as a final solution of ‘one best way’ but as a stimulant to cross-sectoral dialogue and collaboration at community level. The main contribution to this dialogue is the presentation of a framework of democratic design criteria intended to assist the community planning, implementation and development processes of community technology. The framework is introduced within the context of community ICT policy, partnerships and practice — the 3Ps of Community Informatics. In this context the chapter is intended as an input to both the interdisciplinary academic discourse accompanying the emergence of Community Informatics as a field of investigation and the emerging cross-sectoral communications found in community ICT practice (Day & Schuler, 2000).

UNDERSTANDING COMMUNITY

In order to avoid interdisciplinary or cross-sectoral misunderstanding in this relatively new area of study and practice, it is worth spending some time developing an understanding of what is meant by the term ‘community’. To begin with, this chapter assumes communities to comprise both active community groups and individual citizens. However, in terms of essential characteristics such as socio-economic environments, culture, social norms and values, needs and behaviour, no one community is alike. There are commonalities but there are also differences. Communities are naturally heterogeneous and rather than attempt a hard and fast definition this chapter adopts a more flexible approach. Butcher’s three interrelated senses of community — descriptive community, community values and active community (1993) — not only provide a starting point for discussion but enable practitioners, researchers and policy-

makers to consider the characteristics, resources and needs of their own communities and plan community initiatives accordingly.

The notion of Descriptive Community, which draws on the word’s etymological origins of having ‘something in common’ provides us with our first sense of community. This ‘something in common’ might refer to a neighbourhood, village, or town, for example, but might also refer to other social determinants such as ethnicity, religion, and sexual orientation. It should be noted that communities based on location or interests are not necessarily mutually exclusive. Indeed geographic communities are often made up of diverse cultures and it is not uncommon for groups and individuals to share knowledge and draw from each other’s experiences, creating new forms of common interests as a consequence. Of course, the opposite can also be true and conflict can and does arise in and between communities, but for communities to be sustainable, especially where diversity of culture and social norms exists, Community Values are significant.

The second sense of community is found in the sharing of certain social values, i.e., solidarity, participation and coherence. Although community values are open to interpretation and can be contested, the principles upon which they are established provide the value base of community initiatives and policies. Solidarity inspires affection and loyalty in communities through mutuality and co-operation in relationships. Participation enables individuals to contribute to and engage in the collective life and aspirations of the community. Coherence connects individuals and community, facilitating an understanding of themselves and their social world. However, the potentially contested nature of community and modern society’s inherent diversity of cultures and belief systems require community members to respect and celebrate the social richness and diversity of community life if they are to co-exist in the same geographical space and share social experiences. This diversity distinguishes the in-

dividual from the collective whilst, at the same time, contributing to the collective.

That communal does not subsume individual might be regarded as paradoxical, but a balance between adequate amounts of privacy, autonomy and localism is required to shape Community Values. Shared public spaces, community associations and activities that provide the opportunity to engage with one another should be tempered with spaces offering both privacy and respect for the diversity of cultural principles.

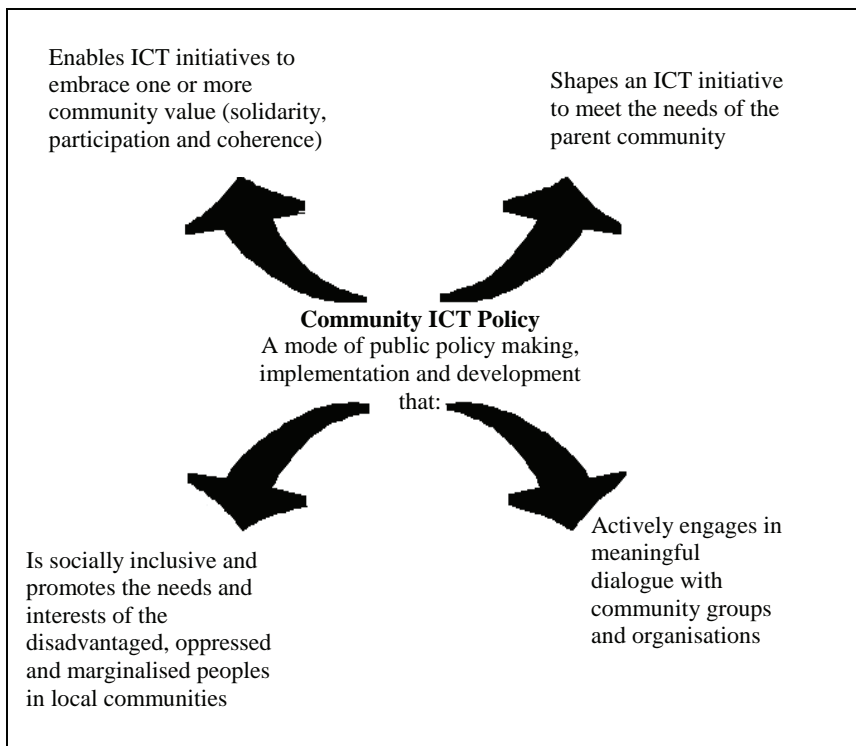
The notion of the Active Community provides the third sense of community and stems from community identity. It is through a sense of belonging to a local community that people engage in community activities. The Active Community refers to collective action by community members

embracing one or more communal values. Such activities are normally undertaken purposively through the vehicle of groups, networks and organisations, which is why the concept of social capital is of such import to any discussion of community. These community and voluntary sector organisations form the bedrock of community life, and although often under-resourced and over-stretched play a significant role in building and sustaining community.

COMMUNITY POLICY

The Active Community is based on the participation of community members, groups and organisations in shaping community life. How-

Figure 1. Community ICT policy (Source: Day, 2001)



ever, a shared value base between community and policy makers is crucial to the formulation of policies that build, develop and sustain active communities. In developing an understanding of what community means at the local level, it is possible to develop policies that are meaningful and relevant to people in those communities in the network society, and community ICT policy can be represented as shown in Figure 1.

THE PARTNERSHIP APPROACH

Partnerships have always played a central role in community policy, and this shows no sign of abating. In fact, if anything, the dependency on partnerships is on the increase today. Significantly, partnerships have also been crucial components of information society policy development and implementation since 1994 (CEC, 1994a) and are therefore of import to community informatics. However, they are complex social arrangements and their impact on the development of community technology, especially community ICT initiatives, is worthy of investigation.

Although partnerships can be both formal and informal arrangements to work together, Wilcox suggests that where a task is complex and long-term, such as a community ICT initiative, a formal partnership is the best approach (1994). He continues by suggesting that one of the first tasks of any partnership should be the clarification of issues such as joint purpose and values. However, although aims are usually identified early in the partnership life cycle, a key problem is that partners often have different social agendas and consequently differ in their interpretations of these aims, which are often deliberately vague so that all partners may feel comfortable with them. Rarely is time spent establishing common purpose and values through open and honest discussion (Day, 2001).

Public/Private Sector Partnerships

The traditional approach to partnerships is based upon the public and private sectors (CEC, 1994a). This model, through its concentration on economic and physical capital, overlooks the significance of social capital (Putnam, 1996) and is usually based on power. The private sector has economic power and the public sector has regulatory, administrative, legislative and some economic power. It is these powers that dictate and drive forward the development of local information society policy. The third sector¹ is excluded from such a scenario and is forced to exert whatever influence it might have through any available channel. Partnerships such as these tend to stimulate social exclusion by failing to include representation from local communities and individual citizens (Harris, 1996).

Cross-Sectoral Partnerships

In a call for a more inclusive attitude, Harris suggests cross-sectoral community partnerships should comprise local authorities, the private sector, and academic and voluntary sector agencies (1996). However, the disempowerment of citizens, found in traditional partnership models, can also be found in some cross-sectoral partnerships. Even where the not-for-profit, or third sector is included, the power of professionals and/or 'experts' (Street, 1997), together with a bureaucratised policy-making process can sometimes be observed (Sanderson, 1999). Where citizen input is sought, this often takes the form of consultation. Local people might be asked their views on a specific proposal and some slight amendments might even be possible but the purpose, budget, outcome, etc. have generally been predetermined. As Arnstein argues, such consultation is usually little more than tokenism (1969).

Tripartite Partnerships

Although cross-sectoral partnerships are now recognised as significant to modern policy-making (New Economics Foundation, 1998), a more equitable approach is required, one that transcends the inherently exclusive nature of traditional partnership models. Tripartite collaboration is posited as an attempt to build on cross-sectoral partnership mechanisms at local level (Day, 1996, 1998). Rather than being driven solely by the economic imperative of public and private sectors, the policy-making process should be based on respect, equity and mutuality between partners and embedded in community need.

The social development of local communities cannot be shaped by economics alone. The economy is only one element of the human condition in community life. Simply said, if the private sector has the right to make profits from the local community then it has the responsibility to contribute, in a meaningful and necessary manner, to the welfare and social fabric of that community. As an enabling authority, it should be the role of local government to oversee such community partnerships.

Collaborating in tripartite partnerships enables each sector to bring its own skills, expertise, experience and knowledge to the local partnership. The private sector is usually good at doing things efficiently. The third sector is good at articulating local views, communicating with users, and developing a sense of citizen ownership and identity. The public sector's² key strengths are its enabling ability, and ensuring that the broader public objectives are achieved by maintaining a strategic overview (Landry & Bianchini, 1995). The diversity of partners' contributions provides the foundation of tripartite partnerships. Diversity of experience, knowledge and skills, as well as more tangible resources should be regarded as partnership assets, i.e., social wealth.

Partnerships developed in this way can promote a more democratic approach to societal changes. However, to be successful they must encourage participation, so that joint purpose, common values and mutual understanding can develop. Enabling local communities to engage in the shaping and utilisation of community ICT initiatives is an important step towards a more inclusive society.

Tripartite Collaboration

Tripartite partnerships signify a major directional shift from the limitations of the partnership policies that underpin many information society development initiatives (Shearman, 1999). They point the way to a more collaborative form of community communications and decision-making in which the influence of social networks is emphasised. However, it should be understood that such collaboration requires changes to the existing social and cultural perspectives of many organisations and agencies. Fresh and open minds are requisite to addressing the needs of local communities and the challenges of collaboration.

The active involvement of the third sector in the policy process through tripartite collaboration also requires a re-examination of assumptions and practices relating to the power of administrators (Day & Harris, 1997). Without changes in the way bureaucracies function, authentic participation will be limited to experiments of academic interest only. Enabling administrators to become co-operative participants in a collective community dialogue will require a significant shift in values of the role of administrators and the organisational cultures of many local authorities. The development of more participatory and inclusive community policies requires research not only into ways of empowering and educating citizens but also into ways of re-educating administrators and enabling administrative structures

and processes to facilitate an effective dialogue between citizens, administrators and policy-makers (King et al., 1998).

Outlining the Need for Change in Partnership Approaches

Policies to meet the challenges of the network society will need to draw from the widest social knowledge base. The facilitation of flexible and fluid partnerships through tripartite collaboration will go a long way to meeting the needs of communities in a rapidly changing socio-economic landscape. By utilising such partnerships in the development of community ICT initiatives, a more accurate representation of the needs of local citizens can be achieved. The participatory and collaborative nature of tripartite partnerships is reflective of, and complimentary to, the networking potentiality of ICTs. However, ICTs do not solve societal problems (only social solutions can do that) but they can provide requisite platforms for the efficient support of effective solutions (CEC, 1994b).

Unfortunately, it is not often recognised by policy makers that richly diverse sources of social creativity exist in local communities. By providing the expertise, resources and support for the creative social processes of local communities through the tripartite approach, a bridge can be built between the formal institutions and the informal networks that characterise the everyday life of local communities.

Harnessing the knowledge and creativity of local communities with the professional skills and expertise of public agencies and, where appropriate, private companies, can facilitate and increase social innovation. Social innovation is defined in this context as social initiatives designed and driven by local people to meet the needs of the local community through the solution of local problems.

The scenario of an empowered citizenship utilising ICTs to address social needs through participatory community practice unfortunately receives little consideration at policy level. Yet it is precisely the potential for citizens to participate in a full and active manner in the network society; designing, implementing and developing initiatives, activities and services that democratically meet community defined social need that transcends the passivity that marks the current techno-economic paradigm.

If the only services available to citizens are those regulated and priced by the service providers of a commercially developed infrastructure, then issues of access, social inclusion and active citizenship are diminished in value because the role of citizen is reduced to that of passive consumer.

Universal Participation

The previous section of this chapter highlighted the role of the third sector in tripartite collaboration. However, whilst such an approach encourages citizens to be actively involved in community groups, etc. — by providing them with a voice in the policy making process — it is important to note that community groups, etc., are not the whole story in respect of communities. Indeed, there is a potential danger that groups or third sector ‘experts’ familiar with the process of local government can dominate participation and actually deter active citizenship (Wilson, 1999).

Similarly, contested values within communities can lead to conflict. This can also act as a deterrent to the involvement of those new to forms of civic engagement and can be used as an excuse for inaction by local authorities. However, where people feel valued by policy-makers as equal citizens and are able to act on this sense of worth, they are more likely to contribute to and participate in shaping their local community. Active participation is therefore related to issues

of social rights and empowerment, and local authorities have obligations to citizens to respect and respond to collective contributions, needs and aspirations (Higgins, 1999).

Consequently, if social inclusion is to be both achievable and sustainable within the network society, all citizens should, as a fundamental democratic right, have the opportunity to participate in its evolution. Universal participation should now be included as part of the network society universality debate, alongside universal service and universal access (Kubicek et al., 1997; INSINC, 1997). In this way, citizens of a network society can both empower themselves and enrich the quality of life of their local communities, and through aggregation, contribute to improving the quality of life at a societal level.

COMMUNITY PRACTICE

As the development of community policies is dependent on encouraging active communities, the implementation of community policies, as has been seen, requires a change in mind-sets, enabling new and distinctive methods and techniques to be embraced (Glen, 1993). Glen describes these processes as ‘community practice’, which may involve some or all of the following components:

- The sustained involvement of paid community workers;
- A broad range of professionals who are increasingly using community work methods in their work;
- The efforts of self-managed community groups themselves;
- Managerial attempts at reviving, restructuring and relocating services to encourage community access and involvement in the planning and delivery of services (Glen, 1993, p. 22).

Describing the symbiotic relationship between community practice and community policies, where each is related to and promotes the other, Glen identifies three community practice approaches:

- Community services approach
- Community development
- Community action³

The last two operate at grassroots level. Community development concerns itself with the empowerment of communities to define and meet their own needs. Community action consists of organising and campaigning to achieve community goals. The community service approach involves altruistic and compulsory forms of assistance to people in need⁴ (Glen, 1993). However, because of the wide range of agencies, organisations, groups, etc., involved in community practice, approaches may be ‘top-down’, i.e., promoted by local authorities or voluntary bodies, or emanate from within local communities, i.e., ‘bottom-up’.

Whatever the complexion of an initiative, community practice should not be viewed as a blueprint for best practice but as a framework of three interrelated elements that assist in the understanding and fulfilling of community need. A brief examination of each element within a Community Informatics context is now conducted.

Community Services Approach

The community services approach requires a great deal of resources and support for the various initiatives/projects. This is the process in which community-oriented organisations and services are developed to meet the identified needs of the community. In a community informatics context, examples of this might include: the provision of online information services, public access centres, low cost ICT provision schemes, and education and training programs.

Community Development

Community development focuses on the promotion of community self-help and empowerment. This requires a continuation of the community services approach but with a view to building the capacity of communities to sustain the initiatives. Stimulating dialogue, collaboration and mutual support within and between the social organisations and networks in a community (social capital) and engaging in a consideration of how ICTs might underpin such activities, e.g., through the design, implementation and development, or community planning processes of a community network, are key goals here.

Community Action

Once empowered, communities are in a position to campaign for community interests and to influence the shaping of community policies. The community services and development approaches are continued to maintain a social safety net, but communities have more autonomy in their own affairs. The aim here is sustainable community through democratic communicative action.

Whatever the partnership composition and balance between the three interrelated elements of community practice, a shared value base that prioritises the identification and realisation of community needs as the motivating force of a community ICT initiative is required if they are to be socially sustainable. Subordinating ICT systems and artifacts to the needs of people living in geographic communities is fundamental to this process. Drawing from Sclove's theory of democratic technology (1995), the next section presents a framework for the participatory planning and implementation of Community ICT initiatives.

A FRAMEWORK FOR THE DEMOCRATIC DESIGN OF COMMUNITY ICT INITIATIVES

This framework is structured in five sections. The first three are based on Sclove's organising principles of institutional setting and association in a democratic society: democratic community, democratic politics and democratic work, and are deemed as essential to establishing democratic community ICT initiatives. The fourth relates to criteria aimed at securing the democratic sustainability of initiatives whilst the fifth introduces criteria intended to perpetuate democratic participation.

Toward Democratic Community

- A. Seek initiatives embracing one or more community value (solidarity, participation and coherence).
- B. Promote community development through the empowerment of citizens to define and meet their own needs.
- C. Relate goals and outcomes to the needs of communities and their citizens.

Criterion A states that democratic community ICT initiatives should be based on one or more community value. As seen previously, solidarity inspires affection and loyalty through mutuality and co-operation in relationships, sustaining community members at an emotional level. Participation benefits individuals through the recognition of their contribution to collective life and self-development. Coherence connects individuals to the community, and leads to an appreciation and comprehension of self and situation that give meaning to and awareness of themselves and their social world. Stimulating and sustaining the community values of solidarity, participation and coherence has been a challenge exercising

Figure 2. Community ICT planning and implementation criteria (Source: Day, 2001)

Toward DEMOCRATIC COMMUNITY:

- A. Seek initiatives embracing one or more community value (solidarity, participation and coherence).
- B. Promote community development through the empowerment of citizens to define and meet their own needs.
- C. Relate goals and outcomes to the needs of communities and their citizens.
- D. Develop activities and services that meet community need identified through sustained and meaningful dialogue of citizens and service providers.
- E. Give priority to the needs and interests of a community's socially excluded citizens.

Toward DEMOCRATIC POLITICS:

- F. Avoid policies that establish authoritarian or elitist social relations.
- G. Ensure initiative independence to encourage participatory community action to achieve community goals.
- H. Contribute to a public space for shared communications that facilitate inter/intra-community conviviality.
- I. Recognise and celebrate diversity of opinion, beliefs, values and culture and avoid policies that promote intolerance and disrespect.

Toward DEMOCRATIC WORK:

- J. Promote self-actualisation through activities and services that stimulate lifelong learning and active citizenship in the community.
- K. Invest in social capital by promoting common community interests and concerns.
- L. Seek to stimulate both social and formal economies of local communities.

Securing democratic sustainability:

- M. Enable meaningful engagement with groups and organisations active within local communities through the development of tripartite partnerships.
- N. Promote social innovation by harnessing the indigenous knowledge and creativity of communities with the resources and expertise of public, private and third sectors.
- O. Develop a sense of community identity and ownership.

Embracing community participation:

- P. Promote universal participation.
- Q. Seek 'local' technological flexibility and 'global' technological pluralism.

the minds of community development workers for decades. It is no less of a challenge within a community informatics context, where, if community technologies are to be employed as tools for community empowerment, their design, as well as their implementation and development, need to be based on community values.

However, understanding that community technology processes are as important as the products or applications themselves is not, in itself, enough. Consequently, Criterion B calls for community ICT initiatives to promote community development by empowering citizens to democratically define and meet community needs. To fulfil criterion B, methods of inclusive and participatory needs analysis must be employed. Such tools must facilitate identification of both the scope and diversity of a community's needs and the appropriateness of community ICT applications to the local needs of a social environment (Criterion C). The development of community technologies that promote local autonomy whilst facilitating collaborative and co-operative action and interaction is crucial to community conviviality.

However, attempts at developing participatory methods that actively engage communities in identifying local needs and applying those needs to the design, implementation and development of community ICT initiatives are few and far between at the moment. Of course, a range of participatory tools and methods exists that are sometimes employed within community practice generally, e.g., citizens' panels, consensus conferences, scenario workshops, community appraisals and focus groups (New Economic Foundation, 1998), but to date few have been used in a community informatics context. Part of the reason for not exploring the potential of such participatory tools can be found in a misplaced but popular belief that the design, implementation and development of technology, and ICT in particular, is the domain of experts into which mere mortals and common folk should not wander.

Despite this conventional wisdom, there is growing evidence to indicate that given the opportunity, non-expert citizens are more than capable of grasping the complexities relating to ICTs in their social environments. In Denmark, for example, the Board of Technology organised a series of consensus conferences on issues ranging from food irradiation and genetic engineering to sustainable agriculture and educational technology. The consensus conferences not only resulted in a better informed Danish public in matters relating to technology but also enabled early public involvement in the development of technologies. To this end, they facilitated "more flexible, socially responsive research and design modifications, [which is a potentially] fairer, less adversarial, and more economic path of technological evolution" (Sclove, 1996).⁵

- D. Develop activities and services that meet community need identified through sustained and meaningful dialogue of citizens and service providers.
- E. Give priority to the needs and interests of a community's socially excluded citizens.

The implementation of community technology activities and services must be effective in meeting community need if such initiatives are to remain sustainable. Criterion D requires sustained and meaningful dialogue between 'experts' (social and technical) and the local community through the forging of democratic partnerships to ensure that initiatives continue to meet community needs. Whilst consensus conferences are useful in achieving and sustaining meaningful dialogue, the dialogue required for the participatory design of community ICTs can require a more dynamic and direct form of engagement between citizens and 'experts'.

Asset-based community technology and community building projects, such as the methodology employed in the low- to moderate income Camfield

Estate in Roxbury, Massachusetts, is an example of such an approach (Pinkett, 2002). The purpose of this project was not just to encourage community participation in the community building process but also to empower the community so that it became the central driver of the 'improvement process' through community technology. Dialogue in Roxbury was between 'experts' and community members as 'agents of change'. This differs from consensus conferences. In Roxbury the purpose was for the community to shape change directly, whereas consensus conferences are usually employed to inform policy so that change might be considered. The point here is not that one participatory method is better than another; both have their appropriate uses. However, their application should be dependent on the social context, i.e., the needs of the social environment in which they are being considered, and this can only be determined through meaningful dialogue. Building on this (Criterion E), priority must be given to the needs and interests of the disadvantaged and marginalised members of a community, if social inclusion is to be achieved.

Toward Democratic Politics

- F. Avoid policies that establish authoritarian or elitist social relations.
- G. Ensure initiative independence to encourage participatory community action to achieve community goals.

The important issue with respect to Criterion F is that ICTs should be harnessed to underpin democratic community. To achieve this it is crucial to select technologies that do not establish authoritarian or elitist social relations, either within partnerships seeking to develop a community technology or the community itself. For example, community initiatives with the best of social intentions, when run by a small number of self-appointed leaders, run the risk of developing

an atmosphere of elitism and being unrepresentative of community wishes. Although many initiatives are started in this way, there comes a time when their governance must be placed in the hands of the broader community, if they are to remain democratic. It is also essential that community ICT initiatives retain some degree of independence from funding agencies or partnership organisations. There may be occasions when the views of the community come into conflict with those of such bodies and some form of community action is required. Criterion G states that initiatives must be independent and free from the influence of vested interests if they are to be used by an empowered community acting to identify and achieve community goals.

- H. Contribute to a public space for shared communications that facilitate inter/intra-community conviviality.
- I. Recognize and celebrate diversity of opinion, beliefs, values and cultures and avoid policies that promote intolerance and disrespect.

Underpinning all community ICT initiatives should be a public space dedicated to open communications (Criterion H). Such a public space supports inter and intra-community communications. If community-driven ICTs are to underpin social activities within local communities by providing an extra forum of communication, then electronic public spaces should be afforded the same importance that sociologists give to 'actual' public spaces or 'third places' such as parks, community centres, civic squares, cafes and pubs. The utilization of ICTs to provide a public space for shared communications at both inter and intra-community levels supports participatory democracy and encourages the valorisation of diversity.

Modern society is both pluralist and multicultural. While this diversity enriches the human experience, it also produces complex social

problems. The many communities, groups, associations, etc., that comprise society often coexist quite peacefully. However, conflict also often exists within and between communities. Criterion I holds that community ICTs should both respect and protect society's diversity. They should not be used to promote views hurtful or damaging to the cultural heritage of others; for example, racist or sexist materials should not be stored or disseminated on community systems. The resolution of problems of conflict can only be achieved through democratic determination within or between communities.

Toward Democratic Work

- J. Promote self-actualisation through activities and services that stimulate lifelong learning and active citizenship in the community.
- K. Invest in social capital by promoting common community interests and concerns.
- L. Seek to stimulate both social and formal economies of local communities.

In this context, democratic work applies to activities engaged in as part of the social economy, but policies could be developed here that relate to telework and other forms of community-based revenue generation. Criterion J relates to awareness raising, training and education activities and services at community ICT initiatives, and states that they should enable self-actualisation and enable community capacity building. The development and application of skills through activities in the social economy enable citizens, through engagement, to contribute to community life in new ways. Consequently, facilitating self-actualisation and capacity building activities in community initiatives is a way for policy and practice to invest in the social capital of a community. It can be done by supporting common interests and concerns, as a recognition of the importance of a community's social wealth⁶ (Criterion K). By adopting more holistic approaches to the social

development of communities, a range of mutual community economic development activities can also be supported and/or identified (criterion L).

Securing Democratic Sustainability

- M. Enable meaningful engagement with groups and organisations active within local communities through the development of tripartite partnerships.
- N. Promote social innovation by harnessing the indigenous knowledge and creativity of communities with the resources and expertise of public, private and third sectors.
- O. Develop a sense of community identity and ownership.

Some form of cross-sectoral partnership often shapes the structure, function and organization of community ICT initiatives. This is because the highly competitive and profit motivated nature of modern capitalist society makes it difficult, if not impossible, for community-driven grassroots initiatives to survive without support of this nature. Partnerships, therefore, are an increasingly important component of civil life. Criterion M necessitates the establishment of tripartite partnerships to secure initiative sustainability. By harnessing the existent knowledge and creativity of communities with the resources and expertise found in the public, private and third sectors, social innovation can be promoted (Criterion N). Criteria M and N contribute to the development of a sense of community ownership and identity. This community identity and sense of ownership are essential if community ICT initiatives are to be sustainable (Criterion O).

Embracing Community Participation

- P. Promote universal participation.
- Q. Seek 'local' technological flexibility and 'global' technological pluralism.

Central to promoting democratic participation is the recognition that whilst policy must enable active community groups to participate in the three organizing principles of a democratic society, this in itself does not represent an inclusive approach to participation. Community groups, whilst important to active communities, do not constitute complete communities. The facilitation of universal participation, where every citizen that wishes to has the right to participate in these principles in some way (Criterion P) goes some way to achieving this. Clearly, it is impractical to enable full citizen participation in every stage of the design, implementation and development of community ICT initiatives. However, a range of participatory community methods exist that can be utilized within local communities where appropriate, e.g., consensus conferences, citizen panels and scenario workshops. It is important that the community socio-technical order remains flexible and democratic. If it becomes too rigid, social relationships become more inflexible and subsequent structural alterations prove difficult. Whilst flexibility is important at the local level, it is also significant globally. Valorising diversity by ensuring local flexibility in all communities ensures the preservation of cultural pluralism and affords communities and individuals the ability to communicate with and learn from other cultures (Criterion Q) in the network society.

CONCLUSION

Central to the examination of the relationship between community policy, partnerships and practice conducted in this chapter have been three fundamental propositions:

- Community policy, partnerships and practice should be embedded in and reflective of the needs of local citizens;

- As citizens, local people have the right to participate in the decisions that shape local communities;
- Within a Community Informatics context this often requires changes in the organisational cultures and mind-sets of partners in order to achieve the trust and mutuality necessary for successful community ICT initiatives.

Strategically, the development of equitable partnerships between the public, private and third sectors promotes a more human-centered approach to local policy making and addresses the concerns of many community initiative practitioners who regard the community policy process as unrepresentative of local needs (Day & Harris, 1997; Shearman, 1999). Operationally, identifying community need through participative methods, such as citizens' forums and consensus conferences, can lead to a more inclusive and holistic approach to community policy and practice in the network society.

The framework presented here is not intended as a blueprint to be imposed, by policy, on local communities. Its value lies in its applicability across the diversity of community ICT practices. With this in mind the intention of this chapter has been to provide an alternative to the techno-economic agenda often found in much of the network society discourse, by providing insights into Community Informatics from a social science perspective. The democratic community planning criteria presented here need to be supported by similar design criteria from the technological perspective. This is the challenge facing the community systems and software developers of the community informatics movement. The development of technical democratic design criteria is an area where important research can be conducted in the future. Synergy between the social and technical components of community ICT research,

practice and policy is crucial to building socially inclusive pathways to the network society.

REFERENCES

- Arnstein, S.R. (1969). A ladder of citizen participation. *Journal of the American Institute of Planners*, 35 (4), 216-224.
- Butcher, H., (1993). Introduction: Some examples and definitions. In Butcher, H., Glen, A., Henderson, P., & Smith, J. (Eds.), *Community and Public Policy* (pp. 3-21). London: Pluto Press.
- CEC. (1994a). *Europe and the global information society: Recommendations to the European Council*. [The Bangemann Report] CD-84-94-290-EN. Retrieved January 19, 2003 from: <http://europa.eu.int/ISPO/infosoc/backg/bangeman.html>.
- CEC. (1994b). *Perspectives for economic and social impacts of advanced communications in Europe (PACE 1994): Socio-economic and technology impact assessment and forecast RACE project R-2086 – Synthesis report* (p. 10). Luxembourg: Office for Official Publications of the European Communities.
- Day, P. (1996). Information communication technology and society: A community-based approach. In Gill, K.S. (Ed.), *Information Society: New Media, Ethics and Postmodernism* (pp. 186-210). London: Springer-Verlag.
- Day, P. (1998). *Community Development in the Information Society: A European Perspective of Community Networks*. Position paper presented to the Designing Across Borders: The Community Design of Community Networks joint workshop of the PDC98 & CSCW98 Conferences, Seattle, WA, USA (November 12-14). Retrieved January 19, 2003 from: http://www.scn.org/tech/the_network/Projects/CSCW-PDC-ws-98/day-pp.html.
- Day, P. (2001). *The Network Community: Policies for a Participative Information Society*. Unpublished PhD Thesis. University of Brighton.
- Day, P. & Harris, K. (1997). *Down-to-earth vision: Community based IT initiatives and social inclusion* [The Commit Report]. London: IBM/CDF. Retrieved January 19 2003 from: <http://www.cdf.org.uk/Raw%20material/Commit.pdf>.
- Day, P. & Schuler, D. (eds.) (2000). Shaping the network society: The future of the public sphere in Cyberspace. In *Proceedings of the DIAC2000 Symposium*. Seattle, WA, USA (May 20-23). Seattle: CPSR.
- Glen, A. (1993). Methods and themes in community practice. In Butcher, H., Glen, A., Henderson, P., & Smith, J. (Eds.), *Community and Public Policy* (pp. 22-40). London: Pluto.
- Harris, K. (1996). Social inclusion in the Information Society. In Wilcox, D. (Ed.), *Inventing the Future: Communities in the Information Society*. Brighton: Partnership Books. Retrieved January 19, 2003 from: <http://www.partnerships.org.uk/itf/socinc.html>.
- Higgins, J. (1999). Citizenship and empowerment: A remedy for citizen participation in health reform. *Community Development Journal*, 34(4), 287-307.
- INSINC (1997). *The net result: Social inclusion in the Information Society: Report of the National Working Party on social inclusion*. London: IBM UK.
- King, C., Feltey, K.M., & O'Neill Susel, B. (1998). The question of participation: Towards authentic public participation in public administration. *Public Administration Review*, 58(4), 317-326.
- Kubicek, H., Dutton, W.H., & Williams, R. (eds.) (1997). *The social shaping of information superhighways: European and American roads to*

the Information Society, (pp. 45-59). Frankfurt: Campus Verlag.

Landry, C. & Bianchini, F. (1995). *The creative city*. London: DEMOS.

New Economics Foundation (1998). *Participation works! 21 techniques of community participation for the 21st century*. London: New Economics Foundation.

Pinkett, R. (2002). The Camfield Estates-MIT Creating Community Connections Project: Strategies for active participation in a low- to moderate-income community. In Tanabe, M., van den Besselaar, P., & Ishida, T. (Eds.), *Digital Cities II: Computational and Sociological Approaches* (pp. 110-124). Berlin: Springer-Verlag.

Sanderson, I. (1999). Participation and democratic renewal: From 'instrumental' to 'communicative rationality'? *Policy & Politics*, 27(3), 325-341.

Sclove, R.E. (1995). *Democracy and technology*. London: Guilford Press.

Sclove, R.E. (1996). Town meetings on technology. *Technology Review*, 99 (5), 24-31. Retrieved January 19, 2003 from: <http://www.loka.org/pubs/techrev.htm>.

Shearman, C. (1999). *Local connections: Making the Network for neighbourhood renewal*. London: Communities Online. Retrieved January 19, 2003 from: <http://www.communities.org.uk/>.

Street, P. (1997). Scenario workshops: A participatory approach to sustainable urban living? *Futures*, 29(2), 139-158.

Wilcox, D. (1994). *The guide to effective participation*. Brighton: Partnership Books. Retrieved January 19, 2003 from: <http://www.partnerships.org.uk/guide/main1.html>.

Wilson, D. (1999). Exploring the limits of public participation in local government. *Parliamentary Affairs*, 52(2), 246-259.

ENDNOTES

- ¹ In addition to traditional voluntary, not-for-profit and community bodies and agencies, the third sector embraces grassroots community groups, associations, interest and cultural groups, trades unions, etc.
- ² For the purposes of this chapter, academia is considered as part of the public sector.
- ³ Sometimes involves the employment of conflict tactics.
- ⁴ Often refers to both statutory and voluntary services.
- ⁵ Richard E. Sclove's paper (1996) provides a detailed insight into consensus conferences, also known as citizens' panels. For an in-depth account of the first US citizens' panel on 'Telecommunications and Democracy' see an evaluation report by David Guston at <http://policy.rutgers.edu/papers/5.pdf>.
- ⁶ Social wealth is defined here as the collective knowledge, skills and expertise possessed by the citizens and groups of a community.

This work was previously published in Using Community Informatics to Transform Regions, edited by S. Marshall, W. Taylor, & X. Yu, pp. 18-36, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.5

Mind the Gap!:

New ‘Literacies’ Create New Divides

Andrew D. Madden

University of Sheffield, UK

J. Miguel Baptista Nunes

University of Sheffield, UK

M.A. McPherson

University of Leeds, UK

Nigel Ford

University of Sheffield, UK

Dave Miller

University of Sheffield, UK

ABSTRACT

The rapid incursion of information and communication technologies (ICT) into the classroom has meant that, within the space of a few years, computers have moved from being peripheral to being an integral part of the learning environment. However, our perceptions of a technology are affected by the age at which we encounter it. This chapter draws on the findings of a number of research projects at the University of Sheffield. These findings are used to explore some

of the ‘generation gaps’ that arise from differing perceptions of learning technologies. The data discussed provide insights into the ICT-based generation gaps that currently exist between and within groups of students, teachers and parents. It is argued that a fundamental gap may exist between students differing in age by as little as 5 years. Results from a related project exploring Networked Information and Communication Literacy Skills (NICLS) are used to introduce a discussion on the nature of any skills gap that must be addressed in light of these generation gaps.

INTRODUCTION

The Sudden Rise of Computers in the Classroom

Computing technologies have been criticized by educationalists and educational philosophers, many of whom feel that they promote shallow learning, mindless copying and pasting, and the decontextualized acquisition of definitions and facts. In short, they are dismissed as being a tool for:

“jogging the memory, not for remembering ... [providing students] with the appearance of intelligence, not real intelligence ... they will seem to [have] wide knowledge, when they will usually be ignorant.”

The quotation above however, is not from a modern educationalist, mistrustful of new technology, but is adapted from Plato’s ‘Phaedrus’ (p. 69), in which the author recalls Socrates’ criticisms of writing.

It is easy to forget that reading and writing are ICT and, like all technological innovations, would have been subject to reactions ranging from unquestioning enthusiasm to reactionary scepticism. Reading and writing, however, permeated society over hundreds of years, so systems could adapt gradually. ICT has had a much more sudden impact.

Douglas Adams (1999) observed that our attitude to technology is determined by the age at which we first encounter it:

1. Everything that’s already in the world when you’re born is just normal;
2. Anything that gets invented between then and before you turn 30 is incredibly exciting and creative, and with any luck you can make a career out of it;
3. Anything that gets invented after you’re 30 is against the natural order of things and

the beginning of the end of civilization as we know it, until it’s been around for about 10 years, when it gradually turns out to be alright, really.

Madden, Nunes, Ford, McPherson, and Miller (2003b) looked at the development of various computer technologies in light of this analysis. Adams, somewhat arbitrarily, selected 30 as the age above which technological developments cease to be readily acceptable. Madden et al. considered developments in computing in the 30 years prior to their report. It provided a useful reminder of the speed with which computers have impacted on society.

30 years: 1973 saw the first appearance in print of the term ‘microcomputer’; Wang unveiled its ‘word-processing’ system; and IBM introduced the Winchester hard disk (Professional Software Systems, 2004). Computers were expensive and delicate machines, to which only highly trained personnel had access.

20 years: In 1983, Time magazine nominated the IBM PC (released in 1981) as its “man of the year”; Microsoft released Word 1.0; and the first IBMPC-based graphics program, PC-Draw, was introduced (Professional Software Systems, 2004). Ten million computers were in use in the United States (US): They were beginning to appear on desktops in the workplace. Few people would have had access to them, however, until they began work or entered higher education. The youngest of teachers in 2003 were 3 years old.

10 years: By the end of January 1993, there were 50 World Wide Web servers known to exist. Later in the year, Mosaic, the first graphic browser (on which Netscape came to be based) was introduced; and the Pentium processor was released (Professional Software Systems, 2004). Encarta 1993 made no mention of the Internet, and dedicated just 62 words to ARPANET. PCs had

Mind the Gap!

become familiar sights in universities and offices around the country, and were beginning to become commonplace in schools (although access was restricted). In 1993-'94, the average secondary school in England had one microcomputer per 10 students: Only 30% of these were capable of supporting a Graphic User Interface (GUI) (Department for Education, 1995). Use of computers in schools was limited to specific lessons in subjects, such as science and math. Although the National Curriculum (which required the incorporation of ICT) had been in place for 5 years, limitations in ICT usability and availability severely restricted the use to which computers could be put across the curriculum (Opie & Katsu, 2000). For most lessons, therefore, the educational technologies used to teach students in 1993 were the same as those that had been used for teaching their parents.

Since 1993: In the intervening years, the learning landscape has changed markedly. GUIs, such as Windows, have become standard; so computer technology has become more intuitive, making it easier for schools to adopt ICT across the curriculum; a factor that presumably has contributed to the rapid growth in computer numbers, as shown in Table 1 (Department for Education and Skills (DfES), 2002a, 2004). These figures are somewhat misleading, since many of the computers in the

early 1990s could not have supported GUIs; but this proviso makes the growth in primary schools all the more noteworthy. Even more remarkable, though, has been the rate at which schools have been gaining access to the Internet.

A Practical Educational Technology

The brief history above provides a reminder that, for most teachers, the idea of using ICT in their teaching would have been impractical until very recently. Furthermore, they could not have used their own childhood experience of school as a model to guide them.

Teachers in secondary schools and in Further Education¹ have had a little longer than their primary school colleagues to become accustomed to the incursion of computers into the classroom. In 1999, Selwyn (p. 163) predicted that:

Smaller schools catering for younger learners ... are probably going to attract less ... funding per learner.

Statistics from the DfES (2002b) (Table 2) confirm the accuracy of this prediction. On average, secondary schools in England have 4.2 times as many full-time students as primary schools. In 1998, shortly before Selwyn published his prediction, average expenditure on ICT in secondary

Table 1. Statistics relating to primary and secondary schools in England (DFES, 2002a, 2004)

| | Mean no. of students per computer | | Percentage of schools connected to the Internet | |
|------|-----------------------------------|-----------|---|-----------|
| | Primary | Secondary | Primary | Secondary |
| 1994 | 23.0 | 10.0 | | |
| 1996 | 19.0 | 9.0 | 5 | 47 |
| 1998 | 17.6 | 8.7 | 17 | 83 |
| 1999 | 13.4 | 8.4 | 62 | 93 |
| 2000 | 12.6 | 7.9 | 86 | 98 |
| 2001 | 11.8 | 7.1 | 96 | 99 |
| 2002 | 10.1 | 6.5 | 99 | 99 |
| 2003 | 7.9 | 5.4 | - | - |

Table 2. ICT expenditure in English schools (DfES: Survey of Information and Communications Technology in Schools, 2002)

| | Average expenditure/school (£) | | | | | Increase in computing power between 1998 and 2002 (by Moore's Law) | |
|-----------|--------------------------------|-------|-------|-------|-------|--|--|
| | 1998 | 1999 | 2000 | 2001 | 2002 | | |
| Primary | 3600 | 7000 | 8300 | 10300 | 15400 | 68.444 | |
| Secondary | 40100 | 45400 | 50100 | 60300 | 76900 | 30.683 | |
| Ratio | 11.139 | 6.486 | 6.036 | 5.854 | 4.994 | | |

schools was more than 11 times greater than expenditure in primary schools. Since then, however, ICT spending in primary schools has risen far faster than in secondary schools. The gap has now closed; and in 2002, secondary schools spent five times as much on ICT as primary schools.

More Powerful Computers

The impact of increased expenditure is even more remarkable when Moore's Law is taken into consideration. In 1965, G.E. Moore, co-founder of Intel, observed that:

The complexity for minimum component costs has increased at a rate of roughly a factor of two per year... (p. 115)

In practical terms, this means that a computer designed in 2006 will have twice the processing power of a computer designed in 2005; four times the power of those designed in 2004 and so forth. Assuming that the cost of a new computer remains constant, then, if a school has as much to spend on ICT this year as it did last year, that same sum of money can buy approximately twice as much computing power. In other words, according to the data in Table 2, secondary schools in 2002 could afford 31 times as much computing power as they could in 1998, and primary schools could afford 68 times as much.

This rise in processing power has played a large part in making the PC a practical tool in

the classroom. It has allowed GUIs to become universal, making PCs easier to use; it has accelerated performance, thereby decreasing user frustration and reducing the risk of students repeatedly pressing buttons on the grounds that "it didn't work last time"; and it has allowed drawing packages to become ubiquitous.

This last point is significant because many primary school students are still coming to terms with reading and writing; so any text-based activity on the PC will have difficulties associated with it that have nothing to do with the technology. It is not surprising, therefore, that drawing is the preferred activity on computers among primary school students (Selwyn & Bullon, 2000; BECTa, 2001a).

Younger Users

Because of the rise in expenditure on ICT in education, the age at which students have routinely come into contact with ICT has dropped rapidly over the last 10 years. Ten years ago, students were unlikely to make regular use of ICT until they went to work or college. One of the much publicized aims of the United Kingdom (UK) Labour Party when it entered government in 1997 was the promotion of ICT in schools. On coming into office, it announced that it was going to make available £700 million to upgrade ICT resources in schools and to connect schools in a National Grid for Learning (NGfL). A further £230 million (New Opportunities Fund) was provided to train teachers to use the new technology.

Mind the Gap!

The figures in Table 2 show that secondary schools were the first to benefit from this initiative. Where ICT was used in primary schools, it often served the function of a 'pacifier,' used to provide an activity for students who finished a task before their peers (Selwyn & Bullon, 2000). Students arrived from primary school to find substantially better ICT resources than they had previously encountered and, in most cases, teachers could confidently treat them as ICT beginners. Increasingly, however, this is changing, and students arrive at secondary school with ever greater ICT skills (Madden, Bates, White, & Apthorpe, 2004), resulting in teachers feeling more and more left behind.

The Skills Gap Between Teachers and Students

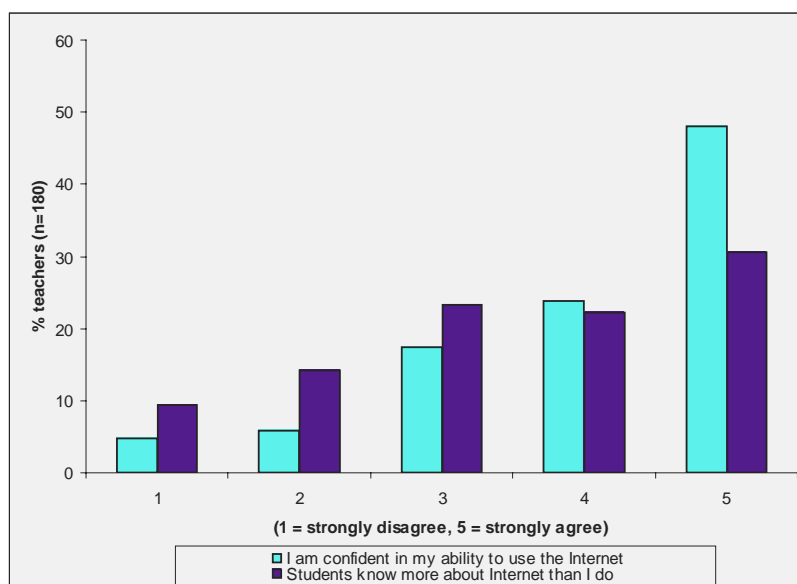
A recent project, funded by the UK's Arts and Humanities Research Board, looked at aspects of the impact of the Internet on education in English schools, and revealed clear differences between the abilities of teachers and students to

work with the new technologies. Eighteen semi-structured interviews were carried out in January and February 2002 with staff at The City School in Sheffield (Madden, Ford et al., 2003). The City School was selected for the project because of the excellence of its ICT facilities and the experience of its staff in using ICT in their teaching. Nevertheless, many interviewees commented that their ICT skills were more limited than those of their students. One head of department confessed to having supervised classes of students using the Internet, despite never having used it himself. Others recognized its value, but were conscious of being less competent users than their students. Examples of the type of comments made by interviewees are as follows:

The kids are ahead of me [in using ICT] ... I wish I was better at using it.

I haven't experienced [problems with students lacking technical skills] ... I think it's the opposite; I think it's the staff sometimes that don't have the technical skills ...

Figure 1. Teacher's responses to questionnaire statements



I have learnt a lot from kids in the past about what to do [on the computer] ...

I always say at the beginning 'Look—I'm an old teacher—I don't know as much about computers as you—I know how they can be used, I know how they're useful, I know how important they are.

These interviews were used to generate a questionnaire that was sent to the heads of departments in all the state-funded secondary schools in Sheffield (Madden, Ford, Miller, & Levy, 2005). The questionnaire comprised a series of statements with Likert scales of 1-5. Two of the statements were as follows:

1. I am confident in my ability to use the Internet.
2. Students know more than I do about the Internet.

A Spearman's Rank Correlation showed responses to these two variables to be significantly negatively correlated ($p=0.01$), suggesting that the more confidence teachers have in their ability to use the Internet, the less likely they are to feel that students know more about the Internet than they do. This finding is much as would have been expected. Despite the correlation, however, most teachers (52.9%) still feel that students know more about the Internet than they do (Figure 1), including a large minority (29.6%) who feel confident in their own abilities (Table 3).

The Skills Gap Between Parents and Children

Evidence for a skills gap between parents and children arose from a project carried out by Sheffield University and The City School (Project 2). In September 2002, a questionnaire was circulated among parents of students newly arrived from primary school. Among other things, parents were asked to assess their own ICT skills and those of their children on a five-point Likert scale. Shortly afterwards, students were given an online test designed by a member of the school's ICT department to assess their ICT skills. Two measures of student ICT ability, therefore, were available:

1. Based on parents' observations and their understanding of ICT skills
2. Based on results of a test developed by the school's ICT department.

The school's ICT test correlates significantly with measures of performance in math, English and science taken at the students' primary schools (Table 4); and with parents' assessment of their own ICT skills. Parental assessment of their children's ICT ability is unrelated to the schools' measures, but is significantly correlated to the child's sex ($p<0.05$: boys are considered more skilled) and with the perceived standard of school resources ($p<0.001$) and teaching ($p<0.01$) in a child's primary school. It seems reasonable

Table 3. Percentages of teachers agreeing with both statements

| | | Students know more than I do about the Internet. | | |
|---|----------|--|----------|--------------|
| | | (Likert score) | | |
| I am confident in my ability to use the Internet. | | 4 | 5 | Total |
| (Likert score) | 4 | 8.5 | 6.9 | 15.3 |
| | 5 | 9.0 | 5.3 | 14.3 |
| Total | | 17.5 | 12.2 | 29.6 |

Mind the Gap!

Table 4. Factors significantly correlated with assessments of students' ICT skills

| Student skills (as assessed by parent) correlate with: | |
|--|-----------------------|
| Student sex (boys' skills rated higher than girls'). | 1% significance, n=65 |
| Perceived standard of primary school resources. | 1% significance, n=65 |
| Perceived standard of primary school teaching. | 1% significance, n=63 |
| English Key Stage 2. | 1% significance, n=57 |

| Student skills (as assessed by school's ICT test) correlate with: | |
|---|--|
| Parents' perception of their own ICT skills. | 1% significance, n=65 |
| Level of ICT concern. | (Negative correlation) 1% significance, n=65 |
| English Key Stage 2. | 0.1% significance, n=57 |
| Maths Key Stage 2. | 0.1% significance, n=58 |
| Science Key Stage 2. | 0.1% significance, n=57 |

to assume, therefore, that the parents surveyed were not in a position to assess the ICT skills of their children.

The Skills Gap Among ICT-Literate Adults

Evidence of another skills gap emerged during the development of a part-time Continuing Professional Distance Education course designed to lead to a master's degree in IT Management (MA in ITM) (McPherson & Nunes, 2004). This MA is delivered via a combination of face-to-face and online learning materials.

In the process of developing the MA, it became apparent that technical skills on their own are not sufficient for a student to make successful use of ICT in learning: A range of social and information skills is also required.

The MA ITM course is designed for professionals in the Information Technology (IT) sector. Initially, it was assumed that, because of the students' technological background, no particular training was required to use the online facilities provided for those on the course (Nunes, McPherson et al., 2000a). However, studies of the usage of these facilities revealed a number of problems. Early intakes of students did not make full use of the available resources; and where use was made,

it was often inappropriate. Many students, for example, showed behaviors incompatible with the purpose for which the system was designed (e.g., flaming and lurking).

By contrast, according to teachers at The City School, their students are enthusiastic users of online communication:

I can go into a room and see youngsters who are supposedly getting information from the Internet—you find them on the chat line.

This is despite the fact that they have received no formal training:

... we've never taught chat in school. We've never taught them to log into chat rooms, or anything else, but ultimately, if you gave them 5 minutes, then you find them on Music Channel Chat room ...

It is also in opposition to the wishes of teachers:

I don't like them going in there, so I keep them out of there, but that's another way of communication which gets them on to a computer and once they see that, that excites them.

DISCUSSION

The three projects referred to above provide evidence of gaps, both in technical skills and in perceptions of technology, between different interested parties in education. These gaps occur not only in the obvious areas—between adults/children and teacher/student—but also between students with differing experiences of ICT in education. The consequences of these gaps are discussed in further detail below.

The Impact of ICT on Learning

In the survey of Sheffield teachers mentioned above, department heads were asked to respond to the following statement:

I am under no pressure to use the Internet in my teaching

Fifty-two percent (n=169) did not agree with the statement. The majority of teachers, therefore, either disagreed (25%) or were ambivalent (27%). Clearly, therefore, many teachers not only feel that that they may be under pressure to use the Internet, but they also believe that their students know more about it than they do. Such a combination of circumstances could result in educationalists failing to recognize the potential of ICT within the learning environment, leading to under usage and inappropriate usage.

Old Teaching and New Technology

Teachers often use new technologies as though they were something old and familiar. That way, they can satisfy any requirement to use the technology without needing to amend their teaching methods. An example of such use is the numerous computer assisted learning (CAL) programs that are little more than electronic books.

Such superficiality in the use of ICT has long been criticized. In 1971, a 2-day symposium

was organized by the Science Research Council and the Social Science Research Council. At the symposium, CAL was criticized on the grounds that:

using computers for pre-stored material, that is, computerized programmed learning, combined inordinate expense with a very superficial philosophy of learning. (Annett, 1976)

Similar concerns were voiced 25 years later, in the report on the evaluation of the Teaching and Learning Technology Programme (Coopers & Lybrand, 1996), where it was felt that the projects would have benefited from:

... a more serious and helpful attempt to encourage projects to engage with pedagogic issues (para 283)

More recently, in a report on the use of interactive whiteboards (IW) in teaching, students are reported as expressing:

... disappointment and frustration with some approaches to using the IW, particularly when they consider that its capabilities are being under-exploited. For example: 'If teachers are going to use them [as a traditional whiteboard], then I wouldn't bother wasting all that money'. (Levy, 2002, p. 17)

Students, therefore, are clearly better able to appreciate the opportunities afforded by ICT than their teachers (Madden, Ford, Miller, & Levy, 2006).

Networked Literacy

Such usage of ICT in teaching neglects not only the 'added value' that new educational technologies can bring, but it also ignores the fact that, to obtain that value, students need to acquire new skills.

Mind the Gap!

As was learned from the experience with the MA ITM, technical knowledge, though necessary, is not sufficient. Many other skills are required by students learning online using computer-mediated technologies. Nunes, McPherson and Rico (2000a) have described such skills as NICTS.

Networked literacy complements traditional basic skills with a new set of information and communication literacy skills. Information literacy requires students to recognize their information needs; to identify ways of addressing gaps in their knowledge; to construct strategies for locating information; to locate and access information; to compare and evaluate information; and to organize, apply and synthesize information (Webber & Johnston, 2000).

In addition, if successful communication is to take place online, learners must change their behavior. The skills required when communicating online form what can be considered communication literacy. NICTS (Nunes et al., 2000b) include information literacy skills (as described above), and online collaboration and cooperation skills. These latter comprise:

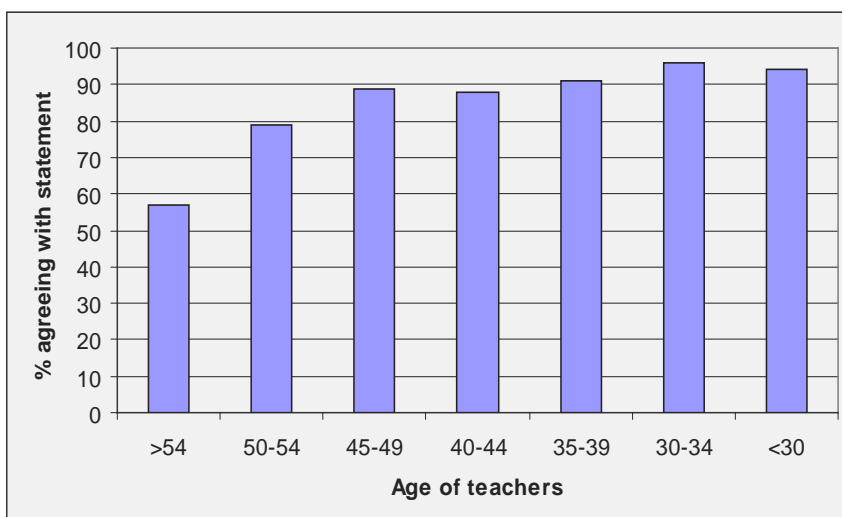
- **Technical aspects**, including the skills needed to use computer-mediated communications (CMC) in an online learning situation
- **Social aspects**, needed to compensate for the unavailability of social cues traditionally delivered by auditory and visual channels.

The technical aspects of NICTS are relatively easy to address, but the social aspects have often been overlooked (Nunes, McPherson & Rice, 2000b; Hara, 2000; McDowell & Pickard, 2000). As a result, experiences such as those in the MA ITM course are common: Communications are misinterpreted, causing unintended offence and provoking inappropriate hostility. Students, therefore, need to be aware of crucial social issues involved in using CMC technologies (Webber & Johnston, 2000).

NICTS at School

Another relevant statement in the AHRB survey of school teachers is as follows:

Figure 2. Percentage of teachers of differing ages agreeing with the statement: 'My Internet skills were acquired informally (e.g., self-taught, learned from friends/colleagues etc.), rather than on a taught course.'



My Internet skills were acquired informally (e.g., self-taught, learned from friends/colleagues, etc.), rather than on a taught course.

Eighty-five percent of respondents (n=188) agreed with this statement; 67% agreed strongly. As can be seen in Figure 2, for teachers younger than 55 years, age seems to make little difference. The youngest respondent was 24 years old; she agreed with the statement.

As stated above, the technical aspects of NICTLS are relatively easy to address. However, of the teachers who responded to the survey, more than 95% never used chat rooms: The importance of the social aspects of NICTLS, therefore, is likely to be unrecognized among them. E-mail was used, at least occasionally, by 70% of responding teachers; but as is the case with interactive whiteboards, e-mail can be related to an existing technology (mail) with which the teachers are already familiar. Two interesting questions, therefore, emerge:

1. What, if any, online social skills are evolving among school children who appear to be enthusiastic users of chat rooms? Are there misunderstandings similar to those encountered on the MA ITM and, if so, how are they dealt with?
2. Does the age at which e-mail skills are acquired affect the nature of e-mails? In particular, do students who learned to write letters before they learned to write e-mails produce more formal and more carefully worded e-mails?

NICTLS Post-1997

The statistics cited in Tables 1 and 2 show how recently ICT resources became widely available in schools. It could reasonably be argued, therefore, that, prior to 1997, it was not practical to teach many of the NICTLS identified by Nunes et al. (2000a) until students moved to further or higher education. As a result, the nature and range of information sources to which today's students

have access is markedly different from those used by students finishing school prior to 1997.

Another significant development took place in the 2003-'04 academic year. DfES (2003) introduced amendments to the teaching of ICT in English schools. The new ICT course is designed to emphasize the relevance of ICT to all national curriculum subjects. If successful, many more students will leave school with NICTLS. In all probability, however, for reasons discussed above, they will have been taught the technical aspects of NICTLS, but will have evolved the social aspects by experimentation with their peers.

ICT Generations and the Resulting Gaps

The title of this chapter refers to a new generation gap: In fact, there may be several generation gaps, arising not only from the introduction of technology, but also from the successful incorporation of NICTLS. The rapidly changing ICT environment within the class will lead to different generations of students having very different experiences at school, as follows:

- **Pre-1997:** ICT resources, where available, are just used for the teaching of subjects relating to math, science and technology. Teaching and learning are largely unaffected, otherwise. Some students acquire technical skills, but there is little opportunity to use computers as a tool for communication. Most students only become familiar with the Internet after leaving school.
- **1997-2003:** ICT resources become widely available. Pockets of expertise in the application of ICT to teaching begin to develop, but most teachers apply the technology cautiously, if at all. Students increasingly make use of ICT (particularly the Internet) as a learning resource. Many teachers (and parents) regard such usage with suspicion. NICTLS are acquired rather than taught.

Mind the Gap!

- **2003-2008:** ICT is increasingly embedded within the national curriculum. Teachers need to demonstrate their usage of it, but often it is employed as though it was an extension of existing technologies (e.g., electronic book) and it is under used. Students begin to learn ICT in primary school, along with reading and writing. More systematic teaching of NICLS begins.
- **Post-2008:** Schools begin to employ newly qualified teachers who grew up with ICT. It was a natural part of their learning environment, so they have no qualms about their students using it. Formalized instruction in the social aspects of NICLS begins.

Consequences of the ICT Generation Gap

The versatility of ICT and its potential value as an educational technology make it probable that, in the future, it will be ubiquitous at all levels of education. Adult learners, therefore, must acquire NICLS if they are successfully to complete any course of which online learning forms a significant component. Failure to do so will result in much frustration for the students, and eventually to lower levels of success (Hara & Kling, 1999).

Such frustrations are unlikely to be experienced, or even understood, by students who became familiar with online learning environments during their formative years. Zafeirou, Nunes and Ford (2001) provide an example of a divide based on varying levels of NICLS, when they describe the problems some students encountered due to lack of typing skills. When using a Virtual Learning Environment (VLE), they experienced what amounted to a virtual speech defect, which severely hampered their efforts to communicate with fellow students.

Further inequities could arise where teachers fail to appreciate the potential of a technology. When home computers first became affordable, teachers were often impressed by well-presented,

word-processed assignments. They quickly came to recognize the signs of 'cut-and-paste' essays; but before they did so, many students received high marks for work that owed more to their ICT skills than their understanding of the subject material.

Social Impact

The consequences referred to above are fairly obvious. Other, more subtle and more profound consequences may also arise, which may be as great as the impact of literacy on education in ancient Greece. It is hard to appreciate exactly what this might have been, because records of educational methods among pre-literate ancient Greeks are textual and, therefore, were made by practitioners of the new technology. Nevertheless, in "Preface to Plato," Havelock (1963) identifies numerous profound changes arising from the development of writing. According to Havelock, the orally based educational regime of pre-literate Greece was based on rote learning of rhythmically structured patterns that were recited and repeated without analysis (which is somewhat ironic, given Socrates' criticism of writing). Their role was, arguably, to stamp on learners the world view of their community. But then:

... at some time towards the end of the fifth century before Christ, it became possible for a few Greeks to talk about their 'souls' as though they had selves or personalities which were autonomous and not fragments of the atmosphere nor of a cosmic life force, but what we might call entities or real substances. (p. 197)

The change is attributed to the spread of writing. In due course, this made it possible for learning to transcend the immediate community. Groups of people, making "... parallel use of texts, both to structure the internal behavior of the groups' members and to provide solidarity against the outside world" are described as 'textual communities' (Stock, 1983).

The spread of reading and writing, therefore, affected individuals, communities and, indeed, the evolution of world culture (Madden, 2004) in ways that would probably have been inconceivable to Socrates and his contemporaries.

CONCLUSION

It took hundreds of years for literacy to become commonplace. Its effects, therefore, took many generations to permeate through communities and cultures. By contrast, ICT has the potential to change education radically in a fraction of a generation.

Some issues arising from the use of ICT in learning and teaching may be subtle and far-reaching. If writing made it possible for ancient Greeks to begin thinking of themselves as individuals, what could be the impact of increasingly sophisticated virtual learning zones?

Questions such as this are impossible to answer without greater experience and additional research, but the kind of meta-analysis of related projects that has been presented in this chapter has allowed a better understanding of the ICT generation gap.

As the 'new' literacies discussed earlier cease to be new but become incorporated in the educational system, the generation that has already passed through that system may be excluded from an increasingly important sector of the education market. Planning, therefore, is necessary to ensure that their needs can be addressed by life-long learning and Continuing Professional Development programs.

In the UK, perhaps one of the most significant developments in the use of computers as an educational technology has been adoption of the acronym ICT in place of IT. The emphasis on communication as well as information is an indication of the growing awareness of the new technology's role in facilitating exchanges and discussions, thereby addressing the shortcomings

that Socrates noted arising from use of the (then) new technology of writing. Properly used, ICT allows students to move from being "hearers of many things" to being active processors of their readings and discussers of many things. In other words, ICT has the potential to enrich the learning process, facilitating an education based on interaction and social negotiation of meanings. Had Socrates been able to use ICT, he could still have subjected students to his methods.

REFERENCES

- Adams, D. (1999). How to stop worrying and learn to love the Internet. *Sunday Times, News Review*, August 29. Retrieved February 10, 2003, from www.douglasadams.com/dna/19990901-00-a.html
- Annett, J. (1976). Computer-assisted learning 1969-1975: A report prepared for SSRC (Social Science Research Council).
- Becta. (2001). Primary schools – ICT and standards. A report to the DfES on Becta's analysis of national data from OFSTED and QCA.
- Coopers & Lybrand, Institute of Education, & Tavistock Institute. (1996). Evaluation of the teaching and learning technology programme (HEFCE).
- Department of Education. (1995). Statistical bulletin: Survey of information technology in schools (issue no 3/95). Government Statistical Service.
- DfES. (2002a). *Survey of information and communications technology in schools*. Retrieved February 10, 2003, from www.dfes.gov.uk/statistics/DB/SBU/b0360/index.html
- DfES. (2002b). *Statistics of education: Schools in England*. Retrieved February 10, 2003, from www.dfes.gov.uk/statistics/DB/VOL/v0359/dfes_schools_final.pdf

Mind the Gap!

- DfES. (2003). *Key stage 3: National strategy key messages from the ICT launch*. Retrieved February 24, 2004, from www.standards.dfes.gov.uk/midbins/keystage3/launch_key_messages.PDF
- DfES. (2004). *Survey of information and communications technology in schools*. Retrieved October 20, 2005, from www.dfes.gov.uk/rsgateway/DB/SFR/s000480/SFR27-2004v6.pdf
- Hara, N. (2000). Students' distress with a Web-based distance education course. *Information, Communication & Society*, 3, 557-579.
- Hara, N., & Kling, R. (1999). Students' frustrations with a Web-based distance education course. *First Monday*, 4(12), December. Retrieved February 24, 2004, from http://firstmonday.org/issues/issue4_12/hara/index.html
- Havelock, E. A. (n.d.). *Preface to Plato*. Cambridge: The Belknap Press of Harvard University Press.
- Levy, P. (2002). *Interactive whiteboards in teaching and learning*. Report published by the Sheffield Excellence in Cities Partnership.
- Madden, A. D. (2004). Evolution and information. *Journal of Documentation*, 60(1), 9-23.
- Madden, A. D., Bates, L., White D., & Apthorpe, C. (2004). *Bridging the gap: ICT in the transition year. A report on the ICT Research Bursaries 2002-03*. ICT in Schools Research and Evaluation Series, No. 16.
- Madden, A.D., Ford, N.J., Miller, D., & Levy, P. (2003). Schoolchildren searching the Internet – Teachers' perceptions. In A. Martin & H. Rader (Eds.), *Information and IT literacy: Enabling learning in the 21st century*. London: Facet.
- Madden, A.D., Ford, N.J., Miller, D., & Levy, P. (2005). Using the Internet in teaching: The views of practitioners. A survey of the views of secondary school teachers in Sheffield, UK. *British Journal of Educational Technology*, 36, 255-280.
- Madden, A. D., Ford, N. J., Miller, D., & Levy, P. (2006). Children's use of the Internet for information-seeking: What strategies do they use, and what factors affect their performance? *Journal of Documentation*, 62(6).
- Madden, A. D., Nunes, M. B., Ford, N. J., McPherson, M., & Miller, D. (2003b, December). A new generation gap: The consequences of increasingly early ICT first contact. *Proceedings of the 2nd International Conference on Multimedia ICT's in Education* (Vol. 1, pp. 6-16).
- McDowell, L., & Pickard, A. (2000, April 17-19). Let's be careful out there: Learning in the world of electronic information. *Proceedings of the 2nd International Conference of Networked Learning*. Retrieved July 8, 2003, from <http://collaborate.shef.ac.uk/nlpapers/McDowell%20Pickard-p%20Web.htm>
- McPherson, M. A., & Nunes, J. M. (2004). *Developing innovation in online learning, An action research framework*. London: Routledge-Falmer.
- Moore, G. E. (1965). Cramming more components onto integrated circuits. *Electronics*, 38, 114-117
- Nunes, J. M., McPherson, M. A., & Rico, M. (2000a, June 5-6). Instructional design of a networked learning skills module for Web-based collaborative distance learning. *Proceedings of the European Conference on Web-Based Learning Environments (WBLE 2000)* (pp. 95-103).
- Nunes, J. M., McPherson, M., & Rico, M. (2000b). Design and development of a networked learning skills module for Web-based collaborative distance learning. *Proceedings of the 1st ODL International Workshop 2000* (pp. 117-131).
- Opie, C., & Katsu, F. (2000). A tale of two national curriculums: Issues in implementing the national curriculum for information and communications technology in initial teacher training. *Journal of*

Information Technology for Teacher Education, 9, 79-94.

Plato. (2002). *Phaedrus*. Robin Waterfield (trans.). Oxford: OUP.

Professional Software Systems. (2004). Retrieved February 24, 2005, from www.prof-soft.com/CompHistory.htm

Selwyn, N. (1999). Schooling the information society? The place of the information superhighway in education.. *Information Communication & Society*, 2, 156-173.

Selwyn, N., & Bullon, K. (2000). Primary school children's use of ICT. *British Journal of Educational Technology*, 33, 321-332

Stock, B. (1983). *The implications of literacy*. Princeton: Princeton University Press.

Webber, S., & Johnston, B. (2000). Conceptions of information literacy: New perspectives and implications. *Journal of Information Science*, 26, 381-397.

Zafeiriou, G., Nunes, J.M.B., & Ford, N. (2001). Using students' perceptions of participation in collaborative learning activities in the design of online learning environments. *Education for Information*, 19, 83-106.

ENDNOTE

¹ Teaching children aged 16-18 years

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 234-252, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 5.6

A New Generation Gap?

Some Thoughts on the Consequences of Early ICT First Contact

Andrew D. Madden
University of Sheffield, UK

J. Miguel Baptista Nunes
University of Sheffield, UK

M. McPherson
University of Sheffield, UK

Nigel Ford
University of Sheffield, UK

David Miller
University of Sheffield, UK

M. Rico
University of Sheffield, UK

ABSTRACT

One possible consequence of information and communication technology's rapid rise will be a new 'generation gap' arising from differing perceptions of the learning technologies. The nature, causes, and consequences of this gap are of interest to educational practitioners and poli-

cymakers. This article uses data from an ongoing project, together with a synopsis of research, to describe the ICT-based generation gap that currently exists between students and their teachers and parents. It is argued that this gap may exist between students differing in age by as little as five years. Results from a related project exploring Networked Information and Communication

Literacy Skills (NICTS) are used to introduce a discussion on the nature of any skills gap that must be addressed in light of this generation gap.

INTRODUCTION

It is often the case that the findings of discrete projects in information and communication technologies (ICTs) in teaching and learning, when analysed and discussed together, will produce findings that would not have been apparent from the separate projects.

This article emerged from discussions that took place between researchers involved in three projects addressing different aspects of ICT in teaching and learning at various levels of education in the UK. As a result of these discussions, issues relating to skills gaps between different stakeholders in the education process became apparent. The full extent of this phenomenon and associated implications were not immediately obvious from the findings of the individual projects and resulted in this article, which has the following purposes:

1. to serve as a reminder of just how recently ICT has become commonplace within education and how exaggerated expectations have led to undue pessimism;
2. to present findings from research at the University of Sheffield concerning the views that teachers and parents have of ICT and its use by children; and
3. to identify problems that may arise when using ICT in post-16 education, as a result of students having differing experiences with the technologies.

Thus this article is not a traditional reporting of one individual research process, but a cross-discussion of the findings of the following projects:

- A three year project, titled “Education for Evidence-Based Citizenship: Improving Pupils’ Information Seeking Skills,” funded by the UK’s Arts and Humanities Research Board (AHRB). This collaboration between the Department of Information Studies and the City School in Sheffield seeks to explore aspects of Internet usage in English schools.
- Research funded by the British Educational Communications and Technology Agency on the teaching of ICT to students in transition from primary (ages five to 11) to secondary (ages 11 to 16) education in England. The research was carried out at The City School in Sheffield, and drew on the AHRB project referenced above.
- A seven-year action research process to design and develop a part-time Continuing Professional Distance Education (CPDE) program leading to an MA in IT Management (MA ITM) (McPherson & Nunes, 2004). This MA is delivered via a combination of face-to-face and online learning materials.

REVIEW OF THE LITERATURE

The Sudden Rise of Computers in the Classroom

Computing technologies have been heavily criticised by educationalists and educational philosophers as a vehicle to promote shallow learning, mindless copying and pasting, and de-contextualised acquisition of definitions and facts. In short, a tool for:

“jogging the memory, not for remembering... [providing students] with the appearance of intelligence, not real intelligence...they will seem to [have] wide knowledge, when they will usually be ignorant.”

A New Generation Gap?

This quotation, however, is not from a modern educationalist, mistrustful of new technology, but is adapted from Plato's 'Phaedrus' (p. 69), in which the author recalls Socrates' criticisms of writing. It is easy to forget that reading and writing are information and communications technologies and, like all technological innovations, would have been subject to reactions ranging from unquestioning enthusiasm to reactionary scepticism.

Reading and writing, however, permeated society over hundreds of years, so systems could adapt gradually. ICT has had a much more sudden impact. Douglas Adams (1999) observed that our attitude toward technology is determined by the age at which we first encounter it. Specifically:

- everything that is already in the world when you are born is just normal;
- anything that gets invented between then and before you turn 30 is incredibly exciting and creative, and with any luck you can make a career out of it; and
- anything that gets invented after you are 30 is against the natural order of things and the beginning of the end of civilisation as we know it until it has been around for about 10 years when it gradually becomes alright.

Madden et al. (2004) looked at the development of various computer technologies in light of this analysis. Adams, somewhat arbitrarily, selects 30 as the age above which technological developments cease to be readily acceptable. It provides a useful starting point, however, for contemplating the speed with which computers have impacted on society.

Thirty years ago: The year 1973 saw the first appearance in print of the term 'microcomputer'; Wang unveiled their 'word-processing' system; and IBM introduced the Winchester hard disk (Professional Software Systems, 2004). Thirty years ago, computers were expensive and delicate machines to which only highly trained personnel had access.

Twenty years ago: In 1983, Time magazine nominated the IBM PC (released in 1981) as its "man of the year"; Microsoft released Word 1.0; and the first IBM PC-based graphics program, PC-Draw, was introduced (Professional Software Systems, 2004). Twenty years ago, 10 million computers were in use in the USA: they were beginning to appear on desktops in the workplace. Few people would have had access to them, however, until they began work or entered higher education. The youngest of today's teachers were three years old.

Ten years ago: By the end of January 1993, there were 50 World Wide Web servers known to exist. Later in the year, Mosaic, the first graphic browser (on which Netscape came to be based), was introduced; and the Pentium processor was released (Professional Software Systems, 2004). Ten years ago, PCs were familiar sights in universities and offices around the country. They were beginning to become commonplace in schools, but access was restricted. In 1993-1994 the average secondary school in England had one microcomputer per 10 students. Only 30% of these were capable of supporting a Graphic User Interface (GUI) (Department of Education, 1995). Use of computers in schools was limited to specific lessons in subjects such as science and maths. Although the National Curriculum (which required the incorporation of ICT) had been in place for five years, limitations in ICT usability and availability severely restricted the use to which computers could be put across the curriculum (Opie & Katsu, 2000). For most lessons therefore, the educational technologies used to teach students 10 years ago were the same as those that had been used for teaching their parents.

Since 1993: In the intervening 10 years, the learning landscape has changed markedly. GUIs, such as Windows, have become standard, so computer technology has become more intuitive, making it easier for schools to adopt ICT across the curriculum — a factor that has presumably contributed to the rapid growth in computer num-

bers in primary and secondary schools (DfES, 2002a). These figures are somewhat misleading since many of the computers in the early 1990s could not have supported GUIs; but this proviso makes the growth in primary schools all the more noteworthy. Even more remarkable though, has been the rate at which schools have been gaining access to the Internet.

FINDINGS

A Practical Educational Technology

The brief history above provides a reminder that, for most teachers, the idea of using ICT in their teaching would have been impractical until very recently. Furthermore, they could not have used their own childhood experience of school as a model to guide them.

Secondary school teachers have had a little longer than primary school teachers to become accustomed to the incursion of computers into the classroom. In 1999, Selwyn (p. 163) predicted that:

“smaller schools catering for younger learners...are probably going to attract less...funding per learner.”

Statistics from the DfES (2002b) confirm the accuracy of this prediction. On average, secondary schools in England have 4.2 times as many full-time students as primary schools. In 1998, shortly before Selwyn published his prediction, average expenditure on ICT in secondary schools was over 11 times greater than expenditure in primary schools. Since then, however, ICT spending in primary schools has risen far faster than in secondary schools. The gap has now closed; and in 2002, secondary schools spent five times as much on ICT as primary schools.

More Powerful Computers

The impact of increased expenditure is even more remarkable when Moore's Law is taken into consideration. In 1965, G.E. Moore, co-founder of Intel, observed:

“The complexity for minimum component costs has increased at a rate of roughly a factor of two per year...” (p. 115).

In practical terms, this means that a computer designed in 2003 will have twice the processing power of a computer designed in 2002, four times the power of those designed in 2001, and so forth. Assuming that the cost of a new computer remains constant, if a school has as much to spend on ICT this year as it did last year, that same sum of money can buy approximately twice as much computing power. In other words, according to the data, secondary schools in 2002 could afford 31 times as much computing power as they could in 1998, and primary schools could afford 68 times as much.

This rise in processing power has played a large part in making the PC a practical tool in the classroom. It has allowed GUIs to become universal, making PCs easier to use; it has accelerated performance, thereby decreasing user frustration, and reducing the risk of students repeatedly pressing buttons on the grounds that “it didn't work last time”; it has allowed drawing packages to become ubiquitous.

This last point is significant because many primary school students are still coming to terms with reading and writing; so any text-based activity on the PC will have difficulties associated with it that have nothing to do with the technology. It is not surprising therefore, that drawing is the preferred activity on computers amongst primary school students (Selwyn & Bullon, 2000; BECTa, 2001a).

Younger Users

Because of the rise in expenditure on ICT in education, the age at which students have routinely come into contact with ICT has dropped rapidly over the last 10 years. As was stated earlier, 10 years ago, students were unlikely to make regular use of ICT until they went to work or college. One of the much publicised aims of the UK Labour Party when it entered government in 1997 was the promotion of ICT in schools. On coming into office, it announced that it was going to make available £700 million to upgrade ICT resources in schools and to connect schools in a National Grid for Learning (NGfL). A further £230 million (New Opportunities Fund) was provided to train teachers to use the new technology.

Secondary schools were the first to benefit from this initiative. Where ICT was used in primary schools, it often served the function of a ‘pacifier’, used to provide an activity for students who finished a task before their peers (Selwyn & Bullon, 2000). Students arrived from primary school to find substantially better ICT resources than they had previously encountered,; and in most cases teachers could confidently treat them as ICT beginners. Increasingly however, this is changing, and students arrive at secondary school with ever greater ICT skills (Madden, Bates,

White, & Apthorpe, 2004a), resulting in teachers feeling more and more left behind.

Skills Gap Between Teachers and Students

The AHRB project referred to in the introduction (Project 1) looked at aspects of the impact of the Internet on education in English schools, and revealed clear differences between the abilities of teachers and students to work with the new technologies. Eighteen semi-structured interviews were carried out in January and February 2002 with staff at the City School (Madden, Ford, Miller, & Levy, 2003). The City School was selected for the project because of the excellence of its ICT facilities and the experience of its staff in using ICT in their teaching. Nevertheless, many interviewees commented on the fact that their ICT skills were more limited than those of their students. One head of department confessed to having supervised classes of students using the Internet, despite never having used it himself. Others recognised its value, but were conscious of being less competent users than their students.

These interviews were used to generate a questionnaire that was sent to the heads of department in all the state- funded secondary schools in Sheffield (Madden, Ford, Miller, & Levy,

Table 1. Percentages of teachers agreeing with both statements

| | | Students know more than I do about the Internet. | | |
|---|----------|--|----------|--------------|
| | | (Likert score) | | |
| I am confident in my ability to use the Internet. | | 4 | 5 | Total |
| (Likert score) | 4 | 8.5 | 6.9 | 15.3 |
| | 5 | 9.0 | 5.3 | 14.3 |
| Total | | 17.5 | 12.2 | 29.6 |

2004b). The questionnaire comprised a series of statements with Likert scales of 1-5. Two of the statements were as follows:

1. I am confident in my ability to use the Internet.
2. Students know more than I do about the Internet.

A Spearman's Rank Correlation showed responses to these two variables to be significantly negatively correlated ($p=0.01$), suggesting that the more confidence teachers have in their ability to use the Internet, the less likely they are to feel that students know more about the Internet than they do. This finding is much as would have been expected. Despite the correlation however, most teachers (52.9%) still feel that students know more about the Internet than they do, including a large minority (29.6%) who feel confident in their own abilities (Table 1).

Skills Gap Between Parents and Children

Evidence for a skills gap between parents and children arose from a project carried out by Sheffield University and The City School (Project 2). In September 2002 a questionnaire was circulated amongst parents of students newly arrived from primary school. Among other things, parents were asked to assess their own ICT skills and those of their children on a five-point Likert scale. Shortly afterwards, students were given an online test designed by a member of the school's ICT department to assess their ICT skills. Two measures of student ICT ability were therefore available: (1) assessment based on parental observation and understanding of ICT skills, and (2) assessment based on results of a test developed by the school's ICT department.

The school's ICT test correlates significantly with measures of performance in maths, English,

and science taken at the students' primary schools and with parents' assessment of their own ICT skills. Parental assessment of their children's ICT ability is unrelated to the schools' measures, but is significantly correlated to the child's sex ($p < 0.05$: boys are considered more skilled) and with the perceived standard of primary school resources ($p < 0.001$) and teaching ($p < 0.01$). It seems reasonable to assume therefore, that the parents surveyed were not in a position to assess the ICT skills of their children.

Skills Gap Among ICT-Literate Adults

Evidence of another skills gap emerged from Project 3. In the process of developing the MA ITM referred to above, it became apparent that technical skills on their own are not sufficient for a student to make successful use of ICT in learning; a range of social and information skills is also required.

The MA ITM course is a distance-learning programme designed for professionals in the information technology (IT) sector. Initially it was assumed that, because of the students' technological background, no particular training was required to use the online facilities provided for those on the course (Nunes, McPherson, & Rico, 2000a). However, studies of the usage of these facilities revealed a number of problems. Early intakes of students did not make full use of the available resources; and where use was made, it was often inappropriate. Many students for example, showed behaviours that were incompatible with the purpose for which the system was designed (e.g., flaming and lurking).

By contrast, according to teachers at The City School, their students are enthusiastic users of online communication:

"I can go into a room and see youngsters who are supposedly getting information from the Internet — you find them on the Chat line."

A New Generation Gap?

This is despite the fact that they have received no formal training:

“...we’ve never taught Chat in school. We’ve never taught them to log into Chat rooms, or anything else, but ultimately, if you gave them five minutes, then you find them on Music Channel Chat room....”

It is also in opposition to the wishes of teachers:

“I don’t like them going in there so I keep them out of there, but that’s another way of communication which gets them on to a computer, and once they see that, that excites them.”

DISCUSSION

As argued, the three projects provide evidence of gaps, both in technical skills and in perceptions of technology, between different interested parties in education. These gaps occur not only in the obvious areas, between adults/children, and teacher/student, but also between students with differing experiences of ICT in education. The consequences of these gaps are discussed in further detail below.

The Impact of ICT on Learning

In the survey of Sheffield teachers referenced above, heads of department were asked to respond to the following statement: “I am under no pressure to use the Internet in my teaching.” Fifty-two percent (n = 169) did not agree with the statement. The majority of teachers therefore, either disagreed (25%) or were ambivalent (27%). Clearly therefore, many teachers not only feel that they may be under pressure to use the Internet, but they also believe that their students know more about it than they do. Such a combination of circumstances could result in educationalists

failing to recognise the potential of ICT within the learning environment, leading to under-usage and inappropriate usage.

Old Teaching and New Technology

Teachers often use new technologies as though they were something old and familiar. That way, they can satisfy any requirement to use the technology without needing to amend their teaching methods. An example of such use is the numerous Computer-Assisted Learning programs that are little more than electronic books.

Such superficiality in the use of ICT has long been criticised. In 1971, a two-day symposium was organised by the Science Research Council and the Social Science Research Council. At the symposium, CAL was criticised on the grounds that:

“using computers for pre-stored material, that is computerised programmed learning, combined inordinate expense with a very superficial philosophy of learning.” (Annett, 1976)

Similar concerns were voiced 25 years later in the report on the evaluation of the Teaching and Learning Technology Programme (Coopers & Lybrand, 1996), where it was felt that the projects would have benefited from “a more serious and helpful attempt to encourage projects to engage with pedagogic issues” (paragraph 283).

More recently, in a report on the use of interactive whiteboards (IW) in teaching, students are reported as expressing, “disappointment and frustration with some approaches to using the IW, particularly when they consider that its capabilities are being under-exploited. For example: “If teachers are going to use them [as a traditional whiteboard,] then I wouldn’t bother wasting all that money” (Levy, 2002, p. 17). Students therefore may be better able to appreciate the affordances of ICT than their teachers.

Networked Literacy

Such usage of ICT in teaching neglects not only the 'added value' that new educational technologies can bring, but it also ignores the fact that, to obtain that value, students need to acquire new skills. As was learned from the experience with the MA ITM, technical knowledge, though necessary, is not sufficient. Many other skills are required by students learning online, using computer-mediated technologies. Nunes et al. (2000a) have described such skills as Networked Information and Communication Literacy Skills (NICLS).

Networked literacy complements traditional basic skills with a new set of information and communication literacy skills. Information literacy requires students to recognise their information needs; to identify ways of addressing gaps in their knowledge; to construct strategies for locating information; to locate and access information; to compare and evaluate information; to organise, apply, and synthesise information (Webber & Johnston, 2000).

In addition, if successful communication is to take place online, learners must change their behaviour. The skills required when communicating online form what can be considered communication literacy. Networked Information and Communication Literacy Skills (Nunes et al., 2000b) include information literacy skills (as described above), and online collaboration and co-operation skills. The latter comprises technical aspects, including the skills needed to use Computer-Mediated Communication (CMC) in an online learning situation, and social aspects needed to compensate for the unavailability of social cues traditionally delivered by auditory and visual channels.

The technical aspects of NICLS are relatively easy to address, but the social aspects have often been overlooked (Nunes et al., 2000b; Hara, 2000; McDowell & Pickard, 2000). As a result, experiences such as those in the MA ITM course

described above are common: communications are misinterpreted, causing unintended offence and provoking inappropriate hostility. Students therefore need to be aware of crucial social issues involved in using CMC technologies (Webber & Johnston, 2000).

NICLS at School

Another relevant statement in the AHRB survey of school teachers is as follows:

"My Internet skills were acquired informally (e.g., self-taught, learned from friends/colleagues, etc.), rather than on a taught course."

Eighty-five percent of respondents ($n = 171$) agreed with this statement; 67% agreed strongly. Seventy-one percent of teachers over 50 ($n = 48$) agreed. Among the under 50s, age made little difference, with 88% of teachers agreeing. The youngest respondent was 24 (she agreed with the statement).

As was stated above, the technical aspects of NICLS are relatively easy to address. However, of the teachers who responded to the survey, over 95% never used chat rooms; the importance of the social aspects of NICLS are therefore likely to be unrecognised among them. E-mail was used, at least occasionally, by 70% of responding teachers; but as is the case with interactive whiteboards, e-mail can be related to an existing technology (mail) with which the teachers are already familiar. Several interesting questions therefore emerge. What, if any, online social skills are evolving amongst school children who appear to be enthusiastic users of chat rooms? Are there misunderstandings similar to those encountered on the MA ITM, and if so, how are they dealt with? Does the age at which e-mail skills are acquired affect the nature of e-mails? In particular, do students who learned to write letters before they learned to write e-mails produce more formal and more carefully worded e-mails?

NICLS Post-1997

The statistics cited in this article show how recently ICT resources became widely available in schools. It could reasonably be argued therefore that, prior to 1997, it was not practical to teach many of the Networked Information and Communication Literacy Skills identified by Nunes et al. (2000a), until students moved to further or higher education. As a result, the nature and range of information sources to which today's students have access is markedly different from those used by students finishing school prior to 1997.

Another significant development takes place in the academic year 2003-2004. The Department for Education and Skills (DfES, 2003) is introducing amendments to the teaching of ICT in English schools. The new ICT course is designed to emphasise the relevance of ICT to all national curriculum subjects. If successful, many more students will leave school with Networked Information and Communication Literacy Skills. In all probability, however, for reasons discussed above, they will have been taught the technical aspects of NICLS, but will have evolved the social aspects by experimentation with their peers.

ICT Generations and the Resulting Gaps

The title of this article refers to a new generation gap; in fact there may be several arising, not only from the introduction of technology, but also from the successful incorporation of NICLS. The rapidly changing ICT environment within the class will lead to different generations of students having very different experiences at school, as follows:

Pre-1997: ICT resources, where available, are just used for the teaching of subjects relating to maths, science, and technology. Teaching and learning are largely unaffected otherwise. Some students acquire technical skills, but there is

little opportunity to use computers as a tool for communication.

1997-2003: ICT resources become widely available. Pockets of expertise in the application of ICT to teaching begin to develop, but most teachers apply the technology cautiously, if at all. Students increasingly make use of ICT (particularly the Internet) as a learning resource. Many teachers (and parents) regard such usage with suspicion. NICLS are acquired rather than taught.

2003-2008: ICT is increasingly embedded within the national curriculum. Teachers need to demonstrate their usage of it, but often it is employed as though it were an extension of existing technologies (e.g., electronic book), and it is under-used. Students begin to learn ICT in primary school, along with reading and writing. More systematic teaching of NICLS begins.

Post-2008: Schools begin to employ newly qualified teachers who grew up with ICT. It was a natural part of their learning environment, so they have no qualms about their students using it. Formalised instruction in the social aspects of NICLS begins.

Consequences of the ICT Generation Gap

The versatility of ICT and its potential value as an educational technology make it probable that, in the future, it will be ubiquitous at all levels of education. Adult learners must therefore acquire NICLS if they are successfully to complete any course of which online learning forms a significant component. Failure to do so will result in much frustration for the students, and eventually to lower levels of success (Hara & Kling, 1999).

Such frustrations are unlikely to be experienced, or even understood, by students who became familiar with online learning environments during their formative years. Zafeirou, Nunes, and Ford (2001) provide an example of a divide based on varying levels of NICLS, when they

describe the problems some students encountered due to lack of typing skills. When using a virtual learning environment (VLE), they experienced what amounted to a virtual speech defect, which severely hampered their efforts to communicate with their fellow students.

Further inequities could arise where teachers fail to appreciate the potential of a technology. When home computers first became affordable, teachers were often impressed by well-presented, word-processed assignments. They quickly came to recognise the signs of 'cut and paste' essays; but before they did so, many students received high marks for work that owed more to their ICT skills than their understanding of the subject material.

Social Impact

The consequences referred to above are fairly obvious. Other, more subtle and more profound consequences may also arise, which may be as great as the impact of literacy on education in Ancient Greece. It is hard to appreciate exactly what this might have been, because records of educational methods among pre-literate Ancient Greeks are textual and were therefore made by practitioners of the new technology. Nevertheless, in his Preface to Plato, Havelock (1963) identifies numerous profound changes arising from the development of writing. According to Havelock, the orally based educational regime of pre-literate Greece was based on rote learning of rhythmically structured patterns that were recited and repeated without analysis (somewhat ironic, given Socrates' criticism of writing). Their role was, arguably, to stamp on learners the world view of their community. Then:

“At some time towards the end of the fifth century before Christ, it became possible for a few Greeks to talk about their ‘souls’ as though they had selves or personalities which were autonomous and not fragments of the atmosphere nor of a cosmic

life force, but what we might call entities or real substances.” (p. 197)

The change is attributed to the spread of writing. In due course, this made it possible for learning to transcend the immediate community. Groups of people, making “parallel use of texts, both to structure the internal behaviour of the groups' members and to provide solidarity against the outside world” are described as ‘textual communities’ (Stock, 1983).

The spread of reading and writing therefore affected individuals, communities, and indeed the evolution of world culture (Madden, 2004), in ways that would probably have been inconceivable to Socrates and his contemporaries.

CONCLUSION

It took hundreds of years for literacy to become commonplace. Its effects therefore took many generations to permeate through communities and cultures. By contrast, ICT has the potential to change education radically in a fraction of a generation.

Some issues arising from the use of ICT in learning and teaching may be subtle and far-reaching. If writing made it possible for Ancient Greeks to begin thinking of themselves as individuals, what could be the impact of increasingly sophisticated virtual learning zones?

Questions such as this are impossible to answer without greater experience and additional research, but the kind of meta-analysis of related projects that has been presented in this article has allowed a better understanding of the ICT generation gap.

As the ‘new’ literacies discussed above cease to be new, but become incorporated into the educational system, the generation that has already passed through that system may be excluded from an increasingly important sector of the education market. Planning is therefore necessary in order

A New Generation Gap?

to ensure that their needs can be addressed by lifelong learning and continuing professional development programmes.

In the UK, perhaps one of the most significant developments in the use of computers as an educational technology has been the adoption of the acronym ICT in place of IT. The emphasis on communication as well as information is an indication of the growing awareness of the new technology's role in facilitating exchanges and discussions, thereby addressing the shortcomings that Socrates noted arising from use of the (then) new technology of writing. Properly used, ICT allows students to move from being "hearers of many things" to being active processors of their readings and discussers of many things. In other words, ICT has the potential to enrich the learning process, facilitating an education based on interaction and social negotiation of meanings. Had Socrates been able to use ICT, he could still have subjected students to his methods.

EDITOR'S NOTE

The authors generously offered an expanded discussion of this research, as well as the tables and figures that graphically represent its findings. For copies of this supplementary information, which includes tables of descriptive and inferential data analysis, please contact J.M. Baptista Nunes at j.m.nunes@shef.ac.uk.

ACKNOWLEDGMENTS

The authors would like to thank the Arts and Humanities Research Board, the British Educational Communications and Technology Agency, and Merlin (a project funded under the EU's Leonardo da Vinci programme) for supporting this research.

REFERENCES

- Adams, D. (1999). How to stop worrying and learn to love the Internet. *Sunday Times: News Review*, (August 29). Retrieved 10 February 2003: <http://www.douglasadams.com/dna/19990901-00-a.html>
- Annett, J. (1976). *Computer-assisted learning: 1969-1975*. A report prepared for SSRC (Social Science Research Council).
- BECTa. (2001). *Primary schools: ICT and standards*. A report to the DfES on Becta's analysis of national data from OFSTED and QCA.
- Coopers & Lybrand. (1996). *Evaluation of the teaching and learning technology programme (HEFCE)*. Coopers & Lybrand, Institute of Education, & Tavistock Institute.
- Department of Education. (1995). *Statistical bulletin: Survey of information technology in schools*. Issue Number 3/95. Government Statistical Service.
- DfES. (2002a). *Survey of information and communications technology in schools*. Retrieved 10 February 2003: <http://www.dfes.gov.uk/statistics/DB/SBU/b0360/index.html>
- DfES. (2002b). *Statistics of education: Schools in England*. Retrieved 10 February 2003: http://www.dfes.gov.uk/statistics/DB/VOL/v0359/dfes_schools_final.pdf
- DfES. (2003). *Key stage 3 national strategy key messages from the ICT launch*. Retrieved 24 February 2003: http://www.standards.dfes.gov.uk/midbins/keystage3/launch_key_messages.PDF
- Hara, N. & Kling, R. (1999). Students' frustrations with a Web-based distance education course. *First Monday*, 4(12). Retrieved 24 February 2003: http://firstmonday.org/issues/issue4_12/hara/index.html

- Hara, N. (2000). Students' distress with a Web-based distance education course. *Information, Communication & Society*, 3, 557-579.
- Havelock, E.A. (1963). *Preface to Plato*. Cambridge, MA: The Belknap Press of Harvard University Press.
- Levy, P. (2002). *Interactive whiteboards in teaching and learning*. Report published by the Sheffield Excellence in Cities Partnership.
- Madden, A.D. (2004). Evolution and information. *Journal of Documentation*, 60(1), 9-23.
- Madden, A.D., Ford, N.J., Miller, D., & Levy, P. (2003). Schoolchildren searching the Internet: Teachers' perceptions. In A. Martin & H. Rader (Eds.), *Information and IT literacy: Enabling learning in the 21st century*. London: Facet.
- Madden, A.D., Bates, L., White, D., & Apthorpe, C. (2004a). *Bridging the gap: ICT in the transition year*. BECTa 2004 (in print).
- Madden, A.D., Ford, N.J., Miller, D., & Levy, P. (2004b). Using the Internet in teaching: The views of practitioners. A survey of the views of secondary school teachers in Sheffield, UK. *British Journal of Educational Technology*, (in press).
- McDowell, L. & Pickard, A. (2000, 17-19 April). Let's be careful out there: Learning in the world of electronic Information. *Proceedings of the 2nd International Conference of Networked Learning*, Lancaster University, University of Sheffield. Retrieved 8 July 2003: <http://collaborate.shef.ac.uk/nlpapers/McDowell%20Pickard-p%20web.htm>
- McPherson, M.A. & Nunes, J.M. (2004). *Developing innovation in online learning, an action research framework*. London: Routledge-Falmer.
- Moore, G.E. (1965). Cramming more components onto integrated circuits, *Electronics*, 38, 114-117.
- Nunes, J.M., McPherson, M.A., & Rico, M. (2000a, 5-6 June). Instructional design of a networked learning skills module for Web-based collaborative distance learning. *Proceedings of the European Conference on Web-Based Learning Environments (WBLE 2000)* (pp.95-103), Faculty of Engineering, University of Porto, Portugal.
- Opie, C. & Katsu, F. (2000). A tale of two national curriculums: Issues in implementing the national curriculum for information and communications technology in initial teacher training. *Journal of Information Technology for Teacher Education*, 9, 79-94.
- Plato. (2002). *Phaedrus* (translated by R. Waterfield). Oxford, UK: Oxford University Press.
- Selwyn, N. (1999). Schooling the Information Society? The place of the information superhighway in education. *Information Communication & Society*, 2, 156-173.
- Selwyn, N. & Bullon, K. (2000). Primary school children's use of ICT. *British Journal of Educational Technology*, 33, 321-332.
- Stock, B. (1983). *The implications of literacy*. Princeton, NJ.
- Webber, S. & Johnston, B. (2000). Conceptions of information literacy: New perspectives and implications. *Journal of Information Science*, 26, 381-397.
- Zafeiriou, G., Nunes, J.M.B., & Ford, N. (2001). Using students' perceptions on participation in collaborative learning activities in the design of online learning environments. *Education in Information*, 19, 83-106.

This work was previously published in the International Journal of Information and Communication Technology Education, edited by L. Tomei, Volume 1, Issue 2, pp. 19-32, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.7

Behavior Change through ICT Use: Experiences from Relatively Healthy Populations

Marieke W. Verheijden

TNO Quality of Life, The Netherlands

ABSTRACT

New communication technologies have made an impact on several areas of our everyday life, including the areas of health and health promotion. The Internet provides opportunities for personalized interactive health communication at a much larger scale than is possible in face-to-face communication. It has been suggested that only interactive health-behavior-change Web sites that advise, assess, assist, provide anticipatory guidance, and arrange follow-up have the potential to lead to successful behavior change. Additional factors that may affect the success rate of behavior-change programs are the reach of and the exposure to such programs. This chapter elaborates on all of these factors.

INTRODUCTION

Rapid developments in information and communication technologies have made a plethora of computer-based applications affecting our everyday life available. Not surprisingly, these applications have also been taken up in health-related areas. Electronic medical records, computerized reminders for preventive services, and computer-aided diagnosis of tumors are examples of this. Examples can also be found in the area of health-behavior change. New communication technologies are increasingly used as a replacement for and supplement to traditional health education and health-behavior-change programs. In addition to searching for health information, large groups of Internet users have received infor-

mation from tailored health-promotion programs through interactive health communication and/or have participated in online surveys (Sciamanna, Lewis, Tat, Napolitano, Fotheringham, & Marcus, 2002).

Evidently, the ultimate goal of Web-based health-promotion programs is to make an impact on public health. The extent to which such programs have an impact on public health is determined by two components: the reach and the efficacy (Abrams, Emmons, & Linnan, 1997). This chapter will discuss the following components in more detail: the Internet as a communication channel, potentials and minimum requirements of Web-based behavior-change programs, the delivery and reach of and exposure to Web-based behavior-change programs, and the feasibility and effectiveness of Web-based behavior-change programs. This chapter focuses specifically on relatively healthy populations as opposed to patient populations. Koelen and Van den Ban (2004) discussed that conventional mass media generally focus on new discoveries about diseases and their treatment. Much less attention is focused on disease prevention, health behavior, or early detection. This is in sharp contrast with the general idea that an ounce of prevention is worth a pound of cure, and stresses the need for a focus on applications for relatively healthy populations. This is particularly challenging because (otherwise healthy) at elevated risk for cardiovascular disease stated that they were more interested in using Web-based health-promoting programs for information when confronted with a direct medical condition than for prevention purposes (Verheijden, 2004).

COMMONLY USED BEHAVIOR-CHANGE THEORIES

Changing health behavior is challenging, and it is widely assumed that to be successful one needs to understand the determinants of behavior and be-

havior change. To help increase this understanding, several models have been developed. It is beyond the scope of this chapter to provide a full overview of health-behavior (-change) models. Therefore, this paragraph only briefly touches upon some of the most frequently used models: the theory of planned behavior and theory of reasoned action, the health belief model, the social cognitive theory, and the stages-of-change model. According to the theory of planned behavior, intention is the basis for any behavior change. Intention in turn is a function of attitude toward the behavior (change), the perception of the social pressure from other people (subjective norm), and perceived behavior control (self-efficacy). The health belief model postulates that health behavior is determined by the belief in a personal health threat combined with the belief in the effectiveness of a healthy behavior, provided that there is an internal or external cue to action, such as an article in a newspaper or a close friend having a heart attack. The social cognitive theory proposes that interrelated personal, environmental, and behavioral factors determine behavior. The stages-of-change model is one of the very few models specifically developed to address behavior change (as opposed to addressing merely the behavior itself). The stages-of-change model postulates that individuals can be classified in one of five stages of change based on their current behavior and on their intentions to change in the (near) future. Progressing through the stages of change thus reflects behavior change. The model also explicitly states that behavior change is not a watershed event. Instead, it is a spiraling progress and regression to earlier stages of change is possible (Ajzen, 1991; Bandura, 1986; Koelen & Van den Ban, 2004; Mullen, Hersey, & Iverson, 1987; Prochaska & DiClemente, 1983; Prochaska & Velicer, 1997). Especially in recent years, the models are increasingly used as a theoretical basis for all sorts of health-promotion practices, including Internet-based programs.

THE INTERNET AS A COMMUNICATION CHANNEL

Communication is essential to inform people about health and to keep health issues on personal and public health agendas. New technologies provide the means for interactive health communication. This was defined by the Science Panel on Interactive Communication and Health (SciPICH) as “the interaction of an individual—consumer, patient, caregiver, or professional—with or through an electronic device or communication technology to access or transmit health information or to receive guidance and support on a health-related issue” (Robinson, Patrick, Eng, & Gustafson, 1998). Electronic applications that focus exclusively on administrative, financial, or clinical data were excluded from this definition. The SciPICH identified six specific functions of interactive health communication: to relay information, enable informed decision making, promote self-care, manage demand for health services, promote peer information exchange and emotional support, and promote healthful behaviors. All aspects can be valuable in health-behavior-change programs.

The outcome of health communication is determined by characteristics of the source, message, channel, and receiver. The word channel refers to the way the message is brought across from the source to the receiver. Evidently, health-promotion messages can be transferred using a number of channels. These channels may vary in the extent to which the receivers are at liberty to interpret the message to their own views, in the extent to which feedback is possible, and in the extent to which group interaction is possible. Channels can also be placed on a continuum ranging from one-way flow of information (e.g., mass media) to active two-way exchange (e.g., an in-person conversation). Channels that typically possess characteristics from both sides of the continuum, such as interactive computer technologies, are usually referred to as hybrid media (Koelen & Van den Ban, 2004). These hybrid media potentially reach large numbers of people and support a level of interactivity that is impossible with conventional mass media. Table 1 (see also Leeuwis & Van den Ban, 2004, for a more detailed discussion) presents characteristics of hybrid media in applications for health-promotion programs.

Table 1. Characteristics of hybrid media for health-promotion programs

| Reach | Potentially large |
|-------------------------------|--|
| Push and pull | Pulled delivery of information, potentially large information overload. Limited insight in the actual reach of the intended target audience |
| Tailoring and personalization | Possible, but only using preprogrammed structure. Less direct than interpersonal communication |
| Social support | Particularly promising for stigmatizing topics when people prefer to be anonymous. Possibly difficult to establish relationships |
| Space and time dependence | At convenience of users, no geographical boundaries. Equipment is still largely tied to locations. |
| Speed | Content can easily be updated in the event of new developments. |
| Costs | Development costs (particularly of advanced applications) can be high. The cost per person may end up being relatively low because of potentially large reach. |

POTENTIALS OF BEHAVIOR-CHANGE PROGRAMS THROUGH THE INTERNET

The increasing research interest in behavior-change programs through the Internet is due in part to the increasing numbers of people at risk for non-communicable lifestyle-related chronic conditions. While individual approaches have shown to be effective for many different health behaviors in many different target groups, they are very expensive, thus limiting their applicability for reaching large groups of people. When targeting large groups of people, most approaches use the same generic information for all members of the target group. This information is oftentimes action oriented and may thus fail to be of interest and relevance to the majority of the target group. As discussed previously, hybrid media may provide a solution to this.

There are also other potentials of new communication technology that may be used for health-promotion programs. In addition to the characteristics discussed in Table 1, using new communication technologies for health-behavior change also has several other advantages related to interactivity, appeal, and engagement. Tailoring and instantaneous feedback based on the responses of the participants, for example, may increase the interactivity and improve the personal relevance of the content. Wantland, Portillo, Holzemer, Slaughter, and McGhee (2004) also suggested that "interactivity may help reduce attrition and provide benefits in producing positive behavioral change." The appeal of health-behavior-change programs can be increased by giving convenient access to the program and by allowing participants to choose what material they receive, when, and how often. Some target groups may also prefer computer-delivered programs over other delivery methods. Finally, computer-based health-behavior-change programs may have advantages over traditional programs in terms of engagement, for example, by facilitating open communication,

particularly on sensitive issues. Furthermore, multimedia interfaces may reduce the level of literacy required to work with the materials, and they allow for role-playing in a virtual environment (Owen, Fotheringham, & Marcus, 2002).

De Nooijer, Oenema, Kloek, Brug, De Vries, & De Vries (2005) conducted a survey among 15 experts involved in the development and evaluation of health-promotion interventions on the Internet. The experts unanimously stated that a solid theoretical base is essential for the success rate, however, the extent to which the large numbers of available Web-based health-promotion interventions are sufficiently theory based may be limited at the present time (Evers, Prochaska, Prochaska, Driskell, Cummins, & Velicer, 2003). Notably, most experts were involved in interventions based on frequently used theories in health-behavior change, such as the social cognitive theory and the stage of change model. Apart from the benefits for the users, the experts also benefits for designers and researchers. These benefits include easy access to information, the reach of potentially large groups of users, low costs for dissemination of information, the possibility to keep the information up to date with relative ease, the possibility for follow-up, integrated questionnaires and feedback, tailored questionnaires, and central data management.

The experts also mentioned several disadvantages of Web-based health-promotion programs. One of the major concerns is related to the actual reach of the target audience. As of yet, it is unclear how experts can assure that the intended target audience knows about the availability of the site, that they will actually access the site, and that they will stay on the site long enough to receive the message. Furthermore, the Internet provides health workers with much less influence on (or control over) what people do with the information that is presented to them. Another concern that was mentioned is the lack of quality control on Web-based information and the large numbers of sites containing false and possibly dangerous

information. Limited personal communication and the possibility that health-related information may easily be overlooked or disregarded in view of the large numbers of e-mails and Web sites people are exposed to were also mentioned.

MINIMUM REQUIREMENTS OF WEB-BASED BEHAVIOR-CHANGE PROGRAMS

Several instruments to rate the quality of Web sites are available (Commission of the European Communities, 2002; Gagliardi & Jadad, 2002; Gattoni & Sicola, 2005; Griffiths & Christensen, 2005; Risk & Deznowagis, 2001). However, very few of these instruments are applicable to the interactive Web sites that are used for health-behavior-change programs (Evers et al., 2003). It was therefore attempted to extrapolate clinical-practice guidelines for face-to-face counseling to guidelines for Web sites that provide interactive health information. These guidelines for Web sites can be summarized using six As, which provide a minimum set of criteria for a Web-based program to have the potential to change behavior (Cummins et al., 2003; Evers, Cummins, Prochaska, & Prochaska, 2005). Notably, meeting all criteria does not guarantee successful behavior change.

The initial criterion in face-to-face counseling is to *ask*. In this step, the behavioral concerns of the patient are assessed. Because it was assumed that

people only visit sites on topics they are interested in or concerned about (e.g., people visiting a site on smoking cessation want help to quit smoking for themselves or for someone close to them), this criterion was not included in the Health Behavior Change on the Internet (HBC-I) screener. The five criteria that were included are to advise, assess, assist, provide anticipatory guidance, and arrange follow-up (Table 2). These strategies will be discussed in more detail below.

Evers et al. (2005) reviewed almost 300 Web sites targeting alcohol use, diet, exercise, smoking, and three disease-management programs using the five As. Less than 10% of the Web sites met all five criteria. The criterion that the fewest Web sites met was anticipatory guidance. The assess criterion was met most frequently (slightly over half of the sites). Sites on smoking cessation, diet, and exercise relatively frequently met four to five of the criteria.

Advise

The first criterion includes advising individuals about behavioral risks and about the need to change this behavior. This may be done in part by using (self-) assessment approaches that will be discussed under “Assess.” It is also recommended that the purpose of the Web-based program (i.e., to initiate and sustain behavior change) is made clear to the users.

Table 2. The five As for Web sites providing interactive health information

| | |
|-----------------------|--|
| Advise | Create sense of urgency about the need to change |
| Assess | Assess (determinants of) behavior |
| Assist | Provide (tailored) feedback on assessments, suggest strategies for change, support behavior-change efforts |
| Anticipatory guidance | Manage tempting situations, provide relapse prevention, maintain motivation |
| Arrange follow-up | Specify time frame, encourage continuous participation |

Assess

People who are unaware of the problem behavior and the need to change will most likely not be interested in any information on behavior change. This makes (self-) assessment of the problem behavior to create a sense of urgency an obvious criterion. Assessment is also important because it provides the basis for tailoring feedback messages. Unfortunately, Anhøj and Jensen (2004) showed that patients were more likely to trust their own (oftentimes incorrect) perception of dietary and physical-activity habits than the outcomes presented to them by a computer program. Similar findings were found in other studies (Anhøj & Nielsen, 2004; Brug, 1999). This complicates the feedback that can be given on self-assessment tools. Yet, as Verheijden, Jans, and Hildebrandt showed that people's belief that their lifestyles are healthy already is one of their major arguments for limited interest in Web-based behavior-change programs, misconceptions about people's actual behavior need to be taken away as much as possible.

A variety of outcomes may be assessed. One may think of weight, BMI (body mass index), exercise levels, fitness levels, nicotine dependence, and so forth. Patients' willingness to change is also frequently assessed (Evers et al., 2003). Several theoretical frameworks to do so are available (e.g., the stages of change model, the precaution adoption process model, the theory of planned behavior). Bensley et al. (2004) presented three behavior-change projects based on the e-health behavior-management model. This model integrates several commonly used behavior-change concepts to assess and affect people's readiness to change behavior. The model subsequently directs the user to stage-matched information that is available on the Internet (as opposed to most tools designed for research purposes that refer people to information specifically designed for the study). Bensley et al. argued that using preexisting information sources reduces costs compared to developing

new computerized expert systems. However, all existing sources people are directed to do need to be reviewed and approved for credibility and appropriateness. The ever-changing nature of the content of Web sites may therefore impose serious constraints on the applicability of this approach. The HBC-I screener also suggests to assess other psychosocial variables that can affect behavior change, such as attitude, self-efficacy, and subjective norms. Collecting data on these variables may be interesting from a research perspective, but their value in behavior-change practice may be limited, as research on dietary behavior thus far has shown no added value of tailoring to psychosocial variables in addition to feedback on food-consumption levels (Brug, Steenhuis, van Assema, Glanz, & De Vries, 1999).

Assist

The assist criterion includes providing support, reinforcement, and understanding; providing people with intervention options and negotiating an intervention approach; and providing assistance during the change process. One may think of increasing knowledge, offering nicotine-replacement therapy, setting realistic goals, developing skills, getting social support, and so forth. Interestingly, while Web-based behavior-change programs allow for interaction with health professionals as well as with peers, the evidence suggests that when given access to both, subjects tend to rely more on communication with health professionals than on peer support (Nguyen, Carrieri-Kohlman, Rankin, Slaughter, & Stulbarg, 2004).

Tailoring may play an important role in the assist criterion. In tailoring, the information that is presented to people is a selection of all available information based on their socio-demographic, behavioral, motivational, psychosocial, and physical characteristics. In this respect, communication through new interactive-technology applications mimics the level of tailoring that can take place

when an individual is given a face-to-face consultation with a health worker. In addition, interactive health communication may also be personalized. The underlying assumption for tailoring the behavior-change program to individuals' characteristics is that this will increase the personal relevance of the message, thus increasing people's attention and the subsequent motivational and behavioral impact (De Vries & Brug, 1999; Dijkstra & De Vries, 1999; Kreuter, Farrell, Olevitch, & Brennan, 2000; McGuire, 1985; Petty, Barden, & Wheeler, 2002). Furthermore, the tailoring process assures that no redundant information is presented to the participant. This saves people time on deciding what they should and what they should not read (see Textbox 1 for a brief description of computerized tailoring).

Anticipatory Guidance

It is generally accepted that behavior change, once successfully initiated, may be difficult to sustain, especially when facing difficult situations. The HBC-I screener therefore includes anticipatory guidance: counseling and support for anticipated barriers and for relapse prevention. This may be done by specifically addressing frequently occurring barriers for behavior-change maintenance. Other possibilities include providing guidance on managing tempting situations or relapse prevention. Evidently, including anticipatory guidance in Web-based behavior-change programs does not guarantee successful maintenance of the desired behavior. However, the frequent relapses that occur in behavior change more than justify

Textbox 1. Computerized tailoring

The first-generation computer tailoring programs produced print communications. This print was in many ways similar to the traditional brochures that were used in non-tailored print approaches, but we presented people with a selection of the information as opposed to including all possibly relevant information. Later generations were available online and provided instant feedback. Interactive Web sites and the delivery of programs through personal digital assistants (PDAs) are examples of this approach (Owen et al., 2002; Redding et al., 1999).

Computer tailoring of health-promotion programs tends to take place in two steps. In the initial step, people complete an assessment instrument to assess (determinants of) the behavior of interest. In the second step, a computer program (sometimes also referred to as an expert system; see, for example, Redding et al., 1999) selects relevant message segments that are combined into tailored feedback on the outcomes of the assessment phase. The feedback often includes personal, normative, and ipsative feedback. This provides the respondent with information relevant to their current behavior (in itself and in relation to their prior behavior), and relevant to their behavior in relation to a reference group of peers (Owen et al., 2002; Redding et al.). Expert systems thus combine the individual matching that can be obtained in an individual clinic-based intervention with the relatively low costs associated with a public health approach. They also have the following additional benefits: ease of documentation, ease of transfer to multiple sites, increased consistency in decision making, increased potential for replicable results, permanence, and low costs (Waterman, 1986). A combination of personal contact and a computerized expert system is also possible, for example, when the health-promoting actions of a health professional are guided by information provided by an expert system (Velicer et al., 1993).

inclusion of this strategy in the HBC-I screener. Unfortunately, as was shown in the study by Evers et al. (2005), anticipatory guidance is infrequently included in health-behavior-change programs.

Arrange Follow-Up

Most researchers and practitioners agree that behavior change is a process that occurs over time rather than a watershed event. To maximize the likelihood of successfully affecting health behavior, repeated efforts are expected to be necessary. These continuous efforts may build on people's motivation levels, or they may help prevent relapse. As a result, the provision of a follow-up, either in the program itself or by referring people to other sources of follow-up interventions, is also part of the HBC-I screener (Evers et al., 2005). In practice, this may take place using daily or weekly e-mail reminders to keep users in touch with the program. Follow-up in person, for example, through telephone calls is also possible. Repeating the assessment tends to be a good trigger for people to participate in follow-up programs.

In addition to the As, health-behavior-change Web sites should be designed to assure sufficient security of potentially sensitive health information by preventing unauthorized access. Password registration and members-only access are examples of this. Evers et al. (2003) found that many behavior-change programs had a privacy-policy statement and provided information on how the data collected from users was used.

DELIVERY OF WEB-BASED PROGRAMS TO PROMOTE A HEALTHY LIFESTYLE

As Abidi and Goh (2000) suggested, "healthcare information should be personalized according to each individual's healthcare needs and it should be pro-actively delivered, i.e., pushed towards the

individual." The need for pushed (as opposed to pulled) delivery may be particularly crucial for lifestyle programs. Yet, as was also discussed by Van Woerkum (1997), the main consequence of using new media for communication is that the role of senders and receivers in the process changes. Traditionally, health professionals and/or knowledge institutions sent messages they deemed useful to the intended users. The initiative for knowledge transfer was thus on the side of these parties. New communication technologies have gradually moved the initiative to the users, who are looking for information on demand to answer any question they may have. Many people have incorrect perceptions of their lifestyle; they underestimate their intake of energy and fat, and they overestimate their physical activity levels. As a result, people may mistakenly perceive themselves to have a healthy lifestyle and may therefore not be interested in programs telling them how to improve their behavior. Pushed delivery of programs with fast and easy self-assessment tools may help to achieve the self-awareness that is crucial to initiate health-behavior change. Evidently, the challenge is to develop a strategy for pushed delivery of such self-assessment and counseling tools. Edutainment (education entertainment) may be a useful approach in this respect. Edutainment uses an entertainment approach (games, quizzes, TV shows, etc.) to make something of an otherwise possibly dull learning experience. *Sesame Street* is one of the clear examples of this strategy. Positive experiences with edutainment in health, for example, in diabetic children have been shown (Aoki et al., 2004). Fewer generally known examples exist for adults. Edutainment, however, has been successfully applied in several health-related areas such as drug abuse, drunk driving, HIV/AIDS, family planning, and nutrition. One of the examples that are currently available for adults in many countries throughout the world is the RealAge test (<http://www.realage.com>, RealAge, Inc.). RealAge provides personalized health information and health-management

tools. Their flagship product, the RealAge test, compares biological vs. calendar age based upon people's answers to several questions on topics that affect the rate of aging. An interesting feature of the RealAge test is that it uses tactics based on the net-present value theory (see Allegrante & Roizen, 1998) to express expected health benefits later in life (a relatively abstract long-term benefit) in life years (a more concrete benefit that makes sense to people in the present). The RealAge test is available though the Internet and is supported by mass media activities such as TV shows.

Reaching the Target Group

One of the important challenges in health promotion is to reach the intended target audience. It has been postulated that the reach and impact of health-promotion programs are likely to be much larger when the target groups' desires are taken into consideration early in the development and planning process (e.g., in the precede-proceed model by Green & Kreuter, 1999). Indeed, as with any other health-promotion activity, the desires and needs of the target audience should be taken into consideration when designing, testing, and implementing Web-based health-promotion programs. At present, the content, style, and graphic design of the health-promotion programs are often based on the message health workers want to convey and on the personal preferences and skills of the Web designers. Yet in the end, the users decide what they like or dislike and can leave a site full of relevant information with one simple mouse click. When users visit a site, they decide in 5 to 10 seconds whether or not they will stay. This decision process tends to be based on the home page and possibly one additional page. This decision is personal and largely emotional, based on several satisfiers and dissatisfiers (ZBC Consultants B.V., 2004). Unfortunately, most programs tend to be designed top-down, which reduces the odds of programs meeting these satisfiers and dissatisfiers.

An alarming notion to add to this is the tendency that "to those who have (information), to those will be given" (Koelen & Van den Ban, 2004). Indeed, Verheijden (2004) conducted a non-response survey and showed that participants in a Web-based tailored nutrition counseling program were a relatively well-educated and healthy sub-sample of the target audience. It was also suggested by Brug, Oenema, and Campbell (2003) that interactive health communication may be particularly appealing to highly educated, motivated women. However, there is also evidence that interactive health communication can be as effective among people with lower education as among higher educated people. The appreciation and exposure may even be more positive among the lower educated people. This is in line with the idea that the ability to adapt the pace of learning to one's personal interests and skills (which characterizes interactive health communication) may be particularly beneficial to lower educated people. Evidently, a crucial factor related to access that needs to be addressed is the possibility that people do not use the Internet because they do not want to use it or because they see no need to use it (Bush, Bowen, Wooldridge, Ludwig, Meischke, & Robbins, 2004). Efforts to counteract this phenomenon need to be made simultaneously with current efforts to reduce the digital divide (see below), which are largely focusing on providing people with access to computers and the Internet and to training in the use of hardware and software.

One of the complicating factors related to the reach of the target group is the digital divide between those who do and those who do not have access to information technology. As discussed by Bush et al. (2004), the term Internet access is used in a variety of meanings in different contexts (see also Leeuwis & Van den Ban, 2004, for a discussion on factors determining the availability of information technology). Based on an extensive search of overlapping information sources, they suggested that issues of Internet and Web access

can be either connectivity issues (for example, availability, capability) or human interface issues (for example, literacy; language; education; race, ethnicity, and culture; income; disability and age; experience and familiarity; skill and training). Although the socio-demographic characteristics of the advantaged and the disadvantaged groups may vary to some extent, younger, well-educated, employed men generally seem to be on the right side of the digital divide. Evidently, the digital divide also limits the rise of Web-based applications in less developed countries. Four successive phases in access to information technology have been suggested: (a) motivation, (b) possession of or access to hardware and software, (c) skills, and (d) actual use (Van Dijk, 2005). The digital divide is believed to be narrowing, but evidently access remains a barrier for some groups, such as the elderly, illiterate, and physically or mentally handicapped people. As a result of this, the use of certain media in health-promotion interventions can have political implications because they have benefit for some but are unavailable to others. Despite the advantages of interactive Web-based behavior-change programs, it has been suggested that communicative intervention programs should use a combination of different media, either simultaneously or in succession. Combining multiple media approaches may increase the likelihood of a program being effective because different members of the target audience may have preferences for and/or access to different media. Furthermore, different media have different qualities that may be combined to form an optimal intervention mix (Leeuwis & Van den Ban).

Data on the reach of Internet-based health information are not readily available. Over the past few years, almost 75% of the Dutch Internet users used the Internet to obtain health-related information. Estimates based on 2002 state that 73 to 110 million American adults used the Internet to look for health information for themselves or for others (Nguyen et al., 2004). U.S. data on use of the Internet for health information by the chronically

ill showed that 46% reported using the Internet to seek for health information or advice in the past year (Wagner, Baker, Bundorf, & Singer, 2004). Over 10% reported at least monthly use. The likelihood of using the Internet for health information was higher among people with multiple chronic conditions than among people with hypertension, cancer, or heart problems only.

A recent study among members of a Dutch Internet panel showed that 28% of the respondents had participated in Web-based tailored lifestyle programs; 57% expressed an interest in such programs, and 15% expressed no interest (Verheijden, Jans, Hildebrandt, 2006). People who were interested in or had participated in such programs were younger and more frequently female than people who expressed no interest. People most frequently reported a general interest in their own lifestyle and in online tests as reasons to participate. Much less frequently, people were interested in possible improvements in their lifestyle. The main reasons for people not to be interested in Web-based tailored lifestyle programs was their preference to discuss lifestyle and health issues with (primary care) physicians or other health professionals. They also did not want to worry about their lifestyles, or believed there was no need for them to participate in Web-based tailored lifestyle programs because their lifestyles were already healthy.

Evers et al. (2004) and Evers et al. (2005) collected similar data in a longitudinal study among a sample of American Internet users on the use of Web-based health-behavior-change programs. At baseline, approximately 25% of the respondents used the Internet for health-behavior-change or disease-management programs. The vast majority of the remaining respondents had no intention to start using such programs. At follow-up 1 year later, most people who were initially using health-behavior-change programs were no longer doing so. This may be explained by the consistently high level of cons across all levels of motivation to use the Internet for health-behavior change that

were found. Other explanations may be that some programs were no longer available through the Internet, or that the programs had a fixed duration of less than 1 year. Whatever the exact reasons, it is safe to conclude that even with continued use, the disadvantages of using programs on the Internet are prevalent, and that users are at risk for discontinuing use (Evers et al., 2004).

EXPOSURE TO WEB-BASED HEALTH-PROMOTION PROGRAMS

The central route of the elaboration likelihood model (Petty & Cacioppo, 1986) suggests that the extent to which people are persuaded to change their behavior depends on the time they spend elaborating on the topic. In Web-based health promotion, one might thus hypothesize that increasing the amount of time individuals spend reading or thinking about content on a Web site increases the likelihood of behavior change (Sciamanna et al., 2002). Future research and practice would therefore benefit from more data on exposure to (specific parts of) interventions. Sciamanna et al. and Leslie, Marshall, Owen, and Bauman (2005) suggested that people with low levels of motivation to increase their physical activity levels use other parts of intervention Web sites and have other preferences than people with high levels of motivation. Unfortunately, data on exposure to intervention programs are hardly ever presented despite the fact that the use of a Web site, visits to specific pages on a site, the use of links, and so forth can all be monitored in contemporary Web-based health-promotion programs. Only 5 of the 22 studies in the review by Wantland et al. (2004) reported measures of intervention exposure. Oenema, Brug, and Lechner (2001) increased the likelihood of high exposure to the intervention program by installing it on a local hard disk, thus preventing people from browsing the World Wide Web. Marshall, Leslie, Bauman, Marcus, and Owen (2003) conducted an 8-week in-

tervention with repeated reminders to use the site. They found that less than half of the participants used the site. Only 26% of the participants used the site more than once. An 8-month intervention program on nutrition counseling (Verheijden, 2004) was used by only 33% of the study participants (median site-use frequency among users was one time). Participants from different study populations were asked to report reasons for their relatively infrequent site use. Barriers that were reported included lack of time, lack of interest in the topic, limited access to computers and/or the Internet, and low expected benefits (Sciamanna et al., 2002; Verheijden, 2004).

CURRENT WEB-BASED BEHAVIOR-CHANGE PROGRAMS

Large numbers of Web sites currently offer people the possibility to participate in behavior-change programs. These sites vary largely in content and quality (Evers et al., 2003). They also vary in the number of health behaviors that are addressed and in the freedom of choice participants have in terms of the topics they would like to work on. Verheijden et al. (2006) showed that possible users of health-behavior-change programs differ in their views about what lifestyle topics should be addressed. Roughly half of the participants said they would like to decide for themselves which behaviors to focus on. The other half stated that Web-based behavior-change programs should address all relevant lifestyle issues. Very little evidence exists about addressing multiple lifestyle issues simultaneously. Evers et al. (2003) found that the vast majority of Web sites cover more than one behavior. Some of these combined programs integrate the five As for all behaviors involved. Others offered a modular approach in which the five As were kept separate. Research by Vandelandotte, De Bourdeaudhuij, Sallis, Spittaels, and Brug (2005) showed that the simultaneous approach may be more effective in certain groups of people than a sequential approach.

THE FEASIBILITY AND EFFECTIVENESS OF WEB-BASED HEALTH-PROMOTION PROGRAMS

As for any other health-promotion tool, a major prerequisite for large-scale implementation of Web-based health-promotion programs is a solid evidence base for their (cost) effectiveness. Conducting feasibility and pilot studies is an important first step in the evaluation of Web-based health-promotion programs (De Nooijer et al., 2005). Unfortunately, there is very little literature available on this topic. This is likely the result of journal editors being more interested in randomized controlled trial on the effectiveness of the final programs. As a result, publishing pilot studies is relatively low on researchers' priority lists. However, to prevent the wheel being reinvented over and over again, the field would benefit from the publication of the successes and failures in pilot studies, such as was done by Anhøj and Jensen (2004). They conducted a feasibility study on a Danish Internet application for lifestyle changes in diet and physical activity among five general practitioners (GPs) and 25 patients. Data were collected rather randomly from different sources and participants were likely a convenience sample. Nevertheless, the results from this study provide some valuable insights for the design of future behavior-change programs. One of the important outcomes of this study is that patients seemed to give a high value to personal relations with a health-care professional. All patients agreed that "the use of the program did not provide the necessary support in their struggle towards a healthy lifestyle." They said that the program itself was merely a tool and that it could never replace support from a health-care professional. It was also reported by both patients and GPs that the program needs to allow for frequent interaction, especially in the beginning, to prevent patients' loss of interest. Anhøj and Jensen (2006) suggested breaking up advice messages into small fragments delivered on a daily basis. They also

suggested allowing patients to complete dietary assessment instruments on a regular (possibly even daily) basis, despite the fact that these instruments may have been developed to assess dietary intake patterns over the past month. Evidently, the latter limits the reliability of questionnaire results and the content of advice, which is one of the other key issues that needs to be addressed for similar programs to be successful in bringing about patients' lifestyle changes.

However, aside from a number of position papers indicating the potential of these programs and a few studies with varying external validity, very little evidence is available. Wantland et al. (2004) reviewed behavioral-change outcomes in Web-based vs. non-Web-based interventions for (amongst others) weight control, weight-loss maintenance, nutrition, physical activity, and the secondary prevention of heart disease. They concluded that there was substantial evidence that use of Web-based interventions improves behavioral-change outcomes. De Nooijer et al. (2005) conducted a systematic review on the effectiveness of Web-based health-promotion programs in the areas of smoking, physical activity, nutrition, weight loss (maintenance), safe sex, alcohol, and drugs. They found favorable effects (part of which were significant) on knowledge, awareness of actual consumption levels, self-efficacy, and intention to change behavior. The evidence on behavioral and biomedical outcomes was conflicting, and effect sizes were predominantly insignificant. Werkman, Kroeze, & Brug (2005) conducted a systematic review of the effectiveness of computer-tailored education on physical activity and dietary behaviors. They found most consistent evidence for tailored interventions on fat reduction. There was very limited evidence to support computer-based tailored programs for physical activity. Textbox 2 briefly presents examples of computerized health-behavior-change programs in the area of physical activity (Marshall et al., 2003), smoking (Velicer et al., 1993), and diet (Block, Block, Wakimoto, & Block, 2004).

Textbox 2. Some examples of computerized health-behavior-change programs

Expert System for Smoking Cessation

Velicer et al. (1993) tested a computerized expert system for smoking cessation in 870 smoking volunteers. People were randomized into one of four groups: (a) standard treatment using self-help manuals and booklets, (b) individualized treatment using manuals based on all constructs of the trans-theoretical model, (c) interactive individualized treatment using manuals based on all constructs of the trans-theoretical model and three printouts of computer-generated reports on people's responses to mailed questionnaires, and (d) extensive interactive, individualized treatment using manuals based on all constructs of the trans-theoretical model, three printouts of computer-generated reports on people's responses to mailed questionnaires, and a series of short calls from counselors to provide personalized feedback. Self-reported smoking abstinence was measured in a pretest and after 6, 12, and 18 months. Individualized treatment and standard treatment led to similar abstinence rates through 12 months. At 18 months, individualized treatment outperformed the standard treatment. Interactive, individualized treatment outperformed standard and individualized treatment at all time points; quit rates were roughly twice as high. The extensive interactive, individualized treatment was slightly less effective than the regular interactive, individualized treatment.

E-Mailed Nutrition Intervention Program

Block et al. (2004) conducted an experiment in which employees at a corporate work site were offered the opportunity to work with the e-mailed Worksite Internet Nutrition (WIN) program. Some of the principles in the WIN program were relevance to the employee, tailoring, flexibility and individual choice, skill facilitation, commitment and goal setting, reminders and reinforcement, and multiple strategies and channels. Eighty-four of the 230 employees participated in the program. No control group was included in the study. The participants increased the frequency of fruit and vegetable consumption by 0.73 times per day and decreased the frequency of fat consumption by 0.39 times per day. Participants found the program helpful (93%) and all of the participants who admitted not to be health conscious at baseline would recommend the program to others.

Web-Site Physical-Activity Program

Marshall et al. (2003) conducted a study among 655 participants who were recruited from an Australian regional university. Participants were randomized to receive either a print-based or a Web-based active-living program. Most people preferred the Web-based program. However, 36% of the participants in the print-based group had kept the intervention materials for future reference, while only 12% of the participants in the Web-based group reported to have bookmarked the Web site. There was a trend for participants in both groups to participate in more physical activity after the intervention, but there were no statistically significant differences within or between study groups.

These examples were chosen because they represent different options in computerizing: Web sites, e-mails, and computerized expert systems. Several methodological drawbacks characterize some of the studies included in the reviews described above. For example, one needs to be cautious when interpreting studies in which a Web-based program (i.e., increasing access to information) is compared to a no-treatment control. The difference in exposure to intervention may be a co-intervention to such an extent that the effects of the use of new media cannot be assessed properly (Nguyen et al., 2004). A nice series of studies in which this was not an issue was conducted by Harvey-Berino, Pintauro, Buzzell, et al. (2002), Harvey-Berino, Pintauro, Buzzell, and Gold (2004), and Harvey-Berino, Pintauro, and Gold (2002). They compared weight-loss maintenance programs, one of which was delivered via the Internet. The studies provided conflicting evidence on the effectiveness of Internet interventions for weight-loss maintenance; the Internet intervention was at best slightly (yet insignificantly) better than other treatment modalities. Generally, the attendance of meetings was lower in the Internet intervention and patients tended to prefer the in-person intervention.

A study by Consoli, Ben Said, Jean, Menard, Plouin, and Chatellier (1995) showed that knowledge scores among hypertensive patients increased significantly more when standard education by physicians, nurses, dieticians, and pamphlets were supplemented with one computer session using an expert system. Some positive experiences were also reported for other conditions, such as heart failure and asthma (Krishna, Francisco, Balas, Konig, Graff, & Madsen, 2003; Stromberg, Ahlen, Fridlund, & Dahlstrom, 2002). It has been suggested, however, that these findings cannot simply be extrapolated to the effectiveness of computerized behavior-change programs in general because the sense of urgency to participate in such programs is much larger for people who have been diagnosed with chronic conditions than

for people who need to make behavioral changes in the prevention of chronic conditions. This may be partly the result of the fact that people can expect benefits from participating in such programs in the long term, while the effort needs to be put in at present (Allegrante & Roizen, 1998).

POTENTIAL FOR HARM

Initially, many interactive health communication systems were available under supervised conditions in academic research settings only. More recently, however, many systems have become available to the general public. There is even less evidence available on these publicly available products than on the academically available ones, and monitoring occurs rarely. As SciPICH (Robinson et al., 1998) already stated, this should raise legitimate questions about their quality, cost, and potential to cause harm. The risks of direct and indirect damage to people's health as a result of health-promotion programs through interactive health communication may be considerable. This may be the result of inappropriate treatment or delays in seeking necessary medical care. The expert panel in the study by De Nooijer et al. (2005) that was discussed previously also expressed concerns about places people can turn to when they need more information after they have read misleading or terrifying information on the Web. Other examples include damaged trust in health-care clinicians and misleading claims for health products. SciPICH strongly equal for the active involvement of health-care professionals in assessing and assuring the quality of interactive health-promotion tools and in contributing to the development and implementation of such tools. It advocated that this approach would lead to much better outcomes for both health-care providers and health-care consumers than an approach in which professionals ignore or disparage such tools.

CONCLUSION

New communication technologies provide many opportunities for health-promotion programs, but they also have some considerable limitations. The ultimate proof of the pudding, of course, is in the eating. As Evers et al. (2005) already stated:

Until the field solves the problem of helping significant percentages of populations toward effective action and maintain such action, Internet programs will not be able to realize their potential to be the lowest cost modality for delivering tailored communications that can have the highest impact on health promotion, disease prevention, and disease management.

It is a challenge for all those involved to make the best possible use of the new technologies for programs that were originally designed for face-to-face or print strategies, as well as to develop new programs specifically designed in a new media format. However, to make full use of the possibilities of face-to-face and computer-based interaction in health communication, the World Wide Web should never fully replace consultations and clinical examinations by health professionals. Depending on factors such as the available resources (time, space, staff, etc.) and the personal preferences of all individuals involved, an ideal mix of intervention approaches may be composed.

REFERENCES

- Abidi, S. S., & Goh, A. (2000). A personalised healthcare information delivery system: Pushing customised healthcare information over the WWW. *Studies in Health Technology and Informatics*, 77, 663-667.
- Abrams, D. B., Emmons, K. M., & Linnan, L. A. (1997). Health behavior and health education: The past, present, and future. In K. Glanz, F. M. Lewis, & B. K. Rimer (Eds.), *Health behavior and health education: Theory, research, and practice* (pp. 453-478). San Francisco: Jossey-Bass.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- Allegrante, J. P., & Roizen, M. F. (1998). Can net-present value economic theory be used to explain and change health-related behaviors? *Health Education Research*, 13, i-iv.
- Anhøj, J., & Jensen, A. H. (2004). Using the Internet for lifestyle changes in diet and physical activity: A feasibility study. *Journal of Medical Internet Research*, 6, e28.
- Anhøj, J., & Nielsen, L. (2004). Quantitative and qualitative usage data of an Internet-based asthma monitoring tool: From the user's point of view. *Journal of Medical Internet Research*, 6, e23.
- Aoki, N., Ohta, S., Masuda, H., Naito, T., Sawai, T., Nishida, K., et al. (2004). Edutainment tools for initial education of type-1 diabetes mellitus: Initial diabetes education with fun. *Medinfo*, 11, 855-859.
- Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice-Hall.
- Bensley, R. J., Mercer, N., Bruski, J. J., Underhile, R., Rivas, J., Anderson, J., et al. (2004). The eHealth behavior change management model: A stage-based approach to behavior change and management. *Preventing Chronic Disease*. Retrieved December 5, 2006, from http://www.cdc.gov/pcd/issues/2004/oct/04_0070.htm
- Block, G., Block, T., Wakimoto, P., & Block, C. H. (2004). Demonstration of an emailed work-site nutrition intervention program. *Preventing Chronic Disease*. Retrieved December 5, 2006, from http://www.cdc.gov/pcd/issues/2004/oct/04_0034.htm

- Brug, J. (1999). Dutch research into the development and impact of computer-tailored nutrition education. *European Journal of Clinical Nutrition*, 53(Suppl. 2), S78-S82.
- Brug, J., Oenema, A., & Campbell, M. (2003). Past, present, and future of computer-tailored nutrition education. *American Journal of Clinical Nutrition*, 77, 1028S-1034S.
- Brug, J., Steenhuis, I., van Assema, P., Glanz, K., & De Vries, H. (1999). Computer-tailored nutrition education: Differences between two interventions. *Health Education Research*, 14, 249-256.
- Bush, N. E., Bowen, D. J., Wooldridge, J., Ludwig, A., Meischke, H., & Robbins, R. (2004). What do we mean by Internet access? A framework for health researchers. *Preventing Chronic Disease*. Retrieved from http://www.cdc.gov/pcd/issues/2004/oct/04_0019.htm
- Commission of the European Communities. (2002). eEurope 2002: Quality criteria for health related Websites: Position Paper. *Journal of Medical Internet Research*, 4(3), e15.
- Consoli, S. M., Ben Said, M., Jean, J., Menard, J., Plouin, P. F., & Chatellier, G. (1995). Benefits of a computer-assisted education program for hypertensive patients compared with standard education tools. *Patient Education and Counseling*, 26, 343-347.
- Cummins, C. O., Prochaska, J. O., Driskell, M. M., Evers, K. E., Wright, J. A., Prochaska, J. M., et al. (2003). Development of review criteria to evaluate health behavior change Websites. *Journal of Health Psychology*, 8, 55-62.
- De Nooijer, J., Oenema, A., Kloek, G., Brug, H., De Vries, H., & De Vries, N. (2005). *Bevordering van gezond gedrag via Internet: Nu en in de toekomst*.
- De Vries, H., & Brug, J. (1999). Computer-tailored interventions motivating people to adopt health promotion behaviors: Introduction to a new approach. *Patient Education and Counseling*, 36, 99-105. Optima Grafische Communicatie in Rotterdam: The Netherlands.
- Dijkstra, A., & De Vries, H. (1999). The development of computer-generated tailored interventions. *Patient Education and Counseling*, 36, 193-203.
- Evers, K. E., Cummins, C. O., Johnson, J. L., Paiva, A., Prochaska, J. O., Padula, J., et al. (2004). *Towards maximizing Internet impacts on health promotion and disease management*. West Kingston, RI: Pro-Change Behavior Systems, Inc.
- Evers, K. E., Cummins, C. O., Prochaska, J. O., & Prochaska, J. M. (2005). Online health behavior and disease management programs: Are we ready for them? Are they ready for us? *Journal of Medical Internet Research*, 7, e27.
- Evers, K. E., Prochaska, J. M., Prochaska, J. O., Driskell, M. M., Cummins, C. O., & Velicer, W. F. (2003). Strengths and weaknesses of health behavior change programs on the Internet. *Journal of Health Psychology*, 8, 63-70.
- Gagliardi, A., & Jadad, A. R. (2002). Examination of instruments used to rate quality of health information on the Internet: Chronicle of a voyage with an unclear destination. *British Medical Journal*, 324(7337), 569-573.
- Gattoni, F., & Sicola, C. (2005). How to evaluate the quality of health related Websites. *Radiologia Medica* (Torino), 109(3), 280-287.
- Green, L. W., & Kreuter, M. W. (1999). *Health promotion planning: An educational and environmental approach* (2nd ed.). Mountain View, CA: Mayfield.
- Griffiths, K. M., & Christensen, H. (2005). Website quality indicators for consumers. *Journal of Medical Internet Research*, 7(5), e55.
- Harvey-Berino, J., Pintauro, S., Buzzell, P., DiGiulio, M., Casey Gold, B., Moldovan, C., et

- al. (2002). Does using the Internet facilitate the maintenance of weight loss? *International Journal of Obesity and Related Metabolic Disorders*, *26*, 1254-1260.
- Harvey-Berino, J., Pintauro, S., Buzzell, P., & Gold, E. C. (2004). Effect of Internet support on the long-term maintenance of weight loss. *Obesity Research*, *12*, 320-329.
- Harvey-Berino, J., Pintauro, S. J., & Gold, E. C. (2002). The feasibility of using Internet support for the maintenance of weight loss. *Behavior Modification*, *26*, 103-116.
- Koelen, M. A., & Van den Ban, A. (2004). *Health education and health promotion*. Wageningen: Wageningen Academic Publishers, The Netherlands.
- Kreuter, M., Farrell, D., Olevitch, L., & Brennan, L. (2000). *Tailoring health messages: Customizing communication with computer technology*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Krishna, S., Francisco, B. D., Balas, E. A., Konig, P., Graff, G. R., & Madsen, R. W. (2003). Internet-enabled interactive multimedia asthma education program: A randomized trial. *Pediatrics*, *111*, 503-510.
- Leeuwis, C., & Van den Ban, A. (2004). *Communication for rural innovation: Rethinking agricultural extension*. Blackwell Science.
- Leslie, E., Marshall, A. L., Owen, N., & Bauman, A. (2005). Engagement and retention of participants in a physical activity Website. *Preventive Medicine*, *40*, 54-59.
- Marshall, A. L., Leslie, E. R., Bauman, A. E., Marcus, B. H., & Owen, N. (2003). Print versus Website physical activity programs: A randomized controlled trial. *American Journal of Preventive Medicine*, *25*, 88-94.
- McGuire, W. J. (1985). Attitudes and attitude change. In G. Lindzey & E. Aronson (Eds.), *The handbook of social psychology* (Vol. 83, pp. 854-864). Mahwah, NJ: Lawrence Erlbaum Assoc.
- Mullen, P. D., Hersey, J. C., & Iverson, D. C. (1987). Health behavior models compared. *Social Science and Medicine*, *24*, 973-981.
- Nguyen, H. Q., Carrieri-Kohlman, V., Rankin, S. H., Slaughter, R., & Stulbarg, M. S. (2004). Internet-based patient education and support interventions: A review of evaluation studies and directions for future research. *Computers in Biology and Medicine*, *34*, 95-112.
- Oenema, A., Brug, J., & Lechner, L. (2001). Web-based tailored nutrition education: Results of a randomized controlled trial. *Health Education Research*, *16*, 647-660.
- Owen, N., Fotheringham, M. J., & Marcus, B. H. (2002). Communication technology and health behavior change. In K. Glanz, B. K. Rimer, & F. Marcus Lewis (Eds.), *Health behavior and health education: Theory, research, and practice* (pp. 510-529). John Wiley & Sons.
- Petty, R. E., Barden, J., & Wheeler, S. C. (2002). The elaboration likelihood model of persuasion: Health promotions that yield sustained behavioral change. In R. J. DiClemente, R. A. Crosby, & M. C. Kegler (Eds.), *Emerging theories in health promotion practice and research: Strategies for improving public health* (pp. 71-99). San Francisco: Jossey-Bass.
- Petty, R. E., & Cacioppo, J. T. (1986). *The elaboration likelihood model of persuasion*. New York: Academic Press.
- Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, *51*, 390-395.
- Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion*, *12*, 38-48.

- Redding, C. A., Prochaska, J. O., Pallonene, U. E., Rossi, J. S., Velicer, W. F., Rossi, S. R., et al. (1999). Transtheoretical individualized multimedia expert systems targeting adolescents' health behaviors. *Cognitive and Behavioral Practice*, 6, 144-153.
- Risk, A., & Deznawagis, J. (2001). Review of Internet health information quality initiatives. *Journal of Medical Internet Research*, 3(4), e28.
- Robinson, T. N., Patrick, K., Eng, T. R., & Gustafson, D. (1998). An evidence-based approach to interactive health communication: A challenge to medicine in the information age. *Journal of the American Medical Association*, 280, 1264-1269.
- Sciamanna, C. N., Lewis, B., Tat, D., Napolitano, M. A., Fotheringham, M., & Marcus, B. H. (2002). Use attitudes toward a physical activity promotion Website. *Preventive Medicine*, 35, 612-615.
- Stromberg, A., Ahlen, H., Fridlund, B., & Dahlstrom, U. (2002). Interactive education on CD-ROM: A new tool in the education of heart failure patients. *Patient Education and Counseling*, 46, 75-81.
- Vandelanotte, C., De Bourdeaudhuij, I., Sallis, J. F., Spittaels, H., & Brug, J. (2005). Efficacy of sequential or simultaneous interactive computer-tailored interventions for increasing physical activity and decreasing fat intake. *Annals of Behavioral Medicine*, 29, 138-146.
- Van Dijk, J. A. G. M. (2005). *The deepening divide: Inequality in the information society*. Sage Publications.
- Van Woerkum, C. M. J. (1997). Media choice in nutrition education of general practitioners. *American Journal of Clinical Nutrition*, 65(Suppl.6), 2013S-2015S.
- Velicer, W. F., Prochaska, J. O., Bellis, J. M., DiClemente, C. C., Rossi, J. S., Fava, J. L., et al. (1993). An expert intervention for smoking cessation. *Addictive Behaviors*, 18, 269-290.
- Verheijden, M. W. (2004). *Nutrition counselling in general practice: The stages of change model*. Unpublished doctoral thesis. Wageningen University: The Netherlands.
- Verheijden, M. W., Jans, M. P., & Hildebrandt, V. H. (in review). *Web-based tailored lifestyle programs: Exploration of the target group's interests and implications for practice*. Manuscript submitted for publication.
- Wagner, T. H., Baker, L. C., Bundorf, M. K., & Singer, S. (2004). Use of the Internet for health information by the chronically ill. *Preventing Chronic Disease*. Retrieved from http://www.cdc.gov/pcd/issues/2004/oct/04_0004.htm
- Wantland, D. J., Portillo, C. J., Holzemer, W. L., Slaughter, R., & McGhee, E. M. (2004). The effectiveness of Web-based vs non-Web-based interventions: A meta-analysis of behavioral change outcomes. *Journal of Medical Internet Research*, 6(4), e40.
- Waterman, D. A. (1986). *A guide to expert systems*. Redding, MA: Addison-Wesley.
- Werkman, A., Kroeze, W., & Brug, J. (2005, June). *A systematic review of the effectiveness of computer-tailored education on physical activity and dietary behaviors* (Abstract 1-50396). Proceedings of the Fourth Annual Conference of the International Society of Behavioral Nutrition and Physical Activity, Amsterdam, The Netherlands.
- ZBC Consultants B.V. (2004). *E-commerce met de e van emotie*. Retrieved December 5, 2006, from <http://www.zbc.nu/main.asp/ChapterID=2555>

This work was previously published in Web Mobile-Based Applications for Healthcare Management, edited by L. Al-Hakim, pp. 118-141, copyright 2007 by IRM Press (an imprint of IGI Global).

Chapter 5.8

Articulating ICT Use Narratives in Everyday Life

Deirdre Hynes

Manchester Metropolitan University, UK

Tarja Tiainen

University of Tampere, Finland

Emma-Reetta Koivunen

University of Helsinki, Finland

Minna-Kristiina Paakki

University of Tampere, Finland

INTRODUCTION

The most common definition of the information society lays emphasis upon spectacular technological innovation and the transformative effects of new information and communication technologies. The key idea is that breakthroughs in information processing, storage, and transmission have led to the application of information technology in virtually all, public and private, sectors of society (Webster, 1995). By the 1990s, to admire and indeed enthuse over new ICTs had become highly fashionable and popular. Such technological enthusiasm has become so pervasive that it has seeped not only into political and policy

discourses, but also into the whole spectrum of the media and fora of public communication (Preston, 2001). In addition, discourses of the information society are often dominated and shaped by male commentators (e.g., Castells, 2000; Gates, 1995; Kelly, 1999; Negroponte, 1995). For example, when compiling a collection of the dominant players of international information-society discourse, Cawley and Trench (2004) were hard-pressed to find female commentators, succeeding only in finding 3 out of a total of 18 critics.¹

We argue that the focus on the artefact, and thus technological celebration, takes precedence over the largely ignored field of technological uses and consumption issues. Hence, we present

a study that analyses the individual user experiences to challenge the stereotypical user traditions represented by the information-society discourse. We wish to present a counternarrative that shifts the emphasis from technical expertise, and technological and transformative benefits of artefacts to more individual-user-focused narratives.

As a result, this brought about a dual-narrative process through which the respondents described their experiences. We found that when people described their uses, consumption patterns, and domestication² experiences of ICTs, they tended to do so by employing contrasting frames of reference. These frames of reference we have termed the objective lens (or narratives) and subjective lens (or narratives). Through what we term objective narratives, we found that some respondents would describe their use through official and technical frames of reference. For example, they employed primarily dominant information-society jargon to frame how they made sense of technologies and their use experiences. Through subjective narratives, we found that respondents would describe their use and experiences from primarily a personal perspective to explain how the technology fitted their lives, the role it played in their everyday routines and habits, and the associated meaning and significance of the artefact.

While these contrasting narratives are not mutually exclusive or contradictory, it became clear from the interviews that a pattern of use narratives was emerging. We found that such narratives slightly reinforced traditional gender roles in which men tend to talk about technologies in highly technical terms of reference, while women portray themselves as technologically helpless or ignorant (Gill & Grint, 1995; Gray, 1992; Lie, 1995). Although we did not look for or find stable gender categories, the emergent gender narratives seem to renew the existing gender roles that link masculinity and technology (Vehviläinen, 2002).

With the development of computer technologies, we have witnessed a shift from IT to ICTs.

This has resulted in a redefinition of the computer as an artefact: from a mere computational device to the newly emergent multimedia-enhanced computers, or what Paul Mayer (1999, p. 1) calls a “meta-medium.” Today, the conceptualisation of the computer is more problematic. It may be thought of as the Web or Internet, computer games, CD-ROMs (compact disc read-only memory), reference works, e-mail, and a diverse range of applications for displaying and manipulating text, images, graphics, music, databases, and the like. Spilker and Sørensen (2000, p. 270) argue that computers are no longer “primarily about programming, systems, control and calculation,” but instead “a gateway to communication and cultural activities.” The shift in identity has opened up or unlocked the conceptualisation of the computer. Therefore, it is possible for wider audiences and previously excluded groups (such as the elderly and women) to translate the computer into something meaningful in their everyday lives. As a result, we were not solely focused on the computer as a separate technology, but instead on the wide range of information and communication technologies that are available in the domestic setting.

BACKGROUND

While the concepts of objectivity and subjectivity are not novel terms to describe contrasting positions, we have used the concepts to facilitate the understanding of how our respondents talk about their experiences and uses of ICTs. Orlikowski and Robey (1991) have employed this approach to address the relationship between information technology and the structuring of organisations. The authors argue that the essence of both social reality and ITs can be described by using objective and subjective perspectives. In Orlikowski and Robey’s approach, the objectivist relationship to technology underlines the importance of the material characteristics of the artefact, while the subjectivist approach focuses on the

importance of the subjective human experience in the interpretation, creation, and modification of the social world.

Although Giddens' (1976) theory of structuration bridged the gap between the objective and subjective social reality in academic circles, and in particular technology studies, the emphasis lies firmly in the objective approach (Orlikowski, 2000). We argue that one must consider both subjective and objective approaches to ICT discourse. The division is maintained in this article as it is constructive and valuable in the ways it enables us to discuss how and why the objective approach to articulating ICT use is publicised, overvalued, and hyperbolised. On the other hand, the subjective approach is often neglected and confined to private, domestic, and unofficial realms. The aim of this article is not to merely point to the existence of both discourses of ICT use, but instead to argue that it is important to locate the common ground between the discourses in order to provide a grounded and holistic picture of the ways people talk about their ICT use.

NARRATIVES OF ICT USE

The data for this article are drawn from a larger study of Finnish families looking at ICTs in everyday life and the use of electronic services.³ The objective-subjective theme discussed here emerged while analysing the ways family members talked about their ICT use. For the purpose of this article, we draw on selective excerpts from the interviews to illustrate the contrasting narratives.

Pure Objective Lens

The dominant narrative of information-society discourse presents ICT use in a normative way, for example, by urging universal access and consumption, which is mirrored through official discourse in the ways everyday users express their

personal experiences. This way of describing ICT use was also reproduced by several respondents, as can be observed in the following quote.

Ville: We had our first computer ... [it] was 2-8-6 ... quite interesting. We have it actually still somewhere; I don't know where.

Interviewer: Was it about when ... [W]ere you still in school?

Ville: Well, it was when [it] cost thirty grant[s] of old money.

Here, Ville was asked about his early memories of the family's first computer, and he replied listing only the technical particulars and the price of the machine. The quote gives an interesting insight into how male respondents often shied away from using personalised or subjective narratives to articulate their everyday use of or relationship with the artefact. Instead, they preferred to employ objective or dominant information-society narratives to describe their relationships with ICTs. We found male respondents would employ such narratives even when discussing Internet use.

Information-society discourse, as we stated earlier, adopts the classic determinist position whereby technical advances are celebrated using hyperbolic expressions (Preston, 2001). This technical enthusiasm is picked up by ordinary users (mostly male) who tend to reproduce these official narratives to describe their own use.

Pure Subjective Lens

We also identified another narrative used by the respondents to describe their use in a more personal or subjective fashion. To illustrate this alternative narrative, we present one example of a female respondent who expresses her use and consumption of the Internet by relating its use to her everyday routines and habits. Here we notice a shift in the respondents' narratives from objective

discourses of use to narratives of personal and individual ways of describing how the artefact fits into everyday life.

[On the Internet] there is lot of instructions, people's gardens, advice. Then there is from these willow works. You find really those instructions, real illustrated, and they talk [on Web pages]. I just devour those. (Helena)

When talking about her use of the Internet, she gives very practical (or subjective) descriptions of her Internet habits, incorporating emotive and expressive language to articulate her use patterns: "and then I can manage without [the] machine [computer], but it is nice to visit [Web pages] if I just can."

She also makes it clear that using the Internet is not an overwhelming activity for her, but one she can do well without. This she explains partly due to the everyday situation in the family, as access to the computer is compromised due to other family members being active users.

Mixed Objective and Subjective Lens

Helena's husband Heikki gives us a very useful insight into the dilemma users face when trying to balance the objective and subjective relationships with the computer. He explains,

I don't really like [to] use it much then ... I don't know if it's character or what, but I feel bad if I'm not working; then when I'm by [the] computer ... I feel I'm wasting my time ... but I do sometimes [on] weekends. (Heikki)

In this quote, we get a sense of how users strive to reconcile the work-related or non-hobby-related uses of the computer and the Internet (objective) with the leisure or entertainment features and functions, and perhaps even communicative elements of ICTs (subjective). Objective discourses tend to focus on "worthy" or beneficial uses of

ICTs while perhaps overlooking the everyday uses such as music downloading, game playing, surfing, and e-mailing. It is only through a subjective discourse analysis that we get a sense of the reality of everyday uses of ICTs and accordingly develop an understanding of the meanings and significance users assign to them.

TRADITIONALLY GENDERED OR GENDERED TRADITIONS?

This section will explore whether gender differences between masculine and feminine users are reinforced, reproduced, or challenged. Ostensibly, there existed some gender differences in describing one's own ICT use. It became apparent during the respondents' narrations that both men and women appeared to adhere to traditional gender stereotypes, in which men are presumed to be technologically oriented and women technologically helpless, or at least not interested in technology (Gill & Grint, 1995). In doing so, they do not just express their own interpretations, but they appear to also confirm and renew the connection between technology and masculinity.

However, on deeper analysis, we found some interesting similarities between the male and female approaches to describing ICT use. We suggest that the presence of such similarities can be argued perhaps as a weak indication that signals the diminishing traditional bond between technology and masculinity (Lie, 1995).

In our interview material, the men, Pekka, Heikki, and Ville, used all three narratives (objective, subjective, and mixed narratives). In spite of this, there also emerged some crucial differences between the men as Ville employed almost exclusively the objective narrative, even as he presented his individual ICT experiences. The other men, Heikki and Pekka, employed mixed narratives when articulating their ICT use. This reinforces the position held by Lie (1995), who argues that "the connection between technology and masculinity

does not imply that all men are equally attached to technology, or that one can prove empirically that majority of them are” (p. 382).

Alternatively, the interviewed women, Paula, Helena, and Leena, employed subjective and mixed narratives. Significantly, they did not employ objective narratives at all. It became apparent that Leena was more aware of the objective discourse, but chose instead to articulate her ICT use in more subjective tones. Paula was quite enthusiastic about computer use and the potential benefits of the information society, using objective narratives to express her opinions. But when she described her individual role as an ICT user, she presented herself as “not the good and legitimate user,” which can be seen as reverting back to subjective narratives. In essence, the female respondents knew of the dominant narrative of information-society discourse, but they used it as a mirror to present their own subjective experiences.

FUTURE TRENDS AND CONCLUSION

Although the objective lens continues to be used as the dominant narrative, we believe the subjective lens will become increasingly pervasive with more user- and consumer-focused research (such as Hartmann, 2003; Miller & Slater, 2000; Ward, 2003). This type of research mirrors the changing faces of ICTs from highly technical artefacts (bound up with programming and networking identities) to technologies with everyday uses for domestic users (with communicative and interactive functions). This shift brings about opportunities for ordinary users to articulate their own subjective relationships with ICTs while lessening the need for dedicated technical expertise and skills to operate information technologies. From a cultural- and media-studies perspective, Silverstone, Hirsch, and Morley (1994) view the “double articulation” of ICTs—both technological

texts and media texts—as having an influence on relationships with ICTs, and in the case of this article, on the discourses people use to describe those relationships. As a result, ICTs are not solely studied from a technological perspective, as by computer scientists, but also from social and human-centred perspectives (e.g., Castells, 2000; Hine, 2000; Lie & Sørensen, 1996).

Furthermore, the scientific paradigm is recognising this shift as studies become less positivist in nature and instead focus more on areas such as interpretive studies (see Walsham, 1995, 2005). In the information-systems field, interpretive studies provide space to consider alternative explanations of ICT use and practice, in particular in new gender studies where the focus is not typified by the differences between the genders but instead on subjective differences, for example, between women’s use of technology. Therefore, we suggest that the subjective analysis of technology use and its discourse should be considered a valuable insight into how users construct individual interpretations of ICTs. In cultural and media studies, the concept of domestication is employed to achieve insights into the experiences of individuals as they tame wild technologies and make them fit into their everyday surroundings, routines, and patterns. Domestication, as an analytical tool, gives scope to researchers to consider the technological and social characteristics of technology and the social factors that influence its use and identity. This approach to technology and everyday life marks a move away from the understanding that technologies appear in society ready to use, to an understanding of technologies as unfinished artefacts. It provides a very useful way of exploring the social complexity of how people experience ICTs beyond any simple idea of the benefits and uses of technology.

In conclusion, as ICTs become more a part of everyday life, we believe the stereotypical connection between technology and masculinity will focus less on male users and female nonusers, but will focus more accurately on the kinds of

uses there are and how those uses are articulated. We posit the technology-orientated male will be replaced, for example, by the sophisticated image and narrative of the open-source programmer, with all the superfluities of high technical expertise. Meanwhile, the technologically helpless female is interchangeable with representations of unsophisticated use or everyday uses of information and communication technologies.

REFERENCES

- Castells, M. (2000). Information technology and global capitalism. In W. Hutton & A. Giddens (Eds.), *On the edge: Living with global capitalism* (pp. 52-75). London: Jonathan Cape.
- Cawley, A., & Trench, B. (2004). *Current perspectives on the information society: Revisiting the future*. Dublin, Ireland: Information Society Commission. Retrieved from <http://www.isc.ie>
- Gates, W. (1995). *The road ahead*. New York: Penguin Books.
- Giddens, A. (1976). *New rules of sociological method*. New York: Basic Books.
- Gill, R., & Grint, K. (1995). The gender-technology relation: Contemporary theory and research. In K. Grint & R. Gill (Eds.), *The gender-technology relation, contemporary theory and research* (pp. 1-28). London: Taylor & Francis.
- Gray, A. (1992). *Video playtime: The gendering of leisure technology*. London: Routledge.
- Hartmann, M. (2003). *The Web generation: The (de)construction of users, morals and consumption*. Belgium: SMIT-VUB, Free University of Brussels.
- Hine, C. (2000). *Virtual ethnography*. London: Sage.
- Kelly, K. (1999). *New rules for the new economy: 10 ways the network is changing everything*. London: Fourth Estate.
- Lie, M. (1995). Technology and masculinity: The case of computer. *The European Journal of Women's Studies*, 2(3), 379-394.
- Lie, M., & Sørensen, K. H. (1996). Making technology our own: Domesticating technology into everyday life. In M. Lie & K. H. Sørensen (Eds.), *Making technology our own* (pp. 1-30). Oslo, Norway: Scandinavian University Press.
- Mayer, P. (1999). *Computer media and communication: A reader*. Oxford: Oxford University Press.
- Miller, D., & Slater, D. (2000). *The Internet: An ethnographic approach*. New York: Berg.
- Negroponte, N. (1995). *Being digital*. London: Hoddler & Stoughton.
- Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science*, 11(4), 404-428.
- Orlikowski, W. J., & Robey, D. (1991). Information technology and the structuring of organizations. *Information Systems Research*, 2(2), 143-169.
- Preston, P. (2001). *Reshaping communications, technologies, information and social change*. London: Sage.
- Silverstone, R., Hirsch, E., & Morley, D. (1994). Information and communication technologies and the moral economy of the household. In R. Silverstone & E. Hirsch (Eds.), *Consuming technologies: Media and information in domestic spaces* (pp. 15-31). London: Routledge.
- Spilker, H., & Sørensen, K. H. (2000). A ROM of one's own or a home for sharing? Designing the inclusion of women in multimedia. *New Media and Society*, 2(3), 268-285.

Vehviläinen, M. (2002). Teknologinen nationalismi [Technological nationalism]. In T. Gordon, K. Komulainen, & K. Lempiäinen (Eds.), *Suomi-neitonen, hei: Kansallisuuden sukupuoli*. Tampere, Finland: Vastapaino.

Walsham, G. (1995). The emergence of interpretivism in IS research. *Information Systems Research*, 6(4), 376-394.

Walsham, G. (2005). Development, global futures and IS research: A polemic. *Journal of Strategic Information Systems*, 14, 5-15.

Ward, K. (2003). *An ethnographic study of Internet consumption in Ireland: Between domesticity and public participation*. Ireland: COMTEC, Dublin City University.

Webster, F. (1995). *Theories of the information society*. London: Routledge.

Interviews

The interviews conducted in South Ostrobothnia, Finland. Names of the interviewees have been changed:

Heikki, interviewed June 2, 2003, by E.-R. Koivunen

Helena, interviewed June 2, 2003, by M.-K. Paakki

Leena, interviewed June 24, 2003, by M.-K. Paakki

Paula, interviewed July 16, 2003, by M.-K. Paakki

Pekka, interviewed July 16, 2003, by E.-R. Koivunen

Ville, interviewed June 25, 2003, by E.-R. Koivunen

APPENDIX

Two of the project members, researchers Koivunen and Paakki, collected the empirical material and interviewed the respondents in the summer of 2003. The interviews were conducted in a South Ostrobothian village in Finland. In the village, there are 400 inhabitants, a school, a shop, a bank, and a church. The interviewees are members of two extended families (see Figure 1).

Family 1 is comprised of the households of two brothers and their families living next to each other. The brothers, for whom we use the pseudonyms Heikki and Pekka, are both married and have young children. Heikki and Helena have two daughters, while Pekka and Paula have four daughters. In these families, all members use the computer and the Internet. We interviewed the brothers and their wives. These interviews took place at their homes.

Family 2 includes a grandmother, grandfather, father, mother Leena, and a 20-year-old son, Ville.

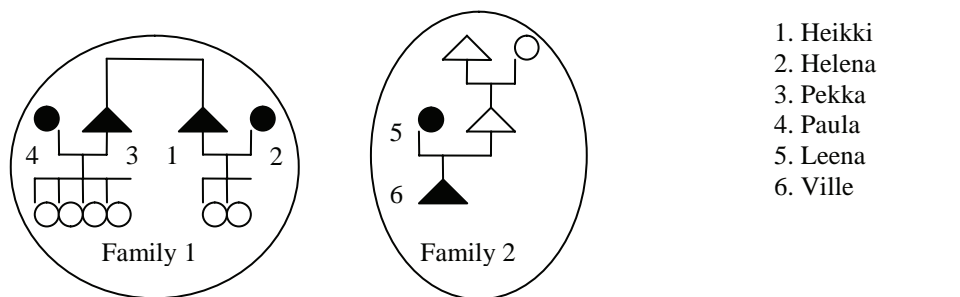
They all live on the family farm. From this family, we interviewed only the mother and the son, who are both known in the village as active and innovative users of ICTs. The other members of the family do not use the computer or Internet. Leena was interviewed at her workplace, which she called her second home, while Ville was interviewed at home.

KEY TERMS

Domestication: Domestication refers to the process whereby technological artefacts are fitted into the routines and practices of the everyday lives of users. It is a process whereby technologies are consumed within specific and localised contexts and become inscribed with meanings, while reproducing values and transforming relations.

Dominant Narratives: Dominant narratives are part of our shared cultural knowledge about standards, which we refer to in explaining our

Figure 1. The interviewees and their family relations



SYMBOLS

married couple

parents
children

interviewed not interviewed
man interviewed (filled triangle) not interviewed (open triangle)
woman interviewed (filled circle) not interviewed (open circle)

Articulating ICT Use Narratives in Everyday Life

acting, knowing, and thinking, and they are produced and reproduced in the discourses of everyday life.

Double Articulation: Double articulation refers to the concept that media lead double lives as both communication media and artefacts. Technologies are doubly articulated in the ways we need to address responses to particular texts or genres brought to us by the media and, on the other hand, the significance of media technologies themselves.

ICTs: Information and communication technologies such as televisions, telephones, the Internet, computers, and so forth.

Information Society: This concept is characterised by a new kind of information-led, service-oriented society that will replace the industrial-based model that had been dominant in the West in the 19th and 20th centuries. Information, and

those who know how to create, assemble, and disperse it, is deemed more valued than labour.

Objective: The objective is nonsituated, impersonal, and not dependent on or influenced by personal opinions or prejudices.

Subjective: The subjective is based on thoughts or feelings derived from individual experiences and personal interpretations.

ENDNOTES

- ¹ Those female commentators are Sherry Turkle, Esther Dyson, and Robin Mansell.
- ² Domestication here refers to the process of rendering new technologies as tame as they enter the domestic setting.
- ³ See Appendix for an extended account of the empirical data sample.

*This work was previously published in *Encyclopedia of Gender and Information Technology*, edited by E. Trauth, pp. 37-43, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).*

Chapter 5.9

ICT, CoLs, CoPs, and Virtual Communities

Antonio Cartelli
University of Cassino, Italy

INTRODUCTION

Every day, information and communication technologies (ICT) are extending their influence on knowing and transmitting knowledge. They act on humankind at different levels: the individual, the society, and the community/organization. The Internet more than other instruments in the past is changing human customs and knowledge strategies mostly due to the online information systems developed during last few years.

BACKGROUND

The experiences described below were from the author in cooperation with M. Palma (professor of Latin paleography) while working on special Web sites to be used in paleography for research and teaching. The Web sites were not e-learning platforms but were used as content management systems (CMS), learning management systems (LMS), computer-supported collaborative learn-

ing systems (CSCLS), and knowledge management systems (KMS).

The use of the above systems is based on the hypothesis the author shares with M. Palma: that ICT and especially the Internet cancelled the temporal gap existing between research and teaching time (at least in paleography). Due to the Internet, in fact, scientists can immediately publish the research results; it becomes, then, more and more difficult to separate the proposal of new scientific paradigms from their translation into educational and didactical materials.

Web Site “Didactical Materials” for Latin Paleography

In the Middle Ages different scripts were used for handwriting documents and their study is based on the analysis of charters and manuscripts. The main problem scholars and students have today is often the simple access to these materials due to security and preservation reasons. Furthermore, proceedings of conferences and meetings are

usually printed some years later and it is very difficult, if not impossible, for scholars, to report the meaning of a hypothesis or the relevance of a discovery to their students, contextually to their proposal.

To respond to the above problems, a Web site was planned to make available the following:

1. Didactical materials for a course on Latin paleography, that is, the plates reproducing the pages of manuscripts and the transcription of their texts.
2. Texts freely extracted and translated from printed or electronic documents, or made available from the authors, and collected in various sections: from codicology to cataloguing and preservation, and so forth.

It has to be noted that the experience of the didactical materials' Web site is mostly unique, not only for the systematic nature of the plates and for the presence of their transcriptions, but also for the documents reported among the texts; many of them are, in fact, papers concerning recent research topics, produced for special events (i.e., mainly conferences) and made available from the authors for didactical purposes.

The Web Site "Women and Written Culture in the Middle Ages"

The main aim of this dynamic Web site (Cartelli, Miglio, & Palma, 2001) was the systematization of the data emerging from the research while leading to an instrument helping scholars to find new elements for further studies.

Data appearing relevant to the scientific community were:

- For the Scribes: (a) the name of the woman as it appears in manuscripts, (b) her qualifications (i.e., if it is known whether she was a nun or a layperson), (c) the date or the period she belonged to (up to the 15th century)

- For the Manuscripts: (a) their shelf marks (i.e., town, library, and number of the manuscript), (b) the place and the country where they were written, (c) the date or the period they belong to, (d) the authors and titles of the texts, (e) the bibliography or its source of information.

Furthermore it appeared important to show for each woman the manuscript(s) she wrote and vice-versa, and if possible and available, at least an image of the copyist's hand.

The site has two separated sections: one being operated only by editors (to insert, modify, delete the data stored in the database), thus ensuring the scientific validity of the information reported; the other is at everyone's disposal to obtain the list of all women and manuscripts in the database, or to make queries concerning women and manuscripts with specific qualifications.

The Open Catalogue of Manuscripts and the Martyrology of Arpino

At the basis of the Open Catalogue of Manuscripts are the results of recent studies concerning the use of the Web for the publication of catalogues of manuscripts (Cartelli & Palma, 2003b). In its final structure, it is an information system devoted to the management of documentary information in ancient libraries and it is based on the use of the Internet and especially of the Web for managing and accessing data. It is composed of five sections: (a) the first one contains documents explaining the history of the library and of its manuscripts; (b) the bibliography ordered by shelf mark and, eventually, alphabetically and chronologically, is housed in the second section; (c) in the third section are the descriptions of the manuscripts; (d) the fourth section is devoted to the images of the highest number of manuscripts in the library (potentially all); (e) the fifth and last section consists of a communication subsystem granting the

easier acquisition, writing, and editing of texts (Cartelli & Palma, 2002).

In Italy the Malatestiana Library in Cesena, an ancient library founded in late 15th century decided to adopt the Open Catalogue for its 453 manuscripts and their catalogues and activated all the sections the author hypothesized for its structure.

On another hand the Martyrology of Arpino, as a single manuscript kept in the church devoted to Our Lady in Arpino (a small town in central Italy), had the suitable features for the creation of an Open Catalogue (Cartelli & Palma, 2003a) made by a single manuscript and a special site for it was carried out in the Faculty of Humanities.

The Bibliography of Beneventan Manuscripts

The BMB experience (Bibliografia dei Manoscritti Beneventani—Bibliography of Beneventan Manuscripts) started in 1992 with the main aim of collecting the quotations of Beneventan manuscripts (i.e., medieval books written in the South Italian national script) by means of a program called BIBMAN. In 1997, the first Web site was developed to make it faster and easier for scholars to download new bibliographic data (nearly monthly).

Recently many problems with the BIBMAN program resulted in a plan to carry out a new Web site: the BMB online (Cartelli & Palma, 2004). It is an information system where various people with permission can store the quotations of Beneventan manuscripts and it can be freely queried by general users. Persons entrusted with the task of collecting the quotations of Beneventan manuscripts are grouped into three categories:

1. contributors, who can write, modify, and delete bibliographic data for the materials assigned to them
2. scientific administrators, who can manage all data and write, modify, and certify biblio-

graphic materials (this last operation being done only once because certified records cannot be accessed for revision)

3. system administrator, who is allowed to do all operations including the modification or deletion of certified data

The access to certified bibliographic materials is possible according to different query pages: (a) by author, (b) by manuscript, (c) by contributor, (d) by one or more words or part of them concerning the title, location, or bibliographical abstract of a given publication.

It has to be noted that in the system are also implemented: (1) a closed communication subsystem made by an electronic blackboard guaranteeing an easy exchange of messages among contributors, (2) some special functions, available only to system administrator, for the production of the printed version of the yearly collected data.

ICT, COLS, COPS, AND VIRTUAL COMMUNITIES IN PALEOGRAPHY

The systems and Web sites described above were carried out by the author at different times but were suddenly introduced in everyday teaching and research work. The effects they produced are analyzed in what follows:

- The students attending the paleography course found the plates on the Web site of Didactical Materials (both for the analysis of the scripts and for training themselves in the transcription of the texts) very useful and were instantaneously led to the themes of most recent research studies and to the debates in the paleographic community. Furthermore, after a very short starting phase, during which people had to be repeatedly invited to submit materials for publishing on the Web site, the number of scholars who autonomously propose the publication of

their works is now growing. At last it has to be noted that many students in other Italian universities use the same materials and ask for explanations via e-mail, thus creating a virtual community on paleography studies.

- Many students not only used the materials reported in the Women Copyists Web site, but were also involved in the description of manuscripts and in the collection of the plates reproducing texts written from women (i.e., they learned to distinguish the different hands of women copyists and their way of writing manuscripts). With time the number of bibliographic notes increased from scholars all over the world. As a consequence the project of an information system which allowed people to autonomously manage the bibliographical data and an enhancement of the virtual community (it is also a community of practice) working on women copyists have been planned,
- Some students were involved in the description of manuscripts of the Malatestiana Library and accessed the communication subsystem of its Open Catalogue so that they could share with the subscribers of the newsgroup the texts they wrote. It has to be noted that the Malatestiana Library staff reports of an increasing number of scholars and students asking for access to the communication subsystem of the Open Catalogue and of a continuously growing number of reports and discussions concerning the manuscripts in the library. By comparing the above results with what is already known on CoPs and virtual communities, it seems that people involved in the Malatestiana Open Catalogue have all the typical features of those kinds of communities.
- The Martyrology of Arpino, on another hand, has been used for teaching as follows: (1) some make-up courses centered on it were

designed for students with gaps in their basic knowledge of History and Latin (i.e., the manuscript was used as a chronicle from 14th-16th century and the historical events reported there had a counterpart in relevant events of that period); (2) students were directly involved in the production of the Web pages of the Martyrology site (with the acquisition and editing of texts and images), in the description of the manuscript and in the transcription of the text. As a result, the students involved in the digitization of the pages of the Martyrology and in the editing of its texts had fewer problems than their friends in learning computer use and there were no cases of rejection of its use as often happened in institutional computing courses in the Faculty.

- Many students, after having attended the basic courses on cataloguing, were asked to become contributors for BMB online and to produce bibliographic materials. The discussions they had with administrators, professors, and among themselves, the use they made of the electronic blackboard and of the e-mail services for the exchange of messages, and last but not least, the chance of working in little groups on the same problems helped them very much in the acquisition of the knowledge and development of the skills they would need (as paleographers) in their everyday work.

CONCLUSION

In the author's opinion the effects induced on knowledge construction/sharing processes can be analyzed from three different points of view:

1. The first one concerns the communities of students involved in the experiences described above and what we know on CoLs. It has to be noted that the groups of

students involved in the experiences (a few elements each time and in the best case no more than 19 subjects) really had the features of CoLs or FCL as described by Brown and Campione (1996). Furthermore the students were satisfied with the new approach to the discipline and got better results in their exams, that is, they had better scores and developed better skills than their counterparts in traditional courses (as it was recognized by the professors). Some new effects never observed before were also detected in the following skills: working in a group (in traditional courses it is a very rare experience), easier facing of complex tasks (thanks to the help each student could have from their colleagues), and raising of the individuals' peculiarities within the community. The ICT also had a great role in all experiences because they helped students in experimenting a metacognitive environment and cognitive apprenticeship strategies, involved them in the discussion and evaluation of the procedures they took part in, and let them experiment with meaningful learning (Varisco, 2002).

2. The second point of view is the one of the communities of practice (CoPs). But is it suitable to look at groups of students as CoPs? With respect to corresponding communities in organizations and corporations, which are autonomously created and have no hierarchies, the presence of a hierarchical structure has to be noted (professors and their collaborators organize the work, suggest what to do, support everyday activity, etc.). Further differences between groups of students and CoPs are (a) community skills are mostly induced/transmitted by professors and not freely shared among individuals, (b) community memory is not made of the repositories of expertise but it is made of the data in the Web pages and in the databases (i.e., it is mostly represented

by the scientific knowledge available from sites browsing and database querying).

Nevertheless, in the author's opinion, the answer to the above question must be affirmative because (a) there is a common task shared among all community members, (b) there is a reciprocal commitment regulating interactions and sharing of experiences among the subjects in the community, (c) there is a shared repertoire of knowledge, instruments and methods by means of which common knowledge is preserved and transmitted (Wenger, 1998).

3. The third and last point of view is the one of virtual communities. It has to be noted that many scholars cooperated in the various projects via the Internet (by sending papers or other texts for the Didactic Materials, by intervening in the discussion groups of the Open Catalogue, or by compiling bibliographic cards as contributors of the BMB online) and often they did not know people carrying out those projects or other people working on them. Nonetheless their contributions were very important for students and for the construction of the community memory. In the author's opinion it can be deduced, at least in the case of paleography, that virtual communities can act as CoPs without needing presence meetings, thus contradicting the third law of Denning (2000). From what has been reported until now, it seems that the overlapping of virtual communities and CoPs features are possible if people joining them have the same highly specialized skills and agree on the target to be hit (also if they do not know one another).

FUTURE TRENDS

From what has been said until now some hints for future research seem possible:

1. If, as emerged above, the contribution to problems analysis and solution coming from different kinds of communities seem to produce better results with respect to the ones coming from individuals or single types of communities, further research has to be carried out on the relationships existing among them and on the consequences that the presence of the same individuals in more than a type of community has on knowledge construction processes.
2. If, at least in the case of paleography, the presence of a virtual community contributes in increasing scientific knowledge construction (and not only teaching), other best practices have to be encouraged and the opportunity for academic and research institutions of making stable and durable their intervention in problems analysis and solution has to be analyzed.

REFERENCES

Brown, A. L., & Campione, J. (1996). Psychological theory and the design of innovative learning environments: On procedure, principles and systems. In L. Schaube & R. Glaser (Eds.), *Innovation in learning* (pp. 289-375). Mahwah, NJ: Lawrence Erlbaum.

Cartelli, A., Miglio, L., & Palma, M. (2001). New technologies and new paradigms in historical research. *Informing Science (the International Journal of an Emerging Discipline)*, 4(2), 61-66.

Cartelli, A., & Palma, M. (2002). Towards the project of an Open Catalogue of Manuscripts. *Proceedings of the 2002 Informing Science + IT Education Conference*, Cork, Ireland.

Cartelli, A., & Palma, M. (2003a). Il Martirologio di Arpino come oggetto di ricerca e strumento didattico. *Tecnologie Didattiche*, 28(1), 65-72.

Cartelli, A., & Palma, M. (2003b). The Open Catalogue of Manuscripts between paleographic research and didactic application. In M. Khosrow-Pour (Ed.), *Proceedings of the IRMA 2003 Conference "Information Technology & Organization: Trends, Issues, Challenges and Solutions"* (pp. 51-54). Hershey, PA: Idea Group Publishing.

Cartelli, A., & Palma, M. (2004). BMB on line: An information system for paleographic and didactic research. In M. Khosrow-Pour (Ed.), *Proceedings of the IRMA 2004 Conference "Innovation Through Information Technology"* (pp. 45-47). Hershey, PA: Idea Group Publishing.

Denning, S. (2000). *The springboard: How story telling ignites action in knowledge-era organizations*. Boston: Butterworth-Heinemann.

Varisco, B. M. (2002). *Costruttivismo socio-culturale. Genesi filosofiche, sviluppi psico-pedagogici, applicazioni didattiche*. Rome: Carocci.

Wenger, E. (1998). *Communities of practice. Learning, meaning and identity*. Cambridge, UK: Cambridge University Press.

KEY TERMS

Cognitive Apprenticeship: It is originated from traditional apprenticeship, which has the following well-known features: modeling, coaching, scaffolding, and fading. When it is applied to educational and research situations, the new features of articulation, reflection, and exploration must be added to the ones above.

Community of Learners (CoL): It is a community of students, teachers, tutors, and experts marked by the presence of the following elements: (1) multiple ZPDs (the zones of proximal development of the subjects in the CoL); (2) legitimated peripheral participation (the respect of the differences and peculiarities existing among the various subjects in the community); (3) distrib-

uted expertise; (4) reciprocal teaching and peer tutoring; (5) various scaffoldings; (6) cognitive apprenticeship; and (7) metacognition.

Community of Practice (CoP): It is a community of individuals having the following elements in common: a) a joint enterprise, as understood and continually renegotiated by its members; b) a mutual engagement binding members together into a social entity; and c) a shared repertoire of communal resources (routines, sensibilities, artifacts, vocabulary, etc.) that members developed over time.

Information System: It is the set of all human and mechanical resources needed for acquisition, storing, retrieving, and management of the vital data of a given system. With human resources are usually intended both the individuals involved in the use of the system and the procedures they have to carry out. With mechanical resources have to be intended both the hardware and software instruments to be used for the management of data.

Online Database: It is a special Web site interfaced with a database (usually relational). Special languages have been developed to make easier for programmers the creation of Web pages for the updating and querying of databases.

Paleography: It is the discipline studying the ancient script from 9th to 15th centuries (until first printing of documents). Dating and localizing a medieval script, as well as identifying a scribe, are the paleographer's essential tasks on which all historical speculations are founded.

Virtual Community: It extends the sociological definition of community by including the groups of subjects who can never meet themselves or physically know one another but who use the Internet for their interpersonal communication, that is, for sharing information, building new knowledge, and socially interacting.

This work was previously published in Encyclopedia of Virtual Communities and Technologies, edited by S. Dasgupta, pp. 248-252, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 5.10

“You’re In My World Now.”™ Ownership and Access in the Proprietary Community of an MMOG¹

Sal Humphreys

Queensland University of Technology, Australia

ABSTRACT

This chapter considers how the interactive and social nature of massively multiplayer online games (MMOGs) presents challenges to systems of organisation, control, and regulation used for more conventional media products. It examines how the interactive structures of games cast players as producers of content, not merely consumers. This productive role creates a distributed production network that challenges the ideas of authorship which underpin copyright and intellectual property. The role of the publishers is shown to encompass community as well as intellectual property management. The communities generated within these games are a key source of economic benefit to the publishers. The contract that determines the conditions of access and the forms of governance inside proprietary worlds is considered in light of this newly intensified relationship between commerce and community. Questions are raised about the accountability of

publishers, the role of the market, and the state in determining conditions of access.

INTRODUCTION

MMOGs are a form of new media that challenge, and will reshape, many of the conventional practices associated with media. These intensely social games, in which hundreds of thousands of players create communities and content with each other, exceed many boundaries associated with the organisation, regulation, and control of media. In particular players help constitute these games through their production of game play, derivative works, secondary economies, and strong social networks. This disrupts some of the key foundations underlying other media. For instance, productive players challenge both the institutions of intellectual property and discourses of consumer rights. The creation of ongoing communities inside proprietary worlds raises

issues about the terms of access and the recourse to justice such communities have. The role that contract law takes in determining the rights of players has implications for a much broader set of online applications which can be defined as social softwares.

In this chapter I will explore the structure of MMOGs, looking at how the emergent quality of these games necessarily means that authorship resides in part with the players. The ceding of some control to the players leads to contention and disagreement. Dialogue between developers, publishers, and player communities indicates an ongoing struggle for power in some areas. I will explore how the rise of active fan and mod communities (players who modify games in various ways or create new artwork and other content for games) has led to the development of new business models, where publishers seek to harness the innovative and creative capacities of players. Who should own the results of players' labours, who can exploit the intellectual property in fan-created items is very much dependent on the type of business model being employed by the publisher. These distributed production networks present some major challenges for all stakeholders in the process.

However, fan-based creation of new game objects is not the key focus of this chapter. The even more interesting feature of MMOGs, and the one that presents an even greater challenge to current practices, is the value of the social networks. MMOGs rely on subscription-based models for revenue, and as such, the ongoing and long-term involvement of players is key to their success. The ways in which social networks are facilitated through the structures of the games are explored, and it becomes clear that the commercial success of these games is very much bound up in the affective investments of players. The stronger the social ties within the game, the longer the player will subscribe. This intensified relationship between commerce and culture raises interesting and contentious issues.

If players conduct large parts of their social lives inside the proprietary spaces of game worlds, the terms of access to those spaces become very important. Access is not only to the content created by the developer, but to the other players and to their own electronic identities. The end user licence agreements (EULA) and terms of service (TOS) to many games are one-sided contracts that work to the benefit of the publishers. As managers of intellectual property, publishers are used to dictating terms which work to the benefit of themselves and the authors of the works they are managing. With social applications such as MMOGs however, they have become managers not only of intellectual property but of communities as well. The level of accountability publishers have with regard to their player communities is shown to be very low. Decisions to ban players and deny them access to their communities and their own electronic identities are made without any requirement of a neutral point of view or fairness. With no appeal mechanisms in place, the contracts institute an unseemly high level of power for the publisher over players' affective connections and identities.

I argue in this chapter that commonly used neo-liberal discourses of the empowered consumer, which hold that players, as consumers, have the power to exit from the product if they find the management of the service unfair, ignore players' role as producers, as well as the high cost of exit. I also argue that understanding MMOGs in terms of more conventional media properties, and thus in terms of intellectual property, ignores the role of affect in the production of value in MMOGs.

Finally, I look at the ways in which the unruly player populations challenge and circumvent the various formal and legal restrictions imposed by publishers. Player productivity and agency may well lead to individual experiences of empowerment through these games. However the terms of access ultimately rest with the publisher and as such represent the power to terminate such experiences of connection and empowerment.

Thus the contracts which determine the terms of access are set to become major areas of contention and dispute.

MMOGS

Computer games are an immensely successful form of media, rivalling Hollywood box office in industry annual turnover (Newman, 2004, p. 3; Prensky, 2001) and achieving a high level of penetration into the entertainment market in many countries. In the U.S., sales figures of video and computer games in 2003 were \$7 billion (Entertainment Software Association, 2004). Comparably high figures apply in the UK, Europe, South Korea (where broadband accessibility has enabled network play); and increasingly, China and other Asian markets. Unlike other, more narrative based media, computer games exploit the cybernetic feedback loops available through the technology to deliver a form of content that allows the user to do things with the text. Computer games of all types establish a relationship between the player and the game that is different from the conventional narrative text's construction of the relationship between reader and text. Because of the goal-driven nature of games, the emotional engagement with the text comes, not from the engagement with characters and events such as occurs in conventional narratives, but because the player is an actor themselves. The engagement comes because the player is the performer, and the game evaluates the performance (Juul, 2001). Crucially the game can assess a player's performance and adapt according to that performance. This means the game can present greater challenges to the player as their skill improves (typically implemented through a levels-based structure). This adaptability is often key to a game's success. It represents responsiveness to the player's actions or performance. How games work as texts is very different from conventional narrative texts.

What is implicated in these observations is the issue of control. In a conventional narrative, although the author is not in control of the many interpretations of the text that will occur, he or she is in control of the crafting; the structure; the order of events; the building of tension; the withholding and revelation of information; and so on (Cameron, 1995; Ryan, 2001). In a game some of this control is ceded to the players, who determine to a greater or lesser extent what will happen next. Control for the developer is asserted through the structures of rules, the coding of object behaviours, and the parameters of the game world they create. Players will construct their own trajectories and game play with more or less freedom depending on the tightness of the control imposed by the developer. But the power dynamic in the dialogue between player and developer is quite different from the negotiations between author and readers of a more conventional narrative text.

MMOGs, as a subgenre of the computer games field, represent a particularly interesting case of the negotiation for control of the text. MMOGs can be cast as emergent texts. Unlike some often single-player games which dictate narrow pathways through a game along a particular trajectory, MMOGs are emergent—the rules and parameters of the games are set, and to some extent shape the possible game play—but the direction of play and the events that unfold are largely determined by the players themselves.

The more this quality of emergence is incorporated into media environments, the more the issues of control and authorship will arise. What is implied in the practice of interactivity, in the construction of emergent environments, is that the users will be creators in a distributed production network. As Leadbeater (2000) has pointed out:

The more knowledge-intensive products become, the more consumers will have to be involved in completing their production, to tailor the product to their needs ... In a knowledge driven economy, consuming will become more a relationship than

an act ... with the consumer as the last worker on the production line ... (pp. 32-33)

The importance of this consumer creativity cannot be underestimated. A production shared between developers and players redefines the concept of authorship and this becomes problematic when dealing with conventional copyright and intellectual property laws which mobilise idealist notions of Romantic authorship. How can such a system cope with distributed production spread across not only paid workers in a development house, but also what have traditionally been thought of as consumers—the players. The more productive the players become, the more stretched these systems of understanding and regulating media will be (Humphreys, 2005b).

MMOGs are persistent worlds which allow players to meet and play inside shared environments online. Although console games are increasingly incorporating network play into their capacities, initial MMOGs have been PC-based Internet games. In South Korea, where broadband penetration is high, and where PC Baangs (Internet gaming cafés) are very popular, MMOGs have attracted large populations of players. Lineage was the most successful of the initial raft of MMOGs, with over 3 million subscribers in South Korea and a further 1 million in Taiwan (Herz, 2002a). In the Western world, EverQuest was for many years the most successful, at one time holding a subscriber base of 450,000. Other notable early Western MMOGs were Ultima Online (which was the first MMOG to really develop a large and persistent player base) and Star Wars Galaxies. More recently the publisher Blizzard’s World of Warcraft achieved figures of over 1 million subscribers in July 2005 (Blizzard Entertainment, 2005).

Players tend to be dedicated, and given the complexity of game play in most MMOGs, casual play is difficult. Surveys carried out by Kline and Arlidge (2002) and Yee (2001) put the average playing time of EverQuest players between 20-24

hours per week, with “hardcore” players spending up to 40 hours or more a week inside the game. It is the role of these players in producing value for the games that I want to examine now.

REDEFINING CONTENT IN AN INTERACTIVE ENVIRONMENT

Many computer games have generated very active communities of fans who create their own artwork and objects to import into their game and to share with other players. These mod (after modification) communities of fans bear some resemblance to the fan fiction writer communities that have sprung up around films and television series (Hills, 2002; Jenkins, 1992). They create new skins (artwork including customised clothing) for their characters or avatars, new levels (environments) to play in and sometimes new AI (artificial intelligence characters to play against) for importing into their games. Occasionally players create entirely new games using the game engine from a favourite game. The very successful game Counter-Strike is the product of a team of hardcore players who collaborated to make a new game using the Half-Life game engine. Counter-Strike has won numerous player and industry awards. Some developers and publishers have been quick to harness this creative and often innovative activity, releasing tools for players to use to create extra content for games and facilitating the uploading and swapping of such content between players (Banks, 2002; Herz, 2002b).

Indeed some companies have moved to a business model where they release a platform and rely on players to create most of the artwork/content. The role of the developer and publisher becomes one of service provider and community facilitator (Humphreys, Fitzgerald, Banks, & Suzor, 2005). Auran for instance, the developer and publisher of a train simulation game, Trainz, relies on fan groups of dedicated train enthusiasts around the

world who create trains and tracks modelled on their local railway systems. Thus there are content developer groups for Trainz in the UK, the U.S., Sweden, Australia, and numerous other countries, all keen to create detailed representations of their favourite local trains and tracks. These fans swap their content and their knowledge on how to build them—sometimes for free and sometimes for money, depending on the motivations of the player-creator. Whether player-creators are allowed to own the intellectual property in their own creations depends on the business model and attitude of the publisher. Auran allows players to own their IP and to trade their content commercially. Other publishers claim all IP in the player-created content and disallow commercialisation of it by the players. The Sims is another example of a game heavily reliant on player-created content (up to 90% of content is created by players according to Herz [2002b]), but Electronic Arts, the publisher, does not allow commercial trading of content created for the game by players.

Many of the MMOGs do not have the facility that allows players to upload their own objects and artwork into the game. There are some straightforward practical reasons for this. In a persistent dynamic world, which may host up to 10,000 players on a single server, and run 50 servers or more, ensuring the smooth technical running of a server becomes much more difficult if new, player-created objects need to be constantly integrated into the world, not only for that player but for every other player on that server as well. Second Life, which is a persistent world (but not a game—it is an environment but lacks the goals and built-in rewards and rules of a game), allows users to create their own objects in the world. This is the exception rather than the rule for persistent virtual worlds. Second Life TOS are such that the players own the intellectual property in their creations. Linden Labs, the publishers, have implemented Creative Commons licencing for their users in an effort to enable smooth interchange

of objects between players. Linden Labs are very clear that they see the main source of innovation and creativity in their world as emanating from the users (Ondrejka, 2004).

Whether players and users are given the right to own the in-game objects, and whether the objects are created by the players or the developers, a secondary market has sprung up on the Internet in which these items are traded for real money (Castronova, 2001; Dibbel, 2004). Their status as property is not really under dispute any longer. Hunter and Lastowka (2004) assert in relation to games and game items that “...no obvious reason exists prohibiting the recognition of legal interests in intangible virtual properties” (p. 294). The issue then becomes what kind of access or exclusions are agreed to in relation to those objects by users/players and developers/publishers through TOS or EULAs. One option is for the publishers to claim all rights of ownership in the objects, and the rights to exploit the value in those objects. Implementing Creative Commons licencing is another. Or, as Benkler (2004) suggests, a further option is to implement the GNU Free Documentation licencing (the form of open source licencing adopted by wikipedia) that effectively creates no exclusions at all.

What I want to address now is the idea that content is more than the coded objects and artwork in these environments. The idea that Benkler (2004) raises, which I want to explore further here, is that it is not the digital objects that we should be focusing on. Referring to these online virtual worlds Benkler says: “... it is a form of social software, mediating a social relation among individuals...” (2004, p. 1). Benkler’s attempt to shift the debate away from who should own the virtual spoon or sword offers an opportunity to begin to understand online interactive environments as more than intellectual property.

When a player logs into an MMOG such as EverQuest what he or she engages with is much more than what the developer has created. The

world and the objects in it have indeed been coded by the developers. But game play is made not purely through engagement with these things. Game play happens through engaging with both the world and its objects and with other players. Solo play is not much fun in these games, although it is possible. However MMOGs tend to be structured to actively reward social play and discourage solo play. EverQuest for instance is not a game where you can fight other players (apart from on a dedicated player-versus-player server). The idea is to team up with other people and fight computer generated opponents. Most computer generated opponents after the early levels of the game are impossible to kill through solo play. The game rules and the game engine code both work to structure social play as the norm. The establishment of in-game communities is an integral part of a games' success.

Thus, while some of the engagement for a player may come from mastering skills inside the game, to a greater or lesser extent, the other source of engagement comes from interacting with other players. What constitutes content in the game is only partially created by the developer. Even in games where players cannot make their own objects for the game, they are still creating game play and content that other players engage with. There are a number of implications that arise from thinking about content in this way.

Firstly, it requires rethinking the model of production from the more conventional linear structure: a chain of events that begins with an author (or team of authors), who create and finish a text, which is published and distributed by a publisher to an audience under particular conditions of copyright. The MMOG product is not finished by the author. It continues to develop after publication. Furthermore, after publication the content is created by both the paid developers and the unpaid labour of the players. Rather than linear, the production model is recursive and networked. Rather than a single author (or

developer team known as author) there are multiple authors.

Thus, secondly, a networked or distributed production model brings into question the idealist conception of the romantic author upon which much copyright is based. How does intellectual property law articulate with collaborative social production? Is it an appropriate form of law to be applied in this context? The complexity of intersecting interests and rights in an environment that embodies social as well as property elements, and production as well as distribution issues, raises serious challenges to the paradigm of intellectual property. In a proprietary environment the implication is that in-game communities are owned and controlled by publishers. Rather than accepting the key terms of the debate, which tend towards arguments about who should own the intellectual property in particular works, it may be more pertinent to ask: Should some things be owned at all?

These are issues that have been explored in relation to indigenous, oral, and folklore cultures which have had to interface with economies based on individual property rights. Solutions for protecting the collectively held rights of those cultures in such contexts have tended to entail the introduction of new mechanisms (and displacement of old ones) for understanding them as property. But when social relations and processes become subject to a property regime they are reified—what was fluid becomes fixed, what was process becomes a thing, a commodity.

Coombe points to the ways in which copyright or IP law freezes:

... into categories what Native peoples find flowing in relationships that do not separate texts from ongoing creativity production, or ongoing creativity from social relationships ... (Coombe, quoted in Smiers, 2002, p.128)

Engagements with property law produce particular effects and kinds of truths about the

medium in question. Invoking property law can preclude other understandings and shape practices in particular ways.

In current contexts, it seems almost inevitable that intellectual property should be the lens through which this multi-user online medium is viewed. Intellectual property shapes the institutional practices surrounding it. But as Frow (2000) points out, the teleological assumptions that accompany arguments of inevitability need not be accepted. Institutional practices (for instance those of the publishing industries) are the result of a historic series of strategic moves made by the stakeholders and represent the enactment of particular power relations. These can be countered in equally specific and strategic ways. The framing of all issues pertaining to this area as property issues closes down other debates that might be had. As Coombe (2003; glossing an argument put forward by Vaidhyanathan) suggests:

... once all questions of authorship, originality, use, and access to ideas and expressions become framed in terms of property rights, discussion simply seems to end and maximum protection seems ordained; how can one argue in favour of theft? (p. 3)

If one looks at what constitutes content in an MMOG environment and understands it as being social interactions as well as bits and bytes of code, then it seems that questions about authorship and property may not be the right questions to be asking. Thus I want to turn now to the role of affect in producing value, and the issues raised by these new forms of interconnections between commerce and culture.

THE VALUE OF SOCIAL NETWORKS

Most MMOGs run as subscription-based games. As such, they rely on players having a sustained

interest in the game. Single player games more often involve a point-of-sale interaction between the publisher and the player. The player engages with the game until they have “cracked” it—mastered it—and then moves on to the next game. MMOGs do not have an end. Players may engage with an MMOG for upwards of 5 years. While the content supplied by the developer and publisher may be one of the reasons for this extended engagement, the key reason will be the strength of the social ties a player develops within the game. The stronger the ties, the longer the engagement, and the longer the monthly subscription rolls in for the publisher. The commercial value of the game is thus very much linked to the social networks generated within the game. This intensified relationship between commerce and culture is one which brings up interesting challenges and issues for both businesses and players.

Developers design their games to reward social play and discourage solo play. While the quality of emergence ensures they cannot predict with total certainty how a game community will unfold, they can structure into the rules and parameters of the game environment affordances which encourage social engagement. For instance, rewards may be greater when slaying a computer generated opponent (mob) in a full group than when slaying it solo. Some higher level mobs may be impossible to kill without a group. In games such as EverQuest slaying a higher level mob can require a raid of several hours and up to 70 players. The ability to organise a group of 70 players to be in one place and fight cooperatively against a joint opponent demands a strong, established network of social contacts as much as it implies strategic and fighting skills.

Most MMOGs offer some kind of infrastructure that allows people to form guilds, or clans—ongoing social groups—that can create the basis for networks that persist over time. Such structures might include: chat channels that allow easy communication between group members, even when not colocated in the game;

tags that identify players publicly as belonging to a particular group; locations within the game that "belong" to the group and where they can meet; tools for creating distinctive group emblems; and so on. These structures do not necessarily mandate the kind of social relations which are built, they more facilitate the building of ties.

My own research in EverQuest showed that guilds ranged in type from the ultra competitive, efficient, and dedicated über guilds that expected their members to raid five or six nights a week for four or five hours a night, to more "family" oriented guilds which focussed less on ultra high achievement and more on friendly, helpful social interaction. I interviewed one player who patiently worked his way through an 8 month admission process, attending five or six raids a week, to get into what he considered to be the most elite guild on his server. On the other hand, one guild I joined and stayed with for several years seemed to run more like a soap opera. Friendships and romantic liaisons were formed and broken; in-guild marriages celebrated; alliances with other guilds made and broken; bouts of group petulance and mass sulking were followed by an exodus of half the guild; recruitment drives were mounted; and various other ebbs and flows of goodwill and rancour kept the members engaged and active. The sometimes repetitive game play, which some of the players had mastered years ago, was made fun again by the social engagements required to pursue it. Raids could be completely absorbing; requiring concentration; coordination of players and groups; and skills on the part of individuals. They could result in triumphant teamwork or abysmal failure and "total mass wipeouts," but as one player told me, you could bond with your group better if you had experienced adversity and obliteration together.

Given the amount of time many of the players spend inside MMOGs it seems clear that at least some are conducting their social lives within the game worlds. They are forming enduring relationships of one kind or another with other players.

Sometimes there is a crossover between online and off-line relationships, with players who know each other off-line playing together inside the game. Sometimes players meet off-line having initially met online. As such, the communities within the game can be seen to exceed the boundaries of the game. But on the whole, the communities conduct their main activities within the proprietary spaces of the publisher.

TERMS OF ACCESS

6. We may terminate this Agreement (including your Software license and your Account) and/or suspend your Account immediately and without notice if you breach this Agreement or repeatedly infringe any third party intellectual property rights, or if we are unable to verify or authenticate any information you provide to us, or upon gameplay, chat or any player activity whatsoever which we, in our sole discretion, determine is inappropriate and/or in violation of the spirit of the Game as set forth in the Game player rules of conduct, which are posted at a hotlink at www.everquestlive.com. (extract from the EverQuest EULA, emphasis added. Sony Online Entertainment, 2005)

The previous paragraph is taken from the EverQuest EULA that all players click through each time they log on. The agreement is some seven pages long, and if the player wants to understand some of the terms they must consult the EverQuest Web site (for instance the Rules of Conduct they agree to in the EULA are only found on the Web site, and consist of a further eight pages of text). It seems doubtful that many players read through the entire document. The contract is not negotiable. It is a manifestly one-sided contract which works in favour of the publisher and to the detriment of the players. Its terms may be changed without notice or negotiation at any time, it lays claim

to all player created content, and it allows the publisher to disclose information about players to government agencies and other private entities at its own discretion.

The EULA represents the point where contract law intersects with a number of other areas of law and renegotiates the boundaries. The right to determine what conditions of governance will exist in a particular game world are premised on ownership of that world by the publisher or developer. Taylor (2002) has noted:

... we increasingly live in a world in which opting out of technological systems is becoming more and more difficult ... and yet participation within them pushes us to accept structures we might oppose. (p. 233)

With the advent of online virtual worlds, we see an increase in the number of people conducting their community life and social relationships within proprietary spaces. The publishers wield power over players through both intellectual property and contract law. The power they exert has the capacity to limit the access people have to their own electronic identities and their communities. This power is based on, as Hardt and Negri (2000) point out, an increasingly abstracted concept of private property, coupled with contract law which is able to reset the terms of engagement between the parties. Contracts are often able to get individuals to waive their rights, and courts are increasingly allowing this to occur.

It is worthwhile highlighting here how contract law can individualise an arrangement, and thus override the collective rights that may be protected by law focused on a more “universal” public good. However, as parts of our lives are increasingly conducted in proprietary spaces, those spaces take on the characteristics of a public commons, and the role of the publisher begins to resemble that of a state. If the publisher is to usurp the state and its powers by redefining law through private contracts, perhaps it is time for the “real” state

to intervene and regulate what the terms of those contracts might be. Leaving this regulation to the marketplace is not an adequate solution, given the lack of real interest the marketplace has in citizen rights, justice, or equality.

The value of affect, of social and emotional investment and its relationship to economics is not easily articulated. Developers and publishers know that the social relationships and the emotional investments of players are the key to a successful MMOG. Businesses know about and utilise affect and cultural production as part of their economic strategies (Jarrett, 2003). Communities and social networks can create “site stickiness” on the Internet. Brand loyalty is a result of an affective process of creating and harnessing desire in consumers. The economic value of affect in the networked, knowledge economy is huge. The intangible nature of affect makes its commodification hard to measure. In a discussion of intellectual property in this context, affect is often ignored or erased—it has no place in a discourse of property. However, rather than ignore it, it may be time to broaden the range of discussion that occurs around interactive media products to encompass the role of affect. Does utilising affect for commercial gain come with any obligations or systems of accountability?

The creation of subscription-based virtual game worlds has generated the creation of communities. How are these communities to be managed? Do game participants hold all the rights of an ordinary off-line citizen—the right to the same protections and freedoms? Is a publisher under any obligation to treat the game world community fairly? For instance, in the EULA for EverQuest, cited previously, Sony Online Entertainment (SOE) reserves the right to ban players’ accounts (and therefore access to the game) on a number of grounds, including if the player plays “against the spirit of the game” (SOE, 2005). Such a catchall term in effect gives SOE the right to terminate the service for pretty much any reason it wants. There is no system for appealing such a decision.

This is the case with many other games and online environments, including various AOL, EA, and MSN services.

[I]t is disturbing to learn that online intermediaries (the companies who create online spaces—currently, games, but in the future, private internets) now have “ownership” of online identities. These providers may not be very accountable or transparent, and their rules may be effectively unreviewable by any terrestrial court or legislature. This means online intermediaries will be handing out “law”, whether we like it or not. Online intermediaries are a different source of law than those we are used to (such as courts and legislatures). (Crawford, 2004, p. 219)

Although it is clear that publishers need to be able to ban players from their games if they are “griefing” other players (cheating or being outrageously disruptive and antisocial)—there is no guarantee that all players operate with the same understanding of griefing (Foo, 2004) or that publisher decisions on this will be fair or right.

A private online intermediary has no particular legal requirement to be neutral as to viewpoints or actions of users. Courts will defer to extraordinarily broad (and ever-changing) terms of service for these online worlds. So the law of identity online is private, contractual law. The use of force online—the removal of identity—has been handed over to private parties. (Crawford, 2004, p. 221)

In current neo-liberal discourses of the empowered consumer in the marketplace, the consumer is seen as endowed with agency and the ability to make choices between products. If a player does not like the style of governance in a game they should change games. To a certain extent this is possible. However the role of affect comes into play here in significant ways. As discussed, players create communities within MMOGs. This entails

often significant investments of time and affect. And once embedded into a community, once many of a players’ friends are to be found within a game, then the cost of leaving the game is very high. Building friendships is a time-consuming process. Accruing social status, constructing networks, building reputations, are all activities that players invest time and affect in. The high switching costs for the player mean they are not free agents, able to move through the market at will. Changing games is not like changing your brand of jeans. Their agency and mobility is constrained by the affective elements of their investment in the game. And let us be completely clear about the fact that the investment of the players in this way is directly, economically beneficial to the publishers. It is the networks and communities that keep players’ subscriptions coming in year after year.

There are two key things of interest here. The first is that the affective and time investments of players create part of the content of the game—they are co-creators of the game with the paid developers. As such, it is limiting to conceptualise players as consumers. They not only consume, they also produce. As what they produce gives them a sense of ownership in the game (and at the very least a sense that they own their own identities online), and constrains to some extent their ability to leave, a discourse of consumerism which locates their power as residing in their exit power, fails to adequately encompass what is at stake. In fact it offers a very diminished position of power to the players. Thus the discourse of the players as consumers erases their role as producers. And we should not fail to notice that their productivity is very profitable to the publishers.

Second, because affect and social networks and communities are intangible, and not properly thought of as property, they are erased from discourses which frame these media products as intellectual property like any other media property. Interactivity and networking—the two key aspects that differentiate new media from more

conventional media thus raise serious challenges to such discourses. These characteristics highlight that in a new media environment, with actively productive users, what is produced bears little resemblance to the other products dealt with by intellectual property law. Not only is the process of production no longer linear, the authorship multiple, and the product never "fixed" like a conventional text, but the nature of networked, collaborative environments is such that communities and social relations are central to the product. The legal rights of people participating in proprietary worlds accessed through contracts need to be considered. The terms of the contracts currently are manifestly one-sided and seem to diminish participants' access to administrative justice at the very least.

THE CHAOTIC UNRULINESS OF PLAYERS

The previous discussion deals with the formal and legal structures associated with MMOGs. But as with any emergent and social environment, the actual practices of the players and the publishers differs somewhat from such formal mechanisms of control. As with any community, online or off-line, proprietary, public or private, behavioural norms are established and policed by the participants as much as by an outside body or institution.

Communities can be to a greater or lesser extent self-governing. Publishers cannot wholly determine every norm within the game through code and customer service policing. Any social group will have ways of establishing and policing community norms. Regulation of conduct can be enforced through a variety of social mechanisms. The public shaming of cheats—shouting the name of "loot stealers" through the zone for instance—can be a means of enforcing certain norms. Group norms vary across the different communities found within the same game. Some guilds are very hierarchical, others more like a

drunken party of equals. Some work towards cohesive team actions, some run like a primetime soap opera. Some groups may establish role-playing norms and others ridicule them. Clashes between groups with differing norms may cause more widespread discontent within the game.

Publishers have a great deal of latitude in how they choose to intervene in the communities. Decision making with regard to community governance can rest to a great extent with the players if that is how the game is designed. The MMOG *A Tale in the Desert* was an example of a game where players were able to suggest and vote on in-game rules and government, up to a point. The balance of power can shift according to the game, but to some extent will be reliant on the nature of the game itself and whether, for instance, having player populations vote on rule making in the game actually fits with the themes of the game.

In a series of interviews conducted in 2003, I encountered a variety of attitudes towards the role and conduct of customer service among players. Some were adamant they would rather seek their own solutions to in-game disputes—be they at the personal or the broader- and inter-guild level. They did not want any external, customer-service-based intervention in disputes. Others said they were quick to report to customer service what they perceived to be bad behaviour or violations of codes of conduct. Most had dealings with customer service over bugs and technical glitches that left them stranded in places they were unable to shift from themselves. I encountered a number of players who had stories about the perceived inconsistencies in the decisions meted out by customer service. Several told stories of being very confused as to what actually constituted an "exploit." Trouble seemed to arise around the finer points of when play is actually cheating and when it is just clever, expert play from someone who knows the game inside out. I heard stories of players who had warnings placed on their accounts or who had been banned for acts they

considered to be perfectly reasonable or to have been misinterpreted by the customer service team (Humphreys, 2005a).

The key issue here is not whether the player was right and the customer service team wrong, but that there is no dispute resolution system in place that can hold the customer service team accountable for its decisions. If a player feels their account has been banned unfairly, where do they go to appeal the decision? If there is misunderstanding about the rules, or differing interpretations of the rules, where can this be argued?

It is at this point, where there is uncertainty or ambiguity about the governance of the community, that the role of the publisher as community manager most obviously becomes problematic. Given the level of investment some players have in the game, and given the value that their investments add to the game for the publisher, is it enough to say "well, there are other games in the market, they can just move on to one of them instead"? Should a player be expected to wear the high cost of a poor decision made by a possibly overworked customer service team, or should they have access to a system of appeal? Should publishers be able to insist on such contracts without these mechanisms in place?

Many players circumvent the customer service team's efforts at policing—buying new accounts (against the terms of the EULA) at online auction sites. However this can be a costly process—high level characters cost many hundreds of U.S. dollars at the online player auction houses. The secondary economy surrounding MMOGs (in which players buy and sell in-game money, objects, and characters), is an indication of the ways players exceed the boundaries laid down in contracts. The trade being done in in-game items through auction houses—the secondary markets—was estimated to be worth \$880 million at the 2004 State of Play Conference at the New York University Law School (Salyer, 2004). Almost all MMOGs explicitly ban this kind of trade, although some publishers are beginning

to work out ways in which they can become the brokers in this market and make money from it themselves, but this model is currently still in its infancy. Whatever the arguments for and against such secondary economic activities, the practice of banned players going online and buying new high level characters still represents a cost to the player for an action on the part of the publisher that could be construed as unfair. The rebuilding of social status and identity is also implied in this process.

Players may be significantly empowered on a personal level through their playing of MMOGs. I conducted one interview in the course of my research with a woman whom I had encountered inside EverQuest. She was a guild leader in a guild with several hundred members. She played about 40 hours a week. She knew just about everything there was to know about EverQuest. Other guild members turned to her for advice and sought her expertise on many aspects of the game. She organised raids and led them a number of times a week. She had a range of characters, all of whom had "partners" online—some were married, others were strategic alliances, and others she characterised as mere flirtations. She held considerable status amongst her peers and was seen as competent and capable. When I travelled to meet this woman and interview her, she turned out to be disabled, limited in her mobility, and unable to get work outside the home. She lived in a basement flat with her husband and two children. She did not really like her husband, but felt unable to leave the relationship because of her financial and physical dependence upon him (she could not, for instance, tie her own shoelaces due to her disability).

For her, EverQuest was a place where she could access social status, recognition for her leadership abilities, romance, and friendships that were unavailable to her in her off-line life. That EverQuest was a source of empowerment for her could not be in doubt. There is, however, a difference between this kind of personal empowerment

and the structural power relationship that exists between her and the publisher. In this relationship, the publisher holds the power to deny her access to EverQuest. All the positive empowering aspects of creating and engaging with online social activities and social networks mean nothing if you cannot actually access them. Thus, I want to make clear the distinction between the kinds of power players that may develop within the game, and the kinds of power involved structurally between players and publishers around the issue of access.

Players have held protests inside games—for instance, in *Star Wars Galaxies* where a swathe of players were banned by customer service after a “duping” scam was implemented by one player. Rather than tracking down the source of illegally duped (duplicated through exploiting a bug in the code) items, any player who had bought one was banned by the customer service staff. These players were unaware of the duped status of the item they bought, but were banned nonetheless. A protest of several hundred players was held in a particular zone of the game. Players were transferred out of the zone by the customer service team and had their accounts warned (a flag that precedes banning).² It was an interesting event for the ways in which it became obvious that the customer service team were the holders of structural power—able to deny access with no accountability. The players held exit power—they could leave in protest and take their business elsewhere—but for many this represented too great a loss to contemplate. While many of the banned accounts were eventually reinstated, the customer service team were actually under no obligation to do so.

Thus while players can be seen to exercise a certain amount of agency within MMOGs, creating their own communities and game play and experiencing various forms of personal empowerment through their activities, there are ultimately structural limits on that agency. While it is in the interests of the publisher not to alienate the communities it is managing inside a game,

this constraint on their behaviour is not enough to ensure players are treated fairly and that access to their online identities and communities is maintained in an accountable manner.

CONCLUSION

MMOGs represent one of the most interesting turns that interactive media have taken—subscription based, interactive, emergent, social, networked—they exploit many of the features of “new media” that are new. They are much more than repurposed “old” media. They are an exemplary knowledge economy product. MMOGs embrace the productivity of their users and turn it to the advantage of publishers very successfully. But this new form also brings with it challenges to conventional publishing and legal practices. The regulation of such media is a complicated proposition, particularly in relation to the fair treatment of individuals and communities conducting their social lives within the game worlds. While it is probably simplest to argue for a free market solution to the questions of governance, I have argued that this latest interface between consumer/citizens and media corporations may require more complex treatment. If online identities and online communities are owned by a third party, the conditions of access to them become crucial. As we come to live more and more of our lives inside proprietary spaces, what role are governments to take in ensuring our fair treatment? Can we afford to let our commonly held public rights devolve into a series of one-sided contractual arrangements with corporations that work in the interests of profit above all else?

While MMOGs may seem like a fringe example in terms of the numbers of people they attract, the issues raised by their structure and the business models used to maintain them, will become important ones across a broad spectrum of applications which also utilise Internet-based social software. Their reliance on distributed

production and the value of social networking, with all the inherent contradictions with copyright and intellectual property laws, and their need for social governance, flag what will become major and complex issues for businesses, law makers, and users. The central role of affect and its intersection with commercial imperatives requires further consideration from all parties.

The users of such applications (be they games or other online environments) take a very active role in constituting the content and may in the future be less willing to accept the very uneven TOS currently on offer. But in a world of constrained choices, where the market does not in fact offer the kinds of terms users might wish for, the role for policy making and regulation will become clearer.

REFERENCES

- Banks, J. (2002). Gamers as co-creators: Enlisting the virtual audience—A report from the net face. In M. Balnaves, T. O’Regan, & J. Sternberg (Eds.), *Mobilising the audience* (pp. 188-212). Brisbane: UQ Press.
- Benkler, Y. (2004, November). *There is no spoon*. Paper presented at the State of Play 2, Law and Virtual Worlds Conference, New York Law School.
- Blizzard Entertainment. (2005, August 29). *World of Warcraft® surpasses 1 million customer milestone in North America*. Press release. Retrieved August 30, 2005, from <http://www.blizzard.com/press/050829-wow.shtml>
- Cameron, A. (1995). Dis simulations. Illusions of interactivity. *Millennium Film Journal*, 28, 33-47.
- Castronova, E. (2001). *Virtual worlds: A first-hand account of market and society on the cyberian frontier*. (CESifo working paper series no. 618.) Fullerton: California State University, Center for Economic Studies and Ifo Institute for Economic Research (CESifo).
- Coombe, R. J. (2003). Commodity culture, private censorship, branded environments, and global trade politics: Intellectual property as a topic of law and society research. In A. Sarat (Ed.), *Companion guide to law and society* (pp. 349-384). Oxford: Basil Blackwell.
- Crawford, S. P. (2004). Who’s in charge of who I am?: Identity and law online. *New York Law School Law Review*, 49(1), 211-229.
- Dibbel, J. (2004). *Playmoney*. Retrieved December, 14, 2004, from http://www.juliandibbell.com/playmoney/2004_04_01_playmoney_archive.html#108209506356337766
- Entertainment Software Association. (2004). *Top ten industry facts*. Retrieved November, 9, 2004, from <http://www.theesa.com/pressroom.html>
- Foo, C. Y. (2004, December, 6-8). *Redefining grief play*. Paper presented at the Other Players Conference, IT University of Copenhagen, Denmark.
- Frow, J. (2000). Public domain and the new world order in knowledge. *Social Semiotics*, 10(2), 173-185.
- Hardt, M., & Negri, A. (2000). *Empire*. Cambridge, MA: Harvard University Press.
- Herz, J. C. (2002a, October 8). *The bandwidth capital of the world*. *Wired*. Retrieved May 6, 2003, from http://www.wired.com/wired/archive/10.08/korea_pr.html
- Herz, J. C. (2002b). Harnessing the hive: How online games drive networked innovation. *Release 1.0*, 20(9), 1-22.
- Hills, M. (2002). *Fan cultures*. London: Routledge.
- Humphreys, S. (2005a). *Massively multiplayer online games. Productive players and their disruptions to conventional media practices*.

- Unpublished doctoral dissertation, Queensland University of Technology, Brisbane.
- Humphreys, S. (2005b). Productive players: Online computer games challenge to conventional media forms. *Communication and Critical/Cultural Studies*, 2(1), 36-50.
- Humphreys, S., Fitzgerald, B., Banks, J., & Suzor, N. (2005). Fan based production for computer games: User led innovation, the drift of value and the negotiation of intellectual property rights. *Media International Australia*, 114, 16-29.
- Hunter, D., & Lastowka, G. (2004). Virtual crimes. *New York Law School Law Review*, 49(1), 211-229.
- Jarrett, K. (2003). Labour of love. *Journal of Sociology*, 39(4), 335-351.
- Jenkins, H. (1992). Textual poachers: Television fans and participatory culture. New York: Routledge.
- Juul, J. (2001). Games telling stories? A brief note on games and narratives. *International Journal of Computer Game Research*, 1(1).
- Kline, S., & Arlidge, A. (2002). *Online gaming as emergent social media: A survey*. Vancouver, British Columbia, Canada: Media Analysis Laboratory, Simon Fraser University.
- Leadbeater, C. (2000). *Living on thin air*. London: Penguin.
- Newman, J. (2004). *Videogames*. London: Routledge.
- Ondrejka, C. (2004). Escaping the gilded cage: User created content and building the metaverse. *New York Law School Law Review*, 49, 81-101.
- Prensky, M. (2001). *Digital game-based learning*. New York: McGraw-Hill.
- Ryan, M.-L. (2001). Beyond myth and metaphor—The case of narrative in digital media. *International Journal of Computer Game Research*, 1(1).
- Salyer, S. (2004). *Recorded conference session, State of Play II, NYU Law School*. Retrieved December 10, 2004, from http://web.stream57.com/nylaw/102904_virtualproperty0004.htm
- Smiers, J. (2002). The abolition of copyrights: Better for artists, third world countries and the public domain. In R. Towse (Ed.), *Copyright in the cultural industries*. Cheltenham, UK: Edward Elgar Publishers.
- Sony Online Entertainment (SOE). (2005). *End user licence agreement*. Retrieved November 3, 2005, from http://eqlive.station.sony.com/support/customer_service/cs_EULA.jsp
- Taylor, T. L. (2002, June 6-8). *Whose game is this anyway?": Negotiating corporate ownership in a virtual world*. Paper presented at the Computer Games and Digital Cultures Conference, Tampere, Finland.
- Yee, N. (2001). *The norrathian scrolls*. Version 2.5. [Electronic version]. Retrieved October, 17, 2002, from <http://www.nickjee.com/eqt/report.html>

ENDNOTES

- ¹ “You’re in our world now”™ is a registered trademark of Sony Computer Entertainment America Inc. and was used as a slogan for the game EverQuest for a number of years.
- ² For player commentary on this event see: <http://intrepid.galaxyforums.com/index.php?showtopic=7190&st=0><http://www.warbucket.com/ibforums/index.php?act=ST&f=23&t=17655> (accessed 2/9/2004)

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 76-96, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.11

Digital Petri Dishes: LiveJournal User Icons as a Space and Medium of Popular Cultural Production

Alek Tarkowski

Polish Academy of Sciences, Poland

ABSTRACT

Internet applications such as Web-based blogging and instant messaging tools or social networking sites often provide their users with the possibility of displaying small graphic elements. Such “pictures” or “icons” allow users to represent and mutually identify themselves. This text is an analysis of user icons displayed on the LiveJournal blogging site. I treat such a user icon as a medium with particular characteristics and patterns of usage. LiveJournal users use such icons to participate in what John Fiske (1992) calls popular culture. A case study of user icons discloses the life cycle of the media form, during which a medium with initial characteristics coded by its creators begins over time to support a wide variety of uses, innovation in usage, and active participation in culture. In this chapter, I consider user pictures and practices that are tied to them as an example of the manner in which popular culture functions in the digital age.

INTRODUCTION

LiveJournal is one of the more popular blogging tools, a Web-based application that allows users to run an online diary or journal. LiveJournal at its nascence was itself a result of user innovation. It was written by a 19-year-old programmer named Brad Fitzpatrick as a tool that would allow him to stay in touch with high school friends after leaving for college. LiveJournal’s user base has been constantly growing and in early September 2005 there were almost 8.2 million registered journals and 1.4 million users who have updated their journal in the preceding month. Although the exact historical data on LiveJournal growth is not readily available, such data is for the purpose of this chapter insignificant, despite the general hype surrounding the growth of blogging. Neither are these numbers quoted to prove the importance of the site, as cultural significance cannot be easily quantified into statistical figures. It is the scale of the phenomenon, which involves hundreds of

thousands of Web pages, users, and communities formed by them, that is important. It is the scale of a fair sized city, a size at which any phenomenon must be internally varied and heterogeneous.

As an online publishing system, LiveJournal is a tool that can be used for production, exchange, and reception of cultural content. Furthermore, this content and the interface with which it is produced forms an axis for communication and formation of social associations. LiveJournal's architecture is designed to support interaction, in particular by enabling the creation of "communities." These collectively written journals are spaces for discussion, similar to online forums. Each community, treated as a media form, is an anchor for a collective of users that expresses itself in the community's online space and is commonly thought of as a community as well. Posts and comments are both instances of personal expression and traces of interactions between users. They are shared and public because they have been archived by the system, while other aspects of these interactions remain invisible, as they took place in private spaces and channels or even beyond the Internet. Although LiveJournal is constantly being accessed in the present, its public space has a historical, archival character as it consists of content stored in LiveJournal servers. A community of users communicating through LiveJournal constructs in parallel a community as a media form, a record of own interactions stored as the system's content.

Defining LiveJournal as a blogging site has its consequences. Blogging is a phenomenon that is a prime example of what Woolgar (2002) calls the cyberbolic social studies of the Internet, based on "...synoptic, top-down (and often un-explicated) depictions of technical capacity and effect" (p. 4). We can instead think of LiveJournal as simply an online infrastructure for publishing content. It is a digital medium primarily designed to support textual communication and to remain open—it has few restrictions or even guidelines

regarding the produced content. There are almost no preferred themes, style guidelines, or editorial policies, except for the general standards of decency, to which users must adhere. The only significant limitation is the difficulty of publishing multimedia content, as LiveJournal does not provide users without paid accounts with server space for content other than text.

A distinction should be made between LiveJournal as either an application designed by its administrators or a material, technical artifact—and LiveJournal as it is perceived by its users. The relative simplicity of the application means that it is the content and not the medium itself that defines user's experience. While sharing the label "LiveJournal journal," individual sites can greatly vary and the system itself can have different meanings for different users. The heterogeneity of uses, themes and interests, or communities means that there is no "typical," model use of LiveJournal, no synoptic description it will fit into (Woolgar, 2002).

LiveJournal as a system has a border that is porous and only roughly relates to the symbolic limits of the livejournal.com domain, making it even more difficult to consider LiveJournal as a single medium and a homogeneous environment. At the level of code and content, users outsource the storage of visual content to other servers and service providers. Links from the site constantly direct the viewer beyond LiveJournal. At the social level, LiveJournal is but one tool and space in a wider digital environment. Users use this tool to varying degrees and ascribe to it varying degrees of importance. Activity at the LiveJournal site is for a vast majority of users only a part of their online activities, which in turn are only one aspect of their media-saturated lives. The porous character of LiveJournal means that its users and components "pertain to them by one side only, but through the other sides, ... escape from the world they constitute" (Tarde, 1999, p. 80).

USER ICONS IN THE CONTEXT OF THE LIVEJOURNAL SITE

A user picture or user icon is a graphic selected by the user and displayed on his/her journal. To some extent, it is designed as a visual counterpart to the username. According to the intentions of LiveJournal designers, these pictures serve to represent the user, disclose elements of his/her identity. The LiveJournal FAQ states that “[u]ser pictures are icons or avatars used to represent yourself, your moods or feelings, your interests, etc. They are displayed in numerous locations on LiveJournal ...” (asciident 2005). An icon appears on a user’s journal page, a user info page containing selected information about the user appears alongside posts and comments authored by the user.

When it comes to choosing an icon, system administrators provide only a limited set of guidelines that pertain solely to the technical and code levels of an icon. Each picture has to be a .GIF, .JPG, or .PNG file, not larger than 100x100 pixels and with a file size not greater than 40kb. While the definition of the user icon does suggest that the image should be iconic in nature, it is not explicitly stated that a user picture must be a picture of the user. The only limitations concern use of explicit content. LiveJournal FAQ informs users that their pictures, especially the default one, are freely accessible and therefore potentially available to any user. Thus the default picture cannot contain explicit content, while other user pictures can be of a more graphic nature.

A user with a free account is entitled to an icon pool of three different pictures, while with a paid account the number increases to 15 different icons. With an additional purchase, a user with a paid account can raise their total number to 100. Additional user icons are one of only a few extensions of the paid suite that a user can purchase. LiveJournal allows users to upload pictures, select the default one, and assign keywords, which

later are used to select a picture accompanying particular posts and comments.

LiveJournal FAQ provides little advice about creating an icon and formatting it so that the technical limitations are met. In order to do so, access to and at least basic competency with graphics or photography software is required. The FAQ states only that: “[y]ou have the option to create a userpic yourself. In order to do this, you will need an image-editing program. If you do not have an image-editing program, you may wish to use your favorite search engine to find one. You can also find a userpic from a website or from a LiveJournal community” (asciident 2005).

Therefore a user does not have to follow any rules or guidelines regarding the creation and usage of icons, and neither is much guidance given. Due to this lack of prescribed uses, and to minimal technical limitations (the size of the image being the only significant one), a user icon is an open tool. An analysis of user icons on LiveJournal shows that with time the way they were used went beyond the simple representation imagined by system’s designers. The ability to freely create icons is coupled with the possibility of selecting, from one’s icon pool, an icon appropriate for the given situation. This allows users to control both a user pool, which can be considered a way of visualizing their personality or identity, as well as the default icon displayed on a user’s journal and icons shown alongside posts and comments. In this manner a seemingly simple feature becomes a potentially versatile medium for not only representing, but also expressing oneself and communicating with others. As we will later see, the usage of icons commonly goes beyond displaying one’s photograph.

The user icon as a medium and a body of specific user icons are the subject of this chapter. An icon is a media species, as well as a population of individual icons. The species itself has its own life cycle, as uses develop and evolve over time and initially prescribed uses become but a

starting point for cultural innovation. It is through contact with users that an icon becomes a hybrid of initial assumptions or specifications and ever new practices, expectations, and imaginations. We can compare the difference that exists between prescribed and actual uses to the distinction between *langue* and *parole* made by De Saussure (1991). User icons can be understood as serving several purposes at once: (1) a tool designed by LiveJournal programmers to fulfill a certain function both within a single journal and in a system of hyperlinked journals; (2) a tool and medium made available to the users, who adapt it to their own uses and needs, transforming its function and potential; or (3) a body of cultural content stored by users on LiveJournal servers and displayed as user icons.

The user icon is a layered phenomenon. A tripartite layer model has been initially proposed by Benkler (2000), who distinguished the physical, code and content layers of the Internet. In the case of user icons, the influence of the physical layer is of secondary importance, as it does not directly affect the icon that exists in an environment formed by several sublayers of the code and content layers, such as the World Wide Web and the LiveJournal application. I therefore distinguish instead between the layers of code, content, and interaction. At the level of code, an icon is a field in an individual database entry, which can store a bit of content data that meets a set of requirements. At the content level, an icon is an image visible in the user's browser. At the interaction level, icons are material artifacts to which cultural practice and social behavior are tied.

The life cycle of an icon as a medium begins when the icon is a potential form with a prescribed usage defined in its code layer. At a later stage, the user icon turns into millions of existing images and displays a complexity and variety typical of the everyday life of LiveJournal users, in which these icons, as tools and objects of popular culture, are involved.

The use made of an icon by a user is influenced by several factors present at different layers of an icon. It is partially defined by the architecture of the icon's code, partially by a prescribed usage, which is a norm defined by LiveJournal's creators (and enforced not only through system's code), and partially by individual experience: by observing other's icons and uses made of them—a collective history of icon usage.

LiveJournal icons are an interesting cultural phenomenon for several reasons. Firstly, they constitute an opportunity to analyze the relation between an initially prescribed use and the actual use patterns developed by users. Or put in other words, to analyze the differences between the imaginations of the creators and users. Media designed as open and interactive have a potential to support cultural innovation. The end-to-end argument (Saltzer, Reed, & Clark, 1984) describes a telecommunication network like the Internet, which by remaining open and simple, effectively hands over control of the service to end users and thus fosters innovation of usage (Lessig, 2000). Alongside improved innovation, an end-to-end network has normative benefits: greater diversity of participating groups and weaker third party control or censorship (Sandvig, 2002). Uses that icons are put to become varied with time and grow beyond the frames set by LiveJournal's creators. Like the Internet, both the LiveJournal system and its user icons form a medium that does not discriminate against transmitted content. In each case, an open code layer supports a varied and vibrant culture at the content level. The Internet thus has a recursive structure and its parts display similar characteristics to the Internet itself. Embedded in the online media environment are media forms that serve as both containers for content and content-generating structures. Multiplicity and variation of forms that grow from a relatively simple and limited medium proves the hypertrophic nature of modern culture. The user icon is but one simple feature of a single

online application, yet it involves a wide number of users and supports varied and lively cultural production.

It is difficult to find direct parallels to user icon usage in off-line or predigital culture. The production of user icons depends on the ability to cheaply and easily find, copy, and transform content, offered by digital tools. When searching for similarities we can compare LiveJournal icons and their uses to:

1. fashion elements, such as pins, t-shirt designs, or patches;
2. scrapbooks with clippings from color magazines;
3. teenage bedrooms, filled with posters and photos;
4. graffiti, stencils, stickers, and other forms of individual expression in public space; and
5. ID documents or membership cards.

My analysis focuses upon icons as symbolic tools and the varied uses made of them. I am less interested in their content and avoid interpreting their meaning or significance. An accurate interpretation is difficult if not impossible and we should heed the warning of Barthes, who describes the “terror of uncertain signs” (Barthes, 1977, p. 39). The meaning of visual content is almost limitless and thus uncertain when they are placed out of context and not fixed by text information, as is often the case in digital media, characterized by an ease of recombining content.

First of all, it is often difficult not only to establish the origin and authorship of a given icon, but also to ascertain whether the given content is a product of the media industry or a popular cultural production. This is due to the fact that homemade, visual Web content can today be of similar quality as commercial content, especially in the case of objects that are relatively small and of low resolution. High levels of cultural competence are required to identify content and

to understand the web of allusions, parallels, and citations weaved by LiveJournal users. Secondly, a single icon is displayed in the multiple contexts of different Web pages, text, and other images. It has a different meaning when displayed alongside all of the user’s icons in the icon pool, different when present—like a digital crest—in a prominent place at the user’s journal and yet another when displayed alongside individual posts and comments. A researcher can also easily extract icons from the system and attempt to analyze them on their own. Following Barthes (1977), we should interpret the meaning of icons as only one layer in a wider web of meanings. However, this would quickly force us to deal with the complexity of analyzed environment, which I tried to avoid by focusing on the user icon as a single, simple feature. LiveJournal content in general, as experienced by the researcher, is separated from the everyday lives of its users and creators, it is but one aspect of a whole largely invisible to a student of online culture.

I believe though that we can also think of icons as a medium with which the researcher can visualize a given cultural phenomenon. While researchers of new media still lack tools for analysis and interpretation of online materials, the visualization of cultural phenomena through a focus on their visual aspect can be a valid method for dealing with encountered complexity. Bendyk (2002), in his analysis of the Bovine Spongiform Encephalopathy (BSE) epidemic, shows how public perception of the threat—an infectious particle known as prion—was changed by visualization techniques: “3D visualization software made the prion, until then an abstract concept for most people, come alive” (Bendyk, 2002, p. 154). Bendyk observes that visualization can provide insight that is imprecise or even false, but the same can occur when we try to grasp complex phenomena with concepts. The term translation (traduction) is used in Actor Network Theory to describe a process of reality construction, in

which a single actor speaks on behalf of others and imposes upon them his/her own description, and therefore construction, of reality. In the process, “identity of actors, the possibility of interaction and the margins of manoeuvre are negotiated and delimited” (Callon, 1999, p. 203). Translation involves opening and closing of phenomena, so they can either be disclosed as complex or made to look like simple “black boxes.” Cyberbolic analysis of new media is criticized by Woolgar (2002) as an example of translation that takes a complex phenomenon and translates it into a homogeneous system with uniform uses and effects.

User icons exist in a space where mass media content and popular cultural content, arising out of everyday life, meet. They therefore allow the researcher both to trace the boundary line and study interactions between the two spheres. We can see how the online lives of LiveJournal users, represented in digital traces such as user icons, are no longer part of the everyday, but are rather elements of the process of popular culture. LiveJournal icons are one of many tools through which people negotiate their relations with dominant cultural content and construct their mediated lives.

User icons are many things at once. They form interface spaces between a dominant culture produced by media industries and the everyday realities of users. They are also tools used by users to build identities with the help of dominant media products and they inject these identities into the shared cultural sphere. They are hybrids formed from cultural, media and technical elements.

POPULAR CULTURE IN THE PREDIGITAL ERA

LiveJournal user pics are a manifestation of popular culture. Fiske (1992) defines popular culture as the process, in which resources provided by a dominant cultural system are excorporated by subordinate users, who make their own culture

out of it. By focusing upon excorporation, rather than incorporation of people in the system, Fiske provides an alternative to a pessimistic approach to modern culture that has its roots in the works of the Frankfurt School. Fiske assumes that “[t]he people are not a passive, helpless mass incapable of discrimination and thus at the economic, cultural and political mercy of the barons of the industry” (Fiske 1987b). Attempts at incorporating them made by the dominant cultural system are a sign of popular vitality and creativity.

Popular culture is not pop culture and the adjective popular does not describe a popularity measured by top hits lists. Popular culture is an autonomous cultural sphere created by and for people at the interface between the dominant cultural industries and everyday life. According to Fiske (1992), cultural commodities circulate not in one, but two different and partially autonomous economies. They are produced in the financial economy of the dominant cultural industry, but later transfer to the cultural economy, in which consumers are also producers. In this second economy production is not for profit, and it is not the products of the dominant cultural industry but meanings and pleasures that are the most important circulating commodities (Fiske 1992). The dominant culture provides the popular culture with resources, but it only to some extent controls their later transformations. Popular culture is a sphere of active reception, interpretation, and transformation of content produced by dominant cultural industries, mainly the mass media. While in itself it is active and vital, popular culture is described by Fiske as always a reaction to the dominant culture. Some cultural commodities have the potential to trigger popular cultural activity. They have an open character and invite new uses or interpretations. Such cultural innovation can be based not only upon the acceptance, but also evasion or opposition to encountered meanings.

There are therefore different terms in which the relationship between dominant cultural industries and popular culture can be described. The major-

ity of metaphors used are based on the concept of conflict or combat. Eco describes activities that “restore a critical dimension to passive reception” or “urge the audience to control the message and its multiple possibilities of interpretation,” as semiological guerrilla warfare (Eco, 1987, p. 144). Michel de Certeau speaks of poachers, who encroach and steal cultural goods without being caught or even subject to the laws of the territory (De Certeau, 1998). Fiske (1992) writes that popular culture has to do with treachery, robbery, sleight-of-hand games played with the cultural industry: “To attract consumers is to attract tricksters; encouraging consumption encourages trickery, robbery, la perruque” (p. 41).

Jenkins (1998) suggests that metaphors of conflict account for only one stream of popular cultural activity, one which he calls “culture jamming”. He distinguishes it from “cultural poaching”. Cultural jamming is more radical and closer, as an intellectual position, to the pessimism of the Frankfurt School. Culture jammers define themselves as outsiders who attempt to liberate their own lives and the lives of others from the mass media that encroach and invade their lives. Cultural poaching in turn is rather a form of cultural symbiosis or parasitism that works not beyond the cultural system, but within its bounds. Poachers participate in the dominant culture, but see themselves as creators and reject the possibility of being marginalized to the position of passive receivers. Both strains of popular cultural activity thus attempt to fulfill the postulate of semiotic democracy, according to which in a good society each one should participate in the creation of meanings that circulate in a culture (Fisher, 2001; Fiske, 1987a). While both are forms of collective cultural action, jamming attempts to achieve what Melucci (1996) calls a breach of the limits of compatibility of the cultural system, while cultural poaching exists largely within the system’s limits. It is the latter of these two strains that the most popular cultural activities present at LiveJournal fit into.

Protest activities are traditionally understood as antagonistic, system-breaching, collective actions. Cultural poaching does not fit this definition, as it does not attempt to breach the system’s limits. Galloway (2004) believes that we need to redefine protest because of the changing nature of power, against which it is directed. Galloway describes a form of distributed, decentralized control, which has been gaining importance in the modern world. It is a procedural form of power exhibited for instance by protocols running at the code layer of the Internet. Resistance to distributed control cannot be based upon the traditional notion of protest, but the concept of hypertrophy: “The goal is not to destroy technology in some neoluddite delusion, but to push technology into a hypertrophic state, further than it is meant to go ... Then, during the passage of technology into this injured, engorged, and unguarded condition, it will be sculpted anew into something better, something in closer agreement with the real wants and desires of its users” (Galloway & Thacker, 2004). Popular cultural activity at LiveJournal is an example of such hypertrophic cultural activity.

DIGITAL MEDIA AND THE TRANSFORMATION OF POPULAR CULTURE

Fiske wrote *Understanding Popular Culture* in 1989, 2 years before the invention of the World Wide Web by Tim Berners-Lee and several years before rapid growth of Internet use began. Popular culture, according to Fiske, circulates in the context of three types of content: primary texts or original cultural commodities; secondary texts that directly refer to them, such as reviews, criticism, or advertisements; and tertiary texts that are the process of everyday life: conversations, patterns of dressing, acting, or dwelling.

In the dominant mode of popular cultural activity, people take ready-made products and replace

ready-made meanings with ones they themselves produce. Commodities that are reused later in the process of popular culture are according to Fiske (1992) poor in meaning, insufficient, “resources to be used disrespectfully, not objects to be admired and venerated” (p. 123). Popular culture takes these incomplete cultural objects and fills them with meanings that make them relevant in everyday life. In this manner, a contradictory culture is formed. It relies upon simple, even unimaginative resources provided by the dominant cultural industry and produces content characterized by “subtle complexity, dense texture of human sentiment and of social existence” (Fiske, 1992, p. 120). Popular culture uses all three types of content, but by itself produces only tertiary texts. Among these most numerous are conversations, through which viewers, readers, and listeners redefine the meaning of cultural commodities. It is also produced through dress styles, patterns of behavior, and lifestyle choices. Ephemeral manifestations of popular culture coexist with cultural commodities without displacing them. “With very few and very marginal exceptions, people cannot and do not produce their own commodities, material or cultural, as they may have done in tribal or folk societies. In capitalist societies there is no so-called authentic folk culture ...” wrote Fiske (1992, p. 27). Predigital times were a period of the Dark Ages for popular creativity (Lessig, 2001). The production of autonomous content, that is, content not derived from commodities produced by cultural industries, was marginal and its distribution was limited and local.

The relation between two segments of contemporary culture, as described by Fiske (1992) or De Certeau (1998), are based upon several key dichotomies: large and small; constant and in flux; and cumbersome and nimble. John Fiske explained the distinction between dominant and popular culture by describing the former as “places” built by the powerful and the latter as “spaces” temporarily set up in these places by the weak (Fiske, 1992). De Certeau (1998) describes

the powerful as cumbersome, unimaginative, and over organized. These traits allow “the weak,” or producers of popular culture, to dwell in dominant content, appropriate it, and to “speak [their own] meanings with their language” (Fiske, 1992, p. 36).

The difference between dominant and popular culture is related to the type of media at the disposal of the two cultures. The cumbersome and slow character of dominant culture is in part an effect of the relative stability and durability of media and objects, to which it is tied. Dominant cultural commodities often take the shape of relatively durable material artifacts like newspapers, books, DVDs, or toys. Otherwise they gain significance and importance as content is broadcast into—so as to almost saturate—the majority, if not the whole, of a society. Actor Network Theory uses the term immutable mobiles to describe objects that retain their shape and characteristics while moving through space and time (Law, 2000). With such objects, and thanks to their durability, power can be enforced and sustained at a distance. An analysis of popular cultural activities shows that such objects are not necessarily immobile. Cultural commodities enforce certain meanings, but at the same time are open to appropriation and reworking of carried meanings. “To be popular, the commodities of the cultural industries must not only be polysemic—that is, capable of producing multiple meanings and pleasures—they must be distributed by media whose modes of consumption are equally open and flexible” (Fiske, 1992, p. 158). In other words, with time and at a certain distance, they become mutable.

In contrast, the creators of popular culture are quick and nimble, unencumbered by products that need to be distributed or property that needs to be protected. Popular culture is not a cultural industry and does not need legal, distribution, or marketing apparatuses. Material artifacts of popular culture, if any, were distributed in circuits that were either local or marginal and in both cases informal and based upon a nonfinancial economy. Lacking

the capability to produce immutable mobiles, popular culture is unable to widely propagate its own meanings.

Digital media have transformed popular culture as much as they are changing the shape of the media market and cultural industries. Today, popular culture still exists at the borderline between dominant cultural content and everyday life, yet the growing popularity and diffusion of digital media in the society means that this interface space is, to a growing extent, digital and online. Mizuko Ito (in press) describes how contemporary popular culture is characterized by a coupling of collective imagination with digital technologies. These have revolutionized the popular production and distribution of symbolic goods by lowering the costs, time, and effort necessary to produce and distribute cultural products. Through these technologies, meanings that were until now ephemeral became anchored in relatively stable digital content.

Since the last decade of the 20th century, the growing influence and popularity of the Internet and other digital media transformed the conditions in which popular culture is both produced and distributed. Digital media gave popular culture the ability to distribute—at least potentially—content at a speed and range comparable to the capabilities of broadcast media. Most of these changes have by now been well documented, and the Internet is commonly described as capable of lowering all sorts of costs that hinder cultural production. Increased ease with which people can actively participate in their culture significantly affects the process of popular culture.

Yet the character of popular culture is most profoundly changed by the fact that digital media give people the potential to produce symbolic goods that are no longer ephemeral, scarce, and only locally available. Digital popular culture is capable of producing not only what Fiske defined as tertiary, but also secondary texts (Fiske, 1992). Potentially digital media enable people even to create their own primary texts, a body of autono-

mous cultural content that is closest to what Fiske calls “authentic folk culture” (Fiske, 1992, p. 27). Digital popular culture is thus able to acquire its own immutable mobiles, objects that can propagate in digital environments, allowing popular culture to grow in size and significance.

Predigital popular culture existed on a small scale, partially invisible to the dominant culture with its cultural industries, which it easily tricked, thus remaining beyond the latter culture’s scope of control (Bey, 1985; Fiske, 1992). This changed with the digital means of symbolic production and communication, when every operation involved making a copy (Lessig, 2004). Once ephemeral activities now produce relatively durable, immutable objects, and cultural poachers are now leaving traces of their own actions. Digital environments allow institutions that form dominant cultural industries to easily and efficiently monitor, track, and mine for data. In this manner, the circulation of materials can be controlled or measured, for instance to protect their own intellectual property or to provide data needed to adjust future production and marketing. They also facilitate reciprocal appropriation of popular cultural practices and aesthetics by cultural industries (Jenkins, 1998).

Cultural poaching has been explained as bricolage (Jenkins, 1998), the art of “making do with whatever is at hand.” Popular cultural production was the domain of the bricoleur: “someone who works with his hands and uses devious means compared to those of a craftsman” (Levi-Strauss, 1966, p. 16). A bricoleur works with a set of parts that is neither planned nor invented—but found, assembled, and appropriated in the conditions of relative scarcity.

Introduction of the digital media into the society has also improved the availability of “raw materials” needed for popular cultural production. In predigital times, before the Internet, cultural commodities could be received as push media broadcasts or had to be bought. The growing World Wide Web places, at the disposal of its

users, a rapidly growing body of digital content. Most of this content can be easily accessed and duplicated, albeit cultural industries attempt to an ever greater extent to curb uncontrolled usage through legal and technical means (Lessig, 2004). Content that is accessible on the World Wide Web is much greater than that available through push media, and access to it is often freed from financial constraints. In such conditions, time or attention span and not money become a crucial investment. In a condition of cultural plenitude, when a great range of materials is always at hand, popular cultural production resembles grazing more than poaching. Due to the vastness of contemporary culture, rational selection is not often possible. Due to limited attention spans we are more than ever choosing from but a thin slice of a culture as a whole. Popular cultural production still makes do with what is at hand, but in a digital era this is a strategy for coping with excess and not scarcity. Bricolage is a mode of experiencing and appropriating a culture characterized by complexity, in which no order is visible and whose elements cannot be “drawn together and properly assembled” (Law & Mol, 2002, pp. 14-15).

As a result of a partial transfer online of both dominant and popular culture, the two spheres began resembling each other to a greater extent. The changing conditions of popular cultural production and distribution weakened the distinction between cumbersome dominant culture and nimble popular culture. Online, all cultural phenomena begin coexisting in a single symbolic space, which furthermore is collectively imagined as a space in which the digital aspect of the process of everyday life is situated. Primary, secondary, and tertiary cultural texts coexist and interact in a relatively homogeneous space of the Internet and the World Wide Web, under protocological control of basic Internet protocols at the code layer of the medium (Galloway, 2004). Equally important are the decreased distance and difference between dominant and popular culture, as well as a mutual contamination occurring between these two

cultures and everyday life. This according to Lash and Urry (1994) is characteristic of what they call the post-modern condition, in which cultural forms increasingly form a part of social reality that is not distinguished as different or specific. In post-modernity, “an audience is sensitized to the reception of such cultural objects because of ‘semiotics of everyday life’ in which the boundary between the cultural and life, between the image and the real, is more than ever transgressed” (Lash & Urry, 1994, p. 135).

POPULAR CULTURE AT CODE AND CONTENT LAYERS OF LIVEJOURNAL

Predigital popular culture could have been imagined as existing in spaces temporarily established at the border or interface, with the dominant culture. In the digital era, the Internet and World Wide Web have provided an environment in which places—symbolic, but nevertheless real—of popular culture can be created. LiveJournal users are not poaching its online cultural resources, but rather producing popular culture in a place that in their imaginations can be inhabited, settled upon. It is a place where humans often dwell only temporarily, as proved by the majority of blogs left fallow by its creators. Still content dwells forever or at least until the death of the server. While our everyday lives remain in constant flux, their record on the Internet, or the objects of online popular culture, remain and are largely static. This is the “dark matter that gets left behind to molder in data vaults and arcane archives as we progress into a great digital future” (Nolan & Levesque, 2005, p. 35). LiveJournal is a place, not a space of popular culture. In this place, popular meanings are not injected into preexisting content by rogue actors, but constitute primary content produced there. Raw digital materials, that is, cultural commodities, are not produced on-site, but brought into the LiveJournal environment. However, to

fully understand the process of popular culture at LiveJournal, we should once again distinguish between the code and content layers. At the code level, users took an informational infrastructure crafted by LiveJournal's creators and adapted the relatively open tools to their own needs. The LiveJournal system itself is to an extent sluggish and unimaginative, dependent upon a certain path coded into its interface and database, a certain historic condition in which Brad Fitzpatrick decided to write the system, and a simple view of future uses imagined by the system's creators. These coded tools have been taken by users and appropriated for new uses. While the code remained the same, LiveJournal as a digital tool grew beyond its initial boundaries.

Furthermore, some of the new and innovative uses of LiveJournal have repurposed it as a tool for the digital production of popular cultural content. LiveJournal is also what Fiske (1992) calls a producerly cultural form. Although accessible and open, it has "gaps ... wide enough for whole new texts to be produced in them" (p. 104). With time, LiveJournal became a space in which popular culture could be performed. Elements of its coded infrastructure could be treated as tools for popular cultural production. LiveJournal user icon is one such tool, originally imagined as a method of personal representation that at some point started being used for popular reuse of dominant content.

THE LIVEJOURNAL USER ICON AS A SITE OF POPULAR CULTURE

User icon usage does not follow a single pattern, but is rather a family of uses that begins with a limited set of uses envisioned by system's creators and then evolves into a dynamic system of both conformist and innovative uses. The user icon was initially designed as an iconic sign that signifies its user based on the principle of similarity. It has been later redefined into a primarily symbolic

sign. The relation between the sign and the user became based upon an arbitrary, agreed convention. User icons contain faces and cropped facial details; celebrities, fictional characters, animated characters, and other people; animals and cartoon creatures; slogans and drawings; landscapes and objects; actors, musicians, and models; users, friends, and strangers. To some extent they retain their prescribed function, so that every image displayed can be interpreted as signifying a given user. Yet we must assume that in the case of many icons the representation of the user is neither the sole or primary goal. The sum of all LiveJournal user icons is a quite faithful visualization of culture as a whole, albeit divided into fragments the size of 100 pixels to a side.

While the interpretation of user icon content goes beyond the scope of this chapter, it is worth making several remarks in this regard. Such an interpretation is a daunting task and does not provide direct insight into the lives and identities of users, hidden behind "photo shopped" layers of images. Nolan and Levesque propose that it is never a real identity, but only an "identity map" (2005, p. 35) that can be recreated from online content—an approximation of the real person. It is worth adding that such identity maps are created not just by researchers and human hackers described by Nolan and Levesque, but by all users. An online persona does not have to take the form of a three-dimensional virtual visualization. More commonly, it is an imaginary actor constructed by others on the basis of available content relating to the given person.

If we treat the user icon as a tool for visualization of contemporary culture and society, then the icon suggests that we live in a reality in which the lines between mediated content and real lives became blurred. The space of user icons is an environment, in which representations of users coexist mostly with cultural commodities. The ecosystem of LiveJournal user icons is monotonous and depleted, inhabited by users, celebrity images, and other mass mediated content, texts,

and slogans and abstract or digital backgrounds. Given the possibility to freely represent and express oneself, users opt to rework cultural commodities and insert themselves into their mix. Other than photographs of oneself, there are few signs of primary cultural texts produced by users who do not choose to represent or express themselves with images of loved ones, favorite objects, or places that are part of their everyday, off-line existence.

As is the case with every medium, LiveJournal users are to a varying extent innovative in their use of icons. Of all users, two partially overlapping communities, fandom and icon makers, are most involved in innovative cultural production with the use of icons. Fans participate in a culture in a manner that is extravertous and hypersocial (Ito, 2005), active enthusiastic and partisan (Fiske, 1992). Fandom prefers cultural poaching to jamming, a mode of appropriation that is dialogic with the dominant culture and respectful of mainstream consumption of the media (Jenkins, 1998). Cultural poachers mainly care about the right to self-expression and reworking of cultural material for their own interests and pleasures. "Fans respond to this situation of an increasingly privatized culture by applying the traditional practices of a folk culture to mass culture, treating film or television as if it offered them raw materials for telling their own stories and resources for forging their own communities" (Jenkins, 1998). Icon making is a hobby, a form of digital craftsmanship and artistic production. For icon makers, a user icon is not just a medium, but also a popular art form. Both types of groups perform popular culture with the use of a user icon, a medium provided by LiveJournal's creators; dominant mass mediated content and a repertoire of techniques of icon creation. For fandom communities, style and techniques developed by icon makers are of secondary importance to playful appropriation of meanings and expression of attachment to their favored cultural commodities. Icon makers place greater emphasis upon cultural production

of icons as an artistic activity. In both cases, icons become a symbolic currency that circulates within these communities, used to express oneself, but also to sustain social relations and establish an individual reputation.

While practically every LiveJournal user is an icon maker, I reserve the term for those users that pay particular attention to this medium and furthermore self-define themselves as such. Icon making is hypersocial. It reflects "forms of sociality augmented by dense sets of technologies, signifiers, and systems of exchange" (Ito, 2005, p. 6), which according to Ito are characteristic of the popular culture of youth and children today. Online hypersocial relations are based in textual conversations taking place in makers' and communal journals, but are first of all sustained through the circulation of icons.

Icon makers have developed a specific aesthetic and style. User icons made by them are usually a collage of three elements: a human face or figure, a short text or slogan, and an abstract pattern or design serving as the background. Icons seem to have evolved into a form that most fully utilizes the limited resources at hand (in particular screen and server space) to perform digital popular culture—that is, to signify user's attachment, involvement, and interaction with cultural commodities.

Icon makers communicate through specialized journals and communities that can play several different functions. They can be: (1) virtual "shops," in which makers accept requests from others; (2) showcases of works; or (3) competition spaces with contests that establish the value of works and artists. Icon making is a social activity and icon makers usually compare their works, accept commissions, or allow others to copy and reuse their icons. It is a community based upon an economy of reputation and the circulation of user icons. A maker's reputation depends upon the quality of his/her works: aesthetic merit, ability to perform popular cultural appropriation, and technical skill.

The last factor seems especially interesting, as makers pay much attention to icon-making techniques. Icon making requires skills with two-dimensional graphics software; an understanding of disc space usage by graphic files and factors that affect their size; and know-how of appropriate digital brushes, fonts, and techniques. Many icon makers are distinguished by an understanding of the relation between displayed content and the code layer of an icon. Icon making is similar to the demoscene, a hacker subculture whose members competed to create short but intense digital graphics called demos. It also has parallels with the “5k contest,” a Web-design competition organized since 1999, in which designers create Web sites of no more than 5kb in size.

While icon makers naturally have varying skills and talent, some of them fit the description of what Leadbetter and Miller (2004) call Pro-Amateurs: “committed and networked amateurs working to professional standards” (p. 9).

Of all LiveJournal users, fans and icon makers are communities that have developed most unorthodox uses for the user icon. To give a final example, a text field set up in the system as a space for a short description of an icon has been used in icon-making communities to attribute the authorship of the author—a function that is crucial in a nonfinancial economy based upon reputation. In such a case, the original function of the icon—the representation of a user—is pushed beyond the icon’s boundaries. System’s administrators later introduced the possibility of commenting icons, possibly in reaction to this practice.

Ito (2004, 2005) describes popular culture of Japanese youth as a coupling of two “sociotechnical innovations”: the hypersociality mentioned previously, supported by digital communication and file-sharing networks, with what she calls “media mixes.” A media mix “integrates different media forms through licensed character content” (Ito, 2004, p. 31), a “heterogeneous but integrated web of reference” (Ito, 2004, p. 31) anchored in cultural commodities and technologies. Media

mixes, argues Ito, create relatively open and porous intertextual networks with which popular culture can interact.

The content reused at LiveJournal is part of wider media mixes, in which images of celebrities or fictional characters are present as well as videoclips, posters, movies, newspaper and magazine articles, t-shirts, DVDs, and so on. Yet LiveJournal seems detached from such mixes. Ito (2005) describes a process of constant negotiation that occurs between dominant and popular interests inside Japanese media mixes. Cultural industries are absent at LiveJournal and do not attempt to commodify or profit from popular cultural activities occurring on the site. LiveJournal is indeed, paradoxically, invisible to the powerful. We can only assume that the site itself retains its autonomous character only because the everyday lives of its users have already been colonized. Yet LiveJournal is not a site of a popular cultural rebellion directed at the dominant culture, but a space in which consumers decide to perform acts of cultural poaching and grazing.

CONCLUSION: PETRI DISHES AND DIGITAL FOLK CULTURE

A user icon is an empty “container”: a field in the database, a bit of space on a server, a space on a journal’s Web page. Such a container is itself a simple form that expresses minimal preferences regarding the content that it can store. We can compare it to a petri dish filled with a selective medium, upon which a bacterial culture can flourish. This metaphor accounts both for the robustness of activities rooted in a simple media form and for the organic manner in which patterns of usage develop over time. We can draw a conclusion from the case of user icons that popular cultural activities flourish when anchored in already existing content and structure. As long as the architecture is not too restrictive, users are drawn by the presence of some (not necessarily

optimal) interface and architecture, the presence of social and cultural conventions, and the presence of others. LiveJournal is like a city, whose “dwellers are not necessarily smarter than other human beings—but the density of space occupation results in a concentration of needs. And so questions are asked in the city that have not been asked elsewhere ...” (Bauman, 2003, p. 104).

I used the example of LiveJournal user icons to present the life cycle of a digital medium, characterized by a relation between a medium that is open at the layer of code and culture that flourishes at the level of content. As such, it is a case study of the robustness and capacity to innovate that is inherent in popular culture. I argue that the Internet is both filled with digital petri dishes of varying size and itself shares structural characteristics with the LiveJournal user icon.

REFERENCES

- asciident. (2005). *FAQ—Userpics*. Retrieved September 10, 2005, from <http://www.livejournal.com/support/faq>
- Barthes, R. (1997). *Image-Music-Text*. New York: Hill and Wang.
- Bauman, Z. (2003). *Liquid love. On the frailty of human bonds*. Cambridge, UK: Polity Press.
- Bendyk, E. (2002). *Zatruta studnia. Rzecz o wBadzy i wolnosci*. [Poisoned Well. On Power and Freedom]. Warszawa, Poland: Wydawnictwo W.A.B.
- Benkler, Y. (2000). From consumers to users: Shifting the deeper structures of regulation toward sustainable commons and user access. *Federal Communications Law Journal*, 52(3), 561-579.
- Bey, H. (1985). *The temporary autonomous zone, ontological anarchy, poetic terrorism*. Retrieved September 10, 2005, from http://www.hermetic.com/bey/taz_cont.html
- Callon, M. (1999). Some elements of a sociology of translation: Domestication of the scallops and the fishermen of Saint Brieuc Bay. In M. Biagioli (Ed.), *The science studies reader* (pp. 67-83). London: Routledge.
- De Certeau, M. (1998). *The practice of everyday life*. Minneapolis: University of Minnesota Press.
- De Saussure, F. (1959). *Course in general linguistics*. New York: Philosophical Library.
- Dery, M. (1993). *Culture jamming: Hacking, slashing and sniping in the empire of signs*. Retrieved June 15, 2004, from <http://www.levity.com/markdery/culturjam.html>
- Eco, U. (1987). *Travels in hyperreality*. London: Picador.
- Fisher, W. W. (2001). Theories of intellectual property. In S. Munzer (Ed.), *New essays in the legal and political theory of property*. Cambridge University Press.
- Fiske, J. (1987a). *Television culture*. London: Routledge.
- Fiske, J. (1987b). TV: Re-situating the popular in the people. *Continuum: The Australian Journal of Media & Culture*, 1(2), 56-66. Retrieved September 10, 2005, from <http://www.mcc.murdoch.edu.au/ReadingRoom/1.2/Fiske.html>
- Fiske, J. (1992). *Understanding popular culture*. London: Routledge.
- Galloway, A. (2004). *Protocol*. Cambridge, MA: The MIT Press.
- Galloway, A., & Thacker, E. (2004, March 24). *The limits of networking*. Nettime. Retrieved September 10, 2005, from <http://amsterdam.nettime.org/Lists-Archives/nettime-1-0403/msg00090.html>
- Ito, M. (2004, Winter). Technologies of the childhood imagination. *Items and Issues*, 4(4).

Retrieved September 10, 2005, from http://www.ssrc.org/programs/publications_editors/publications/items/online4-4/ito-childhood.pdf

Ito, M. (in press). Technologies of the childhood imagination: Yugioh, media mixes, and everyday cultural production. In J. Karaganis & N. Jeremijenko (Eds.), *Structures of participation in digital culture*. Durham, NC: Duke University Press.

Jenkins, H. (1998). *The poachers and the stormtroopers: Popular culture in the digital age*. Retrieved September 10, 2005, from <http://web.mit.edu/cms/People/henry3/pub/stormtroopers.htm>

Lash, S., & Urry, J. (1994). Postmodernist sensibility. In A. Giddens, D. Held, S. Loyal, D. Seymour, & J. Thompson (Eds.), *The polity reader in cultural theory* (pp. 134-140). Cambridge, UK: Polity Press.

Law, J. (2000). *Objects, spaces, others*. Retrieved September 10, 2005, from <http://www.lancs.ac.uk/fss/sociology/papers/law-objects-spaces-others.pdf>

Law, J., & Mol, A. (2002). *Complexities: Social studies of knowledge practices*. Durham, NC: Duke University Press.

Leadbetter, C., & Miller, P. (2004). *The pro-am revolution. How enthusiasts are changing our economy and society*. London: Demos.

Lessig, L. (2000, March 27). Innovation, regulation and the Internet. *The American Prospect*, 11(10). Retrieved September 10, 2005, from <http://www.prospect.org/print/V11/10/lessig-1.html>

Lessig, L. (2001). *The future of ideas: The fate of the commons in a connected world*. New York: Random House.

Lessig, L. (2004). *Free culture. How big media uses technology and the law to lock down culture and control creativity*. New York: The Penguin Press.

Levi-Strauss, C. (1966). *The savage mind*. Chicago: University of Chicago Press.

Melucci, A. (1996). *Challenging codes. Collective action in the information age*. Cambridge: Polity Press.

Nolan, J., & Levesque, M. (2005, February). Hacking human: Data-archaeology and surveillance in social networks. *ACM SIGGROUP Bulletin*, 25(2), 33-37.

Reed, D., Saltzer, J., & Clark, J. (1984). End-to-End arguments in system design. *ACM Transactions on Computer Systems*, 2(4), 195-206.

Sandvig, C. (2002, November 22-23). *Communication infrastructure and innovation: The Internet as end-to-end network that isn't*. Paper prepared for the AAAS/Columbia/Rutgers Joint Research Symposium with the Next Generation of Leaders in Science and Technology Policy, Washington, DC.

Tarde, G. (1999). *Monadologie et socialologie*. Paris: Les Empêcheurs de penser en rond.

Woolgar, S. (Ed.). (2002). *Virtual society? Technology, cyberbole, reality*. Oxford University Press.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 118-139, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.12

Competent Web Dialogue: Thoughts Linked in Digital Conversations

Eva Fåhræus

Stockholm University and Royal Institute of Technology (KTH), Sweden

Marianne Döös

VINNOVA, Sweden

ABSTRACT

Conducting a dialogue on the Web is a matter of linking thoughts in digital conversations. This article is intended to contribute toward learning qualities in such conversations. The term “dialogue” refers to a special kind of conversation, having structure, purpose, and learning qualities. The focus is on learning Web dialogues taking place in a course context using text-based, asynchronous meetings. An overview of factors that influence digital group conversations is presented together with a model for dialogue competence face-to-face. The dialogue potential of Web dialogues is highlighted. Course leaders and teachers wanting to create opportunities for learning Web dialogues, as well as the interlocutors themselves, need to wise up on the digital interchange of thoughts as a form.

INTRODUCTION

Conducting a dialogue on the Web is a matter of linking thoughts in digital conversations. Contacts and conversations via the computer are growing in volume. People are successively changing their understanding of what this kind of conversation is, and of its possibilities and difficulties. When conversing with others via the computer, we are moving in the border zone between solitude and company. In order to achieve learning qualities in these digital conversations, the interlocutors need to wise up on the digital interchange of thoughts as a form. This article is intended to contribute in that direction, partly by borrowing knowledge concerning group dialogue and dialogue competence in face-to-face situations. The focus of attention is on the dialogue in connection with the text-based, asynchronous meeting,

and in particular on digital group conversations in connection with courses, training programs, and university education. Often, though not always, these conversations are conducted with an element of examination or with a stipulation of presence and activity. Above all, though, they are meant to be good learning conversations, that is, conversations in which people learn with and from each other. The term “dialogue” as used in this article refers to a special kind of conversation, one having both a structure and a purpose (cf. Wilhelmson, 2006).

Digital technology has led us into new forms of conversation, and in some digital exchanges the similarity is so great that it has become natural to say that we are talking, even though we are actually writing. Different people have very different images of what communicating on the Web and at a distance implies. There are great variations of experience and competence. For example, there are generation differences, and the fact of our writing with completely different kinds of software and with different degrees of digital competence. The lack of common images, that is, similar understanding of what digital conversations can be, is an important basic precondition that will have to be taken into consideration for many more years to come. Dialogue does not come easily, even when people see and hear each other. A group dialogue requires practiced skills, but its learning potential, that is, the possibility it affords, in the company of others, of increasing one’s understanding and pondering one’s experience, makes it worth the trouble.

Two Digital Conversations by Way of Illustration

The participants in a distance course are given the task of conversing in writing with each other, by computer, about gender aspects of IT use. They are each to have read an article or a book chapter on the subject and are now to give their views on it and converse with each other in groups of about 10

people. This conversation is expected to continue for a fortnight in a conference system of the First Class type. In one group the conversation makes rather slow progress. When the participants have described the content of the article they have read, communication comes to a standstill. The course leader then intervenes to ask whether anyone has had personal experience of gender discrimination in connection with IT use, whereupon a number of participants describe experience of the kind, and others reply with affirmative comments on some of these contributions. Nothing much more happens after this.

In another group the communication gets off to a somewhat hesitant start but soon gets quite lively. In connection with describing the article, one participant relates personal experience of the subject. Another participant relates a similar experience, while a third objects that the reason must have been something other than gender discrimination. A lively conversation ensues as to what the reasons might have been. There are still some people who have not voiced an opinion, and so the person who was first to speak asks the “silent ones” to give their opinions. The conversation flows on and now gets quite heated. Someone writes that she feels insulted by the doubt cast on her story. The person who queried what she wrote apologizes and clarifies his meaning. The misunderstanding is cleared up, and the conversation continues on a frank and friendly basis.

What did the participants in the two groups learn from all this? Those in the first group presumably learned a certain amount from the articles they read and perhaps too from the summaries provided by other group members. No one, presumably, got much out of the Web talk. At worst, the participants may have come to the conclusion that electronic conversations are worthless. The other group probably learned quite a lot, both facts about gender issues and various possible perspectives on IT and gender. Perhaps they even changed their opinions about certain forms of IT use and saw greater opportunities for their own

part. We shall be returning to these examples later on in this article.

Factors Influencing Digital Group Conversations

There are a large number of factors influencing the way in which a group discussion on the Web develops and how much the participants get out of it. The nature and wording of the task, the choice of subject, the size and composition of the group, and the participants' private situation and attitude to the task make a difference to motivation and activity. This in turn makes a difference to what and how much different people learn and how they allow themselves to be influenced. Another important factor is the way in which the dialogue is conducted and how conscious the participants are of the role they themselves are playing in it. The electronic dialogue, like the face-to-face (f2f) variety, can be improved by the participants developing their dialogue competence (Wilhelmson & Döös, 2002). Ability to link thoughts together in digital conversations makes a substantial addition to learning, especially in the case of distance learning. As a participant in digital conversations, one needs, then, to cultivate the ability to conduct learning conversations and also think about creating good preconditions both for oneself and for others.

The person planning and conducting a course also has great possibilities of influencing how instructive the digital conversations become and the extent to which they attain qualities concerned with linking thoughts between and within the individuals taking part. This is primarily a question, not of intervening in the actual conversation, but rather of course planning, and of course leaders and teachers understanding why, and by what means, a digital conversation proves successful. In this way they can contribute toward positive opportunities and conditions in the form of tasks, group composition, and requirements.

When arranging dialogue group conversations f2f, one can speak of the importance of reserving "a bubble of time" affording scope and tranquility for reflection (Wilhelmson & Döös, 2002). A counterpart in dialogue on the Web could be concerned with each participant assuming personal responsibility for allotting time to be present in the task of writing and reading, that is, the Web conversation's two counterparts speaking and listening. This implies a degree of carefulness that differs from the impulses characterizing a great deal of computer communication—availing oneself of the possibility inherent in choosing for oneself, not only the point in time, but a period of time when Web talk takes place with peace and quiet for study. Just as the members (Dixon, 1994) of an organization (meaning, in everyday speech, associates/employees) have to shoulder their responsibility for the learning required for performance of the task in hand, so the members of the conversation have to assume personal responsibility for rigging up good preconditions for getting something out of the digital conversations that are a part of the course they are taking. This assumption of responsibility, however, is connected with the nature of the task that, as a participant, one sees ahead of one. Articulating this to oneself and to the others can help to prevent problems later on, for example, regarding work inputs and digital attendance, problems rooted in participants' differing perceptions of the task. For example, is it something you undertake because you are bursting to learn, or are you attending the course for some other purpose and aiming for it to take up as little of your time as possible?

BASICS ABOUT LEARNING

Dialogue for the purpose of learning is based on different people having different ways of looking at things because they have led different lives and acquired purely personal experience. In dialogue, the fact of us thinking and feeling more

or less differently is both a precondition and an obstacle. We shall now turn to consider learning processes of relevance in the sense of helping us to understand how a competent Web dialogue can be conducted.

Learning in Action

Experience-based learning takes place in concrete contexts, while the learning individual is occupied with quite different things from learning, namely the performance of tasks or duties, conversing, solving problems, and understanding things (Döös, in press; Kolb, 1984). Everyday learning, then, takes place within tasks; in other words, you busy yourself with something and you learn into the bargain. The individual person's learning proceeds by short steps, with the greater part of learning consisting, not of new things, but of confirmations and more of the same. One experience is added to another, and everyday knowledge is constructed and consolidated continuously. Differences and deviations also appear against this background. Only when one knows what something ought to be like, or usually is like, is it possible to be surprised by deviations (Döös, 1997). Learning through conversations with others can be described in similar terms (Bjerlöv, 1999).

When learning takes place via the Web, Fåhræus (2003) has identified three parallel learning processes: learning to communicate and converse electronically, learning to learn together (the collaborative aspect), and learning the matter with which the course is concerned (the content). These three learning processes proceed in parallel and, at best, support one another. As a teacher and course leader, one should bear all three processes in mind and remember that they need time and attention in order to come about and acquire quality.

Collective Learning

Reflection is a vital ingredient of learning, with the result that dialogue, conversation, communication and so forth have attracted a great deal of attention in recent decades, on research as well as practice. When people learn together, collaboratively (Fåhræus, 2003), in an interactive and communicative process, then in favorable circumstances we can also find collective learning taking place (Dixon, 1994; Ohlsson, Granberg, & Stedt, 2004). If so, we get synergistic effects, with 1+1 making more than two, that is, the participants change their conceptions in a different way from what each of them could do on his or her own. Instead of just each individual learning by belonging to a group, learning results in the participants' conceptions during the conversation becoming collective, that is, a great deal more similar, almost communal. In Swedish worklife education research, collective learning has been made theoretically comprehensible through studies of f2f meeting conversations of different kinds. It has been described as something that happens in teams or other clearly delimited, (most) often formalized and small groups in which it is established and known which people are included and what their functions are. Collective learning, however, has partly different principles and sequences in different specific environments, in different contexts (Döös & Wilhelmson, 2005). The engendering process results in changed understanding and similar preparedness for action. In more distributed contexts in working life, it has been possible to identify the importance of a common arena for action (op. cit.) in that product development in the telecommunications and data communication industry has led to collective learning through a host of paired contacts by telephone, Internet, e-mail, electronic subscription, and meeting points. The common arena for action consisted of coordination in the task, that

is, joint development of the technology. Accordingly, the results of one's own actions and other people's actions were also gathered together in technical artifacts.

WHAT IS DIALOGUE COMPETENCE?

Dialogue is something more and different than ordinary conversation. It differs from discussion by not being aimed at beating or convincing other participants in the conversation. Bohm (in Senge, 1990) describes discussion as a subject being tossed between the participants: the subject is analyzed and arguments for and against presented. Each participant's purpose "is normally 'to win' and in this case winning means to have one's views accepted by the group" (p. 240). The purpose of the dialogue, in contrast, is described as that of "going beyond any one individual's understanding ... individuals gain insight that simply could not be achieved individually" (p. 241). In a dialogue, one is not out to prevail over others; the purpose "is to reveal the incoherence in our thought" (p. 241).

Dialogue conversation is difficult and demands a competence that many people need to practice for. It contains (see Table 1) four different parts: speaking, listening, critical self-reflection, and critical review of other people's standpoints (Wilhelmson, 2002). In learning dialogues, people can meet by making different perspectives visible, conversing on a subject, and helping each other to relate it to a wider context, gaining an overview and seeing one's own part of the overall picture.

Group conversations can be powerful learning situations that change people's learning processes and the preconditions of those processes by providing an opportunity for the communal creation of meaning. This means creating conversation topics that make the conversation meaningful and necessary in relation to what is to be learned on this particular occasion. It is also recommended

that the topic of conversation be of such a kind that there are no right or wrong answers, and that if possible it should also concern something of which the participants have personal experience or knowledge. Dialogical quality of conversation (Wilhelmson, 2006) helps to make conversations in themselves instructive in a qualitatively good sense.

The point of departure for learning dialogues is for each individual taking part in the conversation to have specific experiences of his or her own that are different from other people's experiences. Wilhelmson (2006) likens the conversation topic to a statue, arguing that the statue is an imaginary picture of the conversation topic, which the participants in the conversation build up together when, from their various perspectives (each individual person's conceptions/experiences), they make different aspects of one and the same subject to reality visible. Together the people conversing walk around the statue and in their conversation highlight as many aspects as possible of the subject that they are together endeavoring to understand.

Speaking and listening are the core of dialogue competence, which is more complicated than it sounds at first. In order to learn from and with each other in the course of conversation and perhaps build new shared knowledge, every participant must be capable of pleading for his or her own standpoint in the conversation but must also be open to other people's arguments. One has to be prepared to query one's own standpoints and to critically review other people's.

A dialogical group conversation has both integrating and differentiating qualities. Contributing as a participant toward integration means building on what others say, gathering the threads of conversation into a fabric—not instantly dismissing other people's differing views, but instead trying to get inside their way of thinking. Contributing toward differentiation means problematizing and questioning on the basis of one's own experience and knowledge, contributing one's own view-

points and experiences, with personal integrity. The friction arising out of difference provides an opportunity for getting to the bottom of things and scrutinizing one's own and other people's conceptions.

DIFFERENT FORMS OF INSTRUCTIVE E-MEETINGS

There are many different kinds of e-meetings. Here, as has already been made clear, we are mainly concerned with electronic meetings conducted within the framework of a course in order for the participants to learn something. Meetings communicated electronically are primarily concerned with text communication, possibly supplemented by image or video transmission in which the participants can see each other. An e-meeting can be conducted in chat form, with all participants active simultaneously, but often an asynchronous (non-simultaneous) meeting is opted for and allowed to last longer. Even the relatively synchronous chat, however, is more asynchronous than f2f conversations, in which the speaker can be heard in mid-sentence, can read off the other participants' facial expressions, and can make the rest of what he or she says take a different course from what it was about to do just now.

Degrees of Liberty and Structure

Just as a dialogical f2f group conversation can be facilitated by adhering to a certain structure,

governing must be considered a natural part of the teaching context. Pedagogics is about processes of influence. Research has shown that computer-based training needs a certain amount of guidance in order to get a rewarding discussion started at a distance (Wännman, 2002). It is not the intention here to define a certain degree of suitable control, but rather to consider how it can be done. Basically, guidance can be exercised in two ways, firstly by intervening, through the medium of conversation, in the individual person's world of thoughts and ideas, directly in people's thoughts and contexts. Use is then made of the changed possibilities of the conversation itself, for example, through a direct question from the course leader to the participants. The other path to guidance involves conditioning surroundings and outward arrangements in such a way as to change the preconditions, for example, through the choice of subject or procedure.

There are ways of imposing a structure on the conversation without necessarily controlling it too closely. One can put out a vignette, which serves as a starting point and stimulus for thoughts and ideas that the participants want to share with each other, the plan being for this to arouse curiosity and trigger conversational activity. The conversation that then ensues can take quite a different turn from what the leader had envisaged, but if it is to be a free conversation, one should refrain from intervening and directing it. Another way of providing a common kick-off point is by asking the participants to see one and the same film or read an article, as in the introductory examples. They can also engage in brainstorming, role play, or a debate (Fåhræus, 2000).

Table 1. Ingredients of dialogue competence (Wilhelmson, 2002)

| | Self | Others |
|-----------|--------------------------|---|
| Closeness | Speak | Listen |
| Distance | Critical self-reflection | Critical review of other people's standpoints |

The next step toward more structure may be to indicate a certain sequence. All participants, for example, are to begin by describing personal experience of gender discrimination before embarking on more two-way conversation. To further structure the procedure, they may be required to read and summarize an article and then ask each other questions that have to be answered within a certain time. This structure can be made highly detailed, and computer support can be used for shaping it up. There can be different electronic conferences or folders in which the participants have to post their article summaries, or question boxes can be used with linking answers.

An extra clear structure is obtained if the system is made to verify that the participants complete all their assignments according to the procedure and remind them of what they have to do next. There are systems that create groups by pairing participants off when they have reached a certain stage in their studies. This can provide teachers and course management with support for the administration and monitoring of large groups. Systems can also direct students' questions in digital conferences, in such a way that they are first processed and thus potentially answered by the student group. This can have the effect of increasing communicative activity as well as lightening the teacher's workload and saving him or her from becoming a bottleneck.

Synchronous or Asynchronous?

The meeting assumes a completely different character if conducted with all participants present and active at their computers simultaneously, compared with the situation of its lasting for a fortnight and the participants deciding for themselves when to access, read, and post contributions. The synchronous meeting can get quite hectic: you have to be pretty nimble-fingered to get a word in edgeways. Without a predefined procedure for the meeting, things often seem pretty chaotic.

In f2f conversations, some moderators use the expedient of a talking stick or ball that has to be replaced in the middle before being picked up by the next speaker. Part of the purpose of this arrangement is to slow down the tempo. The time lag in the asynchronous conversation rules out the need for any such dodges. Basically it gives us more time to work out what we want to say, reread what we or other people have written previously, and amend what we write before sending it off. Each individual is enabled to say his or her piece, without being interrupted by those who have "the gift of the gab." Instead, another sort of time shortage is liable to occur, owing to competition from everyday commitments; reserving a bubble of time is not always easy.

An asynchronous meeting is sometimes found to be unenthusiastic and slow-moving. One variant that can pep things up and help to overcome the difficulty of reserving time is for the group to fix certain times when everyone will be online at once, an online seminar, or at least a day or two when everyone participates more frequently in a dialogue. This is something midway between the synchronous and the asynchronous, an attempt to combine the advantages of both.

Choosing Different Forms

It is natural, in a learning process during a course, to vary and utilize different forms at different stages. Perhaps you begin by getting a group to formulate their own questions in a subject on a brainstorming basis. What are the problems? What do we need to know? Or do? For arriving at a decision, for example, on a working plan, the synchronous meeting is the best alternative. Afterward, perhaps the participants will search individually for information on the Web, updating each other on important discoveries as they go along. Then a communal asynchronous dialogue ensues on the most interesting or controversial points, ending perhaps with a joint verbal debriefing to a larger audience.

On a course it may be a good idea to ask the participants to reflect on the form of dialogue in itself. One initial task could be to link up thoughts on one's notions and experiences of conducting a learning conversation and of doing so digitally. This is one way of getting the participants, right from the outset, to create their own understanding and insight concerning what is expected to take place, and what can take place, so long as they themselves make something of it. For example, the group could be issued with three pictures to begin with, for example, linking thoughts, Web talk, and alternation. Such digital starting conversations can be returned to, reread, and talked about again later on during the course, in order to reflect on their application in practice, what has been learned, what experiences have been gained, and what can be done differently for the remainder of the course.

THE DIALOGUE POTENTIAL OF THE MEDIATED CONVERSATION

Conversation at a distance *versus* f2f presents both similarities and dissimilarities. Among other differences, whereas communication in a group conversation on the Web is text-formulated, delayed, and enduring, f2f communication is oral, immediate, and evanescent. Dialogue, as already remarked, is a concept originally referring to a particular variant of oral f2f conversations.

Can one really speak, then, of conducting a dialogue when people cannot see each other, cannot read off the small but often distinct signs of the interlocutors being on the same wavelength or objecting to what one is saying? In the electronic meeting, a lot of the things people communicate to each other in the physical meeting through vision and hearing are lacking. To make up for this in the electronic meeting, extra care has to be taken not to offend each other and to verify that the person we are conversing with has understood us properly.

Habitual distance speakers often supplement the written word with emoticons¹, such as ☺, “laugh,” or <J> (for “joking”). Emoticons serve to clarify the participants' feelings and the meaning behind their words, which in turn can contribute toward involvement and help to underpin the dialogue. Emoticons can also have a disarming effect or provide a touch of humor.

The time lag is one characteristic of the asynchronous electronic meeting that can both impede and facilitate dialogue. Perhaps we are sitting at the computer, describing a harrowing experience we have been through or a new idea that has come to us. We would then prefer to know instantly what the others think of it. Instead, hours or days may pass before anyone picks up the thread of one's contribution. This can be frustrating, indeed frightening, and make us lose interest in the conversation. On the other hand a modicum of delay can be a good thing. There are advantages to allowing oneself time for reflection between the lines. One way of reducing the disadvantages of the time lag is for all participants to try to answer each other's contributions as promptly as possible, sometimes perhaps just to show that they have read what was posted and want to give it more thought before pitching in with their own viewpoints. That way I am spared the feeling of writing in a vacuum; someone out there can “hear” me (Fähræus, 2000).

Once the e-meeting conversation has gotten underway, the participants sometimes get very active, writing long contributions and many of them. This may complicate matters, with the participants finding it hard work and perhaps also tedious to read everything. There is a risk of one or two participants dominating the proceedings and crowding out others, just as in an f2f meeting. If the participants themselves do not notice this and propose a different speaking order, the course leader may have to intervene. Often just making everyone aware of what has happened and suggesting they keep it a bit shorter will help. Or again, one can identify different topics

of conversation and assign them to different communication spaces.

In an electronic conversation, whatever is said/written is perpetuated. Perhaps you happened to write something unusually silly, offensive, or ill-considered. Once sent away it cannot be retracted; it can be read and reread over and over again. What has been written can offend somebody seriously. That kind of damage is extra difficult to repair from a distance. But the permanence of the text also gives us instruments with which to proceed from other people's contributions, deepening the arguments. It all adds up to a different dialogue from the face-to-face variety, offering still greater opportunity for reflection, which may suit some people better than others.

In order for the thoughts about dialogue competence to be applicable to e-meetings, concepts like "speaking" and "listening" have to be reinterpreted. After all, we are not really talking but writing to each other. The speech component means presenting our viewpoints, arguments, and known facts in writing. We state who we are and what our background is. This applies not only to the content—the subject matter of the dialogue—but also to matters concerning the communication and learning process. Instead of just shaking our heads at a contrary opinion, we have to write about it. Not being ourselves visibly in purely physical terms, we have to be made visible by what we write.

The listening component in the dialogue competence matrix is concerned with reading what others have written, and showing that we wish to know more, are curious to see what others can contribute. In f2f meetings, just looking at a participant may be sufficient inducement for them to speak. Here we have to write a message and send it off, as a part of active listening.

Dialogue competence includes critical self-reflection. In an e-meeting this is achieved by writing in a way that shows we are open to changing our understanding. We should also tell the others when we have changed our minds and

tell them how we have received and understood other people's experiences and knowledge. Critically scrutinizing what other people say means that we describe how we interpret what others have written. We show what we agree with and suggest other ways of understanding and thinking, as the case may be. We can also query the other person's input data, requesting more facts and arguments.

CONCLUDING REMARKS

The electronic meeting can be regarded as an inferior variant of face-to-face conversation, but this is an oversimplification and an outmoded way of looking at things. Instead, possibilities are opening up for different forms of communication. These have their own advantages and disadvantages, knowledge of which increases with use. This article draws attention to what is new in relation to ordinary conversation, and, more specifically, it highlights group dialogues as learning conversations. Course leaders and teachers wanting to create opportunities for learning Web dialogues, as well as the interlocutors, need to wise up on the digital interchange of thoughts as a form. We hope that this article has contributed in this direction, even though the scope of it does not include clear-cut recommendations or considerations for developing a dialogue-based course.

An electronic meeting is here seen as an offer, an arena which I visit of my own volition. There I can find the thoughts contributed by my fellow-students and can decide for myself what to read and what to reply to. I can choose what to show of myself, but at the same time I should realize that my choice, my arena behavior, will affect the other participants and the group's interaction, and with them the benefit to myself from our coming together. It is hard to divest oneself entirely of the comparison with the f2f meeting and not to see the latter as the ideal worth pursuing, which makes it appropriate to recall the manifold disruptions

occurring in the course of ordinary conversation, the fact of some things being easier to talk about on the phone and the fact of many lessons and meetings being deadly dull and basically just a way of killing time. But the parallel to conversations in which people have, face-to-face, developed their capacity for engaging in a dialogue (Wilhelmson, 2006) is a useful one; knowledge from this field spurs each and every one to ponder the nature of its digital counterpart.

With technology present in the conversation space, we have access to tools that can create new meetings and a different kind of understanding. We can imagine an asynchronous conference system that projects the structure and flow of the conversation onto a screen that all the participants can see: who is talking, who is listening, and what is being critically appraised. Would this help the participants to reflect on their behavior and by doing so to succeed in deepening the argument? Or would it only be a source of confusion and disturbance? A system of this kind could resemble what are termed visualizing argumentation systems (Kirschner, Buckingham Shum, & Carr, 2003).

Returning to the example with which this article began, and considering what happened in the two groups, we may note that the participants in the first group showed little of themselves or where they stood. When, at the course moderator's request, they presented personal experiences, these did not meet with any critical appraisal. Assenting remarks can be encouraging to hear, but similarities alone will not deepen the conversation, and the dialogue fails to materialize. In the other group, both differentiating and integrating conversational qualities were present. The misunderstanding that occurred threatened to detract from confidence within the group, but the open dialogue that had already been treated enabled the misunderstanding to be cleared up. Arguments concerning the nature of gender discrimination and its causes gave the participants new perspectives on their own experiences. In

this instance the participants can be said to have demonstrated their dialogue competence in the electronic meeting.

Even if a computerized analytical system is not being used, it may help to pause every now and again during a course to reflect on meeting forms and the tone of conversation. The concepts presented in this article can be a good help. One cannot expect everyone to possess dialogue competence without having been given an opportunity for practice and reflection. It may, for example, be appropriate to have course tasks underpinning the participants' own awareness of what it takes for conversations to attain dialogical quality. This is a matter of understanding the basic ingredients of the f2f dialogue and of jointly considering, in the digital conversation, how it can be applied to e-meetings.

Talking in writing must be termed essentially alien to our human nature, and yet it is common enough. Digital exchange in the learning context involves changing one's thoughts, not just exchanging words. Verbal exchanges by computer are associated, not infrequently, with hasty action and impulsive responses, sudden statements, and brief questions. Pensiveness, exchange of thoughts, and individual learning are associated with paper, books, and armchairs. Perhaps technology today offers a digital context that can be likened to the common arena of action that is important for the occurrence of collective learning (Döös & Wilhelmson, 2005). Computer conferences have become a new way of meeting, and people now have the possibility of also being dialogue competent in digital conversations.

REFERENCES

- Bjerlöv, M. (1999). *Learning in work based discourse. A study of talk and learning in meetings at a workplace*. Arbete och Hälsa 1999:1, Solna, NIWL (in Swedish, English summary).

- Dixon, N. (1994). *The organizational learning cycle. How we can learn collectively*. London: McGraw-Hill.
- Döös, M. (1997). *The qualifying experience*. Arbete och Hälsa 1997:10, Solna, National Institute for Working Life (in Swedish, English summary).
- Döös, M. (2007). Organizational learning: Competence-bearing relations and the breakdowns of workplace relations. In L. Farell & T. Fenwick (Eds.), *Year book 2007. Educating the global workforce: Knowledge, knowledge work and knowledge workers*. (pp.141-153) Kogan Page.
- Döös, M., & Wilhelmson, L. (2005). Collective learning—On the importance of interaction in action and a common action arena. *Pedagogisk Forskning i Sverige*, 10(3/4), 209-226. (In Swedish)
- Fähræus, E. R. (2000). *Growing knowledge—How to support collaborative learning e-discussions in forum systems*. No. 00-005. Dept. of Computer and Systems Sciences, Stockholm University/KTH. Retrieved from <http://www.dsv.su.se/~evafaahr/lic/index.html>
- Fähræus, E. R. (2003). *A triple helix of learning processes—How to cultivate learning, communication and collaboration among distance-education students*. Unpublished doctoral dissertation, Dept. of Computer and Systems Sciences, Stockholm University/KTH, Report No. 03-015. Retrieved from <ftp://ftp.dsv.su.se/users/jpalme/eva-f-doktorsavhandling.pdf>
- Kirschner, P. A., Buckingham Shum, S. J., & Carr, C. S. (Eds.). (2003). *Visualizing argumentation: Software tools for collaborative and educational sense-making*. London: Springer. Retrieved from <http://www.visualizingargumentation.info/>
- Kolb, D. (1984). *Experiential learning. Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.
- Ohlsson, J. Granberg, O., & Stedt, L. (2004). Collective learning—The bridge between the individual and the learning organization? In *Workplace learning—From the learner's perspective*. Denmark: LearningLab.
- Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday Currency.
- Wännman, G. T. (2002). Women creating knowledge on the Web. Umeå universitet, Pedagogiska institutionen.
- Wilhelmson, L. (2002). On the theory of transformative learning. In A. Bron & M. Scheemann (Eds.), *Social science theories in adult education research* (pp. 180-210). Münster: LIT Verlag.
- Wilhelmson, L. (2006). Dialogue meetings as non-formal adult education in a municipal context. *Journal of Transformative Education*, 4(3), 243-256.
- Wilhelmson, L., & Döös, M. (2002). Dialogue competence for development in working life. Stockholm: NIWL. (In Swedish)

ENDNOTE

¹ emotion + icon

Chapter 5.13

Differential Impacts of Social Presence on the Behavior Modeling Approach

Charlie C. Chen

Appalachian State University, USA

Lorne Olfman

Claremont Graduate University, USA

Albert Harris

Appalachian State University, USA

ABSTRACT

The continued and increasing use of online asynchronous learning (OAL) environments for training raises the question whether and to what extent behavior modeling, the most effective training method in live instruction, will prove to be effective in OAL environments. This article analyzes the effect of applying behavior modeling training in an OAL environment. Behavior modeling training can be delivered in three modes: face-to-face, videotaped, and scripted. Each behavior modeling mode expresses social presence to a different degree, which could impact both learning performance and the willingness of students to take online asynchronous training. This study reports on the effect of behavior

modeling mode on these variables in an OAL environment. Nine hypotheses were proposed. Four hypotheses were supported and five were not. This research found that the face-to-face environment is not significantly more effective than an OAL environment.

INTRODUCTION

The worldwide corporate e-learning market is expected to grow to \$24 billion (\$18 billion in the U.S.) by 2006, with a compound annual growth rate of 35.6% according to IDC (2003). The burgeoning online learning and training markets, and the increasing training budgets of businesses and

schools, have provided users of online training and marketing tools with practical reasons, as well as compelling research motives, to investigate the effectiveness of online asynchronous software training.

Behavior modeling is viewed as the most effective training method in live instruction (Simon, Grover, Teng, & Whitcomb, 1996; Compeau & Higgins, 1995). Three general modes of behavior modeling have been compared experimentally: (1) face-to-face (F2F) instruction, (2) videotaped instruction, and (3) scripted instruction. Since online asynchronous training does not use live instructors, it is possible that the F2F mode may be more effective than the other behavior modeling training modes. This article presents the results of a study to compare three modes of software training delivered in a Web-based format. It uses a "live instructor" behavior modeling format as a control.

The experiment was prompted by the need of 135 college undergraduate Business majors at the California State University, Northridge, and Loyola Marymount University, Los Angeles, to learn Access 2002 in an introductory computer course. The three general modes of behavior modeling training noted above were compared to see which produced the best performance, student satisfaction, and agreement with learning style.

LITERATURE REVIEW

Simon et al. (1996) categorize general training approaches into instruction-based, exploration-based, and behavior modeling. These three approaches are designed to improve learning outcomes for students with different learning styles in an F2F environment. Although not equivalent now, the online asynchronous learning (OAL) environment may eventually replace the F2F environment for practical training purposes. It is already the case that an online student can study lecturers' prepared slides, browse relevant

Web sites, and ask for solutions via discussion boards, among other means of assistance in solving problems. However, in the OAL environment, the immediacy of an instructor's F2F demonstration is hard to achieve. It is doubtful that behavior modeling methods have yet been adapted fully to the OAL environment.

Behavior modeling may be one of the better approaches for F2F instruction, but it may not be equally effective for online asynchronous instruction because it is based on instructor demonstration. For example, in a live training class, the instructor will demonstrate some software processes and ask the students to repeat the activity. However, in an OAL environment, where there is no live instructor, the demonstration may lose some of its benefits. The possibility exists that the behavior modeling approach is not the most effective training method in online training situations. Therefore, the effectiveness of behavior modeling in its different modes should be established in an OAL environment.

From the perspective of research design, "replication can and should mean testing empirical implications of theory — interpreting 'theory' broadly—in similar and dissimilar situations and experimentally and nonexperimentally" (Kerlinger & Lee, 2000, p. 570). The OAL environment provides a research opportunity to validate the assertions of Bostrom, Olfman, and Sein (1990) and Simon et al. (1996), and to extend their software training frameworks to the OAL environment.

LEARNING STYLES AND ONLINE BEHAVIOR MODELING

Online asynchronous training differs from traditional training in its self-directed and self-paced learning approach (Belanger & Van Slyke, 2000). As a result, it is plausible that individual differences have more influence on learning outcomes in the OAL environment. Many researchers

(Davis & Davis, 1990; Palvia, Palvia, & Zigli, 1992; Vessey & Galletta, 1991) have investigated learning preference and its influence on learning outcomes. It is widely believed (even being a tenet of the Kentucky Education Reform Act of 1990) that students learn more effectively if they are taught via their preferred learning styles. Ramsden (1988) affirms that learning styles or orientations of students need to be taken into consideration when a teacher designs curriculum.

Different studies propose different learning styles (e.g., Myers-Briggs's Type Indicators and Kolb's Learning Style Inventory — LSI) to serve their needs (Mitchell, 2000). Most of them agree that learning styles are experiential or phenomenological in nature (Kolb, 1984; Lewin, 1951). Students change their learning styles based on their learning experiences (Harris & Scwahn, 1961). Students with different learning styles also show preferences for different teaching methods (Gregorc, 1982) and software training methods (Bostrom et al., 1990).

In the OAL environment, instructors should customize Web-based learning tools for students with different learning styles. For instance, online training tools may need to be tailored for students based on their LSI profiles (Ross & Schultz, 1999). The behavior modeling approach has been considered the most effective approach in the F2F environment. Learning style seems to be inconsequential with respect to behavior modeling. It is possible that the behavior modeling approach may still be the most valid method for training in the OAL environment, regardless of the students' learning style. It is not known which learning medium would be the most effective vehicle for the behavior modeling approach in the OAL environment.

OAL Environment

Built on his personal distance training and education experiences since 1971, Horton (2000) suggests that online synchronous and asynchronous

learning and training be designed for different purposes. Synchronous learning demands the control of schedule, time, people, class size, video and audio equipment, and place. These factors constrain the possibility of reaching large numbers of students at any given time and in any given place.

This study limits its focus exclusively to software training in an online asynchronous mode to avoid the influence of these factors embedded in synchronous online training. This choice reflects the reality that most online training delivered across continents is in the online asynchronous mode, and that use of that mode is destined to grow incrementally and exponentially. Therefore, this study is intended to develop a more versatile, compatible, and responsive online software training strategy for online asynchronous students in the IT field.

Online Asynchronous Mediums for Behavior Modeling

Simon et al. (1996) define the behavior modeling approach as “a combination of the exploration and instruction methods that concentrates on the idea of observing and doing while following a role model” (p. 44). The behavior modeling approach customizes the learning environment for all students, making it easier to understand learning materials. Its lecture formats include specific learning points and hands-on experimentation. Imitating the instructor in using a target system encourages the students to participate and experiment using the target system to follow their own paths. Online asynchronous training mediums empower the practice of behavior modeling because users can study lecture slides on one hand, rely on external resources to solve problems, and get feedback from teachers and students.

Without the presence of a live instructor, the scripted solution potentially narrows the difference of training approaches (yielding a smaller effect size) that may contribute to the difference

of training outcomes. Videotaped or videotaped-based behavior modeling may somewhat resemble the F2F learning environment. Since a live instructor is replaced with a scripted or videotaped demonstration, there is a necessity for students to play a more active role in an OAL environment. Nevertheless, the suitability of delivering behavior modeling in these different modes is unclear. Assessing the relevance and applicability of behavior modeling training method in different modes is the first important step toward discovering an optimal online asynchronous behavior modeling training method.

Social Presence and Information Richness of Online Asynchronous Mediums

Theories of social presence and information richness (SPIR) have strong implications to online learning. For instance, e-mail with social cues can deliver psychological presence, while asynchronous conferencing (e.g., whiteboard and net chatting) can deliver more rich information than downloaded files. Figure 1 shows a taxonomy illustrating the SPIR features of online asynchronous training mediums.

In the F2F environment, exploration-based, instruction-based, and behavior modeling approaches are three useful training methods to teach software use. In an OAL environment, different online mediums can support each traditional training approach. Lecture slides, indexing, FTP, and other accesses to workstation applications can be used in instruction-based mode for software training. Message systems, conferencing, and browser links to Internet sites, on the other hand, allow students to explore solutions for problems given by instructors.

The effectiveness of behavior modeling is a function of people and the environment (Lewin, 1951). Integrating mediums with differential SPIR degrees into the OAL environment may affect the usefulness of behavior modeling method.

Comparing behavior modeling method in F2F, scripted and videotaped modes allow students to investigate the impact of differential social presence on learning effectiveness.

Potential Difference of Training Approaches between F2F and OAL Environment

Numerous studies came to a similar conclusion, which is, there is no significant difference in end-user satisfaction (Russell, 1999) and learning outcomes (Smeaton & Keogh, 1999) between F2F and online modes of education. Swan (2002) recommended that social presence and interaction be incorporated into the design of online courses to improve student satisfaction and learning outcomes. Unlike online education, incorporating the three general software training approaches (instruction-based, exploration-based, and behavior modeling) that have long been successfully established in the traditional F2F environment into an OAL environment can be problematic. As a case in point, the success of the exploration-based training approach in the OAL environment is contingent upon: (1) the quality of the course materials, (2) the OAL environment (Web site) design, and (3) the available bandwidth. This differs from the training approach in the F2F environment where quality of course materials is the major determinant. Moreover, generic examples used in the course materials may be relevant to some online asynchronous users and irrelevant to the others. In the OAL environment, the student population is more diversified. An inability to customize course materials based on students' backgrounds may reduce the effectiveness of the exploration-based training approach. Lack of a live instructor is likely to make the situation worse. Students with lower motivation may direct their attention to other matters not relevant to the immediate learning task, without the presence of an instructor to provide the necessary discipline to redirect students' attention.

Differential Impacts of Social Presence on the Behavior Modeling Approach

Through the reiterative communication process, the exploration-based approach in the F2F environment can mitigate any misunderstanding between instructor and students about the goals of the training and course materials. In the OAL environment, an asynchronous communication pattern takes place. Misunderstanding is generally identified after a learning attempt takes place, that is, the instructor and students do not communicate with each other at the same time (asynchronous). This phenomenon may discourage some students with lower self-guidance abilities from keeping pace with the goals. The wealth of Internet information can even distract some students' attention away from the course objective. In the F2F environment, the live instructor can facilitate the process, give timely feedback, and quickly get a discussion back on track. This condition does not exist in the OAL environment. There is a need to make a trade-off between information richness and reach for students who do not have high-bandwidth connections at home or work. An instructor may need to give up some richness of

information to reach larger number of students. Without knowing the accessibility of students to the Internet, instructors will have trouble deciding the right trade-off. Class size adds another variable, complicating the situation. The greater the class size, the more time an instructor will need to respond to students' questions in both the F2F and OAL environments.

The behavior modeling method is an enhanced mode of instruction-based and exploration-based methods. As a result, the behavior modeling method naturally inherits potential flaws of the other two methods in the OAL environment. In addition, in the OAL environment students may have trouble with the lack of modeling behavior from a live instructor to assist their learning. One alternative that can address this issue is to substitute scripted or videotaped lectures for the instructor's lectures. The interactive presence of the instructor was the key determinant for the success of the behavior modeling approach in the F2F environment. The validity of the claim that using the video replacement for the instructor is

Figure 1. SPIR features of e-learning mediums (based on Fulk, 1993; Daft & Lengel, 1986; Zack, 1993)

| | | | |
|----------------------|------|--|---|
| Information Richness | High | Asynchronous conferencing (Discussing Board, Net chatting and Whiteboard Browser links to Internet sites) | Face-to-Face Video-conferencing |
| | Low | Download lecture slides Access to workstation applications Indexing systems | Web-casting, Messaging Systems (E- mail or Voice-mail) Download lecture slides with audio or video |
| | | Low | High |
| | | Social Presence | |

the most effective training approach for students of all learning styles in the asynchronous environment may not be supported. Additionally, learning outcomes can be further degraded because the real-time reiterative communication process between instructor and students is lost.

Our literature review found that no effective online asynchronous training strategy has been formulated to date. Assessing the relevance and applicability of behavior modeling in an OAL environment is the first important step towards discovering more suitable strategy to deliver it in different modes.

RESEARCH DESIGN

This study applied Simon et al.'s (1996) well-constructed training theory to test experimentally three modes of the behavior modeling approach in an OAL environment. In doing so, we hoped to detect the effects of the independent variables (training method and learning style), as well as their combination, on training outcomes. The experiment was conducted in a field setting that enabled the study to garner greater external validity than would be the case with a laboratory experiment. A field experiment methodology has the merits of "testing theory" and "obtaining answers to practical questions" (Kerlinger & Lee, 2000, p. 583). The exploratory nature of the study requires that variables (e.g., learning style, training methods, and subject areas of study) under investigation be manipulated.

The setting for the field experiment comprised courses offered by two accredited universities: California State University at Northridge and Loyola Marymount University. The experiment was motivated by the need of 135 college undergraduate Business majors to learn Microsoft Access 2002.

Regardless of the teaching environment (online or off-line), computer training is intended to instill in users a level of competency in using the

system and to improve their satisfaction with the system. A user's competency in using a system is contingent upon his or her knowledge absorption capacity. Ramsden (1988) finds that effective teaching needs to align students with situations where they are encouraged to think deeper and more holistically. Kirkpatrick (1967) also suggests that learning effectiveness needs to be evaluated by students' reaction, learning, and knowledge transfer. The levels of knowledge absorbed by students, Bayman and Mayer (1988) suggest, may include syntactic, semantic, schematic, and strategic knowledge. Mennecke, Crossland, and Killingsworth (2000) believe that experts of one particular knowledge domain possess more strategic and semantic knowledge than novices. Knowledge levels, as Simon et al. (1996) suggest, can be categorized as near transfer, far transfer, or problem solving.

Near-transfer knowledge is necessary for being able to understand software commands and procedures. Procedural knowledge is important for a student to use software in a step-by-step fashion. Far-transfer knowledge is to ensure that a student has the ability to combine two or more near-transfer tasks to solve more complicated problems.

Both the use of software and the satisfaction levels of using them are useful surrogates to measuring the effectiveness of an information system (Ives, Olson, & Baroudi, 1983). End-user satisfaction levels have been widely adopted as an important factor contributing to the success of end-user software training. Since the study is to replicate Simon et al.'s research in a dissimilar environment, near-knowledge and far-knowledge transfer, and end-user satisfaction levels were adopted in this study to measure training outcomes.

Participants filled out a questionnaire regarding their experiences with Microsoft Access and other database applications. This survey was used to check subjects' computer literacy and experience.

To determine the effectiveness of the training treatments, subjects were evaluated immediately after training. Evaluation of retention and transfer of learning included 10 multiple-choice questions and one Microsoft Access database problem to solve. This study further links scientific investigation and solutions to real-world situations, while exploring the possibility of applying key determinants for the success of IT training strategy, found in the traditional training environment, to the online asynchronous training situation.

Hypotheses

The online behavior modeling approach replaces the live (face-to-face) instructor with the videotaped or scripted demonstration. Some key elements of the Face-to-face Behavioral Modeling (FBM) approach may be lost. Behavior modeling training in the F2F mode may be more effective at improving the learning outcome for a student than the behavior modeling approach in the online asynchronous mode. Researchers have demonstrated that behavior modeling is more effective than instruction-based or exploration-based approaches in the traditional environment. A similar relationship may still be identified in the OAL environment. Proving that the F2F behavior modeling is more or less effective than the online behavior modeling could justify the validity of replicating the same pattern in the OAL environment. Hence, it is only hypothesized that the FBM approach is more effective than online behavior modeling to improve learning outcomes for students of all learning styles. In the OAL environment, the videotaped-based training may retain more key elements of the online behavior modeling approach, such as the psychological presence of an instructor, than the scripted training approach. Therefore it is plausible that the videotape-based training is more effective than the scripted training approach. In all cases, we are hypothesizing that the FBM approach is more

effective than the Videotaped Behavioral Modeling approach, which is more effective than the Scripted Behavioral Modeling approach.

Perceived Usefulness (PU)

H1a: The Face-to-face Behavioral Modeling approach is more effective than the Videotaped Behavioral Modeling approach to improve perceived usefulness for students regardless of learning styles.

H1b: The Face-to-face Behavioral Modeling approach is more effective than the Scripted Behavioral Modeling approach to improve perceived usefulness for students regardless of learning styles.

H1c: The Videotaped Behavioral Modeling approach is more effective than the Scripted Behavioral Modeling approach to improve perceived usefulness for students regardless of learning styles.

Knowledge Near-Transfer (KNT)

H2a: The Face-to-face Behavioral Modeling approach is more effective than the Videotaped Behavioral Modeling approach to improve knowledge near-transfer for students regardless of learning styles.

H2b: The Face-to-face Behavioral Modeling approach is more effective than the Scripted Behavioral Modeling approach to improve knowledge near-transfer for students regardless of learning styles.

H2c: The Videotaped Behavioral Modeling approach is more effective than the Scripted Behavioral Modeling approach to improve knowledge near-transfer for students regardless of learning styles.

Knowledge Far-Transfer (KFT)

H3a: The Face-to-face Behavioral Modeling approach is more effective than the Videotaped Behavioral Modeling approach to improve knowledge far-transfer for students regardless of learning styles.

H3b: The Face-to-face Behavioral Modeling approach is more effective than the Scripted Behavioral Modeling approach to improve knowledge far-transfer for students regardless of learning styles.

H3c: The Videotaped Behavioral Modeling approach is more effective than the Scripted Behavioral Modeling approach to improve knowledge far-transfer for students regardless of learning styles.

Procedures

The experiment's procedure and timeline utilized in this study are outlined and described below.

Phase 1. Pilot Study

- Solicit opinions of 10 users using a prototype online asynchronous training Web site. These users are not participants in the actual experiment.
- Correct online training-related problems before executing the actual experiment.

Phase 2. Recruitment

- Students are college Business major undergraduates.
- Obtain a copy of students' registration records (names and student ID).
- Randomly assign students to different training methods on the class basis.

Phase 3. Pre-Training Activities (20 minutes)

- A five-minute analogical instruction to explain how the e-training system at <http://blackboard.csun.edu> and <http://www.lmu.edu/blackboard> could help students learn how to use the Access 2002 software.
- Provide students 10 minutes to fill out a pre-training questionnaire.

Phase 4. Training (20 minutes)

- Conduct the training session. The class instructor decided the timeline based on his ability to complete the teaching of five subjects covered in the experiment.
- Since the length of time can affect the learning outcomes, the timeline is standardized for online training approaches.

Phase 5. Post-Training Evaluation (30 minutes)

- Provide students five minutes to complete near-transfer knowledge testing.
- Provide students 30 minutes to complete far-transfer knowledge testing (solve a real problem).
- Provide students 10 minutes to fill out a post-training questionnaire.

Recruitment

Subjects were undergraduates who needed to learn Microsoft Access 2002. The subjects received no additional pay or monetary benefits for their participation in the experiment. Rather, students were notified in advance of their mandatory presence. Students also knew that an additional score of 5 (out of 100) would be credited to their total score of the semester. Subjects were not pre-screened

Figure 2. Allocation of participants

| Training Approach | Behavior Modeling Modes | | | Number of Total Subjects |
|------------------------|-------------------------|-----|-----|--------------------------|
| | FBM | VBM | SBM | |
| Number of Participants | 45 | 35 | 35 | 115 |

for their participation because of the nature of the field experiment.

The students were randomly assigned to one of the three treatments on the class basis: (1) F2F behavior modeling (FBM), (2) scripted behavior modeling (SBM), and (3) videotaped behavior modeling (VBM). A total of 115 students registered to participate in the classes and all participants were expected to attend the mandatory class. Figure 2 shows the arrangement by which these students were to receive one of the three treatments.

Training

The topic to be taught included five main features and functions: (1) create tables, (2) create forms, (3) input records, (4) create queries, and (5) generate reports. All training sessions were conducted using a single instructor, providing continuity throughout all training sessions. This was to prevent the influences of teaching experiences and skills on learning effectiveness.

In the OAL environment, the instructor's presence is often not an essential factor. The limitation of bandwidth also constrains the use of videotaped teaching materials. The study recognized the limitations of these constraints. Therefore, scripted and videotaped presentations were conducted in a computer lab where the 10/100 Mbps LAN infrastructure was established. The length of time for both online behavior modeling methods was controlled to be the same across all three treatments to avoid the outlier influence

of exposure time. Although the compromised solution might not fully capture all the key elements of each training approach, it adequately reflected the real situations of conducting online asynchronous training. Teaching materials were deliberately designed to reflect the key elements of the behavior modeling approach.

Scripted Behavior Modeling

SBM is an enhanced mode of exploration and instruction approaches. The behavior modeling approach includes both inductive and deductive approaches. The treatment was conducted in the same computer classroom as the other online training treatments. Both general concepts and procedural information sections were conducted utilizing Hyperionics' Hypercam Version 1.70.06 software screen capturing application. The application allowed the researchers to record all the step-by-step cursor movements of instruction with voice annotation. More importantly, the Hypercam application substituted for the live instructor-based delivery. Each scripted demonstration focused on one particular function of the database management topic. At each learning point of a particular function, students were encouraged to experiment by practicing the related exercises.

Videotaped Behavior Modeling

Videotape is employed to deliver the image of a live instructor and his/her voice to students on the OAL environment. Like video-conferencing,

videotaped-based training permits psychological presence in addition to using both inductive and deductive approaches. Despite the benefit, the instant interaction between instructor and students are eliminated. Students may have a lower satisfaction level when taking the videotaped-based training rather than the F2F training. Videotaped-based training enlarges the difference between the instruction-based and exploration-based approaches. This increases the effect size that may have higher impact on the effectiveness of training.

F2F Behavior Modeling

Without the presence of a live instructor, the scripted solution had the potential of narrowing the differences between training approaches that may contribute to the difference of training outcomes (a small effect size). To properly control the potential problem, a group in which students received the traditional FBM training approach was introduced. The instructor followed the same script as the one designed for the behavior modeling class in the online asynchronous training mode. The length of time allotted to conduct the training was controlled to be the same as the other online training approaches. The traditional behavior modeling group took the same pre- and post-training tests as the three online groups to properly evaluate the contribution of training approaches and learning styles to training outcomes. The training literature recommends that a control group in a training experiment be included (Wexley & Latham, 1991).

Post-Training Evaluation

Treatment and control groups were administered two tests and satisfaction evaluations upon completion of the 20-minute training treatment. The two tests included 10 multiple-choice questions and one Access database problem to solve.

The multiple-choice questions were intended to evaluate students' procedural knowledge of the commands and features needed to manage a database using Access 2002. Solving a real problem allowed the researcher to evaluate the ability of the students to transfer that knowledge to another subject. There were a total of four sub-questions that required more than one command to solve. Five minutes were allocated for the multiple choice test, while 30 minutes were allocated for the problem-solving test. The two tests were graded on a 10-point scale. The multiple choice test result was based on the number of questions correctly answered. The Access database problem assigned a value based on the number of functions successfully completed.

Experimental Controls

Training Materials

Training materials were carefully crafted by adopting the non-anonymous Delphi method to reach a consensus of experts. Many rounds of discussion with experts insured that the customized content of training materials could properly capture the key elements of different training approaches. This was to ensure that the effect of size across training treatments was well addressed.

Training Packages

The training packages were designed to maximize the effect size or the difference of three training treatments. All training packages began with the illustration of four examples to manage a database using Access 2002. Two examples are prepared for each major. Subjects were encouraged to use one of the two examples relevant to their major to practice through the training session. Step-by-step instruction was adopted to illustrate each function.

Prior Computer Experience

All participants were classified as “novice” computer users or beginners because of their first exposure to the in-class training. Since it was a challenge to locate novice users or users with absolutely no computer experience, the recruitment of undergraduate Business majors from California State University at Northridge and Loyola Marymount University controlled the potential influence of varying prior computer experiences of participants. Most importantly, the majority of these students had not been exposed to Access 2002. Only six students (2.6% of the total number of subjects) self-reported their limited experiences (in the range of one to three hours) of using the software. This situation provided an objective baseline from which to assess the real effects of training approaches by managing the outliers of computer experiences.

Motivation

Controlling for motivation insured that all students had the same incentive to participate in the experimental study. Since the students were students who registered for the class, their participation was not voluntary. Upon completion of the training session, students took two exams, a 10-question multiple-choice test and an MS Access problem to solve. The total scores represented 5% of their aggregate semester grade.

Training Session Time Length

The length of training time is closely correlated with the learning performance of novice students (Wexley & Baldwin, 1986). To mitigate the influence of varying training time, the training time was fixed at 20 minutes based on the class instructor’s judgment as to the optimal time in which to complete teaching five features of the topic “Database Management” in the FBM class.

While 20 minutes may seem short for a training session, given the well-defined domain of the task, the 20-minute session was deemed appropriate and validated by external sources.

Dependent Variables

For reasons of internal validity, the study uses the same measurable indicators — near-knowledge and far-knowledge transfer — extensively used in training and learning experiments. Near-transfer knowledge is a student’s ability to understand syntactic and semantic concepts and procedures after taking an online asynchronous training. Multiple-choice questions are most widely used for this purpose in other studies. In addition, the study was particularly interested in understanding the problem-solving capabilities of students after taking online asynchronous training. Built upon prior studies, the study asked students to actually use the target system to solve a given real problem within a limited time. The MS Access project results were used to measure far-transfer knowledge.

The study also uses Davis and Olsen’s (1984) perceived usefulness and perceived ease of use instruments to measure end-user satisfaction levels.

DATA ANALYSIS AND RESULTS

Ninety-seven students completed the experiment; 18 did not complete the assignment due to missing data and class absence. Due to the possible interaction effects of attitudes and learning performance (near- and far-knowledge transfer), the assumptions of homoscedasticity ($p=0.023$) and normality were tested and supported. Mean and standard deviations of dependent variables are reported for three treatments in Table 1. Multivariate tests of significance are conducted to investigate the effects of personal factors on dependent

Differential Impacts of Social Presence on the Behavior Modeling Approach

Table 1. Means and standard deviations of dependent variables

| Dependent Variables | FBM | | VBM | | SBM | |
|---------------------|------|-------|------|-------|------|-------|
| | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| Satisfaction | 5.50 | 1.095 | 4.11 | 1.484 | 4.62 | 1.382 |
| Near Transfer | 7.80 | 1.44 | 8.48 | 1.57 | 7.83 | 1.76 |
| Far Transfer | 7.70 | 3.11 | 8.14 | 2.29 | 5.78 | 3.11 |

Table 2. Multivariate test of significance

| Effect | Wilks' Lambda | F | df | p | Observed Power |
|------------|---------------|-------|-------|--------|----------------|
| BM Modes | 0.736 | 5.081 | 2; 94 | 0.000* | 0.993 |
| Experience | 0.656 | 1.631 | 8; 88 | 0.035* | 0.965 |
| Class Year | 0.866 | 2.283 | 2; 94 | 0.038* | 0.786 |
| GPA | 0.751 | 2.268 | 4; 92 | 0.010* | 0.915 |

variables (see Table 2). Testing results indicate the existence of main effects of behavior modeling modes. Database application experiences, class year, and GPA are only three personal factors that have a statistically significant effect. These findings lend support to the proposition that different behavior modeling modes could have an impact on students' learning performance and attitudes due to their social presence attribute.

Univariate tests were further performed to understand the accountability of factors for the overall significant results (see Table 3). Significantly differential impacts of behavior modeling modes, frequency of using database applications, class year, and GPA were detected across dependent variables. For instance, behavior modeling modes of training and GPA have significant impact on the end-user satisfaction and knowledge far-transfer capability. In contrast, the frequency of

using database applications has little relationship with end-user satisfaction.

The post-hoc test (Wilcox, 1987) was assimilated in order to verify the formulated hypotheses (see Tables 4 and 5). The analysis results indicate that subjects taking FBM have higher perceived usefulness than the two online asynchronous treatments. The finding supports H1a and H1b. Contrary to these hypotheses, students receiving VBM did not express higher satisfaction levels than students receiving SBM. The existence of reversed relationship in the measure of far-knowledge transfer may be due to higher expectation of VBM than SBM. However, its statistical evidence on H1c is not clearly indicated. Technical barriers of retaining the same resolution level as SBM in VBM course materials may not properly meet the expectation of students.

Our findings did not support H2a, H2b, and H2c. First, VBM and SBM groups scored higher

Differential Impacts of Social Presence on the Behavior Modeling Approach

Table 3. Univariate tests of between-subject effects

| Source | Measure | SS | df | MS | F | P | Observed Power |
|-------------------|----------------------|---------|----|--------|-------|------|----------------|
| BM Modes | Satisfaction* | 15.243 | 2 | 15.243 | 9.085 | .000 | .972 |
| | KNT | 7.197 | 2 | 3.598 | 1.417 | .247 | .297 |
| | KFT* | 100.147 | 2 | 50.073 | 5.732 | .004 | .856 |
| Experience | Satisfaction | 11.319 | 4 | 2.830 | 1.472 | .217 | .440 |
| | KNT* | 24.449 | 4 | 6.112 | 2.540 | .045 | .698 |
| | KFT* | 93.050 | 4 | 23.262 | 2.584 | .042 | .707 |
| Class Year | Satisfaction* | 20.855 | 2 | 10.427 | 5.857 | .004 | .864 |
| | KNT | 2.552 | 2 | 1.276 | .493 | .612 | .129 |
| | KFT | 25.616 | 2 | 12.808 | 1.344 | .266 | .284 |
| GPA | Satisfaction* | 21.247 | 4 | 5.312 | 2.927 | .025 | .767 |
| | KNT | 16.772 | 4 | 4.193 | 1.684 | .160 | .499 |
| | KFT* | 101.322 | 4 | 25.331 | 2.842 | .029 | .753 |

Table 4. Post hoc analysis of BM modes on end-user satisfaction

| BM Modes | | Mean Difference | Significance |
|----------|-----|-----------------|--------------|
| FBM | SBM | .8840* | .015 |
| | VBM | 1.3949* | .001 |
| SBM | FBM | -.8840* | .015 |
| | VBM | .5109 | .360 |
| VBM | FBM | -1.3949* | .001 |
| | SBM | -.5109 | .360 |

* $s = 0.05$

Table 5. Post hoc analysis of BM modes on knowledge far-transfer effectiveness

| BM Modes | | Mean Difference | Significance |
|----------|-----|-----------------|--------------|
| FBM | SBM | 1.92* | .021 |
| | VBM | -.44 | .857 |
| SBM | FBM | -1.92* | .021 |
| | VBM | -2.37* | .017 |
| VBM | FBM | .44 | .857 |
| | SBM | 2.37* | .017 |

* $s = 0.05$

than FBM in the measure of knowledge near-transfer. Second, while students receiving VBM scored higher than those receiving SBM, the score differential was not statistically significant. The similar performance in the measure of knowledge near-transfer across three behavior modeling modes indicates that the element of social presence may have no effects on the dependent variable.

H3a is not supported because the VBM group scored higher than FBM, even though there is no significant difference between these two modes. This may indicate that both FBM and VBM modes present a similar degree of social presence to students. The effect size seems to be much larger between SBM and any other two behavior modeling modes. Both FBM and VBM groups outperformed the SBM group with statistical difference. H3b and H3c are supported. Our speculation that social presence has an impact on knowledge far-transfer effectiveness is partially supported.

Correlation tests showed that a positive correlation exists between end-user satisfaction and three elements of social presence attribute—control (0.621, $p=0.01$), sensory (0.559, $p=0.01$), and distraction (0.446, $p=0.01$). Realism (-0.086) is the only social element that is reported as having no correlation with the measure. These findings do confirm our speculation that the social presence would have impacts on the satisfaction levels of end-users who take online asynchronous training. That is, subjects taking FBM expressed a higher degree of control, realism, sensory, and distraction than VBM. And subjects taking VBM have higher degree of social presence than those taking SBM. The same pattern of evidence is also detected on the correlation tests between social presence elements and the other two dependent variables—knowledge near- and far-transfer effectiveness. These evidences further affirm the importance of integrating social presence elements into online asynchronous training.

DISCUSSION

Behavior modeling preserves not only the strength of induction and deduction pedagogy, but also allows students to imitate the behavior of instructors in the F2F environment. Facing technological discrepancy in their learning environment, online asynchronous students may not be receptive to behavior modeling course materials with high social presence. The reality has necessitated the trade-off among different training behavior modeling modes. Therefore, key challenges ahead of us are to understand whether the trade-off is necessary. There may exist no significant difference among three behavior modeling modes in terms of their social presence impact on end-user satisfaction and learning performance. If this is the case, lights may need to be shed on non-technological issues. Otherwise, technological barriers, particularly the bandwidth and course materials with a high social presence element, may still be an issue.

The results reported above indicate that students assimilating software knowledge through either VBM or SBM achieved comparable levels of satisfaction. However, most students still reported higher satisfaction by taking the FBM than the other two online asynchronous behavior modeling approaches. This result, somewhat consistent with the stated hypotheses, indicates the differential impacts of social presence appear to be much higher between the F2F and OAL environment. VBM and SBM deliver the same degree of social presence element that leads to a similar satisfaction level.

Social presence seems not to be a crucial factor contributing to the effectiveness of transferring near-knowledge. Three behavior modeling modes of training lead to no differential impact. The step-by-step element of the instruction approach seems to be more important than the social presence element. Three behavior modeling modes of training retain the induction element, thereby

allowing students to have the same mastery level of software command and functions.

Counter to the findings, social presence elements did lead to higher performance in knowledge far-transfer effectiveness. FBM and its counterpart VBM preserve a comparable degree of social presence that contributes to higher mean scores than SBM. These evidences clearly prove our viewpoints that behavior modeling modes with higher social presence would have a higher impact on knowledge far-transfer than behavior modeling modes with lower social presence.

LIMITATIONS

Course materials of VBM and SBM were delivered to students through a projector. Technical barriers to have students take advantage of higher levels of student control and flexibility available in the OAL environment seem to be an issue that leads to insignificant difference of end-user satisfaction between VBM and SBM. Most of answers towards the open-ended question, “What were missing from or needed to be added to the online training session?” centered on the control issue. One student commented that “sometimes there was confusion and the training went on further and caused some confusion.” Another participant stated that she needs “the ability to stop and go back, just in case you missed something.” Another way of expressing the lower control level of the course materials includes the control of audio quality and learning pace. Students with varying degrees of experiences and knowledge in database applications expressed dissatisfaction with the play speed of course materials and the frequency of repeating some basic commands. For instance, one student stated, “maybe the sound could be better and a little bit slower pace,” while other students suggested that “background noise should be omitted — [it was] distracting”; “long pauses should be omitted”; and “it may not have been necessary to instruct the users on how to

drag and drop when creating the queries (at least not more than once).”

Although the study was not designed to have replay/forward/backward functions, the degree of control seems to be an issue here to stay. Given no differential impact on the end-user satisfaction and knowledge near-transfer, we will not be able to determine whether the control or social presence is a more influential factor. Despite of the limitations, we can confidently conclude that the control factor is a less important issue than the social presence factor to the effectiveness of far-knowledge transfer. Subjects of the study taking VBM and SBM were given no control of the replay/forward/backward functions. Yet, we can clearly identify the differential impact of social presence on the measure of far-knowledge transfer. This evidence points out the possibility that the control factor may have an impact on the end-user satisfaction and knowledge near-transfer. The study could not testify and quantify the possibility because we could not overcome technical barriers of having the replay/forward/backward functions enabled for all students in the first place. That explains why we used the open-ended questions to measure participants’ opinions about the potential value of such functions. Additionally, the control element of social presence is also measured using a survey. Our findings indicate that three modes of behavior modeling training do provide a satisfactory level of control. In the future study, to measure end-user satisfaction and near-knowledge transfer, the degree of control may need to be manipulated to directly investigate its relative impacts.

A second limitation concerns the existence of potential flaws in recording quality and speed. Although we conducted a survey to measure the realism factor of VBM and SBM, no significant impact on three dependent variables can be identified. This may result from the varying perceptions of audio and video quality, pace, and so forth among all participants. A better instrument to measure these perceptions should be used next

time to serve as covariates for further analysis.

Failure to equalize cell size of three treatments demands that the assumptions of MANOVA and ANOVA be complied to improve the study's reliability. Most of their assumptions were met, except that the independent observations and equal variance-covariance were somewhat complied. Participants receiving FBM treatment are students from Loyola Marymount University, Los Angeles. Other participants are students from California State University, Northridge. They received VBM and SBM treatments. The former is a private university, while the latter is a state university. Students' demographical background may pose a potential threat to the assumption of the independent observations. Additionally, the assumption of equal variance-covariance may also be endangered. The correlation test indicates that students' self-reported GPA, class year, and frequency of using database application positively correlate with learning outcomes. Interpreting our findings may require the consideration of the correlation effect.

In addition to the potential threats of internal validity, the experimental study is also constrained with the generalizability of its findings to the assimilation of conceptual knowledge. However, we do believe that this would not be an issue because the study was principally rooted in the end-user computing field and had a clear objective of improving the learning effectiveness of IT skills, that is, primarily procedural knowledge. Still, researchers can make the generalizability of our findings a less debatable issue by replicating the study with different applications or with different research methodologies.

CONCLUSIONS AND IMPLICATIONS

While the importance of learning strategy and of degree of a student's control may continue to prevail, the design of course materials with a higher social presence element may need to be properly

incorporated in the OAL environment. Doing so allows students to improve their satisfaction level and knowledge far-transfer. There are two options to integrate our findings into the implementation of online asynchronous software training. In the scenario that students are unfamiliar with an OAL system or environment and face-to-face meetings can take place at the beginning of the session, a two-phased hybrid approach could be more effective than a pure online behavior modeling approach. Instructors may want to first conduct an FBM approach in the beginning of training sessions before students familiarize themselves with the training platform. Once the introduction phase is concluded, a VBM mode of training could be assimilated to accommodate the personal schedules of the instructor and students. Based on our findings, the hybrid approach may lead to the same degree of end-user satisfaction and learning performance, particularly in knowledge far-transfer.

In the second scenario, where most students have had experiences of taking online asynchronous training and are familiar with online asynchronous system, VBM could be as useful as FBM in terms of improving end-user satisfaction and knowledge far-transfer. Contingent upon what scenario an instructor is faced with, the two-phased hybrid of FBM and SBM, along with pure SBM may need to be used interchangeably.

A salient fact is that conducting online asynchronous software training is much more complex than the choice between hybrid and pure behavior modeling modes. When faced with a more complex learning environment (e.g., subjects with varying cultural and educational backgrounds, IT skills, cognitive ability, and learning platforms) (Piccoli, Ahmad, & Ives, 2001), control, interaction, and other factors may have more influential impact than social presence factors on the learning outcomes. Investigating those factors is not within the scope of the study and may need to be further probed.

These preliminary results suggest a number of avenues for future research. As we found, the degree of control may enhance or relegate the learning outcomes of students. Too much control by an instructor may risk devaluing the merits of personalized and flexible learning experiences. Without a certain degree of control by an instructor, students may risk over-exercising the merits of flexible learning experiences that may lead to distraction and degraded learning productivity. How to balance the degree of control relegated to students — and based on what factors — may need to be researched.

Our findings also indicate that personal attributes (e.g., experiences with targeted software and intelligence level) correlated with learning outcomes. Some students complained that learning materials were not customized for them. Their answers are either “too fast,” or “too slow” for certain commands, such as “how to drag and drop when creating the queries.” Future research direction may want to focus on the capability of an online asynchronous training session to present alternatives for students with varying personal backgrounds. For instance, an instructor may want to distribute to students a package of learning materials with differential control levels. The package may include three modes of the behavior modeling approach in VCD format (e.g., .avi file), or video stream formats for a few popular applications (Realplayer, Windows Media Player, and QuickTime). This technological design would allow us to closely examine the importance of control factor.

The human dimension is far more challenging to an instructor in a pure OAL environment where “in class” never takes place. A wide variety of individual characteristics may lead to the incapability of any instructor to individualize programs for all students. This leads to inefficiency of producing online course materials and ineffectiveness of satisfying end-users. The friction between users’ desire for learning flexibility and instruc-

tors’ scarce resources is “the biggest challenge in online learning” (Cameron, Beam, & Beam, 2000, p. 101). Nonetheless, future research may be able to cope with the challenges by examining the impact of cognitive styles on the effectiveness of different online asynchronous functions. For instance, researchers who are interested in the Discussion Forums function may want to investigate the usefulness of forming forums based on leadership, learning, or creativity styles.

Students with different creativity styles may be receptive to different tasks (Fellers & Bostrom, 1993). An online asynchronous platform could be a fertile “Press” or environment that can be used to support both explorative and generative tasks. Since the student-centered environment improves the accessibility and availability of information and domain experts (instructors and knowledgeable classmates), it is possible that the production of creativity could be more efficient than the traditional F2F environment (Csikszentmyhalyi, 1990). However, whether the OAL is suitable for any particular creativity style remains an open question.

In conclusion, the study attained its objectives by clearly illustrating the differential impacts of three behavior modeling modes of software training, namely FBM, VBM, and SBM, on end-user satisfaction and knowledge transfer effectiveness. On top of that, the study attests to the potential of presenting viable and effective alternatives to exercise different behavior modeling modes of training.

REFERENCES

- Bayman, P. & Mayer, R.E. (1988). Using conceptual models to teach BASIC computer programming. *Journal of Educational Psychology, 80*(3), 291-298.
- Belanger, F. & Van Slyke, C. (2000). End-user learning through application play. *Information*

Differential Impacts of Social Presence on the Behavior Modeling Approach

- Technology, Learning, and Performance Journal*, 18(1), 61-70.
- Bostrom, R.P., Olfman, L., & Sein, M.K. (1990). The importance of learning style in end-user training. *MIS Quarterly*, 14(1), 101-119.
- Cameron, B., Beam, M., & Beam, P. (2000). Creation, costs and management: The measure of full-service online learning. *Proceedings of IEEE Professional Communication Society International Professional Communication Conference and Proceedings of the 18th Annual ACM International Conference on Computer Documentation: Technology & Teamwork* (pp. 99-109). Piscataway, NJ: IEEE Educational Activities Department.
- Compeau, D. & Higgins, C. (1995). Application of social cognitive theory to training for computer skills. *Information Systems Research*, 6(2), 118-143.
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper-Collins.
- Daft, R.L. & Lengel, R.H. (1986). Organizational information requirements, media richness, and structural design. *Management Science*, 32(4), 554-571.
- Davis, D.L. & Davis, D.F. (1990). The effect of training techniques and personal characteristics on training end users of information systems. *Journal of Management Information Systems*, 7(2), 93-110.
- Davis, G.B. & Olson, M.H. (1984). *Management information systems: Conceptual foundations, structure, and development*. New York: McGraw-Hill.
- Fellers, J.W. & Bostrom, R.P. (1993). Application of group support systems to promote creativity in information systems organizations. *Proceedings of the 26th Hawaii International Conference on Systems Sciences*.
- Fulk, J. (1993). Social construction of communication technology. *Academy of Management Journal*, 36(4), 921-950.
- Gregorc, A.F. (1982). *An adult's guide to style*. Columbia, CT: Gregorc Associates.
- Harris, T.L. & Scwahn, W.E. (1961). *Selected readings on the learning process*. New York: Oxford University Press.
- Horton, W. (2000). *Designing Web-based training*. New York: John Wiley & Sons.
- IDC. (2003, January). *Begin act II: Worldwide and U.S. corporate e-learning forecast*. International Data Corporation.
- Ives, B., Olson, M., & Baroudi, S. (1983). The measurement of user information satisfaction. *Communications of the ACM*, 26(10), 785-793.
- Kerlinger, F.N. & Lee, H.B. (2000). *Foundations of behavioral research*. New York: Harcourt Brace.
- Kirpatrick, D.L. (Ed.). (1967). *Evaluation of training. Training and development handbook*. New York: McGraw-Hill.
- Kolb, D.A. (1984). *Experimental learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.
- Lewin, K. (1951). *Field theory in social science: Selected theoretical papers*. New York: Harper & Row.
- Mennecke, B.E., Crossland, M.D., & Killingsworth, B.L. (2000). Is a map more than a picture? The role of SDSS technology, subject characteristics, and problem complexity on map reading and problem solving. *MIS Quarterly*, 24(4), 601-627.
- Mitchell, J.L. (2000). *The effect of matching teaching style with learning style on achievement and attitudes for women in a Web-based distance education course*. Indiana State University.

- Palvia, S., Palvia, P.C., & Zigli, R.M. (Eds.). (1992). *Global information technology environment: Key MIS issues in advanced and less-developed nations. The global issues of information technology management*. Hershey, PA: Idea Group Publishing.
- Piccoli, G., Ahmad, R., & Ives, B. (2001). Web-based virtual learning environments: A research framework and a preliminary assessment of effectiveness in basic IT skills training. *MIS Quarterly*, 25(4), 401-426.
- Ramsden, P. (Ed.). (1988). *Context and strategy: Situational influences on learning. Learning strategies and learning styles*. New York: Plenum Press.
- Ross, J.L. & Schultz, R.A. (1999). Using the World Wide Web to accommodate diverse learning styles. *Journal of Education for Students Placed at Risk (JESPAR)*, 47(4), 123-129.
- Russel, T.L. (1999). *The no significant difference phenomenon*. Retrieved February 2, 2003, from http://teleeducation.nb.ca/no_significantdifference
- Simon, S.J., Grover, V., Teng, J.T.C., & Whitcomb, K. (1996). The relationship of information system training methods and cognitive ability to end-user satisfaction, comprehension, and skill transfer: A longitudinal field study. *Information Systems Research*, 7(4), 466-490.
- Smeaton, A. & Keogh, G. (1999). An analysis of the use of virtual delivery of undergraduate lectures. *Computers and Education*, 32(1), 83-94.
- Swan, K. (2002). Immediacy, social presence, and asynchronous discussion. In J. Bourne & J.C. Moore (Eds.), *Elements of quality online education* (Volume 3, pp. 157-172). Needham, MA: Sloan Center for Online Education.
- Vessey, I. & Galletta D. (1991). Cognitive fit: An empirical study of information acquisition. *Information System Research*, 2(1), 63-84.
- Wexley, K.N. & Latham, G.P. (1991). *Developing and training human resources in organizations* (2nd edition). New York: HarperCollins.
- Wexley, K.N. & Baldwin, T.T. (1986). Post-training strategies for facilitating positive transfer: An empirical exploration. *Academy of Management Journal*, 29(3), 503-520.
- Wilcox, R.R. (1987). *New statistical procedures for the social sciences: Modern solutions to basic problems*. Hillsdale, NJ: Lawrence Erlbaum.
- Zack, M.H. (1993). Interactivity and communication mode choice in ongoing management groups. *Information Systems Research*, 4(3), 207-239.

This work was previously published in the International Journal of Technology and Human Interaction, edited by B. C. Stahl, Volume 1, Issue 2, pp. 64-84, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.14

Exploring the Behavioral Dimension of Client/Server Technology Implementation: An Empirical Investigation

Eitel J.M. Lauría
Marist College, USA

ABSTRACT

This paper explores the impact of human factor and organizational behavior on the outcome of information technology implementation projects. Client/server technology implementation is used as the leading case, given the fact that it is a good example of a major paradigm shift¹. The results draw attention to the importance of end-user interaction and the maturity level of organizations as significant factors in the success and benefits of the project. Client/server projects seem to be more successful, are executed in a more timely manner, and yield greater benefits when end users take an active participation in some of the stages, particularly during the implementation phase.

INTRODUCTION

Information has become one of the most important assets in today's business world. The threats, busi-

ness drivers and pressures on organizations in the information age were summarized by Hammer and Champy (1993) as the three Cs — *Customers*, *Competition*, and *Change*. Knowledgeable customers, increasing competition, and constant change have driven organizations to find new ways to respond in order to excel or even survive. At the center of the stage, information technology (IT) holds an ever-increasing role, steering innovation in products and services, enabling new business processes, and linking individuals and organizations.

It comes as no surprise that the impact of IT implementation in organizations has been one of the most important topics in both business and information systems research in the last 30 years. Organizations have increasingly relied on IT to maintain their competitiveness. However, the track record of IT implementation is not very good. In many cases, IT driven innovations have not fulfilled their potential to enhance efficiency and effectiveness within companies, due largely to human and organizational reasons. Benjamin

and Levinson (1993) suggest that the benefits of IT are not being realized because investment is heavily biased toward technology and not toward managing changes in process and organizational structure and culture. Among all factors that may undermine an IT project, behavioral issues are perhaps the less well understood. This perspective is the motivating force behind the current work.

The study has two primary objectives: 1) develop a causal model to assess the effect of human and organizational factors on the outcome of an IT implementation project; and 2) empirically validate the model on client-server implementation survey data, given the fact that client/server computing is a mature technology that introduced a major shift from legacy data processing systems.

The following section provides a short overview of IT implementation models and critical success factors, in particular those related to behavioral issues. Next the paper introduces the causal model, describing the hypotheses under consideration. Then the paper presents the client/server case study, depicting the survey data, the statistical methods applied for model validation, the outcome of the statistical analysis and a discussion of the results. Finally, the paper provides a summary, which includes future research opportunities.

IT IMPLEMENTATION MODELS AND CRITICAL SUCCESS FACTORS

There has been plenty of interest in identifying the critical drivers of IT implementation's success and to gauge their impact on how well projects perform. The reasons leading to mediocre and sometimes disastrous results can be viewed from multiple perspectives, including behavioral factors (people and organizational issues), planning, complexity, and technological issues. There is still no general agreement, though, as to the complete set of factors that lead to a successful

implementation, and their relationship or order of precedence. This fact suggests that considerable work remains to be done. We cite here some of the available research recognizing that we are just presenting an overview of the extant literature, and apologize for any notable omissions.

Researchers have developed a number of frameworks and models to better understand IT implementation success. Delone and MacLean (1992) propose a model based on six categories of IS success measures: System Quality, Information Quality, Organizational Impact, Individual Impact, User Satisfaction, and IS Use. Seddon (1997) considers three types of constructs: measures of information system quality, measures of net benefits regarding IS use (perceived usefulness, user satisfaction) and behavior with respect to IS Use. The Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989; Venkatesh, 2000; Venkatesh & Davis, 2000) regards perceived usefulness and perceived ease of use as critical factors that influence an individual's technology adoption decision. Somers, Nelson, and Karimi (2003) argue that user satisfaction is one of the most important determinants of IS success.

According to Griffith and Northcraft (1996), less than 10 percent of technology implementation failures stem from technical problems. Instead, most of these failures resulted from human or organizational difficulties. Technological change is always a big issue in any organizational context. It can mean loss of jobs, requires new skills and impels new working relationships and business decisions that were never made before. Focus is typically placed on tangible benefits and changes are usually applied without considering the human side of IT driven change. Some authors have gone even further in their criticism of the computerization phenomenon. In his book "The Squandered Computer", Peter Strassmann (1997) points at the lack of correlation between IT investments and financial returns, stressing the importance of the human dimension. In Strassmann's own words:

It is not computers that make the difference, but what people do with them. Elevating computerization to the level of a magic bullet of this civilization is a mistake that will find correction in due course. It leads to the diminishing of what matters the most in any enterprise: educated, committed, and imaginative individuals working for organizations that place greater emphasis on people than on technologies.

Researchers have focused on such issues as user involvement and management support, IT alignment with business objectives, and organizational maturity. Baroudi and Orlikowski (1986), and Baronas and Louis (1988) contend that user involvement results in more useful and accessible information systems. Kuk (2004) shows that, in the context of vendor-managed inventory (VIM) implementation, organizations with high levels of employee involvement are more likely to accrue the potential benefits of the new technology.

Ettlie, Bridges, and O'Keefe (1984), Cheney, Mann, and Amoroso (1986), and Brancheau, Schuster, and Mar (1989) suggest that senior management support is essential for effective IS planning and execution. Ravichandran and Rai (2000) identify top management leadership as an important element of a quality-oriented software development effort. Wixom and Watson (2001) via a Partial Least Squares (PLS) derived model, demonstrate that management support increases the likelihood that data warehousing projects will finish on-time, on-budget, and with the right functionality.

In a classical article on IT implementation and organizations, Markus (1983) explains that resistance to IT change is the product of the interaction of system design features and intra-organizational distribution of power. An empirical study conducted by the IBM Consulting Group (1994) indicates that organizational readiness is a critical implementation factor. Reich and Benbasat (2000) argue that congruence of IT vision (long-

term alignment) and shared domain knowledge among business and IT executives are contributing IT implementation success factors. According to Laudon and Laudon (2004), organizational culture is a powerful restraint on technological change. The ease with which change and innovation can be instrumented through the use of IT will vary according to organizational factors, the nature of its leadership and the way in which employees perceive these changes.

MODEL DEVELOPMENT

Client/Server computing technology represents a form of distributed cooperative processing in which a client, or requester, submits requests to the server, which in turn processes the requests and returns results to the client (Stallings & Van Slyke, 1998). Not since the evolution from batch processing systems have we witnessed such fundamental shift in systems architecture. The commercial Internet, the deployment of Web-based applications and the whole concept of electronic commerce can be considered as a side effect of the client/server craze that has swept organizations, at least from the perspective of IT change.

Based on findings from relevant prior research, an overview of which was presented in the previous section, we propose here a causal model for systematic analysis of behavioral issues of IT implementation, in the context of client/server technology projects. Specifically, the proposed model suggests that an IT implementation project success can be explained or predicted by behavioral issues. Behavioral issues in the proposed model revolve around two major themes: the human factor and organizational behavior.

Human Factor: We conceptualize human factor in two principal dimensions: end-user interaction and top management involvement. End users are people at work in the organization, including various levels of supervision and functional management that may be directly or indirectly affected

by the new technology put in place, and have the potential of being instrumental in its implementation. The most common reaction to IT implementation in organizations is resistance to change. New technology implies change, and change is threatening and disruptive if it portrays a future dissociated from past experience. McNurlin and Sprague (1998) explain that people resist change, especially technological change, when they view it as a crisis. If the employee does not feel as part of the overall transformation process, IT-driven change is likely to lead to job dissatisfaction. Greater participation by all those affected by the implementation of new technology contributes to a much more positive response.

Top management involvement adds another critical dimension to the human factor issue. This typically comprises the higher levels in the organizational hierarchy, including CEOs and CIOs. Since the early 1990s, there has been more awareness on the need for IT savvy executives. However, still few chief officers have the depth of background in IT that they have with their functions, such as marketing or finance. Most still do not understand the issues that drive technology and think primarily of the IT function as cost. This sketchy appreciation is augmented by the current hype and potential of new technologies such as the Internet and electronic commerce. IT is perceived as a technical issue and is often overlooked and left out of the scope of top management decisions.

Organizational Behavior: Organizational behavior is the other main theme. We focus on two dimensions when describing organizational behavior: shared vision and maturity. Shared vision synthesizes IT alignment with the organization's objectives and business goals. Maturity characterizes the organization's consistency and readiness to implement IT. McNurlin and Sprague (1998) define a technologically mature organization as one that realizes the business value of information and IT, and manages the assimilation of IT

into its business. New operating procedures and business policies are put in place to deal with IT implementation. Project details are approached in a systematic manner, as a part of a well laid out plan.

Project Success: We take the outcome of the project as the natural empirical indicator of IT implementation success, conceptualizing it in terms of four dimensions:

- **Benefits:** Benefits are usually a good objective measure of the outcome of a project, but they fail to capture other aspects of implementation success
- **Timeliness:** measures whether the project was delivered on time.
- **End-User Effects:** How were users affected by the project? Are they willing to use the new technology?
- **Overall Perception:** What is the general feeling of the organization with regards to the outcome of the project? Was it successful or was it a failure?

Additional Factors: Along with human factor and organizational behavior there are, of course, numerous other factors that could account for project success. Previous studies found that the result of a technology implementation project may be linked to the characteristics of the organization and of the project. For example, Duchessi and Chengalur-Smith (2000) found that the initiation and adoption process of client/server technology in organizations is affected by the market position of the firm and on certain characteristics of the application. Organizations that implement systems that are too complex for them or take too long to be implemented are likely to fail. Then again, applications that are too simple will not yield significant benefits. The inherent characteristics of the organization, (its culture, the level of centralization, the nature of its leadership, the distribution of power) may also have a major influence on the outcome of an IT project.

In order to control for the characteristics of the organization implementing technology and the nature of the client/server project, a group of measures have been included:

- Organization Characteristics
 - Private organization or government / public organization
 - Market position (dominant, major competitor, minor competitor)
- Project Characteristics
 - Length of the project
 - Project relevance (how critical the project is for the organization)
- Organizational Culture / Management Style
 - Degree of authoritativeness
 - Degree of decentralization

Causal Model and Research Questions

Figure 1 is a graphical representation of the causal model underlying this analysis. The goal is to explore the relationship between several measures of human factor and organizational behavior and several measures of project results, while controlling for background characteristics of the organizations, and the applications that they implemented.

Accordingly, we raise the following research questions:

- What is the effect of human and organizational issues on the result of the project?
- Are end-user interaction and top management involvement critical success factors?
- Are increases in organizational maturity and shared vision related to increases or decreases in project success?
- How are project benefits related to human and organizational issues?
- What is the influence of the organization and the project's characteristics on the outcome of the implementation.

RESEARCH DESIGN AND DATA COLLECTION PROCEDURES

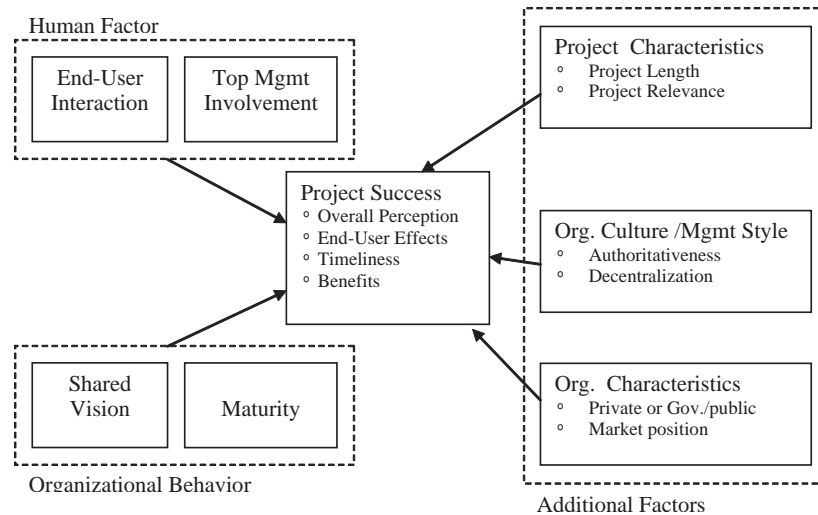
The objective of this study is to examine the effects of people issues (human factor) and organizational issues on the outcome of client/server projects and validate the behavioral model by statistically analyzing survey data of client/server implementations. At the time of the survey, client/server architecture had become the mainstream technology for development of distributed applications. Most organizations were either committed to actually implementing client/server applications or had shown considerable interest in the technology.

Data Source

The source of data for this analysis is a nation wide survey of companies implementing client-server systems (Duchessi & Chengalur-Smith, 2000).² The sampling list for the survey came from CMP Direct Marketing Services, which provided a database of about 400,000 organizations, either using client/server systems or interested in them. From this database a random sample of 5000 executives was selected. Questionnaires were mailed to 4593 executives (the other 407 entries had incomplete data) and 350 usable responses were received.

The questionnaire is composed of a set of closed-ended (structured, fixed response questions) organized into five sections: 1) background (organization and application); 2) information planning; 3) project's analysis and design; 4) implementation; 5) systems support. The unit of analysis could be an entire company, a division, or a product group. Most of the questions, except those that require a specific input from the respondent, were based on a 5-category Likert scale, where 1 means "strongly disagree" and 5 means "strongly agree". The average number of missing values per field is 14, with a standard deviation of 13.

Figure 1. Causal model showing the effects of human factor and organizational behavior on project success and project benefits



Sample Profile

The majority of respondents to the survey were senior IT executives (41 percent); 24 percent senior corporate executives (presidents, CEOs, and chairpersons); senior managers, (9 percent), and the rest (26 percent) including primarily IS and functional managers (see Figure 2). Regarding implementation, 19 percent had completed at least one client/server implementation project, 56 percent were in the late stages of the project (most clients and servers implemented), and 26 percent were in early implementation (systems planning and analysis, network infrastructure). About 30 percent of the respondents classified their companies as dominant market leader, 47 percent regarded themselves as being a major competitor, and the remaining 23 percent classified as minor competitors.

The distribution of organizations' size, as measured by number of employees, was the following: 26 percent of organizations had less than 100 employees; 29 percent had between 100 and

1000 employees; 35 percent had between 1000 and 10000 employees; and only 11 percent had more than 10000 employees. This means that the sample is representative of small, medium, and large organizations.

Twelve percent of the respondents belonged to Government organizations; the other 88 percent were distributed in service (24 percent), industrial (18 percent) financial (18 percent) and retail and publishing (32 percent). Sixty percent of the applications spanned three or more functional areas, and 75 percent of the respondents described their applications as mission critical. Close to 50 percent of the respondents claimed their organizational structures are decentralized, and nearly 45 percent reported that their companies are highly authoritative.

Research Methodology

The research methodology followed a straightforward quantitative approach, through the application of multivariate regression analysis

Exploring the Behavioral Dimension of Client/Server Technology Implementation

The questionnaire asked respondents to report the way in which the client server application had been proposed, introduced, and deployed in the organization; the way in which the end users and the organization as a whole had faced the challenge; and the outcome and benefits of the project. The survey questions were used to operationalize each dimension associated with each variable in the model. Each dimension was measured as a combination (i.e. an average) of answers to survey questions.

Table 1, for example, shows the behavioral constructs (Human Factor and Organizational Behavior), their associated dimensions, and the survey questions that were used in each case to

formulate the measures. Note that in order to assess user participation at different stages of the project's life cycle, "End-User Interaction" was subdivided into two stages: Planning, Analysis, and Design; and Implementation and Support. Appendix 1 presents detailed definitions of all the constructs, dimensions, and survey questions used in the study.

Data Analysis and Results

We used ordinary least squares regression analysis (OLS) to relate the behavioral factors to three measures of project result, and the remaining one was analyzed using logistic regression. We applied

Figure 2. Sample profile of respondents

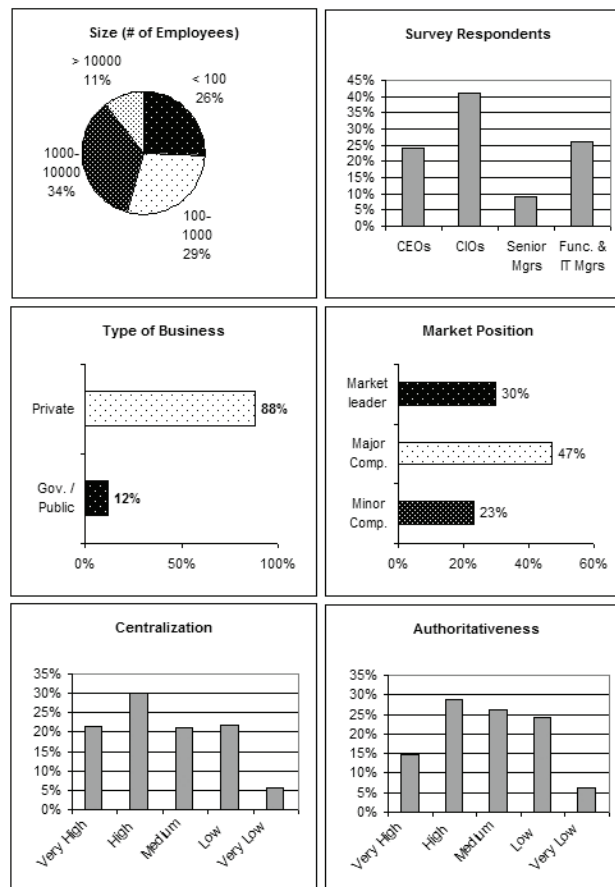


Table 1. Operationalization of behavioral constructs

| Construct | Dimension | Survey Questions |
|-------------------------|---|---|
| Human Factor | End-User Interaction (Planning, Analysis, and Design) | <ul style="list-style-type: none"> ◦ functional managers are active in developing information strategy ◦ functional managers determine the requirements of c/s apps ◦ users had input in design of the c/s application ◦ proportion of end users in project team |
| | End User Interaction (Implementation and support) | <ul style="list-style-type: none"> ◦ users guided and directed testing activities ◦ users have been trained to use c/s app ◦ IS group works with users to ensure that c/s app continues to satisfy user requirements ◦ user consider IS group as partners |
| | Top Management Involvement | <ul style="list-style-type: none"> ◦ CEO is a technology champion ◦ CIO participates in strategic planning ◦ someone with full authority attended steering committee meetings ◦ steering committee met regularly |
| Organizational Behavior | Shared Vision | <ul style="list-style-type: none"> ◦ strategic fit of c/s app with IT strategy I ◦ IT strategy is part of SBU's strategic plan ◦ IS applications are aligned with SBU goals ◦ c/s app is an integral part of IT strategy ◦ business function requirements reflect business needs |
| | Maturity | <ul style="list-style-type: none"> ◦ cost/benefit analysis was used ◦ project team prepared detailed specs ◦ project team developed a migration plan ◦ new business policies and operating procedures were developed and promulgated ◦ project team had technically skilled people ◦ vendor products / services were tested |

OLS in the case of *Overall Perception* (Regression 1), *End-User Effects* (Regression 2), and *Benefits* (Regression 3). Note that although *Overall Effects* is a discrete variable, it was approximated to a continuous variable. On the other hand, and due to its dichotomous nature, we applied logistic regression in the case of the dependent variable *Timeliness* (Regression 4).

We evaluated the reliability of the independent and dependent variables, specifically those composite measures generated by averaging groups of questions available in the survey (see Appendix 1). Reliability was assessed using Cronbach's alpha. Most of the investigated factors exhibited an alpha value greater than 0.70, suggesting a reliability exceeding the common acceptable level. End-User Interaction in Planning, Analysis, and Design showed an alpha value of 0.53, somewhat lower (but not by much) than the reliability threshold (0.60) considered adequate in exploratory studies.

Additional statistical tests were performed on the data to check for outliers, influential observations, and assess the degree of multicollinearity of the data. These tests as well as the details of the reliability analysis are depicted in Appendix 2.

The results of the multiple regression analysis are presented in Tables 2 and 3. Table 2 shows the coefficients for the independent variables from ordinary least-squares regression analyses predicting three different aspects of the outcome of the project: overall perception, end-user effects and benefits obtained. Table 3 displays the result of the logistic regression applied to predict the timeliness of the project.

The results of Regression 1 show that Human Factor (measured from the point of view of end-user interaction during the implementation stage of the project) and Organizational Behavior (measured in terms of the maturity of the organization to address technological change) are positive predictors of the project's success. A slope of 0.71 in

end-user interaction, implementation and support (HFEUIIS) means that, for each unitary increment in HFEUIIS index, the overall perception of success (OVERALL) increases 0.71 points, controlling for organizational behavior, organization's characteristics, culture and management style, and project's characteristics. In a similar manner, a slope of 0.50 in organization's maturity level (OBSMAT) means that, for each unitary increment in OBSMAT, the overall perception of success (OVERALL) increases 0.50 points, controlling for the rest of the independent variables. Mission critical projects tend to be more successful: for each unitary increase in MISSCRIT, the overall perception of success increases by 0.22 points. The results of Regression 1 also show that there are no significant differences in overall success between private and government organizations and among organizations with different market

shares (dominant, major competitor, minor competitor). Organization's culture and Management style are also not significant: project success is not affected by the degree of decentralization and authoritativeness in organizations.

Regression 2 and 3 confirm the findings of Regression 1. In Regression 2, Human Factor clearly predicts positive end-user effects, reinforced by the fact that in this case, end-user interaction during the planning, analysis, and design stage (HFEUIPAD) is also significant: a unitary increase in HFEUIPAD, raises end-user effects by 0.29 points. Organizational behavior, driven by maturity level, predicts an increase of 0.16 units in end-user effects for every unit of increase in maturity.

Project relevance (MISSCRIT) is not significant in Regression 2, and shorter projects seem to be slightly related to positive end-user effects

Table 2. OLS regression analysis

| | Regression 1 | | Regression 2 | | Regression 3 | |
|--|--------------------|------|------------------|------|--------------|------|
| | Overall Perception | | End User Effects | | Benefits | |
| | B | (SE) | B | (SE) | B | (SE) |
| <i>Human Factor</i> | | | | | | |
| End User Interaction, Planning Analysis & Design | 0.30 | 0.18 | 0.13 ** | 0.05 | 0.09 | 0.07 |
| End User Interaction, Implementation & Support | 0.71 *** | 0.21 | 0.29 *** | 0.06 | 0.25 ** | 0.09 |
| Top Mgmt. Involvement | 0.07 | 0.17 | 0.00 | 0.05 | 0.00 | 0.07 |
| <i>Organizational Behavior</i> | | | | | | |
| Shared Vision | -0.09 | 0.23 | 0.10 | 0.07 | 0.07 | 0.09 |
| Maturity | 0.50 * | 0.22 | 0.16 * | 0.06 | 0.30 ** | 0.09 |
| <i>Organization Characteristics</i> | | | | | | |
| Mkt. Position, major competitor ^a | 0.08 | 0.26 | 0.05 | 0.07 | -0.03 | 0.10 |
| Mkt. Position, minor competitor ^a | 0.08 | 0.30 | 0.05 | 0.09 | 0.08 | 0.12 |
| Private Organization ^b | -0.47 | 0.48 | -0.18 | 0.14 | -0.11 | 0.19 |
| <i>Org. culture - Mgmt. style</i> | | | | | | |
| Degree of authoritativeness | -0.01 | 0.10 | 0.01 | 0.03 | 0.00 | 0.04 |
| Decentralization | 0.01 | 0.09 | 0.02 | 0.03 | 0.02 | 0.04 |
| <i>Project characteristics</i> | | | | | | |
| Project length | 0.00 | 0.01 | -0.01 * | 0.00 | 0.00 | 0.00 |
| Project relevance | 0.22 * | 0.10 | 0.05 | 0.03 | 0.13 ** | 0.04 |
| Intercept | 0.56 | 1.09 | 1.10 *** | 0.31 | -0.02 | 0.45 |
| R ² | 0.209 | | 0.372 | | 0.276 | |
| N | 266 | | 269 | | 257 | |

* p<0.05; ** p<0.01; *** p<0.001.

^a The comparison category is Dominant.

^b The comparison category is Public Organization.

(an increase of 1 month in project length reduces overall perception of success by 0.01 points). As in the case of Regression 1 there are no significant differences among organizations with different characteristics (government/private, market position), different culture and management style (authoritative, decentralized). Regression 3 follows the pattern of Regression 1: unitary increases in Human Factor (end-user interaction during implementation) and Organizational Behavior (maturity level), increase benefits by 0.25 points and 0.30 points respectively. Mission critical projects are positively related to project's benefits and there are no significant differences in benefits among organizations with different characteristics, culture and management style.

Regression 4 describes the effect of Human Factor and Organizational Behavior on the timeliness of the project controlling for several project characteristics, organization characteristics, cultural issues and management style (see Table 3). We could verify that each unitary increase in end-user interaction during the planning, analysis, and design stage (HFEUIPAD) increases the log odds of timeliness by 0.67. This means that an increase of 1 point in HFEUIPAD raises the odds of meeting the target dates of the project by 96.4 percent. Major competitors have 0.76 less log odds of finishing the project on time than organizations with a dominant market position, controlling for Human Factor, Organizational Behavior, project characteristics and organization's characteristics,

Table 3. Logistic regression analysis

| | Regression 4 Timeliness of the Project | | | | |
|---|---|----------|------|---------------------|----------|
| | B | (SE) | Wald | Odd Ratio Exp(B) | % Effect |
| Human Factor | | | | | |
| End User Interaction, Planning Analysis & Design | 0.67 ** | 0.25 | 7.47 | 1.964 | 96.4 |
| End User Interaction, Implementation & Support | 0.17 | 0.28 | 0.38 | 1.186 | 18.6 |
| Top Mgmt. Involvement | -0.15 | 0.23 | 0.44 | 0.862 | -13.8 |
| Organizational Behavior | | | | | |
| Shared Vision | 0.02 | 0.30 | 0.01 | 1.022 | 2.2 |
| Maturity | 0.28 | 0.29 | 0.98 | 1.326 | 32.6 |
| Organization Characteristics | | | | | |
| Mkt. Position, major competitor ^a | -0.76 * | 0.35 | 4.63 | 0.467 | -53.3 |
| Mkt. Position, minor competitor ^a | -0.21 | 0.42 | 0.24 | 0.813 | -18.7 |
| Private Organization ^b | -1.22 * | 0.59 | 4.26 | 0.295 | -70.5 |
| Org. culture - Mgmt. style | | | | | |
| Degree of authoritativeness | 0.14 | 0.13 | 1.20 | 1.155 | 15.5 |
| Decentralization | 0.01 | 0.12 | 0.01 | 1.011 | 1.1 |
| Project characteristics | | | | | |
| Project length | -0.02 | 0.01 | 2.64 | 0.984 | -1.6 |
| Project relevance | 0.06 | 0.14 | 0.18 | 1.059 | 5.9 |
| Intercept | -2.68 | 1.46 | 3.39 | 0.068 | |
| Chi- Square | 27.124 | p < 0.01 | | | |
| N | 262 | | | | |

* p<0.05; ** p<0.01; *** p<0.001.

^a The comparison category is Dominant.

^b The comparison category is Public Organization.

organization's culture, and management style. This means that the odds of a timely project decrease by 53.3 percent. Minor competitors seem to have no significant differences with dominant organizations regarding the timeliness of the project.

In the same manner, private organizations have 1.22 less log odds of finishing the project on time than government organizations, controlling for Human Factor, Organizational Behavior, project characteristics and organization's characteristics, organization's culture and management style. This means that the odds of committing to the target dates of the project decrease by 70.5 percent.

Discussion

The results of this analysis suggest that people and organizational issues influence the outcome and benefits derived from technology implementation projects. End-user interaction and organizational maturity were identified as two positive factors of project success. Projects seem to be more successful, are executed in a timelier manner, and yield greater benefits when end users take an active participation in the project, particularly during the implementation and support phase. This entails well trained end users that participate in testing and review procedures, and have established a fluid relationship with the IS group.

We would also have expected a significant positive influence of end-user interaction during the planning, analysis and design phase, as end users tend to feel a certain "ownership" of the project, which usually leads to higher levels of commitment and increased productivity. When end users are committed to the project from its early stages, the new technology is not perceived as a burden or a threat, but rather as a new component in the end user's set of skills. This is straightforward in the case of "end-user effects" and project timeliness.

But the results of the regression show no evidence of significant influence in the overall perception of success, and benefits of the project. This might mean that end users take a leading role at later stages of the project. It is during the implementation and support phase that their involvement can radically change the fate of a project. Activities such as testing, training and continuous review are critical to implementation success. It is possible that respondents' answers might have reinforced this view, reducing the relevance of end user's participation during the early stages of the project. Also, we must consider the possibility of some inconsistency in the composite measure (HFEUIPAD) given the fact that it has the lowest alpha value of all constructs.

Surprisingly, top management involvement does not seem to be a significant issue in the final outcome of the project. This result, which would otherwise contradict mainstream organizational theory, requires further investigation. A reliability error in the construct does not seem to be a plausible explanation: the alpha value for top management involvement is high enough (0.78). Neither could we find any correlation in the variables that would explain the lack of significance. We assume in principle that the outcome may be due to some bias in the way in which the respondents interpreted certain questions in the survey.

Regarding organizational behavior, maturity is a significant factor in the project's success, and subsequent benefits generated by the project. This is quite intuitive if we consider the attributes that define maturity: pragmatism to assess the cost-benefit equation of the project; methodic approach at defining and executing each phase, and aligning business procedures and policies with the implementation of new technology; and rigor to assemble the project's team and/or selecting the right vendors for the task. These are tangible qualities that easily reflect on the outcome of the project.

On the other hand, shared vision does not seem to significantly influence the project's results or its timeliness. This may be due to the fact that the survey questions used to operationalize such concept stand at a higher level of abstraction and may derive in positive effects only when measuring such effects in the long term. It is reasonable to assume that IT alignment with the organization's goals and strategies is a desirable feature. But in the short run, the effects may not be as visible as those coming from those related to maturity. It is precisely this set of attributes that are prevalent in defining short term results, which are basically those being measured by this study.

CONCLUSION

A contribution of this work is the extension of the IT implementation literature through the investigation of behavioral issues affecting client/server implementation projects. Both IT implementation research and client/server and distributed technologies research can benefit from these findings, stimulating future research and practice considerations.

We were also able to identify end-user interaction and the maturity level of organizations in addressing IT driven change as significant factors in the success and benefits of the project. Client/server projects seem to be more successful, and yield greater benefits when end users are actively involved in the implementation.

This work is based on a survey reflecting results of projects implementing "traditional" (2-tier / 3-tier) client/server architectures. While this approach is convenient, given the wealth of data available in the client/server survey, further research is required to broaden the definition of client/server architecture, in lieu of the fact that Web-based applications fall under this category. This opens up an avenue of research in confirming whether this study's findings are likely to hold true in a client/server Web-based environment.

REFERENCES

- Baronas, A., & Louis, R. (1988). Restoring sense of control during implementation: How user involvement leads to system acceptance. *MIS Quarterly*, 12(1), 11-23.
- Baroudi, J., & Orlikowski, W. (1986). A short form measure of user information satisfaction: A psychometric evaluation and notes on use. *Journal of Management Information Systems*, 4(4), 44-59.
- Benjamin, R., & Levinson, E. (1993). A framework for managing IT-enabled change. *Sloan Management Review*, 34(4), 23-34.
- Brancheau, J., Schuster, L., & Mar, S. (1989). Building and implementing an information systems architecture. *Data Base*, 20(2), 9-17.
- Cheney, P., Mann, R., & Amoroso, D. (1986). Organizational factors affecting the success of end-user computing. *Journal of Management Information Systems*, 3(1), 65-80.
- Davis, F., Bagozzi, R., & Warshaw, P. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 34(8), 982-1002.
- Delone, W., & McLean, E. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, 3(1), 60-95.
- Duchessi, P., & Chengalur-Smith, I. (2000). Client server implementation: Some management pointers. *IEEE Transactions on Engineering Management*, 47(1), 127-145.
- Ettlie, J., Bridges, W., & O'Keefe, R. (1984). Organizational strategy and structural differences for radical versus incremental innovations. *Management Science*, 30(6), 682-695.
- Griffith, T., & Northcraft, G. (1996). Cognitive elements in the implementation of new technol-

- ogy: Can less information provide more benefits? *MIS Quarterly*, 20(1), 99-110.
- Hammer, M., & Champy, J. (1993). *Reengineering the Corporation: A manifesto for business revolution*. New York: HarperCollins.
- IBM Consulting Group. (1994). *Report on client/server*. White Plains, NY.
- Kuk, G. (2004). Effectiveness of vendor-managed inventory in the electronics industry: Determinants and outcomes. *Information & Management*, 41(5), 645-654.
- Laudon, K., & Laudon, J. (2004). *Managing the digital firm* (8th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Markus, M. (1983). Power, politics and MIS implementation. *Communications of the ACM*, 26(6), 430-444.
- Mc Nurlin, B., & Sprague, R. (1998). *Information systems management in practice* (4th ed.). Prentice Hall.
- Ravichandran, T., & Rai, A. (2000). Quality management in systems development: An organizational system perspective. *MIS Quarterly*, 24(3), 381-416.
- Reich, B., & Benbasat, I. (2000). Factors that influence the social dimension of alignment between business and information technology objectives. *MIS Quarterly*, 24(1), 81-111.
- Seddon, P. (1997). A respecification and extension of the DeLone and McLean model of IS success. *Information Systems Research*, 8, 240-253.
- Somers, T., Nelson, K., & Karimi, J. (2003). Confirmatory factor analysis of the end-user computing satisfaction instrument: Replication within an ERP domain. *Decision Sciences*, 34(3), 595-610.
- Stallings, W., & Van Slyke, R. (1998). *Business data communications* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.
- Strassmann, P. (1997). *The squandered computer: Evaluating the business alignment of information technologies*. New Canaan, CT Information Economics Press.
- Strassmann, P. (1997). Will big spending on computers guarantee profitability? *Datamation*, 43(2), 75-85. Retrieved from <http://www.strassmann.com/pubs/datamation0297/>
- Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research*, 11(4), 342-365.
- Venkatesh, V., & Davis, F. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186-205.
- Wixom, B., & Watson H. (2001). An empirical investigation of the factors affecting data warehousing success. *MIS Quarterly*, 25(1), 17-41.

ENDNOTES

- ¹ An abridged version of this paper entitled "The Behavioral Dimension of Technological Change: The Case of Client/Server" was presented at IRMA 2004, New Orleans, May 23-26, 2004 (conference proceedings pp. 981-983).
- ² American Management Systems, Andersen Consulting, and Ernst & Young sponsored the survey.
- ³ Multicollinearity — the fact that some or all predictor variables may be correlated among themselves — tends to increase the variance of the regression coefficients' estimates, conse-

Exploring the Behavioral Dimension of Client/Server Technology Implementation

quently, affecting the significance tests: as the standard error of the slope increases, the

test statistics decrease and it is more difficult to find a statistically significant effect.

This work was previously published in International Journal of Technology and Human Interaction, Vol. 2, Issue 3, edited by B.C. Stahl, pp. 63-81, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

APPENDIX 1. MEASURES USED IN MULTIPLE REGRESSION ANALYSIS

Organization characteristics

- Market Position (MKTPOS): categorical, dominant=1, major competitor=2, minor competitor=3 (Mean =1.94)
- Government or private: (ORGTTYPE, recoded from INDUST2): categorical, 0=Gov, 1=private (Mean = 1.88)

Organization's culture / management style

- Authoritative (AUTHORIT): 1=low to 5=high (Mean=2.79, SD=1.15)
- Decentralized (DECENTRAL): 1=low to 5=high (Mean=2.6, SD=1.2)

Client Server application characteristics

- Length of the project (MONTHS): measured in number of months (Mean=17.79, SD=13.14)
- Mission Critical (MISSCRIT): 1=low to 5=high (Mean=3.97, SD=1.07)

Human Factor

— End User Interaction

- **HFEUIPAD: Planning, Analysis and Design: Mean of 4 measures, 1=low to 5=high (Mean=3.51, SD=0.66)**
 - PFUNDEV: Functional Managers are active in developing information strategy
 - PFUNREQ: Functional Managers determine the requirements of c/s applications
 - ADUSERIN: Users had input into designing the c/s application
 - PCTENDUS: Proportion of end users in project team (normalized to meet the 1 – 5 scale)
- **HFEUIIS: Implementation and support: Mean of 4 measures, 1=low to 5=high (Mean=3.68, SD=0.6)**
 - UGUIDE: Users guided and directed testing activities
 - UTRAIN: Users have been trained to use c/s app
 - ISWORKS: IS group works with end users
 - UPARTNER: User consider IS group as partners
- **Top management involvement (HFTMI): Mean of 4 measures, 1=low to 5=high (Mean=3.74, SD=0.72)**
 - PCHAMP: CEO is a technology champion
 - PCIOPART: CIO participates in strategic planning
 - SAUTHOR: Someone with full authority attended steering committee meetings
 - SCOMMREG: Steering committee met regularly

Organizational behavior

- **OBSHV: Shared vision: Mean of 5 measures, 1=low to 5=high (Mean=3.91, SD=0.59)**
 - ADSTRAT: Strategic fit of c/s app with IT strategy was used as a basis for going forward with c/s application
 - PITSTRAT: Information technology strategy is part of SBU's strategic plan
 - PALIGN: IS applications are aligned with SBU objectives and strategies
 - PINTEGRT: Client Server Application is an integral part of IT strategy
 - ADFUNREQ: Business function requirements reflect business needs

- **OBMAT: Maturity: Mean of 6 measures, 1=low to 5=high (Mean=3.52, SD=0.61)**
 - ADCOSTB: Cost/benefit analysis was used as a basis for going forward with the c/s project
 - TDESPECS: Project team prepared detailed specs for all c/s modules
 - SPTDEV: Project team developed a migration plan for network systems, mgmt and org. change
 - TNEWPROC: New business policies and operating procedures were developed and promulgated
 - SPTSKILL: Project team had technically skilled people
 - VTESTING: Vendor products / services were tested to see if they functioned as advertised

Project Result

- **Overall Perception: 1=low to 10=high (Mean=6.7, SD=1.94)**
 - OVERALL: To date, overall, how successful has your client server implementation been
- **EUEFF: End User Effects: Mean of 5 measures, 1=low to 5=high (Mean=3.81, SD=0.6)**
 - UENHANCE: Users job performance is enhanced by client server application
 - UPREFER: Users prefer to use alternative systems whenever possible
(value reverted to convert into ascending scale)
 - UENABLE: C/S applications enables users to accomplish tasks that were not previously feasible
 - UTHREAT: User feel that this C/S pp threatens their employment
(value reverted to convert into ascending scale)
 - UFEELRES: Users feel responsible for success of this client server app
 - **Timeliness: categorical, Yes=1, No=0 (Mean=0.66)**
 - TIMELNSS: Target dates were met

BENEFITS: mean of 15 measures, 1=low to 5=high (Mean=3.16, SD=0.79)

- BINTEGRT: Integration of business information
- BORGPROD: Increased organizational productivity
- BCUSLINK: Improved linkages with customers
- BSUPLINK: Improved linkages with suppliers
- BFINPOST: Improved financial position
- BCOMPOST: Improved competitive posture
- BCUSERVC: Improved customer service
- BSYSRELY: Improved system reliability
- BSYSACCS: Improved decision making
- BDECMKG: Reduced decision making time
- BREDTIME: Reduced cycle time
- BREDCYCL: Reduced costs
- BREDCOST: Better control / mgmt of business

- BCONTMGT: Empowerment of employees
- BEMPOWER: Reengineered business processes

APPENDIX 2. STATISTICAL TESTS

Several statistical tests were performed to check the reliability of the constructs and to verify that OLS assumptions were satisfied by the data. The details of these analyses are described below:

Reliability Assessment

We ran Cronbach alpha tests for each set of survey questions that define a composite measure verifying that the reliability of the chosen constructs ranged between 0.53 and 0.89 (HFEUIPAD=0.53; HFEUIIS=0.74; HFTMI=0.78; OBMAT=0.78; OBSHV=0.70; BENEFITS=0.89; EUEFF=0.83). Note that although those tests correspond to additive composite indexes, we used the mean of the group of component variables as a summary statistic representative of the whole set. The reason is that the average provides a more robust measure, by allowing inclusion of cases missing responses.

Multicollinearity Assessment

To evaluate the degree of multicollinearity³ among the independent variables we calculated the variance inflation factor (VIF), which measures the proportion by which the variance of the slope is inflated by multicollinearity. A standard cutoff for VIF is 4, equivalent to $R^2_k=0.75$ (R^2_k is the coefficient of multiple determination in each auxiliary linear regression equation where the independent variable X_k is taken in turn as dependent variable). We verified that for each of the OLS regressions, VIF was below 1.8, which means that multicollinearity stayed below 0.45. For the four regressions (including logistic regression), we also checked the correlation matrix and verified that the Pearson coefficient was in all cases below 0.45.

Outliers and Influential Observations

For each of the three OLS regressions, we checked the studentized residuals, searching for outliers and influential observations.

We could verify that in all three regressions more than 93% of the observations were within 2 standard deviations of the regression hyperplane, which is a good approximation to normality. Extreme outliers (greater than 3 std. deviations) did not exceed 1.5%.

In the case of influential observations, less than 10 % of the leverage values in all three OLS regressions exceeded the cutoff value of twice the Mean Centered Leverage ($2 * \bar{h}$), which remained around 0.05. The residual scatterplots (Figure 3) show that data is rather evenly distributed with respect to the horizontal line drawn at 0; but regressions 2 and 3 exhibit a visible pattern in the deviations around the fitted regression hyperplane probably due to the fact that both dependent variables are quasi-discrete in nature.

Chapter 5.15

A Capacity Building Approach to Health Literacy through ICTs

Lyn Simpson

Queensland University of Technology, Australia

Melinda Stockwell

Queensland University of Technology, Australia

Susan Leggett

Queensland University of Technology, Australia

Leanne Wood

Queensland University of Technology, Australia

Danielle Penn

Queensland University of Technology, Australia

ABSTRACT

There has been substantial interest in delivering ICT training options to rural and remote areas of Queensland, Australia, in order to bridge the rural-urban divide. But there is more than just education and training going on: Participants are being empowered to gain new skills and confidence, form new networks, become active in the community, and be proactive in addressing their own health and well-being needs.

THE RURAL AND REMOTE CONTEXT

Rural and remote populations often experience poor access to services (Simpson, Wood, Daws, & Seinen, 2001; Wagenfeld, Murray, Mohatt, & DeBruyn, 1997). This applies to essential health services, to services that enable individuals and communities to gain the skills necessary to participate in the social changes affecting the population, and to the peer-support services

needed by isolated professionals. In Australia, long-standing factors in service delivery to rural communities, such as sparse population, distance, and limited availability of public transport, are being exacerbated by the reduction in and withdrawal of existing face-to-face services. In terms of health services, access constitutes a significant issue for rural communities. At the same time, the traditional jobs base for these communities in primary production is shrinking, resulting in psychological pressures and the need for the re-skilling of many of those people formerly employed in such industries.

Health literacy, understood in its broadest sense, is a key issue for these communities. Parker (2000, p. 280) notes, "... for those with limited health literacy, as health care is becoming increasingly complex and health information is becoming more diffuse in the public domain, there is more reliance on written materials to educate and inform people about their health." As governments at all levels seek ways to simplify, and reduce the costs of, the task of meeting health-service needs, the attractions of e-government for service delivery to a receptive "wired" community are strong (and ICT vendors have encouraged that attraction). However, for those community members used to the supportive environment of face-to-face service delivery and unfamiliar with ICTs, the focus on service provision via the Internet creates new challenges. The incentive for computer literacy (Hamm as cited in Loader & Keeble, 2004) is strengthening.

The problems associated with negotiating the changed rural social and service environment impact particularly those people who have characteristics that may intensify their isolation and lack of access to information, including people of cultural and linguistic diversity (CALD), disabled people, and people with low literacy skills. A socially inclusive society requires informed communities that have the means, skills, and opportunities to communicate (IBM, 1997). For those unable

to meet these criteria because of age, ethnicity, disability, income, or circumstance, difficulties associated with the acquisition of everyday information via the Internet can potentially create considerable frustration and distress, increasing the degree to which these people are marginalized within their community, and impacting their health and well-being.

THE CASE-STUDY PROJECTS

The projects build on earlier work that identified the difficulty in accessing accurate current information and in obtaining appropriate health and well-being support for these populations. Interviewees in fieldwork for *Creating Rural Connections* (Simpson et al., 2001) reported a variety of information needs, including more timely access to a wider range of information, and the desire for specific information in response to an identified need (such as to address a health problem), to locate employment, or to improve the family business.

Community members identified two levels of specific need. First is the need for access to specialist services, including medical services and counseling; ongoing access to help, companionship, and mentoring; community-service databases to facilitate better networking and referral services; improved access to services for disability groups, particularly services that have the potential to overcome the effects of communication limitations and personal isolation; and opportunities to identify and reinforce existing support networks. They also identified the need for re-skilling regarding computing skills as a necessary tool in the changing work and social environment. The projects developed to help address these needs have provided an inclusive and supportive learning environment for individuals who had experienced marginalization in their communities. The focus in each project has been

on Bella and Bishop's (2004) "building on" community capacity: "helping people believe in their own skills" (p. 13).

HOW THE PROJECTS OPERATE

The projects are built on the recognition that social isolation and access to information are significant issues for marginalized people in far-north Queensland and, in particular, for people who speak little or no English, for indigenous peoples, and for disabled people. Drawing on research that has shown the Internet to be an effective, appropriate means of meeting such needs for a diverse range of people (Communication Centre, 2001; Simpson et al., 2001), the projects sought to:

- enhance the skills base in small communities;
- help create a more informed community and a more equitable society in part via access to information by marginalized groups;
- facilitate the sharing of skills through the development and creation of online and face-to-face social networks;
- develop an innovative and transferable process that will be relevant to other groups and other communities;
- increase awareness of the potential of online technologies for contributing to the social connectedness and overall well-being of potentially marginalized groups, particularly but not exclusively in rural and remote areas; and
- provide "train the trainer" instruction for volunteer community members from marginalized groups that will assist them in conducting training that is appropriate for their client base, taking into account the specific needs arising from age, gender, rurality, ethnicity, literacy, and/or disability.

While these aims focus on the technical and training needs of people in rural and remote communities, it is how these goals are enacted that creates the powerful social and health outcomes. Projects intended to deliver ICT training to marginalized groups have often failed. When asked what the problems were with computer training programs they had attempted, participants identified the following:

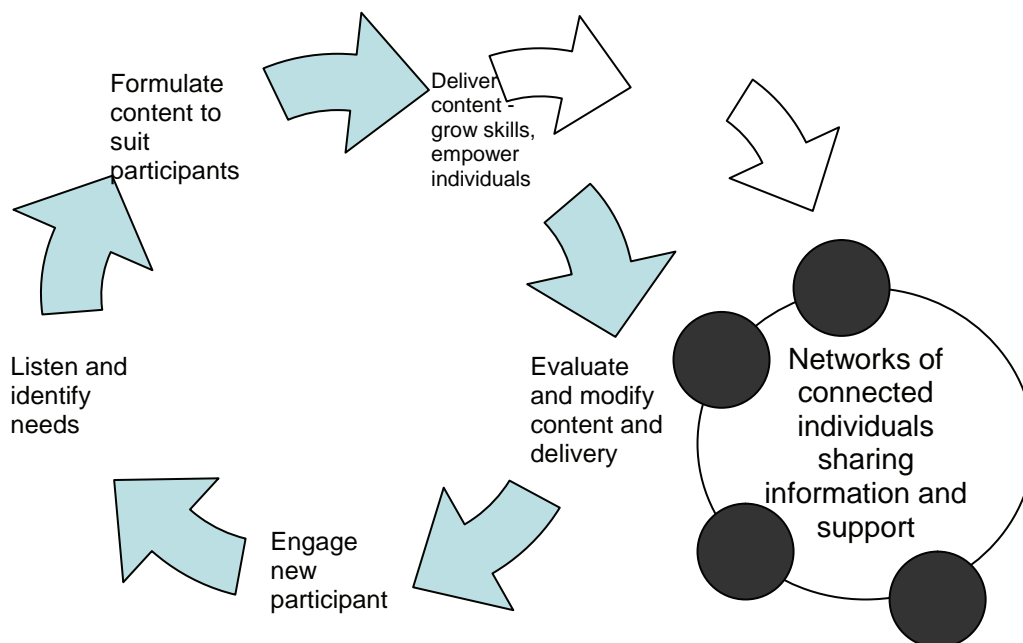
- Modules not relevant to their needs
- Training moved too quickly for them to keep up with the group
- Could not understand the trainer
- Class sizes too big
- Felt alienated from the other students
- Felt alienated from the teacher
- Too old
- Left it too late

As Feinstein, Hammond, Woods, Preston, and Bynner (2003) found, for those who have been away from learning for some time, there are particular qualities in the learning environment that enable the wider benefits to flow. Such programs need to "ensure engagement ... [C]lasses that are not sensitive to learners' needs are not necessarily going to generate the wider benefits. The provision of facilities and encouragement for interaction would also appear to be essential components" (p. 74). The projects described emphasize the need to surmount these issues, and the need for building a supporting and sustaining social infrastructure. The e-life cycle is the methodology common to all these projects,¹ revolving around a five-stage approach (illustrated in Figure 1): Engage the marginalized, listen to the learner, identify the need(s), formulate effective programs, and evaluate and modify.

Engage the Marginalized

Engaging the community and ascertaining their training needs is the crucial first step. Tu-

Figure 1. Inclusion, connectedness, and information sharing: Making connections face-to-face and online



tors publicize their programs through community places like hotels, community centers, and shops, as well as through recruiting clients via other community organizations, which refer people with literacy and/or numeracy needs to the program, and also offer services to learners taking part in the program.

Listen

Developing effective strategies for access and participation that take differences in community needs and the whole range of local social, economic, cultural, and technological factors into account can provide more equitable access to ICTs while increasing the overall success of community informatics initiatives (Rural Women and ICTs Research Team, 1999; Simpson, 2004;

Simpson et al., 2001). Providing an environment in which participants feel they are valued and are treated as capable equals is crucial to the e-life cycle's listening stage; participants here voice their needs explicitly, and those needs are addressed. Empowerment is also important for, as Feinstein (2002, p. 9) found, "Psychological well being, which encompasses a sense of personal control, and freedom from stress and hostility, in turn appears to lead to better health outcomes."

Identify

In this environment, specific training needs can be accurately identified since participants gain a sense that they are valued, that their needs are unlikely to be "way out" or in some way unacceptable, and that their contributions and concerns

will be treated with respect. Tutors encourage participants to use the technology to follow their own interests in the belief that something that has direct relevance to their own lives will be more enjoyable and more relevant, and will enhance the internalization of the learning process.

Formulate

Formulating effective programs, then, draws on the expressed interests of the participants. For example, participants might express a desire to be able to e-mail a friend or relative overseas, or to access a particular Web site or support group via the Internet. The learning is structured around this need while following a series of specified guidelines, and it is intended to provide all participants with skills in basic computing and connectivity.

There are both accredited and nonaccredited schemes in operation. In the nonaccredited training programs, material is taught in a flexible, self-paced delivery mode. Participants are encouraged to attend each session but are not penalized for not doing so. Emphasis is on meeting the learner's needs. Feinstein et al. (2003) found that the particular value of unaccredited courses is that they "may equip adults with the personal and social confidence as well as other necessary skills to progress to more challenging accredited courses, especially if appropriate guidance is available" (pp. 76-77).

Evaluate

In the projects in north Queensland, opportunities are provided for trying out new skills, sometimes in real-world situations, enabling the teacher to evaluate and modify the training. Is it working? Are participants moving toward confidence and facility? What adjustments can be made?

PRINCIPLES FOR COMMUNITY WORKERS

These projects have demonstrated a clear link between increased social cohesion and connectedness, health literacy, and health outcomes. Four crucial aspects of the e-life-cycle approach are the following.

Participation and Inclusion

The equitable and inclusive participation of people in planning, evaluation, and decision making is vital to sustainable community and economic development. The programs are specifically targeted at marginalized individuals, with the trainer taking a proactive approach to inclusion. The existing capacities and experiences of participants are overtly valued and celebrated, with trainers and other class members supporting and empowering one another in an encouraging, inclusive environment.

Content

It is crucial that content is individually tailored in a group setting to the needs and interests of the clients, is culturally sensitive and gender inclusive, and is made accessible by attention to the language and literacy needs of specific groups within the community. Hence, courses are designed around what participants want, using real-life learning needs or desires to shape learning delivery.

Delivery

Delivery must be flexible and responsive to learners' needs, incorporate design features that capitalise on the tools made available by evolving communication technologies, and support access by people with varying levels of ability, including

those with mobility, vision, hearing, and cognitive difficulties. In designing training-delivery projects, differences between people therefore need to be taken into account, including gender, age, ethnicity, occupation, and level of knowledge of new technologies.

Time

Allowing sufficient time for the development of the positive attitudes and skills necessary for the effective adoption and utilization of online technology is important. For example, the need for “hastening slowly” is evident in each of the human factors affecting the acceptance and value of Web-based services (Communication Centre, 2001). Taking this into consideration, some courses are self-paced, allowing participants to work through individual modules at their own pace and with the support of peers, tutors, family, or friends. This flexibility allows for work and family commitments, and allows participants to work around farm and seasonal commitments.

FUTURE TRENDS AND CONCLUSION

Advances in information technology and telecommunications may offer many potential benefits to Australia’s underserved communities by reducing the barriers of distance and space that disadvantage rural areas; this can only happen where projects enable the participation of all groups in the community. Improvements in the knowledge and use of such technologies have been identified as being beneficial in improving health literacy in rural communities, and they will continue to be an area of attention to reduce health inequities in Australia.

REFERENCES

- Bella, L., & Bishop, R. (2004, October 17-19). *Community capacity development: A framework for understanding the contribution of community access computers at MacMorran Community Centre to community capacity, literacy and health*. Paper presented at the Canadian Conference on Literacy and Health, CPHA, Ottawa, Ontario.
- Communication Centre. (2001). *Developing indicators to determine the effectiveness of Web-based service delivery: An holistic approach*. Brisbane, Australia: Author, QUT.
- Feinstein, L. (2002). *Wider benefits of learning research report no. 6: Quantitative estimates of the social benefits of learning, 2: Health (depression and obesity)*. London: Centre for Research on the Wider Benefits of Learning.
- Feinstein, L., Hammond, C., Woods, L., Preston, J., & Bynner, J. (2003). *Wider benefits of learning research report no. 8: The contribution of adult learning to health and social capital*. London: Centre for Research on the Wider Benefits of Learning.
- IBM. (1997). *The net result: Social inclusion in the information society*. Report of the National Working Party on Social Inclusion. London: IBM UK.
- Loader, B., & Keeble, L. (2004). *Challenging the digital divide? A literature review of community informatics initiatives*. York, UK: Joseph Rowntree Foundation & York Publishing Services.
- Parker, R. (2000). Health literacy: A challenge for American patients and their health care providers. *Health Promotion International, 15*(4), 277-283.
- Rural Women and ICTs Research Team. (1999). *The new pioneers: Women in rural Queensland collaboratively exploring the potential of communication and information technologies for*

personal, business and community development. Brisbane, Australia: The Communications Centre, QUT.

Simpson, L. (2004). *Community informatics and sustainability: Why social capital matters.* Paper presented at the Community Informatics Research Networks Conference, Prato, Italy.

Simpson, L., Wood, L., Daws, L., & Seinen, A. (2001). *Creating rural connections.* Brisbane, Australia: The Communication Centre, QUT.

Wagenfeld, M. O., Murray, J. D., Mohatt, D. F., & DeBruyn, J. C. (1997). Mental health service delivery in rural areas: Organizational and clinical issues. *NIDA Research Monograph, 168,* 418-437.

KEY TERMS

Capacity Building: The development of sustainable skills, organizational structures, re-

sources, and commitment to health improvement in health and other sectors.

Health Literacy: The capacity of an individual to obtain, interpret, and understand basic health information and services, and the competence to use such information and services in ways that are health enhancing.

Social Connectedness: The relationships people have with others and the benefits these bring to individuals and society.

ENDNOTE

- ¹ Workers delivering training refer to the process as “normal mode,” a label that downplays its exceptional and innovative qualities.

This work was previously published in the Handbook of Research on Informatics in Healthcare and Biomedicine, edited by A. A. Lazakidou, pp. 431-438, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 5.16

Transforming Democracy through ICT

Andy Williamson

Wairua Consulting Limited, New Zealand

INTRODUCTION

This article explores the potential of ICT to be used to transform the processes of citizen engagement such that a citizen-centred approach to e-democracy becomes both viable and desirable. It will do so by exploring three tensions relating to democracy and civil society: first that participation in traditional democracy is falling, yet new technologies are mobilising citizens on a global and local scale (such as antiglobalisation protests and electoral protests in the Philippines and Spain); second, ICT increases the technocracy of government but also offers citizens a chance to become closer to it; and third, that macro strategies for ICT access are not enough to remove localised exclusion.

The transformation of government and democracy toward online models does not predetermine that our communities will be strengthened or that satisfaction in or engagement with civil society will increase. The potential success of technology in this field lies in its value as a tool or conduit, the ability of technology to remove barriers of

time and space and to provide access to information. To do this effectively, we need ICT solutions that transform the processes of civil society such that citizens are privileged at the centre of the discourse and so that systems and processes are citizen-centred. This article will attempt to resolve these tensions through the description of a simple evolutionary framework that privileges activities at the citizen-led end of the continuum. The model can be used to identify issues, maturity, and progress of ICT in a community or group of communities and act as input into the development of policy and localised models for community ICT that privilege citizens.

BACKGROUND

Observers such as Putnam (2000) note that engagement in traditional community activities has been declining since the 1960s. Although this decline is mirrored in the political realm, Coleman and Götze (2002) see a drift away from participation as having more to do with apathy brought about

by the increasing technocracy and perceived distance of governments, rather than apathy for democracy itself. ICT, they and others suggest, offers the potential to dramatically change the processes of government and the interactions between government and citizens (Coleman & Götze, 2002; Mälkiä, Anttiroiko, & Savolainen, 2004).

The potential for citizen-led agencies to successfully harness new and emerging technologies in order to subvert hegemonic discourses can be seen in the role that text messaging played during the 2001 Presidential Elections in the Philippines. SMS-enabled mobile devices are now considered ubiquitous in Manila, and a technology-savvy subculture is able to effectively utilise the Internet and new mobile technologies (Quintos de Jesus, 2002). On this occasion, the actions of over a million citizens were coordinated, and street demonstrations organised in what became known as the Manila “People Power II” demonstrations. These events led directly to the downfall of the regime of President Estrada. The 2004 terrorist attacks on Madrid’s rail system occurred days before a general election. While Spain prohibits political demonstrations during the 24-hour period before an election, Spanish citizens used text messaging to self-organize spontaneous demonstrations. Text traffic was 20% higher than normal on the day before the election and 40% higher on election day (Rheingold, 2002, 2004). On a local scale, Williamson (2003) discussed how community activists were able to subvert a political discourse through the use of a Web site and online publishing: A study of housing development in an environmentally contentious area commissioned by Waitakere City Council surprisingly came out against all but a very limited amount of further subdivision. The prodeveloper council attempted to hide the report, refusing to publish it, and, even when forced to by a Parliamentary Commissioner, the city council made access difficult. Obtaining a copy of the report, community activists then scanned

and published it on two local Web sites. E-mail networks were used to widely publicise links to the report. Those with access to the Internet were encouraged to print and distribute the report, thereby ensuring as wide a circulation as possible of this controversial public document.

MAIN THRUST OF THE ARTICLE

News media has long been considered a bridge between the public (and public opinion) and government, yet today it offers little more than “an uneasy compromise between quality and popular news discourses—that represents the worst of both worlds” (Atkinson, 2001, p. 317). This reduction in diversity has occurred alongside a dramatic increase in the management of news, leaving only limited opportunities for citizens to express their own views (Gustafson, 2001). Technology clearly offers citizens the potential to reclaim their voices at a time when there is ever-increasing decentralisation of decision making away from elected representatives toward “experts.” In this new technocracy, decisions are based on science and professional knowledge, not public opinion (Mälkiä et al., 2004). The Internet is a powerful tool for connecting people with information. ICT is valuable when harnessed (like other media) for communicating a message; however, it also extends the traditional concepts of media into an interactive experience, where the views of many can be expressed and potentially disseminated widely. It is this potential that sets ICT apart from traditional print and electronic media and that offers great potential for citizens to become more involved in the political and democratic processes.

Schuler (2000) observed that ICT provides tools for strong democracy, such as e-mail, forums, and online access to documents. Organisations such as Minnesota e-Democracy (www.e-democracy.org) and the Waitakere E-democracy Group (www.wedg.org.nz) demonstrate the

potential for citizen-led engagement. Examples of top-down, government-led initiatives include Brisbane City Council, Camden Council (UK), and Rutland County Council (UK) (online fora), the Queensland and Scottish Parliaments (e-Petitions), and Estonia, Queensland, and Camden Council (broadcasting of legislature and executive). In 2002, Ronneby (Sweden) created an e-democracy Web site and discussion forum with the intent of increasing interest in the upcoming municipal election. Council candidates were able to present their views, and the public could enter into online discussions. An evaluation of the project rated it as a successful pilot, and it was well received by citizens, however, it was not successful in increasing voter turnout (Ronneby Kommun, 2002). While many of these examples are aimed at engaging online with those already engaged in the democratic processes, Queensland has also gone further, creating a Web site for the State's youth to connect with government (www.generate.qld.vic.giv.au).

While the rhetoric of government values engaged citizens and governments feel the need to solicit "feedback in order to develop good policy and services at all levels" (Office of the e-Envoy, 2001, p. 1), citizen involvement should not be assumed. Ranerup (2000) observed that, while on-line fora can be initiated by governments, the community, or other active stakeholders (such as researchers), her own experience of Swedish local government was that citizens, while seen as participants in a forum, were not necessarily consulted over its establishment and design. This highlights a gap between the technocracy of public administration and the desire of those citizens interested in democratisation and the revival of representative bodies (Chadwick, 2003).

Although most developed countries have an e-government strategy, there is no clear articulation of the link between the often-stated efficiencies gained in the delivery of government services and strong democracy (Coleman & Götze, 2002). There is a discourse within governments that sees

e-government as a tool for the management and delivery of services from the centre out. While the New Zealand e-Government Unit observed that "new technologies will enable easier access to government information and processes. People will be better informed and better able to participate" (2003, p. 1), the strategy for achieving this identifies only three limited objectives:

- Make government information easier to find.
- Publish key government information online.
- Provide multiple channels for contact with government.

ADOPTION OF TECHNOLOGY

ICT is not ubiquitous, and clearly, a significant number of citizens remain excluded from the "information economy." Many more are yet to acquire the skills needed, first, to become effective users of ICT (Gurstein, 2003), and, second, to become producers of information, news, and knowledge.

The Australian Government noted that in June 2003, 62% of people in metropolitan areas and 53% of those in nonmetropolitan areas had accessed the Internet (a total of 59% of all Australians). They observed that 55% of the Australian households had Internet access in the home. Although these statistics show encouraging growth over previous surveys, they still point to 45% of Australian households having no Internet access. Only 7% of this group are able to access the Internet elsewhere, and the overwhelming majority cite the high cost (25%) or a lack of interest (25%) as the reason for no Internet access (National Office of the Information Economy, 2003).

Beyond statistics, Zhu, Taylor, Marshall, and Dekkers (2003) observed that, in considering the adoption of ICT, it is important to consider the microlevel motivators, both societal and personal.

They suggest that individuals need to first be aware of and then motivated to want to use ICT, and, subsequently, that it is important that individuals and groups are able to identify value in its ongoing use. As Moore (1999) suggested, adoption is based on an individual's perception of the value and attributes of technology, and the discontinuity of change caused by ICT adoption can itself act as a barrier to uptake and ubiquity.

FUTURE TRENDS

As new ways of communicating supported by ICT emerge, it is necessary to reconceptualise the way we communicate and engage in democracy. While technology can lead to the privileging of experts, it also offers the potential to transform democratic processes from government-led to citizen-led. E-democracy, Chadwick (2003) suggested, is about scale, rendering convenient access to participation beyond traditional constraints of space and time. ICT must become ubiquitous for e-democracy to be effective, and barriers to ubiquity can be technical, economic, cultural, social, or political. Where local communities can become effective users of ICT and active producers of their own content, it is demonstrably possible to affect change and influence local political decision making (Williamson, 2003). The challenge for policy makers and practitioners alike is that many communities do not have equitable access to ICT, not all citizens are ICT literate, and many communities and interest groups lack the knowledge and skills to be effective users.

The community ICT model described here draws on literature that includes Patterson's (1997) four interconnected nodes (design, access, critical mass, and impact) and O'Neil's (2002) meta-analysis of community ICT studies, which reveals five key areas of research: strong democracy, social capital, individual empowerment, sense of community, and economic development opportunities.

Day's (2004) three components of community informatics (policy, partnerships, and practice) are considered, which he underpins with a framework for the democratic design of community ICT initiatives. Day asserts that communities need to be empowered before they can campaign for their own interests and influence community policy, and they must create a "democratic community planning agenda" (Day, 2004, p. 33) by defining the critical criteria for successful and sustainable community ICT projects.

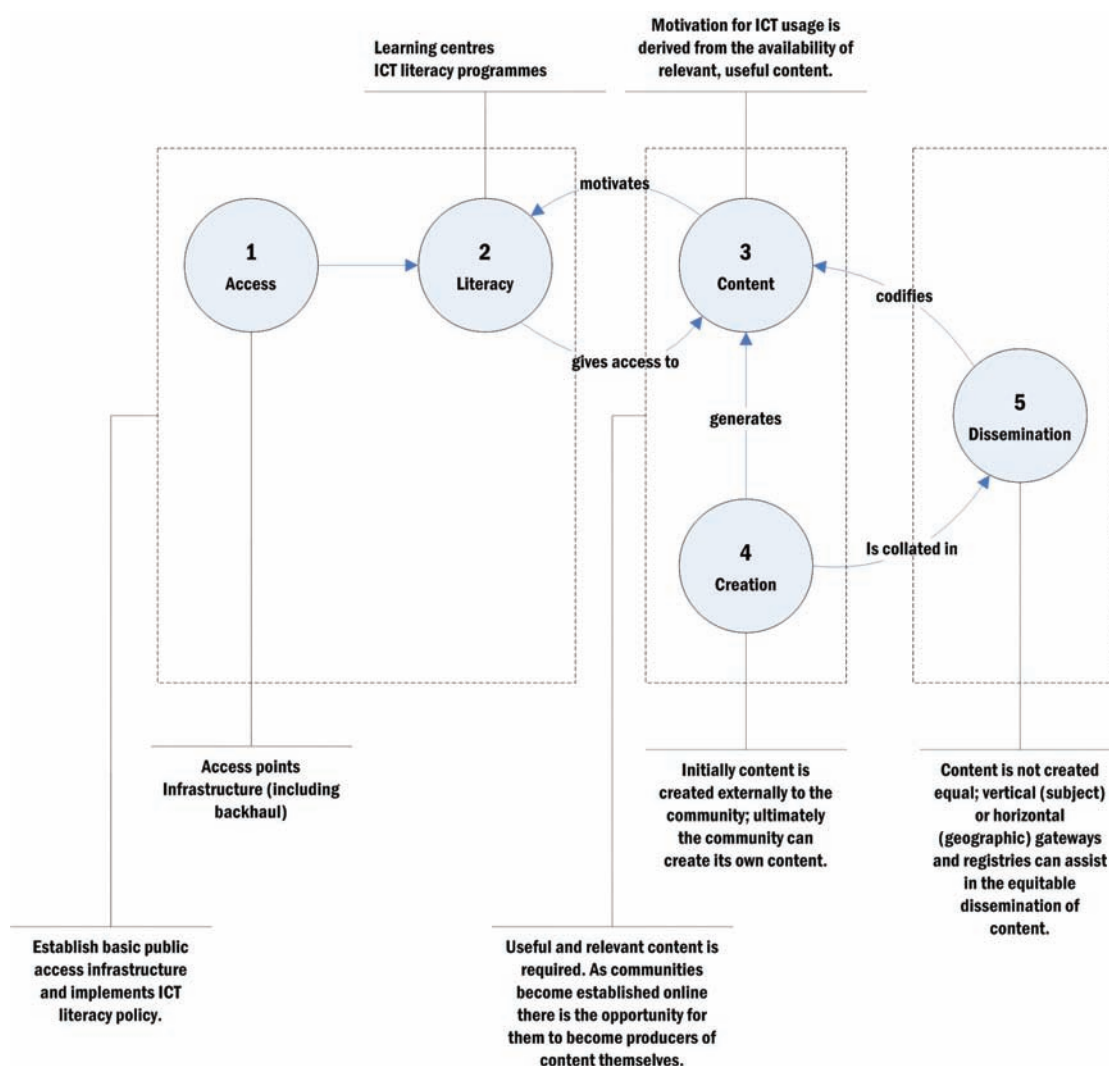
Practical experience informs the design of this model. In particular, discussions held on the Waitakere E-democracy Group Discussion list and within the Waitakere City Council EcoTech Working Party have strongly influenced its design. This draft model is strengthened by drawing on the evolving New Zealand National Information Strategy (Library and Information Association of New Zealand Aotearoa, 2002). Although the LIANZA model is developed locally, it is, in part, derived from UK models for library and information strategy. It has three core levels:

- Knowledge Access/Te kete tuātea (infrastructure)
- Knowledge Resources/Te kete aronui (content)
- Knowledge Equity/Te kete tuauri (empowered access to information) (Library and Information Association of New Zealand Aotearoa, 2002, p. 8)

This then extends to encompass issues of continuity and collaboration. The LIANZA model appears to be information centric, rather than community or people centric.

The temporal model shown in Figure 1 identifies five stages of maturity for the use of ICT within communities and can be used as both an assessment tool (for current maturity) and as a planning or policy development tool. Each of the five stages recognises an increasing maturity and

Figure 1. Five-stage model (Williamson, 2004)



sophistication in ICT usage, however, the model should not be seen as linear; the target is not to reach stage five, rather to ensure that technology is being applied in a way that is seen as appropriate to the community in question at a point in time (either present or future).

Stages one through four occur within communities. They are not necessarily formal and are not entirely dependent on each other. The requirements and relative importance (or even existence) of a stage are related to the maturity of

ICT usage. In other words, each of the four stages, while to some degree reliant on its predecessor, does not require that prior stages are or were formalised or even articulated. (There is likely to be a continuum between a laissez-faire approach and formal strategy or policy initiatives.)

Stage 1: Access

It is not lack of access that causes the digital divide but the consequences of that lack of connection

(Castells, 2001); hence, strategies are required to ensure equity of access and opportunity. Citizens must have basic access to ICT. This could be through private ownership, community ownership, or privately owned access points. Stage 1 can be subclassified in terms of the nature, cost, and availability of access.

Stage 2: Literacy

It is not enough that we simply provide community-based ICT resources. It is imperative that those in the community whom the technology is intended to benefit are trained to make effective use of it. As the generation of knowledge supersedes physical production in the postindustrial age, literacy can be judged at two levels: basic literacy and literacy in ICT.

Stages 1 and 2 are not necessarily formal; if access and literacy are already present or if no policy/strategy addresses them, they could be ad hoc, however, this requires individual motivation. Formal strategies are more likely to be needed where other socioeconomic factors restrict opportunities for access.

Stage 3: Content

For ICT to be useful and for communities to be motivated to use it, material and services must be available online that are of a perceived value to the community. Communities must be aware of such information and services and have access to them.

Stage 4: Creation

Communities have the knowledge, skills, and facilities necessary to produce and publish information themselves and to repackage or highlight information that is directly pertinent to them. Logically, Stage 4 must have occurred elsewhere to provide usable and useful material for communities entering Stage 3.

Stage 5: Dissemination

The final stage, Stage 5, is a meta-stage, occurring beyond individual community boundaries. As communities become publishers of new knowledge, society risks becoming overwhelmed with information. At present, there is also a reality that some information is more readily available and accessible than others (because the producer is more widely known or because of search engine bias). In a truly participative model for community ICT, processes need to exist to ensure the fair and equitable dissemination of information (that is being received at Stage 3 and created at Stage 4). Examples of such models might be portals or more likely would involve meta-data, meta-indexes, and registries.

Stage 5 becomes viable and appropriate once critical mass has been reached at Stage 4. Dissemination can then take place via fora that are geographical (by city, region, country, etc.) or topical (democracy, environment, social services, etc.). At this level, a clearly defined taxonomy is vital, and the use of agreed upon standards for metadata becomes important (Surman, 2002).

The five stages (access, literacy, content, creation, and dissemination) are temporal and nonstatic. Community A can be a newcomer to ICT, getting up to speed with computers in a new learning centre. However, they require content to make the technology useful. This is potentially delivered by others locally or elsewhere who are already creating content. At some point, some members of Community A become both literate and motivated enough to publish their own information: stories, histories, and news. Once enough vertical or horizontal communities have become publishers, it becomes viable to offer a collated dissemination service, by way of a portal or gateway or through online registries. The potential of this model is that it empowers communities by creating a transferable road map that acts as a good to assess where a community

is currently situated and provides direction for future strategic development.

CONCLUSION

This article has explored the tensions that exist in the use of ICT to support engagement in the democratic process: falling participation vs. ICT as a tool for citizen-led engagement; technocracy vs. closeness of the citizen to government; and centralised models of access leaving some citizens behind. It proposes a model based on localised solutions that privilege the position of the citizen at the centre of democratic discourse. Inherent in this is the recognition of ICT value in supporting localised solutions to transform the processes of citizen engagement.

The relative low cost and increasing ubiquity of ICT means that communities can now realistically expect to be able to publish their own stories and create citizen-led initiatives to influence and interface with governments. However, this does not become truly democratic until the barriers to ICT ubiquity have been overcome. Policy is required to promote ICT literacy as a life skill and ensure that access is available to all who want it. However, localised solutions are vital; no two communities are alike, and the model presented in this article is designed to act as a broad road map, assisting communities in identifying their own paths to becoming effective users of ICT and for measuring the effectiveness of community ICT projects. Equally, this model can inform policy makers in terms of recognizing the critical phases of ICT maturity within a community.

REFERENCES

Atkinson, J. (2001). Tabloid democracy. In R. Miller (Ed.), *New Zealand government and politics* (3rd ed., pp. 305-319). Auckland, NZ: OUP.

Castells, M. (2001). *The Internet galaxy: Reflections on the Internet, business, and society*. New York: Oxford University Press.

Chadwick, A. (2003, November 28). e-Democracy: The ugly duckling. *e-Government Bulletin*.

Coleman, S., & Götze, J. (2002). *Bowling together: Online public engagement in policy deliberation*. London: Hansard Society.

Day, P. (2004). Community (information and communication) technology: Policy, partnership and practice. In S. Marshall, W. Taylor, & Y. Xinghuo (Eds.), *Using community informatics to transform regions*. Hershey, PA: IGP.

E-Government Unit. (2003). *Participation*. Retrieved Jan 20, 2004, from www.e-government.govt.nz/participation/

Gurstein, M. (2003). Effective use: A community informatics strategy beyond the Digital Divide. *First Monday*, 8(12), Available online: www.firstmonday.dk/issues/issue8_12/gurstein/

Gustafson, B. (2001). Rebuilding civil society. In R. Miller (Ed.), *New Zealand government and politics* (3rd ed., pp. 26-37). Auckland, NZ: OUP.

Library and Information Association of New Zealand Aotearoa. (2002). *Towards a national information strategy*. Wellington, NZ: Library and Information Association of New Zealand Aotearoa.

Mälkiä, M., Anttiroiko, A.-V., & Savolainen, R. (Eds.). (2004). *eTransformation in governance: New directions in government and politics*. Hershey, PA: IGP.

Moore, G. A. (1999). *Crossing the chasm: Marketing and selling high-tech products to mainstream customers* (Rev. ed.). New York: HarperBusiness.

National Office of the Information Economy. (2003). *The current state of play: Online participation and activities*. Canberra, ACT: Commonwealth of Australia.

O'Neil, D. (2002). Assessing community informatics: A review of methodological approaches for evaluating community networks and community technology centers. *Internet Research: Electronic Networking Applications and Policy*, 12(1), 76-102.

Office of the e-Envoy. (2001). *International benchmarking report: Case studies of e-government services: Accessibility to IT and information*. Retrieved March 16, 2002, from: http://www.e-envoy.gov.uk/publications/reports/benchmarkingV2/access_intro.htm

Paterson, S. (1997). Evaluating the Blacksburg electronic village. In A. Cohill & A. Kavanagh (Eds.), *Community networks: Lessons from Blacksburg*. Norwood, MA: Artech.

Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*. New York: Simon & Schuster.

Quintos de Jesus, M. (2002, July 23). *Globalization and the Philippine print media*. Paper presented at the Philippine Association of Communication Educators (PACE) National Conference, Manilla, Philippines.

Ranerup, A. (2000). On-line discussion forums in a Swedish local government context. In M. Gurstein (Ed.), *Community informatics: Enabling communities with information and communication technologies*. Hershey, PA: IGP.

Rheingold, H. (2002). *SmartMobs: The next social revolution*. Cambridge, MA: Perseus.

Rheingold, H. (2004). *Political texting: SMS and elections*. The Feature. Available online: <http://www.thefeature.com/article?articleid=100479>

Ronneby Kommun. (2002). *Val2002: E-demokratiprojekt Ronneby kommun*. Ronneby, Sweden: Ronneby Kommun. Available online val2002.ronneby.se/sammanfattning_sv.pdf

Schuler, D. (2000). New communities and new community networks. In M. Gurstein (Ed.), *Community informatics: Enabling communities with information and communication technologies*. Hershey, PA: IGP.

Surman, M. (2002). *Understanding civil society portals: Online content and community models for the CSO sector*. Association for Progressive Communication.

Williamson, A. (2003). Shifting the centre: The Internet as a tool for community activism. In S. Marshall & W. Taylor (Eds.), *Proceedings of the 5th International Information Technology in Regional Areas (ITiRA) Conference* (pp. 149-155). Rockhampton, QLD: Central Queensland University.

Williamson, A. (2004). *Getting ready for e-democracy: A five-stage maturity model*. Paper presented at the Australian Electronic Governance Conference 2004, Centre for Public Policy, University of Melbourne, VIC.

Zhu, G. X., Taylor, W., Marshall, S., & Dekkers, J. (2003). Why don't people connect to the Internet at home? Analysing the internal barriers affecting Internet adoption at home in Central Queensland. In S. Marshall & W. Taylor (Eds.), *Proceedings of the 5th International Information Technology in Regional Areas (ITiRA) Conference* (pp. 92-103). Rockhampton, QLD: Central Queensland University.

KEY TERMS

Access: Citizens have access to the technology they need. Access is both physical (ICT is located

at a physically appropriate place, such as in the home, community centre, library, or school) and economic (it is affordable).

Citizen-Led E-Democracy: Bottom-up, transformative process. Citizens create and sustain ICT applications, including e-mail lists, discussion boards, chat, and Web sites, etc., that accurately capture and reflect the discourse of citizen. Such fora can be vertical (subject) or horizontal (geographic). Such an entity must be able to influence government actions either directly (through shared involvement) or indirectly (through public, media, or political influence). Citizen-led e-democracy involves governments “working with,” rather than “delivering to” citizens.

Content: Online material or services that are relevant, useful, and timely for the community and that are made available in appropriate and affordable ways.

Creation: The ability and opportunity for communities to create and publish their own online content that actively reflects their own position and that is inherently counterhegemonic.

Dissemination: Because information is not created equally, it must be codified and aggregated such that one producer of knowledge is not privileged over another. For example, a city portal where all community information is collated or republished.

E-Democracy: The electronic process through which citizens engage with government and its agents (and vice versa), including consultation and voting. E-democracy is a two-way process that can be driven by either government or citizens.

E-Government: The provision of information, transactions, and services between government agencies and from government to citizens and businesses. E-government encapsulates the electronic delivery of government “business” from the centre out (governments “doing to” citizens).

Government-Led E-Democracy: Top-down, change process. Governments create points of electronic interface in order to consult or capture opinion from citizens. This is most often a change process—a new way of recreating existing communication and consultation models, for example, consultation on policy issues or planning processes and clinics with politicians.

Literacy: Citizens have the skills to use ICT effectively to meet their needs. In policy terms, ICT literacy should be considered a basic skill alongside traditional literacy. Strategies are required to achieve equity in this area and ensure that existing educational, geographical, cultural, or socioeconomic barriers do not exacerbate the digital divide.

*This work was previously published in *Encyclopedia of Developing Regional Communities with Information and Communication Technology*, edited by S. Marshall, W. Taylor, & X. Yu, pp. 698-703, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).*

Chapter 5.17

ICTs, Empowerment, and Development: Articulating Grassroots Analysis Through Participatory Approaches

Hannah Beardon
ActionAid, UK

ABSTRACT

The digital divide has its roots in the political and power dynamics that underlie all inequality. It follows, therefore, that the response from the development sector should be rooted in learning from the long experience of tackling inequality and unequal power relations in many other fields. This chapter draws on the example of the Reflect ICTs Project to show how participatory theories, tools, and processes can be applied to ensure that ICT initiatives fundamentally address power and empowerment issues rather than ignoring or, worse, exacerbating them. The project methodology is described and some findings shown, in an attempt to show how attention to the human communication dimension of ICTs can make applied technology more sustainable and appropriate for poor communities in their struggle to access their rights.

INTRODUCTION

Information and communication technologies (ICTs) can be an empowering force, providing access to rapid communication and timely information. According to a recent study of ICT for Development (ICT4D) projects in Africa, access to communications technologies can improve people's livelihoods, access to services, agricultural practices, participation in government (and government's accountability and transparency), incomes, voice, security, social relationships, and health.

Where people are struggling to access even their most basic needs, such as clean water or school for their children, information and communication technologies may not appear to be a priority. However, within a rights- or empowerment-based approach to development, there are many types and levels of work: whether to enable

people to access their rights; to influence policy makers; to enhance communication between actors; or to develop new methodologies, tools, and resources. Information and communication are at the heart of all these. As such ICT4D can be an important part of the empowerment process, if (and only if) explicitly placed within a wider movement to achieve equity and social change through access to and realisation of human rights.

Learning from the Past

The so-called digital divide is a term which, although of relatively recent coinage, deals with concepts and problems of long-standing in the development world. For the divide between those who can avail themselves of ICTs for rapid and efficient communication and those who suffer from lack of timely and reliable information has at its root the same dynamic as any other gap between rich and poor, have and have-not, exploiter and exploited. As such, the same theories and practices which have evolved in the development sector in the past 50 years also have great significance for the field of ICTs for development or empowerment.

This chapter draws on the example of the Reflect ICTs Project to show how participatory theories, tools, and processes can be applied to ensure that ICT initiatives fundamentally address such gaps rather than ignoring or, worse, exacerbating them.

The project, which has been running pilots in Burundi, India, and Uganda since 2003, highlights in its methods and findings the importance of recognising politics and power relations at all levels, and of forming transparent and effective partnerships between different actors in the field. Here, some of the methods are shared and their applicability to different contexts discussed, based on a review of some of the perspectives and theories underlying the work.

BACKGROUND

Participatory theories, such as Participatory Rural Appraisal (PRA) and Participatory Learning in Action (PLA), have evolved over the last two decades to enable and encourage a shift in relationships within the development sector. This means away from a traditional paternalistic donor/beneficiary paradigm towards a situation where the traditional targets of development — the poor, women, older people, refugees, and so forth — could become the drivers of change in their own environment. Values such as equality, empowerment, solidarity with the poor and marginalised, and gender-equity are explicitly held at the heart of such approaches.

Participation is the vital ingredient in the PLA process (Ruland, 2003). Participation is understood as a process, not an event, whereby local people undertake their own analysis, reflection, and action. Theories, tools, and methods have been developed to understand and deal with the dynamics of power, confidence, and culture that create elites, amplify some voices, and drown out others. It acknowledges the ways that built pedagogies constrain some learning practices and enable others, and the works to create dimensions that catalyse empowerment through participation (Monahan, 2000). The most famous include visual and oral methods for facilitating appraisal, analysis, and planning. Examples of such tools and reviews are available in a number of literatures (Wilcox, 1994; UNDP, 1997; Belgeonne & Brookes, 1999; Allen & Kilvington, 2001; Allen, Kilvington & Horn, 2002; Bates, Bruce, Doig, & Gitonga, 2002), including Communication and Power (CIRAC, 2003), on which this project is partly based.

The focus on group dynamics and power relations is not simply an objective one, but involves a transformation of our own roles as researchers and practitioners as well. This relationship is transformed from one of doing, directing, or

transferring technology, to one of facilitating, sharing, enabling, catalysing, as well as learning and reflecting ourselves.

The early theories and methods have been used, adapted, rejected, and reinvented for innumerable contexts and thematic focuses so we now have what Robert Chambers describes as:

A growing family of approaches, methods, attitudes, and behaviours to enable and empower people to share, analyse, and enhance their knowledge of life and conditions, and to plan, act, monitor, evaluate, and reflect. (Chambers, 2004)

ICTs in Participatory Theory

In light of this shifting relationship and empowerment focus, information and communication technologies have an interesting (potential) significance, for information and communication are at the very heart of the appraisal, analysis, and action which make up this approach to development. Good choices are well-informed choices. People can make more appropriate decisions or plans if their local analysis is rooted in an understanding of the larger-scale processes which influence them. Technologies, including video, radio, and the Internet, can be put to use to ensure both that information flows adequately and that voices are heard more fairly. As the Rockefeller Foundation states on its Web site (www.rockfound.org):

Communication can enable poor people to move from being passive recipients of externally generated development interventions to being effective advocates for the enrichment of their own lives and, finally, generators of their own development.

The Reflect ICTs Project was designed as a participatory approach to ICTs for Development. In essence, the aim is to test the assumption that ICTs chosen by communities based on a thorough

and participatory analysis of their communication and information needs (and practices) will be more useful, more empowering, more sustainable, and ultimately have more impact. The project builds on the existing work of Reflect practitioners in the pilot locations and around the world.

The Reflect Approach

Reflect is an approach to adult learning (see Figure 1) and social change, which is used by over 350 organisations in 60 countries (CIRAC, 2002). It began as a fusion of the pedagogical theories of Paulo Freire, who argued that education is not a neutral process and therefore must be deliberately designed to liberate (Freire 1968, 1994), with participatory methodologies such as PRA (Chambers, 1994). The result was an approach to adult learning which focuses on power relations and works through systematising and deepening people's existing knowledge to enable them to base their choices and actions on thorough analysis (Archer & Cottingham, 1994; Phnuyal, Archer, & Cottingham, 1998).

Although Reflect originated as an approach to adult literacy, it has in recent years evolved to link empowerment with communication practices more broadly, including access to information and influence over decision makers. People need to articulate their views through any available or appropriate means of communication — oral, written, visual, or audio — to strengthen their participation in decisions that affect their lives.

Some of the principles and methods behind this are collected in the recent Reflect publication *Communication and Power* (CIRAC, 2003). With this, local groups and community organisations are able to own and adapt the resources and techniques of PRA to strengthen their voices and sharpen their struggle for change. In different contexts this means different things, whether communication for peace and reconciliation in Burundi, holding local institutions accountable

Figure 1. Women from Babel reflect circle, Orissa, India



through budget tracking or school management in El Salvador and Mali, challenging racism in the UK, or accessing land rights in South Africa. More examples are available on the Reflect Web site (www.reflect-action.org).

With this changing focus of Reflect, and the emergence of the digital face of the resource gap, the Reflect ICTs Project was born. The project, funded for three years by the UK Department for International Development (DFID), aims to build on the emerging understanding of the relationship between communication and power, not only to provide a critical analysis of existing ICT for Development work, but also to provide resources and models for applying participatory principles and theories to future ICT projects.

ISSUES AND PERSPECTIVES

Though ICT for Development is a relatively new field, it has taken a well-trodden path. A technology which the market has made cheaply and easily available to the more advantaged and wealthy, then becomes considered important or necessary

to those the market does not reach — the poor and marginalised. Various powerful individuals, international and local non-governmental organisations (NGOs), governments, and their departments and agencies develop policies and plans in order to make these technologies and their valuable impact more widely available. Meetings, conferences, and summits are convened; articles, papers, and books published, trying to understand why technology is not being taken up, reaching the poorest, or making a difference.

From a participatory or empowerment perspective, it is possible to see a link between the involvement of people in decisions made for and about their lives, and the sustainability and impact of development interventions. Too many failed or questionable development projects suffer from a surplus of good ideas and intentions from the top and a deficit of real involvement and understanding at the grassroots. So what looks good on paper does not translate directly into reality. Plenty of evidence, anecdotal or otherwise, exists of such failures: of fully equipped telecentres in Argentina remaining unused, or complex computer systems aimed at decentralising land registration in India

ending up in the hands of the same corrupt elites who routinely use their power to deny poor people their constitutional rights (Sanjoy, 2003).

Participatory theory has emerged from an understanding that development must not be done on behalf of others, but must be based in locally generated processes. The field of ICT for development or empowerment also needs to follow such logic to avoid such failures and be fair to those in whose name the work is done. The value of a computer or a video lies not in its existence, but in its use. Empowerment is not an easy process, and requires taking sides and making waves. It is a political process, whereby the voices of poor and marginalised people are strengthened and broadcast to challenge the status quo that exploits them. Information and communication can transform, if the aim is to expand meaningful participation in decision making. But for this to be possible, attention needs to be paid not only to the technologies applied, but also (and more importantly) to the relationships and processes that underlie interventions and policies.

This places at the centre of project planning the question: How can the voices and knowledge of poor people be sufficiently represented in policies, technology design, and implementation? This is a question which the Reflect ICT project aims to highlight, but also to tackle through example and by developing transferable methodologies and tools.

A Critical View of ICTs

It is common to find evangelistic attitudes towards ICT for development, and this project and learning is based very much in a critical analysis of the tools and approaches in the field. ICTs may have a lot of potential for empowerment, but they also have potential to be tools for exploitation and cultural imperialism. In fact, there is probably a lot more evidence of the latter than the former in existence.

As is argued in the publication *ICTs for Development: Empowerment or Exploitation* (Beardon, 2004), modern ICTs are generally the product of powerful western and commercial cultures, and both are designed to meet the needs of that community first and also to fit in with their existing logic and communications culture. If such technologies are promoted blindly throughout the world, it could in effect consolidate existing power relations between cultures and communities in the world. It could also have the practical effect on the ground of relegating traditional forms of knowledge and its expression to second-best or lower value.

Other negative effects of the introduction of ICTs can be the brain-drain effect of equipping people with skills and education without the accompanying opportunities, meaning that they leave the local community to find opportunities elsewhere. Even where this may be a positive impact for the individual involved and their family, it should still be recognised that any change in their individual circumstances does not constitute empowerment as such. While these people cannot determine the terms of their employment, or appropriate the technology to meet the needs of their own communities, they remain vulnerable to exploitation.

This means that ICT projects and initiatives which are aimed to empower and strengthen local cultures and strategies need to be explicitly designed for this. If technology is merely introduced with no awareness of these issues, then the exact opposite may end up taking place, weakening local traditions and structures which are the basis for survival strategies. ICT projects that are not explicitly aimed at empowerment of the poorest and most vulnerable — that is, real structural change — are also likely to end up replicating and consolidating the status quo.

Whether at household or community level, those who already have the best opportunities and advantages will be the first to avail of the new

technologies provided. In all three of the Reflect ICT pilots, the groups noted that women have little access to, or control over, existing information technologies such as radio and newspapers. A gender analysis, as part of a wider power analysis, should form the basis of any empowerment-focused ICT project.

LEARNING AND RECOMMENDATIONS

The Reflect ICTs Project was developed in order to combine the experience and techniques of participatory theory with the potential of ICTs for empowerment and development. This potential is great, and not to be ignored, since access to timely and reliable information is the heart of a rights or empowerment-based approach to development. Only with strong communication capacity can people really influence the decisions — or access the rights and benefits — that affect them. Reflect participants across the world have shown how they can use a collective analysis of their situation to bring about real and significant changes.

The basis for the Reflect ICT project is a set of resource sheets for facilitators to use in order to encourage analysis of the value of information, the strengths and weaknesses of existing and traditional communication practices, and potential means of improving access to information and communication capacity. Existing Reflect groups in the three pilot locations of Ruyigi (Burundi), Bukuuku (Uganda), and Balangir (India) used the sheets to build a comprehensive picture of the context into which any new technologies would be applied. This includes analysis of the appropriateness of different technology to different sections of the community including women, youth, social classes, and so on. From this analysis was developed a plan for a community communications system, which combined new technology resources with clearly defined and accountable roles and relationships.

In the case of these three pilots, limited funding for the new system was pre-assured. However, it is hoped that the resource sheets will go on to be used either for community groups to develop clear proposals for funding and resourcing from outside, and/or for donor groups and implementing agencies to strengthen the participatory needs assessment element in their own programmes.

The Facilitated Process

The process was structured around five Reflect ICT resource sheets (Beardon, 2004), which set out some key issues for communication and provide simple exercises to encourage discussion and contextual analysis. The first of these looks at the value of information, and how it can make a difference to people's lives and livelihoods. Participants are encouraged to think of examples from their own experience and develop them into analysis of general factors and trends.

The second sheet explores the different factors which make a piece of information useful or meaningful, which can include the source, format, media, relevance of the information, or capacity or confidence of the person receiving it. It is this analysis which feeds into the design process of a communication system that really fits the needs and culture of a community. In many cases people may not use information unless it comes from an already known and trusted source. So new technologies and media must be introduced carefully and only to strengthen existing networks and information sources.

Another sheet helps groups to think through the value and purpose of documenting their own knowledge, then how best this can be done. Exercises and facilitated discussions help them to think through who might wish to share their knowledge, what the implications might be, and what media could be used to store and transmit it. In the first place, it encourages people to recognise the knowledge they have, as often people take their own knowledge for granted. This is

also an important step in building people’s own confidence to communicate.

The other sheets help groups to identify specific information gaps and evaluate different strategies and resources for overcoming these. Visualisation techniques such as matrices can be used for groups to list and rank the different communications media and technologies in terms of their availability, appropriateness, or affordability. Finally there is a sheet to help with planning, highlighting areas to be considered in a funding proposal or work plan.

The Diverse Pilot Contexts

The three pilot locations emerged through a process of communication and consultation with active Reflect implementing organisations. When the project was in conceptualisation, Reflect practitioners and organisers were encouraged to get involved, share ideas, and participate through the

Reflect network. Where there was clear convergence between the aims and ideas of the Reflect ICT project concept and the existing work and direction of Reflect implementing organisations or networks, strong links were made, and from there the three pilot locations were chosen. Although all three pilot locations are poor, rural areas, they each have marked differences in terms of size, terrain, infrastructure, social and economic realities, and as a result, in pertinent issues.

Burundi

In this society dealing with and emerging from conflict, Reflect is oriented towards promoting peace and strengthening the role of women in building peace and reconstruction. Communication is key to this, as mistrust and misinformation have been key factors in perpetuating the conflict at local and national levels.

Table 1. Access to communications media: Burundi

| | Women | Men | Youth | Aged | Leaders | Ex combatants | Refugees | Students |
|-----------------|-------|-----|-------|------|---------|---------------|----------|----------|
| Radio | | X | | | X | | X | |
| Radio magazines | | X | X | | | | | X |
| EJO newsletter | X | X | X | | X | X | X | X |
| Mobile video | X | X | X | | X | | | X |
| Letter | | X | X | | X | X | X | X |
| Telephone | | | | | X | | X | X |
| Cinema | | | X | | | | | |
| TV | | | | | X | | | X |
| Markets | X | | | X | X | X | X | |
| Meetings | X | X | X | X | X | X | X | |
| Churches | X | | X | X | X | X | X | X |
| Internet | | | | | | | | X |
| Cultural events | X | X | X | X | X | X | X | X |
| Schools | X | X | X | | X | | | X |

There are currently 91 circles operating in Ruyigi province, offering a space for Hutu and Tutsi neighbours to meet and talk, share accurate information, and rebuild confidence and collaboration. Participation is around 60% male and 40% female, and in total approximately 1,000 people participate regularly in groups involved in the pilot. A newsletter called Ejo is compiled by ActionAid of contributions from Reflect participants, and is distributed in villages and in refugee camps to promote accurate and trusted information on conflict, development, gender, health, and other relevant issues. Cultural activities are also promoted and organised to bring communities together.

As Table 1 shows, women and older people are specifically disadvantaged in access to communications media, relying mostly on face-to-face contact. This type of analysis, deepened through the Reflect ICT process, enabled the team and participants to devise a communications system which caters for these excluded groups. New equipment, including Internet-connected computers, are being used to strengthen the scope and quality of Ejo, while both content and receivers for video and radio are integrated into the Reflect process. The analysis shown in Table 1 also highlighted for Reflect facilitators the role of access to information as an indicator of vulnerability to conflict — a key for future programme work.

India

This pilot is located in Balangir in the state of Orissa, near the Bay of Bengal. The majority of the population live below the poverty level and literacy is under 40% (among women only 21%). Reflect is used by 19 local organisations in 344 villages to support popular planning and mobilisation processes. The organisations form a network known as Collective Action for Drought Mitigation in Balangir (CADMB) and supported by ActionAid India; 112 of these villages are involved directly in the Reflect ICT pilot, with the others

indirectly involved through facilitators forums, public meetings, and collective planning.

In total, nearly 5,000 people participate directly in Reflect groups in Balangir, of whom 42% are women. Sixty-six percent are from scheduled castes and tribes, meaning the lowest social status, as opposed to only 37% of the general population.

The focus of the project in this area is transparent and accountable governance. A drought-prone area, many of the poorest people are forced to sell their land or migrate seasonally to nearby cities and industrial areas. Food security, land rights, and labour protection are all key issues, and at the heart of them all is good information about rights and entitlements available in the constitution and state laws. In many cases in the pilot area, information is withheld by the local elites, and the poorest people are kept in the dark about funds or entitlements which are their rights. In this situation it is clear that information is not neutral, and access to it needs (see Figure 2) to be carefully targeted and monitored.

The initial analysis carried out in Reflect circles showed that poor people depend on other people, such as facilitators, health workers, or elected representatives, for information (see Figure 3). Televisions, telephones, and even radios are out of reach of the majority of people, and literacy levels are so low as to make printed information require interpretation.

As a result of such analysis, the emerging communication system relies heavily on oral communication and accountable, informative relationships. There is great emphasis on not only the articulation of information needs at the village level, but the communication of these needs to the appropriate authorities and advocacy at different administrative levels to ensure that the needs are both heard and met. Equipment, including video and radio, as well as cultural troupes, leaflets, and public meetings, have been funded in order to increase information flow among and between village communities.

Figure 2. Matrix developed by Patharla Reflect circle shows information needs

| RANKING OF INFORMATION NEEDS - PATHARLA-VILLAGE | | | | | |
|---|---|------------------------|------------------------|-------|------|
| INDICATORS | SOCIAL ANGLE | ECONOMICAL ANGLE | OVERALL IMPACT ON LIFE | SCORE | RANK |
| INFORMATION RECEPTION | 00000 000 (08) | 00000 0000 (09) | 00000 00000 (10) | 22 | 01 |
| HEALTH CARE | 00000 (05) | 0000 00 (06) | 00000 00000 (10) | 21 | 03 |
| GOVT. SCHEMES | 00000 05 | 00000 00000 (10) | 0000 00000 (08) | 23 | 02 |
| WATER RESERVE | 00000 00000 (10) | 00 (02) | 00000 00000 (08) | 20 | 04 |
| QUALITY RIGHTS | 00000 00000 (10) | 00 (02) | 0000 000 (07) | 19 | 05 |
| LAND RIGHTS | 000 000 (06) | 0000 0000 (08) | 00000 0000 09 | 23 | 02 |
| LAND RIGHTS | 000 (03) | 00000 00 (07) | 0000 00 (05) | 15 | 07 |
| WASTE RATE | 0000 (04) | 0000 00000 (09) | 00000 (05) | 18 | 06 |
| Participants | Surtia Amole, Jastawa, Manadhat, Sita, Ukia, Inabani, Amule, Mudiakere, Teklu, Dalimati, Saria, JALINA, Riwa & Tindhi | | | | |

Figure 3. Map by Kundamal Reflect group showing available sources of information



Uganda

Bukuuku sub-county is in Eastern Uganda, bordering the Democratic Republic of Congo. The area has 25 villages and a total population of slightly more than 25,000 people. Most households live in absolute poverty (less than \$4 per day) despite fertile soils and good agricultural conditions. In large part this poverty is due to poor market information, leaving local farmers vulnerable to exploitation. Another key development issue is health, in particular HIV/AIDS, and with family sizes averaging 8 to 10, access to education is also a major problem.

Figure 4. Reflect participant listening to a radio set provided by project



There are 12 Reflect groups in the area, each with an average of 30 members, most of whom are women (see Figure 4). In addition there are seven school knowledge groups, which are Reflect groups based in the local primary (5), secondary

(1), and tertiary (1) educational institutions to address issues relating to local youth. Since the introduction of the Reflect ICTs project, new circles have been introduced and the demand is increasing. Literacy and Empowerment, a lo-

Table 2. Matrix by Bulera Reflect group ranking ICTs

| | Accessible | Available | Affordable | Appropriate | Rank |
|----------------------|------------|-----------|------------|-------------|----------|
| Posters | 3 | 1 | 0 | 10 | 6 |
| Local council | 10 | 5 | 4 | 10 | 4 |
| Alarm | 10 | 10 | 10 | 10 | 1 |
| Radio | 5 | 10 | 5 | 10 | 3 |
| Phone | 4 | 10 | 2 | 10 | 5 |
| Drum | 10 | 10 | 10 | 10 | 1 |
| Newspapers | 0 | 1 | 1 | 10 | 7 |
| Video | 0 | 0 | 0 | 10 | 8 |
| Oral | 10 | 10 | 10 | 10 | 1 |
| Music/drama | 10 | 6 | 7 | 10 | 2 |
| Meetings | 10 | 10 | 10 | 10 | 1 |
| Letters | 5 | 8 | 6 | 10 | 4 |

cal community-based organisation, implements Reflect, training and supporting facilitators and circles, and manages the ICT project with support from ActionAid Uganda.

The Uganda pilot has the best access to telecommunications infrastructure and conducive ICT government policy, and both mobile and fixed-line telephones are widespread. However, the Reflect circles' analysis showed that poor people still rely on trusted, well-informed individuals and organisations to access required social and economic information (see Table 2). Meetings, cultural events, and social gatherings were ranked as the most widely used and useful media of communication, while radio, video, and telephone were desirable but less accessible. Internet awareness was quite low, especially among adults.

Due to the smaller scale of the pilot, the groups were able to plan for a centralised resource centre with Internet access and training, bolstered by radio sets for each circle. Databases have been established to catalogue local knowledge of herbs which can be used to treat opportunistic diseases related to HIV, and another to list and monitor all orphans living in the area. Training is tailored to the needs of the groups, and additional funding and sponsorship is being sought to meet capacity needs. Women in particular are targeted for training on ICT use.

Some Interesting Insights

The actual findings of the pilot communities are part of the planning process and not to be taken as stand-alone facts and figures. However, they provide an interesting opportunity for researchers and policy makers to compare the outcomes of grassroots-level analysis with their own assumptions in applying new ICTs to poverty reduction.

In all three pilot areas, oral communication was the primary and most trusted source of information. This may be through local health or child

care workers, leaders or facilitators, or through mutual exchange at meetings and gatherings such as church or market. Beyond this, media such as radio, cultural performances, posters, and leaflets or newspapers were considered useful and accessible. Due to high levels of illiteracy in all areas, textual information is only accessible to many through an interpreter and is therefore not directly effective.

Thus, literacy can be treated as one important factor in determining existing access to and control over ICTs. Other factors include social class, education, income, and gender. In Orissa, for example, the cost of a black-and-white television set is more than the value of the land of most villagers. In Uganda, where households do own radio sets, they are usually controlled and operated by the male head of household, who chooses what to listen to. In Burundi, Reflect facilitators noted that vulnerable groups, such as the very poor, widows, elderly, and displaced people, were less able to access reliable information about security threats which make them still more vulnerable to the effects of conflict.

The types of information that people wanted to access also differed between groups. For example, in Uganda, while everyone wanted market and credit information, men and boys were more interested in job opportunities while women and girls in health and women's rights. The youth were more interested in HIV prevention and reproductive health than their parents.

In each pilot the funds for ICTs were spent differently, but in all three places the resulting plan was a combination of technologies and people to transmit information and queries. In this way, the community communications systems continue to build on people's preference for face-to-face communication. The resulting systems were influenced heavily by the size and level of infrastructure in each area.

- Uganda, being a smaller-scale pilot, has been able to create a central information/

resource centre, backed up by training and advice sessions, equipment, and continued activities of Reflect circles.

- In India, where the scale is much larger (over 100 villages), the groups have developed a complex network of local organisations, committees, and individuals to support the flow of existing information to Reflect participants and their communities, as well as advocating to different levels of government for better information provision. At different levels this network is using the Internet, video and radio programmes, travelling cultural troupes, and printed information.
- In Burundi insecurity has created a problem of mobility, and the main technologies being adopted are radio and video, and the Internet will be used to support and strengthen an existing community newsletter as well as linking Diaspora communities.

FUTURE TRENDS FOR ACTION AND RESEARCH

The Reflect ICT Process aims to enable groups to develop and define their own knowledge—about their context, needs, and existing patterns and prejudices. Theirs is not the only knowledge needed to ensure a good, effective ICT project or programme. However, it is necessary to ensure that their perspective is heard and informs the decisions of other players in the process, including technology experts, policy makers, and donors. It appears that effective and equal working relationships between these different actors, built on mutual respect and transparency, is the key to a sustainable intervention. More research is needed to understand the nature of such relationships and how existing modes of working in development need to adapt in order to allow them to flourish.

As such, the Reflect ICTs model is useful for strengthening the grassroots analysis element of any ICT for Development project. The model can

be made more effective in combination with other perspectives, expertise, and resources.

Policy advocacy is also important in order to strengthen the impact and reach of the Reflect ICT Project, and approach this in two areas. Firstly there is the question of directly influencing ICT policy. Grassroots analysis of information needs and the applicability of different ICTs should be heard and considered by those making policy decisions at local, national, and international levels. It is up to projects, organisations, and research institutions to help to establish this link.

There is also the question of what happens to the types of information and analysis that participants in projects such as this are creating and documenting. As documentation of analysis improves through participation in such projects, there is scope for forging greater linkages between the issues arising from such grassroots-level analysis and the development, advocacy, and aid agendas of NGOs and donors at national and international levels.

CONCLUSION

This chapter argues that in order to unlock the full potential of ICTs for empowerment and rights-based development, the knowledge and resources of the full range of stakeholders need to be combined. It is not only donors, technicians, and large implementing organisations who hold the key to successful project planning and implementation. A large and essential chunk of the knowledge and expertise needed rests with the people and communities who are the intended beneficiaries.

The Reflect ICT Project has been created to build on and complement existing participatory theories, approaches, and techniques, and make sense of ICTs and the digital divide in this context. The aim is to provide a model for developing this grassroots analysis of communication needs and appropriate technologies. However, finding ways

to effectively bring this perspective together with all the other essential elements of good ICT for development policy and practice is a challenge still very much ahead of us.

REFERENCES

- Allen, W., & Kilvington, M. (2001). *Building effective teams for resource use efficiency* (Landcare Research Contract Rep. LC0001/060). Lincoln, New Zealand.
- Allen, W., Kilvington, M., & Horn, C. (2002). *Using participatory and learning-based approaches for environmental management to help achieve constructive behaviour change*. Retrieved March 31, 2005, from http://www.landcareresearch.co.nz/research/social/par_rep.asp
- Archer, D., & Cottingham, S. (1996). *REFLECT mother manual*. London: ActionAid.
- Bates, E., Bruce, N., Doig, A., & Gitonga, S. (2002). *Participatory approaches for alleviating indoor air pollution in rural Kenyan kitchen* (Boiling Point No. 48) (pp. 12-15).
- Beardon, H. (2004). *ICT for development: Empowerment or exploitation*. London: ActionAid.
- Belgeonne, C., & Brookes, H. (1999). *PSE and participatory learning*. London: WWF-UK.
- Chambers, R. (1994). The origins and practice of participatory rural appraisal. *World Development*, 22(7), 953-969.
- Chambers, R. (2004). *Notes to accompany PRA/PLA familiarisation workshops*. Retrieved from <http://www.ids.ac.uk/ids/particip/research/pranotes04.pdf>
- CIRAC. (2001). *Reflect global survey*. London: CIRAC.
- CIRAC. (2003). *Communication and power*. London: CIRAC.
- Freire, P. (1968). *Pedagogy of the oppressed*. New York: Seabury.
- Freire, P. (1994). *Pedagogy of hope: Reliving pedagogy of the oppressed*. New York: Continuum Publishing Company.
- Gerster, R., & Zimmerman, S. (2003). *Information and communication technologies and poverty reduction in Sub-Saharan Africa: A learning study*. Richterswil: Gerster Consulting.
- Monahan, T. (2000). Built pedagogies and technology practices: Designing for participatory learning. In *Proceedings of the Participatory Design Conference*. Palo Alto, CA: CPRS.
- Phnuyal, B., Archer, D., & Cottingham, S. (Eds.). (1998). *PLA notes 32: Participation, literacy and empowerment*. IIED.
- Ruland, C. D. (2003, March). *Participatory learning and action*. Youth Lens.
- Sanjoy, A. (2003). *Critical analysis of the Gyan-doot project*. Retrieved from <http://www.reflect-action.org>
- UNDP. (1997). *UNDP guidebook on participation: Empowering people: A guide to participation*. UNDP.
- Wilcox, D. (1994). *The guide to effective participation*. Partnerships online. Retrieved March 31, 2005, from <http://www.partnerships.org.uk/guide/index.htm>

TERMS AND DEFINITIONS

Digital Divide: The condition of one group (the dominant group) having an advantage over another group (the marginalised group) concerning computer or technological skills. It can also refer to the general lack of access to computers and the Internet, which affects women, children, various ethnic groups, and older citizens.

Empowerment: Involves a process which pays attention to power relations and their impact on the opportunities individuals and communities have to create changes in their lives. Empowerment is about structural changes. More than simple service delivery, it is about building capacity of people to make demands and influence decision making.

Empowerment Processes: The processes of empowerment can be at individual, group, or community level, and include capacity building and participatory approaches.

ICT for Development (ICT4D): When ICTs assist to meet development objectives, in particular global development goals for poverty reduction, education, health, and environment as a tool for economic growth.

Participatory Approaches: Techniques to promote participation in development through a focus on Participatory Learning and Action (PLA) information exchange. In particular, participatory

approaches allow a community to express and analyse the realities of their lives, plan themselves what action needs to be taken to change the situation, and monitor and evaluate the results by themselves. Participatory approaches have been used in many settings in development both in rural and urban aspects.

Participatory Learning in Action (PLA): An umbrella term of methodologies in participation of people in the processes of learning about their needs and opportunities, and in the action required to address them. PLA techniques are being used to encourage community members to express their ideas and needs.

Participatory Rural Appraisal (PRA): A label given to a growing family of participatory approaches and methods that emphasise local knowledge and enable local people to make their own appraisal, analysis, and plans. It evolved from rapid rural appraisal — a set of informal techniques used by development practitioners in rural areas to collect and analyse data.

This work was previously published in Empowering Marginal Communities with Information Networking, edited by H. Rahman, pp. 44-61, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.18

Enacting and Interpreting Technology—From Usage to Well-Being: Experiences of Indigenous Peoples with ICTs

Bjöm-Sören Gigler

London School of Economics and Political Science, UK

ABSTRACT

Under which conditions can information and communications technologies (ICTs) enhance the well-being of indigenous communities? This chapter investigates this question, focusing on the role of information and communications technology in promoting indigenous peoples' development. First, the chapter analyzes key factors under which information and knowledge can be instrumental and substantive for the empowerment of marginalized groups. Hereby, it will be argued that improved informational capabilities, similar to the enhancement of a person's writing and reading skills, can enhance poor people's capabilities to make strategic life choices and to achieve the lifestyle they value. The chapter develops an alternative evaluation framework for ICT interventions based on Sen's capability approach.

This framework places, in contrast to the current discourse around the digital divide, the human development of the poor and not technology at the center of the analysis. The chapter concludes that a direct and causal relationship between ICTs and enhanced well-being does not exist, but that in fact this relationship is being shaped by a dynamic, multi-dimensional interrelationship between technology and the social context.

INTRODUCTION

What is the impact of information and communication technologies (ICTs) on indigenous peoples¹? Can the introduction of ICTs enhance their human and social capabilities and thus improve their well-being²? The starting point of the following chapter is to investigate the impact

of ICTs on development from the vantage point of marginalized communities themselves. This approach centers on people and their well-being rather than on technologies. It underscores the notion that communities are not mere beneficiaries of development, but have the capacity and creativity to define their own development priorities, goals, and vision for the future (Chambers, 1983; Cernea, 1991; Eade, 2003; Max-Neef, 1991; Korten & Klaus, 1984). Using this concept, an alternative evaluation framework of ICT programs has been developed that places their human development rather than technology at the core of its analysis (Madon, 2003) and which operationalizes Amartya Sen's capability approach.

The chapter addresses the two key questions, whether and under which conditions the improved access to information and knowledge facilitated by ICTs can enhance the capabilities of marginalized groups to better achieve the lifestyles they value. At the outset, it will be argued that information and knowledge can play an important role to improve the well-being of marginalized groups, as long as they are fully integrated into the broader socio-political realities of the communities (Castells, 1997, 1998; Madon, 2000; ITDG, 2001; O'Farrell, Norrish, & Scott, 1999). This approach places communities' assets and capabilities in the center, and examines the catalytic role of information and knowledge flows in expanding the capabilities of marginalized groups. Within this framework the chapter investigates key factors that enable marginalized groups to gain real and meaningful access to ICTs and allow them to appropriate these technologies as an instrument for their own development.

On the basis of two case studies, the chapter will provide a set of conclusions, which point out that it is in fact not possible to identify a direct and causal relationship between ICTs and the improved well-being of marginalized groups, stressing the complex and dynamic interdependency between people, social institutions, and technology.

BACKGROUND: INDIGENOUS PEOPLES AND ICTS FOR DEVELOPMENT

Indigenous peoples have historically been the poorest and most excluded in Latin America. They have not only faced serious discrimination in terms of their basic rights to ancestral property, languages, cultures, and forms of governance, but also in terms of access to basic social services (education, health and nutrition, water and sanitation, housing, etc.) and the essential material conditions for a satisfying life. These conditions of extreme poverty and material deprivation — what might be best described as a denial of the fundamental social citizenship rights of indigenous peoples — are widespread in many parts of the world (Davis, 2002; Partridge & Uquillas with Johns, 1998).

In recent years, the potential of information and communications technologies³ for development has gained a lot of attention in the development discourse (Braga, 1998; Heeks & Kenny, 2002; Panos, 1998; UNDP 2001; Wade, 2002; World Bank, 1995, 2000). Within this debate, critics highlight that the emphasis is frequently being placed on providing access to ICTs to the poor before analyzing the value information and knowledge exchanges play for development at the local level (Black, 1999; Mansell, 1998; Menou, 1993, 1999; Norris, 2001). But an unanswered question remains — what is in fact the impact of ICTs on the lives of indigenous peoples?

The analysis will draw on the contextual approach to ICTs, emphasizing the importance of the socio-economic and cultural milieu, considered crucial for a better understanding of the potential effects of ICTs on development (Avgerou, 2001; Kling, 2000; Walsham, 1993, 1995). This approach stresses that technology only receives meaning once it is enacted by users, and thus people can exert control over its use by interpreting and appropriating it to their specific realities (Orlikowski, 2000). In essence, it places human action rather

than technology at the center, and emphasizes the interdependencies between technology and the social context (Orlikowski, 2000; Avgerrou, 2001). The chapter focuses on this very interrelationship between technological and social change, in effect, seeking to broaden the focus from simply studying the immediate and measurable effects of ICT diffusion and usage to a wider scope encompassing the analysis of social, economic, and cultural aspects of the local context in which ICTs are placed. This approach follows earlier empirical works (e.g., Harris, Bala, Songan, & Khoo, 2001; Madon, 2001; Miller & Slater, 2000; Nelson, 1996) which have demonstrated that the researcher has been able to discern the specific factors (i.e., local culture and social structures) influencing whether or not technologies have a positive impact on the daily lives of poor communities (Avgerou & Madon, 2003).

KEY FACTORS FOR ICTS AND INDIGENOUS PEOPLES' DEVELOPMENT

The chapter highlights the following main factors that influence whether and to what extent the access to and use of ICTs can enhance the capability of indigenous peoples, ultimately resulting in their improved well-being. These include the following:

1. The role of existing indigenous information systems,
2. The role of intermediary organizations,
3. The appropriation process of technology, and
4. The broader socio-political context.

The Role of Existing Indigenous Information Systems

In contrast to more conventional approaches to ICTs, this chapter highlights the key role indig-

enous information systems — which are based on indigenous knowledge and communication practices — play for securing the well-being of indigenous peoples (Agrawal, 1995; Chambers, Pacey, & Thrupp, 1989; Brokensha, Warren, & Wern, 1980; Harris et al., 2001; Wang et al., 1994). This approach emphasizes that the existing information and knowledge gaps are rather mutual in nature, whereby not only poor communities lack access to information and knowledge, but at the same time policy makers in capital cities lack knowledge about the local and cultural context of the poor and marginalized groups (Scoones & Thompson, 1994; Long & Villareal, 1994). It is thus crucial to first analyze the existing information ecology and traditional information systems and communications channels before exploring the impact of the introduction of ICTs (Madon, 2003; ITDG, 2001; O'Farrell et al., 1999; Slater, 2002).

These traditional information systems are embedded into the existing social and organizational structures at the community level. A common reason for the failure of ICT programs is that key community members (e.g., elders and other information brokers) perceive the new technologies as a mechanism to undermine the existing information systems embedded in the social and organizational structures of the community (Robinson, 1998; Long & Villareal, 1994).

The Role of Intermediary Organizations

The literature points to the critical role intermediary organizations are playing in the process of introducing ICTs to local communities (Madon, 2000; Heeks, 2002; McConnell, 2000). For instance, Heeks argues that intermediaries play a critical role in supporting rural communities to overcome some of the previously-mentioned barriers while providing ICT services (Heeks, 2002). However, the literature has neglected to specify the exact role that intermediaries play in

the process. Instead it takes a more institutional perspective and analyzes the effects of ICTs within organizations (Avgerou, 2001; Powell, 1999; Meyer, 1997).

Based on this gap in the literature, the chapter suggests investigation in greater detail of the different types and levels of intermediation in ICT programs, hereby distinguishing between the following two types: (1) ICT or technical and (2) social intermediaries. The main role of ICT intermediaries is defined as an organization providing effective support to local communities in the use and adaptation of technology. Most commonly an ICT intermediary will be a specialized organization from outside the community, such as a non-governmental organization, local government, or international donor. On the other hand, a social intermediary is defined as a local institution from within the community, such as a community-based organization. This classification will be used to analyze the two main aspects of the intermediary process: (1) the manner in which ICTs are being introduced and which technical support services (i.e., training, content development) are being provided to the community, and (2) the extent to which the ICT program is embedded into existing social and organizational structures (i.e., the relationship between existing informal information systems and the ICT intervention).

The Process of Technology Appropriation

Based on this contextualized approach to ICTs (Avgerou, 2001; Madon, 2001; Walsham, 1998, 1993), the chapter emphasizes that the local appropriation of technologies by local communities and the contextualization of information provided through ICTs is a key factor that determines whether indigenous communities are able to derive real benefits out of the use of ICTs. Pure access to ICTs by the poor does not translate into improved well-being (O'Farrell, 2001). In fact, a tool such

as the Internet is a very 'western' medium and needs to be appropriated by poor communities before real benefits can be derived. For instance, the content on the Internet often does not reflect the realities of local communities (Ballantyn, 2002). Also, language many times represents a prohibitive barrier for communities in their use of information, as most of the Internet's content is written in a rather academic or business style, and thus is not directly applicable at the grassroots level. Another factor which acts as a barrier to access, stems from the fact that the majority of the content available on the Internet is in English — limiting access in poor communities across most developing countries (Gurstein, 2000).

The Broader Socio-Political Context

Several authors have argued that existing barriers to the use of ICTs are not simply about the lack of access to technology or inadequate access to relevant and timely information, but that these are in fact much more deeply rooted in underlying social and institutional structures which continue to perpetuate existing socio-economic inequalities between the elites and marginalized groups of society, ultimately reproducing themselves also in the uneven benefits accrued from ICTs (Castells, 1997, 1998; Hamelink, 1994; Hewitt de Alcántara, 2001; Mansell, 2004; Skuse, 2000). Thus, rather than the lack of knowledge of marginalized groups, the existing political, socio-economic, and cultural barriers between the urban elites and the poor inhibit them from making their information and knowledge known and disseminated, blocking their participation in the dominant society's political and economic system.

THE CAPABILITY APPROACH

Amartya Sen argues that human development should be viewed first and foremost as a process of expanding people's capabilities. What matters,

according to Sen, is what people are capable of being, or doing, with the goods to which they have access. A person's capability therefore refers "to the alternative combinations of functionings that are feasible to achieve. Capability is thus a kind of freedom: the substantive freedom to achieve alternative functioning combinations (or, less formally put, the freedom to achieve various lifestyles)" (Sen, 1999, p. 75). Capabilities include things that a person actually has done, as well as things people can possibly do. In other words capabilities refer to the extent of one's positive freedoms (Gasper, 2002, p. 5).

The concept of functioning "reflects the various things a person may value doing or being" (Sen, 1999, p. 75). They represent "various components or aspects of how a person lives" (Gasper, 2002, p. 4). A person's ability to realize her or his desired and valued functionings very much depends on her or his capabilities as well as entitlements or assets.

Operationalizing Sen's Capability Approach

In the last couple of years, there has been significant debate in the literature on ways to operationalize Sen's capability approach and to apply it in a more practical way to empirical research (Alkire, 2002; Comin, 2001; Corbridge 2001; Gasper, 1997, 2002; Stewart & Deneulin, 2002). On the one hand, as Comim has suggested, the capability framework is well suited for "evaluating and assessing social arrangements, standard of living, inequality, poverty, justice, quality of life or well-being" (Comim, 2001, p. 4).

On the other hand, however, several scholars have highlighted the difficulties to operationalizing the approach. Comin points out that these difficulties derive from the capabilities approach's "theoretical underspecification and inclusive view of operationalization which contest not only the evaluative but also the practical foundations of utilitarianism" (Comim, 2001, p. 2). Furthermore,

a key challenge has been to define a-priori a set of basic capabilities, in order to have a baseline from which to start specific evaluations (Nussbaum, 2000; Alkire, 2002).

Another difficulty related to operationalizing the capability approach is that some capabilities are harder to measure than others. For instance, it is much more difficult to assess a person's ability to have self-esteem than their ability to write and read. This represents particular challenges for gathering data on the non-material aspects of people's well-being.

Comim highlights that the capability approach is particularly suited for micro-level studies, since to a large extent it focuses on non-income variables (Comim, 2001). Such an approach, he argues will reveal more interesting findings at the micro-level than at the macro-level, as research at this level can better analyze people's ability to choose what to do or be.

TOWARD AN ALTERNATIVE EVALUATION FRAMEWORK OF ICT PROGRAMS

Based on the theoretical background discussed earlier, the chapter develops an alternative evaluation framework (AEF) of ICT interventions based on Sen's capability approach (Garnham, 2000). The center of the analysis focuses on whether or not and under which conditions the improved access to information and knowledge facilitated by ICTs can enhance the individual and collective capabilities of marginalized groups to better achieve the lifestyles they value.

This approach stands in contrast to the majority of existing ICT evaluations that have focused primarily on the issue of access and usage, and assume that the improved access to ICTs will have a direct positive impact on the lives of the poor (Daly, 1999; Hudson, 1995; McConnell, 1995, 2000; Wilson, Daly, & Griffiths, 1998; White, 2000). These evaluations focus on measuring more

immediate and quantifiable output indicators, such as the increase in total numbers of Internet hosts and computers per capita.

In an earlier analysis Richard Heeks (1999) has argued that information instead of technologies needs to be in the center of the analysis. The proposed approach, however, goes even one step further and places individual and collective capabilities in the center, with information and ICTs being placed at the outermost circle of the model. The aim is to underscore that ICTs are not a means to an end by themselves and that in fact only under certain conditions can they act to expand the capabilities of the poor and realize improved economic, social, political, and cultural opportunities. Although it is argued that the right to information and knowledge is an important entitlement and its absence can be a contributing factor to poverty, this notion needs to be balanced against the broader context of existing social and economic inequalities, which may reinforce themselves through the technology (Hewitt de Alcántara, 2001; Castells, 1997). Consequently, the sustainable livelihoods framework⁴ will be integrated to attempt a more holistic socio-economic analysis of the possible effects of ICTs through its breadth and scope.

As a starting point, it is being argued that it is important to introduce information as an additional asset or capital into the sustainable livelihoods framework. The analysis of the role that information and knowledge can play for development and the view that the right to information represents an important entitlement of the poor serve as the rationale for including the concept of informational capital into the livelihoods approach. This concept is defined through the following four components:

1. The extent to which the poor have access to information from the formal institutions of the market, state, and civil society;
2. The ability of the poor to process and evaluate information;

3. The extent to which the poor do not only consume, but produce and share information within their community and networks; and
4. The extent to which indigenous knowledge is used.

As Table 1 shows, the informational capital has been added as an additional dimension to the set of livelihood resources of the poor. Thus the framework aims to underscore that the interlinkages between informational capital and all the other capitals are crucial for evaluating the role information and ICTs play in the livelihoods of the poor. At the same time, it is being argued that information in its own right is an important asset for the poor to improve or secure their livelihoods.

This approach contends that the capability of individuals and social groups to transform valued functionings into realized functionings depends to a large extent on their livelihood resources or capitals (Bebbington, 1999). The expansion of capabilities is hereby understood as the strengthening of people's capitals. However, questions remain such as: what is the role that information plays in this context, and what justifies broadening the livelihood approach by the additional dimension of the informational capital? The main argument for including this dimension into the framework is that information and ICTs can play an important role not only in their own right, but can act as a catalytic agent for the strengthening of the poor's capital in multiple areas. As the literature has demonstrated, only the combination of strengthened resources and agency can lead to enhancing individual and collective capabilities (Kabeer, 1999; Bebbington, 1999). Based on these findings, the AEF analyzes under which conditions the expansion of the informational capability can have a positive multiplier effect on the other capabilities. In other words, does the expansion of the poor's capability to make meaningful use of ICTs strengthen their capabilities to achieve valued

Table 1. Empowerment through ICTs framework

| CONTEXT | LIVELIHOOD RESOURCES | INSTITUTIONAL PROCESSES | CAPABILITIES | LIVELIHOOD OUTCOMES |
|---|--|--|---|---|
| Socio-Economic Conditions < | Economic/financial capital | Existing social structures | <u>Individual</u> | Informational Capabilities strengthened |
| Demographics < | Natural capital | Existing information system | Material Human Social Informational | Human Capabilities strengthened |
| Cultural Context | Human capital | - | - | Human Capabilities strengthened |
| Political Context | Social capital | Level and degree of ICT intermediation < | <u>Collective</u> | Social Capabilities strengthened |
| ICT diffusion | Informational capital | - | Voice Organization Networks Informational | Social Capabilities strengthened |
| ICT policy Framework | - | - | - | - |
| <u>Stages of ICT project</u> | | | | |
| Existing Information Systems and Environments | Assess Information needs Informational capital | 1) Community ICT Access 2) Local and relevant content 3) Capacity-Building | Local Appropriation and Use of ICTs | Ownership Sustainability |
| INFORMATION | | | ICTs | IMPACT |

functionings in multiple areas? This notion stems from Sen's concept on the role that human capital plays not only in enhancing a person's ability to generate income, but also in expanding her or his capabilities to lead a freer and more fulfilled life, and to reach her or his valued functionings (Sen, 1997, p. 1960). In this sense the focus is on the agency role of human capabilities for bringing about social change. The AEF applies this concept to the field of ICTs, arguing that better access to information and improved ICT skills similar to the enhancement of a person's writing and reading skills can increase people's capabilities to make choices in their lives in various areas, including the economic, social, and political spheres. Thus, as a result of expanded informational capabilities, individuals will be able to increase their control over important life choices — in this sense information and ICTs can contribute towards the empowerment of the poor.

It is, however, important to emphasize that in this scenario the improved access to ICTs has indirect rather than direct effects on the well-being of the poor. In fact the relationship between these variables is multi-dimensional and needs to be seen within the broader socio-political context of a country.

Moreover, the framework requires that at the outset of ICT programs, an assessment of existing indigenous information and knowledge systems be carried out (Brown, 1991). A common reason for the failure of ICT programs is that key community members perceive the new technologies as a mechanism to undermine existing information systems and as a challenge to the role of traditional knowledge brokers (Robinson, 1998; Long & Villareal, 1994). Thus, it is decisive to carry out an information needs assessment prior to introducing ICTs, and to use this tool in identifying the key stakeholders and their interests in the information system. Such an assessment will make explicit the role that information plays for the community, and which information and communications channels

(i.e., oral tradition, community-radios) have been used traditionally.

Furthermore, the evaluation framework underscores the importance of understanding the institutional structures and processes that mediate the transformation process from livelihood resources into the expansion of capabilities, thus contributing to the attainment of positive livelihood outcomes. Hereby, it is important to analyze the interrelationship between existing social structures and ICT inter-mediation. The framework contends that a successful mediation process by an effective and local intermediary is required before ICTs can have a positive contribution towards expanding the livelihoods of the poor. In addition, intermediaries play a decisive role in: (1) identifying and providing access to ICT products and services that suit the local communities' information needs; (2) supporting the generation of local and relevant content; and (3) providing ongoing support in the areas of training and capacity-building (Delgadillo, Gomez, & Stoll, 2003; Gurstein, 2003). Based on this contextualized approach to ICTs (Avgerou, 2001; Madon, 2001; Walsham, 1993, 1995), the AEF emphasizes that the local appropriation of technologies by local communities and the contextualization of information provided through ICTs is a key factor that determines whether indigenous communities are able to derive real benefits out of the use of ICTs.

AN OVERVIEW OF EXPERIENCES IN USING ICTS FOR INDIGENOUS PEOPLES' DEVELOPMENT

In spite of tremendous challenges associated with the use of ICTs, indigenous peoples have been proactive in embracing the opportunities provided by the use of new ICTs. In particular, the indigenous leadership has used these new technologies to establish or strengthen existing

national, regional, and international networks. Hereby indigenous peoples frequently stress the need to foster horizontal exchange of information, knowledge, and experiences among each other. Furthermore, many indigenous peoples have used the Internet as an instrument to strengthen their alliances with international NGOs, academic institutions, and international donor agencies, as well as to raise the awareness of the international community about their needs and concerns.

In order to analyze the specific effects of new ICTs on indigenous peoples, it is necessary to clearly distinguish the different levels at which indigenous peoples are making use of ICTs. In the analysis, the chapter will distinguish between the following five levels: (1) international indigenous leaders, (2) regional leaders (i.e., in Latin America), (3) national leaders, (4) community leaders, and (5) indigenous communities⁵.

At the international level, indigenous peoples are increasingly gaining spaces at the international fora, such as through the United Nations Permanent Forum of Indigenous Issues established by the U.N. Economic and Social Council, the U.N. Working Group on Indigenous Issues of the High Commissioner of Human Rights, or various global summits, such as the World Summit on Sustainable Development. As a consequence of this renewed international interest in indigenous peoples' concern, a new international indigenous leadership has been formed. This new indigenous leadership makes intensive use of the Internet mainly as a communication tool in order to coordinate their actions, to lobby for indigenous rights, and to maintain close contact to international organizations, governments, and international NGOs. A good example of this proactive use of ICTs by international indigenous leaders is the Indigenous Media Network (<http://www.indigenousmedia.org>). This network was established in May 2002 with the support of the U.N. High Commissioner for Human Rights and the Advocacy Project to bring together indigenous journalists from all

parts of the world to "promote indigenous identity, language, culture, and human rights" (Indigenous Media Network Website, www.indigenousmedia.org). The initiative was conceived as a reaction to concerns by indigenous peoples that the traditional mass media is solely based on the values of mainstream society, and thus can lead to the erosion of indigenous peoples' culture or be misused as an instrument to stereotype against them. The indigenous leaders see their own initiative as a key vehicle for reporting more accurate and culturally appropriate news coverage from indigenous perspectives to a broad international audience, including indigenous communities, international NGOs, governments, and international agencies.

An experience that demonstrates the new opportunities ICTs can provide indigenous peoples to influence international policy dialogues is the program of Indigenous Dialogues jointly organized by the Rigoberta Menchú Tum Foundation (<http://www.frmt.org>), the University of the Autonomous Regions of the Nicaraguan Coast — URACCAN (<http://www.uraccan.edu.ni>), and the Development Gateway⁶ (<http://www.developmentgateway.org>). In a series of seven videoconferences, the program connected indigenous leaders from up to 17 countries — primarily from Latin America and to some extent from Africa, Asia, Europe, and North America — to exchange their views and make their voices heard on such global issues as sustainable development, human rights and discrimination, cultural diversity, women and development, and free trade. The program enhanced the participation of indigenous peoples in international policy dialogues. For instance in October 2001, more than 300 indigenous leaders participated in a dialogue to evaluate the results of the World Conference Against Racism, Racial Discrimination, and Xenophobia. Through the use of videoconferencing, hundreds of indigenous leaders, who were not been able to travel to this international conference, were enabled to par-

ticipate in the debate and in the development of a joint indigenous peoples' position. This experience highlights that the new international indigenous leadership has proactively engaged with new ICTs and appreciates the value it can bring towards furthering their causes. Dr. Myrna Cunningham, the director of URACCAN, expressed this view by stressing:

We, the indigenous leaders have to take full advantage of this wonderful technology to continue discussing key issues of our concern and to prepare ourselves for international summits, as for instance the World Summit on Sustainable Development. (Gigler with Simmons, 2002, p. 1)

At the regional level, increasingly indigenous peoples are using new ICTs to better coordinate their activities and to develop joint regional programs. A good example of the use of ICTs at this level is the experience by the Fondo Indígena para el Desarrollo de los Pueblos Indígenas en America Latina y el Caribe (<http://www.fondoindigena.org>). This regional international organization, representing indigenous peoples of 16 countries in Latin America, has developed since mid-2000 a strategy to use new ICTs as an instrument to: (1) enhance the organization's transparency, (2) improve the information flow between its indigenous and government representatives, (3) promote indigenous peoples' issues at a regional and global level, and (4) enhance the capacity of indigenous leaders to make use of the new ICTs. In order to implement its strategy, the Fondo Indígena established a small communications team, which developed an institutional Web site as one of its first activities, containing information about the institution, specific programs, news, a calendar of events, and contact information. In addition, the organization started a quarterly newsletter, which provides its members and the general public with regular updates about its main activities.

A second main challenge of the institutions represented the need to improve the information

flow between its member governments and indigenous representatives. As an important step the organization organized jointly with the Development Gateway in September 2001 the first of a series of capacity-building workshops in the use of ICTs for indigenous leaders. The core objectives of these workshops were: (1) to train national and regional indigenous leaders in the practical use of the Internet (i.e., use of e-mail, Web-searches); (2) to provide indigenous leaders with specific online tools and resources (i.e., through the hosting of Web sites and the provision of free e-mail accounts); and (3) to promote a culture of information sharing and enhanced information flows between indigenous peoples.

Third, the Fondo Indígena became the main partner of the Development Gateway in developing an international Indigenous Peoples Community Portal (<http://www.developmentgateway.org/indigenous>). The main objectives of this portal is to develop an interactive Web-based platform, where indigenous organizations, international NGOs, governments, and international donors can freely share information about development projects, best practices and lessons learned, research reports, contact information, current events, and related information on such issues as indigenous rights, cultural diversity, sustainable development, and indigenous health. The portal offers a broad range of information on indigenous issues; provides indigenous peoples with the opportunity to access information about the activities of international donors, NGOs, and governments; and disseminates its own information and content to a broad international audience. Moreover, the portal serves as a major source of information about the current situation of indigenous people for the international community.

Finally, one of the key objectives of this ICT program, aiming to strengthen indigenous peoples' capacity to design and develop their own community sites, has however encountered a series of important difficulties. Due to the lack of access to computers, Internet connectivity, and

technical skills, many indigenous peoples remain de facto excluded from the services provided by the program. Even national indigenous leaders and organizations frequently lack the resources and capacity to make meaningful use of the portal and other online services. Furthermore, a key lesson of the project is that there exists an abundance of content on indigenous issues, which is more academic or theoretical in nature. However, it is very challenging to develop content that meets the local needs of indigenous leaders or local communities. Finally, due to the previously-described important differences within the indigenous leadership, the portal is confronted with the challenge of serving the information needs of a very diverse audience. For instance, the information needs of international leaders are entirely different from the needs of a community leader.

At the national level, there exists an abundance of experience of the use of ICTs by indigenous organizations which provide useful information about existing national policies, laws, and government policies; the current situation of indigenous peoples; and other issues relevant to indigenous peoples. In Ecuador, for instance, the national confederation of indigenous peoples, CONAIE — with the support of an international NGO and volunteers — is providing a broad range of information of the situation of indigenous peoples in Ecuador through its Web site (<http://www.conaie.nativeweb.org>). Furthermore, the organization has been quite effective in using its Web site and e-mail listservs in coordinating its joint actions between the different indigenous groups, as well as to influence the national and international policy dialogue on such issues as land rights or the structural adjustment programs.

In Canada, the main indigenous organizations have formed an alliance with the government in the development of a national Aboriginal portal (<http://www.aboriginalcanada.gc.ca>). The main objective of the portal is to provide a single, national Aboriginal window on federal, provincial, and local Aboriginal information and services.

Many indigenous peoples however continue to perceive this program as a government-led initiative, since the content and the design of the portal has been coordinated by a technical group within the Ministry of Indian and Northern Affairs. In order to minimize this type of criticism and to allow the full participation of the main national aboriginal organizations, the government has created a Working Group for the project, where all the main aboriginal groups of Canada are represented. The main function of this Working Group is to define the strategic priorities of the portal's future development.

Another example of how the Internet can facilitate indigenous peoples' access to the political arena and can raise awareness about indigenous peoples' issues at the national level is the Mirror Art Group from Thailand. Since 1991, this small NGO composed of young professionals committed to social change has supported the Akbar hill tribe in the highlands of Thailand. The Group's Web site (<http://www.bannok.com>) has obtained on average 300,000 hits a month, making it one of the country's most popular Web sites. Through its Web site the organization has successfully promoted indigenous peoples' rights, and carried out many campaigns to support the Akbar people through the recruitment of volunteers and solicitation of financial resources and in-kind donations. Furthermore, the Akbar people have had some success in trading their arts and crafts through the site (Gigler, 2001).

These examples, however, illustrate in themselves a key challenge — that the large majority of information found on the Internet is produced by outsiders (i.e., international NGOs or academic institutions), rather than developed by indigenous organizations themselves. An evaluation of 200 Web sites from Latin America carried out by the author in 2002 demonstrates that approximately 75% of these sites are being produced and maintained by international volunteers, NGOs, and academic institutions, rather than by indigenous peoples themselves. An interesting case high-

lighting this issue represents the AymaraNet (<http://www.aymaranet.org>), which provides some of the most comprehensive coverage about the Andean Aymara culture on the Web. Although the site provides information in English, Spanish, and Aymara, it is significant that the site has been developed and maintained by an Aymara activist living and working in Washington, DC, instead of being locally developed and owned by indigenous leaders of the region.

At the community level, there seems to exist a discrepancy between the use of ICTs by community leaders and community members. Frequently, community leaders have started to use new ICTs by using cell phones and Internet services (mainly in the form of e-mail), particularly when they are traveling to the nearby urban centers. For instance in Peru currently exist approximately 1400 public telecenters exclusively in urban centers, which enable community leaders and certain more privileged indigenous subgroups (i.e., indigenous professionals) to access ICT services. At the same time, the large majority of indigenous peoples living in their communities remain completely excluded from the access to new ICTs.

Furthermore, local indigenous leaders play a key role in deciding whether or not communities should engage with the new forms of ICTs. In the Ecuadorian community of Sumbagua in the Cotopaxi province, for instance, a proactive local community leadership cooperated with Chasquinet (<http://www.chasquinet.org>) — a local NGO dedicated to promoting the use of new ICTs for social change and sustainable development by developing a telecenter in the community. The center directly supported the livelihoods of the local community, when community members were able to find a solution to an insect plague that was threatening the local potato harvest via the Internet. This came about after connecting themselves with indigenous communities that had faced similar problems in Bolivia, Brazil, and Peru. The community leaders were able to use the provided information in order to launch

an awareness campaign on how to combat the plague, and through a consolidated effort the community was able to control the plague (Gigler with Daly, 2003). On the other hand, in Mexico one of the main reasons for the failure of several community-based telecenter pilot projects located at the edge of Mexico City and in the State of Michoacán has been the opposition to the project encountered by local indigenous leaders, who felt that the introduction of new ICTs would undermine their position of power as the main holders of information (Robinson, 2000).

Based on this brief overview, it seems key to analyze the impact of ICTs on indigenous peoples in more detail through specific case studies. In the following section, the chapter will provide a more in-depth analysis of two cases studies, whereby ICTs have been introduced to indigenous peoples at the community level. The main reason for limiting the analysis to the community level is that it seems that ICTs have the potential to most directly impact the well-being of indigenous peoples at the community level. As the previous analysis has shown, many of the ICT programs at the international, regional, and national levels seem to reach only a relatively small number of indigenous leaders, as well as having rather indirect effects on the well-being of indigenous peoples. It is thus the aim of the following section to apply the previously-developed Alternative Evaluation Framework (AEF) to the analysis of the impact of ICTs on the well-being of indigenous peoples at the community level.

UNUMA: BILINGUAL AND INTERCULTURAL EDUCATION PROJECT FROM VENEZUELA

Since 2000, UNUMA — Sociedad Civil de Apoyo al Indígena (<http://www.unuma.org>) — a local NGO working for the promotion of indigenous peoples' development and rights in Venezuela, has focused on the innovative use of ICTs to support

a bilingual and intercultural education project of indigenous peoples.

The key objectives of the program are to strengthen the capacity of indigenous teachers from the Wayuu (Guajira peninsula), Kari'ña (El Tigre, Anzoategui), Uwo'tuja, Hiwi (Amazonas), and Pemón communities (Estado Bolívar) by providing training in linguistics; production of books in indigenous languages, mathematics, and psychology; and the use of ICTs (see Appendix 1). The role of the ICT capacity program was catalytic in nature and sought to reinforce the other training modules, rather than focusing exclusively on the field of ICTs themselves. Early findings demonstrate the high value of integrating an ICT intervention into a bilingual and intercultural education program. Most indigenous teachers had never used a computer before the training and were enthusiastic about the ICT program. During a field visit in December 2000, an indigenous leader showed the author his computer artworks — all of which were based on traditional Kari'ña cultural and spiritual motifs. He explained to me that this activity was also an important source of income, as he took his digital artworks (see Figure 1) and reproduced them on t-shirts and other prints, selling them in the local marketplace.

Based on the success of this pilot experience and the strong demand from indigenous peoples

to continue the program, UNUMA was able to finance a second phase of the program in 2002 through a \$50,000 grant from the Development Marketplace of the World Bank. As a first step, a series of consultation workshops with indigenous communities was organized, where it was decided that several computers needed to be purchased in order to expand the ICT program and provide the training to more indigenous teachers, in addition to organizing a series of capacity-building workshops at the community level. Due to the strong interest from many communities, the indigenous communities in all three regions developed a system of sharing the computers, whereby indigenous youth themselves were trained to maintain the equipment and organize the distribution of computers among the different communities. This model is based on collective identity and the strong organizational tradition of indigenous communities, drawing on their cultural value of reciprocity, which provided the basis for the sharing of computers among different communities.

Impact of the Project on the Well-Being of Indigenous Peoples

These first findings from the field clearly illustrate that ICTs can play an important role in strengthening the human and social capabilities of marginalized groups. It is, however, important to take a closer look at the program and to analyze the following questions:

1. What is the overall socio-political context in which the project is taking place?
2. What were some of the ingredients of this successful application of ICTs?
3. What role did the local NGO play in enhancing the individual and collective capabilities of indigenous peoples?
4. In what manner did the project build on and strengthen existing community structures?

Figure 1. Artwork: Graphic designed by an indigenous leader of the Pemón community



5. What are the effects of the project on the cultural identity of indigenous communities?
6. What are some of the key challenges the project is facing?

Firstly, the overall socio-political context of the program is characterized through a permanent struggle of the cultural survival of indigenous peoples in Venezuela. With a population numbering between 2 to 3% of the overall population, indigenous peoples represent a very small minority within the Venezuelan society. For instance, the Kari'ña live in the surroundings of El Tigre, a city that has been for the past 70 years a major area of oil exploration in Venezuela. As a consequence of the oil boom in this region, the cultural identity and social institutions of the Kari'ña communities have come under significant pressure. Many Kari'ña communities are today facing a situation of severe poverty, struggling to make their ends to meet and attempting to preserve their cultural identity.

In spite of this challenging socio-economic and political context, the project is demonstrating that the meaningful use of ICTs by indigenous peoples can significantly enhance their human and social capabilities. One of the key success factors of the project is the fact that the ICT project was fully integrated into the bilingual and intercultural education program. The main role of the ICT program is to enhance the other program components such as increasing literacy capacity, rather than to support the capacity-building of indigenous peoples in the use of computers and the Internet on a stand-alone basis. It is important to highlight that the overall program responds to a key priority of indigenous communities — the strengthening of their cultural identity by recuperating their own languages and improving the quality of the existing bilingual education programs.

This case study illustrates how ICTs can form part of a holistic approach towards promoting

indigenous peoples' development, and they can act in a catalytic manner enhancing the human capabilities of indigenous peoples, thus ultimately contributing to improving their well-being. In the project, the instrumental value of ICTs are being well integrated into the more substantive aspects of the education program, thus contributing in a significant manner to its overall objectives. In this sense, the objectives of the ICT capacity-building activities are to enhance indigenous peoples' informational capabilities not for their own sake, but in order to enhance their skills and further their human capabilities in the cultural, social, and economic spheres of their lives.

A very positive aspect of the ICT program is the enthusiasm the project has created for the overall program, particularly among indigenous youth (see Figure 2). For instance, several youth were able to find employment as a result of their newly acquired computer skills. Furthermore, for the first time, six students from the Kari'ña community have been accepted to pursue a career in computer science in several universities in Caracas. A more intangible effect of the program

Figure 2. Training workshop with indigenous youth in a Kari'ña community of Venezuela (photo by Haydée Seijas, Executive Secretary, UNUMA)



was that the increase in self-esteem of most of the indigenous youth who participated in the training workshops. An important ingredient of the program's success has been the key role that the local NGO has played in acting as a facilitator in promoting the process of individual and collective empowerment of indigenous peoples. It is important that UNUMA has continuously been working with the same indigenous communities since 1992 and thus has gradually gained the respect and trust of many indigenous peoples. Furthermore, the executive director of the NGO has been a longtime ally of indigenous peoples in their struggle to maintain their cultural identity and affirmation of their rights.

Finally, an important aspect of the program has been the emphasis on building all project activities on the existing traditional social structures. Hereby, indigenous leaders have played a key role in facilitating an open participatory approach that includes all community members, including the most marginalized groups (e.g., women and youth). A key aspect of this process encompassed a detailed needs assessment carried out in 2000 with indigenous teachers in order to better understand their attitudes, needs, and perceptions towards the role of information and ICT for development.

In spite of the overall positive outcomes of the program, several important challenges remain. Firstly, due to the overall difficult political situation in Venezuela, the execution of the program was seriously delayed. Furthermore, the indigenous organizations, particularly among the Uwojtuja, Hiwi, and Kari'ña communities, remain relatively weak, and thus the entire financing as well as a large portion of the program management responsibilities remain with UNUMA. Finally, the program very much relies on the personal commitment of the executive director of UNUMA, and it was not yet possible to transfer its management to the indigenous communities themselves.

INTERNET ACCESS IN THE PERUVIAN AMAZON

The following case study illustrates the significant challenges involved in promoting the use of ICT for indigenous peoples' development. In the year 2000, the Ashaninka community Marakiri Bajo (see Figure 3), with the support of IDRC Canada and the Red Científica Peruana, initiated the first telecenter project located in a remote indigenous community in the Peruvian Amazon.

The Ashaninka represent the largest indigenous group of the central Peruvian Amazon region. They live in severe poverty, while their cultural identity and subsistence economy are under severe pressure due the exploitation of natural resources and invasion of indigenous lands since the early 1900s (Garcia Hierro, Hvalkof, & Gray, 1998). Moreover, their access to such basic social services remains very limited. Within this overall political and socio-economic context, many indigenous peoples had very high expectations about the potential benefits of the project, while others remained skeptical about the usefulness of ICTs from the beginning. This early enthusiasm about ICTs is best reflected in the words of Mino Eusebio

Figure 3. Ashaninka leaders of Mari Kiri Bajo using the Internet



Castro, the Asháninka leader, who spearheaded the project from inception. In an interview with the author in early 2001, he emphasized that “through the help of the Internet[,] indigenous peoples have the opportunity to overcome their exclusion and to have improved access to education, markets, and political participation. The Internet also enables us for the first time to directly contact international donors, to present our opinions in policy debates, and to directly negotiate funding proposals without any intermediaries.”

In the first phase, the project focused on finding a technical solution to provide telephone and Internet connectivity to the remote village of Marakiri Bajo, a community without access to electricity and running water. Furthermore, since it was one of the key objectives of the program to provide distance education to indigenous youth, the program installed in the community a state-of-the-art videoconference facility (via a generator-operated satellite system).

What was the impact of such a high-level investment in technology at the community-level? How did the community react to the newly introduced telecenter? What were the reactions of the Ashaninka in the surrounding communities? Was it possible to maintain the interest of the community into the project? Were people really empowered and did they derive real value out of its use?

At first, it seemed that the project was quite successful. Many indigenous peoples—in particular, indigenous youth and women—started to explore the new technologies. Based on this demand, the project initiated a capacity-building program for indigenous peoples in the use of ICTs. As a result of the training, in particular indigenous youth quickly learned how to use the technology and started to make contact with the Ashaninka living in Brazil and other indigenous groups throughout Latin America. Based on the new skills, several community members developed a Web site for the community and began using the videoconferencing facility. At this stage of the project in late

2000, the international audience started to become interested in the project, and Mino Eusebio Castro, one of the community’s indigenous leaders and champion of the project, was invited to several international conferences to present the case as a best practice on how the Internet can ‘empower’ indigenous peoples by providing them with an instrument for the reaffirmation of their cultural identity and to contribute to their economic and social self-development.

At the same time, however, the project ran relatively quickly into serious difficulties. Firstly, right from its inception only a relatively few number of people actually used the telecenter and the entire project was controlled by a small group of indigenous leaders. As a consequence many indigenous peoples from within and in the surrounding communities felt excluded and began to envy the ones who were able to use and manage the center. Thus the project aggravated existing social tensions between the different groups within the community. Due to the long assimilation process within the project area, about half of the population in Marakiri Bajo identifies themselves as Ashaninka, with the other half as mestizos who have settled in the community relatively recently. The telecenter was controlled by the Ashaninka and was not open for the general public, excluding the non-indigenous population from its potential benefits.

In addition, the telecenter did not meet the high expectations of many indigenous peoples about its potential benefits, in particular in economic and social terms. At first, many people hoped that the new technologies would enable them to better sell their products of fruits and artisans to the market in Lima. Unfortunately, this objective went unrealized due to the lack of an online market for such products within Peru, as well as the communities’ limited knowledge and experience with e-commerce.

Moreover, many people encountered problems in terms of being able to relate to the new media due to the lack of local content in their own

language. In particular, many women became relatively quickly disinterested in the technology, as they felt that the center did not provide them with any concrete information or services they could use in their daily lives. The only group that continued to use the center was indigenous youth. Finally, the videoconference equipment was entirely underused due to a lack of both the supply of educational programs and a very low demand for this service from the community.

On the night of August 29, 2001, these difficulties culminated, when the telecenter burned down and was almost entirely destroyed. It remains unclear to this date who was responsible for this incident or what the motives might have been for the destruction of the center. After this incidence, several community members decided to rehabilitate parts of the center and restarted the program the following year, giving it clearer objectives and grounding it in a much more realistic approach. After a 6-month period of reflection and internal discussion, the community relaunched the ICT program through the opening of a local radio station. The Ashaninka radio station is now producing and broadcasting local programs about agriculture, education, health, and cultural topics in the Ashaninka language to about 10,000 people in the project area. The Internet continues to be used, but through existing telecenters in Satipo, the closest intermediary city.

This case study raises a series of research questions: What are some of the key lessons learned from this example? What are some of the key factors that led to the difficulties of the program? How could some of the problems have been avoided?

The first important factor that contributed to the difficulties of the project is the overall complex political and socio-economic context of the project area. As a result of almost 100 years of continuous colonization of the Ashaninka territory, many communities such as Marikiry Bajo have been divided and have suffered under tremendous pressure to maintain their cultural

identity. In addition to invasion of their lands, many indigenous peoples became the victims of violence during the confrontations between the Shining Path and government troops in the 1980s. This violence had severe consequences for them, and in spite of the end to the widespread violence, several guerrilla groups remain sporadically active in close proximity to the project area (see Appendix 2).

Secondly, the project entirely bypassed the existing organizational structures of the indigenous peoples of the Amazon region in Peru. In order to represent the interests and to fight for indigenous rights within the political system of Peru, the indigenous peoples have formed AIDSESEP, a national indigenous organization representing the large majority of the indigenous peoples of the Peruvian Amazon. AIDSESEP as a membership organization has six regional offices, one of which is located in Satipo and represents the interests of the Ashaninka people of the central Amazon. By executing the project directly at the community level, without any coordination with the traditional organizational structure of the indigenous in Peru, the project created tensions between the different indigenous communities and alienated many Ashaninka leaders within AIDSESEP.

Thirdly, the project's design overemphasized the role of technology and did not carry out the necessary groundwork for the ICT investment. It seems that the consultative process at the planning phase was much too scattered and did not provide sufficient space for discussion and dissent within the community. The process did not include from the outset the non-indigenous population, which contributed to the raising of tensions within the community. Furthermore, the technological solutions, in particular the videoconferencing facility, were not based on real needs from the communities and thus remained underused.

Finally, the local community was not supported by any local intermediary organization; instead the project was being monitored by the

Colombian foundation, Fundación Multicolor. In this way, the investment on the infrastructure was not adequately complemented by key preparatory steps identified earlier such as the carrying out of an information needs assessment, building of local content, or extensive capacity-building workshops in the use and maintenance of the technology.

KEY CHALLENGES IN THE USE OF ICTS FOR INDIGENOUS PEOPLES' DEVELOPMENT

While the case studies mentioned have demonstrated that new ICTs have the potential to improve the well-being of indigenous peoples, there continue to exist tremendous challenges for indigenous peoples to make meaningful use of ICTs. The following section will highlight several key challenges.

Ownership and Trust

One of the most important issues for indigenous peoples is how they can control the process of the introduction and use of ICTs in their communities. Many indigenous peoples have expressed their concerns that this process is being driven by outsiders and emphasize that there exists a threat that these new technologies can lead to new dependencies for indigenous peoples. In order to avoid such new dependencies, it is particularly important that indigenous peoples are appropriating these technologies in order to be able to adapt ICTs to their own cultural and social context. It seems that the potential benefits of ICTs for indigenous communities can only be fully recognized, if indigenous peoples themselves acquire the necessary technical skills and know-how in managing and “owning” the technology (Gigler, 2001, p. 36). As shown earlier in the case studies, intermediary organizations that enjoy the trust of local communities play an essential role within

this process by providing long-term technical assistance to indigenous communities.

Generation of Local and Relevant Content

Indigenous communities are rich in traditional and indigenous knowledge. At the same time, however, the traditional indigenous information systems are based on an oral tradition, and there are not many experiences through which indigenous communities were able to produce their own local content and to disseminate it through the Internet. As the previous analysis has shown, the large majority of information found on the Internet is being produced by outsiders to the communities, instead of being developed by indigenous peoples themselves. The experiences described in the case studies have demonstrated that the capacity building of indigenous peoples not only in the use of the Internet, but also in the development of their own content, is crucial to allow indigenous peoples to derive more meaningful benefits out of the use of new ICTs. The production and sharing of content is particularly important to enable indigenous communities to share information and lessons learned with each other, and learn from each other's experiences.

Intellectual Property Rights and Indigenous Knowledge

Another important challenge for indigenous peoples is the issue of how they can control and manage their intellectual property rights and protect their indigenous knowledge. Many indigenous leaders have expressed their suspicion about the use of information about their communities by outsiders. They emphasize that the introduction of ICTs has to be based on the recognition of indigenous peoples' basis rights (i.e., self-determination, land rights, etc.), as ICTs cannot be seen in isolation from the overall context in

which indigenous peoples live. Consequently, a key demand of indigenous peoples is to establish clear international and national frameworks for the protection of their intellectual property rights, in order to avoid that the introduction of ICTs threatens their cultural heritage and indigenous knowledge (WSIS Global Forum of Indigenous Peoples and the Information Society, 2003). As the example of the telecenter project from Mexico has demonstrated, frequently ICT projects underestimate the importance of taking the cultural and political context of indigenous communities (i.e., the need to adequately protect indigenous knowledge) into account and subsequently face serious problems in their implementation (Robinson, 2000).

Literacy and Capacity Building

A large number of indigenous peoples speak and write their own indigenous language. In particular, indigenous women have frequently very limited access to formal education and thus are monolingual. Consequently, they have great difficulties interacting with the world outside their own communities. Low literacy levels represent a major challenge in increasing the use of ICTs in indigenous communities around the world. The high correlation between being indigenous and poor is based to a large extent on the lack of equal access to education (Pscharapoulos & Patrinos, 1994). As the case studies have demonstrated, it is crucial that indigenous peoples gradually build up capacities to use and manage modern technologies, so that they can determine by themselves how to make use of ICTs for their own development. The objectives of ICT capacity-building activities hereby should not only be limited to train indigenous peoples in the practical use of ICT applications (i.e., use of e-mail), but also to enhance their ‘informational capabilities’ (i.e., capacity to analyze and evaluate information). In spite of the efforts to strengthen the capacity

of indigenous peoples to use new ICTs, language barriers remain a major challenge when making use of the new technologies. It is estimated that approximately 75% of the content on the Internet is in English, and there exists almost no content in indigenous languages. Consequently the benefits of using the Internet are relatively limited to many indigenous peoples (Kenny, 2003). A very innovative solution addressing this issue represents the multilingual translation system, Atamiri (<http://www.atamiri.cc>), developed by Iván Guzmán de Rojas, a Bolivian scientist. This computer translation system is made up of a set of natural language processing programs based on a set of mathematical algorithms and is capable of automatically translating text from six languages into the Andean language of Aymara and vice versa.

Existing Economic and Social Inequalities

It needs to be stressed that the impact of ICTs has to be seen within a much broader context of existing economic, social, and political inequalities that are key barriers to indigenous peoples’ development. It needs to be fully acknowledged that these structural constraints frequently limit the impact ICTs can have on the well-being of marginalized groups. For instance, the extent to which subsistence farmers can benefit from information provided by the Internet will vary according to other factors such as land rights, proximity to market, available means of transportation, and the overall existing degree to which large-scale producers are dominating agricultural markets. Improved access to market prices represents an important but not sufficient condition to address existing market failures (Curtain, 2004). Thus important challenges remain to make use of ICTs for social change. It seems that the introduction of ICTs can only incrementally improve the well-being of marginalized communities, and needs to

be accompanied with complementary programs addressing existing structural inequalities. For instance, in the case of subsistence farmers, they could form a cooperative in order to join forces and to enhance their overall negotiating power position within the marketplace.

Information Flows Between Different Levels of Indigenous Leadership

A key challenge for the effectiveness of ICTs is the lack of information flows between the different levels of indigenous leadership. This issue addresses the underlying power relationships within the indigenous movements. It seems that a very small number of international indigenous leaders have privileged access to information and do not share this information with national leaders or with the grassroots. While ICTs have contributed to the enhanced access of indigenous peoples to the political arena at the international level and have supported the establishment of strong international networks, it seems that these new technologies have not contributed to the same extent to the democratization and enhanced transparency of the indigenous movement. For instance, the participants of the U.N. Working Group on Indigenous Populations and the U.N. Permanent Forum on Indigenous Issues seemed to be very well connected with each other, while the large majority of national and local indigenous leaders are not aware of the advancements achieved at these global fora. Within countries, there frequently exists a conflict of interest and a certain degree of factionalism between different leaders which impede the free exchange and sharing of information. At the same time, the example of the Fondo Indígena has demonstrated that ICTs have the potential to improve the transparency of indigenous organizations and significantly enhance the information flows between the different levels of indigenous leadership⁷. It needs however to be stressed that ICTs solely remain an instrument, and the main challenge remains

to find the political will of indigenous leaders and organizations to promote the open and free exchange of information.

CONCLUSION

The previous analysis has shown that ICTs under certain conditions can significantly enhance the human and social capabilities of marginalized groups. At the core of the process of introducing ICTs into marginalized communities stands the notion that ICTs can enhance people's control over their own lives. Similarly to literacy, newly acquired informational capabilities can act as an agent for change for individuals and communities — enhancing their abilities to engage with the formal institutions in the economic, political, social, and cultural spheres of their life.

In this context, the issue of whether ICTs are channeling resources away from the real priorities and needs of poor communities seems to be misguided. Instead this question should be rephrased and address the issue of how ICTs could be used to meet the basic needs of the poor.

Furthermore, the chapter has illustrated that there is no direct and causal relationship between ICT and poverty reduction. This relationship is much more complex and indirect in nature, whereby the issue of its impact on the livelihoods of the poor depends to a large extent on the dynamic and iterative process between people and technology within a specific local, cultural, and socio-political context. Frequently, the most immediate and direct effect of ICT programs seems to be the psychological empowerment of poor people, whereby newly acquired ICT skills provide the marginalized with a sense of achievement and pride, thus increasing their self-esteem.

A key recommendation of the chapter is that the human development of people, rather than technology itself, should be the center of the design and evaluation of ICT programs. As has been shown, the important advantage of using the capability

approach as the basis for the evaluation of ICT programs is its emphasis on the ability of ICTs to improve the daily livelihoods of poor communities, in contrast to more conventional approaches that overemphasize the significance of technology itself for social change. Furthermore, evaluations of the impact of ICT programs should focus on an analysis from the vantage point of the poor, rather than from the perspective of outside donors.

In addition the analysis provides the following concrete recommendations on the manner in which ICT programs should be designed in order to be most effective to enhance the well-being of marginalized groups:

- First, the potential benefits of ICTs are largest when they are being fully integrated into other sectoral development programs (i.e., in education or health). As the case study from Venezuela on the use of ICTs in bilingual education has demonstrated, ICTs can make a significant contribution towards reaching the core objectives of this development project — in this case improving the access to bilingual education to indigenous peoples.
- Second, it is essential that ICT programs prior to initiating any project activities carry out a detailed assessment of existing information flows and information needs. Hereby, the analysis should focus on how the new technologies can strengthen existing communication and information exchanges within and in between communities. The assessment should furthermore identify key information intermediaries in the community and analyze existing power relationships as they relate to the transfer of knowledge within the communities. Thus it is essential that poor communities first identify and define their own needs and development priorities before, in a second step, a project can define whether and how ICTs can support the community's development goals. As has been shown in the Ashaninka case, in cases where such a process was not undertaken and the exact objectives of the ICT project were not defined, ICT programs frequently fail.
- Third, it is crucial for the evaluation of the impact of ICTs on the well-being of marginalized communities to analyze the process of how ICTs are being introduced. Hereby, outside agents or intermediaries are playing a key role in supporting communities in appropriating the technologies to meet their own local and cultural needs. Within this process, it is essential that community members gradually gain the skills to make meaningful use of ICTs as well as gradually take ownership of the management of the program. As the case studies have demonstrated, capacity-building activities and the provision of local content through intermediaries are the two important factors that influence whether or not an ICT program will indeed strengthen the capabilities of the poor and thus contribute towards improving their livelihoods.
- Fourth, ICT programs are most effective when combining traditional media with new forms of ICTs. As the case study of the Ashanika community has demonstrated, the convergence between two different technologies — the Internet and community radio stations — is combining the advantages of both media. While the Internet is a powerful tool to connect networks and to exchange large amounts of information across long distance, community radios have a very broad reach, and represent the most accessible and inclusive technology for the poor. Due to the oral tradition of indigenous communities, this is of particular importance, considering that its use does not require literacy.

Finally, the chapter has demonstrated that the most important factors influencing whether an

ICT program has positive or negative outcomes are social, political, and cultural in nature, and in fact technical issues involved in the provision of ICTs frequently do not play a key role. The analysis highlights that frequently, ICT programs are not responding to a concrete need expressed within the communities, but are designed in a top-down supply-driven approach. In order to avoid the potential negative social effects, it is crucial to frame any ICT intervention around the existing social community structures. Thereby, the programs should strengthen traditional information systems, building on existing indigenous knowledge and enhancing existing information channels without undermining the existing structures.

REFERENCES

- Agrawal, A. (1995). Dismantling and divide between indigenous and scientific knowledge. *Development and Change*, 26.
- Alkire, S. (2002). *Valuing Freedoms: Sen's Capability Approach and Poverty Reduction*. Oxford: Oxford University Press.
- Arunachalam, S. (2002). *Reaching the unreached: An Indian experience in empowering people through information access*. Vidura: MS Swaminathan Research Foundation, Press Institute of India
- Avgerou, C. (2001). The significance of context in information systems and organizational change. *Information Systems Journal*, 11, 43-63.
- Avgerou. (2002). *Information systems and global diversity*. Oxford: Oxford University Press.
- Avgerou, C., & Madon, S. (2003). *Framing IS studies* (Working Paper Series). Department of Information Systems, London School of Economics.
- Ballantyn, P. (2002, June). Collecting and propagating local development content. *INASP Newsletter*, (20).
- Bebbington, A. J. (1999). Capitals and capabilities: A framework for analyzing peasant viability, rural livelihoods and poverty in the Andes. *World Development*, 27(12), 2021-2044.
- Black, J. (1999). *Information rich — information poor, bridging the digital divide*. International Institute for Communication and Development, Den Haag.
- Braga, C. P. (1998). *Inclusion or exclusion. Information for Development (InfoDev), the World Bank*. Retrieved from http://www.unesco.org/courier/1998_12/uk/dossier/txt21.htm
- Brokensha, D., Warren, D., & Werner, O. (Eds.). (1980). *Indigenous knowledge systems and development*. Lanham, MD: University Press of America.
- Brown, D. (1991). Methodological considerations in the evaluation of social development programs: An alternative approach. *Community Development Journal*, 26, 4.
- Castells, M. (1997). *The Information Age: Economy, society and culture. Volume 2: The power of identity*. Oxford: Blackwell.
- Castells, M. (1998, June). Information technology, globalisation and social development. In *Proceedings of the UNRISD Conference on Information Technologies and Social Development*. Geneva.
- Castells, M. (2001). *The Internet galaxy*. Oxford: Oxford University Press.
- Cernea, M. (Ed.). (1991). *Putting people first: Sociological variables in rural development* (2nd ed.). Oxford: Oxford University Press.
- Chambers, R. (1983). *Rural development: Putting the last first*. Harlow, UK: Pearson Education Limited.

- Chambers, R. (1997a). *Whose reality counts: Putting the last first*. London: Intermediate Technology Publications.
- Chambers, R. (1997b). Editorial: Responsible well-being: A personal agenda for development. *World Development*, 25(11), 1743-1754.
- Chambers, R., Pacey, R., & Thrupp, L. (Eds.). (1989). *Farmer first: Farmer innovation and agricultural research*. London. Intermediate Technology Publication.
- Chambers, R., & Conway, G. (1992). *Sustainable rural livelihoods: Practical concepts for the 21st century* (IDS Discussion Paper 296). Brighton: IDS.
- Comim, F. (2001, June 5-7). Operationalizing Sen's capabilities approach. In *Conference Proceedings—Justice and Poverty: Examining Sen's Capability Approach*. Von Hugel Institute, St. Edmund's College, UK.
- Corbridge, S. (2001). Development as freedom: The spaces of Amartya Sen. *Progress in Development Studies*, 2, 183-217.
- Curtain, R. (2004). *Information and communications technologies and development: Help or hindrance?* Australian Agency for International Development (AusAID), Melbourne.
- Daly, J. (1999, May 21). Measuring impacts of the Internet in the developing world. *iMP Magazine*.
- Davis, S. (2002). Indigenous peoples, poverty and participatory development: The experience of the World Bank in Latin America. In R. Sieder (Ed.), *Multiculturalism in Latin America*. London: Palgrave Macmillan.
- Delgadillo, K., Gomez, R., & Stoll, K. (2002). *Community telecentres for development: Lessons from community telecentres in Latin America and the Caribbean*. Ottawa, Canada: IDRC.
- Eade, D. (2003). *Capacity-building: An approach to people-centred development*. Oxford: Oxfam.
- Garcia Hierro, P, Hvalkof, S., & Gray, A. (1998). *Liberation through land rights in the Peruvian Amazon* (IWGIA Document No. 90).
- Garnham, N. (2000). Amartya Sen's "capabilities" approach to the evaluation of welfare: Its application to communications. In B. Cammaerts & J.-C. Burgelman (Eds.), *Beyond competition: Broadening the scope of telecommunication policy* (pp. 25-36). Brussels: VUB Press.
- Gasper, D. (1997). Sen's capability approach and Nussbaum's capability ethics. *Journal of International Development*, 9, 281-302.
- Gasper, D. (2002). *Is Sen's capability approach an adequate basis for considering human development?* (Working Paper Series No. 360). The Hague: Institute of Social Studies.
- Gigler, B. S. (2001, July/August). *Empowerment through the Internet: Opportunities and challenges for indigenous peoples*. Technology for social action. Vienna: TechKnowLogia.
- Gigler, B. S. with Daly, J. (2003, July 21). *ICT for indigenous development*. Development Gateway Special. Retrieved from <http://www.developmentgateway.org/node/133831/sdm/docview?docid=627584>
- Gigler, B. S. with Simmons, L. (2002, February 28). Giving voices to indigenous peoples. *Global Development Learning Network Newsletter*. Retrieved from <http://lnweb18.worldbank.org/External/lac/lac.nsf/GDLN/B15E0B2985256B6E007D2433?OpenDocument>
- Gomez, R., Hunt, P., & Lamoureux, E. (1999). Enchanted by telecenters: A critical look at universal access to information technologies for international development. In *Proceedings of the New IT and Inequality*. University of Maryland, USA.

- Gurstein, M. (2000). *Community informatics: Enabling communities with information and communications technologies*. Hershey, PA: Idea Group Publishing.
- Gurstein, M. (2003). Effective use: A community informatics strategy beyond the digital divide. *First Monday*, 8(12).
- Hamelink, C. J. (1994). *Trends in world communication, on disempowerment and self-empowerment*. Penang, Malaysia: Southbound, Third World Network.
- Hamelink, C. J. (2002). Social development, information and knowledge: Whatever happened to communication? *Development*, 45(4).
- Harris, R. W., Bala, P., Songan, P., & Khoo E. (2001). Challenges and opportunities in introducing information and communication technologies to the Kelabit community of North Central Borneo. *New Media and Society*, 3(3).
- Healy, K. (2001). *Llamas, weavings, and organic chocolate: Multicultural grassroots development in the Andes and Amazon of Bolivia*. Notre Dame, IN: Notre Dame University Press.
- Heeks, R. (1999). *Information and communication technologies, poverty and development* (Development Informatics Working Paper Series No. 5). IDPM: University of Manchester, UK.
- Heeks, R. (2002). I-development not e-development: Special issue on ICTs and development. *Journal of International Development*, 14(1), 1-11.
- Heeks, R., & Kenny, C. (2002). ICTs and development: Convergence or divergence for developing countries? In *Proceedings of the 7th International Working Conference of IFIP WG9.4*. Bangalore, India.
- Hewitt de Alcántara, C. (2001). *The development divide in a digital age* (Technology, Business and Society Programme Issue Paper No. 4). Geneva: UNRISD.
- Hudson, H. (1995). *Economic and social benefits of rural telecommunications: A report to the World Bank*. Retrieved from <http://www.usfca.edu/facstaff/hudson/papers/Benefits%20of%20Rural%20Communication.pdf>
- IDS Bulletin. (1994). Knowledge is power? The use and abuse of information in development. University of Sussex. *Institute of Development Studies Bulletin*, 25(2).
- ITDG. (2001). *Enable people to make technologies work for them*. ITDG's response to the Human Development Report 2001. Retrieved from http://www.itdg.org/html/advocacy/docs/itdg_response_to_hdr_june2.pdf
- IWGIA. (2003). *Indigenous peoples and information technology in indigenous affairs* (No. 2/2003). Copenhagen, Denmark: IWGIA.
- Kabeer, N. (1999). Resources, agency, achievement: Reflections on the measurement of women's empowerment. *Development and Change*, 30(3), 261-302.
- Kenny, C. (2003, January-February). *Development's false divide: Giving Internet access to the world's poorest will cost a lot and accomplish little*. *Foreign Policy* 76-77.
- Kling, R. (2000). Learning about information technologies and social change: The contribution of social informatics. *The Information Society*, 16(3).
- Korten, D. C., & Klauss, R. (Eds.). (1984). *People-centered development; contributions toward theory and planning framework*. Bloomfield, CA: Kumarian Press.
- Long, N., & Villareal, M. (1994). The interweaving of knowledge and power in development interfaces. In I. Scoones & J. Thompson (Eds.),

Beyond farmer first: Rural people's knowledge, agricultural research and extension practice. London: Intermediate Technology Publications.

Madon, S. (1992). The impact of computer-based information systems on rural development: A case study in India. *Journal of Information Technology*, 7, 20-29.

Madon, S. (2000). The Internet and socio-economic development: Exploring the interaction. *Information Technology and People*, 13.

Madon, S. (2003). *Evaluating the developmental impact of e-governance initiatives: An exploratory framework* (Department of Information Systems Working Paper Series No. 124). London School of Economics.

Mansell, R., & When, U. (1998). *Knowledge societies: Information technology for sustainable development.* Oxford: Oxford University Press.

Mansell, R. (1999). Information and communication technologies for development: Assessing the potential and the risks. *Telecommunications Policy*, 23, 35-50.

Mansell, R. (2004). Political economy, power and new media. *New Media & Society*, 6(1), 74-83.

Martínez-Cobo, J. (1986). *Study of the problem of discrimination against indigenous populations* (E/CN.4/Sub.2/1986/7). U.N. Subcommission on Prevention of Discrimination and Protection of Minorities, Geneva.

Max-Neff, M. (1991). *Human scale development conception, application and further reflections.* New York/London: Apex Press.

McConnell, P. (Ed.). (1995, July 10-12). Making a difference: Measuring the impact of information on development. In *Proceedings of Workshop*, Ottawa, Canada. Rome, Italy: FAO.

McConnell, P. (2000). Connecting with the unconnected: Proposing an evaluation of the impacts of

the Internet. In D. Richardson & L. Paisley (Eds.), *The first mile of connectivity: Advancing telecommunications for rural development through a participatory communication approach.* FAO.

Menou, M. (1993). *Measuring the impact of information on development.* Ottawa: International Development Research Centre.

Menou, M. (1999, July). Impact of the Internet: Some conceptual and methodological issues, or how to hit a moving target behind the smoke screen. In D. Nicholas & I. Rowlands (Eds.), *The Internet: Its Impact and Evaluation: Proceedings of the International Forum.* London.

Menou, M. (2002). *Information literacy in national information and communications technology (ICT) policies: The missed dimension, information culture* (White Paper prepared for UNESCO, Information Literacy Meeting of Experts). Prague, The Czech Republic.

Miller, D., & Slater, D. (2000). *The Internet, an ethnographic approach.* Oxford: Berg.

Meyer, C. (1997). The political economy of NGOs and information sharing. *World Development*, 25, 7.

Nelson, D. (1996). Maya hackers and the cyberspatialized nation state: Modernity, ethnostalgia, and a lizard queen in Guatemala. *Cultural Anthropology*, 11(3), 287-308.

Norris, P. (2001). *Digital divide: Civic engagement, information poverty and the Internet worldwide.* Boston: Harvard University John F. Kennedy School of Government.

Nussbaum, M. (2000). *Women and human development: The capabilities approach.* Cambridge: Cambridge University Press.

O'Farrell, C. (2001). *Information flows in rural and urban communities: Access, processes and people.* Reading, UK: The University of Reading.

- O'Farrell, C., Norrish, P., & Scott, A. (1999). *Information and communication technologies (ICTs) for sustainable livelihoods: Preliminary study*. London: ITDG, AERDD.
- Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science*, 3(3), 398-429.
- Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organizational Science*, 11(4), 404-428.
- Panos. (1998). *The Internet and poverty* (Panos Media Briefing No. 28). London: Panos Institute.
- Partridge, W., & Uquillas, J. with Johns, K. (1998). Including the excluded: Ethnodevelopment in Latin America description. In *Poverty and Inequality: Proceedings of the Annual World Bank Conference on Development in Latin America and the Caribbean* (pp. 229-250). Washington, DC: World Bank.
- Powell, M. (1999). *Information management for development organizations*. Oxford: Oxfam.
- Psacharopoulos, G., & Patrinos, H. (1994). *Indigenous peoples and poverty in Latin America: An empirical analysis*. Washington, DC: World Bank.
- Robinson, S. (2000, October 26-27). Telecenters in Mexico: Learning the hard way. In *Proceedings of the Partnerships and Participation in Telecommunications for Rural Development: Exploring What Works and Why Conference*. University of Guelph, Canada.
- Scoones, I. (1998). *Sustainable rural livelihoods: A framework for analysis* (IDS Working Paper 72). Brighton, UK: IDS.
- Scoones, I., & Thompson, J. (Eds.). (1994). *Beyond farmer first: Rural people's knowledge, agricultural research and extension practice*. London: Intermediate Technology Publications.
- Sen, A. (1985). Well-being, agency and freedom. The Dewey Lectures 1984. *Journal of Philosophy*, 82(4), 169-221.
- Sen, A. (1992). *Inequality reexamined*. Cambridge, MA: Harvard University Press.
- Sen, A. (1993). Capability and well-being. In M. Nussbaum & A. Sen (Eds.), *The quality of life* (pp. 30-53). Oxford: Clarendon Press.
- Sen, A. (1997). Editorial: Human capital and human capability. *World Development*, 25, 1959-1961.
- Sen, A. (1999). *Development as freedom*. New York: Knopf Press.
- Skuse, A. (2000). *Information communications technology, poverty and empowerment*. Retrieved November 20, 2004, from <http://www.imfundo.org/knowledge/skuse.htm>
- Slater, D. (2002). Social relationships and identity on/off-line. In L. Lievrouw & S. Livingstone (Eds.), *Handbook of new media: Social shaping and consequences of ICTs*. London: Sage Publications.
- Stewart, F., & Deneulin, S. (2002). Amartya Sen's contribution to development thinking. *Studies in Comparative International Development*, 37(2), 61-70.
- UNDP. (2001). *Human Development Report 2001: Making new technologies work for human development*. Oxford: UNDP.
- Wade, R. (2002). Bridging the digital divide: New route to development or new form of dependency? *Global Governance*, 8(4).
- Walsham, G. (1993). The emergence of interpretivism in IS research. *Information Systems Research*, 6(4), 376-394.

Walsham, G. (1995). Interpretative case studies in IS research: Nature and method. *European Journal of Information Systems*, 4, 74-81.

Walsham, G. (2001). *Making a world of difference*. Chichester: John Wiley & Sons.

Wang, G., & Dissanayake, W. (Eds.). (1994). *Continuity and change in communication systems: A cross-cultural perspective*. East-West Communication Institute, Honolulu, Hawaii.

White, A. (2000). *Assessing community telecenters*. Ottawa, Canada: Acacia Initiative, IDRC.

Wilson, G., & Heeks, R. (2001). Technology, poverty and development. In T. Allen & A. Thomas (Eds.), *Poverty and development: Into the 21st century*. London: Open University & Oxford University Press.

Wilson, E., Daly, J., & Griffiths, J. -M. (1998). *Internet counts, measuring the impact of the Internet*. Washington, DC: Office of International Affairs, National Research Council.

World Bank. (1990). *World Development Report, 1990*. New York: Oxford University Press.

World Bank. (1995). *Harnessing information for development*. Washington, DC: World Bank Group, Vision and Strategy.

World Bank. (1999). *Knowledge for development* (World Development Report). New York: Oxford University Press.

World Bank. (2000). Global Information and Communication Technologies Department. *The Networking Revolution, Opportunities and Challenges for Developing Countries*.

WSIS Global Forum of Indigenous Peoples and the Information Society. (2003). *Summary narrative report of the discussions during the meeting*. Geneva: WSIS.

ENDNOTES

¹ No universal definition of indigenous peoples exists, and due to the history of political repression, and discrimination and assimilation policies by states, indigenous peoples usually reject being defined by external agencies. In order to be able to identify rather than define indigenous identities, I am suggesting to make use of the working definitions provided by the International Labor Organization (ILO) Convention 169 and by U.N. Special Rapporteur José Martínez Cobo, both of which emphasize that the self-identification as indigenous should be used as the main criteria for the identification of indigenous peoples.

² The research will use Sen's multi-dimensional approach of well-being developed in the capability approach (CA) (Sen, 1984, 1992, 1993). The approach moves away from an income-based perspective of well-being (utilitarianism) to account for the constitutive plurality of human life. It thus emphasizes the non-material aspects of human well-being (i.e., spiritual, cultural, political aspects). The CA characterizes well-being in terms of what a person is actually able to do or to be (achieved functionings) and the combinations of beings and doings that a person can achieve (capabilities).

³ For the purpose of this research, I will use Hamelink's definition of ICTs: "Information and communication technologies (ICTs) encompass all those technologies that enable the handling of information and facilitate different forms of communication among human actors, between human beings and electronic systems, and among electronic systems" (Hamelink, 1997, p. 3). This functional definition of ICTs includes both the new (i.e., Internet, e-mail) and traditional

(i.e., community-radio) forms of ICT into its definition.

⁴ The definition used for sustainable livelihood framework is one provided by Chambers and Conway (1992): “A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resources base” (pp. 7-8).

⁵ This classification was defined in an interview with Mateo Martinez, Technical Director, Fondo Indígena, on January 14, 2005.

⁶ The Development Gateway is a program of the Development Gateway Foundation (<http://www.dgfoundation.org>) that aims to bring together people, resources, and information on development and poverty reduction. This interactive portal further provides a space for communities to share experiences on development efforts.

⁷ In the case of the Fondo Indígena, the introduction of ICTs supported an institutional change within the organization towards increased transparency. The impetus for the use of ICTs came during the organization’s General Assembly held in 2000 in Mexico, in which the need to restructure the organization and to enhance its transparency was discussed by its international donors, as well as government and indigenous representatives.

TERMS AND DEFINITIONS

Capability: The chapter uses Sen’s definition of capability as developed in the “capability approach” (Sen, 1999). A person’s capability therefore refers “to the alternative combinations of functionings that are feasible for her to achieve.

Capability is thus a kind of freedom: the substantive freedom to achieve alternative functioning combinations (or, less formally put, the freedom to achieve various lifestyles)” (Sen, 1999, p. 75). Capabilities include things that a person actually has done, as well as things people can possibly do. In other words capabilities refer to the extent of one’s positive freedoms.

Indigenous peoples: No universal definition of indigenous peoples exists and due to the history of political repression, discrimination, and assimilation policies by states, indigenous peoples usually reject to be defined by external agencies. In order to be able to identify rather than define indigenous identities, I am suggesting to make use of the working definitions provided by the International Labor Organization (ILO) Convention 169 and by U.N. Special Rapporteur José Martínez Cobo, both of which emphasize that the self-identification as indigenous should be used as the main criteria for the identification of indigenous peoples.

Indigenous knowledge: There does not exist a single definition of indigenous knowledge; the literature however emphasizes the concept’s main characteristics as being: (1) rooted in a particular local community and situated within broader cultural traditions; (2) experimental, meaning that it is being tied to action and based on experiences from trial and error; (3) implicit or tacit, meaning that it is often difficult for people to express this knowledge unambiguously and to find words to express what one knows (Giddens 1984); (4) transmitted orally, or through imitation and demonstration; and (5) being a dynamic mix of past traditions and present innovations.

Information and communication technologies: In the Chapter I use Hamelink’s definition of ICTs: “Information and communication technologies (ICTs) encompass all those technologies that enable the handling of information and facilitate different forms of communication among human

actors, between human beings and electronic systems, and among electronic systems” (Hamelink, 1997, p. 3). This functional definition of ICTs includes both the new (i.e., Internet, e-mail) and traditional (i.e., community-radio) forms of ICT into its definition.

Informational capital: This concept is being defined through the following four components: (1) the extent to which the poor have access to information from the formal institutions of the market, state, and civil society; (2) the ability of the poor to process and evaluate information; (3) the extent to which the poor do not only consume, but produce and share information within their community and networks; and (4) the extent to which indigenous knowledge is used.

Sustainable livelihoods: The definition used for sustainable livelihood framework is one provided by Chambers and Conway (1992): “A liveli-

hood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resources base.”

Well-being: The chapter use Sen’s multi-dimensional approach of well-being developed in the capability approach (CA) (Sen, 1984, 1992, 1993). The approach moves away from an income-based perspective of well-being (utilitarianism) to account for the constitutive plurality of human life. It thus emphasizes the non-material aspects of human well-being (i.e., spiritual, cultural, political aspects). The CA characterizes well-being in terms of what a person is actually able to do or to be (achieved functionings), and the combinations of beings and doings that a person can achieve (capabilities).

APPENDIX 1

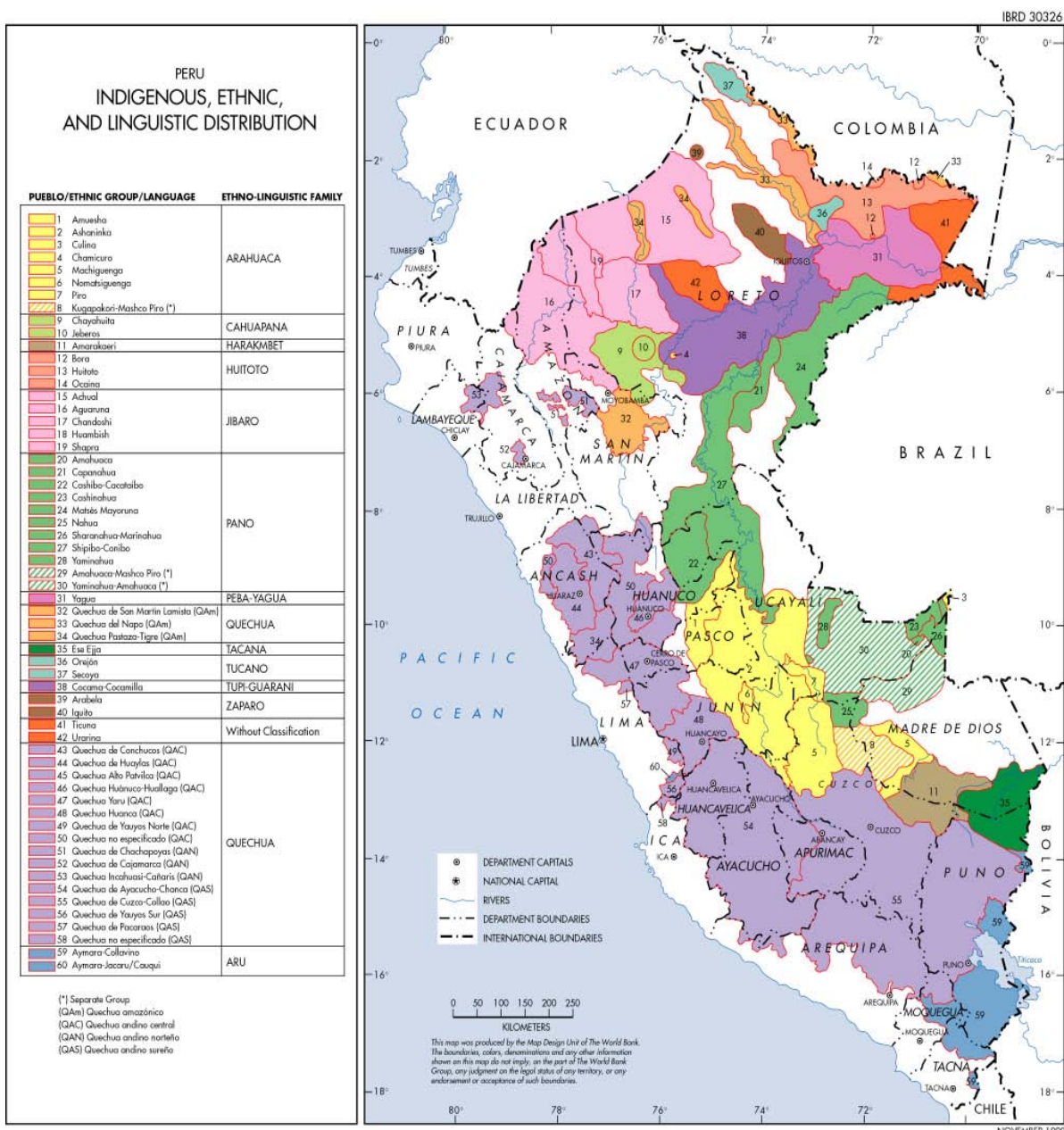
Map: Indigenous Peoples in Venezuela



Source: <http://a-venezuela.com>

APPENDIX 2

Map: Indigenous Peoples in Peru



Source: World Bank, 1999

This work was previously published in *Empowering Marginal Communities with Information Networking*, edited by H. Rahman, pp. 124-164, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.19

ICTs and Educational Benefits in Regional Development

James J. Rennie

Simon Fraser University, Canada

ABSTRACT

ICTs can play an important role in improving public education in rural regions. The effects of ICT use in schools can, in turn, bring unexpected economic benefits to the region. ICT developers interested in building economies can use education as a sustainable, grassroots building block for future growth. While many development programs tend to focus on private models for ICT dissemination in remote regions (such as telecenters), public education embodies a spirit of universal accessibility that can bring global technologies into the daily lives of all world citizens. When ICTs are recognized as pedagogical tools, they serve both the long-term economic and cultural needs of communities.

ICT IN A GLOBALIZED WORLD: EDUCATION AND ECONOMICS COLLIDE

Information and communication technologies (ICTs) have changed the way of thinking about the planet by transforming almost every field of human activity, from agriculture to entertainment, from government to education. While many rural regions of developing nations have yet to experience all of the benefits of a high-tech era, significant efforts are being made to bring ICT to all communities around the globe. However, building and maintaining the infrastructure of a networked world is no small undertaking, and many governments strain to justify the costs of bringing cutting-edge technologies to impoverished regions in the developing world. Furthermore, the technologies exported from developed

nations seldom come without considerable ideological baggage concerning their usefulness, as well as their social and environmental impacts. If many communities around the world continue to struggle with basic necessities, it can certainly be asked whether or not an aggressive strategy of ICT development is really a universal priority.

Nevertheless, ICT's potential to bring about radical growth and development is difficult to dismiss. In regions where many development agencies continue to focus on providing clean water and protecting fundamental human rights, other development groups are exploring ICT dissemination as a useful tool in those same projects. Although ICT growth is often at odds with established programs of development, many innovative projects attempt to balance these two, seemingly contradictory sets of demands. ICT infrastructure is an extraordinary expense for many developing governments, but short-term costs must be considered in relation to long-term advantages. Communication networks allow remote regions to interact with urban centers, democratizing trade and protecting against widespread health crises. Telecenters and computer kiosks provide rural communities with increased access to government records and forms, improving democratic transparency and aiding with legal disputes.

Furthermore, and most importantly for this chapter, information and communication technologies radically transform public education, allowing students and teachers to bridge the gap between local communities and global issues. ICT development can introduce young learners to an incredible realm of information and culture, while at the same time allowing students to express their own identities to the world. Technical literacy, supported with the critical skills needed to protect cultural awareness, can open unimaginable possibilities for students, bringing the realities of a global knowledge economy to any schoolroom on the planet.

Accordingly, the international community has long held education as a fundamental and

inalienable human right. Education helps to create citizens for the world in which they want to live, allowing individuals to develop their identities within a context of historical, cultural and ethical norms. As a result, education plays a pivotal role in development projects; as the Director-General of the United Nations Educational, Scientific and Cultural Organization (UNESCO), Koïchiro Matsuura, argues, "Education—in all its forms and at all levels—is not only an end in itself but is also one of the most powerful instruments we have for bringing about the changes required to achieve sustainable development" (UNESCO, 2004, p. 8). Education fosters development because it encourages learners to consider their own, local circumstances in a broader context. Furthermore, it promotes sustainable development by situating new perspectives within historical frameworks; whereas individual development projects may bring about positive changes for a community, long-term initiatives must rely on local knowledges in order to sustain the growth and benefits of development. As a central site for nurturing and teaching local knowledges, schools are invaluable resources for development projects.

The challenge for ICT development programs is to recognize both the pedagogical and economic potential of ICT-enhanced education. Too often, ICT infrastructure is built for a specific set of predetermined functions, ignoring broader community needs and desires. Most ICTs, however, are inherently adaptable; to limit their use is to limit the abilities and outcomes of the people who use them. It is precisely through innovation and ingenuity that ICT finds its most important economic function: that of harnessing human knowledge as a creative, productive force. As Avgerou and Rovere (2003) argue, it is difficult to assign concrete financial value to ICT development, as "The significance of ICT innovation cannot be adequately captured in concepts of economic value; ICT is implicated in social changes that are not driven by norms of economic rationality" (p. 5). In order to achieve long-term economic

success, it is in a government's best interests to allow ICT to develop on its own terms, relying on the individual and collective ingenuity of citizens to transform technological systems into productive industries.

At its best, ICT development can empower communities and individuals alike, allowing for unexpected applications and undiscovered abilities. At its worst, ICT development merely reinforces existing hierarchies of power, ignoring community and identity, subjugating all local knowledges to a singular, technical, expert knowledge. This chapter will attempt to show that when innovative technologies are introduced to communities through private industry, the potential for economic development is severely limited. However, if ICT developers place schools and students at the center of their communities, the resulting dissemination of technology will have an enormous benefit for everyone involved.

A PHILOSOPHY FOR EDUCATIONAL DEVELOPMENT INITIATIVES: ICT IN CONTEXT

Development projects often represent a fundamental conflict between local knowledge and perceived Western hegemony. Aid materials and social programs bring with them the underlying values, assumptions and beliefs of a distant culture, threatening the identities of individuals and communities alike. Programs of ICT development are further burdened with cultural and ideological baggage, as hardware and software are often designed and produced far from the site of dissemination. Development agencies must carefully consider these challenges before undertaking any project, particularly in a field as culturally specific as education. Whereas many economic activities in developing regions are directly tied to modern and colonial interference, education must continue to serve the values and purposes of local communities. These goals, however, need not

be incompatible with the economic development of regions and nations. As Uma Kambhampati (2004) observes, "the process of education is seen to encourage self-discipline, hard work, and an achievement orientation, characteristics pinpointed by modernization theorists as being necessary for the transition from tradition to modernity" (p. 228). The recovery of traditional cultural practices and identities can, therefore, take place inside increasingly modernized communities. Within this transformation, education represents the single most important site for the intersection of tradition and innovation in the developing world.

Tradition and innovation in teaching and learning methods, however, must be considered as only one part of education's role in community life. Thus, even though the challenges facing developing communities are often at odds with sound pedagogical practices, it is imperative that development organizations recognize the role that education can play in addressing broader social issues. UNESCO (2004) has recognized two fundamental characteristics of education and its role in sustainable development initiatives, the first being that "education is a fundamental human right that has its own intrinsic benefits for individuals" (p. 13). The second characteristic is less evident to many developers; as UNESCO argues:

... education is a tool for introducing the values, skills and competencies needed to address the challenges of today's world ... such as poverty, social and political conflicts, gender discrimination, violation of human rights, unsustainable patterns of consumption and production, environmental degradation and unsustainable use of natural resources, and the fight against HIV/AIDS and other infectious diseases, etc. (UNESCO, 2004, p. 13)

Despite the obscured visibility of education's second role, it is essential that developers keep

this role in mind when creating and operationalizing projects.

It is equally important, however, to treat each specific development project as a unique set of circumstances and obstacles. Educational practices and curricula may be standardized across entire regions, but cultural and geographic varieties are unavoidable, as certain pedagogical goals are relatively universal: each community and society hopes to teach their children how to survive in the world; cultures sustain themselves by passing on to children the languages, customs, traditions, and values most important to the group. Students are encouraged to develop a sense of their identity, both personal and collective, as part of their general lifelong education. In order to achieve these educational goals, communities build schools, train teachers, and select appropriate educational content; although development projects can assist in each of these areas, it is imperative that developers recognize the cultural politics that exist at all three stages. If content is developed for local schools by educators who are not part of that community, the result will be an inevitable loss of local culture; no matter how good the intentions of foreign, “expert” educators may be, the value of local knowledge cannot be replaced. The success or failure of ICT initiatives in the developing world will greatly depend on a collective recognition of education’s value in society, coupled with a global respect for local knowledge in all forms.

Although the increasingly global nature of development threatens community identities, it also reminds developers of the richness and vitality that are inherent to diversity. As individual citizens and organizations from developed countries carry out more and more projects, the impacts on remote communities are inseparable from the impacts on the developers themselves. External development groups working in the field of education may act as unwitting cultural crusaders in modern disguise, but they are also unacknowledged ethnographers, explorers, and

innovators waiting to be taught. As John Fien of UNESCO observes:

Globalization is proving to be a particular challenge to education. Its economic impacts have been uneven and its cultural impacts threaten local ways of viewing the world. However, globalization has brought an awareness of the scale of the shared burdens we face and of ways of cooperating with others to address them. (UNESCO, 2004, p. 97)

The practices and priorities of development agencies are always open to renegotiation in the field, allowing for flexible, community-driven additions and revisions to stated developmental outcomes. What is most important is that education developers recognize globalization’s inherent oscillation between universal aims and local realities.

In order to ensure that ICT development recognizes and confronts the various challenges posed by public education, it is imperative that governments and development organizations underpin their projects with appropriate philosophical paradigms. In concrete terms, this would require ICT development projects to thoroughly question their own motivations, assumptions, and ambitions. Epistemological issues might not seem to hold the same economic weight as technical issues of compliance and compatibility, but the broad and unforeseen effects of ICT dissemination necessitate serious consideration during the early stages of a program’s development. Recognizing the educational (and thus long-term financial) benefits of ICT development strategies does not always come easily to the creators and vendors of specific technologies. It is, therefore, essential to any project’s success that community members themselves play an active role in the development of ICT initiatives.

One possible strategy for ensuring such contribution in ICT development is to pursue programs and projects that are conducive to an inclusive arrangement of technology and human-

ity, such as “Community Informatics” (CI) or Clement and Shade’s rainbow model. Michael Gurstein (2003) defines CI as “the application of [ICTs] to enable community processes and the achievement of community objectives including overcoming the digital divides both within and among communities”; more importantly, however, CI approaches can go on “to examine how and under what conditions ICT access can be made usable to the range of excluded populations and communities and particularly to support local economic development, social justice, and political empowering using the Internet” (p. 4). Initiatives grounded in the principles of CI may suffer many of the same pitfalls as any other program of ICT development, but the overarching belief that technology can bring excluded peoples into global economies should be the cornerstone of all ICT projects. Without this belief in the revolutionary potential inherent in ICTs, development projects are condemned to stagnate in their own inherent limitations.

Similarly, Clement and Shade (2000) have developed what they term the rainbow model of ICT infrastructure development, which is “an integrated model for analyzing and discussing access to network services” (p. 35). The rainbow’s seven layers (Carriage Facilities; Devices; Software Tools; Content/Services; Service/Access Provision; Literacy/Social Facilitation; and Governance) must be considered as a unified whole, wherein each factor plays a significant role in the overarching success of ICT initiatives (p. 36). Like Gurstein’s community informatics, the Rainbow model provides developers with an initial framework for development projects, ensuring that ICT infrastructure is developed in a sustainable, socially equitable manner. As Clement and Shade (2000) argue:

The design process must be broadly participative and dynamic. It must be carried out in the face of strong pressures from rapid technological change, ideological opposition, ignorance of technical pos-

sibilities and social implications, strained public resources and societal instability. (p. 49)

Both models recognize the importance of aligning development’s long-term goals with the social and economic needs of communities and countries. Furthermore, both models stress the need to design ICT initiatives that recognize and respond to the marginalized voices in rural settings. Most importantly, by underpinning ICT development projects with models of this type, developers recognize and respect the essential difference between development and modernization; whereas the former seeks to assist societies in their own evolution and progress, the latter, “although it may affect certain groups . . . is always induced; and it is the metropolitan society which derives the true benefits therefrom” (Freire, 2004, p. 161). Keeping pace with technological change may dominate the economic agendas of many ICT projects, but the long-term sustainability of such a narrow focus must now be seen as increasingly untenable.

When considered in greater detail, a model such as Community Informatics begins to generate more specific criteria for ICT development projects. In Gurstein’s model, informatics can be understood to forward the following characteristics:

- A commitment to universality of technology-enabled opportunity including to the disadvantaged
- A recognition that the “lived physical community” is at the very center of individual and family well-being—economic, political, and cultural.
- A belief that this can be enhanced through the judicious use of ICTs.
- A sophisticated user-focused understanding of Information technology.
- Applied social leadership, entrepreneurship, and creativity.

- Networked linkages (particularly ethnic or cultural) in urban communities as compared to the more limited overlapping in rural communities. (Gurstein, 2003, p. 5)

It is worth noting that Gurstein's list recognizes both the economic and cultural wealth of communities, as well as ICT's ability to enhance or hinder both. Development projects that only consider the positive outcomes of ICT dissemination risk any number of unforeseen disturbances in community life. Similarly, development projects that only consider the economic benefits of ICT use can inflict long-term cultural damage, which can ultimately undermine the short-term economic gains of ICT development. By adopting a framework such as CI, developers are encouraged to see economic and cultural factors as inextricably linked.

The interplay of a community's cultural life with its economy is a delicate and complex connection, and any disruption of one will undoubtedly impact upon the other. ICT developers interested in assessing the health and wellness of this important balance would be well advised to use public education as a sort of barometer; schools are a natural space for the forces of culture and business to collide, as their very mandate is to develop future citizens and workers. Providing attention and resources to public education is quite simply one of the easiest and most effective strategies for monitoring the status of community well being. If ICT developers want to know how effectively a new technology has been introduced to a community, they can start by gauging its impact on the local schools; if students are aware of the technology and are intrigued by its possible uses, there is a very good chance that the project will have a lasting impact on the community.

Constructive, sustainable development initiatives in the field of education must confront the twin forces of culture and economics, particularly with respect to actual curricular content. Although ICT development necessitates the addition of technical skills training in public education, the

realities of rural communities necessitate the preservation of skills and values that are often perceived of as outdated in a globalized era. As Fien cautions:

Parents around the world are rightly keen that their children should do well at school and then get a job. However, job opportunities are increasingly difficult to find, especially in rapidly changing economies. Most students will make their living at home, in villages, on farms, working with their families using the resources of their local environment or in the informal or 'popular' economies in cities. Those who continue to higher levels of schooling may find employment in the formal sector, but they will still need knowledge and skills in order to help their communities make informed decisions. (UNESCO, 2004, p. 108)

Development initiatives, and particularly those that promote ICT hardware and solutions, must consider that the changing face of international business and communications will only affect most of the world's citizens peripherally. Thus, the breed of techno-fetishism, which currently consumes many in the developed world, might not be an appropriate export to developing communities in remote, rural regions. Many ICT applications bring with them enormous economic advantages, but some of these advantages are, in fact, culturally and politically specific. For example, ICTs designed to enhance productive efficiency in industrial settings are the result of a unique set of business demands. If developers unquestioningly extol the virtues of these technologies, they ignore the business demands that are unique to every other country and region in the world. This is because, as Kambhampati (2004) writes:

With most research and development being undertaken in capital-rich, labour-scarce Western economies, new technology is more likely to be labour-saving. International competition and

the need for efficiency, together with the reliance on imported capital goods, have reinforced the tendency to use the most up-to-date technology (usually labour-saving) even in labour-rich developing countries. (p. 39)

While the tools and techniques of most ICT initiatives in education are wholly different from the industrial technologies of the economic sector. This example of ideological assumptions and their potentially catastrophic consequences illustrates the dangers inherent in all ICT development projects. There is a pressing need for local solutions to problems, even when those problems recur from one community to the next. It is a mistake to believe that what works in one instance will work in all instances. Therefore, while educational reform is undoubtedly an urgent and ongoing struggle, it is essential that solutions are as varied as the crises are numerous; developers gain nothing from the unquestioned mimicry of standardized reforms.

CURRENT APPROACHES AND CONTROVERSIES: TELECENTERS, KIOSKS, AND THE NEED FOR GRASSROOTS CONSULTATION

Despite the enormous economic and social potential of ICTs for the developing world, current programs for ICT dissemination warrant a more critical appraisal; the telecenter model of ICT access, and how it has failed to properly consider the role of education in development initiatives, is an illustrative example. Broadly defined, telecenters are remote information kiosks that connect specific technologies (typically including phone lines, fax machines, computers, printers, scanners, digital cameras, and Internet access) to national and global information networks. A system of telecenters allows citizens in rural communities to access contemporary technologies from permanent sites in the region, thereby increasing technological literacy and simplifying

the bureaucratic processes of centralized government offices. Many telecenters are built with the assistance of development agencies, in the hopes that increased access to ICTs will improve the daily living conditions of communities and citizens.

For example, in a district of Dhar in Madhya Pradesh, central India, a Rural Intranet Project established a network of “village information kiosks” in order to provide citizens with agricultural information, government forms, and public health announcements. In addition, the network allows public officials to learn of potential crises immediately, so that outbreaks of disease and environmental contamination can be contained (Bhatnagar, 2003, pp. 38-41). Many ICT kiosks in the developing world—such as those in the Dhar project—are operated as private businesses by local entrepreneurs, generating income from customers who can afford the services provided. In an alternate model, paid employees of a central organization, public or private, staff the telecenter networks, ensuring that the kiosks remain open whether there is substantial demand for the services or not. As Colle and Roman (2003) observe, both models depend on the usefulness of the applications provided for financial sustainability: “One of the biggest challenges telecenters face is providing relevant information and services for their stakeholders. To survive, telecenters must be substantially demand driven whatever their sources of income. This translates into the need to have relevant and useful content” (p. 83). ICT kiosks have the potential to connect rural communities with the global world of culture and trade; their potential, however, depends on universal access, reliable service, and above all grassroots content development. If community members are active participants in ICT dissemination, rather than passive recipients of mere tools and techniques, they will have a tangible interest in maintaining and expanding ICT networks.

Consequently, it is imperative that telecenter networks depart from their exclusive relationship with private industry. Despite the economic advan-

tages of privatized telecommunications industries (as demonstrated by Henriques & Sadorsky, 2005, among others), privately owned telecenters dull the effectiveness of ICT networks in two important ways. Firstly, so long as ICT kiosks are operated for profit, they limit their usefulness in any community by attaching a price to information itself. Although many individual citizens may choose to pay for certain conveniences (e.g. submitting government forms electronically in order to avoid travelling to a central office), the majority of citizens will be hard-pressed to justify the cost of casual ICT use. Instead of introducing the benefits of long-range communication, unlimited research opportunities, cultural expression and improved education, ICT risks becoming an expensive gadget for those that can afford its limited use.

The second problem that arises from privately owned telecenters is a broader issue of harnessing knowledge for purposes of control. When the kiosk operator rations out ICT use to individual customers, there is little opportunity for individual community members to learn how these technologies really work. Widespread technical literacy may develop over time, but actual hands-on experience is limited to paying customers. The kiosk operator, usually trained by the network owners, holds a monopoly of technical knowledge in the community. Although he or she may choose to share their skills with customers and community members, there is no necessary incentive to do so.

To avoid the problems raised by private ownership, telecenter networks need to be developed as part of a region's public infrastructure. The costs can be prohibitively high, but the long-term economic advantages are very real. Building and maintaining a system of ICT kiosks seems expensive, but what is the real cost of an illiterate, under-employed community? How expensive is a family that falls sick because they had no way to know that their water supply was contaminated? ICT development forces us to consider the real costs

associated with social and economic progress. If ICT infrastructure is treated as an expensive addition to a nation's economy, it will continue to serve the narrow interests of select individuals and industries. If, however, ICT infrastructure develops in tandem with a nation's educational institutions, citizens and communities will be encouraged to adapt ICTs to existing needs and desires, thereby exploring the real and unexpected benefits of global technology.

It should be noted, however, that in many regions of the developing world, education and learning have long been at the core of economic and social planning. In a study of the Fast Reliable Instant Effective Network for Disbursement of Services (FRIENDS) project, Shirin Madon notes that the Indian state of Kerala, where FRIENDS introduced a network of "one-stop, IT-enabled payment counter[s]" for all government bills, has long benefited from the presence of village libraries (Madon, 2003, pp. 76-78). As Madon writes, "These libraries are now an established part of village life in Kerala, being used as centers for adult literacy and the venue for political meetings and youth events. Education has played a larger role in the evolution of Kerala's society by encouraging the growth of the print media and communication industry" (p. 76). Nevertheless, the FRIENDS project, aimed at simplifying a number of bureaucratic processes through ICT design, operated independently of the village libraries. Faced with the major investments in ICT infrastructure needed to establish the FRIENDS network, the decision was made to keep new technologies away from centers of learning. The failure to recognize this type of ICT dissemination as both educationally and economically advantageous to a region is symptomatic of ICT development projects throughout the world. Even in a state that actively encourages learning and education, the FRIENDS designers chose to build narrow-use telecenters, conceived of for specific bureaucratic functions. Had these ICT

kiosks been developed in coordination with the village libraries, they may have proven to be of far greater value to communities.

In addition to recognizing and respecting the role played in communities by schools and libraries, ICT developers must understand that these educational institutions represent the unique identities of rural communities. Although there are a great many advantages to the high-tech schools in developed nations, there are also a number of ongoing pedagogical debates surrounding the use of ICTs in these schools and, therefore, it is essential that these debates follow educational technologies, wherever they may be adopted. For example, it would be a mistake to assume that ICT-equipped schools can replace traditional, teacher-student models of learning. Although networked computer terminals can facilitate online learning, it does not follow that students in remote communities are best served by distance learning. Online and distance education have plenty of critics around the world, as these models place individual learners at the core of the education process. Introducing ICT-based learning to the developing world runs the risk of alienating students from their actual communities, threatening cultural survival and encouraging individuals to see themselves at global citizens first, community members second. As Bresnihan and Doyle (2004) argue, “virtual communities tend to be based purely on communities of interest leading to narrow discussions on mostly predefined topics which, while giving the contributors a sense of community, can in fact keep them dislocated from the real world” (p. 389). The online communities created by distance and ICT-enhanced learning promote global citizenship at the expense of the very real communities that students inhabit. There are, undoubtedly, significant benefits associated with online and distance-learning models, including improved access to education (particularly for students with physical disabilities or learning disorders)

and standardized delivery of content, benefits that are harder to obtain with traditional methods of communications and teaching. As Quan-Haase and Wellman (2004) argue, “Although face-to-face and telephone contact continue, they are complemented by the Internet’s ease in connecting geographically dispersed people, institutions, and organizations bonded by shared interests” (p. 123). Nevertheless, the potential for misuse (intentional or not) of these technologies must be acknowledged before introducing ICTs into the classrooms of the developing world.

The value of grassroots consultation simply cannot be overstated in development paradigms. Regardless of its economic outcomes, a successful development strategy will recognize local systems of knowledge as the foundation for any real progress. As George Dei (2000) argues in his analysis of African development:

For the idea of "development" to have any credibility at all, it must speak to the social, cultural, economic, political, spiritual, and cosmological aspects of local peoples' lives, as well as to their specific needs and aspirations. Debates about "development" must be situated in appropriate social contexts that provide practical and social meaning to the actors as subjects, rather than as objects of development discourse. (p. 73)

When development projects fail to appreciate the centrality of local culture and knowledge, they risk mimicking the colonial and imperialist adventures of the past. Development requires the community to acknowledge the limitations of their own beliefs and assumptions. As developers attempt to bring the benefits of modern ICTs to the rest of the world, it is imperative that they treat all knowledge systems as equal, valid, and enlightening. Furthermore, it is important to recognize the spectrum of educational differences that exist within countries, as not all regions and communities share common values and needs.

As Gasperini and Lakin (2003) observe, “Most developing countries have a unitary, centrally determined curriculum, which is generally designed for pupils familiar with an urban environment and may contain elements that conflict with local customs and beliefs” (p. 89). Promoting appropriate ICT use in local schools may therefore strengthen community autonomy and identity, as grassroots ICT applications can transform centralized practices and programs.

Developing communities can benefit from the educational benefits of ICT infrastructure in a number of ways, many of which occur outside of traditional classrooms. The increasing use of ICTs in their economic and cultural lives has seen an incredible growth in the field of adult literacy training. People who did not enjoy the benefits of public education in their youth are now adopting the model of the “lifelong learner” in order to keep pace in an increasingly technological world. As Fien argues, this form of literacy:

... is an essential skill for coping with the economic and social changes that are rapidly affecting traditional rural ways of living. Literacy and continuing education projects are needed to help rural people understand the ‘what’ and ‘how’ of production and the marketing of goods and services. ... Above all, adult education must help rural people suffering from poverty to develop positive attitudes and values that enhance their self-esteem and self-confidence. (UNESCO, 2004, pp. 119-120)

Adult literacy programs can introduce mature learners to the benefits and wonders of a networked planet, thereby opening an untold number of doors for future employment and expression. Nevertheless, ICT development projects need to differentiate between the goals of adult literacy programs and primary public education. Although it is economically responsible to *double up* ICT infrastructure in rural regions, it must be noted that technologies cannot always be shared among vari-

ous groups with equal success. Public schools are the long-term caretakers of critical and technical knowledge, as they continue to share information and knowledge with each subsequent generation. Adult literacy must, therefore, be treated as a one-time project aimed at bringing entire communities into a knowledge economy, whereas public schools will ensure that future citizens will have the skills and knowledge necessary to survive and prosper. As the long-term economic benefits of ICT instruction are the responsibility of public education, it would be appropriate for efforts aimed at “doubling up” ICT infrastructure to concentrate their resources in schools. Teachers and students might, however, use ICT resources during regular school hours, and adult education programs could access the same facilities during evenings and weekends.

Certainly, there are a range of ICT applications that can benefit communities and individuals in developing regions. Projects such as FRIENDS, which emphasize bureaucratic processes and governmental business, might best be served by an independent network of telecenters. Had the FRIENDS kiosks been placed in public schools, for example, their usefulness would have been severely limited by their accessibility; had regular business hours overlapped with the school’s schedule, their would have been a never-ending contest for use of the machines. Similarly, the Rural Intranet Project in Dhar could not function as an effective public health advisory system if news of a possible contagion first reached a young child in the classroom. Nevertheless, it is troubling that so many ICT development programs fail to consider the economic importance of public education. The immediate utility of bureaucracy-driven networks is undeniable, but it should not come at the expense of the long-term prosperity of a region.

Unless significant efforts are made to provide technical and critical training to communities, ICT development will quickly reach the limits of its own effectiveness. Warnings of this type tend

to be dismissed as mere neo-Luddism, stemming from Western academics with their own personal axes to grind with all things technological. What should not be lost in the calls for cautious ICT development is the insistence on inclusive, sustainable practices that respect local knowledges in all forms. This is not a crude, Orientalist reverence for all things exotic and rural—the developing world is home to a multitude of voices that continue to be ignored in the dominant discourses of technology and progress. As Dei (2000) argues, “Leaders must include local people—particularly women and the poor, whose knowledge and power have been marginalized—at all stages of the conception, planning, implementation, and evaluation of development activities” (p. 83). If the marginalized voices are not accorded their inherent worth in development initiatives, local and regional economies will continue to be burdened by individuals and communities who cannot or will not participate in the productive activities that fuel economies. Education generally, and public schools specifically, represent the development movement’s best chance at ensuring total, equal participation in local economies.

The single greatest obstacle for ICT development to address is the marked division between internal community needs and external perceptions of need. Newly introduced ICTs must meet some type of existing demand—consciously expressed or not—in order to play a meaningful role in community life. As Avgerou (2003) explains, “the socio-technical analysis suggests that the innovation process depends on the situated actors’ capacity to make sense of the value of the new artefacts and organizing techniques, and to accommodate them in their historically-formed enactments” (p. 157). She goes on to warn that, “The risk—all too visible in the widespread ‘failures’ of IS projects in developing countries—is that technology-diffusion policies which push specific technologies as ‘drivers’ to desirable ‘impacts’ or business ‘best practice’ distort local economic activities and frustrate,

rather than enable, improved performance” (p. 157). When development groups see ICT applications as “drivers” for specific outcomes they fail to recognize existing social and economic practices that constitute community experience. Worse still, prescriptive ICT solutions relegate local community members to passive roles in a networked world. As Paulo Freire (2004) warns, “In cultural invasion the actors (who need not even go personally to the invaded culture; increasingly their action is carried out by technological instruments) superimpose themselves on the people, who are assigned the role of spectators, of objects” (p. 180). Developers must recognize that their technological instruments have the same potential to become cultural invaders as they themselves do.

The inherently flexible nature of ICT tools and techniques is what encourages many groups to actively develop ICT infrastructure in a variety of communities (see, for example, Diane Nelson’s, 1999, discussion of “Maya-hackers” in Guatemala). It is this same degree of flexibility that creates new opportunities for cultural expression and economic growth in communities, and that ensures a healthy balance between global perspectives and local identities. However, as Russell Bishop, a Maori scholar, writes, “When one curriculum, one set of knowledges and narratives is constructed as representing ‘the truth’ or ‘the real,’ and it obliterates or marginalizes alternative conceptions, it is an act of violence” (as quoted in O’Riley, 2003, p. 62). Constructive, successful development initiatives embrace the alternative conceptions that are characteristic of ICTs, because they recognize the short-sightedness of advancing pre-determined goals and outcomes.

Finally, although ICT development has become a priority for many governments and agencies, the enormity of the obstacles to ICT development must be confronted before any serious attempts at dissemination are undertaken. For example, an organization known as Learning

and Development Kenya (LDK) is attempting to build ICT infrastructure that will benefit both the social and economic development of that country. Although the group considers education to be a central area for focus, there are a number of challenges to be faced: “Despite the fact that more educational opportunities have been created in the last decade, many children ages 6 to 13 years are still not in school. ... The enrolment levels are compounded by high rates of dropouts, and the situation is becoming more complicated with high death rates of the parents due to HIV/AIDS” (p. 95); as Philip Ndeti (2003) notes, “This trend is not promising for the successful use of ICT by the majority of Kenyans” (p. 95). LDK’s success is, therefore, inextricably linked to the health and social crises affecting entire communities in Kenya. Although specific ICT initiatives may bring economic benefits to select groups and individuals in Kenyan society, it is impossible to ignore the broader concerns of daily life and their impacts on development projects. Education initiatives are linked to food shortages, the spread of disease, and even to cultural norms and mores of specific regions; if ICT development projects are to achieve any real degree of effectiveness it is imperative that organizers and implementers pay attention to the greatest possible number of considerations.

GENERAL RECOMMENDATIONS

As this chapter has attempted to argue, ICT development in rural communities is most effective when it embodies the values and goals of local knowledges. One of the most effective methods for securing and institutionalizing this link is to build development projects around existing sites of public education. A few simple principles and practices can greatly enhance the effectiveness and sustainability of ICT projects; taken as a whole, the recommendations in this section can provide a sound foundation for future develop-

ment initiatives. Nevertheless, it is important to recognize that this is only a first step; the world of development changes and evolves as quickly and unpredictably as the world of technology, and it is necessary that developers of all types continue to stay informed and alert.

The University and the Schoolhouse: Centralized vs. Localized Knowledges

For many ICT developers, it is tempting to devote significant resources to the most visible, influential sites of education in a country—the universities. For example, the Sudan Virtual Engineering Library—Sustainability Network (SudVEL-SKN) uses centralized resources in order to disseminate knowledge across ICT networks; as Anna McKenzie (2005) writes, “Databases such as these are needed in every country to draw out local material and ensure technology transfer from international sources into the curriculum of engineering students, material for researchers and professional development” (p. 438). Universities and colleges employ a large number of citizens as teachers and researchers, and they tend to be important sites of research and development for ICTs, making them ideal hubs for future investment in ICT infrastructure. For example, in their study of sustainable development initiatives, Colle and Roman (2003) see Universities playing a key role in ICT development around the world. Universities, they argue:

- Conduct continual research on community information needs so that appropriate information resources can be developed.
- Convert their own research and academic knowledge into education, information, and training packages suitable for community use.
- Mobilize, interpret, integrate, and package information from external authoritative

- sources and tailor it to the needs of populations in surrounding communities.
- Design and execute ICT training programs for various community groups, especially those that are likely to be bypassed by conventional ICT training. (p. 85)

Despite these positive outcomes, universities currently occupy too much of the development movement's time and effort. Although universities are important resources for the economic and educational development of a country, their impacts are not always felt directly in rural communities. Public schools and local libraries benefit from actual grassroots involvement, allowing community members to participate in educational initiatives and to see the results firsthand. Universities tend to concentrate resources and personnel in large urban centers, distancing ICT infrastructure from the millions of citizens that the development movement hopes to serve. The SudVEL-SKN initiative, although a useful tool for Sudan's engineering students, draws out *local material* in order to support the advanced learning of a small group. While university staff and students may *design and execute ICT training programs* for use in rural communities, relying on such a centralized model of knowledge dissemination hardly seems practical or desirable. One need only consider the ill-fated notion of *trickle-down economics* in order to see the inherent limitations of a university-centered strategy for ICT development.

Additionally, and perhaps more importantly, the benefits of a university education tend to help individuals rather than communities, whereas primary and secondary schools benefit both groups. Education, generally speaking, benefits both individuals and communities. Although students alone receive formal education in school settings, the effects on the community are palpable and desirable; as Kambhampati observes, "The social returns from education can be higher than the private returns if education leads to technologi-

cal progress not captured in the private returns to education, or if education produces positive externalities like a reduction in crime rates and social security pay-outs, or more informed political decisions" (p. 229). As primary education enhances the collective security and well being of communities, it is funded by local and national governments, which consider long-term social benefits to be a good investment. While similar collective gains are recognized at the level of secondary schooling, tertiary education (universities and colleges) represents a different set of costs and benefits. Thus, although "many empirical studies indicate that tertiary education has higher private than social benefit, and there is therefore a case for it to be privately funded," writes Kambhampati (2004), "most developing country governments spend more on it than its social benefits warrant" (p. 235).

Rather than treating universities as the educational and economic cores of a nation's school system, developers need to treat universities as important, centralized hubs for individual advancement in specific economic and cultural fields. Even though the tertiary educational sector generates and sustains a great deal of a nation's technical and historical knowledge, it should not receive a disproportionate share of a nation's ICT infrastructure. Universities have an important role to play in ICT development, but they must not overshadow the pivotal role of primary and secondary schools, which have a far greater potential to reach the entire population of a country.

Telecenters and the Private Sector: ICT and Profitability

Even though universities and colleges have received a disproportionate amount of resources and attention from ICT development initiatives, it can at least be argued that some portion of the resulting benefits have helped individuals and communities in impoverished regions. Privately operated telecenters and kiosks, however, continue

to benefit only a narrow cross-section of any population. Before governments and development agencies begin to design massive ICT networks in remote rural settings, it is imperative that they appreciate what distinguishes rural ICT applications from their urban equivalents. As Bhatnagar (2003) thoughtfully observes:

Rural areas need to be serviced through low-cost, low-bandwidth solutions that have high reliability. This means that technology solutions will have to be adapted to local terrain and conditions. Demand for information services would have to be generated through aggressive marketing, and overheads kept low to serve a cost-sensitive market. Large organizations in the public or private sector are unlikely to be able to operate in this manner. (p. 51)

The question, then, is whether or not ICT infrastructure in rural regions can (or even should) be expected to generate any real profits. Bhatnagar suggests that large public organizations are unlikely to operate successfully in these economic confines; although this reflects the prevailing attitudes in many countries, the public sector nevertheless remains the only body capable of building and maintaining ICT networks in rural regions.

Whereas a private business model of kiosks and telecenters requires *aggressive marketing* and low overheads, a public model based on existing educational infrastructure does not. It is entirely possible that ICT solutions for rural regions cannot become sustainable investments for private businesses. However, if neither businesses nor governments can perceive benefits to offset investment losses, then ICT development will be mothballed indefinitely. What is needed is either a stabilization of rural markets in order to appeal to private firms, or an effective *doubling up* of community ICT infrastructure with existing government programs and institutions. If stabilization remains unlikely in the near future, then

public schools offer an ideal site for additional investment and development, as the project of widespread, meaningful ICT use significantly overlaps the goals and values of public education. If young people are taught to read, write, and express themselves creatively using ICT tools and techniques, an entire generation of young citizens will be comfortable working with the knowledge tools of a globalized world.

The issue of staffing and maintaining ICT kiosks, too, becomes far less problematic if developers seek out existing institutions and organizations. In their discussion of telecenters and operating practices, Colle and Roman (2003) emphasize the importance of volunteers in maintaining the effectiveness of telecenters: “The challenge for telecenters is to move from largely spontaneous use and management of volunteers to developing an explicit strategic plan for recruiting, training, retaining, and rewarding volunteers” (p. 86). Such a strategic plan can be grounded in the community structures surrounding public schools, so that teachers and students themselves can play an active role in the community use of ICTs. Once ICT infrastructure is a part of school life, the nature of volunteer recruitment drives will be drastically different.

Culture and Language: Long-Term Investments

Although projects aimed at improving educational opportunities carry with them the inherent economic advantages of a well-educated populace, the preservation and promotion of local cultures and languages often seem less imperative than other, more technology-aligned aspects of ICT-enhanced education. Publicly funded initiatives are therefore essential to the success and sustainability of ICT development programs, because they recognize that many important projects cost far more money than they can immediately return. In Thailand, for example, the Inter-village Connectivity and Empowerment initiative introduced

ICT to a number of rural areas, in order to “disseminate knowledge and information to support economic stability and increased international competitiveness” (UNESCO, 2005, p. 7). One of the initiative’s projects was the translation of herbal medicine texts from a traditional, at-risk language, the Lanna script (“which only a few people in the [Ban Samkha] village can read and understand”), into modern languages, in order to preserve historical, cultural knowledge (p. 9). Similar programs include the “Chakma Language Preservation Project” in India and the “Pukllasunchis Primary School” project in the Andean region of Peru (King & Schielmann 2004, pp. 139, 217). These are costly, Labor-intensive ICT development programs with only a few financial incentives. Seen in a long-term perspective, however, the preservation of scripts and medicinal practices may bring enormous benefits, both cultural and economic, to the entire world.

The issue of language preservation is especially significant in development programs focused on ICT dissemination, because unless ICT applications are developed with grassroots consultation, they will tend to present themselves to communities in the dominant, hegemonic languages of international business and trade. In a list of conclusions drawn from multiple ICT development initiatives, UNESCO (2005) notes that:

Language becomes an important issue at the global and national levels because approximately 80 per cent of the world’s websites are in English. Thus, English literacy is needed to access the global online information network. Likewise, literacy in the national language is necessary to read documents related to local and national programmes. (p. 31)

With this warning in mind, UNESCO (2005) goes on to note that:

There is a certain belief at all levels that ICT tools are something given by outside experts rather than

developed locally. Although external support is essential for initiating new activities and updating knowledge and skills, local people need to develop a sense of ownership of their ICT programmes, including the technology itself. (p. 31)

It is imperative that the development movement recognizes the extreme sensitivity of the hundreds of distinct languages used in remote regions of the world. Although public education can be an effective site for the preservation and growth of cultural practices, ICT tools and applications themselves can greatly undermine these efforts if proper consideration is not given before their dissemination.

THE FUTURE OF ICT AND EDUCATION IN DEVELOPMENT PROJECTS

Future ICT initiatives should begin to look for precedents that are widely regarded as both economically and pedagogically successful. Although it can be difficult to identify such successes, particularly in the short-term, there are several indicators that can alert researchers and developers to good practices and anticipated results. Firstly, developers should look for ICT projects that introduce technologies broadly, allowing local community residents to adapt and innovate as they see fit. For example, project organizers might be well served to consider one of the conclusions UNESCO draws from the connectivity initiative in Thailand: “If the use of ICT is linked to solving different community problems, and not restricted to learning in school, the villagers will realize its functional importance and become more interested in acquiring ICT skills” (UNESCO, 2005, p. 11). ICT development may help businesses, and it may also help schools, but it can also bring with it many unimagined opportunities for additional growth, so long as developers do not limit its use to one single sector. Secondly, it is equally use-

ful to consider how ICTs can solve many, but not all, problems facing rural communities. In the same list of UNESCO's conclusions regarding the connectivity initiative in Thailand, they observe that, "ICT is one tool used to create a good learning environment in the community. So it is not necessary to start with ICT in every learning activity" (p. 11). When developers try to apply ICT solutions to every economic and educational crisis they perceive, the end result is usually far from what had been anticipated.

Thirdly, developers can identify successful ICT initiatives by their commitment to grassroots consultation. From the early planning of a project to ensuring and maintaining its ongoing sustainability, community members themselves—particularly the marginalized, the poor, and women—must play an active role in ICT development. Educational applications in particular must be developed locally, to ensure that local needs are not supplanted by centralized, national imperatives, or by international forces. As a useful template for future projects, Lavinia Gasperini and Michael Lakin (2003) list four guidelines for ensuring that educational content is developed properly:

First, the curriculum should relate to the local context, customs, livelihoods and rural development activities. Second, it should take due account of the teachers' qualifications and training (although ideally these should be in accord with the curriculum). Third, it should make use of locally available skills, knowledge and other resources. Fourth, it should respond to the expressed wishes of the community (i.e., be demand-driven). (p. 145)

Once curricular content is established along these guidelines, developers can begin to support and complement pedagogical practices with ICT tools and applications. If ICT becomes a driver, rather than a useful navigational instrument, it risks wrenching control out of the hands of com-

munities and placing it in the hands of distant ICT experts.

A fourth consideration for ICT development initiatives in rural communities is particularly important to public education, as it stresses the involvement of education's primary audience. Often ignored in grassroots consultations, children and youth must play a central role in development programs focused on ICT applications in education. As UNESCO notes, children offer creative input in a wholly unique manner, as "They can help to alter the mindset of adults by coming up with some unusual, but effective, ways of doing things" (UNESCO, 2005, p. 11). As ICTs allow young people to explore the networked world in greater detail, developers should look to students for innovative ideas that remain grounded in local communities. Therefore, as UNESCO suggests, "Encouraging children and youth to become active partners in the process of community development is an effective way to achieve a higher level of sustainability for both ICT and community development activities" (p. 11). Grassroots consultations can no longer afford to ignore such a vital, fresh source of inspiration and reflection.

Finally, ICT developers need to seek out models for infrastructure development that do not limit their definition of ICTs solely to computers and computer technologies. In order to sustain the benefits of increased connectivity and creative expression, development initiatives should attempt to match community needs and desires with appropriate tools and techniques. UNESCO's summary of findings from multiple projects indicates that, "Although many countries believe that ICT means computers and the Internet, the use of other kinds of ICT such as radio, television, and audio technology are worth further exploration. Some of these media are more useful for raising awareness and also more cost-effective than computers" (UNESCO, 2005, p. 31). Technologies that seem older and less attractive to Western development

agencies may in fact be ideally suited to the immediate needs and desires of rural communities in developing regions.

CONCLUSION

The project of ICT infrastructure development brings with it the promises and dreams of a networked society, where every individual and community can play an active role in the economic and cultural life of the planet. Remote communities and rural centers alike can share the benefits of a connected world, humanized and democratized by the forces of technology. This vision is, of course, still a long way off. Significant economic disparities continue to handicap whole countries and regions, while fundamental issues of access and training prevent millions of citizens from participating in the hi-tech global community. If developers are to realize any form of a vision for the future, they need to begin by addressing the obstacles of access and disparity in the developing world. Public education is quite simply the single most important weapon for social progress in the world. When coupled with the radical transformative potential of ICTs, public education can become a site for economic, cultural, and personal growth on a previously unimagined scale.

For development groups interested in exploiting the potential of ICTs for economic growth, the most important lesson to learn is that economic growth cannot be sustained without a corresponding investment in education. ICT applications must be introduced to communities as tools and resources, and not simply as economic drivers for limited functions. The creative uses and applications of ICTs are bound only by the human spirit of imagination and ingenuity. Historical understandings of ICT use simply do not provide ample space for individuals and communities to develop real world solutions to existing problems. This is particularly true in education, where young

minds and exciting technological opportunities can combine in an infinite number of possibilities. As Stephen Kerr (2001) observes of ICT use in schools, "We tend to see the future, as Marshall McLuhan noted, through the rear-view mirror of familiar approaches and ideas from the past. In order to allow the potential inherent in educational technology to flourish, we need to shift our gaze and try to discern what lies ahead, as well as behind" (p. 164). It is time that ICT infrastructure developers look to what lies ahead. They should start in the classroom.

REFERENCES

- Avgerou, C. (2003). New socio-technical perspectives of IS innovation in organizations. In C. Avgerou., & R. Rovere (Eds.), *Information systems and the economics of innovation* (pp. 141-161). Cheltenham, UK: Edward Elgar Publishing.
- Avgerou, C., & Rovere, R. (2003). Introduction. In C. Avgerou & R. Rovere (Eds.), *Information systems and the economics of innovation* (pp. 1-11). Cheltenham, UK: Edward Elgar Publishing.
- Bhatnagar, S. (2003). Development and telecommunications access: Cases from South Asia. In C. Avgerou & R. Rovere (Eds.), *Information systems and the economics of innovation* (pp. 33-52). Cheltenham, UK: Edward Elgar Publishing.
- Bresnihan, N., & Doyle, L. (2004). Sharing places, enhancing spaces: An investigation into the effects of mobile networking technologies on physical communities. In K. Morgan, C. A. Brebbia, J. Sanchez, & A. Voiskounsky (Eds.), *Human perspectives in the Internet society: Culture, psychology and gender* (pp. 387-396). Southampton, Boston: WIT.
- Clement, A., & Shade, L. R. (2000). The access rainbow: Conceptualizing universal access to the information/communications infrastructure. In M. Gurstein (Ed.), *Community informatics:*

Enabling communities with information and communications technologies (pp. 32-51). Hershey, PA: Idea Group Publishing.

Colle, R. D., & Roman, R. (2003). Challenges in the telecenter movement. In S. Marshall, W. Taylor, & X. Yu (Eds.), *Closing the digital divide: Transforming regional economies and communities with information technology* (pp. 75-92). Westport, CT: Praeger Publishers.

Dei, G. J. S. (2000). African development: The relevance and implications of "Indigenism." In G. J. S. Dei, B. L. Hall & D. G. Rosenberg (Eds.), *Indigenous knowledges in global contexts: Multiple readings of our world* (pp. 70-86). Toronto: University of Toronto Press.

Freire, P. (2004). *Pedagogy of the oppressed: 30th anniversary edition* (M.B. Ramos, Trans.). New York: Continuum International Publishing Group Inc.

Gasperini, L., & Lakin, M. (2003). Basic education in rural areas: Status, issues and prospects. In D. Atchoarena & L. Gasperini (Eds.), *Education for rural development: Towards new policy responses. A joint study conducted by FAO and UNESCO* (pp. 77-174). Paris: United Nations Educational, Scientific and Cultural Organization Publishing.

Gurstein, M. (2003). Perspectives on urban and rural community informatics: Theory and performance, community informatics and strategies for flexible networking. In S. Marshall, W. Taylor, & X. Yu (Eds.), *Closing the digital divide: Transforming regional economies and communities with information technology* (pp. 1-11). Westport, CT: Praeger Publishers.

Henriques, I., & Sadorsky, P. (2005). Risk and investment in the global telecommunications industry. In H. S. Kehal & V. P. Singh (Eds.), *Digital economy: Impacts, influences and challenges* (pp. 39-61). Hershey, PA: Idea Group Publishing.

Kambhampati, U. S. (2004). *Development and the developing world*. Cambridge, UK: Polity Press.

Kerr, S. T. (2001). Toward a sociology of educational technology. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 143-169). Mahwah, NJ: Lawrence Erlbaum.

King, L., & Schielmann, S. (2004). *The challenge of indigenous education: Practice and perspectives*. Paris: United Nations Educational, Scientific and Cultural Organization Publishing.

Madon, S. (2003). IT diffusion for public service delivery: Looking for plausible theoretical approaches. In C. Avgerou & R. Rovere (Eds.), *Information systems and the economics of innovation* (pp. 71-85). Cheltenham, UK: Edward Elgar Publishing.

McKenzie, A. (2005). Changing hearts and minds: The role of education. In K. C. Hargroves & M. H. Smith (Eds.), *The natural advantage of nations: Business opportunities, innovation and governance in the 21st century* (pp. 430-444). London: Earthscan.

Ndeti, P. (2003). ICT integration in social and economic development: Kenya's perspective. In S. Marshall, W. Taylor, & X. Yu (Eds.), *Closing the digital divide: Transforming regional economies and communities with information technology* (pp. 93-100). Westport, CT: Praeger Publishers.

Nelson, D. M. (1999). *A Finger in the wound: Body politics in quincentennial Guatemala*. Berkeley, CA: University of California Press.

O'Riley, P. A. (2003). *Technology, culture, and socioeconomics: A rhizoanalysis of educational discourses*. New York: Peter Lang Publishing, Inc.

Quan-Haase, A., & Wellman, B. (2004). How does the Internet affect social capital? In M. Huysman

ICTs and Educational Benefits in Regional Development

& V. Wulf (Eds.), *Social capital and information technology* (pp. 113-132). Cambridge, MA: The MIT Press.

UNESCO. (2002, September 2-3). Educating for a sustainable future: Commitments and partnerships. In *Proceedings of the High-Level International Conference on Education for Sustainable Development at the World Summit on Sustainable Development*, Johannesburg, South Africa. Paris:

United Nations Educational, Scientific and Cultural Organization Publishing.

UNESCO. (2005) *Information and communication technologies (ICTs) for community empowerment through non-formal education: Experiences from Lao PDR, Sri Lanka, Thailand and Uzbekistan*. A report by UNESCO's Asia-Pacific Program of Education for All (APPEAL). Bangkok: UNESCO Asia and Pacific Regional Bureau for Education.

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 1-21, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.20

Support Networks for Rural and Regional Communities

Tom Denison

Monash University, Australia

ABSTRACT

Using a case study approach, this chapter examines the role of organizational networks in the success and failure of information and communications technology projects. Within a framework informed by the literature of information systems failure, the diffusion of innovation and social network analysis, it argues that information systems projects must take into account the social context in which they are implemented. To be successful such networks require a mix of extended and locally based support networks, because they provide access to much needed resources, including innovations, strategic advice, training, and support at the appropriate level. It further argues that the people who are working in a regional setting felt themselves to be in an extremely disadvantageous situation because they typically lacked support from similar net-

works. The author hopes that highlighting the importance of such support networks will lead to a better understanding of systems failure and success, and will contribute to improved policy formulation and practice.

INTRODUCTION

Quite often it is assumed that the mere implementation of technology and some initial guidance and training in its use will result in successful projects and their ongoing effective use. Time after time this has been found to be insufficient. The literature on information systems failure deals with the multiple causes of this phenomenon, but the intention of this chapter is to focus on one aspect that is particularly important in the context of rural and regional development: the role and type of support networks that are needed to properly

plan, implement, and sustain information and communications technology (ICT) projects.

The starting point will be a brief overview of the literature on information systems failure, highlighting recent research that seeks to emphasise the importance of understanding the social context in which systems are implemented and the impact that can have on their success or failure. This will be followed by an introduction to the literature on the diffusion of innovation and social network analysis. Then it will provide a broad theoretical background that can be used to examine the characteristics of organisations as nodes in broader networks, the nature of the relationships they establish within those networks and the importance of those relationships in providing access to information, skills, and resources. These theoretical concerns will then be illustrated by drawing upon a selection of case studies available in the literature, as well as practical experience the author gained when implementing information systems in Vietnam.

The case studies have been chosen because they provide examples of the theoretical issues in rural or regional settings. While some, such as the attempt to implement geographic information systems in India (Barratt, Sahay & Walsham, 2001), serve to illustrate the extent of the problems that can arise when a lack of local knowledge and infrastructure is not addressed, most of the studies illustrate more positive outcomes and act to reinforce insights derived from the theory. As a whole, they demonstrate that network relationships are essential for development in rural and regional areas because they provide access to new ideas and innovations, strategic advice, training and support, as well as a host of other necessary resources. They also demonstrate that some resources, such as access to new ideas, should typically continue to be provided through extended networks, but successful and sustainable projects require the development of a localised infrastructure capable of harnessing resources in a trusted environment.

INFORMATION SYSTEMS FAILURE

There is a significant body of literature that has been found discussing the causes of information systems failure from a project management perspective, for example, the work of Lyytinen and Hirschheim (1987), Keil, Cule, Lyytinen, and Schmidt (1998), and Schmidt, Lyytinen, Keil, and Cule (2001). These have tended to focus on management issues, such as the lack of top management commitment to the project, failure to gain user commitment, misunderstanding the requirements, lack of adequate user involvement, lack of required knowledge/skills in the project personnel and lack of frozen requirements (Schmidt et al., 2001) although recently there has been significant interest in concepts such as learning organizations (Lyytinen & Robey, 1999) and their role in nurturing projects. The main thrust of the literature, however, relates to the ability of large organisations to successfully undertake new systems development.

Given its importance, the focus of this chapter is to assist those who seek to implement information systems in regional areas, specifically in the creation of the infrastructure or framework necessary for the successful diffusion and sustainability of technology. It complements the work of others such as Kling (2000) and Orlikowski (2000) who, having recognised that technology is not socially neutral, have attempted to broaden the understanding of the factors that contribute to systems failure by considering the social context in which information systems are implemented. The importance of such an approach has clearly been recognised by the United Nations Development Program (UNDP) Evaluation Office which identified six generic challenges that critically affect ICT for development initiatives: awareness; politics; access; relevancy and meaningful use; sustainability; and coordination (UNDP, 2001).

The work of Heeks (2002) is also important in this context, as he has attempted to model the implementation of information systems in

developing countries in such a way as to identify the potential for failure, including what he terms “sustainability failure.” He identified “design-actuality differences” as a powerful contributor to systems failure and suggested that systems which allow “contingent improvisation” – that is the ability to accommodate design changes and adapt to local needs – are more likely to be successful, and proved to be sustainable. As he notes, however, the success of this approach is based on environments in which the necessary skills and resources to adapt and successfully implement systems are available locally. This raises the question, then, of just what skills and resources are required, and how access to them can be provided. In this respect, this chapter provides significant insights relating to the diffusion of innovation and to network analysis.

DIFFUSION OF INNOVATION AND NETWORK ANALYSIS

The literature on the diffusion of innovation is dominated by Rogers (2003), who defines innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (p. 12). He describes five attributes of innovations: relative advantage, compatibility, complexity, trialability, and observability. According to Rogers, the way in which these attributes are perceived by those who are the beneficiaries of the innovation determines both the speed of adaptation and the degree to which a specific innovation is adopted, modified or ignored. This framework has been successfully used to model the diffusion of innovation in a wide range of studies, for example, Grover and Teng’s (1992) study on the take-up of database technology, and Garrison’s (2001) study on the adoption of online technology by news organisations.

Studies on the diffusion of innovation have been enriched by adding insights derived from social network analysis which, as Wellman (1988)

explains, is based on the relationships between units, rather than the categorisation of those units into predefined categories, and on interpreting behavior in terms of structural constraints on activity rather than in terms of inner forces. In this theory, networks structure collaborative and competitive activities in order to secure scarce resources including information, support, and power. So, to understand the behavior and capabilities of those units it is necessary to consider the relationships between all groups and individuals in their immediate environment. These relationships are important to innovation, because it is through them that many of Rogers’ five attributes are realised.

A highly influential work in this field is that of Granovetter (1973), whose work centered on the strength of weak ties, defined as a casual or infrequent connections between two people or organisations. He emphasised the importance of social networks in the distribution of information and resources, arguing that those with networks of weak ties are best placed to receive new information and resources, since they can act as bridges to the broader community. He also found that the longer linked the network – that is the more links required to establish a connection between two people or units – the less effective it is.

In contrast, Coleman (1988) studied dense closed networks—those with multiple strong internal links but few weak links—finding them to be important for the enforcement of social norms, obligations, and expectations. These, he argued, are important in facilitating effective action. He further argued that those with limited ties to external communities have structural holes that, if they are not closed, can result in a lack of access to the information and resources necessary to facilitate action, particularly innovation. Burt (2000), building on this, argued that all networks can have structural holes and that those who can arrange relationships spanning across those holes may achieve a competitive advantage because they are best placed to obtain new ideas, information,

support, and other resources. In this view, network closure is about maintaining the status quo while brokerage is about change. However, a number of researchers (Aldrich & Zimmer, 1986; Kadushin, 2002) have found that both brokerage and cohesion networks are required for the successful diffusion and exploitation of resources.

Considering the issues relating to brokerage and cohesion networks in more detail, Aldrich and Zimmer (1986) emphasised that the maintenance of effective networks requires the continual creation of weak ties so as to prevent a few strong ties from closing them to opportunities and alternatives, while Kadushin (2002) argued that “safety drivers,” which act against change, are common when the costs of interaction are low, visibility is high, and moral obligations are more salient—a situation typical of rural and regional networks. And, in work of special significance for the diffusion of innovation, Valente (1995, 2005) found that a significant difference between effectiveness (brokerage) networks and safety (cohesive) networks is the location of trust, which is an important factor in the realisation of Rogers’ (2003) five attributes.

Others have attempted to identify issues that relate to the development and success of regional groupings, and their work has obvious implications for developments in rural and regional areas. For instance, Hakansson (1990) suggested that networks are a new organisational form necessary to supplement internal competencies and that this implied a mutual dependence between government and business, particularly in regional areas where location has a strong impact on the availability of resources. Steward and Conway (2000) examined the conflicting goals and cultural variations that are likely to exist between organizations with extended supply chains, and identified that differences in culture, language, and business practices at the levels of individuals and organizations are potential sources of tension.

Finally, Furst, Schubert, Rudolph, and Spieckermann (2001) related the concepts of cohesion

and brokerage to the complementary categories of stationary and mobile social capital. In their view, regional networks need a high degree of stationary capital to ensure self governance but also need to be able to lock in mobile social capital in order to bring in new ideas and the flexibility needed for development. Bebbington (1997) provided a clear example of this in the author’s study on communities in the Ecuadorian and Bolivian Andes that had managed to improve their local economies, reversing trends in both migration and environmental protection, via a program of agricultural intensification based on the use of new technology. He demonstrated that this could not have been achieved without a broadening of support networks and the access to ideas, contacts, and resources they bring, nor without the involvement of strong local community groups that helped create the pre conditions to take advantage of those networks and opportunities when they were presented.

In summary, the successful diffusion of technology, particularly in rural and regional areas, is in large part dependent on the flow of resources and the capacity for local improvisation. Organizations and communities seeking to implement technologically based change, require both brokerage and cohesion networks: brokerage networks because they provide access to opportunities, innovation, strategic advice, new skills and support; cohesion networks because they provide a trusted environment in which to operate, harness local capacity and manage “contingent improvisation.”

CASE STUDIES

There are a significant number of case studies in the literature that explore these issues, but for the purposes of this chapter it will be sufficient to highlight five. The first, a study by Sherry (1998), illustrates a straightforward analysis of a technology diffusion program, using Rogers’ (1995)

framework to evaluate IT training programs in regional school districts in the United States. In the second, an ambitious, three year longitudinal study by Barratt, Sahay, and Walsham (2001), the efforts of the Indian Ministry of Environment and Forests (MoEF) to apply geographic information systems (GIS) technology to forestry management and wasteland reclamation are examined. Issues of trust are explored in some depth, as are the types of problems can arise when local conditions and expertise are not adequately acknowledged, themes that are further developed in an Australian study by Terziovski and Howell (2001). They examine network linkages connecting multiple stakeholders, demonstrating that interaction between government, business, and the community is important in facilitating new initiatives, particularly if trusted local connections can be harnessed.

An extended examination of the author's experiences in implementing a series of information systems in regional Vietnamese university libraries is then provided. This is a prime example of a project that was struggling to succeed because the technology was implemented without regard to the local context, but which was revitalised when gaps in local infrastructure were identified and the need to establish local support networks recognized (Johanson, Denison & Otis, 2004). This is complemented by the final case study, that of Gibb and Adkihary (2000) on the work of non-government organisations (NGOs) in South Africa. They explore the nature and role of NGOs as network brokers capable of supporting external interventions by using their relationships to assist in the development of local stakeholder networks.

Training and the Diffusion of Skills: Boulder Valley Internet Project

Sherry (1998) used Rogers' (1995) framework for studying the diffusion of technology to evaluate the Boulder Valley Internet Project (BVIP), a five-

year collaborative venture between the University of Colorado at Boulder and the Boulder Valley School District (BVSD). The project was funded by the National Science Foundation (NSF) and aimed to incorporate Internet-based technologies and strategies into the teaching program of the District, by developing training programs and integrated telecommunications throughout.

Commencing in 1992, the project used a trainer-of-trainers model to create a core group of 26 teachers. Their mission was to become proficient in the use of e-mail and in investigating Internet resources, and experienced in integrating these into school curricula, so as to pass on their skills to other teachers within the district. Using a participatory design model, the bulk of the training concentrated on the needs of classroom teachers. Workshops and classes were given in BSVD classrooms, using the very platforms that the teachers would use once their classrooms were connected. Sherry found that the program achieved considerable success and that, as of January 1996, there were 435 teachers on the BSVD network who logged in regularly. However, she also reported that the project later lost much of its momentum when it lost the support of the school administrators and key policy makers at the district level.

She made the following points with respect to the level of success that was achieved:

- Rogers' (1995) framework emphasises the role of change agents in influencing their clients' behavior, and their ability to help them realise change. In this case, the project used BSVD teachers drawn from the district as change agents rather than relying on outside experts that could have been drawn from the project's partner organizations. This ensured a significant level of client/agent empathy.
- By focusing on providing an authentic context (dealing with real issues in an actual work environment) in which situated learning could take place, the project presented

the opportunity for clients to observe the benefits of the technology firsthand, another critical factor in Rogers' (1995) model.

- The self-reflection involved in the participatory design process ensured that trainers and trainees explored the issues, dealt with conflicts and solved problems together, contributing substantially to the success of the training program.
- At least in its initial stages, the district as an organization ensured that the effort was aligned with district-wide visions and policies and integrated into the established telecommunications channels. As a result, the project had strong grassroots support from the local teachers who were the primary participants in the training program.

As Sherry (1998) noted, however, the project was not a complete success. The reason for this was that, as the project evolved, the attitudes of the policy makers became more conservative and the project gradually ceased to address the needs of all stakeholders, specifically the school administration and the district's policy making bodies. As a result, it received a lower priority and stalled. Sherry concluded that "If there was a single lesson to be learned from the BVIP experiment it is ... [that] information technology interventions cannot be separated from their ecological contexts or from the educational activities that they enhance" (p. 141).

Rogers' (1995) model postulates five stages that a successful intervention must pass through. They are: (a) seeking information about the innovation's existence and some understanding of how it functions; (b) forming a favourable or unfavourable attitude towards it; (c) engaging in activities that lead to a choice to either adopt or reject the innovation; (d) putting the innovation to use; and (e) seeking reinforcement of an innovation decision that has already been made (Sherry, 1998). In the case of the BVIP project, it can be seen that external linkages (brokerage

networks) were used to successfully introduce new technology as in step (a), while the strong peer-to-peer (cohesive networks) represented by the teachers within the district assisted steps (b) to (d). However, the ultimate failure of the project was due to the poor management of its broader internal stakeholder network, allowing Kadushin's (2002) "safety drivers" to take affect, thereby cutting off access to the required resources and external support needed to reinforce the innovation as in step (e).

The Role of Trust in Local Adaptation: GIS Systems in India

Barratt et al. (2001) also undertook an in depth case study of a technology diffusion program. It was a three-year longitudinal study of the efforts of the Indian Ministry of Environment and Forests (MoEF) to apply geographic information systems (GIS) technology in the areas of forestry management and wasteland reclamation. For their analysis they used a framework strongly influenced by both Giddens (1990, 1991) and Kling (2000) to explore the types of problems that can arise when local conditions and expertise are not adequately acknowledged and utilised during the introduction of new systems.

The project commenced in 1991, initiated by the U.S. Agency for International Development (USAID), which also provided seed money, training, and software. Phase 1 of the project aimed to establish the technical feasibility of using GIS in eight scientific institutions. Phase 2 envisaged the subsequent transfer of those systems to local district offices. Although Phase 1 was completed in 1993, by the end of the research period only minimal progress had been made in transferring the technology to district level and it is this failure that the analysis focuses on.

While acknowledging variable management support that affected the enthusiasm with which the project was undertaken in different districts, Barratt et al. (2001) identified a number of specific

issues that contributed strongly to the failure of Phase 2:

- There was no work culture based around the use of IT because there was no history of access to technology. At the same time, the social structure, organizational forms, and existing work arrangements were not taken into consideration. The pressure for change had come from external sources—governmental agencies and international bodies such as the World Bank and the United Nations (UN). These pressures confronted strong existing traditions and systems of work, but while the process of technology transfer was useful in providing know how, technology, and funding, it promoted western values and management techniques that were often incompatible within the context of a developing country. The difficulties caused by these unresolved tensions hampered the development of the restructured and standardised work practices required to introduce GIS at the local level.
- Compounding the problems mentioned in the first point, the technology itself was not neutral. GIS systems were built on western notions of rationality and coordination, while the depiction of space as an objective was a value-free reality. Assuming the widespread use of maps and knowledge of spatial planning concepts, the new systems required a reorientation from planning based on non-spatial parameters such as development schemes and households, as was the existing practice, to planning based on spatial criteria, such as “watershed units” and “wasteland distributions.” These concepts were in conflict with local practice and, as a consequence, the system was perceived to be less relevant to local need.
- There was a lack of relevant professional skills. The effect of the first two points may have been ameliorated had more attention

been given to providing support and building local expertise and capacity. Forestry officials needed to develop new conceptual skills to translate their forestry related problems into the spatial terms required by the GIS models, but they also needed the skills to adapt those models to local conditions in order to facilitate contingent improvisation. The professional skills that were locally available enabled the achievement of success in Phase 1, but not in Phase 2. However, the models developed in Phase 1 reflected the view of the institutes as scientific research and development centers by placing little emphasis on other important socioeconomic variables in the context of the districts, for example population and livestock data.

- Regarding professional skills requirements, it was recognized by a number of the institutes that there would be problems in transferring the technology to the districts, because they considered that their technical resources and the skills of institute staff were inadequate to provide sustained support in the field. They lacked a core group of people with GIS expertise who could nurture the projects over time and, in any case, many scientists considered that their institutional mandate was limited to developing the technology, not its transfer to the district level.

As can be seen, this was an intervention that required significant changes in professional culture, technical skills, and work practices. Remote organizations were encouraging the take up of the technology, and although the project provided support networks sufficient to ensure implementation by the scientific institutions, the networks that were provided were inadequate to ensure the transfer of skills and the conditions required to effectively exploit the technology at the local level.

The analysis by Barratt et al. (2001) is also of interest because of the way in which it uses Gid-

dens' (1990, 1991) theories to explore notions of trust, the lack of which they consider contributed to the problems that arose. Giddens identified two types of trust, distinguishing between situations in which the actors are face-to-face and those in which they are not. In this case, a typical situation in which information systems are implemented for the first time, it is a prime example of the latter, and required reconciliation between traditional and new knowledge systems and the development of new trust systems. However, the effectiveness of these processes depended on the manner in which the technology was introduced and the nature of support provided and, in this case, these were inadequate to the task. As a result, the disembedding of traditional practices of forestry management did not occur, and made it difficult for standard methodologies to be modelled, codified, and applied.

The introduction of GIS technology also exposed workers at all levels to new networks of people, required to introduce and support the technology. For the project to be successful, they needed to develop trust in these new networks. But this could not happen in conditions where an unresolved tension existed between local requirements and the introduced system.

Barratt et al. (2001) argued that the project was not successful because it attempted to impose a new professional and technological framework without taking local conditions into account. There seems to have been little provision for local contingency in design, and little recognition of the types of support and support networks that would be required to implement and sustain the new environment. Significantly, there seems to have been little recognition of the need to develop trust in this new environment or the impact that that might have on the success of the project. Their final comment, noting that "the entry of the private sector into government GIS projects is one factor that can potentially lead to more rapid changes in the future" (2001, p. 15), clearly indicated an important issue. This comment is

significant because it recognises that the private sector represents a means of providing additional expertise and support, localised in a way that enhances trust.

The Role of Trust in Technology Diffusion: E-Commerce in Regional Australia

The issue of trust also arises, albeit in a slightly different form, in an Australian study by Terziovski and Howell (2001). Reviewing a series of e-commerce projects undertaken by local government in regional Victoria, they found that while network linkages connecting external stakeholders were important to drive new initiatives, trusted local connections were also essential for their proper implementation and ongoing exploitation.

The scheme in question, VEEM (Victorian E-Commerce Early Movers) Scheme, was funded by the state government with the aim of identifying linkages that could aid and support local government usage of e-commerce and its subsequent take up by local industry and the wider community. A number of local government areas were funded to develop a range of projects, including promotional events such as e-commerce business planning workshops and regional expos, and more specific activities such as the development of regional business portals and the development of business plans to enable local businesses to adopt online fulfilment and procurement.

Feedback from participants confirmed that the scheme was a success, with e-commerce being embraced by business and communities alike. They also noted that, as the project progressed, many of the activities had been customised to better fit community and private sector expectations, reflecting the flexibility that had been built into the scheme, and the willingness of the responsible government agency to work with local government in a meaningful way.

Terziovski and Howell's (2001) report highlighted several strategies that were critical to this

success, but noted that to achieve sustainability it was necessary for participants to develop their own expertise, and it was important that strategies had been framed with that end goal in mind. Specifically, they commented that:

- Participants recognized that the projects would not have been undertaken without the stimulus provided by the state government, nor would they have been seen as a high priority for local government without that support, which provided credibility, resources, and a secure working environment.
- While participants acknowledged the important role of the state government, they also understood that, in order to ensure meaningful participation, it was essential to devolve decision making to local government and communities. In this context, local government saw its role as seeding community or industry based networks, and providing infrastructure support and training.
- As local small businesses were intensely focused on their own immediate needs, it was considered far more effective to use local experts to talk to local people, maintaining the focus on their needs rather than those identified by external stakeholders. These grassroots champions were seen as important because they could provide examples of success and act as marketing agents for uptake of technology. These are important factors in reducing local indifference. It was also considered more effective to have a number of champions, drawn from different business sectors, who had existing relationships with other local centers of influence such as banks, accountants, and community business groups. For example, one local government office sponsored six business champions from three targeted industry sectors – transport/distribution,

manufacturing, and services industries – and was instrumental in connecting them to the economic development in the region by providing better access to its networks.

- While it was recognized that external expertise was essential to the success of the diffusion process, and that that expertise would be required on an ongoing basis, it was also recognized that much expertise could, and should, be localised. To facilitate this, the report recommended that the state government should fund an ICT Center in each regional area, using a local body such as part of the council or a university or the local e-commerce association, to deliver information, training, and so forth. These centres could not only provide trusted support, but could also strengthen the relationship between the State Government, local councils, and the community, thereby providing a sound foundation for future programs.
- Finally, it was recognized that something as simple as a database of service providers could be invaluable in assisting both local government and local businesses, by preventing duplication of time and resources when identifying and evaluating existing service providers.

Reflecting these considerations, the report proposed a model of best practice based on a tripartite relationship between state and local government, and local government and the community. In this model, the state government provides the vision, policies, initiatives, and funding, while local government provides a leadership role to facilitate e-commerce diffusion, working with local businesses and the community to address real needs.

All of the strategies adopted by the project built on existing networks and relationships to facilitate the successful diffusion of e-commerce, using them to establish and reinforce existing trust systems and to develop strong relationships on a regional,

business and individual basis. The creation of support (brokerage) networks that facilitate a flow of information, skills and resources was absolutely essential, but it was recognised that these would only be useful if they were combined with the strengths and resources of the local community (cohesion networks). As in the MoEF project (Barratt et al., 2001), trust in the ability of those managing the project to understand local needs and conditions was identified as a significant factor, but unlike the MoEF project, trust was harnessed and the project achieved its goals.

Building Support Networks: University Library Systems in Vietnam

Many of the themes and issues raised in this chapter found practical application in a series of projects in which the author participated, involving the diffusion of new technology among regional universities in Vietnam. In this case, which has been documented by Johanson et al. (2004), the NGOs managing the project not only brokered networks to support the initial diffusion of technology and distribution of resources, but also assisted in the development of more localized networks capable of exploiting the technology on an ongoing basis.

The first of these projects began in 1999, after Atlantic Philanthropies (AP), a US based NGO, decided to contribute to the educational infrastructure of Vietnam by developing a series of Learning Resource Centers (LRCs) in collaboration with regional universities in Da Nang, Hue, Can Tho, and Thai Nguyen. Each project involved the design and construction of a modern library facility based on western models and standards of information service, together with the provision of state of the art technology, and high quality teaching and learning facilities.

The initial project, the Da Nang University Information Resource Center (IRC), was completed in 2001 with high expectations. Staff had

received training in the form of a short study tour to Australia and an introduction to the use of library management systems. The initial collection included 10,000 monograph and serial titles, in both English and Vietnamese, and access to a range of electronic resources. A Vietnamese company was contracted to provide both a local area network and an integrated library management system (ILMS) to manage housekeeping and public access functions. Although well resourced in comparison with other university libraries, it quickly became apparent that it was under utilized. Management decided not to circulate material and, partly in consequence of that decision, staff used only a fraction of the functionality of the ILMS. Further, without a support contract for either the communications infrastructure or the ILMS, there were ongoing problems with the stability of the technology.

AP was surprised by this result and delayed work on the remaining LRCs while a review was conducted. That review, undertaken by RMIT University Vietnam, found that strong and committed management had been provided and, although there were a number of resourcing issues, the most significant problems related to the fact that the IRC was operating without the supportive infrastructure that its western counterparts take for granted:

- The proposed operating environment of the IRC was essentially new to academic libraries within Vietnam and, although there was a training program for staff, it was both limited in scope and had no provision for ongoing support. There were only a few librarians with whom they could discuss ideas and share experience. The library schools were not producing appropriate graduates and the limited number of similar libraries were scattered throughout the country. Somehow, with little advice from the scanty professional infrastructure, traditional tasks such as cataloguing fared well, but new

areas such as circulation, the use of IT, and the identification, acquisition, and use of electronic resources, did not.

- Also, apart from the inability to obtain immediate practical advice at a local level, the overall professional library infrastructure within the country was underdeveloped. There was little support for activities such as the adoption and promotion of national standards, the nurture of a national professional association or the encouragement of local systems vendors. That made it difficult for management to obtain strategic advice.
- Neither staff nor vendors had the experience to develop procedures that would allow them to incorporate the automated system into the new style of operation, nor to identify problems with the system that would allow them to recommend appropriate modifications. There was little capacity for local adaptation.
- Modern western libraries make intense use of IT, relying on a shared infrastructure that allows them to reduce the real costs of that technology as well as the resources required to manage it. Typically, that infrastructure includes consortia to support the purchase of electronic resources, the shared development of IT strategies and applications, interlibrary loan networks, and shared cataloguing. None of this was available to the IRC.
- The decision on how to proceed with acquiring an ILMS was crucial to the successful operation of the IRC. At that time the available choices were limited to importing an international system or developing one locally. Importing one had the advantage that it could be expected to be fully functional and would comply with the relevant standards, but there would also be several disadvantages: none had a Vietnamese language version; none provided local support; and none provided support in Vietnamese. Furthermore, the cost of the initial purchase

and of ongoing maintenance was unaffordable. Eventually, a Vietnamese company was commissioned to develop an ILMS for the IRC. The chosen company was new to libraries and although it learnt quickly, the system it initially delivered had a number of serious problems.

- There were, and there still are, serious limitations in the national infrastructure with regard to the availability of trained IT staff, particularly in the regions where, although the number of IT staff is growing, there remains a shortage because there is an increasing demand for their services from other developing industries.

AP had come to realise that developing a sustainable service required a significantly broader perspective than that was at first apprehended. One other thing they recognised was that the LRCs not only had to be effective in themselves, but also they had to be integrated within the broader educational and professional communities. To advance their interests it was necessary to work within the already established framework in the country, putting emphasis on those aspects that had been identified as being important to the LRC projects and their further development. The profession within Vietnam had already instigated work on a program of modernization but had been hampered by lack of funds. AP sponsored a workshop to discuss further on the adoption of standards at a national level. That workshop also explored issues of cooperative and collaborative activity, including the possibility of developing a national organisation of professional librarians and library educators, as well as recommending a national strategy for the development and acquisition of library management systems within the country. Working closely with the profession, AP subsequently initiated projects in a number of these areas.

From the view point on the diffusion of innovation and Rogers' (2003) framework, this

intervention was strong enough in terms of relative advantage, but at the same time was weak in terms of compatibility, complexity, trialability, and observability. It became obvious that the success of the first IRC was dependent on the broader national infrastructure and it could not be considered successful if it was treated as self-contained. It could only be considered successful if it was treated as a first stage in the overall development of services within the country. In their analysis, Johanson et al. (2004) argued that support networks were essential to the success of these projects because they provided access to strategic advice, skills transfer, and an ongoing professional culture. Hence, the LRCs could not achieve their full potential until stakeholder communities had themselves progressed to the stage where they could provide the required additional support. In network terms, the first IRC had been created with numerous structural holes that could not be effectively closed until a shorter linked brokerage network and a stronger internal (cohesive) network had been established. Therefore, the other elements of Rogers' (2003) framework could come into play until that had been done.

The project is also of interest from the point of view of developing local capacity in order to support local adaptation or contingent improvisation. As mentioned earlier, the library management system was plagued with problems and the resolution of these problems was beyond the reach of the staff of the IRC and the vendor. An outside expert was called in to evaluate the system and to work with both parties to recommend improvements so that the resultant system would at least provide the necessary core functionality and meet international standards. This strategy resonates well with the views of Heeks (2002) because it allowed the staff of the local vendor and the IRC to build up the expertise required to take future development of the system under their own control. In this case, even though the need for local adaptation had been recognized, the capacity to

undertake it was only achieved when the relevant support networks had been established.

Concluding their analysis, Johanson et al. (2004) reported that these issues were addressed directly in the development of the subsequent LRCs. They found that not only were the subsequent projects more successful, but that their success contributed to a revitalization of the Da Nang IRC.

Using NGOs to Build Support Networks: The CEFÉ Network in South Africa

A common question running through these case studies is the question of how best to maximise the effectiveness of external interventions. The work of Barratt et al. (2001) highlights some of the problems that can occur, and although Terziowski and Howell (2001) describe a more successful case, they are clearly considering a technically potent and culturally homogenous environment. The projects documented by Johanson et al. (2004) are useful in that they provide examples of a successful intervention in a developing country, but a more general consideration of the issues is provided by Gibb and Adkinary (2000) who examine the role of NGOs in this process. In their view, NGOs can provide a useful mechanism for promoting the diffusion of innovation and development because they are more likely to be embedded in their communities and, as a consequence of that, are more likely to be capable of helping to develop the networks of trusted stakeholders that lead to sustainable outcomes.

They studied the Competency-based Economies through the Formation of Enterprise (CEFE) Network, an alliance of six NGOs in South Africa. In South Africa, the role of small business is seen as critical in supporting government policy, in meeting targets for new job creation, and as an effective means of redistributing income and opportunity to the indigenous population. NGOs, such as those of the CEFÉ Network, are important because they

are seen as a means of delivering financial and business development services, including training and consultancy, and establishing the necessary support structure for small businesses to thrive. CEFÉ is important because it forms part of a national grouping of NGOs operating with a broader stakeholder group comprising major national players, including government organizations and public funding sources, national and international, private businesses (large and small), professional service companies, local and regional government, business representative organisations, and the media. Thus, it is in a position to broker a wide range of services.

Gibb and Adkihary (2000) chose the CEFÉ Network to study because, since its inception in 1995, it had successfully met a number of challenges, including the need to deliver services over a broad geographic area by focusing on local need and underpinning sustainability. As a result, it had been successful in helping its member NGOs to distribute resources and provide training, while developing a more standardised range of services that allowed them to mesh better with national priorities. By studying their experience, Gibb and Adkihary aimed to identify and promote new forms of partnerships and governance that could be used to assist the development of small and medium enterprises (SMEs) more generally.

They found that NGOs can play an important role in this type of activity because they are essentially bottom-up organizations which are more likely to be embedded in their communities and are thereby more likely to reflect local needs. Not only that, but they also have the ability to act as brokers, capable of connecting those communities to the support networks that can provide them with the access to external expertise and the resources they require to meet their needs. In this way, they can act to identify the local needs and close structural holes.

Gibb and Adkihary also recognised that NGOs are not without potential problems, though they are intrinsically connected with their strengths.

For example, NGOs often have a weak resource base, and as a result, can fall into the trap of expending their energies on chasing funding to ensure their continued existence rather than on fulfilling local needs. By focusing more on the requirements of their funding bodies, they react more to supplier needs rather than those of the community they seek to serve. Another potential problem is that, because of their commitment to meeting local needs, they may find it difficult to standardize service delivery by harming their ability to fit into national networks and to align with national priorities.

Gibb and Adkihary observed that, to be successful in helping their communities, NGOs must develop strategies to neutralise those problems. To that end, they proposed a Stakeholder Assessment Model (SAM) of NGO effectiveness, based on a series of key evaluation questions, including:

- To what degree the overall focus of the NGO on meeting the needs of the stakeholders?
- How well is the NGO known by the stakeholders?
- How clear is the mission/objectives of the NGO to the stakeholders?
- How well is the NGO perceived by the stakeholders to be meeting its objectives?
- To what extent does the NGO undertake joint ventures in partnership with stakeholders?
- Are these initiatives perceived as being successful? (Gibb & Adkihary, 2000, p. 145)

The model as developed, focuses on the requirements of NGOs as organizations at the center of stakeholder networks that need a clear understanding of their own missions and the needs of their various stakeholders. Gibb and Adkihary observed further that, if used correctly, the model can not only ensure a focus on client needs, but also can help in setting management objectives by contributing to NGO sustainability.

The study concluded by reporting that the CEFÉ Network was continuing to deliver success-

ful programs and gain greater acceptance from government. By increasing its range of strategic alliances, it was also improving its ability to broker new services. Gibb and Adkihary's (2000) examination of the CEFE network demonstrates that, despite the potential problems, NGOs that focus on the issues identified in their SAM model can successfully act to facilitate network development and achieve the mutual support that derives from bringing local groups and external stakeholder communities together.

FUTURE TRENDS

International agencies that are involved in development projects, for example the World Bank, are including social capital measurements in their analyses and are starting to acknowledge the role of social factors in their strategies for systems development (UNDP, 2001). Significant research is being undertaken in the areas of technology diffusion, social capital and network analysis. However, despite the examples provided in this chapter, much of it relates to the role of business and the corporate world, which are generally seen as the most important drivers of economic growth. Furthermore, much of the work in regional areas is actually undertaken through the agency of NGOs, and therefore, there needs to be more intensive research into characteristics, role, and operating culture of NGOs.

This is particularly important in developing countries and there are a growing number of organizations working to explore those issues, for example, the research being undertaken by the Institute for Development Policy and Management at Manchester University, which focuses on policy formulation and implementation, and organisational design (Baark & Heeks, 1998; Madon, 2000). The emergent field of community informatics is also making a strong contribution in this context. For example, two recent conferences focusing on technology for development,

and framing the issues in terms of sustainability and the social appropriation of technology, are of special relevance to the issues raised in this chapter (Erwin, Taylor, Bytheway, & Strumpfer, 2005; Johanson & Stillman, 2004).

CONCLUSION

The projects discussed in this chapter demonstrate that an over-emphasis on technology and technology-based services, and their development in isolation from the communities that they are intended to serve, will not lead to successful and sustainable outcomes. Successful, sustainable projects are the result of a careful interplay of controlled variables, many of which may need to go through a complex iterative process based on changing stages of organizational culture. Projects targeted at rural and regional communities must address the real needs of the communities they aim to serve. That requires not only long term commitment and strategic funding, but also, meaningful participation and proper consideration of all influences within and between the affected communities.

This chapter has used a framework provided by the diffusion of innovation within a network environment to highlight how necessary resources can be provided to make such developments a sustainable reality. Successful, sustainable projects require access to a complex infrastructure maintained by a range of stakeholders. Network relationships are essential in both the development and maintenance of such infrastructure because they provide access to new ideas and innovations, strategic advice, training, technical support, and a host of other resources. While some of these resources, such as access to new ideas, typically should continue to be provided through extended networks, successful and sustainable projects require a localized infrastructure capable of localizing and harnessing resources in a trusted environment. Specifically, it is important to recognise

this sort of support network in rural and regional areas, and even more so in developing countries, because it is precisely these network structures that they lack.

The case studies examined, particularly those of Johanson et al. (2004) and Gibb and Adkinary (2000), highlight the fact that those networks are often brokered through the agency of NGOs, who provide access to contacts and resources that would otherwise be inaccessible to local communities. And while it could be argued that broad networks could be established without NGOs, the case studies emphasise that their importance derives from the fact that they are more often embedded within their communities, so that they can make use of existing trust systems and local links to identify and close structural holes which would otherwise deny those communities access to much needed resources and expertise.

ACKNOWLEDGMENT

This chapter is based on research supported by the Australian Research Council.

REFERENCES

- Aldrich, H., & Zimmer, C. (1986). Entrepreneurship through social networks. In D. Sexton & R. Smilor (Eds.), *Art and science of entrepreneurship*, 3-23. Cambridge, MA: Ballinger,
- Baark, E., & Heeks, R. (1998). Evaluation of donor-funded information technology projects in China: A lifecycle approach. *Development informatics working chapter series*. Manchester: Institute for Development Policy and Management, University of Manchester.
- Barratt, M., Sahay, S., & Walsham, G. (2001) Information technology and social transformation: GIS for forestry management in India. *The Information Society*, 17, 5-20.
- Bebbington, A. (1997). Social capital and rural intensification: Local organizations and islands of sustainability in the rural Andes. *The Geographical Journal*, 163(2), 189-197.
- Burt, R. (2000). The network structure of social capital. *Research in Organizational Behavior*, 22, 345-423.
- Coleman, J. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, 94, S95-S120.
- Erwin, G., Taylor, W., Bytheway, A., & Strumpfer, C. (Eds.). (2005, August 23-26). CIRN2005: *The Second Annual Conference of the Community Informatics Research Network, Cape Town, South Africa*.
- Furst, D., Schubert, H., Rudolph, A., & Spieckermann, H. (2001). Regional actor networks between social capital and regional governance. *Connections*, 24(1), 42-67.
- Garrison, B. (2001). Diffusion of online information technologies in newspaper newsrooms. *Journalism*, 2(2), 221-239.
- Gibb, A., & Adhikary, D. (2000). Strategies for local and regional NGO development: Combining sustainable outcomes with sustainable organizations. *Entrepreneurship & Regional Development*, 12, 137-161.
- Giddens, A. (1990). *The consequences of modernity*. Cambridge: Polity Press.
- Giddens, A. (1991). *Modernity and self-identity: Self and society in the late modern age*. Cambridge: Polity Press.
- Granovetter, S. (1973). The strength of weak ties. *The American Journal of Sociology*, 78(6), 1360-1380.
- Grover, V., & Teng, J. (1992) An examination of DBMS adoption and success in American organizations. *Information Management*, 23(5), 239-248.

- Hakansson, H. (1990). Technological collaboration in industrial networks. *European Management Journal*, 8(3), 371-379.
- Heeks, R. (2002) Information systems and developing countries: Failure, success, and local improvisations. *The Information Society*, 18(2), 101-112.
- Johanson, G., Denison, T., & Otis, N. (2004, September 29-October 1). Building sustainable learning communities in Vietnam. In G. Johanson & L. Stillman (Eds.), *Sustainability and community technology: What does this mean for community informatics?* Monash Prato Colloquium, Prato, Italy. Available at <http://www.ccnr.net/?q=node/5>. Accessed Jan. 30, 2006
- Johanson, G., & Stillman, L. (Eds.). (2004, September 29-October 1). *Sustainability and community technology: What does this mean for community informatics?* Monash Prato Colloquium, Prato, Italy.
- Kadushin, C. (2002) The motivational foundation of social networks. *Social Networks*, 24, 77-91.
- Keil, M., Cule, P., Lyytinen, K., & Schmidt, R. (1998). A framework for identifying software project risks. *Communications of the ACM*, 41(11), 76-83.
- Kling, R. (2000) Learning about information technologies and social change: The contribution of social informatics. *The Information Society*, 16, 217-232.
- Lyytinen, K., & Hirschheim, R. (1987). Information Systems failures – A survey and classification of the empirical literature. *Oxford Surveys in Information Technology*, 4, 257-309.
- Lyytinen, K., & Robey, D. (1999). Learning failure in information systems development. *Information Systems Journal*, 9(2), 85-101.
- Madon, S. (2000). International NGOs: Networking, information flows and learning. *Development informatics working chapter series*. Manchester: Institute for Development Policy and Management, University of Manchester.
- Orlikowski, W. (2000). Using technology and constituting structures: A practice lens for studying technology in organisations. *Organization Science*, 11(4), 404-428.
- Rogers, E. (1995). *Diffusion of innovations* (4th ed.). New York: The Free Press.
- Rogers, E. (2003). *Diffusion of innovations* (5th ed.). New York: The Free Press.
- Schmidt, R., Lyytinen, K., Keil, M., & Cule, P. (2001) Identifying software project risks: An international Delphi study. *Journal of Management Information Systems*, 17(4), 5-36.
- Sherry, L. (1998). An integrated technology adoption and diffusion model. *International Journal of Educational Telecommunications*, 4(2/3), 113-145.
- Steward, F., & Conway, S. (2000). Building networks for innovation diffusion in Europe: Learning from the SPRINT Programme. *Enterprise and Innovation Management Studies*, 1(3), 281-301.
- Terziovski, M., & Howell, A. (2001). *e-Commerce best practice: A review of the Victorian e-Commerce early movers* (VEEM) scheme in Victorian local councils. Report prepared for Multimedia Victoria, State and Regional Development.
- UNDP. (2001). Information communications technology for development. *Essentials*, 5. Available at http://www.undp.org/eo/documents/essentials_5.PDF. Accessed Jan. 30, 2006.
- Valente, T. (1995). *Network models of the diffusion of innovations*. Cresskill, NJ: Hampton Press.
- Valente, T. (2005). Models and methods for innovation diffusion. In P. Carrington, J. Scott, & S. Wasserman (Eds.), *Models and methods in social network analysis*. Cambridge: Cambridge University Press.

Wellman, B. (1988). Structural analysis: From method and metaphor to theory and substance. In B. Wellman & S. Berkowitz (Eds.), *Social structures: A network approach* (pp. 19-61). Cambridge: Cambridge University Press.

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 102-120, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.21

Digital Divide: A Glance at the Problem in Moldova

Liudmila Burtseva

Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova

Svetlana Cojocaru

Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova

Constantin Gaidric

Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova

Galina Magariu

Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova

Tatiana Verlan

Academy of Sciences of Moldova Institute of Mathematics and Computer Science, Moldova

ABSTRACT

In this chapter, we want to state shortly the basic components and manifestations of the digital-divide problem, as well as the ways of its solution in a specific country with its specific regional, social, historical, and political features. Moldova is taken as such a country. The problem is interesting to consider in the example of such a country because it is especially manifested in countries of such type: those that are waking up to development and are limited in means.

INTRODUCTION

“The love for one’s country impels and imperiously dictates to everyone, who intends to describe the customs of one’s nation, to praise the nation, to which he belongs by birth, and to laud the population of the country which gave him birth (generally speaking, not many strangers know the customs of moldovan people). On the other hand, the love for truth hinders and forbids praising of what is to be condemned upon a fair balance. It will be more useful for country if we will not hide

from its citizens' eyes the shortcomings, which are current among them in abundance..."

(Demetrii Cantemirii,
"Descriptio Antiqui et Hodierni
Status Moldaviae," Petropoli, 1727)

No problem could be explained if we speak only about a problem in general. When putting forward some general conclusions and discussions, one should always examine them with concrete examples. In real life, the problem is manifested by concrete facts, at a concrete place and at a concrete time.

In the previous chapter, we examined basic statements of the digital-divide problem: a short history, the situation in the world, and basic manifestations and approaches to its solution that the world community undertakes and recommends. These discussions were illustrated by some examples from the history of different countries. In the present chapter, the authors base their arguments on the judgments and conclusions stated in their chapter for the examination of the digital-divide problem, and give possible ways to its solution in a specific country. Moldova is chosen as such a country.

Moldova is a country that just now became aware of the necessity to create the information society. Though scientists of the country have told about this for more than 10 years, extreme poverty and instability did not allow people to even think about any purposeful actions in spite of having a comparatively good infrastructure. The concrete, real steps have been started only since the year 2003, although the corresponding rhetoric sounded in different documents and speeches earlier.

The chapter describes the economic situation in the Republic of Moldova (RM) as one of the countries with strongly pronounced symptoms of the digital divide, and describes Moldova's steps in the creation of the information society and the problems that it faces. The chapter shows the degree of the complexity of the digital-divide

problem in this country, and what priorities and difficulties occur.

Naturally, national peculiarities are present in Moldova as in any other country. This is not just a type, but a real country. The authors have no pretension about Moldova's oneness, but want to emphasize only that every country, when resolving the digital-divide problem, should take into consideration general statements and the country's individuality as well. In the course of the whole chapter, the authors compare Moldova with other countries by all measured and available indices.

The situation in Moldova is considered in the context of other countries, namely, its direct neighbors (Romania, Ukraine) and a set of other countries from the former socialist camp and that are just passing or has just passed through the phase of transition from planned to market economies (Estonia, Slovakia, Slovenia, etc). Certainly, the analysis includes also those countries in which the solution of the digital-divide problem can serve as a guiding line for ones just starting the problem solving.

On the basis of this analysis, the complex actions that, in the authors' opinion, can provide the solution of the problem in Moldova are offered.

MOLDOVA'S E-PLACE IN THE WORLD

For more precise understanding of manifestations of the digital-divide problem (in particular, the domestic one) and ways of its overcoming, it is useful to consider it with an example of a specific country. Most sharply, this problem is manifested and more difficult to be tackled in poor countries with a prevailing agricultural population. An example of such a country is Moldova, the small (with an area of 338,000 km²), poor, agrarian country located in the southeast part of Europe, with its capital Chisinau (see Figure 1). Moldova, formerly part of the Soviet Union, now belongs to

Digital Divide

Table 1. E-readiness, population, and GDP per capita for range of countries (Source: Table is made by the authors of this chapter using data from ASPA & UNDPEPA, 2002; GEOHIVE: Global Statistics, n.d.; UN, 2003)

| Country | 2001 | | 2003 | | | |
|------------------------|-------------|---------------------|-----------------------|----------------------------|---------------------------------|--------------------------------|
| | E-Gov Index | Rank of E-Readiness | E-Gov Readiness Index | Population Total (million) | Urban Population (% from total) | GDP per Capita (thousand \$US) |
| USA | 3.11 | 1 | 0.927 | 294.04 | 80.1 | 37.007 |
| Australia | 2.60 | 3 | 0.831 | 19.73 | 92 | 26.273 |
| Norway | 2.55 | 7 | 0.778 | 4.53 | 78.6 | 48.881 |
| United Kingdom | 2.52 | 5 | 0.814 | 59.25 | 89.1 | 30.293 |
| Netherlands | 2.51 | 11 | 0.746 | 16.15 | 65.8 | 31.677 |
| Denmark | 2.47 | 4 | 0.820 | 5.36 | 85.3 | 39.599 |
| Sweden | 2.45 | 2 | 0.840 | 8.88 | 83.4 | 33.888 |
| Spain | 2.30 | 29 | 0.602 | 41.06 | 76.5 | 20.363 |
| Estonia | 2.05 | 16 | 0.697 | 0.96 | 69.4 | 8.739 |
| Russian Federation | 1.89 | 58 | 0.443 | 143.25 | 73.3 | 3.026 |
| Ukraine | 1.80 | 54 | 0.462 | 48.52 | 67.2 | 1.021 |
| Slovakia | 1.71 | 40 | 0.528 | 5.40 | 57.4 | 5.899 |
| Slovenia | 1.66 | 28 | 0.631 | 1.98 | 50.8 | 13.247 |
| Romania | 1.63 | 50 | 0.483 | 22.33 | 54.5 | 2.703 |
| Azerbaijan | 1.30 | 94 | 0.364 | 8.37 | 50 | 0.851 |
| Moldova, Rep. of | 1.29 | 95 | 0.363 | 4.27 | 46 | 0.460 |
| Honduras | 1.20 | 124 | 0.280 | 6.94 | 45.6 | 1.005 |
| Guatemala | 1.17 | 109 | 0.329 | 12.35 | 46.3 | 2.003 |
| Kyrgyzstan | 1.01 | 110 | 0.327 | 5.14 | 33.9 | 0.338 |
| Kenya | 0.90 | 118 | 0.299 | 31.99 | 39.4 | 0.433 |
| Madagascar | 0.79 | 144 | 0.229 | 17.40 | 26.5 | 0.314 |
| Sierra Leone | 0.68 | 167 | 0.126 | 4.97 | 38.8 | 0.160 |
| Ethiopia | 0.57 | 166 | 0.128 | 70.68 | 15.6 | 0.094 |
| Bosnia and Herzegovina | - | 115 | 0.309 | 4.16 | 44.3 | 1.673 |
| Albania | - | 114 | 0.311 | 3.17 | 43.8 | 1.934 |
| Liechtenstein | - | 154 | 0.178 | 0.03 | 21.6 | - |
| Papua New Guinea | - | 136 | 0.250 | 5.71 | 13.2 | 0.594 |

Table 2. Population and Internet-usage data for range of countries for year 2005 (Source: The Table uses the data from Internet World Stats, 2005)

| Country | 2005 | | | | | |
|---------------------------|--------------------------------------|----------------------------------|--|---|--|-----------------------|
| | Population (million) 2005 est. | Popu- lation % of World | Internet Usage (million) Latest Data | Usage Growth (%) 2000- 2005 | Popu- lation Pene- tration (%) | World Users (%) |
| USA | 296.21 | 4.61 | 202.89 | 112.8 | 68.5 | 21.614 |
| Sweden | 9.04 | 0.14 | 6.66 | 64.4 | 73.6 | 0.709 |
| Australia | 20.51 | 0.32 | 13.78 | 108.9 | 67.2 | 1.468 |
| Denmark | 5.41 | 0.08 | 3.72 | 90.8 | 68.7 | 0.396 |
| United Kingdom | 59.89 | 0.93 | 35.81 | 132.5 | 59.8 | 3.815 |
| Norway | 4.61 | 0.07 | 3.14 | 42.7 | 68.2 | 0.335 |
| Netherlands | 16.32 | 0.25 | 10.81 | 177.1 | 66.2 | 1.151 |
| Estonia | 1.34 | 0.02 | 0.62 | 69.4 | 46.2 | 0.066 |
| Slovenia | 1.96 | 0.03 | 0.93 | 210.0 | 47.5 | 0.099 |
| Spain | 43.44 | 0.68 | 15.57 | 188.9 | 35.8 | 1.658 |
| Slovakia | 5.38 | 0.08 | 1.82 | 180.0 | 33.8 | 0.194 |
| Romania | 21.38 | 0.33 | 4.94 | 517.5 | 23.1 | 0.526 |
| Ukraine | 46.66 | 0.73 | 5.28 | 1305.0 | 11.3 | 0.562 |
| Russian Federation | 144.00 | 2.24 | 22.30 | 619.4 | 15.5 | 2.376 |
| Azerbaijan | 8.33 | 0.13 | 0.30 | 2400.0 | 3.6 | 0.032 |
| Moldova, Rep. of | 3.90 | 0.06 | 0.29 ^a | 1052.0 | 7.4 | 0.031 |
| Guatemala | 12.33 | 0.19 | 0.40 | 515.4 | 3.2 | 0.043 |
| Kyrgyzstan | 5.31 | 0.08 | 0.20 | 287.6 | 3.8 | 0.021 |
| Albania | 3.09 | 0.05 | 0.03 | 1100.0 | 1.0 | 0.003 |
| Bosnia and Herzegovina | 4.45 | 0.07 | 0.10 | 1328.6 | 2.2 | 0.011 |
| Kenya | 33.39 | 0.52 | 0.50 | 150.0 | 1.5 | 0.053 |
| Honduras | 6.57 | 0.10 | 0.27 | 580.0 | 4.1 | 0.029 |
| Papua New Guinea | 5.85 | 0.09 | 0.07 | -44.4 | 1.3 | 0.008 |
| Madagascar | 17.96 | 0.28 | 0.07 | 135.0 | 0.4 | 0.008 |
| Liechtenstein | 0.03 | 0.00 | 0.02 | 122.2 | 57.3 | 0.002 |
| Ethiopia | 70.60 | 1.10 | 0.10 | 900.0 | 0.1 | 0.011 |
| Sierra Leone | 5.03 | 0.08 | 0.02 | 300.0 | 0.4 | 0.002 |

Digital Divide

a group of underdeveloped countries. According to the preliminary data of the population census from 2004, the population of the country is 3.386 million inhabitants (Biroul National de Statistica [BNS], 2005b). According to the state's official statistical data (BNS, 2005a), the urban population makes up 38.6% of the total population, and rural population makes up 61.4%; the gross domestic product (GDP) per capita has grown from \$458 in 2002 up to \$719 in 2004.

Let us consider Moldova among other countries according to Web presence and e-readiness. The world community carried out the huge amount of work on the development of methods and the calculation of parameters. For the definition of Moldova's place in the world, the authors of the chapter, in their analytical study (Burtseva, Cojocar, Gaidric, Magariu, & Verlan, 2004b) made for the United Nations Development Program (UNDP), had based their data on two international analytical reports:

- A UN report (American Society for Public Administration & United Nations Division

for Public Economics and Public Administration [ASPA & UNDPEPA], 2002) on the basis of 2001 data

- A review (UN, 2003) made by the Department of Economic and Social Affairs of the United Nations (on the basis of 2003 data)

In 2001, a statistical analysis was done comparing the ICT infrastructure and human-capital capacity for 144 out of 190 UN member states. One hundred forty-three countries from them were listed as using the Internet in some capacity. In 2003, the coverage was expanded to include all UN member states. Only 173 out of 191 member states had a Web-site presence. In both surveys, an assessment of the e-government index was done. Different methodologies were used for this index calculation, but each of them takes into account such important indices as Web-presence measure, infrastructure measure, and human-capital measure, which in their turn are calculated on the basis of several other characteristics. In the 2003 survey, the rank of the e-government index and Web-presence measure were determined for each of the 173 assessed countries.

Figure 1. Moldova's geographical position



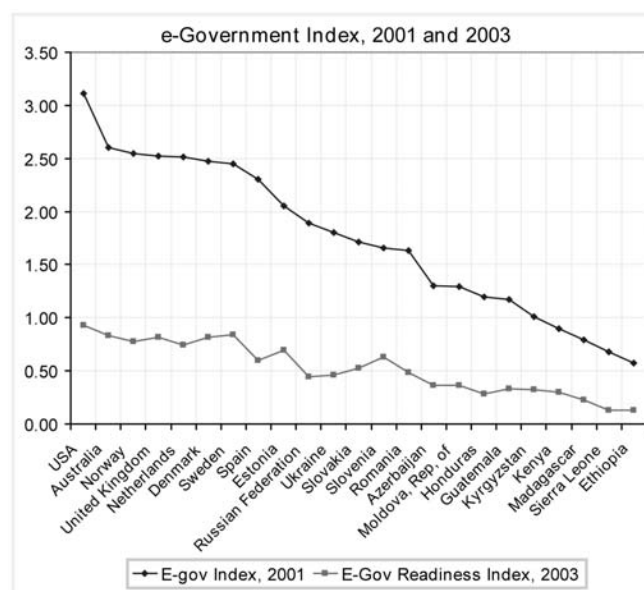
Thus, the e-readiness index (readiness of the countries for transition to e-governance) allows one to estimate in any measure the degree of the use of ICT in the country, and hence to judge about the digital divide between countries. For comparison, the authors chose the following categories of countries:

- Those with the highest values of the e-readiness index (USA, Australia, Norway, United Kingdom, Netherlands, Denmark, Sweden, Spain)
- Geographical neighbors of Moldova, and countries from the former USSR and from the former socialist community (Estonia, Russian Federation, Ukraine, Romania, Azerbaijan, Kyrgyzstan, Slovakia, Slovenia)
- Agrarian countries, where the percent of the rural population is close to (or lower than) the Figure in Moldova (Bosnia and Herzegovina,¹ Albania,¹ Honduras, Guatemala,

Kenya, Madagascar, Sierra Leone, Ethiopia, Liechtenstein,¹ Papua New Guinea¹)

- Table 1 contains the following information about the chosen countries.
- E-readiness index values for 2001 (ASPA & UNDPEPA, 2002) and for 2003 (UN, 2003), which allow one to judge about the degree of ICT use in the country
- Population number for 2003 (GEOHIVE: Global Statistics, n.d.), which allows us to judge about the size of the country
- Percent of urban population for 2003 (GEOHIVE: Global Statistics, n.d.), which characterizes the degree of the rurality of the country
- GDP per capita in U.S. dollars in 2003 (GEOHIVE: Global Statistics, n.d.), which allows one to judge about the level of well-being or the degree of poverty in the country
- Note that because the year 2003 is the latest one for which data on e-readiness are avail-

Figure 2. Comparison of e-government indices for the years 2001 and 2003 (Source: Diagram is made by the authors of this chapter data from the UN reports: ASPA & UNDPEPA 2002 & UN 2003)



able, the rest of the data in Table 1 were also from this year. To carry out the comparison² on the basis of the latest data (year 2005), we took the Internet-users penetration index—the percent of the country’s population that use the Internet (see Table 2)—for the same country range as in Table 1.

In Table 1, countries are ordered according to the decrease of the 2001 e-government index so that by the position of the country in that list, we are able to judge about the digital divide between chosen countries.

In 2001 and 2003, calculations were made by using different methods, and therefore absolute values of these indices are incomparable. However, one may observe the ratios of values of each country to the values of others and how these ratios evolved (see Figure 2).

One may notice the progress of Australia, Norway, Great Britain, Holland, Denmark, and Sweden, which came close to the United States. It means that the digital divide between them and the United States decreased. Estonia made

considerable progress. Slovakia, Slovenia, and Romania also progressed. Moldova and Azerbaijan remained at the same low level and did not change their positions relative to the other countries. Their ranks in 2003 were correspondingly 95 and 94. They remain amongst the countries for which the digital divide is the largest as compared with leading countries.

The global e-government reports (West, 2001, 2002, 2003, 2004, 2005) present annual results on global e-government: the delivery of public-sector information and online services through the Internet. In Figure 3 we show the e-government rank orderings gathered from all these reports for the chosen range of countries.

It is necessary to note once more that the absolute values for different years for the same country are not comparable and not indicative. However, they are indicative of the correlation between countries for one year. So, Moldova in 2001 was situated among lagging countries and occupied the 155th place with an e-government rank value equal to 21.6. Only Azerbaijan came after Moldova in the selected range of countries.

Figure 3. E-government ranks for the range of countries (Source: Digram is made by the authors of this chapter using data from the reports for the Center for Public Policy by Darrell M. West 2001-2005)

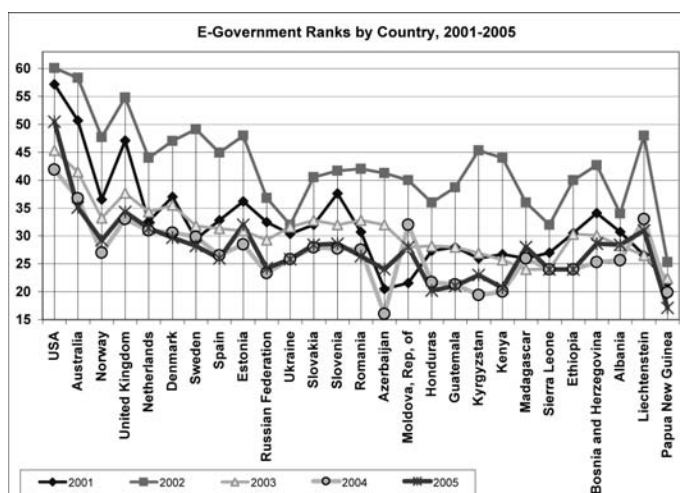


Figure 4. Comparison of levels of urban population and GDP per capita for the range of countries (Source: Diagram is made by the authors of this chapter using data from the Web site GEOHIVE: Global Statistics, n.d.)

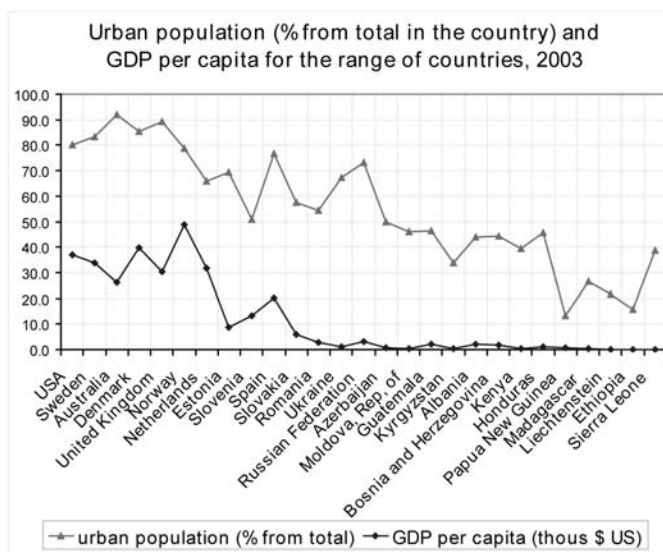
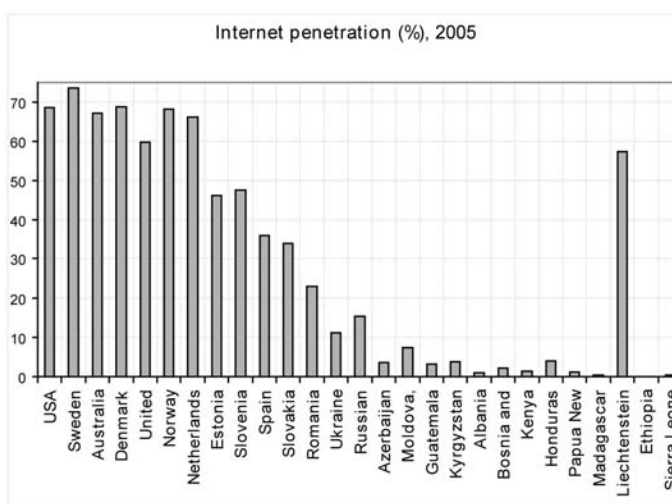


Figure 5. Percentage of Internet users in a country's population for the range of countries (Source: Diagram is made by the authors of this chapter using data from the Web site Internet World Stats, 2005)



Digital Divide

In 2002, Moldova occupied the 105th place with an e-government rank value equal to 40.0. Then, nine countries from the selected range came after Moldova. In 2003, Moldova came out at the 62nd place, in 2004 at 21st place, and in 2005 it was at the 61st place. The abrupt improvement in 2004 is evidence not so much of abrupt development acceleration in Moldova as it is of slackening speed in other countries (if we exclude the possibility of the inaccuracy of the data on the basis of which the calculations were made). The fact that the results for the years of 2003 and 2005 are close confirms this conclusion.

Now we shall compare the e-government index (that is, the degree of ICT use) with the percent of the urban population and with the GDP per capita of the countries.³ Since the data for this comparison are for 2003, it is logical to arrange the countries in decreasing order of e-government index for 2003 (see Figure 4).

One can precisely trace the following dependence: The percent of the urban population and the GDP per capita in the countries with a high degree of ICT use are higher, and vice versa. Consequently, the resulted Figures confirm that the degree of the digital divide is influenced both by the ratio of the city population to the rural one, and by the country's standard of living. Moldova, with its poverty and high percent of rural population,⁴ alongside other agrarian countries, is at the end of this spectrum.

There are some slight (and quite explainable) deviations from the described tendency. For example, Estonia and Slovenia, by their position in the list of chosen countries, possess high-enough values of the e-government index with a rather low percent of urban population and a low GDP per capita. Slovakia and Romania, with lower percents of urban population than Ukraine and Russia have (and approximately identical GDP per

Figure 6. Comparison of Internet-usage growth for the range of countries for the period 2000-2005 (Source: Diagram is made by the authors of this chapter using data from the Web site Internt World Stats, 2005)

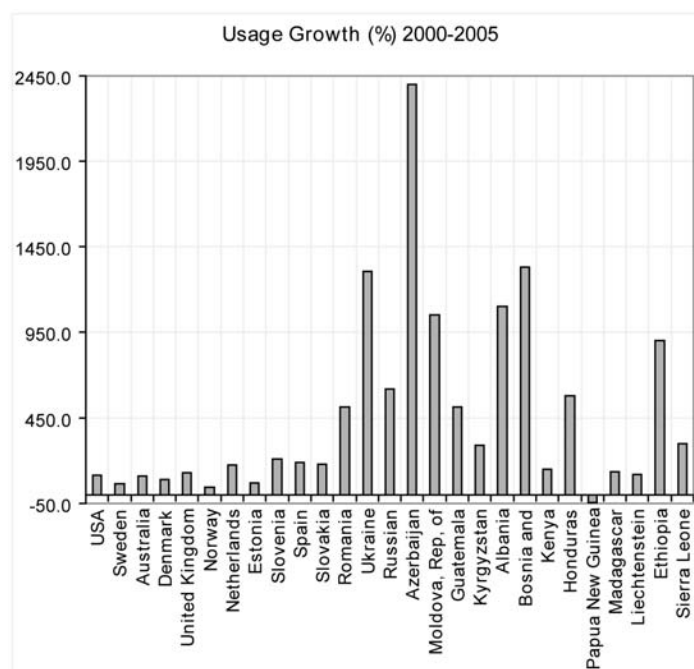


Table 3. General socioeconomic data of Moldova (Source: The Table is made by the authors of this chapter using data from official reports, DSSRM, 2004; BNS, 2005a)

| Type of Data | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Total Area (thousand km ²) | 33.8 | | | | | | |
| Number of Population ^a (million inhabitants) | 3.6493 | 3.6435 | 3.6345 | 3.6272 | 3.6177 | 3.6068 | 3.3860 |
| Population of Urban/Rural (in % of the total) | 42.0/58.0 | 42.0/58.0 | 41.3/58.7 | 41.4/58.6 | 41.4/58.6 | 41.4/58.6 | 38.7/61.3 |
| GDP (million \$US, current prices) | 1170.83 | 1288.46 | 1480.71 | 1661.83 | 1957.81 | 2595.00 | - |
| Indices of GDP (previous year = 100) | 96.6 | 102.1 | 106.1 | 107.8 | 106.6 | 107.3 | - |
| Economically Inactive Population (in % of the total) | 53.9 | 54.6 | 55.6 | 55.5 | 59.2 | 60.3 | - |

Note: ^aData from the official annual report for year 2004 (DSSRM, 2004) are the result of recalculation by the methodology applicable in the periods between population censuses.

capita), possess higher values of the e-government index. As to Moldova, its place according to the value of the e-government index corresponds to its percent of urban population among the chosen countries. If we analyze the parity of the values of GDP per capita, we see several countries with lower e-government index values but with higher values of GDP per capita: Guatemala, Albania, Bosnia and Herzegovina, Honduras, and Papua New Guinea.

These examples and deviations show that agrarianism and the poverty of the country are not unique factors that determine the digital divide.

Figure 5 helps to draw the conclusion: The rank of the countries based on Internet penetration in 2005 basically meets the same order (the decrease of the e-government index value for 2003) with some exceptions. The obvious exception represents Liechtenstein: For its number of Internet

users in 2005, this country takes an essentially higher place than the one for its e-government index value in 2003. Some of the less advanced countries have made a greater step forward than more advanced countries. Moldova is among them, too. This proves to be true also by the data on Internet growth as shown in Figure 6. In several less developed countries, the number of Internet users has increased during 5 years by more than 1,000%, including Moldova (1,052%). With that, the index of Internet penetration in Moldova is still very low. Compare the 7.4% in Moldova with the 68.5% in the USA, the 35.5% in Europe, and the 13.9% in the whole world; the index value of usage growth is equal to 1,052% in Moldova, 112.8% in the USA, 151.9% in Europe, and 146.2% in the whole world.

Having considered the position of Moldova among other countries, we shall examine the

Digital Divide

dynamics of the parameters influencing the digital divide in Moldova, its current condition relative to the digital divide inside the country, what was undertaken, and what is necessary to undertake for overcoming the digital divide. In the beginning, we shall consider the dynamics of the basic socioeconomic indices during the last few years.

THE GENERAL SOCIO-ECONOMIC DATA OF MOLDOVA

The general socioeconomic data of Moldova from official reports (BNS, 2005a; Departamentul Statistica si Sociologie al Republicii Moldova [DSSRM], 2004) are presented in Table 3.

Figure 7. Distribution of employment by economic activities in Moldova (Source: Diagram is made by the authors for this chapter using data from official reports of DSSRM 2004; BNS 2005a)

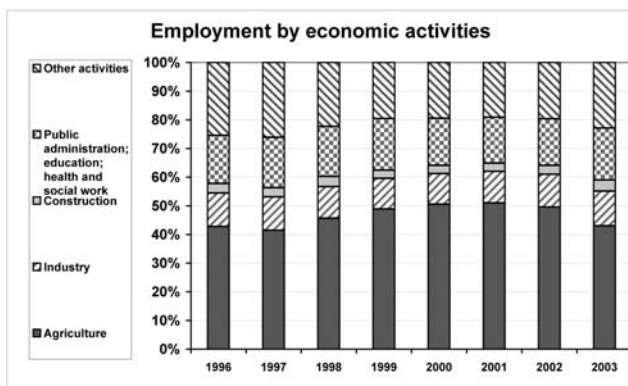
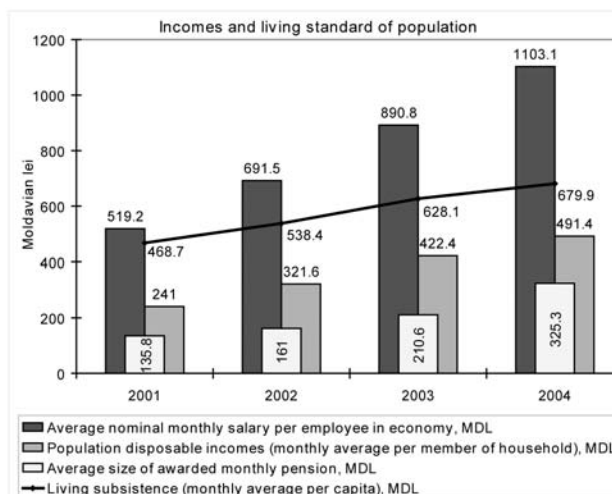


Figure 8. Incomes and living standards of the population in Moldova (Source: Diagram is made by the authors of this chapter using data from official reports of DSSRM 2004; BNS 2005a)



The data show that Moldova's population is rural to a great extent (61.3%), and the percent of the rural population in the country is growing. The same tendency is true for a number of economically inactive populations. The indices of GDP are slightly growing from year to year, but it is most likely due to inflation. The level of living standard has grown a little, too. Nevertheless, as the data in Table 1 show, the GDP per capita in Moldova is very low.

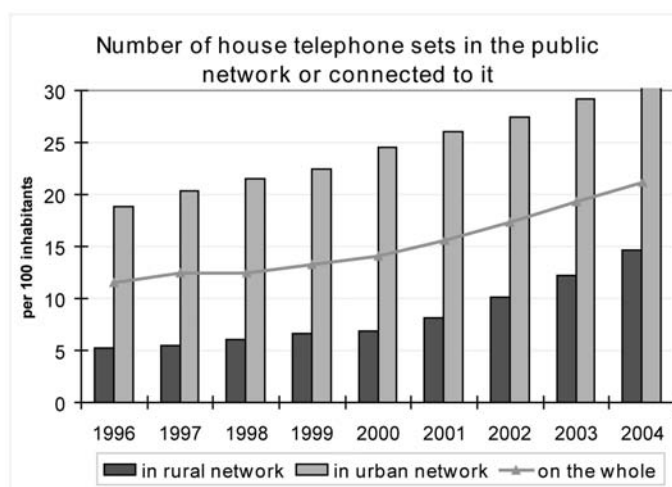
Regarding the employed part of the population, one can see that the rate of the agricultural sector is dominant (see Figure 7).

The comparison of population incomes and its living subsistence also bears eloquent evidence of the population's poverty. The corresponding data are presented in Figure 8. The monthly average per member of a household (not to mention the average size of awarded monthly pension) is essentially lower than the living subsistence.

Table 4. Telephone means for public use (Source: The Table is made by the authors of this chapter using data from official reports, BNS, 2005a; DSSRM, 2004)

| Type of Data | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Number of House Telephone Sets in Public Network or Connected to It (per 100 inhabitants total) | 11.5 | 12.4 | 12.5 | 13.3 | 14.1 | 15.6 | 17.3 | 19.3 | 21.2 |
| In Urban Network | 18.8 | 20.4 | 21.5 | 22.5 | 24.5 | 26.1 | 27.5 | 29.2 | 30.3 |
| In Rural Network | 5.2 | 5.5 | 6.0 | 6.6 | 6.9 | 8.1 | 10.1 | 12.2 | 14.7 |
| % Rural of Urban | 27.66 | 26.96 | 27.91 | 29.33 | 28.16 | 31.03 | 36.73 | 41.78 | 48.51 |

Figure 9. Rural-area and urban-area provision of common telephone connection in Moldova (Source: Diagram is made by the authors if this chapter using data from official reports of DSSRM 2004; BNS 2005a)



Digital Divide

When estimating the cited data, it is necessary to take into account the situation in the country. For example, part of the population illegally works outside the country, and this number is beyond all calculation. People leave their native places in search of jobs for which they can earn some money to keep their families in Moldova. Offi-

cially, this part consists of 366,000 inhabitants, but according to independent experts' estimations, it includes about 1.3 to 1.6 million inhabitants who in 2004 transferred to the country approximately \$970 million. So, not all statistical data are present, and those we have are not always absolutely authentic. The data from different sources do not

Figure 10. Nonuniformity of access to Internet in settlements of Moldova (Source: Data is given by the Department of Informational Technologies of Moldova. This data is collected from economical agents only.)

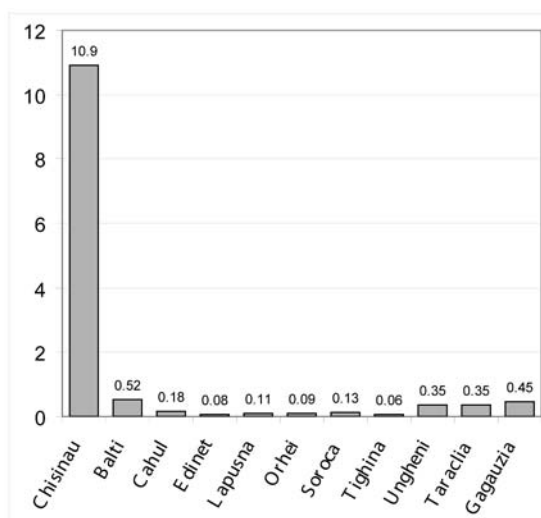


Figure 11. Ratio of provision of telephone sets in rural areas to this provision in urban areas of Moldova (Source: Diagram is made by the authors of this chapter using data from official reports of DSSRM 2004; 2005a)

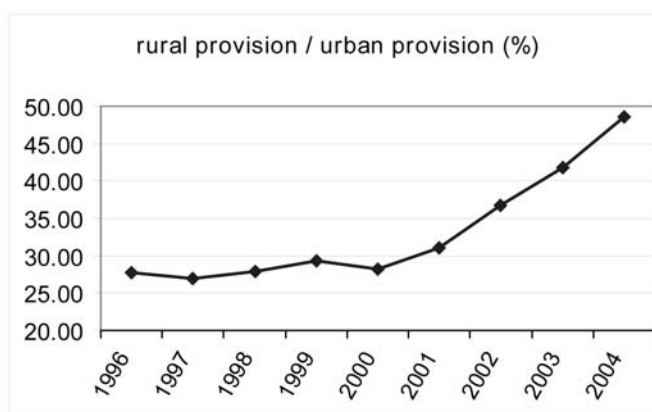


Figure 12. Density of mobile-telephone communication (Source: Data is taken from Annual Report 2004; NRATI 2005)

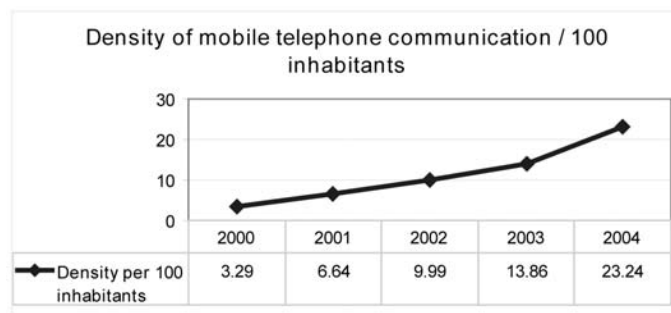
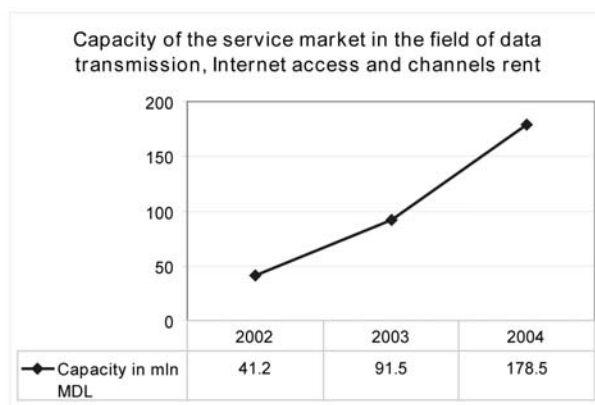


Figure 13. Capacity of service market in the field of data transmission, Internet access, and channel renting (Source: Data is from Annual report 2004; NRATI 2005)



always coincide. Inside the country, the regular gathering and processing of statistical data on all parameters and techniques accepted in the world is not adjusted yet. Nevertheless, the data we have help us to track the tendency and ratio of the parameters we are interested in.

These factors, along with others, constitute the serious obstacles in the way of the implementation of ideas about the information society in Moldova.

DOMESTIC DIGITAL DIVIDE IN MOLDOVA BY FIGURES

Table 4 presents the data about the number of house telephone sets in the public network disaggregated by the urban area and the rural one for the period from 1996 to 2004. These data show that during this period of time, the provision of the rural area with common telephone connection is much less than it is in the urban one (see Figure 9).

Digital Divide

Figure 14. Number of providers of Internet-access services broken down by type of connection (on January 1, 2005) (Source: data is from Annual report 2004; NRATI 2005)

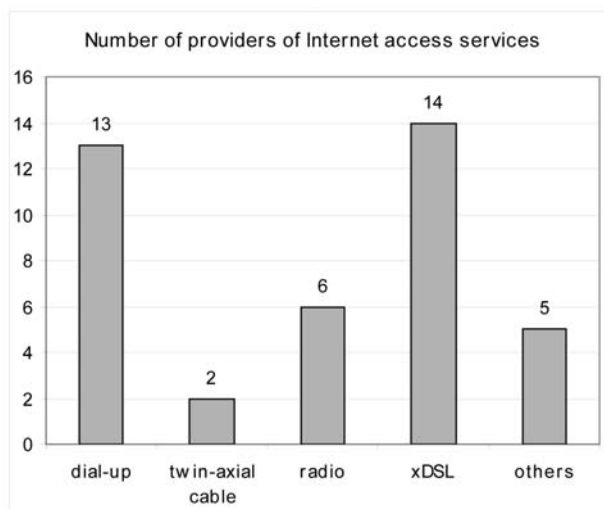
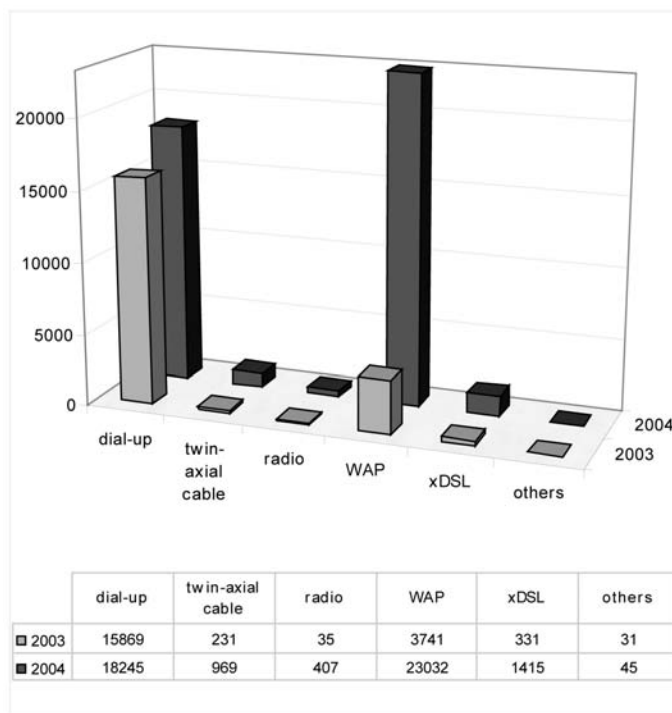


Figure 15. Dynamics of the number of connections for Internet access broken down by type of connection (Source: Data is taken from Annual report 2004; NRATI 2005)



The same tendency of weak provision of ICT technologies in rural areas is confirmed by the data from the National Regulatory Agency in Telecommunications and Information (NRATI) site (n.d.) about granted licenses. On July 1, 2005, only 1 in 27 holders of the date-transfer license was from the village Bardar. All 21 holders of licenses for IP (Internet protocol) phone services are from the capital of the country, Chisinau. All six holders of licenses for fixed phone services are from Chisinau, too.

In Figure 10, the data for the year 2003 about the number of registered Internet users per 10,000 inhabitants as distributed by different districts of Moldova are presented. They show the nonuniformity of access to the Internet. It is one of the sharpest problems for Moldova. This urgency has been taken into account by the development of the action plan on overcoming the problem, that is, first of all, to direct efforts and means for the creation of the minimal conditions for inhabitants of rural areas. The state should give to citizens

Table 5. Data on ICT infrastructure development in Moldova (Source: The Table uses data from official reports, BNS, 2005a; DSSRM, 2004)

| Type of Data | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|--|------|------|------|-------|--------|--------|--------|--------|--------|
| Share of the Length of Lines with Optic Cable in the Total Length of Cable Long-Distance Lines of Telecommunications (%) | 17.1 | - | 23.7 | - | 23.9 | - | 43.3 | - | - |
| Share of Channel Length in Total Length of Long-Distance and International Telephone Channels (% of digital transmission systems with optic cable) | 8.5 | 18.2 | 38.6 | 49.4 | 69.1 | 59.6 | 99.6 | 100.0 | 100.0 |
| Number of Mobile-Phone Service Subscribers (thousand) | 0.92 | 2.20 | 8.50 | 17.93 | 109.64 | 224.78 | 338.30 | 475.94 | 786.94 |
| Number of Internet Networks and Access Points | 6 | 10 | 32 | 55 | 223 | 386 | 415 | 415 | 415 |

Table 6. NRATI licenses (Source: The Table uses data from NRATI, n.d.)

| Data Type | 2003 | 2004 | 2005 (November 1) |
|--------------------------|------|------|-------------------|
| Total | 230 | 247 | 230 |
| Inclusive for Rural Area | 1 | 21 | 110 |

at least a minimal but guaranteed set of services that will allow them to not remain outside of the modern information society.

As a result of current natural, social, historical, economic, and political conditions in the country, it is possible to note the pronounced digital divide, both international and domestic. The Figures indicate the negative specificity of the country, at the same time emphasizing the sharp necessity to pass to modern technologies, and the difficulty to implement these technologies as well.

POSITIVE DYNAMICS TOWARD THE INFORMATION SOCIETY

Although the previous section of the chapter showed that Moldova is at low level of development, the following data demonstrate that the situation becomes better from year to year.

ICT Infrastructure

Let us see the Figures in Table 4 from another point of view: Compare the ratio of telephone-set provision in rural areas to this provision in urban areas. One will see the sTable, positive dynamics from the year 2000 (see Figure 11).

The dynamics of ICT infrastructure development are also demonstrated by data in Table 5.

According to the data for year 2004 (NRATI, 2005), the development of mobile-phone services

in RM made essential progress. During the period from 2000 to 2003, the number of new connections in the market grew from 110,000 to 130,000 subscribers per year. In the year 2004, 317,500 subscribers were connected to networks; that is 67.6% more. As a result, in 2004 the density of mobile telephony essentially increased (see Figure 12).

Let us consider the market of telecommunications in Moldova: Services for data transmission, Internet access, and the renting of channels make up about 6.66% of the total amount of services (NRATI, 2005). In 2004, the cost of the market of these services increased in comparison with the previous year by 95% (see Figure 13). Figure 14 presents the distribution of providers of Internet-access services broken down by the type of connection on January 1, 2005.

In 2004, the number of Internet connections increased by 22,004 in comparison with 2003. The progress is due to the following connections: WAP connections grew by 19,291; coaxial cable by 738; xDSL connections, in particular, ADSL (asymmetric digital subscriber line), by 1,084; radio connections by 372; dial-up connections by 505; and other kinds of connections by 14 (see Figure 15).

According NRATI(2005), in 2004 the amount of broadband Internet connections increased by 4.75 times, having reached 2,791 connections by January 1, 2005 (compare to 597 connections in

Table 7. Data on Higher Education Institutions (Source: The Table uses data from official reports, BNS, 2005a; DSSRM, 2004).

| Type of Data | 1996/ 1997 | 1997/ 1998 | 1998/ 1999 | 1999/ 2000 | 2000/ 2001 | 2001/ 2002 | 2002/ 2003 | 2003/ 2004 | 2004/ 2005 |
|--|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Higher University Educational Institutions | 24 | 28 | 38 | 43 | 47 | 47 | 45 | 40 | 35 |
| Students (thousand) | 58.3 | 65.6 | 72.7 | 77.3 | 79.1 | 86.4 | 95.0 | 104.0 | 114.6 |
| Students (10,000 inhabitants) | 162 | 180 | 199 | 212 | 217 | 238 | 262 | 288 | 318 |
| Pedagogical Staff (thousand) | 4.4 | 4.6 | 4.7 | 5.1 | 5.3 | 5.3 | 5.5 | 5.7 | 5.9 |

2003). It has taken place, basically, due to the increase in the amount of connections of twisted telephone pairs by 1,084 connections. The increase in the number of connections through the twisted telephone pairs is caused by the development of xDSL broadband technologies, in particular, ADSL. Note that the world community recognizes xDSL as prospective technologies, but the implementation of xDSL services in the CEE 10 is still at a very early stage.

The NRATI data about granted licenses are evidence of ICT infrastructure improvement, particularly in the rural sector. The licenses issued by NRATI (n.d.) are distributed as in Table 6.

Toward the beginning of the second half of year 2005, NRATI had registered 333 holders of the licenses that allow the provision of services of computer science in public places, 84 of them working in rural settlements (Server, n.d.).

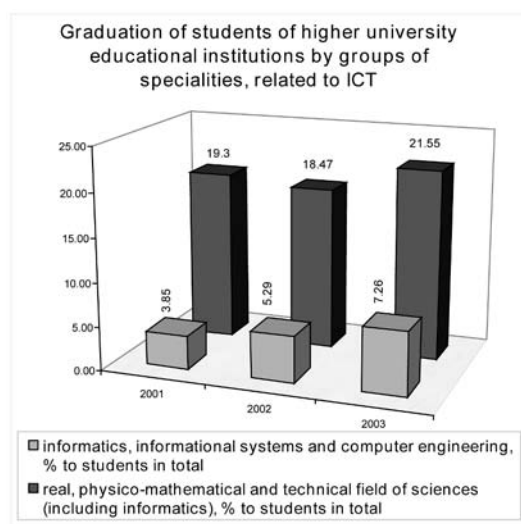
The data brought to this subsection confirm that there exists a national satisfactory structure of communication highways, which may serve as a foundation for the implementation of the actions directed to the information society's creation.

Educational Level

According to the data of the UNDP (2003, 2005) human-development reports, the following parameters are evidence of the high literacy rate of the population.

- Literate adult population (older than 15): 99.0% in 2001 (UNDP, 2003), 96.2% in 2003 (UNDP, 2005)
- Literate youth of ages 15 to 24: 99.8% in 2001 (UNDP, 2003), 98.7% in 2003 (UNDP, 2005)
- Net secondary enrollment ratio (number of students enrolled in a level of education who are of official school age for that level as a percentage of the population of official school age for that level): 68% in 2000 to 2001 (UNDP, 2003), 69% in 2002 to 2003 (UNDP, 2005)
- Tertiary students in science, math, and engineering (percent of all tertiary students): 44% in 1994 to 1997 (UNDP, 2003); later data are absent

Figure 16. Graduation of students of higher university educational institutions by groups of specialities related to ICT (Source: Diagram is made by the authors of this chapter using data from official report of DSSRM 2004)



Digital Divide

Note that in spite of economic difficulties, there remains the big craving for higher education in the country. See data on higher education institutions presented in Table 7. The ever-growing number of students in the country testifies to it. Also note that the share of students training in the ICT area is great enough and also grows. One can see it by analyzing the data in Figure 16.

So, regardless of the pauperization of the population, there persists the consciousness of the knowledge necessity. Moreover, a lot of people, not only the young, receive a second (and sometimes a third) higher education, aspiring not only to have the big opportunity to get a prestigious and well-paid job, but also to get more opportunities for self-realization.

The described situation in the country is confirmed by UN report Figures (UN, 2003). From the point of view of electronic-government implementation, Moldova occupies the 95th place among 173 estimated countries. As to presence on the Internet, Moldova occupies the 146th place. It is lower than any European country, although the indices of human capacity are rather high: 0.9 (the maximal one is 0.99).

Political Will

An important component on the way to bridging the digital divide is political will. Within the last 10 years, activity in this area in Moldova bore a rather declarative character. At last, during the latest 2 years, the specific steps and results have appeared. The presence of political will in the country is shown by the chronology of the issued decisions of the government and accepted laws.

1. **November 21, 2003:** The parliament of RM passed the law about informatization and state information resources.
2. **March 19, 2004:** The decree of the president of RM about the creation of an information society is issued.
3. **May 2004:** The program SALT, which assumes the maintenance of physical access to the Internet for all schools in the country, is accepted.
4. **July 15, 2004:** The parliament of RM passed the law regarding electronic documents and digital signatures.
5. **February 22, 2005:** RM is among the first countries from the Commonwealth of Independent States to sign in Brussels the plan of action “European Union: Moldova,” which has a section about information-society development.
6. **February 23, 2005:** The government has accepted the strategy of information-society creation called “Electronic Moldova” and the action plan for its implementation.
7. **In 2005,** in the structure of the newly elected government, the Ministry of Information Development appeared.

The authors of the present chapter are the eyewitnesses and participants of the process of national strategy development. This document was developed on the basis of numerous meetings, seminars, and round Tables with the participation of scientists, experts, and advisers in the field of ICT, representatives of civil society, and also governmental and commercial structures. Results of the analytical research that has been carried out in various relevant directions by commissions of experts have been taken into account. This process passed iteratively in some stages, thus in full conformity to recommendations of the Genoa Plan of Action, Point I:

These strategies, generated by the countries themselves, should be the result of a consultative process involving all relevant interested parties in the country, including the private sector and non-profit organizations (NPOs). Such eStrategies should be regularly reviewed and updated, and benchmarked internationally; they should,

where appropriate, be reinforced by regional and sub-regional coordination efforts, notably in the context of economic integration.

(Digital Opportunity Task [DOT]
Force, 2001, p. 13)

There are a lot of programs in which the specific steps, directed at increasing the living standard and improving the life conditions of the population, and connected with ICT introduction into daily life, are stipulated. The examples of such programs in Moldova are the Program of Economic Growth and Struggle Against Poverty, the Moldovan Village, and SALT. Besides these, nongovernmental organizations have their own programs focused on information-society development.

Other Facts and Events

There are also other manifestations in society that testify to the positive dynamics in overcoming the digital divide.

- **Example 1:** The State Office of Public Prosecutor (SOPP) of Moldova is the first and, for the time being, only establishment of RM in which computers on a multifunctional network provide fast and protected information interchange between the SOPP and other state structures (E-uriadnik, n.d.-a).
 - This information-telecommunication center provides Internet services and e-mail on 150 computers that are interconnected and offer opportunity for further expansion. The center is connected to information-telecommunication systems of local public bodies. Furthermore, the connection of all territorial divisions of SOPP and all law-enforcement bodies to the new telecommunication center is supposed.
- The work is carried out within the framework of the project the Protected Information System of the SOPP of RM with financial support from the European Union (EU) and the UNDP, and at the additional support of experts of the state enterprise the Center of Special Telecommunications.
- **Example 2:** Since June 15, 2005, the Moldavian FinComBank has offered a new service: the payment for municipal services through the Internet (E-uriadnik, n.d.-b). Owners of Visa and MasterCard credit cards can pay for municipal services at <http://www.fincompay.com>. The client also has the opportunity to view archives, receive extracts from the account, and get information on the rest of the card.
- **Example 3:** On August 19, 2005, the official Web representation of the RM government opened (E-uriadnik, n.d.-c). The governmental Web site <http://www.gov.md> contains information on the structure of the agency, the ministers' biographies, information on the next government assemblies, and agendas.
 - Citizens can be familiarized with government activity for 2005 to 2009, laws on the state budget, the strategy for economic growth and decrease in the level of poverty, the plan of action European Union: Moldova, and various strategies and plans of activity. One can also access news information as press releases, communiqué, and so forth at the site. The Web site has three language versions: Romanian, Russian, and English.
 - On the basis of cited Figures and facts, and also on the basis of analysis of the level of e-government development and of the volume of e-services rendered in Moldova (Burtseva, Cojocaru, Gain-

dric, Magariu, & Verlan, 2004a, 2004c; Cojocaru & Gaidric, 2003), it is possible to consider that the preconditions for information-society creation in the country exist.

THE SOLUTIONS FOR THE DIGITAL DIVIDE PROBLEM IN MOLDOVA

All the aforesaid shows that Moldova is at a low-enough economic and social level that naturally influences its e-state. Nevertheless, it is possible to take available advantages and to bypass certain obstacles.

The priorities are the following:

1. Attraction, vocation, and orientation of the majority of youth to the information-society technologies
2. Absence of viable alternatives of economy relaunching and the creation of new workplaces
3. Communications facilities and means for data processing have constantly decreasing prices, reduce energy consumption, and are not pollutants.
4. Existence of national structure of communication lines
5. Absence of real dependence on outdated information systems
6. Favourable international context (European, UN, and World Bank initiatives)
7. Still good-enough quality of higher education for relevant specialities

Some vulnerable points include the following:

1. Internet access is expensive and unreliable, and has reduced speed
2. Reduced access to new technologies (caused by the low purchasing capacity of the popu-

lation), correlated with nonuniform Internet penetration and great discrepancies between urban and rural areas

3. Inertia of officers of central and local public administration
4. Bureaucracy, fraud, and corruption cause some to look at the evolution toward the information society as the irreducible enemy
5. Absence of sufficient information distribution for the general public
6. Massive migration of gifted and qualified youth, accompanied by the growth of the population older than 50
7. Chaotic and noncorrelated mode of informatization of public institutions, as well as the inclination toward individualized solutions that are not harmonized on the basis of unitary conception
8. Tendency to invest mainly in equipment (to the detriment of management and knowledge-exploitation tools), without analysis, the preliminary setting of needs, and adequate personnel policy
9. Relatively reduced interest of investors and absence of trust of financial institutions that could place investments
10. Presence of the insufficiency of knowledge in relevant domains within secondary education

On the other hand, alongside the described manifestations of the digital divide, there are positive factors in the country promoting the development of the information society, such as the presence of political will on the part of the state, a good corresponding ICT infrastructure, and the high educational level of the population.

In our previous chapter, the basic directions of the balanced nationwide-system approach to the digital-divide problem are listed as (a) policy, (b) access, (c) services, (d) content, (e) knowledge and skills, and (f) motivation. Also, the steps to overcoming the digital divide that are necessary

to undertake in these directions are described. In the present chapter, it is appropriate to consider in detail the state of affairs in Moldova regarding these basic directions.

1. The national strategy for building the E-Moldova information society has been formulated. In all government programs, including those for economic growth and poverty reduction, there are sections for information-society creation and the wider granting of services to the population by the government.

Moldova actively participates in the Southeast Europe initiative on the integration into the information society. The parliament accepted the law that stimulates firms working on ICT development and introduction. The firms dealing with software development received a “tax vacation.”

2. The state has provided the creation of a communication infrastructure. All regional centers are connected by optical cable. There are two rings of optical cable that provide communication reliability.

Within the framework of SALT (Jump), 1,364 schools of 1,644 already have physical access to the Moldtelecom network (since February 15, 2006), as the minister of education V. Tsvirkun asserts (personal communication, February 16, 2006). All 1,364 schools, 140 sport schools, and children’s creative houses will be connected to the Internet by the first of September, 2006. Prime Minister V. Tarlev formed the working group for this monitoring program.

The relations between the state and local governments and the private sector are still very weak. There are practically no joint projects for providing information services to the population. The rate of growth in providing information services (see Table 6) has sharply increased recently. It especially concerns the rural area. The number

of licenses for providing information services in villages granted during the first half of 2005 is more than the number achieved during the whole year of 2004 (see Table 6). For this period, NRATI granted licenses to 68 companies, 35 of which are working in villages.

3. Unfortunately, it is necessary to establish the fact that the e-services the government provides the population and business are not enough and do not respond to population demands. These services are limited to providing information: addresses, phone numbers, work schedules, lists and prices of provided services, samples of documents for filling out, and normative and legislative documents related to institution activities (Burtseva et al., 2004b, 2004c). Unfortunately, this information is not always full and updated in time. Interactivity is actually absent.

However, there are successes. For example, take the modern information system at the SOPP (example 1 previously in this chapter). It is the first step to the introduction of automated systems for document circulation in SOPP.

As to commercial structures, there is already an example of interactive services: the payment of municipal services through the Internet (example 2).

4. For 2005, the government, on behalf of the Ministry of Information Development with the assistance of UNDP, provided the development of the following:

- A functioning e-governance-portal model with at least two available pilot services for citizens (e.g., tax payment)
- A standard for governmental Web sites and a data-storage and communications protocol

- A regulatory mechanism for the implementation of online services

In this development, both the governmental structures and representatives of the scientific organizations, universities, and civil society are involved. This provides taking into account various aspects of Moldova development (national, economic, world outlook, etc.). The first steps are made already, and there are first successes: The site has already opened (example 3). However, for the time being, the site is only informative. The declared interactive services are planned to be available by the beginning of 2007.

5. Teaching and skills in ICT use are stipulated in all training programs at schools, lyceums, and all university faculties. However, the challenge is that this knowledge is to be sufficient and focused on the future specialist's needs. The president of Moldova has set the objective that in all schools, each pupil will have Internet access. Surely, the objective formulated is general enough. Various ministries carry it out on their own understanding. Having quite a good ICT infrastructure, Moldtelecom successfully supplies cable to the schools. However, the Ministry of Education has not actually started the process of training the teachers (besides those of computer science). One important problem, for which the Ministry of Education has not yet determined how to approach, is the problem of content. Ensuring that pupils are supplied with the necessary information in their native language is a problem not only of pedagogical science, but also of sociologists, mass media, and the whole society as well.
6. Problems in the creation of motivation for ICT use remain for the time being without the attention of both the government and the civil society. The program Moldova-e of the public broadcasting company has been

carrying out the broadcast of "Information Society" for almost 1 year. But this program, unfortunately, is not thought over enough, and there is no confidence that it will waken the motivation for ICT use in the work of businessmen, farmers, and others. For the present, the most powerful incentive for business is the example set by partners from other countries and the necessity of entering into regional and European structures. Banks and other financial structures, insurance companies, and so forth, in which the level of ICT use is essentially higher than in other branches, can serve as examples. Let us address again example 2 from earlier in this chapter. To implement such an interactive service (the payment for municipal services through the Internet), undoubtedly, it was necessary to use advanced ICT achievements, basing on the last legislative acts concerning electronic signatures, person identification, and the right to use authorization. Motivation is important here, too: Such a service undoubtedly is attractive for the population as it allows one to save time and to carry out this operation in any one moment convenient for the citizen.

Taking into account the weak provision of literature in libraries, it is sharply necessary to create in Moldova an electronic library accessible free of charge for the population. The library should contain educational, national, and classical literature. This action will help to develop the motivation and the long-term habit to use ICT in daily life, study, and work for the majority.

As to daily life, it is not just the most competent people who can find applications of the newest technologies if only the availability of these technologies would be provided. The bright, real episode from village life illustrates this idea well. Two already elderly farmers are talking. The question arises about mobile phones. One farmer tells another, "Yes, mobile phone—it's

great! Can you imagine, Ion, I'm pasturing cows far in the field, and suddenly a 'gentleman' became urgently necessary for your cow. I call you by mobile phone and inform: 'Urgently take away your cow. It has alarmed the entire herd!' Now you can act immediately, and the problem is solved!" (P. Pastoohov, personal communication, June 25, 2005)

As regards the motivation for Internet use by the elderly (especially rural) people in Moldova, there also are special reasons. As we already mentioned above, a great number of inhabitants who are able to work have been compelled to leave their families in search of earnings in other countries. To maintain communication with their families—with the grandmothers and grandfathers with whom they have left their children—some of these persons before departure had taught the old men not only to use e-mail, but also to use multimedia means for online conversations.

Complex Conditions Necessary for Overcoming the Digital Divide in Moldova

Note that the basic obstacle in bridging the digital divide is the fact that today in Moldova there is no cooperation between the state sector and private capital. It is possible to understand what the government sees: that the gross national product is very small for the present, that most of the population able to work does not find workplaces in the native land, that industry is not restored yet (production has not reached the level of 1993), that agriculture is noncompetitive, and that import strongly outstrips export. This tendency is being amplified; investments do not grow at the necessary rate. Therefore, clearly, the basic care is an aspiration to raise the standard of life for the population. Unfortunately, not everyone understands that wide introduction of ICT is able to not only promote but also speed up economic growth.

Such problems arise not only in Moldova. Even the World Summit on the Information Society (WSIS) in its *Tunis Agenda for the Information Society*, when writing about financial mechanisms for meeting the challenges of ICT for development, it stated, "We recognize the existence of the digital divide and the challenges that this poses for many countries, which are forced to choose between many competing objectives in their development planning and in demands for development funds whilst having limited resources" (WSIS, 2005a, p. 1).

Nevertheless, it considers ICT development of great importance and writes the following: "We encourage all governments to give appropriate priority to ICTs, including traditional ICTs such as broadcast radio and television, in their national development strategies" (p. 3).

When speaking about complex conditions and the actions necessary for overcoming the digital divide, we shall see that not all of them are carried out. Therefore, it is especially important for a country to find its own way of overcoming deep digital divides.

Let us consider the complex of necessary conditions:

1. There is a lack of physical access to the Internet. As it was already mentioned, there is an advanced network of optical lines. Within 2 years, all schools will be connected to the Internet. Meanwhile, the share of people having a PC at home is too small. Therefore, the majority of users have access at their workplaces. There are not enough public Internet-access points (PIAPs). Internet access is expensive.
2. Only a part of the society (those who have graduated from universities during the last 10 years, employees of banks and insurance campaigns, and some employees of state machinery) understands the value and realizes the necessity of ICT use for work.

Digital Divide

Probably, other parts of the society would like to use ICT, but they are too poor to buy a computer.

3. According to the reports of the UN and other organizations, the degree of democratization in Moldova for the time being is not too high. However, recent events (elections of the parliament; the accepted laws on liberalizations of the press, radio, and TV; economic activities' liberalization; the law of "guillotine"; and orientation to integration into Europe) convince some that the degree of democratization will increase and be sufficient for information-society construction. It, in its turn, will promote wider democratization of the society.
4. The level of population literacy is high enough.
5. The laws accepted during the last 2 years serve as a strong basis for information-society creation.
6. We already mentioned the weak interaction between state and commercial structures.

Practically, each of them works independently. However, commercial structures already give an impulse of ICT penetration into the countryside. In cities, private firms influence ICT distribution, though it is not enough.

7. The financial assets put into ICT are too small. The basic share of the investment is the resources of private enterprises. However, according to the action plan European Union: Moldova, the action plan for the implementation of the national strategy for information-society development e-Moldova, the budget for 2007 will have the separate expense item for ICT introduction in the economy, education, public health services, and local management.

The problems of attracting investments into e-government development and services provision to the population remain sharp. The United Nations Development Program assists some of the nongovernmental organizations, but it is obvi-

Table 8. Public places for PIAPs in different countries (Source: The Table is made by the authors on the basis of an analysis of a number of different Web sources, Burtseva, Cojocar, Gaidric, Magariu, & Verlan, 2005)

| Country | Schools | Libraries | Telecommunications | Other |
|-----------|---------|-----------|--------------------|-------|
| France | | | Yes | |
| Austria | Yes | | Yes | |
| Finland | | Yes | Yes | |
| Greece | Yes | | | |
| Croatia | Yes | | | |
| Estonia | Yes | Yes | Yes | |
| Brazil | | | | Yes |
| Romania | | | Yes | |
| Latvia | | Yes | | |
| Scotland | Yes | Yes | Yes | Yes |
| Lithuania | Yes | Yes | Yes | Yes |
| Slovenia | Yes | Yes | | |
| Moldova | Yes | Yes | Yes | |

ously insufficient. The investments of those who understand that all expenses will be repaid and will result in economic growth are necessary.

8. If 5 to 7 years ago state support was only declarative, the last 2 to 3 years were the turning points (see subsection “Political Will”).

Note that the problem of information distribution among the population remains on the second plan up until now. The state so far is going to invest in systems that will give results quickly. Those stated above, the concrete measures accepted and planned for the nearest 1 to 2 years, and the worldview of people that came into the state structures allow us to offer public Internet-access points as a way to accelerate overcoming the digital divide. Basically, the majority of actors influencing information-society development in Moldova supports these measures; at least we have not met open opponents.

Taking into account the current situation and limited financial opportunities, the coordination of actions in all programs for more expedient use of investments is necessary. As the first stage for such coordinated actions, the opening of PIAPs in all settlements with the participation of the state, nongovernmental organizations, and commercial structures is supposed. It corresponds to Point II of the Genoa action plan (DOT Force, 2001, p. 14):

The establishment of public and community ICT access points in developing countries should be supported as a key means to facilitate timely, broad, affordable and sustainable access to ICT; for this purpose facilities such as post offices, elementary schools, Internet cafés or community multimedia centers could be used; emphasis should be placed on providing both access and training... Approaches to promote universal access for rural and remote areas in developing countries should be pursued...

This question remains the actual one. So, at the last WSIS forum devoted to information-society problems, including the digital divide, in the Tunis Commitment it was written (WSIS, 2005b, p. 3), “We urge governments, using the potential of ICTs, to create public systems of information on laws and regulations, envisaging a wider development of public access points and supporting the broad availability of this information.”

PIAPs could provide the following:

The basic parts of the information society (such as e-government, e-democracy, e-culture, e-medicine, e-commerce, etc.) to be created locally

- Nondiscriminated access of all of the population to information (which is more important)
- Participation in the e-democracy
- Services of e-government

Let us explain now the method of choice in Moldova and consider our propositions about PIAP development, supply, and maintenance.

Description of PIAPs Proposal

The PIAP functionality supposes the presence of necessary items: hardware, software, room, connection, personnel, training, user’s payment, traffic cost, and technical maintenance. The implementation of these items requires financial aid and technical efforts. An at-once realization of such a project is impossible with the current situation in Moldova, so we propose to move from stage to stage.

At the first stage, the PIAP creation is offered on the basis of schools (after hours). The following circumstances that are specific for Moldova underlie this choice:

- School is one of not many public institutions that are active in the countryside.

Digital Divide

- Schools have their own buildings.
- Schools in the countryside have the necessary ICT infrastructure.
- There is the presence of personnel (informatics teachers) for initial training to use the computer and Internet.

Similar ways were chosen by Austria, Greece, Croatia, Slovenia, Estonia, Scotland, and Lithuania. One can see that Croatia and Slovenia are in this list of countries, and they have similar social-economical conditions. Our closest neighbor, Romania, took another way.

Certainly, each country solves this problem individually, proceeding from national features (Table 8). As a rule, public places convenient for inhabitants that people already visit and also that already are a part of their daily life are being chosen: schools, libraries, post offices, national bank branches, railway and bus stations, airports, shops, cafes, hotels, clubs, churches, and so forth.

The mentioned-above circumstances, specific for Moldova and which cover some necessary items of PIAP, do not resolve the problems of hardware equipment and the technical maintenance of PIAP. Intending to use the school hardware at the first stage, we take in consideration the fact that many of rural schools have no computer class. This problem requires collaboration with state education authorities; in Moldova, this is the Ministry of Education, Youth, and Sport. The payment for traffic and other supplies is also a significant problem. At the first stage, it is supposed that the local budget can be implemented only by persuading the local authorities. The principal companies dealing with Internet-traffic support and electricity can give a discount for state programs. For resolving the problem of PIAP maintenance, we propose to initially get the teachers of computer science for this work, who will receive additional payment. Cascade training (as supposed in SALT as well) be offered by engaging teachers, rural intellectuals, and, further on, people with secondary education.

This stage fulfilling allows the second stage to expand further the PIAPs network by opening these points in city halls, libraries, post offices, and other public places. This way, the necessary supplies can be covered by the corresponding institutions. The state or joint enterprises can be created for PIAP's technical maintenance.

Then, at the third stage, the telecenters can be established in hotels, bars, and so forth. This stage requires business investments from Internet providers, banks, and the ICT sector.

The implementation of the second and third stages would be impossible without mutual coordinated actions of local administration and business. According to this plan, the local administration should find a way to awake business interest to support the PIAPs.

To reduce expenses and ensure the PIAP functionality, we propose the establishment of a standard for the minimal information services guaranteed to each member of society irrespective of whether he or she lives in the countryside or not: e-mail; access to the legislative database; access to the membership of the local networks created for different business branches; weather reports; and so forth. For this, it is necessary to establish Internet content for these services and to provide each PIAP with a minimal software set supporting these services.

Now we argue for our choice of software tool kit for PIAP. This tool kit is set by each country according to its specific social-economic situation. Several initiatives, for example, Cambridge Online City (*About Cambridge Online City*, n.d.), prefer complex solutions by Microsoft. However, we share the position with those who propose open-source solutions.

Open-source software or free software (OSS or FS) are programs that have licenses that give users freedom to run, study, and modify the programs, and to redistribute copies of either the original or modified programs (without having to pay royalties to previous developers; *Open Software License v. 2.1*, 2005).

Many countries accept the OSS solution at their administrative level (Wong, 2004).

- OSS is used for local government network support:** This choice is made by countries with both high and low levels of ICT. The countries with high ICT levels use OSS mostly because of the necessity for independence from software developers: the governments of the USA (Aitoro, 2005), Australia (“Government Open Source Guide Coming Next Month,” 2005), and Italy (“Italian IT Leader Engineering Ingegneria Informatica,” 2005). Certainly, countries with low ICT levels take OSS solutions mostly because of financial and copyright reasons. Several specific projects of OSS-usage advancement have been initiated for different regions of the world: Asia (International Open Source Network, 2004), Africa (FOSSFA, n.d.), and so forth. In this context, it is remarkable that such populous countries as China (“China’s Bet on Linux,” 2005), India (Noronha, 2002), and Indonesia (“Indonesia Government Opts for Open Source,” 2004) choose OSS for government networks. The Government Information Technology Officers’ Council (GITOC; 2003) in South Africa promotes OSS in its strategy. Brazil’s government announced its intention to change from Microsoft’s operating system to OSS on 300,000 government computers (Goldmark, 2005).
- OSS is used for Internet provision at schools:** The corresponding projects were announced in 2005 by the governments of France (Marson, 2005a), South Korea (Ilett, 2005), and New Zealand (Marson, 2005b). In New Zealand, 2,600 state schools will use Novell’s software for a reduced price. The Republic of Macedonia in 2005 decided to deploy Linux at 468 schools and 182 computer labs nationwide (“Macedonia Deploys 5,000 GNOME Desktops in Public Schools,”

2005). The School-to-School Project in China plans to load nearly 140,000 PCs with a national Linux version (“Largest Asian Linux Rollout Ever,” 2005).

- OSS is used for PIAPs (considered in detail as follows):** There are a lot of reasons for using OSS in noncommercial domains (schools, local government, state PIAPs). The first reason for OSS usage for PIAPs and especially for local government networks is the independence from software manufacturers. Despite the different financial situations in countries that supply PIAPs by OSS, the reason of economy is equally significant. The main objections of opponents are the inadequacy of OSS regarding users’ needs and the absence of support. The thesis of inadequacy became baseless with the modern development of OSS. For example, the Microsoft solution for an ordinary PIAP hardware set includes the Windows 2003 Enterprise Server operating system for 25 clients (\$1,875); the e-mail server Microsoft Exchange 2000 Server 25-Client Enterprise (\$6,899); and the RDBMS server Microsoft SQL Server 2000 Enterprise Edition (\$7,500). The prices are from an Internet shop’s (Amazon.com, n.d.) price list. However, the corresponding OSS solution, for example, Linux, provides for an unlimited number of clients. E-mail and RDBMS servers are embedded in the operating system. Any OSS scripting tool can be used. So, the OSS now has functional completeness. OSS security can also be set to the due level.

BZ Media LLC, a privately held high-tech media company, issued BZ Research. Its survey of 6,344 software-development managers shows that Linux is superior to Windows for operating-system security attacks, and OSS was in most categories considered equal or better at the application layer (“Linux Wins on Security in

survey,” 2005). From the point of view of performance and reliability, OSS also shows results that are comparable to or better than the results of commercial software. Eighty percent of the top 10 most reliable hosting providers ran OSS or FS (“Most Reliable Hosting Providers During May,” 2004). The performance of “heavy” RDBs like Oracle under Linux was so preferable (Burleson, 2003) that software giant Microsoft with Windows 2003 Server started lagging.

Although OSS has no developer support, this lack can be converted to an advantage, especially in the case of PIAP. The active developing of new OSS products and new versions of existing ones eliminates the main fear of users about update difficulty. The distribution of OSS by free CDs made by state or business-state enterprises, for example, like the French government does, resolves the problem of obtaining software.

So, maintaining the software is the only feature of developer support that remains to be discussed.

Let us consider this feature in the specific situation of PIAPs in Moldova. The backcountry districts are hardly reachable for developers’ help. Being in use by nonprofessional persons, computers of PIAPs are always at risk of hardware or software damage. So, the preinstalled type of software is inconvenient. The boxed software versions require the presence of a specialist for software installation, and moreover have a higher price. Usually, this problem is resolved by the creation of easily installable pirate software versions.

The OSS license allows software recompiling without breaking privacy. Recompilation gives the PIAP suppliers wide possibilities to resolve their specific problems. First of all, they can adapt the software exactly to the spoken language, hardware, and executing services of the specific PIAP. As it was mentioned above, the possibility to develop easily installable software is also important. In Moldova, there are professionals who

can handle the recompiling process. Moreover, in autumn 2005, a center for Linux training and certification by international standards was opened at the State Technical University of Moldova.

Thus, the OSS license combines the significant financial economy with wide possibilities of maintenance. The software realized under this license today has due functionality and has less of the disadvantages of the early years. The OSS can be successfully used for PIAP supply, especially in financially weak states with poor ICT infrastructure in rural areas. Thus, in Venezuela in 2004, numerous info centers and PIAPs with free software were opened throughout the country (Wilper, 2004). As well, in Romania since 2002, the number of PIAPs and of used Linux servers have been growing (Sandu & Nagler, 2005).

Generalizing the discussion above, we can formulate the solution below. We propose to establish a network of PIAPs with the following characteristics:

- Use the financial support of state and local administrations
- Have a supply of standard software
- Give access to a standard minimal set of services

The standard software tool kit consists of the following:

1. Interactive guides and tutorials (for computer usage, Internet navigation, installed software, and the development and support of personal Web pages)
2. Editors (for text, Web pages, graphics, and presentations) and miscellaneous programs (spell checkers, dictionaries, and support for small databases)
3. Internet browsers (access to a free e-mail service, to global and local search engines, and to online dictionaries and translation systems)

Indices for Digital-Divide Monitoring in Moldova

The WSIS Thematic Meeting on “Measuring the Information Society” resulted in the recommended core list of ICT indicators and its broad involvement (“Final Conclusions,” 2005). Taking into consideration Moldova’s specificity and more precise monitoring of the digital divide in Moldova, the following indices can be recommended additionally by this chapter’s authors.

1. Number of PIAPs per 10,000 inhabitants
2. * Number (and percent) of settlements that have PIAP
3. * Number (and percent) of PIAPs where inhabitants use services gratis
4. ** Number of computer classes per 1,000 pupils
5. ** Average number of subjects at schools in which ICT are used in teaching

An asterisk identifies specific indicators for Moldova.

Two asterisks identify indicators whose influence will affect the digital divide afterward (they contribute to population training).

The authors of this chapter will endeavour to promote these indices so they will be taken into consideration in the state policy in the process of information-society creation in Moldova.

CONCLUSION

The digital-divide problem is a reality that is present in any society. It will be present later on as well, reflecting the immanent objective, social, economical, and confessional peculiarities inherent in a country or ethnic groups. A striking example from the life of our country (Moldova) is the fact that some Orthodox believers made a protest and refused to get identity cards with personal codes. Obviously, these persons will not be able to use the opportunities that ICTs

give. However, in any democratic society, the tendency to provide every member of the society with equal possibilities will promote decreasing the digital divide.

One should not automatically transfer the methods of the solution of the digital-divide problem from one country to another. Nevertheless, the experience accumulated by some countries is certainly useful for others since the common elements—the necessity of state political decisions, of attracting economic agents and civil society, and so forth—should find reflection in decisions that are specific for each country. Even negative experiences of other countries, for example, the termination of the PIAPs and telecenters on the completion of state or other grants, are rather valuable, too, inasmuch as they reveal those aspects of the problem that would be difficult to deal with.

Starting from the specific economic conditions in our country, we consider that the proposed measures and those that are already being realized in Moldova are able to decrease people’s differences regarding the possibilities to take part in public and economic activities; that is, they enable the country’s development.

Certainly, it might do well to speed up realizing these measure, but the real possibilities of the country, and chiefly the very low GDP, do not allow the majority of the population to purchase computers (the cost of which is about five average nominal monthly salaries per employee in the economy in November 2005) or Internet connections (the cost of a monthly subscription for the Internet is about 17% of the average nominal monthly salary). From this follows the proposed solution for the rural population (which constitutes 61.4% of the total population):

- Usage of school computer classes as PIAPs
- Local administration participation in PIAP financing

Digital Divide

- Determination of a standard for minimal services that are provided for any person in any settlement of the country. It is not an obstacle in the way of widening the provided possibilities when the local administration can permit itself such widening.
- Training the population in necessary skills for working with computers and for Internet usage by using the cascade method
- Along with the European indicators for e-readiness monitoring, the introduction into state statistics the specific indicators for Moldova

Several social programs are carried out nowadays in the Republic of Moldova.

- Program for economic growth and poverty reduction, which includes the establishment of PIAPs along with the measures for economic growth
- Moldova's Village, which includes measures for economic and cultural development, for ethical-norms revival, and for the provision of elementary conditions of life (provision for drinking water and gas in each village)
- SALT, providing schools with Internet connections and equipping them with computers
- European Union: Moldova

The main condition for the successful implementation of each of these programs is the coordination of their actions. Certainly, the problem of the digital divide will be resolved indirectly as well. But the purposeful opening of a PIAP in every settlement by means of attracting the existing infrastructure, the possibilities of local self-government, and the good will of teachers of informatics and volunteers can speed up the solution of the problem.

It is very important to establish a system of statistical indicators for monitoring information-

society creation, and in particular, the digital divide.

We hope that Moldova's approach, stated in this chapter, will fill up the "money box" of world experience, too, and that it can be useful in those countries where there are similar conditions, mainly those with an agrarian economy and a mainly rural population, which, at that, has a high-enough educational level and keeps a strong thirst for knowledge. The presence of good ICT infrastructure in combination with the implementation of a state program to connect all schools to the Internet became the precondition of the approach suggested (and proved) by us, based on the creation of PIAPs at schools. We have tried to fix the whole spectrum of problems arising at the acceptance of such an approach and to plan possible solutions to them.

REFERENCES

About Cambridge online city. (n.d.). Retrieved January 27, 2005, from <http://www.colc.co.uk/colc/colc.html>

Aitoro, J. R. (2005, June 9). State, local governments to leverage open source. *Informationweek*. Retrieved August 18, 2005, from <http://www.informationweek.com/story/showArticle.jhtml?articleID=164302017>

Amazon.com. (n.d.). Retrieved August 25, 2005, from <http://www.amazon.com>

American Society for Public Administration & United Nations Division for Public Economics and Public Administration (ASPA & UNDPEPA). (2002). *Benchmarking e-government: A global perspective*. Retrieved February 29, 2004, from http://www.itpolicy.gov.il/topics_egov/docs/benchmarking.pdf

Biroul National de Statistica (BNS). (2005a). *Moldova in Figures: Short statistical book*. Chisinau, Moldova: Statistica.

- Biroul National de Statistica (BNS). (2005b). *Nota informativa Nr. 14-01*. Retrieved April 19, 2005, from http://www.statistica.md/statistics/dat/596/ro/Nr_pop_la1ian_2005.doc
- Burleson, D. (2003). *Oracle Windows or Oracle Linux?* Retrieved August 18, 2005, from http://www.dba-oracle.com/oracle_tips_linux_oracle.htm
- Burtseva, L., Cojocaru, S., Gaidric, C., Magariu, G., & Verlan, T. (2004a). Electronic services in public administration (e-government): Privacy and freedom of information (Review of study made for situation in Moldova). *Computer Science Journal of Moldova*, 12, 467-496.
- Burtseva, L., Cojocaru, S., Gaidric, C., Magariu, G., & Verlan, T. (2004b). *Servicii electronice in sectorul administratiei publice (e-government): Inviolabilitatea informatiei personale si dreptul la informatie* (Tech. Rep.). Chisinau, Moldova: Academy of Sciences of Moldova, Institute of Mathematics and Computer Science.
- Burtseva, L., Cojocaru, S., Gaidric, C., Magariu, G., & Verlan, T. (2004c). Sravnitel'ny'y analiz razlichny'h podhodov k realizacii e-pravitel'stva: Uslugi e'lektronnogo pravitel'stva. In *Abstracts on BIT+2004 "IV International Conference on Information Technologies 2004"* (pp. 66-68).
- Burtseva, L., Cojocaru, S., Gaidric, C., Magariu, G., & Verlan, T. (2005). Internetul in mediul rural. In *Teze si comunicari de conferinta nationala "Comunitatile Rurale si Renasterea Satului"* (pp. 133-135). Chisinau, Moldova: Academia de Stiinte a Moldovei.
- China's bet on Linux. (2005). *CIO-Asia.com*. Retrieved January 28, 2006, from <http://cio-asia.com/ShowPage.aspx?pagetype=2&articleid=3015&pubid=5&issueid=71>
- Cojocaru, S., & Gaidric, C. (2003). *Considerente asupra edificarii societatii informationale in Moldova*. Chisinau, Moldova: Stiinta.
- Departamentul Statistica si Sociologie al Republicii Moldova (DSSRM). (2004). *Statistical yearbook of the Republic of Moldova*. Chisinau, Moldova: Statistica.
- Digital Opportunity Task (DOT) Force. (2001). *Digital opportunities for all: Meeting the challenge*. Retrieved March 25, 2005, from http://www.labi-berlin.nubb.dfn.de/bibliothek/positionspapiere/dot_force.htm
- E-uriadnik. (n.d.-a). *General'naia prokuratura Moldovy poluchila sovremennuiu informatsionnuiu sistemu*. Retrieved July 15, 2005, from <http://www.e-uriadnik.org.ua/modules.php?name=News&file=article&sid=2454>
- E-uriadnik. (n.d.-b). *V Moldove stalo vozmozhnym oplachivat' kommunal'nyie usluzhi cherez Internet*. Retrieved July 20, 2005, from <http://www.e-uriadnik.org.ua/modules.php?name=News&file=article&sid=2322>
- E-uriadnik. (n.d.-c). *V seti otkryl'sea ofitsial'nyie veb-sait Pravitel'stva Respubliki Moldova*. Retrieved August 21, 2005, from <http://www.e-uriadnik.org.ua/modules.php?name=News&file=article&sid=2596>
- Final conclusions. (2005). *WSIS Thematic Meeting on "Measuring the Information Society."* Retrieved November 28, 2005, from <http://www.itu.int/wsis/docs2/thematic/unctad/final-conclusions.pdf>
- FOSSFA. (n.d.). Retrieved January 28, 2006, from <http://www.fossfa.net/tiki-index.php?page=FOSSFA>.
- GEOHIVE: Global Statistics. (n.d.). Retrieved August 8, 2005, from <http://www.geohive.com/index.php>
- Government Information Technology Officers' Council (GITOC). (2003). *Using open source software in the South African government*. Retrieved January 28, 2006, from http://www.oss.gov.za/docs/OSS_Strategy_v3.pdf

Digital Divide

- Goldmark, A. (2005). *Brazil makes move to open source software*. Retrieved January 30, 2006, from <http://www.npr.org/templates/story/story.php?storyId=4471963>
- Government open source guide coming next month. (2005). *LinuxWorld*. Retrieved August 18, 2005, from <http://www.linuxworld.com.au/index.php/id;1912876672;fp;2;fpid;1>
- Ilett, D. (2005). *Korea brings open source to 10,000 schools: No offence to Microsoft...* Retrieved August 15, 2005, from <http://software.silicon.com/os/0,39024651,39131325,00.htm>
- Indonesia government opts for open source. (2004). *Public sector technology & management*. Retrieved January 29, 2006, from <http://www.pstm.net/article/index.php?articleid=224>
- International Open Source Network. (2004). Retrieved July 25, 2005, from <http://www.iosn.net>
- Internet World Stats*. (2005). Retrieved July 25, 2005, from <http://www.internetworldstats.com/stats.htm>
- Italian IT leader engineering Ingegneria Informatica joins Objectweb Consortium. (2005). *OSDIR.COM*. Retrieved August 19, 2005, from <http://osdir.com/Article5664.phtml>
- Largest Asian Linux rollout ever: 140,000-plus PCs deploying to Chinese schools. (2005). *Linux Today*. Retrieved January 30, 2006, from <http://www.linuxtoday.com/news/2005100402426NWDTPB>
- Linux wins on security in survey of 6,000+ software developers. (2005). *LWN.net*. Retrieved August 17, 2005, from <http://lwn.net/Articles/131788/>
- Macedonia deploys 5,000 GNOME desktops in public schools. (2005, December 2). *The Gnome Journal*. Retrieved January 30, 2006, from <http://www.gnomejournal.org/article/33/macedonia-deploys-5000-gnome-in-public-schools>
- Marson, I. (2005a). French students to get Linux CDs. *ZDNet UK*. Retrieved August 17, 2005, from <http://news.zdnet.co.uk/software/linuxunix/0,39020390,39212812,00.htm>
- Marson, I. (2005b). New Zealand's schools to get open source for less. *ZDNet UK*. Retrieved August 17, 2005, from <http://news.zdnet.co.uk/software/linuxunix/0,39020390,39209666,00.htm>
- Most reliable hosting providers during May, ranking by failed requests and connection time, May 1st-31st 2004. (2004). *Netcraft*. Retrieved August 17, 2005, from http://news.netcraft.com/archives/2004/06/02/most_reliable_hosting_providers_during_may.html
- Noronha, F. (2002). *The Penguin's flying-carpet: Free/libre and open source software in India*. Retrieved January 29, 2006, from http://www.unesco.org/webworld/portal_freesoft/reports/the_penguin.pdf
- National Regulatory Agency in Telecommunications and Information (NRATI). (2005). *Annual report 2004*. Retrieved June 30, 2005, from http://www.anrti.md/index_en.htm
- National Regulatory Agency in Telecommunications and Information (NRATI). (n.d.). Retrieved August 15, 2005, from <http://www.anrti.md>
- Open software license* (v. 2.1). (2005). Retrieved August 25, 2005, from <http://opensource.org/licenses/osl-2.1.php>
- Sandu, T. G., & Nagler, M. (2005). *A brief overview: Open source software in Romania*. Retrieved February 1, 2006, from <http://europa.eu.int/idabc/servlets/Doc?id=23392>
- Server. (n.d.). Retrieved July 28, 2005, from <http://www.server.md/news/11702/>
- United Nations (UN). (2003). *World public sector report 2003: E-government at the crossroads*. Retrieved March 25, 2004, from http://www.unpan.org/dpepa_worldpareport.asp

United Nations Development Program (UNDP). (2003). *Human development report 2003. Millennium development goals: A compact among nations to end human poverty*. Retrieved March 17, 2005, from http://hdr.undp.org/reports/global/2003/pdf/hdr03_complete.pdf

United Nations Development Program (UNDP). (2005). *Human development report 2005. International cooperation at a crossroads: Aid, trade and security in an unequal world*. Retrieved September 13, 2005, from http://hdr.undp.org/reports/global/2005/pdf/HDR05_complete.pdf

West, D. M. (2001). *WMRC global e-government survey*. Retrieved September 28, 2005, from <http://www.insidepolitics.org/egovt01int.html>

West, D. M. (2002). *Global e-government*. Retrieved September 28, 2005, from <http://www.insidepolitics.org/egovt02int.html>

West, D. M. (2003). *Global e-government*. Retrieved September 28, 2005, from <http://www.insidepolitics.org/egovt03int.pdf>

West, D. M. (2004). *Global e-government*. Retrieved September 28, 2005, from <http://www.insidepolitics.org/egovt04int.pdf>

West, D. M. (2005). *Global e-government*. Retrieved September 28, 2005, from <http://www.insidepolitics.org/egovt05int.pdf>

Wilper, G. (2004). *Chavez announces that Venezuelan state will switch to "free software."* Retrieved February 1, 2006, from <http://www.venezuelanalysis.com/news.php?newsno=1373>

Wong, K. (2004). *Free/open source software: Government policy*. Retrieved January 28, 2006, from <http://www.iosn.net/government/foss-government-primer/foss-govt-policy.pdf>

World Summit on the Information Society (WSIS). (2005a). *Tunis agenda for the information society*. Retrieved November 28, 2005, from

http://www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2267|0

World Summit on the Information Society (WSIS). (2005b). *Tunis commitment*. Retrieved November 28, 2005, from http://www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2266|0

ENDNOTES

- ¹ For these countries, the values of the e-readiness index for 2001 are absent. Nevertheless, they are included in the range of countries because they are agrarian countries close to Moldova in their percent of rural population. In Table 1, they are at the end of the list, and in the comparative analysis presented in Figure 2 they are not included. However, in the subsequent analysis they are examined.
- ² Not all of the desired data were available for all countries, years, and indices (in particular, for countries from the chosen list), so the authors tried to make the comparative analysis of the state and dynamics of digital-divide development on the basis of the information found to be available. At that, the data are taken from different sources. The data given for the same country by different sources are not always comparable since they are calculated by different methods. However, the authors set for themselves the objective to follow up on the tendency of the development of conditions in the country and between countries. For this purpose, the described state of affairs with data was not an obstacle.
- ³ Moldova's national source (NRATI, 2005) gives the GDP figure for Moldova in MDL (Moldova's national currency), which, when recalculated in U.S. dollars, differs from the figure given in GEOHIVE: Global Statistics (n.d.). The difference is not large (compare \$541, the result of our recalculation, and

Digital Divide

\$460; GEOHIVE) and does not essentially change the picture. So, in our research, we use the UN statistics.

- ⁴ The data on the percent of the urban population in Moldova, 46% (GEOHIVE: Global Statistics, n.d.), are a little bit overestimated in comparison with the data given in the national statistical report: 41.4% (DSSRM, 2004). The data from the national statistical report in the greater degree met the described tendency.

Note: ^a The site <http://www.internetworldstats.com> gives this Figure. However, the national source NRATI (2005) gives the following

Figures: 288,000 Internet users in 2003 and 406,000 in 2004. As well, we should say the same about Internet penetration. The Ministry of Informational Development of Moldova gives the following information: According to the sociological questioning made in 2004, the number of Internet users in Moldova constituted 17.4% of the total population. This Figure is closer to the one of NRATI. However, in our research, we use the *Internet World Stats* (2005) data to keep the world picture given there.

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, and M. Acevedo-Ruiz, pp. 77-115, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.22

Digital Opportunities, Equity, and Poverty in Latin America

Simone Cecchini

United Nations Economic Commission for Latin America and the Caribbean (ECLAC), Chile

ABSTRACT

This chapter examines the digital divide that exists within Latin American countries. It argues that information and communication technology is creating new opportunities that can be seized to support human development and poverty-reduction strategies. However, it also clarifies that ICT on its own cannot leapfrog the old institutional and organizational weaknesses of Latin American economies and societies. The author hopes that understanding the deep-rooted inequalities that underlie ICT access in Latin America will not only inform researchers on the challenges for the development of the information society in the region, but also assist policy makers in the preparation and implementation of appropriate public policies.

REALIZING THE HUMAN-DEVELOPMENT POTENTIAL OF ICT IS NOT AN AUTOMATIC PROCESS

Poverty and inequality represent two enormous challenges for the countries of Latin America. In

2004, about 220 million people—43% of Latin Americans—were poor, and the average incomes of the richest 20% of the population were between 10 (Uruguay) and 44 times (Bolivia) higher than the average incomes of the poorest 20% (Economic Commission for Latin America and the Caribbean [ECLAC], 2005b). The region is considered the least equitable in the world, with vast disparities not only between rich and poor, but also between urban and rural areas, men and women, African descendants, and indigenous and nonindigenous people (ECLAC, 2005a).¹

In an age where information and communication technology² is bringing about profound changes to societies in the developed world—where it is becoming essential for economic success and personal advancement, entry into good career and educational opportunities, full access to social networks, and opportunities for civic engagement (Norris, 2001)—it is thus relevant to analyze whether these technologies can contribute to human development and poverty reduction in the Latin American region, and what the impact on inequality may be.

Consensus exists that the primary task for the countries of Latin America is the transformation of

their productive structures in a context of progressively greater social equity. Such a process should make it possible to achieve some of the objectives inherent to development: growth, improvement of income distribution, consolidation of the democratization process, greater autonomy, establishment of conditions that will halt the deterioration of the environment, and improvement of the quality of life of citizens (ECLAC, 1990).

It is also apparent that ICT can be utilized to support human development and poverty-reduction strategies in at least two areas: developing poor people's capacity, mainly by enhancing their access to education, health, and government services, and increasing their opportunities by improving their access to markets and the labor force (Cecchini & Scott, 2003; World Bank, 2000). However, as highlighted by Kirkman (1999, p. 1), translating the potential of ICT into reality is not simple:

In practice, whether or not a developing country can build an ICT-based economic or social sector depends on overcoming many of the same macroeconomic and microeconomic barriers that have long contributed to its underdevelopment—What is the state of its educational system? How are telecommunications costs regulated? Is there a reliable transportation network? Are there limits on direct foreign investment? What sources of investment capital are there for small or medium sized businesses?...The list goes on and on.

Indeed, while ICT such as the Internet and mobile phones is growing significantly in Latin America (Table 1), its increased penetration goes hand in hand with the persistent structural heterogeneity of the region's economies, characterized by the presence of a great number of low-productivity firms and workers in the informal sector, as well as with high levels of social inequality. It is thus clear that ICT on its own cannot leapfrog the old institutional and organizational weaknesses of Latin American societies and economies. Digital

technologies can be used as a tool to execute solutions to poverty, but cannot root out poverty on their own; the risk that ICT actually ends up contributing to higher inequality is thus very much real (Cimoli & Correa, 2003).

Drawing on micro- and macroeconomic theory and empirical data, this chapter argues that realizing the pro-poor potential of ICT requires attentive public-policy formulation and careful policy design. Insufficient information and communication infrastructure, high access costs, and low levels of education have so far bestowed the benefits of ICT on the better off, urban segments of the population rather than on the poor and rural areas. In order to reach the poor, policies that foster the supply of low-cost and accessible telecommunications and information-technology infrastructure are needed. This chapter maintains, however, that the success of ICT projects and programs for development also depends on policies that promote the demand of ICT. These policies include the provision of locally contextualized information and pro-poor services, as well as investment in ICT training and awareness-raising campaigns. Furthermore, it suggests that successful projects are led by grassroots-based organizations that have the appropriate incentives to work with marginalized groups, and are characterized by the use of appropriate technology, local ownership and participation of the community, financial sustainability, and the use of monitoring and evaluation (M&E) techniques.

LITERATURE ON THE INTERNAL DIGITAL DIVIDE

In this chapter we will focus on the gaps that exist between different socioeconomic groups within the countries of the region—the “internal” digital divide—rather than on the divergence in ICT access between Latin American and developed countries—the “international divide.” Accord-

ingly, we present at this point a very brief review of some of the literature related to the internal divide.

Rogers' (1995) diffusion theory provides an important interpretation of social stratification in technological adaptation, showing that early adopters of new innovations are characteristically drawn from groups with higher socioeconomic status. Rogers also suggests that the adoption of successful new technologies often reinforces economic advantages so that the rich get richer and the poor fall farther behind. This pattern, however, is not inevitable since the conditions under which an innovation is implemented determine, in part, their social consequences. These conditions include the existence of initiatives to broaden technological access by the state and nonprofit sectors, the degree of inequality in the society, and the financial resources and educational skills required to access technology. Without state intervention, for instance, a relatively costly ICT requiring high educational skills such as the Internet is expected to exacerbate existing social divisions (Norris, 2001).

Cecchini and Scott (2003) come to similar conclusions by using a microeconomic model showing why the rich and the poor use different communication techniques and how the nature of technological change has until now been biased toward the rich, widening the digital divide. Since the value of time is lower for the poor, due to underemployment, and the cost of ICT capital is high,³ when ICT consists of communications techniques such as oral (person to person), written word, and fixed-line telephony, the poor tend to communicate orally. The rich, who face the opposite constraints, choose to communicate via fixed-line telephony, which is relatively capital intensive. When the Internet, requiring more capital per unit of information communicated than any other existing technique, becomes available, the rich switch from fixed telephony to Internet usage,⁴ while the poor continue to communicate orally. Therefore, the model has two implications

for a pro-poor ICT policy. First, the relative price of capital for communications purposes should be reduced for the poor. Second, the focus of research and development in ICT has to favor user-friendly hardware and software for the poor.

Indeed, mobile phones, which unlike the Internet can be easily used even by illiterates and do not need a permanent electricity supply, are now seen by some observers as potentially the most effective response to the digital divide ("Technology and Development: The Real Digital Divide," 2005).

Using macroeconomic evidence, Forestier, Grace, and Kenny (2002) show that historically telecommunications rollout has benefited the wealthy, with a positive and significant impact on increasing income inequality within countries. The authors' regressions illustrate that countries with high initial teledensity (allowing for income) and countries that have high growth in teledensity (allowing for growth in income) see significantly higher growth in income inequality. The diffusion of the Internet in developing countries is said to be following a similar pattern, suggesting that it is a force for growing income inequality. Without intervention, ICT might be even more strongly "sub-pro-poor" than has been true for the telephone. The Internet, in fact, requires not only more ICT capital, but also a higher level of education and skill to operate than the telephone (Forestier et al.).

As Heeks and Kenny (2002) point out, the diverging effects of ICT may be a consequence of the fact that ICT was almost entirely developed within the context of high-income countries. ICT was thought of for a capital-rich setting and embodies significant quantities of technical, human, and institutional capital. Since rich countries already have a large stock of personal computers (PCs) and telephone lines, Internet access represents a small marginal investment compared to the existing fixed stock of ICT capital. They also have more educated, highly skilled employees to install, operate, and maintain ICT.

In developing countries, with few PCs, limited telephone networks, and lower levels of human capital, the same is not true. Furthermore, ICT embodies within it rich countries' assumptions about ICT-friendly institutional strategies at the organizational level and ICT-friendly laws and regulations at the national level. For developing countries, where such institutional arrangements are less likely to exist, ICT warrants a range of investments in institutional reform.

ACCESS TO ICT WITHIN LATIN AMERICAN COUNTRIES⁵

During the 1990s, access to ICT grew at exponential rates, and today Latin America and the Caribbean is one of the developing regions with the highest penetration rates of fixed and mobile phones, the Internet, and PCs. ICT access rates, however, are still much lower than those in the developed world (the international digital divide) and testify that countries of the region are still far from reaching universal access (see Table 1).

Here, we will thus again focus on how access is distributed within countries (the internal digital divide) using data from household surveys that support some of the ideas presented in the previous section on ICT literature.

The internal digital divide is a multidimensional phenomenon tapping many social divides (Norris, 2001) related to differences in incomes, education, and geographical area of residence. Starting with the income dimension, we can note that within Latin American countries, the poor have much worse access to ICT than rich citizens (Table 2). In Chile, in the year 2000, only 32% of the poorest 10% of households had a fixed or mobile phone; computer presence (1.9%) or Internet connection (0.8%) in the poorest households was even more infrequent. Among the richest 10% of Chilean households, contrarily, 60% had a computer and 38% an Internet connection; almost all (95%) had a fixed or mobile phone (SUBTEL, 2002). In Paraguay, in 2001, the percentage of people with access to ICT in the poorest quintile of the income distribution was close to zero, with the exception of mobile phones (6.1% of the

Table 1. Percentage of ICT in Latin America and in the world, 1990 and 2003 (Source: United Nations Statistics Division [UNSD], 2006)

| Region | Fixed & mobile phones | | Internet users | | PCs | |
|---|-----------------------|-------|----------------|------|------|------|
| | 1990 | 2003 | 1990 | 2003 | 1990 | 2003 |
| Latin America and the Caribbean | 6.4 | 40.4 | 0.0 | 9.0 | 0.6 | 6.8 |
| Transition countries of Southeastern Europe | 13.8 | 57.7 | 0.0 | 13.5 | 0.2 | 6.5 |
| Eastern Asia | 2.4 | 47.3 | 0.0 | 8.9 | 0.3 | 5.6 |
| Western Asia | 10.0 | 45.8 | 0.0 | 7.2 | 1.2 | 5.6 |
| Commonwealth of Independent States | 12.5 | 29.4 | 0.0 | 3.6 | 0.3 | 6.8 |
| Northern Africa | 2.9 | 21.0 | 0.0 | 3.4 | 0.1 | 3.4 |
| Southeastern Asia | 1.4 | 20.4 | 0.0 | 6.1 | 0.3 | 2.8 |
| Oceania | 3.4 | 10.1 | 0.0 | 3.8 | 0.0 | 6.1 |
| Southern Asia | 0.7 | 7.1 | 0.0 | 1.7 | 0.0 | 1.1 |
| Sub-Saharan Africa | 1.0 | 6.0 | 0.0 | 1.1 | 0.3 | 1.2 |
| Developed countries | 45.4 | 124.7 | 0.3 | 44.8 | 11.1 | 44.9 |

poorest quintile declared possessing a cell phone). However, among the richest quintile, more than half of the people had a fixed or mobile phone in the household, 22% owned a PC, and 4.6% had Internet access. In Peru and in the urban areas of Ecuador, we can observe similar results. Table 2 also suggests that, with the exception of data on fixed phones in Paraguay, access to PCs and the Internet is worse distributed than access to telephones.

In a region characterized by the stratification and inequality of its educational systems, which

over time have tended to become more elitist (Hopenhayn, 2002), more educated people have better access to, and make better use of, ICT. Data from household surveys show that in the countries of Latin America, between 19% (Nicaragua) and 68% (Brazil) of people with 15 years or more of education have a PC in the household. Ownership of a PC by those with less than 2 years of education ranges instead between 0.4% (Nicaragua) and 11% (Uruguay). Similarly, Internet access rates of more educated citizens are between 6 (Uruguay) and 107 (Chile) times higher than those of less

Table 2. Access to ICT by the poorest and richest quintile of the income distribution; selected countries, 2000-2002 (Source: Author; SUBTEL, 2002).

| ICT | Country (year) | % of people with access to ICT in the household | | |
|-----------------|-------------------|---|------------|---------------------------|
| | | Quintile 1 | Quintile 5 | Quintile 5/ Quintile 1 |
| Fixed telephone | Chile (2000) a/ | 22.0 | 86.0 | 3.9 |
| | Ecuador (2002) b/ | 33.0 | 81.0 | 2.5 |
| | Paraguay (2001) | 0.6 | 56.5 | 94.2 |
| | Peru (2001) | 7.8 | 46.4 | 5.9 |
| Mobile phone | Chile (2000) a/ | 13.0 | 79.0 | 6.1 |
| | Paraguay (2001) | 6.1 | 55.6 | 9.1 |
| | Peru (2001) | 1.7 | 10.2 | 6.0 |
| PC | Chile (2000) a/ | 1.9 | 59.7 | 31.4 |
| | Paraguay (2001) | 0.0 | 22.2 | - |
| Internet | Chile (2000) a/ | 0.8 | 38.0 | 47.5 |
| | Paraguay (2001) | 0.0 | 4.6 | - |

Table 3. Percentage of urban and rural access to ICT in Peru, 2002 (Source: INE Peru, 2003).

| | Lima | Other urban areas | Rural areas |
|--|------|-------------------|-------------|
| Households with fixed telephone | 44.7 | 21.6 | 0.4 |
| Households with mobile phone | 17.9 | 7.9 | 0.5 |
| Households with computer | 14.1 | 6.4 | 0.1 |
| Households using public Internet service | 44.2 | 30.2 | 3.6 |
| Households with Internet | 2.3 | 0.5 | 0.0 |

Digital Opportunities, Equity, and Poverty in Latin America

educated citizens.⁶ As a consequence, in a country like Chile, about 89% of Internet users have had tertiary education (UNDP, 2001).

Urban areas are much better connected to ICT than rural areas. The case of Peru is illustrative: In Lima, the national capital, 45% of households have a fixed-line phone at home and 18% own a cellular phone, while only about 0.5% of rural households own a fixed-line telephone or a mobile phone. The divide is no better with respect to PCs and the Internet. In Lima, 14% of households have a computer and 44% use public Internet services, while in rural areas of Peru, these percentages are 0.1 and 3.6, respectively (see Table 3; INE Peru, 2003). In Chile in 2000, only 0.8% of rural households had access to the Internet, compared to 9.4% of urban households (SUBTEL, 2002).

It must be noted, however, that in Latin America a great heterogeneity of incomes and human

development also exists within urban areas. This is reflected in different levels of access to ICT. In one of the richest municipalities (Las Condes) of the capital of Chile, Santiago, 85% of people have access to a PC, while in La Pintana, one of the poorest, access is only 20% (see Table 4; Raad, 2004).

The internal digital divide is not limited to income, education, and geographical area of residence, but also extends to gender, age, race, and ethnic inequalities. The percentage of female Web users in Latin America and the Caribbean has been estimated at around 38%, which is far from gender parity,⁷ although the gender gap seems to be closing in many countries (Bonder, 2002; SUBTEL, 2002; UNDP, 2001). Older and indigenous people are also at a disadvantage. In Mexico in 2002, 36% of people aged 20 to 29 used the Internet, against 9% in the age group of

Table 4. Access to ICT in selected municipalities of Santiago, Chile, 2000 (Source: Raad, 2004, on the basis of the 2000 CASEN survey)

| | Las Condes | La Florida | La Pintana |
|---|------------|------------|------------|
| Monthly average household income (US\$) | 3,833 | 964 | 445 |
| Poor (%) | 0.2% | 8.5% | 31.1% |
| Average years of schooling | 14.3 | 11.3 | 8.7 |
| People with access to a PC (%) | 85.4% | 56.5% | 11.3% |
| People with Internet access (%) | 71.7% | 20.1% | 8.7% |

Note: Exchange rate CH\$/US\$: 620.

Table 5. Percentage of household ICT access by racial group in urban areas of Brazil, Costa Rica, Ecuador, and Honduras, 2000 census (Adaptation of Rangel, 2005).

| Country (year) | Telephone lines | | PCs | |
|-------------------|---------------------|--------|---------------------|--------|
| | African descendants | Others | African descendants | Others |
| Brazil (2000) | 8.1 | 16.1 | 1.3 | 5.1 |
| Costa Rica (2000) | 17.4 | 18.2 | 3.7 | 5.2 |
| Ecuador (2001) | 7.0 | 13.1 | ... | ... |
| Honduras (2001) | 6.3 | 6.6 | ... | ... |

40 to 59. In the 60-and-above age group, Internet use was only 4%. In the year 2000 in Costa Rica, Mexico, and Panama, the probability of having a computer at home was 5 times higher for nonindigenous sectors of society than it was for indigenous people (ECLAC, 2003). Furthermore, data from the 2000 census show that in urban areas, household access to telephones and personal computers is lower for African descendants than for the rest of the population, especially in countries such as Brazil and Ecuador (see Table 5).

PUBLIC POLICIES: ICT SUPPLY

The careful formulation and design of national strategies to promote the information society is essential for countries to realize the potential of

ICT for human development. Examples of such strategies in Latin America are the Digital Agenda in Chile, the Connectivity Agenda in Colombia, and e-Mexico (ECLAC, 2003). Specifically, an effective mix of public policies to foster both the supply and the demand of ICT is required to improve poor people's lives and to contribute to equitable development. Supply-side policies focus on increasing connectivity and lowering information infrastructure costs, and are a crucial prerequisite for poor people to be able to access ICT.

Universal Access to ICT

Low-cost access to information infrastructure is the basic necessary but insufficient condition to reach the poor, as inadequate or absent con-

Table 6. Telephone main lines and mobile telephones in Latin America, 1990-2003; per thousand people (Source: World Bank, 2005)

| Country | Telephone main lines | | Mobile phones | |
|--------------------|----------------------|------|---------------|------|
| | 1990 | 2003 | 1990 | 2003 |
| Argentina | 93 | 219 | 17 | 178 |
| Bolivia | 28 | 72 | 4 | 152 |
| Brazil | 65 | 223 | 16 | 264 |
| Chile | 66 | 221 | 22 | 511 |
| Colombia | 69 | 179 | 13 | 141 |
| Costa Rica | 101 | 251 | 14 | 111 |
| Dominican Republic | 48 | 115 | 11 | 271 |
| Ecuador | 48 | 122 | 5 | 189 |
| El Salvador | 24 | 116 | 4 | 176 |
| Guatemala | 21 | 71 | 4 | 131 |
| Honduras | 17 | 48 | 0 | 49 |
| Mexico | 65 | 158 | 11 | 291 |
| Nicaragua | 13 | 37 | 1 | 85 |
| Panama | 93 | 122 | 3 | 268 |
| Paraguay | 27 | 46 | 7 | 299 |
| Peru | 26 | 67 | 8 | 106 |
| Uruguay | 134 | 280 | 25 | 193 |
| Venezuela | 76 | 111 | 26 | 273 |

nectivity, expensive hardware and software, and unstable power supply reduce the economic viability of ICT projects (Kirkman, 1999). Given the budget constraints faced by Latin American governments, it is not realistic to provide telephone lines, computers, or Internet access to all households (“universal service”). Government and regulators in the region are thus concerned with policy instruments for achieving universal access, of which community telecenters⁸ and public pay phones are the most common examples.

Countries such as Argentina, Brazil, Chile, Peru, and others have focused their universal-access policies on the extension of telephone lines to isolated rural areas and on the provision of free Internet access for low-income citizens through community telecenters. Indeed, in Latin America, telecenters represent one of the most common public-policy tools to provide universal access to ICT (Proenza, Bastidas-Buch, & Montero, 2001). In Argentina, the National Program for the Information Society focuses on universal access to the Internet through a countrywide network of 1,350 community technological centers that give free Internet access to lower income citizens (Finkelievich, 2003). In Chile, various governmental organizations have contributed to the creation of a network of more than 1,300 telecenters (Díaz, 2003).

Telecommunications: Competition and Regulatory Mechanisms

During the 1990s, fixed-line teledensity and especially mobile-phone penetration grew greatly in the region. Indeed, data presented in Table 6 suggest stagnation in the growth of fixed-line phones given that in most countries mobile phones’ penetration is now higher than fixed-line phones’ penetration. The widespread diffusion of mobile phones in Latin America can be explained in part with the existence in several countries of forms

of prepayment, which are particularly appealing for low-income citizens. The International Telecommunications Union (ITU, 2001) cites, together with competition and lower connection rates, the introduction of prepaid services in Bolivia in 1999 as one of the key factors for the rapid growth of subscribers to mobile phones in the country. Before, many people did not have a credit rating sufficient to ensure post-payment mobile-phone services.

Prices of residential telephone and Internet connection remain high, both in absolute terms as well as in terms of percentages of per capita incomes, especially in the poorest countries of the region. While in developed countries such as the United States or France Internet access charges—about \$15 per 20 off-peak hours—represent less than 1% of monthly per capita income, in Latin America, where charges go from \$13 (Argentina) to \$51 (Nicaragua), there are countries (Bolivia, Ecuador, El Salvador, Guatemala) where charges are more than 20%, 37% (Paraguay), 53% (Honduras), or even 139% (Nicaragua) of monthly per capita income (see Table 7).

One explanation for high costs is the existence of impediments to effective competition: During the 1990s, first entrants in the business after privatization often got generous exclusivity periods, as was the case of the Telefónica Group of Spain (Estache, Manacorda, & Valletti, 2002; Rozas Balbontín, 2003). Furthermore, the market by itself has not been able to provide a sufficient level of connectivity to the poorest and most isolated rural areas. Large telecommunications companies give priority to more lucrative urban markets and are reluctant to enter the smaller, less profitable rural markets. In Peru, the fixed-line telephony market is officially liberalized, but the incumbent Telefónica del Perú offers the only wireline service outside Lima. Many telecenter operators outside of the capital complain about bottlenecks, delivery at much lower speeds, and slow response to problems. Telecenters in Lima,

Table 7. Telephone and Internet access costs in Latin America (Source: Estache et al., 2002; World Bank, 2005)

| Country | Fixed monthly charges for residential phones (US\$) | | Average cost of a local call (US\$ per 3 minutes) | Internet service provider (ISP) charges per 20 off-peak hours (US\$) | ISP charges per 20 off-peak hours (% of monthly gross national product [GNP] per capita) |
|----------------|---|------|---|--|--|
| | 1996 | 1999 | 2003 | 2003 | 2003 |
| Argentina | 11.1 | 13.2 | 0.02 | 13.3 | 3.9 |
| Bolivia | 5.5 | 1.7 | 0.09 | 22.3 | 29.8 |
| Brazil | 2.7 | 6.0 | 0.03 | 28.0 | 11.8 |
| Chile | 15.3 | 16.3 | 0.10 | 21.8 | 6.1 |
| Colombia | 2.9 | 3.8 | 0.03 | 18.6 | 12.2 |
| Costa Rica | 5.3 | 3.9 | 0.02 | 25.8 | 7.6 |
| Dominican Rep. | 6.6 | 6.6 | 0.06 | 33.1 | 17.1 |
| Ecuador | 1.0 | 1.7 | 0.03 | 31.8 | 26.3 |
| El Salvador | ... | 7.1 | 0.07 | 48.1 | 27.8 |
| Guatemala | 0.7 | 0.0 | 0.08 | 31.2 | 21.4 |
| Honduras | 2.3 | 1.5 | 0.06 | 40.6 | 52.9 |
| Mexico | ... | 14.5 | 0.16 | 22.6 | 4.6 |
| Nicaragua | 6.6 | 2.1 | 0.08 | 51.1 | 138.6 |
| Panama | ... | ... | 0.12 | 36.0 | 10.7 |
| Paraguay | 3.3 | 4.8 | 0.09 | 36.3 | 37.3 |
| Peru | 8.9 | 14.0 | 0.08 | 32.8 | 19.2 |
| Uruguay | 9.1 | 8.5 | 0.17 | 26.5 | 7.3 |
| Venezuela | 2.5 | 9.5 | 0.02 | 19.5 | 5.7 |
| United States | ... | 19.9 | 0.00 | 15.0 | 0.5 |
| France | ... | ... | 0.15 | 14.2 | 0.8 |

where there are multiple service providers, are more likely to lease faster connections and pay lower rates (Best & Maclay, 2002).

The key to achieving connectivity for poor and rural areas is to determine how far market forces will carry the rollout of voice and data networks. The gaps left by the private sector can then be remedied by public intervention through

regulatory mechanisms. One alternative is to invite private operators to bid for services in areas that are not commercially viable in return for a subsidy financed from a universal access fund. A concession contract is then awarded to the company requesting the smallest subsidy. In Chile, this mechanism was used by the telecommunications secretariat to leverage \$40 million

in private investment on the basis of just over \$2 million of public subsidy. As a result, 1,000 public telephones have been installed in rural towns at around 10% of the costs of direct public provision. In Peru, since 1999, OSIPTEL (n.d.) has subsidized the provision of public pay phones and community telecenters to about 4,500 rural villages and 500 rural district capitals. Another alternative is represented by “microtelcos,” small-scale telecom operators that combine local entrepreneurship, and municipal and community action to extend ICT services in areas that are unattractive to large private operators. The advantage of microtelcos lies in the mobilization of local resources, such as in-kind labor and private rights of way, as well as in the use of new low-cost technologies and innovative business models. In Latin America, a variety of microtelcos, ranging from telephone cooperatives in Argentina to small private operators in Colombia, are effectively servicing areas of little interest to traditional operators (Galperin & Girard, 2005).

PUBLIC POLICIES: ICT DEMAND

Even if information infrastructure becomes available at a very low cost, there is no guarantee that the poor will access ICT applications in a meaningful way. What are some of the public policies available to foster the demand for ICT?

Locally Contextualized Information and Pro-Poor Services

Content provided through ICT should not be limited to the knowledge that can be accessed from outside sources, but rather extended to ensure that the poor have the means to speak for themselves, as they know their needs, circumstances, worries, and aspirations best. In summary, the poor may demand access to locally contextualized information more than access to existing information from an alien context (Heeks, 1999). It is also advis-

able that ICT projects focus on a limited number of well-run pro-poor services and expand them incrementally rather than offer a great number of services that end up unutilized. Among the core services that telecenters can offer to attract clients and generate revenue, voice and text communication services are among the best candidates. Information systems that connect people to each other despite barriers of time, distance, literacy, and ownership of a telephone or PC are in fact in high demand among poor rural communities (Best & Maclay, 2002).

“Old” ICTs such as the telephone have demonstrated to be able to contribute in important manners to improve the economic opportunities of small farmers and entrepreneurs in isolated regions. An evaluation of the use of public telephones installed in poor rural areas of the Frontera Norte region of Peru in 1999 reveals that around 20% of the population use the telephone to conduct economic activities, and of that 20%, about 72% use the phone to get information on market prices. With respect to the economic impact of the project, people highlight improvements in agriculture, cattle raising, and trade. In particular, they emphasize improvements in the access to market information, which allows them to negotiate better prices and to sell more products, as well as in their contacts with clients and suppliers, in technical assistance for agriculture and cattle raising, and in the coordination of products transportation (see Table 8; OSIPTEL, 2002).

Innovative examples of the provision of content relevant for human development are Agronegocios in El Salvador and Viva Favela in Brazil. Agronegocios⁹ is a project launched in 2000 by the Ministry of Agriculture that offers technical and entrepreneurial training to small farmers and fishermen through computer centers, videos, and a Web site with practical information. Ten Agronegocios centers throughout the country offer technical and commercial assistance as well as free access to a Web site with information on recommended crops, market prices, financial

Table 8. Economic impact of public telephones in rural areas of Frontera Norte, Peru (Source: Author, on the basis of OSIPTEL, 2002; survey in which 401 people were interviewed)

| | Agriculture | Cattle raising | Commerce |
|--|-------------|----------------|----------|
| <i>Activities that have improved with the use of public phones (%)</i> | 83.3 | 40.9 | 39.9 |
| <i>Improved activities (% over the total in each activity):</i> | 100.0 | 100.0 | 100.0 |
| Information on market prices | 36.2 | 4.3 | 28.1 |
| Contacts with clients and/or suppliers | 33.3 | 5.5 | 54.4 |
| Technical and/or veterinary assistance | 10.2 | 18.9 | 0.6 |
| Sales and/or prices | 7.5 | 5.5 | 8.7 |
| Products transport and/or communications needed to sell cattle | 6.0 | 64.6 | 0.6 |
| Other | 6.8 | 1.2 | 7.6 |

costs and benefits of agricultural activities, investment opportunities, and a virtual market where product supply and demand can be published (Op de Coul, 2003). Viva Favela¹⁰ is a Web site offering information on job opportunities, credit sources, taxes, and other topics relevant for the informal sector.

In order to provide information and services that truly respond to the necessities of low-income communities, it is critical to make use of participatory surveys, such as the participatory rural appraisals (PRAs), which ensure community participation and ownership of development projects. In the rural and isolated Peruvian Alto Amazonas province, the Hispano-American Health Link program (EHAS) carried out a study on the information and communication needs of primary health-care personnel before launching a low-cost voice and e-mail communication system. The study identified poor infrastructure, time spent traveling to transmit administrative reports, lack of feedback information on epidemiological topics, and insufficient training as the main problems faced by health-care professionals. As a result, EHAS decided to center its services on remote access to health information

and on distance training. Each week, an electronic health training publication is sent to health-care personnel, and courses on childhood and maternal health, childhood diarrhea, infectious diseases, nutrition, and other prevalent diseases of rural areas are sent through e-mail. These distance courses can be used off-line and have a system for self-examination and remote evaluation. Furthermore, health-care personnel can now use e-mail to receive information from health experts (A. Martínez, Pozo, Seoane, & Villaroel, 2002; F. A. Martínez, 2003).

Awareness Raising and Training

The presence of useful ICT applications does not guarantee that the poor will make use of them. Raising awareness among the poor about the potential of ICT (for instance, in the creation of new opportunities in the job market) is thus another key aspect of successful ICT projects and programs. Word of mouth is often a very powerful tool for publicity: Leaders of poor communities, as well as schoolchildren, could be brought to telecenters for a demonstration that shows what ICT can do for them. Furthermore, investment in custom-

ized training in information-technology skills represents one of the most important factors that may facilitate access to new ICT by low-income citizens (Norris, 2001). In particular, training for poor people with low levels of education should focus on innovative, interactive, and participatory training approaches as learning is more effective through practice.

In Brazil, the Committee for Democracy in Information Technology (CDI) has provided computer and civics training to young people living in urban slums, or favelas, since 1995. CDI emerged from the belief that computer literacy can maximize opportunities in the job market and promote democracy and social equity. Along with training in word processing, spreadsheets, accounting programs, and Web design, CDI teaches civic participation, nonviolence, human rights, environmental awareness, health, and literacy. There is growing anecdotal evidence of CDI's success on several fronts. After a 3- or 4-month course, graduates are said to find well-paid jobs, start microbusinesses, or become certified teachers within the organization. Some CDI graduates who had dropped out of public school have decided to go back and complete their formal education;

many others put their computer skills to work in various community activities, including health education and AIDS awareness campaigns. A survey conducted in 2000 by Instituto de Estudos da Religião (ISER), a research institute, confirmed that the program is reaching the poor and that 87% of students consider that CDI courses have contributed to positive changes in their lives (see Table 9). The teaching environment, however, is a difficult one: Sometimes students cannot get to school because criminal gangs do not let them (CDI, n.d.; World Bank, n.d.).

At the national level, it is important to launch countrywide awareness campaigns to sensitize the population to the potential of ICT and to train poor people in the use of the new technologies. In 2003, the government of Chile trained about 100,000 people in the use of personal computers and the Internet through a national campaign of digital alphabetization. The campaign, which will continue up to 2005, is directed at workers and microentrepreneurs. These take 18-hour courses that help them learn word processing and Web surfing (Gobierno de Chile, 2003).

Public schools can also play an important role in the diffusion of knowledge about ICT through

Table 9. CDI student profile and impact of courses in Brazil (Source: Author; on the basis of the Information and Development Program, infoDev, 2003)

| | % |
|---|----|
| <i>Student profile:</i> | |
| Aged between 10 and 18 | 65 |
| Women | 56 |
| African descendants | 65 |
| Live in households with four or more members | 77 |
| Without income | 63 |
| With income between one and two minimum salaries | 29 |
| <i>Impact of courses:</i> | |
| Courses corresponded to expectations | 90 |
| Courses contributed to a positive change in the life of the student | 87 |

programs that provide computer and Internet access to students. These programs are currently under way in several countries of the region, such as Brazil, Chile, and Costa Rica (Hopenhayn, 2002, 2003). However, while it is important to train and sensitize students about the use of ICT, to expect PCs to be a source of deep changes in classrooms seems naïve and could lead away from a thorough analysis of what prevents institutional reforms of education. Research from the United States, where the average number of students (from kindergarten to grade 12) per PC in school went down dramatically from 125 in 1981 to only 5 in 2000, shows no evidence that computers can be credited with any student achievement gain at any level (Cuban, 2001).

IMPLEMENTATION OF PUBLIC POLICIES

Appropriate Technology

Some prerequisites are needed to make the introduction of ICT in development projects and programs cost effective and sustainable, including not only a stable electric power supply and good connectivity, but also the human capacity to manage hardware and software. If these essential factors are not present, it may be better to look for low-tech but more appropriate solutions.

For instance, in Latin America, the use of electronic commerce on the part of micro and small businesses still faces enormous obstacles. Among the most important challenges to the financial sustainability of micro and small electronic-commerce activities, we should highlight the high costs of deliveries; the low levels of the quality of telecommunications infrastructure, especially in rural areas; the lack of human capital needed to fix equipment when problems arise (SustainIT, n.d.); and the low penetration of credit cards in several countries of the region. In Bolivia, for example, at the end of the last decade there were only 200,000

credit cards in circulation, corresponding to less than 2% of the population (ITU, 2001).

Clearly, no single technology constitutes a “magic bullet,” and the type of ICT that will be appropriate depends on the circumstances (Organisation for Economic Cooperation and Development [OECD], 2005). In Peru, EHAS devotes special attention to the maintenance of its low-cost voice and e-mail communication system based on VHF (very high frequency) radio and solar power. The program has set up local security backups for all hard drives and a remote maintenance system to reach all the computers through radio links (A. Martinez et al., 2002; F. A. Martinez, 2003). In Bolivia, Prodem Private Financial Fund (Prodem FFP) employs smart cards,¹¹ voice-driven ATMs (automated teller machines), and fingerprint-recognition technology to provide financial services to low-income communities. Many of its 50,000 customers are illiterate, speak only the local Quechua or Aymara languages, have no familiarity with modern financial services, and often live in rural areas lacking a reliable telecommunications infrastructure. In order to serve this market, Prodem FFP offers secure access to ATMs with color-coded touch screens. When customers use an ATM, they can choose to receive audio instructions in Spanish, Quechua, or Aymara. Since the customers’ account balances are stored in the smart card, it is not necessary for the ATM to connect to the Internet to complete a transaction. ATMs are assembled in Bolivia at half the cost of a traditional ATM with limited functionality (Hernandez & Mugica, 2003).

Radio programming, cheap enough to be produced locally and in a range of languages, can be used to inform farmers about agricultural techniques and commodities prices. In Latin America, most radio programming (as opposed to Internet content) is produced locally or nationally. In Peru alone, an estimated 180 radio stations offer programs in Quechua, a language spoken by around 10 million people and almost completely absent

from the Internet (Kenny, 2002). Furthermore, in areas with poor connectivity, databases that can be accessed off line as well as the delivery of documents and certificates on floppy disks may be an alternative to Internet-based versions of e-government.

Community Participation and Ownership

The advantages of community ownership¹² have long been demonstrated in infrastructure projects in developing countries. Whether in irrigation or electricity projects, community ownership and participation means that the community is willing to invest in the projects, that the projects are well maintained, that the infrastructure can better address community needs, and that community resources can be leveraged (Girard & Ó Siochrú, 2005). Organizations planning ICT projects and programs should thus ensure that ICT applications respond to the priorities of the community as the ownership and development of ICT applications in collaboration with local staff foster the success and resilience of ICT projects. In Brazil, CDI schools are created through partnerships with community organizations, nongovernmental organizations (NGOs), and religious groups. Communities have complete ownership of the schools and are responsible for their staffing, management, and maintenance. To develop a CDI school, a community sets up a committee to assess local demand, identify future instructors and a suitable location, and establish security measures for the computers. CDI trains the instructors, works with the school to obtain a hardware donation from sponsors, helps the school install the computers, and once a school has been established, serves as a consultant. It is the community that is responsible for making the school self-sustainable (CDI, n.d.; World Bank, n.d.).

In contrast, outside control and top-down approaches waste resources in the initial periods of projects, endangering their future sustainability.

A 2000 survey of Internet access centers set up by the government of Buenos Aires found that although the program was providing free Internet access, it did not provide training to users nor did it promote the participation of the local community in the decisions related to the project. Researchers that analyzed the survey observed that telecenters can have an impact on society when the members of a local community have a sense of ownership and take active participation in management activities, promoting the telecenter sustainability (Finkelievich, 2001). Menou, Poepsel, and Stoll (2004, p. 48) noted that governmentally initiated telecenters set up without adequate preparation on the part of the institutions hosting them (schools, public libraries, and others) have been characterized by a “continuing seesaw between emphatic promises, delayed and/or partial implementation, and occasional implementation especially in pre-election times” more than by sustainable development. Others in Latin America have observed that purely commercial telecenters have a particularly limited capacity to benefit low-income populations with little education (Proenza et al., 2001).

Grassroots ICT Intermediaries

In Latin America, direct ownership and use of ICT, for instance, through a PC with Internet access, applies only to a relatively small fraction of the population. Poor people have to rely on a human intermediary between them and ICT, in what is termed a “reintermediation model” (Heeks, 2001).

In Chile, for instance, the majority of Internet users belonging to middle and lower middle socioeconomic classes access the Web through a third person, while high-income citizens are usually direct Internet users (Instituto de Estudios Mediales UC, 2004).¹³ The profile of the intermediaries who add human skills and knowledge to the presence of ICT is thus critical for projects that want to reach the poor (Heeks, 1999). Successful examples of ICT projects for poverty reduction

are conducted by grassroots intermediaries that have the appropriate incentives and proven track record of working with poor people. A study on telecenter initiatives in Latin America noted that to achieve economic and social development, they need to “be run by someone that is personally committed to the project, willing to contribute his or her own capital and time, backed by the community in which the center operates, and willing to address the community’s objectives and needs” (Proenza et al., 2001, viii). If these intermediaries are grassroots based, understand the potential of ICT for social change, and can be held accountable to the communities they serve, they can be tremendously effective in promoting local ownership of ICT projects. Given the right incentives and opportunities, these intermediaries are keen to make access to information easily available for everybody and are willing to train others in the community.

Financial Sustainability, Monitoring, and Evaluation

A major challenge for ICT projects is reaching financial sustainability, but, since most ICT projects are recent, experience in sustainability is limited. The spending capacity of the poor is low by definition and limits the chances to provide for operating costs, which are higher in rural than in urban areas. In rural areas, telecommunications cost much more, computer equipment maintenance is hard to find and expensive, and skilled operating and maintenance personnel are practically nonexistent. Deficiencies in the rural power supply make additional devices necessary, such as voltage stabilizers, surge suppressors, backup power supplies, shock protection, and grounding. Where no electricity is available, recourse must be made to solar or wind energy, which raises costs (Proenza et al., 2001).

How will we know whether the benefits derived from existing ICT projects outweigh the costs? In order to answer this question, rigorous monitoring

and evaluation of the social and economic benefits of ICT projects are needed. M&E measure performance, identify and correct potential problems early on, and improve the understanding of the relationship between different poverty outcomes and ICT policies (Kenny, Navas-Sabater, & Quiang, 2001). M&E are especially needed to measure the success of many pilots currently under way. In fact, in the case of pilots, successful outcomes might be implicitly biased due to the choice of favorable places and conditions. Projects might not yield the same results in more challenging and realistic situations. Some (infoDev, 2005) even go as far as suggesting that while undertaking M&E during and after an ICT pilot project is a standard good practice to address the immediate purposes of a project, this is not sufficient; ICT pilot projects should thus be viewed as applied research, addressing specific hypotheses and generating appropriate ideas. In particular, ICT pilot projects should be assessed in terms of their contribution to core development priorities and as to whether they can be taken to scale.¹⁴

CONCLUSION

In Latin America, as in much of the developing world, reaching the poor and realizing the potential of ICT for human development and poverty reduction is a difficult endeavor. Low-cost and accessible telecommunications and information-technology infrastructure are necessary but insufficient conditions to reach the poor. Key to the success of ICT projects for development are “soft” issues such as local ownership and participation of the community, implementation by grassroots-based intermediaries that have the appropriate incentives to work with marginalized groups, and provision of access to locally contextualized information and pro-poor services. Attention must be also placed on training, awareness-raising campaigns, financial sustainability, and monitoring and evaluation.

REFERENCES

- Best, M. L., & Maclay, C. M. (2002). Community Internet access in rural areas: Solving the economic sustainability puzzle. In *The global information technology report 2001-2002: Readiness for the networked world* (pp. 76-88). Cambridge, MA: Oxford University Press.
- Bonder, G. (2002). *From access to appropriation: Women and ICT policies in Latin America and the Caribbean*. Paper presented at the Expert Group Meeting on ICTs and their Impact on and Use as an Instrument for the Advancement and Empowerment of Women, Seoul, Republic of Korea.
- Cecchini, S., & Scott, C. (2003). Can information and communications technology applications contribute to poverty reduction? Lessons from rural India. *Information Technology for Development, 10*(2), 73-84.
- Cimoli, M., & Correa, N. (2003). Nuevas tecnologías y viejos problemas: ¿Pueden las TICs reducir la brecha tecnológica y la heterogeneidad estructural? In F. Boscherini, M. Novik, & G. Yoguel (Eds.), *Nuevas tecnologías de información y comunicación: Los límites en la economía del conocimiento* (pp. 55-72). Buenos Aires, Argentina: Miño y Davila.
- Committee for Democracy in Information Technology (CDI). (n.d.). *Institutional profile*. Retrieved January 14, 2004, from <http://www.cdi.org.br>
- Cuban, L. (2001). *Oversold and underused: Computers in classroom*. Cambridge, MA: Harvard University.
- Díaz, A. (2003). *La agenda digital 2003-2005*. Chile: Ministerio de Economía del Gobierno de Chile.
- Economic Commission for Latin America and the Caribbean (ECLAC). (1990, March). *Changing production patterns with social equity* (LC/G.1601-P/I, ECLAC Books No. 25). Santiago, Chile.
- Economic Commission for Latin America and the Caribbean (ECLAC). (2003). *Road maps towards an information society in Latin America and the Caribbean*. Santiago, Chile.
- Economic Commission for Latin America and the Caribbean (ECLAC). (2005a). *The millennium development goals: A Latin American and Caribbean perspective*. Santiago, Chile.
- Economic Commission for Latin America and the Caribbean (ECLAC). (2005b). *Panorama social de América Latina 2004*. Santiago, Chile.
- Estache, M., Manacorda, M., & Valletti, T. (2002). *Telecommunication reforms, access regulation, and Internet adoption in Latin America*. Washington, DC: World Bank.
- Fink, C., & Kenny, C. (2003). *W(h)ither the digital divide?* Washington, DC: World Bank.
- Finkelievich, S. (with Lago Martínez, S., Jara, A., Bauman, P., Pérez Casas, A., Zamalvide, M., Fresoli, M., & Turrubiates, R.). (2001). Los impactos sociales de la incorporación de las TICs en los gobiernos locales y en los servicios a los ciudadanos: Los casos de Buenos Aires y Montevideo. In M. Bonilla & G. Cliche (Eds.), *Impactos sociales de las tecnologías de información y comunicación (TIC) en Latinoamérica y el Caribe* (pp. 213-278). Quito, Ecuador: FLACSO-IDRC.
- Finkelievich, S. (2003). *ICT and economic development in Latin America and the Caribbean*. Paper presented at the World Summit of Cities and Local Authorities on the Information Society, Lyon, France.
- Forestier, E., Grace, J., & Kenny, C. (2002). Can information and communication technologies be pro-poor? *Telecommunications Policy, 26*, 623-646.

- Galperin, H., & Girard, B. (2005). Microtelcos in Latin America and the Caribbean. In H. Galperin & J. Mariscal (Eds.), *Digital poverty: Latin American and Caribbean perspectives* (pp. 93-114). Lima, Perú: REDIS-DIRSI.
- Girard, B., & Ó Siochrú, S. (2005). *Community-based networks and innovative technologies: New models to serve and empower the poor*.
- Gobierno de Chile. (2003, May 13). Campaña de alfabetización digital beneficiará a medio millón de chilenos. *Economía.cl*. Retrieved June 30, 2003, from www.economia.cl
- Godoy, S., & Herrera, S. (2004). Internet usage in Chile and the world: First results of the World Internet Project-Chile. In *Cuadernos de información* (No. 16, pp. 71-84). Santiago, Chile: Universidad Católica, Escuela de Comunicación.
- Heeks, R. (1999). *Information and communication technologies, poverty and development* (Development Informatics Working Paper Series, Paper No. 5). Manchester, United Kingdom: University of Manchester, Institute for Development Policy and Management.
- Heeks, R. (2001). *Understanding e-governance for development* (i-Government Working Paper Series, Paper No. 11). Manchester, UK: University of Manchester, Institute for Development Policy and Management.
- Heeks, R., & Kenny, C. (2002). ICTs and development: Convergence or divergence for developing countries? In *Proceedings of the Seventh International Working Conference of IFIP WG 9.4, Information and Communication Technologies and Development: New Opportunities, Perspectives and Challenges* (pp. 29-44).
- Hernandez, R., & Mugica, Y. (2003). *Prodem FFP's multilingual smart ATMs for microfinance: Innovative solutions for delivering financial services to rural Bolivia* (What Works Case Study). World Resource Institute.
- Hopenhayn, M. (2002). Educar para la sociedad de la información y de la comunicación: Una perspectiva Latinoamericana. *Revista Iberoamericana de Educación*, 30, 187-217.
- Hopenhayn, M. (2003). Educación, comunicación y cultura en la sociedad de la información: Una perspectiva Latinoamericana. *CEPAL Review*, 81, 175-193.
- INE Peru (Instituto Nacional de Estadística, Peru). (2003). *System of indicators of information and communication technologies*. Presented at Monitoring the Information Society: Data, Measurement and Methods, Geneva, Switzerland.
- Information and Development Program (infoDev). (2003). *ICT for development contributing to the millennium development goals: Lessons learned from seventeen infoDev projects*. Washington, DC: World Bank.
- Information and Development Program (infoDev). (2005). *Framework for the assessment of ICT pilot projects: Beyond monitoring and evaluation to applied research*. Washington, DC: World Bank.
- Instituto de Estudios Mediales UC (Universidad Católica). (2004). *Principales resultados WIP Chile*. Santiago, Chile: Instituto de Sociología UC-World Internet Project.
- International Telecommunications Union (ITU). (2001). *Internet en los Andes: Estudio de caso sobre Bolivia*.
- International Telecommunications Union (ITU). (2003, November 19). *ITU Digital Access Index: World's first global ICT ranking* [Press release]. Geneva, Switzerland: Author.
- Kaufmann, D. (2002). *Governance, corruption and poverty: Analytical and empirical approaches*. Presented at *Attacking Poverty for APP Family*, Washington, DC.
- Kenny, C. (2002). *The costs and benefits of ICTs for direct poverty alleviation*. Washington, DC: World Bank.

- Kenny, C., Navas-Sabater, J., & Quiang, C. (2001). Information and communications technologies and poverty. In *World Bank poverty reduction strategies sourcebook*. Washington, DC: World Bank.
- Kirkman, G. (1999). *It's more than just being connected: A discussion of some issues of information technology and international development*. Paper presented at the Development E-Commerce Workshop, MA.
- Martínez, A., Pozo, F. del, Seoane, J., & Villaroel, V. (2002). EHAS program: Rural telemedicine systems for primary healthcare in developing countries. In *Proceedings of the 2002 International Symposium on Technology and Society (ISTAS '02), Social Implications of Information and Communication Technology* (pp. 31-36).
- Martínez, F. A. (2003). *Evaluación de impacto del uso de tecnologías apropiadas de comunicación para el personal sanitario rural de países en desarrollo*. Unpublished doctoral dissertation, Escuela Técnica Superior de Ingenieros de Telecomunicación, Universidad Politécnica de Madrid, Madrid, Spain.
- Menou, M., Poepsel, K., & Stoll, K. (2004). Latin American community telecenters: It's a long way to TICperary. *The Journal of Community Informatics*, 1(1), 39-57.
- Norris, P. (2001). *Digital divide: Civic engagement, information poverty, and the Internet worldwide*. New York: Cambridge University Press.
- Op de Coul, M. (2003). *ICT for development case studies: Central America*. Oneworld International/Building Digital Opportunities.
- Organisation for Economic Cooperation and Development (OECD). (2005). Good practice paper on ICTs for economic growth and poverty reduction. *DAC Journal on Development*, 6(3), 27-96.
- OSIPTEL (Oranismo Supervisor de Inversión Privada en Telecomunicaciones). (2002). *Estudio sobre las condiciones de uso y el impacto de la telefonía en los centros poblados rurales que forman parte del Proyecto Frontera Norte*. Fondo de Inversión en las Telecomunicaciones (FITEL).
- OSIPTEL. (n.d.). *Rural telecommunications and universal access in Peru: Fund for Investment in Telecommunications (FITEL)*. Retrieved February 2, 2004, from <http://www.osiptel.gob.pe/Index.ASP?T=P&P=3295>
- Proenza, F. J., Bastidas-Buch, R., & Montero, G. (2001). *Telecenters for socioeconomic and rural development in Latin America and the Caribbean*. Washington, DC: FAO, IADB, ITU.
- Raad, A. M. (2004). Reflexiones sobre la participación en una cultura digital. In R. A. Dujisin & M. A. Porrúa (Eds.), *América Latina puntogob: Casos y tendencias en gobierno electrónico*. Santiago, Chile: FLACSO-Chile & Organization of American States (OAS).
- Rangel, M. (2005). *La población afrodescendiente en América Latina y los Objetivos de Desarrollo del Milenio. Un examen exploratorio en países seleccionados utilizando información censal*. Presented at Seminario Pueblos Indígenas y Afrodescendientes en América Latina y El Caribe, Santiago, Chile.
- Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: Free Press.
- Rozas Balbontín, P. (2003). Gestión pública, regulación e internacionalización de las telecomunicaciones: El caso de Telefónica S.A. *ECLAC, Serie Gestión Pública*, 6. Santiago, Chile: ECLAC.
- SUBTEL (Subsecretaría de Telecomunicaciones). (2002). Caracterización socioeconómica de los servicios de telefonía y tecnologías de información y comunicación. *Serie Informes de Estadísticas del Sector de las Telecomunicaciones*, 4. Santiago, Chile: Gobierno de Chile.

SustainIT. (n.d.). *PEOPlink*. Retrieved January 10, 2004, from http://www.sustainit.org/cases/full_cases.htm

Technology and development: The real digital divide. (2005, March 10). *The Economist*, p. 9.

United Nations Development Program (UNDP). (2001). *Human development report 2001: Making new technologies work for human development*. New York: Oxford University Press.

United Nations Development Program (UNDP). (2002). *Human development report 2002: Deepening democracy in a fragmented world*. New York: Oxford University Press.

United Nation Statistics Division (UNSD). (2006). *World and regional trends: Data for years around 1990 and 2000*. Retrieved January 30, 2006, from http://millenniumindicators.un.org/unsd/mi/mi_worldreg.asp

World Bank. (2000). *World development report 2000/2001: Attacking poverty*. New York: Oxford University Press.

World Bank. (2002). *Information and communication technologies: A World Bank group strategy*. Washington, DC: Author.

World Bank. (2005). *World development indicators 2005*. Washington, DC: Author.

World Bank. (n.d.). Case study: Committee for the Democratization of Information Technology Brazil. In *School based telecentres training materials*. Retrieved January 14, 2004, from http://www.worldbank.org/worldlinks/telecentres/workshop/sbt-pdf/case-studies/allcasestudies_pdf.pdf

ENDNOTES

¹ In Latin America, indigenous people (who account for more than 25% of the population in Bolivia, Ecuador, Guatemala, and Peru)

and African descendants (who account for more than a quarter of the population in Brazil, Nicaragua, and Panama) are, to a large extent, the poorest in the region, have the worst socioeconomic indicators, and receive scant cultural recognition or access to decision-making levels (ECLAC, 2005a).

² ICT can be defined as the set of activities that facilitates the capturing, storage, processing, transmission, and display of information by electronic means (World Bank, 2002).

³ In this model, ICT capital consists of hardware, software, and human capital.

⁴ Of course, in practice the rich are likely to use both mobile phones and the Internet, but each for different purposes. Furthermore, mobile phones can in certain circumstances provide access to the Internet.

⁵ As highlighted by Fink and Kenny (2003), the digital divide should not be measured only on the basis of access to ICT, but also on the basis of the impact of the use of the new technologies. However, the current availability of data substantially limits measurement possibilities and, therefore, we will have to focus on access to ICT.

⁶ Again, we are comparing persons with 15 years or more of education with persons with 2 or less years of education, and are referring to Internet access in the household.

⁷ Given that women have a life expectancy (75.2 years in Latin America) higher than men (68.8 years), and that the elderly have less access to ICT than other age groups, it would be advisable that gender parity indices on ICT access take into account the age structure of the population.

⁸ In Latin America, telecenters have fairly standard features. They consist of premises stocked with several PCs located on desks or tables and with chairs for users. The main service offered is access to the Internet and to software such as word processing and spreadsheets (Proenza et al., 2001).

⁹ See <http://www.agronegocios.gob.sv>

¹⁰ See <http://www.vivafavela.com.br>

¹¹ A smart card looks like a plastic credit card and has a microprocessor or memory chip embedded in it. The chip stores electronic data and programs that are protected by security measures enabling controlled access by appropriate users. Smart cards provide data portability, security, convenience, and transparency of financial records and transactions.

¹² Community ownership can refer to three related concepts, often found in some combination: a process of internalisation of responsibility for a development process and its outcomes, a determining degree of

decision-making power, and full or majority legal ownership of an initiative (Girard & Ó Siochrú, 2005).

¹³ The study excluded the poorest Chileans, those with household monthly incomes lower than \$160, corresponding to 13.5% of the population (Godoy & Herrera, 2004). It is to be expected that the proportion of Internet users through intermediaries among the poorest is even higher than in other socioeconomic levels.

¹⁴ It must be noted, however, that the rapid pace of technological innovation and social adaptation often makes studies on the impact of ICT what Norris (2001, Chap. 2 p. 1) has called “blurred snapshots of a moving bullet.”

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, and M. Acevedo-Ruiz, pp. 1-28, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.23

Integrating ICTs in African Development: Challenges and Opportunities in Sub-Saharan Africa

Bobak Rezaian
The World Bank, USA

ABSTRACT

This chapter reviews the role of information and communication technologies in socioeconomic development and poverty-reduction programs in sub-Saharan countries. To this end, the author first provides an overview of the status of ICTs and national ICT strategies in sub-Saharan Africa. He then analyzes the treatment of ICTs in three major policy documents that provide the framework for economic growth and poverty reduction efforts in most developing countries. These are (a) national poverty-reduction strategies, (b) country assistance strategies of the World Bank, and (c) poverty-reduction support credits. The analysis reveals that while a majority of national ICT policies strongly promote the use of ICTs for socioeconomic development, the poverty-reduction

and country assistance strategies focus primarily on the use of ICTs in public-sector management. Hence, there is a persistent disconnection between the ICT policies and the poverty-reduction strategies. The author identifies some of the main challenges and the substantial opportunities that would arise from the mainstreaming of ICTs in national development initiatives.

BACKGROUND

The contribution of information and communication technologies to economic growth in developed countries has been the subject of research, discussion, and debate since the early 1990s.¹ The Organization for Economic Cooperation and Development (OECD) has quantified the positive

contribution of ICTs to gross domestic product (GDP) growth in several advanced economies.² Some of these countries have taken the necessary steps to create an information society by educating citizens and gradually organizing their economy around knowledge and information.

The potential impact of ICTs on socioeconomic development and the possible use of ICTs as effective tools for facilitating service delivery to the poor have led to a global debate on the role of ICTs as enablers of poverty reduction in developing countries. Based on a series of ICT success stories in developing countries, various researchers suggest that ICTs can help promote local economic growth, expand social and cultural opportunities, increase the efficiency of markets and institutions, facilitate public-service delivery, and provide the poor with a voice in decisions that affect their lives and communities.³

Developing countries and their development partners are investing considerable resources in harnessing the promise of ICTs for poverty reduction and economic growth.⁴ Yet, most ICT success stories have remained anecdotal as scaling up pilot initiatives on a sustainable basis has proven difficult.⁵ This trend has been more pronounced in sub-Saharan Africa (SSA), where the development efforts are often exacerbated by the complexity of challenges in adapting the global knowledge and technology to local conditions and needs.

Clearly there are major differences between the developed and developing countries in terms of requirements for the effective use of ICTs. These requirements include adequate information and communication infrastructure, affordable access to ICTs, well-trained human resources, and incentives for the use of appropriate technologies to improve productivity and efficiency in service delivery and production. These differences are bound to influence how ICTs can play an effective role in the socioeconomic development process.

In September 2000, the United Nations Millennium Summit adopted eight specific millennium development goals (MDGs) to measure the prog-

ress of global development efforts. These include the eradication of extreme poverty and hunger; universal primary education; gender equality and the empowerment of women; the reduction of child mortality; the improvement of maternal health; the combating of HIV/AIDS, malaria, and other diseases; the ensuring of environmental sustainability; and global partnerships to attain a more peaceful, just, and prosperous world.⁶

The MDGs are now a benchmark for measuring the success or failure of most poverty-reduction programs, and the more recent national poverty-reduction strategies have incorporated the MDG targets as an integral part of their goals and objectives.

In what follows, the national poverty-reduction strategies, country assistance strategies (CASs) of the World Bank, and the poverty-reduction support credits (PRSCs, which are often a multidonor basket fund for providing budget support to developing countries) are reviewed for their discussion of ICTs as development tools. Key categories for identifying the appropriate ICT discussions in poverty-reduction strategy papers (PRSPs), CASs, and PRSCs are selected from different aspects of the ICT sector, as well as the priority sectors in each country, for example, in health, education, agriculture, and the environment.

The broader categories selected for this review include telecommunications infrastructure; broadcasting; computer technology; local content and applications; human-resource development; public-sector applications; policy and regulatory environment; information generation, access, and dissemination; ICT applications in agriculture, health, and education; rural connectivity; service delivery to the poor; ICT-sector development; small- and medium-enterprise development, and poverty monitoring.

In this chapter, the author reviews the set of available policy documents (30 PRSPs, 25 CASs, and 21 active or closed PRSCs). He then normalizes the results within each category to allow for a more meaningful comparison. At the

time of this review (mid-2005), there were only 11 countries in Africa that had prepared all three poverty-reduction strategy documents (PRSP, CAS, and PRSC). Therefore, the author makes a comparison between the results for the above group of 11 countries and the larger set to examine the consistency of his findings.

The majority of national ICT policies strongly promote the use of ICTs for economic growth, improved governance, public-service delivery, and private-sector development. However, these recommendations often have neither been integrated into the strategies and action plans for poverty reduction in their respective countries, nor have they strongly influenced them. Some of the contributing factors to this endemic disconnection are discussed, and a few practical steps are proposed for closing this gap.

It must be noted that the analyses in this chapter are qualitative in nature since the available data on the role and impact of the ICTs in developing countries are very limited. Quantifying and measuring the impact of the ICT activities proposed in PRSP, CAS, and PRSC documents also pose very significant challenges. In the absence of more reliable quantitative data, however, it is hoped that the qualitative assessments of this information will contribute to a better understanding of the challenges and opportunities, and will lead to a more effective integration of appropriate technologies in development efforts.

THE DIALOGUE ON ICT FOR DEVELOPMENT

The past decade has witnessed a series of high-level international efforts to integrate information and communication technologies into development programs and poverty-reduction efforts. We define poverty to mean more than inadequate income or the inability to meet basic needs like nutrition, clothing, and shelter: It also incorporates disadvantages in access to land, credit, health,

and education, and vulnerability to violence, external economic shocks, natural disasters, and social exclusion.⁷

In 1996, the United Nations Economic Commission for Africa (UNECA) initiated the African Information Society Initiative (AISI) as a common vision for Africa to create effective digital opportunities to speed up the continent's entry into the global information and knowledge economy.⁸

Several international initiatives have supported the use of ICT for development (ICT4D), the most prominent being the G-8's (group of eight major industrial democracies, namely, Canada, France, Germany, Great Britain, Italy, Japan, Russia, and the United States) Digital Opportunity Task Force, the United Nations' ICT Task Force, and the World Summit on the Information Society (WSIS).⁹ Encouraged by the support of various bilateral and multilateral development organizations, most African countries have begun developing policies and strategies for the use of ICTs in their broader national development programs.¹⁰

Accenture Consulting, the Markle Foundation, and the United Nations Development Programme (UNDP; 2001) reviewed the record and potential of ICTs in development and presented their findings in *Creating a Development Dynamic: Final Report of the Digital Opportunity Initiative*.¹¹ This report includes several case studies, including some from Africa. A key finding of the report is that when strategically deployed, ICTs can trigger a development dynamic that gains momentum as targeted steps are taken in key areas of policy, infrastructure, human capacity, entrepreneurship, and development of locally relevant content and applications.

MDGs have now become the global yardstick for measuring the success or failure of poverty-reduction efforts in many developing countries. In most developing countries, they have also become the framework for development policies in general, and ICT4D initiatives in particular.

At the regional level, the secretariat for the New Partnership for Africa's Development (NEPAD)

Box 1. NEPAD and ICTs in Africa (NEPAD, 2002)

“The problem of inadequate access to affordable telephones, broadcasting services, computers and the Internet in most African countries is due to the poor state of Africa’s ICT infrastructure, the weak and disparate policy and regulatory frameworks and the limited human resource capacity in these countries. Although African countries, in recent years have made some efforts to facilitate the ICT infrastructure deployment, rollout and exploitation process in a number of areas, Africa still remains the continent with the least capability in ICT and least served by telecommunication and other communications facilities.

The threat posed by the digital divide to the rapid development of African countries can on the whole be attributed to their inability to deploy, harness and exploit the developmental opportunities of ICTs to advance their socio-economic development. There is therefore an urgent need to put in place and implement ICT initiatives to bridge the digital divide at four levels namely: (i) bridging the divide between the rural and urban areas within a given country, (ii) bridging the gap between countries of a given sub-region, (iii) bridging the inter-regional gap and (iv) bridging the gap between Africa and the rest of the world.”

has prepared an integrated socioeconomic-development framework for Africa. This framework includes proposals for various initiatives to bridge the digital divide in Africa (see Box 1).¹²

During the past decade, most African countries’ initial focus on ICTs has been on (a) the computerization of public-sector operations, (b) the expansion of telecommunications infrastructure, (c) the liberalization of telecom value-added services, and (c) the introduction of ICTs in higher education institutions.

This trend is still evident in several ICT strategies, PRSPs, CASs, and PRSCs. In the public sector, for example, African governments are showing increasing interest in the computerization of their budget and expenditure management, payroll, customs, and other operations.

Various international agencies and bilateral and multilateral development organizations support the computerization of public-sector operations in African countries. They find this approach

consistent with their own public-sector capacity building and good governance objectives and initiatives. The governments’ desire for modernization of the public sector, and the international organizations’ advocacy of improved public-sector management and telecom-sector liberalization have been major factors in the framing of national ICT strategies in Africa.

ICTS IN AFRICA

The growth of ICTs in SSA is a story of uneven development, with discernible general patterns dotted with exceptions. Three major trends emerge from the data: (a) Other factors being equal, the middle-income sub-Saharan countries are performing consistently better in the ICT sector compared to the lower income countries, (b) countries with smaller populations are generally doing better in terms of ICT competitiveness

compared to more populous countries, and (c) sub-Saharan countries are generally far behind in terms of connectivity infrastructure and the use of new technologies compared with rest of the world.

Of the 48 sub-Saharan countries, 38 fall in the low-income category (based on the 2004 gross national income, or GNI, per capita of \$825 or less).¹³ The SSA countries that are performing well in the ICT sector are all middle-income countries. For example, the GNI per capita for Botswana, Mauritius, Namibia, and South Africa is \$3,530, \$4,100, \$1,930, and \$2,920, respectively (World Bank, 2005). These countries also have higher levels of per capita telecommunications infrastructure, personal computers (PCs), Internet hosts, telephone main lines, and mobile phones compared with other SSA countries. The economic performance of these countries has a direct bearing on their state of education, infrastructure, availability, and affordability of ICTs for public, business, and private applications.

Between 1 to 9% of the population of every middle-income SSA country uses the Internet. Among the smaller middle-income SSA countries (both in terms of size and population), Cape Verde and Seychelles stand out in terms of the number of telephone main lines and personal computers per capita.

With the exception of South Africa, all these middle-income countries have relatively small populations (see Table 1). As a result, South Africa's performance in any of the ICT categories has a significant impact on the overall performance of the subcontinent.

For example, in 2002, the number of personal computers in sub-Saharan Africa was 11.9 per 1,000 people. Excluding South Africa, this number would decrease to 7.02 computers per 1,000 people. Also, in 2000, the average number of Internet hosts for sub-Saharan Africa was 3.1 per 10,000 people (see Table 2). However, excluding South Africa, this number would decrease by an order of magnitude to 0.32 Internet hosts

per 10,000 people. The impact of South Africa's performance on the overall performance of the region in the telecom sector is also very significant (see Table 3).

It is important to note that the official data from international sources do not fully reflect the fast pace of growth in the telecommunications sector in some SSA countries, particularly in the mobile segment (e.g., the Democratic Republic of Congo and Ethiopia). This fact notwithstanding, the overall teledensity in the sub-Sahara still remains far below other regions.

The Global Information Technology Report (Dutta, Lanvin, & Paua, 2004) provides the Networked Readiness Index (NRI) ranking for 102 countries, including 21 sub-Saharan African countries. The NRI is defined as the degree of preparation of a nation or community to participate in and benefit from ICT development. NRI is a composite measure of three components: the environment for ICTs offered by a country, the readiness of the countries' key stakeholders (individuals, businesses, and governments) to use ICTs, and the usage of ICTs among these stakeholders. The Networked Readiness Index is therefore a good indicator for evaluating a country's relative development and use of ICTs.

The Africa Competitiveness Report 2004 (Hernandez-Cata, Schwab, & Lopez-Claros, 2004) provides data on the Growth Competitiveness Index, reflecting the combined effects of public institutions, macroeconomic environment, and technology indices. This report also provides a Technology Index for the same group of African countries. The Technology Index is a measure of innovation, technology transfer, and ICTs in the country. These data confirm that the performance of countries like Botswana, Mauritius, Namibia, and South Africa is in fact consistently better than the rest of the SSA countries in all these assessment categories, while still lagging considerably behind the rest of the world (see the rankings in Table 4).

Integrating ICTs in African Development

Table 1. ICTs in sub-Saharan Africa: Population, income, and literacy (Source: Compiled from Africa Development Indicators 2005)

| | Population Mid-2003 (millions) | GNI Per Capita 2003 (Atlas dollars) | % Literacy Rate (2002) | | |
|----------------------|--------------------------------|-------------------------------------|-------------------------------|------|--------|
| | | | Population 15 Years and Above | | |
| | | | Total | Male | Female |
| SSA | 705.2 | 506 | 65 | 72 | 58 |
| Excluding SA | 659.4 | 342 | 62 | 71 | 54 |
| Angola | 13.5 | 760 | | | |
| Benin | 6.7 | 440 | 40 | 55 | 26 |
| Botswana | 1.7 | 3,530 | 79 | 76 | 82 |
| Burkina Faso | 12.1 | 300 | | | |
| Burundi | 7.2 | 90 | 50 | 58 | 44 |
| Cameroon | 16.1 | 650 | | | |
| Cape Verde | 0.5 | 1,440 | 76 | 85 | 68 |
| Central African Rep. | 3.9 | 270 | | | |
| Chad | 8.6 | 240 | 46 | 55 | 38 |
| Comoros | 0.6 | 430 | 56 | 63 | 49 |
| Congo, D. R. | 53.2 | 100 | | | |
| Congo | 3.8 | 650 | 83 | 89 | 77 |
| Cote d'Ivoire | 16.8 | 660 | | | |
| Djibouti | 0.7 | 910 | | | |
| Equatorial Guinea | 0.5 | ... | | | |
| Eritrea | 4.4 | 190 | | | |
| Ethiopia | 68.7 | 90 | 42 | 49 | 34 |
| Gabon | 1.3 | 3,400 | | | |
| Gambia, The | 1.4 | 270 | | | |
| Ghana | 20.7 | 320 | 74 | 82 | 66 |
| Guinea | 7.9 | 430 | | | |
| Guinea-Bissau | 1.5 | 140 | | | |
| Kenya | 31.9 | 400 | 84 | 90 | 79 |
| Lesotho | 1.8 | 590 | | | |
| Liberia | 3.4 | 100 | 56 | 72 | 39 |
| Madagascar | 16.9 | 290 | | | |
| Malawi | 11 | 160 | 62 | 76 | 49 |
| Mali | 11.7 | 300 | | | |
| Mauritania | 2.8 | 400 | 41 | 51 | 31 |
| Mauritius | 1.2 | 4,100 | | | |
| Mozambique | 18.8 | 210 | 46 | 62 | 31 |
| Namibia | 2 | 1,930 | 83 | 84 | 83 |
| Niger | 11.8 | 200 | 17 | 25 | 9 |
| Nigeria | 136.5 | 350 | 67 | 74 | 59 |
| Rwanda | 8.4 | 190 | 69 | 75 | 63 |
| Sao Tome & Principe | 0.2 | 330 | | | |
| Senegal | 10.2 | 550 | 39 | 49 | 30 |
| Seychelles | 0.1 | 7,350 | | | |
| Sierra Leone | 5.3 | 160 | | | |
| Somalia | 9.6 | ... | | | |
| South Africa | 45.8 | 2,920 | 86 | 87 | 85 |
| Sudan | 33.5 | 460 | 60 | 71 | 49 |
| Swaziland | 1.1 | 1,340 | 81 | 82 | 80 |
| Tanzania | 35.9 | 310 | 77 | 85 | 69 |
| Togo | 4.9 | 310 | 60 | 74 | 45 |
| Uganda | 25.3 | 250 | 69 | 79 | 59 |
| Zambia | 10.4 | 380 | 80 | 86 | 74 |
| Zimbabwe | 13.1 | ... | 90 | 94 | 86 |

Table 2. ICTs in sub-Saharan Africa: PCs, Internet hosts, and users (Source: Compiled from Africa Development Indicators 2005)

| | Personal Computers | Internet Hosts (per | Internet Users | | Internet |
|----------------------|--------------------|---------------------|----------------|-------------|--------------|
| | (per 1,000 people) | 10,000 people) | (thousands) | (thousands) | Users (%) |
| | 2002 | 2000 | 2001 | 2003 | 2001 |
| SSA | 11.90 | 3.10 | 4,491 | 2,957 | 0.64% |
| Excluding SA | 7.02 | 0.32 | 1,601 | 2,957 | 0.24% |
| Angola | 1.94 | 0.01 | 20 | ... | 0.15% |
| Benin | 2.21 | 0.04 | 25 | 70 | 0.37% |
| Botswana | 40.70 | 13.99 | 50 | ... | 2.94% |
| Burkina Faso | 1.59 | 0.19 | 19 | 48 | 0.16% |
| Burundi | 0.72 | 0 | 7 | 14 | 0.10% |
| Cameroon | 5.69 | 0.01 | 45 | ... | 0.28% |
| Cape Verde | 79.73 | 0.05 | 12 | 20 | 2.40% |
| Central African Rep. | 2.02 | 0.02 | 3 | 6 | 0.08% |
| Chad | 1.65 | 0.01 | 4 | ... | 0.05% |
| Comoros | 5.51 | 0.72 | 3 | 5 | 0.50% |
| Congo, D. R. | ... | 0 | 6 | ... | 0.01% |
| Congo | 3.94 | 0.01 | 1 | 15 | 0.03% |
| Cote d'Ivoire | 9.34 | 0.38 | 70 | 240 | 0.42% |
| Djibouti | 15.24 | 0.62 | 3 | 7 | 0.43% |
| Equatorial Guinea | 6.93 | 0 | 1 | ... | 0.20% |
| Eritrea | 2.51 | 0.02 | 6 | 30 | 0.14% |
| Ethiopia | 1.48 | 0.01 | 25 | 75 | 0.04% |
| Gabon | 19.25 | 0.21 | 17 | 35 | 1.31% |
| Gambia, The | 13.85 | 0.11 | 18 | ... | 1.29% |
| Ghana | 3.78 | 0.06 | 40 | ... | 0.19% |
| Guinea | 5.48 | 0 | 15 | 40 | 0.19% |
| Guinea-Bissau | ... | 0.1 | 4 | 19 | 0.27% |
| Kenya | 6.39 | 0.32 | 200 | ... | 0.63% |
| Lesotho | ... | 0.49 | 5 | 30 | 0.28% |
| Liberia | ... | ... | 1 | ... | 0.03% |
| Madagascar | 4.40 | 0.36 | 35 | 71 | 0.21% |
| Malawi | 1.34 | 0 | 20 | 36 | 0.18% |
| Mali | 1.41 | 0.05 | 20 | ... | 0.17% |
| Mauritania | 10.81 | 0.20 | 7 | 12 | 0.25% |
| Mauritius | 116.48 | 27.68 | 106 | 150 | 8.83% |
| Mozambique | 4.50 | 0.1 | 30 | ... | 0.16% |
| Namibia | 70.93 | 18.16 | 45 | 65 | 2.25% |
| Niger | 0.60 | 0.12 | 12 | ... | 0.10% |
| Nigeria | 7.10 | 0.01 | 115 | 750 | 0.08% |
| Rwanda | ... | 0.47 | 20 | ... | 0.24% |
| Sao Tome & Principe | ... | 45.00 | 9 | 15 | 4.50% |
| Senegal | 19.85 | 0.51 | 100 | 225 | 0.98% |
| Seychelles | 160.85 | 0.49 | 9 | ... | 9.00% |
| Sierra Leone | ... | 0.16 | 7 | ... | 0.13% |
| Somalia | ... | 0 | 1 | ... | 0.01% |
| South Africa | 72.60 | 41.94 | 2,890 | ... | 6.31% |
| Sudan | 6.15 | 0 | 56 | 300 | 0.17% |
| Swaziland | 24.22 | 7.07 | 14 | 27 | 1.27% |
| Tanzania | 4.18 | 0.16 | 60 | 250 | 0.17% |
| Togo | 30.78 | 0.35 | 150 | 210 | 3.06% |
| Uganda | 3.32 | 0.07 | 60 | 125 | 0.24% |
| Zambia | 7.48 | 0.88 | 25 | 68 | 0.24% |
| Zimbabwe | 51.57 | 2.5 | 100 | ... | 0.76% |

Integrating ICTs in African Development

Table 3. ICTs in sub-Saharan Africa: telecom, radio, and TV (Source: Compiled from Africa Development Indicators 2005)

| | Main Lines (per 1,000 people) | Mobile Phones (per 1,000 people) | Radios (per 1,000 people) | Television (per 1,000 people) |
|-----------------------|----------------------------------|-------------------------------------|------------------------------|----------------------------------|
| SSA | 15 | 37 | 198 | 69 |
| Excluding SA | 8 | 18 | 188 | 62 |
| Angola | 6 | 9 | 78 | 52 |
| Benin | 9 | 32 | 445 | 12 |
| Botswana | 87 | 241 | 150 | 44 |
| Burkina Faso | 5 | 8 | 433 | 79 |
| Burundi | 3 | 7 | 220 | 31 |
| Cameroon | 7 | 43 | 161 | 75 |
| Cape Verde | 160 | 98 | 181 | 101 |
| Central African Rep. | 2 | 3 | 80 | 6 |
| Chad | 2 | 4 | 233 | 2 |
| Comoros | 13 | 0 | 174 | 4 |
| Congo, D. R. | 0 | 11 | 385 | 2 |
| Congo | 7 | 67 | 109 | 13 |
| Cote d'Ivoire | 20 | 62 | 185 | 61 |
| Djibouti | 15 | 23 | 83 | 78 |
| Equatorial Guinea | 17 | 63 | 425 | 116 |
| Eritrea | 9 | 0 | 464 | 50 |
| Ethiopia | 5 | 1 | 189 | 6 |
| Gabon | 25 | 215 | 488 | 308 |
| Gambia, The | 28 | 73 | 394 | 15 |
| Ghana | 13 | 21 | 695 | 53 |
| Guinea | 3 | 12 | 52 | 47 |
| Guinea-Bissau | 9 | 0 | 178 | 36 |
| Kenya | 10 | 42 | 221 | 26 |
| Lesotho | 13 | 42 | 61 | 35 |
| Liberia | 2 | 1 | 274 | 25 |
| Madagascar | 4 | 10 | 216 | 25 |
| Malawi | 7 | 8 | 499 | 4 |
| Mali | 5 | 5 | 180 | 33 |
| Mauritania | 12 | 92 | 148 | 99 |
| Mauritius | 270 | 289 | 379 | 299 |
| Mozambique | 5 | 14 | 44 | 14 |
| Namibia | 65 | 80 | 134 | 269 |
| Niger | 2 | 1 | 122 | 10 |
| Nigeria | 6 | 13 | 200 | 103 |
| Rwanda | 3 | 14 | 85 | 0 |
| Sao Tome and Principe | 41 | 13 | 318 | 93 |
| Senegal | 22 | 55 | 126 | 78 |
| Seychelles | 269 | 553 | 543 | 202 |
| Sierra Leone | 5 | 13 | 259 | 13 |
| Somalia | 10 | 3 | 60 | 14 |
| South Africa | 107 | 304 | 336 | 177 |
| Sudan | 21 | 6 | 461 | 386 |
| Swaziland | 34 | 61 | 162 | 34 |
| Tanzania | 5 | 19 | 406 | 45 |
| Togo | 10 | 35 | 263 | 123 |
| Uganda | 2 | 16 | 122 | 18 |
| Zambia | 8 | 13 | 179 | 51 |
| Zimbabwe | 25 | 30 | 362 | 56 |

The same data show that compared to rest of the world, even the best performing SSA countries are barely keeping up with other regions as demonstrated by their global ranking among the 102 countries considered. It appears that the higher GNI per capita and the lower population of most middle-income SSA countries are making it easier for them to deal with the questions of infrastructure development, investment in information technology, and human-resource development.

However, a closer examination of the in-country variations in terms of per capita income, telecom access, and other factors demonstrates

that while the overall national statistics may appear impressive, there is a high level of disparity among the larger and smaller urban centers, and between urban and rural populations in terms of income, connectivity, access to resources, literacy, and related factors that make the use of ICTs possible.

The prevalent lack of adequate connectivity infrastructure, human resources, an enabling policy environment, and local content in most sub-Saharan countries require more in-depth assessment. The disparities within and across countries in the access to and use of ICTs also require more serious attention by government

Table 4. Networked readiness and growth competitiveness indices for 21 SSA countries (Source: Adoted from The Global Information Technology Report 2004, & The Africa Competitiveness Report 2004).

| Country | Networked Readiness Index | | Technology Index | | Growth Competitiveness Index | |
|--------------|---------------------------|------|------------------|------|------------------------------|------|
| | Score | Rank | Score | Rank | Score | Rank |
| South Africa | 3.72 | 37 | 4.35 | 40 | 4.37 | 42 |
| Mauritius | 3.62 | 43 | 4.10 | 49 | 4.12 | 46 |
| Botswana | 3.34 | 55 | 3.78 | 59 | 4.56 | 36 |
| Namibia | 3.28 | 59 | 3.72 | 62 | 3.99 | 52 |
| Tanzania | 3.09 | 71 | 3.22 | 81 | 3.77 | 61 |
| Ghana | 3.06 | 74 | 3.10 | 86 | 3.49 | 69 |
| Nigeria | 2.92 | 79 | 3.16 | 82 | 3.21 | 83 |
| Uganda | 2.90 | 80 | 3.25 | 77 | 3.34 | 79 |
| Senegal | 2.90 | 81 | 3.04 | 89 | 3.34 | 79 |
| Gambia, The | 2.85 | 82 | 3.22 | 80 | 3.93 | 55 |
| Cameroon | 2.82 | 83 | 2.80 | 93 | 2.98 | 91 |
| Kenya | 2.81 | 84 | 3.36 | 74 | 3.21 | 83 |
| Zambia | 2.80 | 85 | 2.96 | 90 | 3.1 | 88 |
| Malawi | 2.71 | 88 | 2.79 | 94 | 3.36 | 76 |
| Madagascar | 2.60 | 92 | 2.47 | 97 | 2.85 | 96 |
| Zimbabwe | 2.53 | 95 | 3.34 | 75 | 2.85 | 96 |
| Mali | 2.52 | 96 | 2.36 | 99 | 2.84 | 97 |
| Mozambique | 2.51 | 97 | 2.84 | 92 | 2.91 | 93 |
| Angola | 2.32 | 99 | 2.43 | 98 | 2.6 | 100 |
| Ethiopia | 2.13 | 101 | 2.17 | 100 | 2.92 | 92 |
| Chad | 2.09 | 102 | 2.06 | 102 | 2.31 | 101 |

policy makers, regional organizations, and development partners.

At the regional level, it is also important to point out that the existence of connectivity infrastructure does not necessarily translate into affordable access to communications for consumers. For example, the SAT-3/WASC (South African Telecommunications/West African Submarine Cable) project connects several West African countries to international networks. However, the price of local access to this infrastructure has been high, and its development impact has therefore remained low so far.

More recent initiatives like NEPAD's backbone infrastructure development in Southern and Eastern Africa and the Regional Communications Infrastructure Program (RCIP), which is a multipartner initiative to overcome the major bottlenecks to growth and competitiveness in the region, are initiatives that require strong support. RCIP's key difference with SAT-3 is that RCIP plans to ensure that access to its infrastructure will be priced competitively so that it can bring benefits to users. These programs could to a large extent address the lack of adequate regional ICT infrastructure in Eastern and Southern Africa, and could facilitate access to affordable ICT services. The RCIP initiative is proposed as the lead instrument for a broader NEPAD regional connectivity program supported by many development partners.¹⁴

NATIONAL ICT POLICIES AND POVERTY REDUCTION

Since the 1990s, a few middle-income sub-Saharan countries such as Mauritius have completed several cycles of e-strategies as part of their broader development programs. Most other SSA countries, however, have started looking seriously at the potential role of ICTs in their development efforts since the beginning of the new millennium.

By mid-2005, close to 30 African countries had already developed national ICT policies and/or e-strategies, and 15 more were in the process of doing so.¹⁵ At this pace, all major African economies will have the first generation of their national ICT policies in place before long.

Various bilateral and multilateral development organizations (e.g., UNECA¹⁶, UNDP, the International Development Research Center [IDRC; Canada], and others) have supported the development of national ICT policies in sub-Saharan Africa with some variation in their approach to the process of policy development.¹⁷ By and large, however, the countries' national development priorities are proposed as the framework within which the role of ICTs as enablers of change and growth are defined.

In reviewing the national ICT policies and e-strategies of sub-Saharan countries, the first challenge is accessing the existing documents. Several of the 30 or so sub-Saharan ICT policy documents are not publicly available. Others are available in draft form, often in multiple versions, making it difficult to verify their official standing. During the preparation of this chapter, the author had access to 18 of these documents. Therefore, to ensure that any other available information on these ICT policies was taken into account, several review papers were consulted, the most significant of which are listed below.

UNECA has published several reports on national, sectoral, and regional ICT policies, plans, and strategies in Africa (see, for example, UNECA 2003a, 2003b, 2004a, 2004b, 2004c). These documents provide an overview of ICT policy-development efforts in Africa, UNECA's framework for policy development, and its role in that process.

Tipson and Frittelli (2003) summarize the experience from various national strategies and initiatives on ICT for development, including some examples from Africa. Their basic conclusion is that despite major opportunities to take advantage of the development potential of ICTs, the results

of most national strategy efforts to date have been disappointing. The authors believe that national strategies frequently flounder or fail by becoming focused on particular technologies or applications in isolation from broader policy, resource, and training initiatives necessary to exploit their capabilities in specific settings.

Wild (2003) reviews the evolution of ICT strategies in various regions, and analyzes the connection between e-strategies and poverty-reduction strategies. She finds that many e-strategies recognize a social dimension but do not systematically address poverty and achievement of the millennium development goals. Among her conclusions, Wild suggests that the international community has now clearly recognized the importance of developing a stronger poverty focus in e-strategy work, and makes a number of recommendations on the steps that can be taken to help countries incorporate an MDG dimension into their national ICT planning process.

Adam (2004) critically discusses the implications of e-strategies for civil-society organizations in Africa by drawing on lessons from the ICT policy-making experience during the past decade in the region. He asserts that:

[i]n practice, although the number of countries aiming to benefit from ICTs by developing their e-strategies is increasing and some of the ICT policies were useful in mobilizing resources and attracting collaborators, by and large, the result of broad-based ICT policy implementation has been inadequate. (p. 3)

He further concludes that:

[c]onsequently, the formulation and implementation of e-strategies has been sluggish in Africa—mired by faulty assumptions about the role of ICTs in development in the region, overestimation of the capacities and underestimation of structural obstacles in the countries and by occasionally cumbersome processes under which policies are promoted, developed and implemented.

As part of the explanation for this, Adam suggests that:

[f]or the most part the debate on e-strategies does not involve countries and institutions who need the ICTs the most. It takes place amongst ICT professionals, donor agencies and a few policy experts

Box 2. Poverty reduction and ICTs in Zambia (Republic of Zambia, 2004)

“1.3 POVERTY REDUCTION & ICTs IN NATIONAL DEVELOPMENT

The need to integrate ICTs as part of the holistic national development agenda means taking ICTs as part of the tools and services in Poverty Reduction Strategy Programmes (PRSP) as well as in developing National Development Plans (NDP). Therefore, it is expected that each sector will mainstream ICTs in their action plans to address the PRSP and the NDPs. The communications sector has registered significant progress and contribution to the GDP1 over the past ten years (1994-2004). This signifies that with further positive policy direction, integration of ICTs in poverty reduction programmes and restructuring of the ICT sector; greater achievements can be recorded. Therefore, this policy framework is by design integrating ICT implementation in all key economic and social sectors with a view of making the ICT sector one of the positive contributors to job creation and other empowerment opportunities.”

independent of the mainstream development professionals and empirical research. Limited involvement of development professionals means that beyond a list of [sic] menu of opportunities there is less substance on the actual impact of ICTs in key development sectors like health, education and agriculture. (p. 10)

He further suggests that civil-society organizations can play a key role in influencing local policy development and promoting broad participation and representation, among other activities.

Adamali, Coffey, and Safdar (2005) provide an overview of how countries are formulating national e-strategies and what they are focusing on. They examine the trends in the national e-strategies of 40 countries, including 8 from sub-Saharan Africa, and evaluate the strength, scope, and direction of these countries' ICT programs based on the goals stated in these countries' e-strategy documents. Adamali et al. identify four themes that appear in over 85% of the e-strategies. These are e-government, infrastructure expansion, e-education, and an enabling legal and regulatory environment. They also identify five additional themes that appear in at least 40% of e-strategies. These are the creation or expansion of the domestic ICT industry, the development of human resources with ICT skills to support the domestic ICT industry, e-business, the creation of locally relevant content, and ICTs to support more effective provision of health services. Based on these reviews and lessons learned, they then offer recommendations for formulating effective e-strategies.

The author's own field experience and his review of the available ICT policies are consistent with most of the above assessments. Several ICT policies consider poverty reduction as a major objective or a key driver of the policy (e.g., Cameroon, Ghana, Mozambique, Nigeria, and Tanzania). Zambia's second-draft ICT policy defines ICTs as tools for poverty reduction and development¹⁸ (see Box 2). Other national policies

and strategies discuss the role of ICTs in poverty reduction either explicitly or in the context of ICTs as tools for the achievement of MDGs through the mainstreaming of ICTs in business and trade, education, health, tourism, agriculture, public-sector services, community centers, and other types of service delivery to the poor.

While the process of ICT policy preparation may vary across countries, the general objectives and areas of priority are similar in most policy documents. These priorities include improvements in the broader ICT-sector policy and regulation, infrastructure, human capacity, content and applications, and an enabling environment for active private-sector participation.

The national ICT policies often include a framework for the use of ICTs as enablers of service delivery to the poor, improved governance, and economic growth. The policies generally encompass a subset of the following topics: (a) expanding the telecommunications infrastructure; (b) using new technologies in public administration, service delivery, and e-government; (c) fostering the use of ICTs in academic, educational, and research institutions; (d) creating a conducive policy, legal, and regulatory environment for the growth of ICTs; (e) creating opportunities for private-sector development and the growth of the ICT sector; (f) developing human resources in the ICT sector; (g) producing local-language content and applications; (h) providing rural connectivity and universal access; (i) facilitating e-commerce; (j) supporting access to ICTs by civil society and NGOs (nongovernmental organizations); and (k) facilitating applications of ICTs as enablers in health, education, agriculture, mining, environment, trade, art and culture, tourism, and other sectors. Malawi's proposed ICT policy is typical of some of the focus areas that are normally found in African ICT policies with an emphasis on certain national priorities (see Box 3).

To establish a clear link between ICT policies and poverty-reduction efforts, a few countries have also developed implementation strategies or

Box 3. Specific goals of the Draft Malawi ICT policy (Republic of Malawi, 2003)

- To facilitate the creation of the necessary enabling environment to support the deployment, utilization, and exploitation of ICTs within the economy and society
- To promote the development of a globally competitive local ICT industry
- To support the development of the nation's human-resource capacity
- To facilitate the deployment and exploitation of ICTs within the educational system to improve on educational access and delivery
- To aid the process of improving Malawi's scientific and industrial research capacity as well as its research and development (R&D) capabilities to support economic development
- To promote and support the development of the nation's information and communications infrastructure as well as the physical infrastructure
- To facilitate the modernization of civil and public service through the deployment and exploitation of ICTs to improve on the effectiveness and efficiency of its operations and service delivery
- To promote and facilitate the development and implementation of the necessary legal, institutional, and regulatory framework and structures required for supporting the development, deployment, and exploitation of ICTs in the country
- To support and encourage the development and promotion of the necessary standards, good practices, and guidelines to guide the deployment and exploitation of ICTs within the society and economy

action plans for their ICT policies that are aligned with their broader poverty-reduction strategies. Mozambique, for example, has developed an implementation strategy that proposes specific projects and activities for each focus area of the national ICT policy, with corresponding implementation schedules and budgets. Other countries have engaged in large-scale rollouts of connectivity or ICT-enabled applications for development. Ethiopia's national secondary school network initiative is one example of such initiatives.

Evaluating the impact of such programs in poverty reduction and economic growth in sub-Saharan countries, however, requires careful

monitoring of various initiatives over longer periods, and detailed impact assessment at various levels. These are tasks that require more attention by all parties involved in the promotion of ICTs for development.

Despite some promising progress, in most SSA countries, the development of an ICT policy has not led to the flourishing of the ICT sector or the large-scale use of ICTs as effective tools for development. A major contributing factor is the starting point (initial conditions) of each country with respect to the main prerequisites for the growth of ICTs, including the communications infrastructure, human resources, the policy

and regulatory environment, affordable access, entrepreneurship, and relevant applications (see Tables 1, 2, and 3). This is particularly more visible in lower income countries, where the level of readiness in various areas of ICT development (e.g., infrastructure, human resources, etc.) lags considerably behind those of middle-income countries. For example, countries like South Africa, Mauritius, Botswana, and Namibia are in a better position to deliver on the promises of their respective ICT programs compared with lower income SSA countries.

Size also matters. Countries like Mauritius and Botswana, with smaller geographic areas and populations, can be more agile and effective in the expansion of their ICT infrastructures across their countries and the mainstreaming of ICTs compared to, say, South Africa.

Disparity between urban and rural areas also matters. For example, Namibia is a middle-income country with a well-developed communications infrastructure that connects the major urban areas. However, the majority of the population lives in the rural areas, and there is a marked difference between the urban and rural communities in terms of income, access to affordable communications infrastructure, and ICT tools and services. This could make it more difficult for Namibia to attain its ICT policy goals in an equitable manner across the country.

Other impediments to the growth of ICTs in many African countries include (a) the inadequacy of the infrastructure, human resources, local-language applications, and funding for large-scale rollouts of ICTs in government, education, and other public-service areas, (b) an overestimation of the existing implementation capacity on the ground, (c) the affordability of the ICT tools and services for the general population, (d) the lag between the fast rate of technology introduction (automation factors) and the slow rate of adaptation to change (human factors), and (e) the “brain drain” due to inadequate local incentives.

A reliable and continuous supply of electricity as a basic requirement is still a problem even in major urban areas across the continent. While countries like South Africa are trying to develop the required power and telecommunication infrastructure for effective use of ICTs, most SSA countries are trailing behind.

For example, South Africa’s annual average power consumption per capita is 3,739.9 kWh (World Bank, 2005). The same indicator for SSA countries excluding South Africa is 116.4 kWh, which is only about 3% of South Africa’s corresponding power usage per capita. Nigeria and Ethiopia’s average power consumption per capita are 73.1 and 22.4 kWh, respectively, reflecting the fact that most rural areas are yet to have access to electricity. In the absence of these prerequisites for the growth of ICTs, the scope of some ICT policy documents appears rather unrealistic.

Despite these obstacles and challenges, the introduction and mainstreaming of appropriate technologies in development programs, when and where possible, are necessary for the growth of ICTs in Africa. This is an effort that will require considerable coordination among the various local and global stakeholders and partners involved.

ICTS IN POVERTY-REDUCTION STRATEGY PAPERS

PRSPs are documents prepared by countries as the frameworks for their development programs. Since 1999, the preparation of a PRSP has become a standard requirement for countries that wish to benefit from the concessional credits, grants, and debt relief offered by the International Monetary Fund and the World Bank Group. The development of PRSPs (or their equivalents under different names) has become prevalent among developing countries, particularly in Africa. By mid-2005, there were a total of 58 countries with PRSPs, of which 30 are in Africa.¹⁹

The approach to preparing PRSPs has evolved over the past few years, moving steadily toward a more participatory and consultative process. As a result, while the earlier PRSPs are mainly focused on government priorities, recent ones are more representative of the needs of diverse communities and stakeholders.

Like the PRSPs themselves, the discussion of ICTs in PRSPs is a new phenomenon, gradually starting in late 2000 (e.g., in Mauritania) and becoming a fairly common topic in PRSPs by 2002 and beyond (e.g., in Benin, Malawi, and Senegal).

The OECD (2003, 2004) is among the few international organizations that has studied the discussion of ICTs in PRSPs. In these studies, OECD reviews whether the PRSPs define or position ICT as a strategic component for poverty reduction and discuss it as an independent item. The OECD studies found that worldwide, over 40% of the PRSPs (12 out of 29, including 8 sub-Saharan countries) meet these criteria (OECD, 2003). The rest mention telecommunications-sector development as an important factor for rural and agricultural development, or as one of the components of the infrastructure for economic growth.

The current study reviewed the 30 sub-Saharan African PRSPs that were available in mid-2005. The results indicate that 16 PRSPs and 1 interim PRSP refer to ICTs as a component of their poverty-reduction efforts or as a means for facilitating economic growth. Some define a more specific role for ICTs as tools for improved communication, public-sector modernization, improved service delivery, and applications in health, education, and rural development.

About half of the PRSPs make references to information and communication technologies as a significant tool for development. These documents also emphasize the telecom sector as an important part of their infrastructure development needs

and significant for economic growth. Over 20% of the PRSPs discuss one or more of the broadcast media (radio and television) and Internet as relevant tools for information dissemination and communication on development issues.

The majority of PRSPs (70%) emphasize the important role of information technology in improving public-sector management and service delivery. These PRSPs include a discussion of improved governance through the appropriate use of ICTs in budget tax, customs, payroll and personnel management, and the establishment or improvement of integrated financial-management information systems (IFMISs).

Over 50% of the PRSPs include fairly extensive references to the potential role of new information and communication technologies in diversifying the economy for accelerated growth, job creation, improved performance in the productive sectors and government services, better access to regional and global markets, and other benefits. An example from the Ghana PRSP is given in Box 4.

In the area of government service delivery, 67% of PRSPs discuss one or more services that focus on streamlining and/or computerizing the corresponding activities. These include developing national health information systems and HIV/AIDS monitoring, legal issues, water and sanitation, social security, and other services. In the education sector, over 30% of the documents refer to one or more of the following actions to improve the efficiency and effectiveness of the corresponding activities: creating or improving higher education networks, strengthening institutional administrative capabilities, establishing computer labs and access to the Internet in secondary schools, introducing computer-based instruction, establishing sector-wide computerized performance-tracking systems, and strengthening distance education programs.

An interesting finding is that only 17% of the PRSPs propose ICT activities that will directly benefit civil society and the private sector, such

Box 4. New ICTs in Ghana's PRSP ("Ghana Poverty Reduction Strategy", 2003)

“Utilising information and communication technology to further enhance our development efforts.

6.1.11 Information and Communication Technology (ICT). The creation of awareness in information access is recognized as being of prime importance. With respect to ICT usage and application, an information technology policy framework is currently being developed which recognizes that the dynamics of global economic growth are changing at a very fast pace. The role of the Internet as a pervasive phenomenon and its implications for the traditional factors of production is taken into account. Economic potential is recognized as being increasingly linked to the ability to control and manipulate information. Within this policy context also, the need for an effective legal and regulatory framework is identified. A National Communication Authority is operational and a National Information Technology Agency is to be established as part of the regulatory and licensing environment. Also to be established is a national communications backbone facility to provide access throughout the country.

In the medium term, the intention is to support the development of electronic commerce to enhance production, productivity and to facilitate business transactions. Government intends to establish Information Technology (IT) parks and incubator areas equipped with the necessary infrastructure for ICT related businesses and to develop human resources that support the deployment and rehabilitation of modern ICT. Government will re-negotiate the existing telecommunications agreements to introduce more competition and accelerate access to telephones, Internet and information technology in the country.”

as the development of streamlined and computerized business registration and market information systems.

On rural-development issues, about 20% of the documents propose plans for the extension and/or expansion of rural connectivity through the establishment of community telecenters, wireless phones, and some use of ICTs for agricultural development.

Regarding information technology (computer technology, hardware, software, networks, applications), almost every document has some

discussion on computerization, networking, information systems, and related topics as shown in Figures 1 and 2.

About one third (33%) of PRSPs include some reference to content development and information dissemination. These include the promotion of rural and community radios, expansion of radio-programs development, production of farmer newsletters, translation and distribution of training materials in local languages, provisions for citizens' access to government information, delivery of meteorological information to farmers

Figure 1. ICT Subsectors in PRSPs.

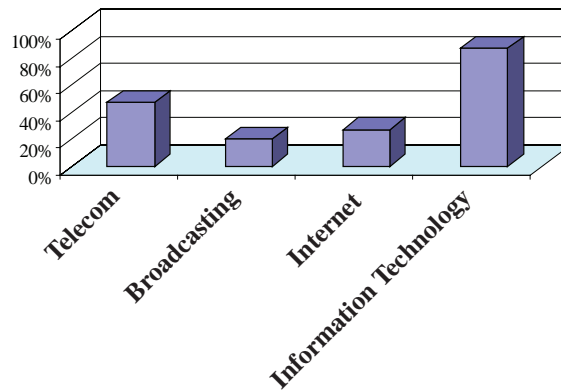
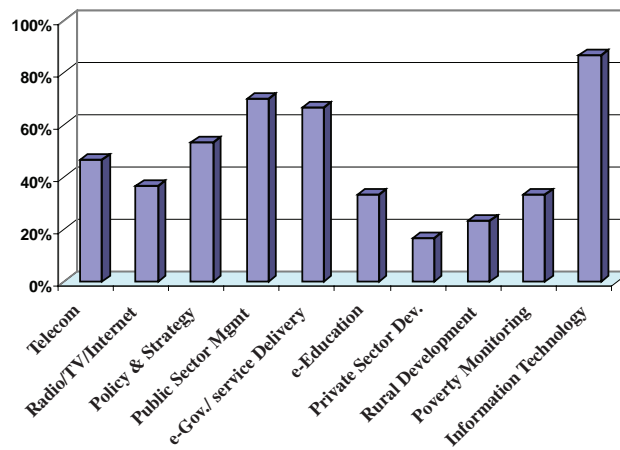


Figure 2. ICTs in PRSPs



and fishermen, and dissemination of information on health and agricultural market information.

The coverage of ICTs in PRSPs is encouraging. However, the PRSP documents often reflect the generic global discourse on the potential of ICTs for poverty reduction. There is very little detail in terms of whether the necessary conditions exist on the ground to make the ICT4D interventions successful and effective in a sustainable manner. It is therefore not surprising to see that there is a visible disconnection between most PRSPs

and the corresponding national ICT policies and e-strategies. Only a few PRSPs (Benin, Cameroon, Ghana, and Rwanda) discuss or refer to the existing national ICT policies or e-strategies and their relevance to poverty-reduction efforts. Most other PRSPs and the ICT discussions therein are not informed by the ICT policy documents or the ongoing ICT efforts and initiatives that are already under way in the country.

Several factors contribute to this situation. The process of ICT policy development is often led

Integrating ICTs in African Development

by national organizations and ICT professionals who are well familiar with the global discourse on the role of ICTs in development. The international partners who support the ICT policy-development efforts are also eager to introduce ICT policy frameworks that are driven by the broader poverty-reduction MDGs and economic-growth objectives. Therefore, most national ICT policies (particularly those supported by international

partners) have an ICT4D orientation. However, these ICT advocacy groups are not necessarily involved in the national poverty-reduction strategy planning, and therefore have little influence on such policy formulations.

The local stakeholders involved in poverty reduction and economic-development planning, on the other hand, are mainly focused on identifying and prioritizing the specific national development

Box 5. Examples of ICTs in PRSPs (Republic of Benin, 2002; Republic of Cameroon, 2003)

Benin: New ICTs

“96. New Information and Communication Technologies (NTIC). The Government also intends to promote the development of new information and communications technologies to benefit from their economic and social potential. These technologies will spur economic growth by better integrating the Beninese economy within the global economic and trade systems, as well as by creating new economic activities and jobs. The development of NTIC and their use in the health and education sectors will lead to a noticeable improvement in quality and a greater range of services offered to poor people and thereby contribute to poverty reduction. The planned actions involve the drafting of a national development strategy for NTIC, support for the dissemination of NTICs and their introduction in the health and education sectors, arrangements to exempt imports of computer equipment from duties and taxes, of these measures to consumers.”

Cameroon: Economic Potential of ICTs

“242. During the participatory consultation, the difficulty of accessing, and the lack of information were mentioned as a determinant of poverty. Moreover, the United Nations considers access to information, this is, access to the knowledge required for basic life functions, to be a major human development indicator. Given the requirements of the New Economy, which is heavily reliant on information, communications, and artificial intelligence, the government will take measures to greatly improve citizens’ access to information. 243. The government intends to: (i) open multimedia community centers in each of the 10 provinces to provide the landlocked population with Internet access to important health, education, agricultural, live-stock, and environmental information; and (ii) install, with support from the UNDP and UNESCO [United Nations Educational, Scientific, and Cultural Organization], new rural radio stations in addition to the 15 already operational stations. The authorities also intend, through the Ministry of Communication, to support the national HIV/AIDS strategy through the implementation of a sector communication plan.

244. The government understands the economic potential of information and communications technologies (ICT) and is committed to promoting the development of this sector. In addition to reducing or eliminating some import duties and taxes for computer equipment, it created a National Information and Communication Technologies Agency (ANTIC) in April 2002. Within its missions, the agency must promote broader access to ICT as well as activities related to these new technologies, which are becoming increasingly popular among the population.”

objectives in traditionally well-established sectors such as health, education, agriculture, water and sanitation, roads, and so forth. In this process, the potential role of ICTs as crosscutting tools for development is often treated as a side issue and not a priority. Consequently, the preparation of existing ICT policies and PRSPs has often taken place on two independent parallel tracks with limited influence on each other.

As the global discourse on the role of ICTs in development continues (e.g., WSIS and NEPAD), it is expected that the integration of ICTs into poverty-reduction strategies will continue to grow in a more substantive manner.

The international development organizations are often consulted during the preparation of PRSPs. Therefore, they may be in a position to point out the need for a more holistic articulation of the potential of ICTs for development in line with the specific development objectives of the PRSPs.

These international partners could also coordinate their technical advice and financial contributions in such a way that the multisectoral and crosscutting nature of ICTs as enablers of socioeconomic development is more clearly understood, assimilated, and articulated by all stakeholders, including the donor community and the bilateral and multilateral development organizations. Box 5 provides some additional examples of ICT discussions in PRSPs.

ICTS IN COUNTRY ASSISTANCE STRATEGIES

The multilateral and bilateral development agencies provide their country assistance to developing countries based on development frameworks that highlight the focus areas of mutual interest. Examples include UNDP's country program out-

Box 6. Telecom examples from CAS documents ("Uganda Country Assistance Strategy", 2000; "Senegal Country Assistance Strategy", 2003)

Uganda

"A recent noteworthy success was the privatization of the telecommunications utility in the spring of 2000 and the accompanying sector reform which have brought in a second national operator and a second cellular licensee, expanding service options and lowering prices."

Senegal

"The advent of private participation in infrastructure, notably telecommunications and water, has accelerated economic growth, and extended service access.* New information technologies are widely available in Dakar and in the larger secondary cities. Rapid growth in coverage is now common."

* The bank estimates that the privatization of the national telephone company, SONATEL, and the related introduction of two cellular phone licenses has added 1% each year to GDP growth since 1997.

line and country cooperation framework (CCF) documents, DFID's (Department for International Development) country assistance plan (CAP), and the World Bank's country assistance strategy.

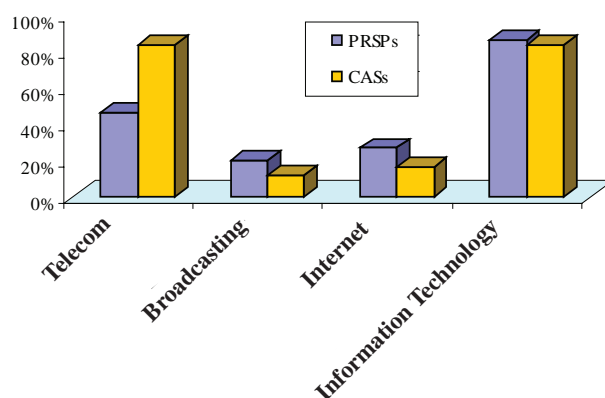
The CAS is a document that describes the World Bank Group's framework for working with a country based on an assessment of priorities in the country as reflected in its PRSP or equivalent documents.²⁰ It also delineates the bank's intended level of assistance based on its comparative advantage and the country's portfolio performance.

The CAS normally outlines the sector-specific and/or programmatic operations that are planned in support of achieving the PRSP objectives. It also specifies whether there is a mutual agreement with the government to provide multisectoral budget support to the government through a PRSC. PRSPs generally provide the framework for the CAS, which in turn will inform the formulation

of the PRSC for achieving the midterm goals of the poverty-reduction strategy. There is, therefore, a sequential yet iterative process that is normally followed in formulating these three documents.

A review of the 25 current CAS documents for African countries reveals that by far the most significant discussion of ICT issues is focused on telecommunications infrastructure and telecom reform. Over 84% of the CAS documents discuss one or more of the following aspects of the telecom sector in the country: (a) challenges in terms of the existing shortcomings and the required investments to improve and expand the telecom infrastructure, (b) plans for the introduction or expansion of privatization, liberalization, or competition, and (c) the necessary reforms to improve access and connectivity through the licensing of new or additional mobile operators. Despite the high frequency of these discussions,

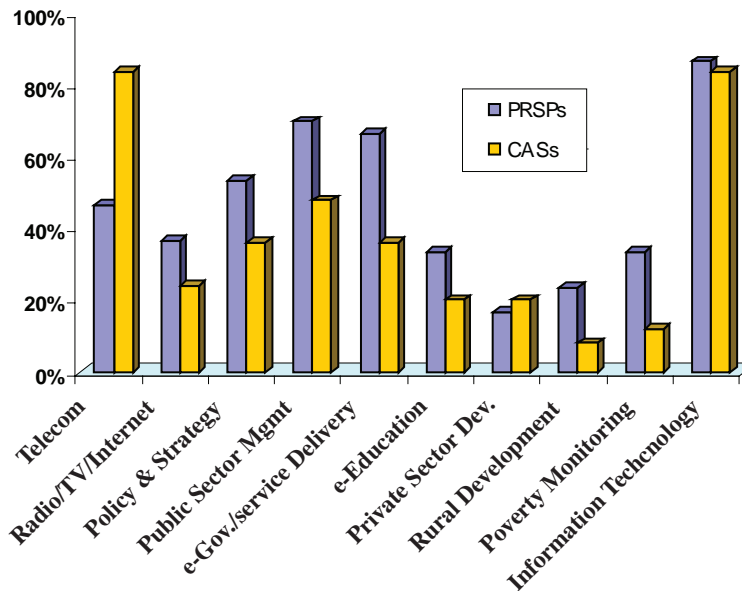
Figure 3. ICT subsectors in CASs and PRSPs



Box 7. Ghana CAS: Freedom of Information Bill. (Ghana Country Assistance Strategy, 2004)

“The draft Freedom of Information Bill is intended to bring about fundamental improvements in political and bureaucratic culture as regard access to information on government business.”

Figure 4. ICT in PRSPs and CASs



Box 8. Examples of ICTs in CASs from various years (“Uganda Country Assistance Strategy”, 2000; “Mauritius Country Assistance Strategy”, 2002; “Ghana Country Assistance Strategy”, 2004)

Uganda (2000)

“Information and communication strategy and policy: It is recognized that the use of information and communication technologies (ICTs) and modern information management systems can increase the credibility and effectiveness of efforts to improve access to information, transparency in public sector decision-making and build private and public sector capabilities. To promote the use of ICTs in Uganda, the Bank will support the Government’s efforts to (i) develop a National Information and Communication Strategy to establish a national ICT policy framework to promote the use of information and communication technologies for development; (ii) implement an integrated Public Sector Management Information System to promote fiscal oversight, transparency and accountability; and (iii) provide support for the establishment of the Uganda Country Gateway web-site.”

Mauritius (2002)

“38. To support the move to a more service based economy, the regulatory framework for the information and communications technology (ICT) and financial sectors has been overhauled. The Government is actively seeking foreign investments in the ICT sector by developing a package of incentives and through the creation of a Cyber City that is expected to be completed by September 2003.”

Ghana (2004)

“26. Information and communication technology (ICT), tourism, and manufacturing: other non-traditional sectors with potential. The potential crosscutting impact from a well-functioning ICT environment on growth and employment, improved government services, and accountability and empowerment, is high. For example, a dynamic ICT sector in Ghana has the potential to bring greater efficiencies to day-to-day operations of both government and private sector, as well as a platform for value-added services, such as outsourced data and call center services for overseas corporations. Strengthening the policy environment and regulatory capacity, and improving ICT infrastructure and access in both urban and rural communities, including resolving an investment dispute between the government and a shareholder of Ghana Telecom, are necessary preconditions to realizing this potential. Ghana’s ICT policy, developed in June 2003 following extensive consultation with stakeholders countrywide, seeks to engineer an ICT-led socio-economic development process with the potential of transforming Ghana into an infrastructure-rich, knowledge-based and technology-driven economy and society.”

the references are very brief. Two examples from the Uganda and Senegal CAS documents are given in Box 6.

Figure 3 compares the relative frequency of CAS discussions on different aspects of ICT sub-sectors with those in the PRSPs. The graph shows very clearly that telecom reform and infrastructure expansion are much more strongly emphasized in the CAS documents compared with PRSPs.

The graph also shows that while there is a high level of emphasis on information-technology applications in CASs, there is limited discussion on the potential role of radio in education and service-delivery efforts, and less emphasis on the Internet. The use of radio and the Internet are areas that could be more effectively explored and discussed during the PRSP and CAS consultations. These options could be of particular interest to the local private-sector and civil-society organizations that are more akin to the use of these tools for information dissemination and service delivery.

On the broader ICT applications, the CAS documents put more emphasis on the public-sector management applications. The development of management information systems and the computerization of budget, expenditure, tax, and customs operations are regularly discussed. IFMISs are often mentioned (43%) either as existing operations in need of improvement, or as new initiatives to improve public-sector management.

The provision of access to government information is an emerging area of policy reform in sub-Saharan Africa. A few countries (e.g., Ghana and Uganda) have taken the necessary steps in developing the policies and laws that will provide their citizens access to various government information. An example from the Ghana CAS highlighting this new trend is presented in Box 7.

Figure 4 provides an overview of the various ICT topics discussed in CAS documents as compared with the discussion of the same topics in PRSPs. The graph shows that with the exception of the treatment of telecom-sector reform

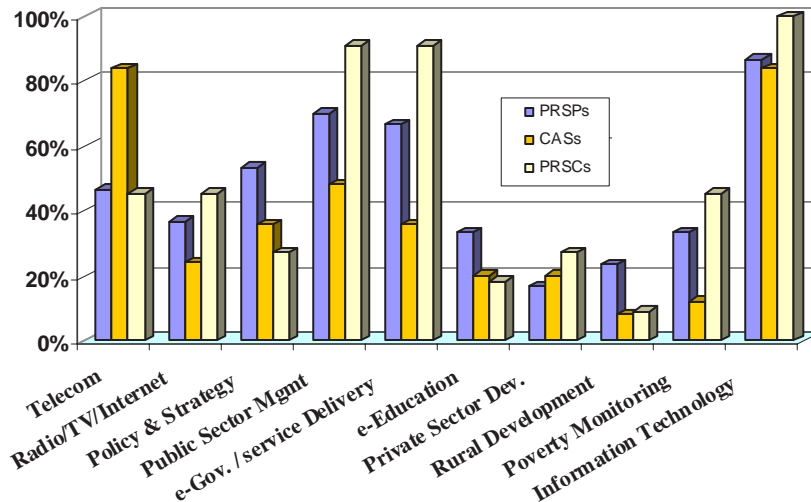
and private-sector development, almost all other aspects of ICTs are treated more emphatically and fully in PRSPs as compared to the CAS documents. This implies that the priorities of the actual development investment plans in the ICT area differ somewhat from those proposed in the broader poverty-reduction strategies, with a stronger emphasis on telecom liberalization and infrastructure expansion, and a somewhat weaker emphasis on public-sector investment in ICT-sector development and ICT applications in sectors.

The graph shows that there is a high level of demand from the countries for information-technology solutions, and the CAS documents also reflect a strong response. In financial terms, however, this response is much more limited in scope compared to the requirements of the demand. This aspect is treated in more detail in the PRSC section below. The results also reflect the strong support of the World Bank's country programs for the use of ICTs in public-sector management. This is not surprising since the findings of the bank's core fiduciary analyses of each country's capabilities in this area also confirm the need for different levels of computerization and other ICT-enabled interventions in the public sector.

About one fourth of the CAS documents mention local content development and information dissemination in various forms. Some CASs propose support for market information systems for small and medium enterprises, and the development of independent media, community, and commercial FM radio stations and private television stations.

The anecdotal examples sited in Box 8 offer a flavor of the evolving nature of ICT discussions in CAS documents between 2000 and 2004. These examples show that the ICT discussions in CAS documents have shifted from focusing on the development of ICT policies in 2000 to articulating the role of ICTs as enablers of development and growth in 2004. This is also partly a reflection of the fact that the level of awareness of the

Figure 5. ICTs in PRSPs, CASs, CASs, and PRSCs.



bank teams, as well as the governments and their domestic or external partners on the role of ICTs in development, has also changed considerably during this period.

ICTS IN POVERTY-REDUCTION SUPPORT CREDITS

The PRSC is a CAS-based development-assistance instrument that is often a multidonor basket fund to support the policy and institutional reform programs intended to help implement the country’s poverty-reduction strategy as described in the PRSP. This type of lending does not finance specific investments, but instead finances overall country budget execution. It is expected that the PRSP/PRSC framework will allow donors to combine their efforts behind a single program with consistent and harmonized monitoring and evaluation focusing on results at the project, program, and country levels within a short to midterm execution period.

As of mid-2005, 11 sub-Saharan countries had active (ongoing) PRSCs. Six of these countries (Benin, Cape Verde, Madagascar, Mozambique,

Rwanda, and Senegal) had their first PRSC in 2004 to 2005, while the other five countries (Burkina Faso, Ethiopia, Ghana, Tanzania, and Uganda) were in the second, third, or fourth cycle of their PRSCs. The rather limited number of countries with PRSCs poses a challenge in terms of any comparative analysis of the PRSC, CAS, and PRSP documents.

To address this challenge, the following approach was adopted for the purposes of this analysis. First, since PRSCs are instruments for the implementation of PRSPs, and each country has only one PRSP, the 21 PRSCs were grouped together by country, leading to 11 groups of PRSCs, and each group was then treated as a single integrated PRSC per country. Next, the ICT-related discussions in each country’s one or more PRSCs were tabulated per category and topic, and for each category and topic, all redundancies across a single country’s PRSCs were removed so that there would be no double counting of any category or topic per country. The results were then normalized with respect to the total number of countries that have PRSCs. This allowed for each country’s total number of PRSCs to be treated as a single document for a single operation in support of the corresponding PRSP.

Box 9. ICTs in poverty-reduction support credits (“Benin Poverty Reduction Support Credit”, 2004; “Burkina Faso Fourth Poverty Reduction Support Credit”, 2004; “Rwanda Poverty Reduction Support Credit and Grant”, 2004; “Senegal Poverty Reduction Support Credit”, 2004; “Uganda Third Poverty Reduction Support Credit”, 2004)

Benin: Government Accounting System. “Improvement of the reliability of government accounts is expected from the completion of full-fledge IFMIS [Integrated Financial Management Information System], in particular with: (i) the strengthening and comprehensiveness of the SIGFIP [integrated expenditure management system]; (ii) the installation of the computerized government accounting system (ASTER); and (iii) the development of a functional interface between SIGFIP and ASTER.”

Burkina Faso: Computerization of Customs. “...(iv) modernizing customs administration by strengthening customs offices 9 by the end of April 2004).”

Rwanda: Environmental management information system. “Enhance capacity of REMA to conduct environmental public awareness campaign. Design and installation of information and ICT systems in REMA. Training of staff to use, update and maintain these systems.”

Senegal: Computerization of the Courts. “49. The private sector operating in Senegal is demanding a better-functioning judicial system. This is also one of the Government’s major objectives, which will be supported by the World Bank Support Credit. Having developed a new sectorial strategy in collaboration with the community as a whole, the Government is now committed to allocating greater budgetary resources to this sector, to launching a human resource development program, and to proceeding with the computerization of courts in order to enhance the efficiency of Senegal’s judicial apparatus.”

Uganda: Integrated Financial Management System. “Completed a detailed study of the Government’s Fiscal Management Systems providing a detailed Information Technology Architecture and Plan, a common Chart of Accounts and User Requirements for an Integrated Financial Management System (IFMS); Contracted consultants to deliver and install an Integrated Financial Management System. The implementation is to be phased through selected Pilot Sites in the 2003/04 fiscal year with further rollout to selected sites commencing in the 2004/05 fiscal year; Established a financial management team of accounting professionals appointed to support the reforms to (a) strengthen the legal and regulatory framework for financial management; (b) enhance the capacity building activities amongst the accounting and auditing cadre in government; and (c) strengthen the budgeting and accounting systems in government (the IFMS); Twenty recent graduates were recruited to assist in the IFMS implementation; MOPS has authorized the recruitment of an additional 16 graduate accountants to strengthen the compliment of accounting staff. The recruitment has been completed and posting to the various ministries is being arranged; ...”

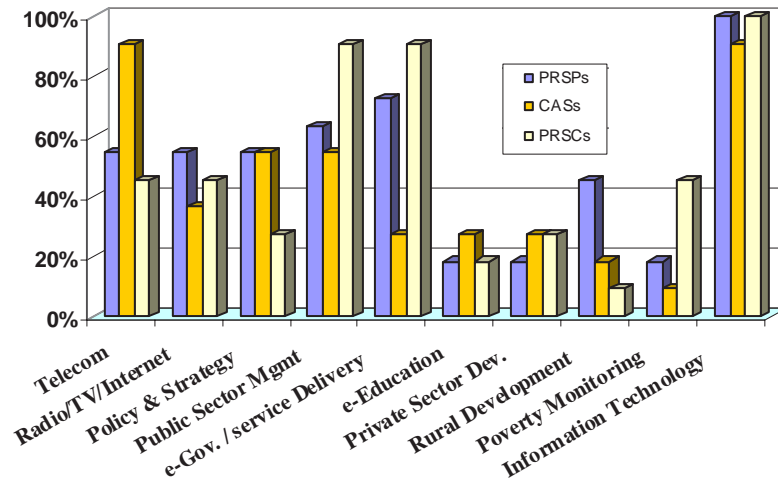
This approach may have skewed the PRSC results to some extent in favor of the countries with multiple PRSCs. Nevertheless, it does provide a means for the qualitative comparison of PRSCs with the corresponding CAS and PRSPs, as well as an overall comparison among all PRSP, CAS, and PRSC documents.

An overall comparison of the key categories of proposed ICT interventions in PRSCs and their corresponding treatment in CAS and PRSPs are presented in Figure 5. Since PRSCs provide the necessary funding for the implementation of any mutually agreed-upon proposed activities, it is reasonable to assume that the statements in these documents offer a more realistic picture

of the actual priorities of the governments and donors.

The results in Figure 5 indicate that with respect to telecom reform and the extension and expansion of communications infrastructure and services, the PRSPs (reflecting the countries’ priorities) and the PRSCs (reflecting the agreed-upon course of action and the corresponding financing by the donors for its implementation) treat these issues with a fairly high level of priority (47% and 45%, respectively). The CAS documents, however, show a much higher level of emphasis on telecom issues (84%). This may reflect the fact that CASs often emphasize the telecom reforms that are considered as important requirements to facilitate economic growth.

Figure 6. ICTs in PRSPs, CASs, and PRSCs of the 11 PRSC countries



Box 10. Uganda's Access to Government Information Law. ("Uganda Third Poverty Reduction Support Credit", 2004)

"48. Government plans to improve the right of access to public information, as one of the measures to improving accountability. First, we plan to revise the Official Secrets Acts, and replace it with a modern access to government information law. Consultations with stakeholders on access to government information have already started and in the next fiscal year, the plan is to assemble recommendations for enactment of the law."

The establishment of community radios and the use of radio, television, and the Internet as tools for awareness raising on development issues (e.g., in public-awareness campaigns on HIV/AIDS, community programs, etc.) is emphasized more strongly in PRSCs than the other documents.

The policy and strategy indicator used here reflects the cumulative references in the relevant documents to the national ICT policies, e-strategies, or specific policy discussions around the use of the new information and communication technologies for development.

It is worth noting that the discussion of ICT policy and e-strategies continues to decline from action planning (PRSPs) to financing envelopes

and programs (CASs) to implementation plans (PRSCs).

An interesting overall finding is that by far the strongest focus of the PRSCs is on the implementation of ICT-based solutions to improve public-sector management and public service delivery. This is significant because it demonstrates a strong consensus among donors and governments alike that ICTs do have a major role to play in improving the governments' fiscal management, accountability, and transparency. At the same time, this focus on ICTs is purely in the context of their use as appropriate tools to improve the efficiency of public-sector management activities only. There is very little emphasis on the significance of sharing

information with the general population through the use of appropriate technologies, or the impact of such applications on the broader objectives of poverty reduction and economic growth.

PRSC support for the introduction of new technologies in education is mostly focused on the introduction of education-management information systems, and in some cases on the introduction of new technologies in the higher education institutions. This does not necessarily imply that one of the broader objectives of PRSPs to mainstream ICTs in the education system is put on the back burner. Rather, it could mean that the sector reform activities and large-scale introduction of ICTs into the education system may require a different implementation support and funding mechanism such as a sector-focused project.

PRSCs also show a moderately strong trend toward increased support for small and medium enterprises; incubation programs; automation; new service-based, ICT-assisted businesses (e.g., call centers, etc.); and similar initiatives. This is encouraging since the trend could be further strengthened in the subsequent PRSCs. Compared to other priorities, the level of implementation support under PRSCs remains rather low.

The use of ICTs for rural development is an area that seems to need special attention. The indicators used in this category are for rural connectivity, the use of appropriate ICTs for rural development, agricultural information systems for farmers, and management information systems at various levels. Overall, this is the least discussed category in the reviewed documents with respect to the role of ICTs as enablers of development. Certainly, the endemic lack of reliable infrastructure and human resources, particularly in rural areas, may partly explain why this is not a priority area. However, successful examples of these types of initiatives could inform future policy discussions.

Another significant finding is that 45% of the PRSCs give high priority to the use of ICTs for poverty monitoring in the form of statistical capacity building, specific poverty indicator moni-

toring across sectors, environmental monitoring, and similar systems. This is a much stronger emphasis compared to CAS documents (12%) and PRSPs (37%), and indicates a growing shift toward focusing on results. References to local content development and information dissemination appear in four PRSCs.

Figure 6 provides an overview of the ICT discussions in the same set of documents for the 11 sub-Saharan countries that by mid-2005 had poverty-reduction support credits. The Figure shows that the salient features of the above comparison among the ICT discussions in all the PRSP, CAS, and PRSC documents for sub-Saharan Africa are also broadly applicable to the subset of documents for the 11 PRSC countries. See, for example, the emphasis on telecom in CASs, and the public-sector-management and service-delivery emphasis in PRSPs and PRSCs. The other trends are also generally consistent with the above findings, with minor variations.

In comparing the overall results among countries, it is interesting to note that Benin, Mozambique, Rwanda, and Senegal (from the group of countries with one PRSC each) all have fairly extensive discussions on the significance of ICTs for poverty reduction and economic development in their PRSPs. However, their respective PRSCs are almost exclusively focused on computerized applications in public-sector management, tax, and customs, and a variety of monitoring or management information systems in different sectors. In other words, major aspects of the role of ICTs in development have been left out of these PRSCs, probably with the expectation that such activities could be funded through other sources. This finding also suggests that the development organizations and donor agencies who are interested in the mainstreaming of ICTs in other aspects of the economy and service delivery to the poor, or as a sector, need to devise or utilize appropriate funding mechanisms beyond PRSCs.

CHALLENGES AND OPPORTUNITIES

The poverty-reduction strategy documents and MDGs provide the framework for country assistance strategies and poverty-reduction support credits in sub-Saharan Africa. The preparation of ICT policies is often carried out based on methodologies that incorporate the framing of the ICT policy in the context of the country's development priorities, the PRSP, and the MDGs. As a result, there is an increasing emphasis on the role of ICTs for economic growth and poverty reduction in the ICT policy documents.

Nevertheless, there is a persistent disconnection between the poverty-reduction strategy-development efforts and the ICT policy-development process. While many PRSPs refer to the role of ICTs in development, they are generally not informed by the ICT policy documents (where they exist), or by the discussions and the partnerships formed around their preparation. Consequently, the ICT policy papers often have little (if any) impact on the ICT priorities set forth in the PRSPs, CASs, or PRSCs. This has led to a strong focus on ICTs as tools for improved efficiency in public-sector operations rather than service delivery to the poor.

Reviewing the national ICT policies, PRSPs, CASs, and PRSCs, six trends stand out among the results.

1. Telecom reform, competition, and the expansion of infrastructure are much more strongly emphasized in country assistance strategies compared to PRSPs and PRSCs. This partly reflects the direction of the ongoing policy dialogue, and the significance that the World Bank Group ascribes to the implementation of telecom reform and the introduction of competition in the sector for economic growth and poverty reduction. The above finding notwithstanding, it is important to note that these issues are all prominently present in PRSPs and PRSCs as well, indicating at least a high level of ongoing dialogue on these themes.
2. Public-sector-management information systems in general and integrated financial-management information systems in particular are much more strongly emphasized in PRSCs than in CAS or PRSP documents. This is indicative of the fact that when it comes to improved public-service delivery, fiscal accountability, and transparency, both governments and the World Bank and donor community agree on the importance of these systems, hence the high level of emphasis on the actual implementation of these systems, and the corresponding appropriation of funds in PRSCs for that purpose.
3. Applications of information and communication technologies for development, particularly in education, the private sector, and rural development, are given low to moderate prominence in these documents. Since the private sector is expected to make most of the investments in the ICT-sector development initiatives, the references in these policy documents to ICT-sector development do not mean much if the private sector does not have the right enabling environment (whether for business at large or for the ICT sector in particular) to play an active role.
4. With very few exceptions, the actual support proposed in PRSCs is mostly focused on the monitoring and/or dissemination of information only rather than on the production and dissemination of relevant content based on local knowledge and/or the adaptation of relevant global experience. These and other areas could potentially benefit from more focused attention in future policy discussions, development strategies, and implementation-support programs.
5. The consultations and discussions during the ICT policy preparations are useful for

awareness raising and sensitizing the policy makers and the public toward the potential of ICTs for development. However, there is a noticeable disconnection in most countries between the ICT policy-development process on the one hand, and the poverty-reduction strategy development and the corresponding poverty-reduction efforts on the other hand.

6. Although the national ICT policies and e-strategies articulate many of the potential benefits of ICTs for development and propose potential applications, these documents also appear to be driven by, and follow, the proposed frameworks of the development agencies, donor organizations, and their local partners that have funded the process. Therefore, some of the policies seem more like a wish list rather than a road map for the use of ICTs in the development process consistent with the realities on the ground. This may partially explain the limited influence of the national ICT policies on the actual poverty-reduction strategies and programs developed by most African countries.

These findings confirm that for ICTs to become effective tools for economic development and poverty reduction, they need to be fully mainstreamed in the national development programs. This is to ensure that the necessary policy decisions as well as the required resources could be put in place for the holistic integration of ICTs in development efforts. The role of the private sector in all aspects of ICT-sector development also needs further emphasis both in poverty-reduction efforts as well as in the use of ICTs for development.

Applications of ICTs in development efforts need to have a clear focus on the use of appropriate technologies for targeted interventions aimed at improving the well-being of the citizens. Such applications of ICTs must be driven by the underlying development objectives and not by technologies. ICTs could play an important role

in poverty reduction only if they are properly adapted to the existing circumstances and used as tools that can help facilitate the achievement of development objectives in specific settings.

Additional work is needed in analyzing the effectiveness of the ICT investments that have been made by the public and private sectors alike in sub-Saharan countries and the impact of these investments on the ground. It is also necessary to assess whether the discussion of various ICT initiatives such as rural connectivity and other ICT programs in PRSP or CAS documents have actually translated into higher public-sector investments in these areas.

The integration of ICTs in development strategies is a necessary, but not sufficient, condition for ICTs to play an important role in the socio-economic development of sub-Saharan countries. The current realities on the ground in terms of low levels of infrastructure, human resources, policy environment, local-language content, and competitiveness are among the major factors that will define the scope of success in the use of ICTs for development in Africa. Therefore, the development of the appropriate ICT infrastructure, human resources, private enterprises, and institutional capacity to respond to these needs must become an integral part of the broader development strategies. In this context, many challenges as well as opportunities lay ahead for sub-Saharan Africa, requiring multifaceted and coordinated efforts to deal with them effectively.

NOTE

The findings, interpretations, and conclusions expressed in this chapter are entirely those of the author and do not necessarily represent the views of the World Bank Group, its executive directors, or the countries they represent, and should not be attributed to them.

REFERENCES

- Accenture, the Markle Foundation, & the United Nations Development Programme (UNDP). (2001). *Creating a development dynamic: Final report of the Digital Opportunity Initiative*.
- Adam, L. (2004). *National ICT policies making in Africa: Implications for CSOs*. Retrieved January 15, 2006, from http://www.ssrc.org/programs/itic/publications/knowledge_report/memos/adam-memo4.pdf
- Adamali, A., Coffey, J. O., & Safdar, Z. (2005). *Trends in national e-strategies: A review of forty countries* [Draft paper]. World Bank GICT Department.
- Bedi, A. (1999). *The role of information and communication technologies in economic development: A partial survey*. Bonn, Germany: ZEF.
- Benin poverty reduction support credit. (2004). *Document of the World Bank. Report No. 26272*, pp. 31-32.
- Burkina Faso fourth poverty reduction support credit. (2004). *Document fo the World Bank. Report No. 28293-BUR*, p. 61.
- Dutta, A., Lanvin, B., & Paua, F. (Eds.). (2004). *The global information technology report 2003-2004*. New York: Oxford University Press.
- Gerster, R., & Zimmermann, S. (2003). *Information and communication technologies (ICTs) for poverty reduction* [Discussion paper]? Swiss Agency for Development and Cooperation (SDC).
- Ghana Country Assistance Strategy. (2004). *Document of the World Bank. Report 27838-GH*, pp. 12-13.
- Ghana poverty reduction strategy: 2003-2004 An agenda for growth and prosperity. (2003). *Vol. I: Analysis and Policy Statement*, 75-76.
- Hernandez-Cata, E., Schwab, K., & Lopez-Claros, A. (Eds.). (2004). *The Africa competitiveness report 2004*. World Economic Forum.
- Lallana, E. (2004). *An overview of ICT policies and e-strategies of select Asian economies*. UNDP Asia-Pacific Development Information Programme.
- Marker, P., McNamara, K., & Wallace, L. (2002). *The significance of information and communication technologies for poverty reduction*. London: DFID.
- Mauritius Country Assistance Strategy. (2002). *Document of the World Bank. Report No. 23904 MAS*, p. 12.
- McNamara, K. S. (2003). *Information and communication technologies, poverty and development: Learning from experience*. Washington, DC: World Bank.
- New Partnership for Africa's Development (NEPAD). (2002). *Short-term action plan: infrastructure*, p.8
- Organization for Economic Cooperation and Development (OECD). (2003). *Information and communication technology (ICT) in poverty reduction strategy papers (PRSPs) as of August 2003*. Global Forum on Knowledge Economy.
- Organization for Economic Cooperation and Development (OECD). (2004). *Role of infrastructure in economic growth and poverty reduction: Lessons learned from PRSPs of 33 countries*. DAC Network on Poverty Reduction.
- Organization for Economic Cooperation and Development (OECD). (2005). *Integrating ICTs into development co-operation* [Background paper].
- Republic of Benin. (2002). *Benin poverty reduction strategy paper 2003-2005* [trans. from French], p. 33.
- Republic of Cameroon. (2003). *Poverty Reduction Strategy Paper*, p. 51.

Republic of Malawi. (2003). *An Integrated ICT-Led Socio-Economic Development Policy for Malawi*, p. 7.

Republic of Zambia. (2004). *National Information and Communication Technology Policy (Second Draft)*. Ministry of Communications and Transport, p. 2.

Rwanda poverty reduction support credit and grant. (2004). *Document of the world bank. Report No. 29467-RW*. Annex 6, p. 6.

Senegal Country Assistance Strategy. (2003). *Document of the World Bank. Report No. 25498-SE*, p. iii.

Senegal poverty reduction support credit. (2004). *Document of the World Bank. Report No. 28332-SN*, Schedule 1, p. 11.

Tipson, F., & Frittelli, C. (2003). *Global digital opportunities: National strategies of "ICT for development."* Markle Foundation.

Uganda country assistance strategy. (2000). *Document of the World Bank*, pp. 3-23.

Uganda third poverty reduction support credit. (2004). *Document of the world bank. Report No. 26078-UG*, pp. 68-69.

United Nations Economic Commission for Africa (UNECA). (2003a). *E-strategies national, sectoral and regional ICT policies, plans and strategies*. Paper presented at the meeting of the Sub-Committee on Information and Communication Technology: ICT and Governance, Addis Ababa, Ethiopia.

United Nations Economic Commission for Africa (UNECA). (2003b). *Policies and plans on the information society: Status and impact*.

United Nations Economic Commission for Africa (UNECA). (2004a). *ICT policy environment within the Great Lakes countries*. Paper presented at the Workshop on Creating an Effective Enabling En-

vironment for ICT Development: First COMESA Business Summit, Kampala, Uganda.

United Nations Economic Commission for Africa (UNECA). (2004b). *National information and communication infrastructure (NICI) plans in Southern Africa*. Report to the Tenth SRO-SA Meeting of ICE, Lusaka, Zambia.

United Nations Economic Commission for Africa (UNECA). (2004c). *National information and communication infrastructure (NICI) plans in West Africa*. Report to the Seventh SRO-WA ICE Meeting, Abuja, Nigeria.

Wild, K. (2003). *A global overview of e-strategies: Making the link with poverty and the millennium development goals*. Paper presented at the Fifth Session of the United Nations ICT Task Force, Geneva, Switzerland.

World Bank. (2005). *African development indicators: 2005*. Washington, DC: Author.

ENDNOTES

- ¹ See, for example, Bedi (1999).
- ² For further details see *OECD Key ICT Indicators: Contributions of ICT Investment to GDP Growth* available at <http://www.oecd.org/dataoecd/20/13/34083403.xls>.
- ³ Accenture Consulting, the Markle Foundation, and the UNDP (2001).
- ⁴ For an overview of donor-agency contributions and programs, refer to the 2003 OCD report *Donor Information and Communication Technology Strategies: Summary Matrix*.
- ⁵ For example, see, McNamara (2003).
- ⁶ See <http://www.un.org/millenniumgoals/>.
- ⁷ See Gerster and Zimmermann (2003).
- ⁸ See the AISI Web site for more details at <http://www.uneca.org/aisi/>.
- ⁹ For details, see <http://www.itu.int/wsis/>.

- ¹⁰ UNECA has taken the lead in this effort through its National Information and Communication Infrastructure (NICI) Strategies program. For further details, see <http://www.uneca.org/aisi/nici/strategies.htm>.
- ¹¹ See <http://www.opt-init.org/framework.html>.
- ¹² For further details, see *Summary of NEPAD Plan* available at <http://www.nepad.org/2005/files/documents/41.pdf>.
- ¹³ The World Bank defines low-income economies during 2004 to 2005 as those with a per capita GNI of less than \$826, and lower middle income as those with a per capita GNI of between \$8,265 and \$3,255. For more details, see <http://www.worldbank.org/data/countryclass/countryclass.html>
- ¹⁴ For further details, see the World Bank Project Information Document for the Africa Regional Communications Infrastructure Project.
- ¹⁵ See UNECA's NICI Web site available at <http://www.uneca.org/aisi/nici/graph.htm>.
- ¹⁶ UNECA has taken the lead in this effort through its NICI Strategies program (<http://www.uneca.org/aisi/nici/strategies.htm>).
- ¹⁷ For a more detailed discussion, see Adam (2004).
- ¹⁸ See the Republic of Zambia's second draft of the *National Information and Communication Technology Policy* (2004) available at <http://www.coppernet.zm/ictpolicy/draft-2nationalictolicyv1.11.pdf>.
- ¹⁹ Of these, 21 are PRSPs and 9 are interim PRSPs.
- ²⁰ See the following World Bank sites for more detail: <http://info.worldbank.org/etools/docs/library/108875/toolkit/sector/cas.htm> and <http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/0,,contentMDK:20120746~menuPL:51551~pagesPK:41367~piPK:51533~theSitePK:40941,00.html>.

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, and M. Acevedo-Ruiz, pp. 1-28, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.24

Poverty Reduction through Community–Compatible ICTs: Examples from Botswana and other African Countries

Rebecca Lekoko

University of Botswana, Botswana

Bantu Morolong

University of Botswana, Botswana

ABSTRACT

ICTs are an integral part of both scientific and lay cultures. However, scientific know-how, whose significant features are high expertise and highly trained personnel, is dominant while traditional cultures are gradually receding. The use of ICTs shows great potential for creating access boundaries between the rich and poor. Out of this awareness, this chapter invites readers to rethink basic questions: What are ICTs? What have been their benefits for the rich and poor? While these questions cannot be answered in detail here, few important points are presented emphasizing that ICTs do not function in a societal vacuum. The type of access to ICTs that the poor need is not

that which only enables them to be like others in using ICTs. They, much more than other sectors of society, have an increasing need to effectively manage their lives, and community-compatible ICTs can be employed for this purpose.

BACKGROUND

The key operational concepts in this chapter are poverty, information communication technologies, and community-compatible ICTs. Even though these are concepts in common usage in the various disciplines, for the purposes of elucidation, they are briefly defined in the discussion that follows. For each of the concepts, the

definition is expanded to highlight some of the fundamental issues that are relevant to the theme of this chapter.

Definitions and Fundamentals of Poverty and Information Communication Technologies

Poverty

Clearly, many definitions of the word poverty reflect the economic impact of being poor. In Botswana, for example, poverty is seen as a “consequence of a narrow economic base, which limits opportunities for gainful employment” (Republic of Botswana, 2004, p.17). To illustrate, in 1993, an estimated 47% of the population lived below the poverty datum line of approximately P100.00 (\$20) per person per month. Poverty here is simply viewed as a state in which a family’s income is too low to be able to buy the quantities of food, shelter, and clothing that are deemed necessary (<http://www.econ100.com/eu5e/open/glossary.html>). Perhaps it is this narrowness of focus that has led Botswana to develop a poverty line (PL) that considers only six categories of items as constituting the basic needs of a family in Botswana, namely, (a) food, (b) clothing, (c) personal items, (d) household goods, (e) shelter, and (f) miscellaneous (Central Statistic Office [CSO], 1991). Such an analysis may mislead because it oversimplifies the complex nature of being poor. It portrays a picture of poverty being measured in monetary and material possessions. Unfortunately, this type of understanding perpetuates a pervasive attitude of looking at the poor as the helpless and hopeless, hence giving those in power unprecedented capacity to determine how the poor should live their lives.

It is observed here that “most countries of the Sub-Saharan Africa are predominantly rural in character: roughly 70 percentage of the population live in the rural areas” (Bryceson, 1995, p.

8). It is in these rural areas where most of the poor people reside. According to the *Botswana Millennium Development Status Report 2004*, the “rates of poverty are higher in rural areas, mainly because of fewer opportunities for formal sector employment” (Republic of Botswana, 2004, p. 21). In these rural areas, the means of survival are relatively nonmonetized and predominantly agricultural. Agricultural production using a plough or hoe and livestock keeping are at a subsistence level. It can fairly be said that “animal and plants constitute human food and their importance is obviously great” in everyone’s life (Mbiti, 1988, p. 50); it is thus important to have them among the indicators of poverty, especially in Africa. It seems not right, therefore, to measure poverty solely in terms of money (mostly earned through employment in the formal sector).

A more complex picture may appear if we think and expand the definition of poverty to include poverty in the noneconomic sense, as is the case in this chapter. For purely analytical purposes, poverty in this chapter is understood as a state of lacking and/or being deprived of the essentials of life such as material and monetary possessions, employment, health services, education, and access to required social services and status, such as being responsible citizens who would participate meaningfully in their own development as well as the overall development of their country. It thus covers among others the lack of nontangible aspects of people’s lives such as power, exposure to different forms of violations, lack of access to information, as well as low levels of equality among social groups. These inequalities are mainly based on gender, class, and ethnicity. It should, however, be noted that poverty remains a very elusive concept. For example, in an attempt to accommodate the issue of the degree of poverty, there is always a desire to distinguish between poverty, absolute poverty, and relative poverty.

Generally, poverty is most noticeable in material deprivation and the psychological stigma

attached to being poor (Heeks, 1999). Wells (2000) contends that prolonged conditions of absolute poverty are associated with low levels of self-esteem, resulting in identity crisis. In some situations, the poor are described as “no-good”, “incompetent” and “stupid” such that they should expect failure of themselves just as the world expects it from them (Heeks, 1999). In simple terms, poverty is seen as being impoverished or underprivileged. Generally, “to be impoverished is to lack or be denied adequate resources to participate meaningfully in society” (<http://www.hsph.harvard.edu/thegeocodingproject/webpage/monograph/glossary.htm>). A bias in this chapter is toward analyzing and looking at poverty as it leads to exclusion in the economic, social, and political spheres of people’s lives, causing conditions of unemployment, and inadequate health and other social services.

Those critical of the definitions as given in the preceding discussion contend that these definitions have misled national leaders to aim at compensating for these deficiencies by setting up welfare systems. The welfare approach includes food handouts, nutrition, counseling, and family planning that merely aim at contributing to immediate relief of a needy situation. Such services continuously relegate the poor to a position of passive recipients of development projects. Whatever else is said and done for the poor opens the doors widely for a sympathetic attitude (Mtshali, 2000). People who are victims of this pity regard governments as power forces that have to change their situations. It is this status of the poor that the current development initiatives are aimed at addressing. This chapter reviews what the role of ICTs can be at the community level. Within the broad thematic area of ICTs and poverty alleviation, the concept of poverty is used here very broadly to refer to a lack of gainful access to and control over resources, with specific emphasis on ICTs as a socioeconomic resource.

Information Communication Technologies

The adoption of the millennium development goals (MDGs) in 2000 has meant that countries started looking for effective means of fighting the poverty scourge. In their search, the national leaders seem convinced that ICTs can be used to counter the crisis of poverty, especially if they are linked to the complex economic, educational, political, and other challenges facing the poor (Gerster & Zimmerman, 2003). Information communication technologies are generally defined as communication devices or applications encompassing radio, television, cell phones, computer networks, and hardware, as well as the services and applications associated with these (<http://searchsmb.teentarget.com>). According to Adeya (2002), it also includes electronic networks and services that embody hardware applied through networks, and services for information accumulation and flow in the public and private spheres. This encompasses Internet services, telecommunication equipment, libraries and documentation centers, and network-based information services. Some have referred to these as the group of technologies that have revolutionized the handling of information. A marked distinguishing feature for these in the current era is their capacity to be available (Gerster & Zimmerman, 2003). Other characteristics of these include (a) interactivity, (b) global reach, (c) reduced costs (cost effectiveness), and (d) usability. According to Gerster and Zimmerman, ICTs also refer to some artifacts, techniques, or knowledge used to create, store, manage, and disseminate information. Heeks (1999) sees them as electronic means of capturing, processing, storing, and communicating information. In discussing sustainable ICTs, Batchelor and Norrish (2002) say that the relevance of ICTs in long-term development goals cannot be realized, achieved, or adequately conceived without considering the three capital assets, which are finances, and physical and social capital.

The approach taken in this chapter in defining ICTs is to consider them in relation to the critical needs for countries to develop. Take, for example, information. In any developing country, one of the prime ingredients of development is information. ICTs provide a platform for information sharing and storage toward sustainable development. Information societies are those societies that have well-developed ICTs to share information for development and innovation (<http://cbdd.wsu.edu/kewlcontent/cdoutput/TR501/page59.htm>). In Africa, for example, information is disseminated for various purposes: information about new agriculture or land development, community building, public health (e.g., HIV/AIDS), and education information campaigns (<http://cbdd.wsu.edu/kewlcontent/cdoutput/TR501/page59.htm>). Thus, ICTs in this chapter are those artifacts that make it possible for people to share information in order to create a sustainable information society. In Botswana, for example, Vision 2016 states that to build an open, transparent, and accountable nation by the year 2016, “Botswana must improve the access of all its people to information and new technologies that are sweeping the world; it must introduce a freedom of information act to protect the rights of citizens to obtain and use information” (Republic of Botswana, 1997, p. 12). In terms of relevance and usability, Botswana intends to “introduce universal and national radio and television stations to bring information to all parts of the country” (p. 12). The use of the local media, for example, the newspaper and other print materials, are to be encouraged. In sum, information sharing and dissemination is a critical principle in defining the potential use of ICTs for the poor people.

Education is yet another critical platform on which ICTs can be defined. The process of education is basically related to information dissemination and ICTs because information educates (or information is education), and ICTs disseminate education or information. Through communication via ICTs, the world is a global village where

people from one country learn about happenings in many other countries as soon as the news breaks (<http://cbdd.wsu.edu/kewlcontent/cdoutput/TR501/page59.htm>).

When a country like Botswana invests in education in order to build an educated and informed nation, it does so with the knowledge that ICTs are critical tools in making it achieve this goal. Worldwide, ICTs are used to share educational information among people and countries for development purposes (<http://cbdd.wsu.edu/kewlcontent/cdoutput/TR501/page59.htm>).

Investment in education is a dynamic investment as the educated are creative enough to use available technology. In other words, education must improve all aspects of people’s lives, including their ability to create, invest in, and use ICTs for their development. A long-term vision for Botswana, Vision 2016, for example, states that “products of our educational systems must be independent, productive, innovative with cutting edge skills” (Republic of Botswana, 1997, p. 11). In this era, when cutting-edge skills are mentioned, skills for the effective use of ICTs are part of them. Botswana works hard to ensure that it maximizes the potentials of ICTs in its dream for an educated, informed, and productive nation. The executive summary of the Botswana ICT policy paper *Maitlamo* states that the ICT policy complements and builds upon Vision 2016, saying that Botswana will be a globally competitive, knowledgeable, and informed society where lasting improvements in social, economic, and cultural development will be achieved through the effective use of ICTs. Annual ICT expenditure is estimated at one billion Pula, demonstrating significant domestic demand for ICT products and services. Pula is Botswana’s currency. Currently, P5 (five pula) is the equivalent of \$1. Realizing this demand, the policy stresses the urgency for increased domestic skills to ensure that young graduates have an ICT career path.

It is in this broad usage of ICTs as information-sharing and dissemination tools for national

development that the concept of ICTs is presented in this chapter. Both the current and more traditional forms of ICTs are considered important.

The Concept of Community-Compatible ICTs

Developments in the area of information communication technologies have gone very far. What is equally true, however, is that “those areas of the world with the greatest access to new technologies have been privileged in their power to represent, to interpret and to influence development in ICTs and their use” (Johnson-Odim, 2002, p. 7). Their influences extended from determining what can be called an ICT to rules, standards, and even controls about access and the pace of development in this area. It is against this background that the concept of community-compatible ICTs has gained currency. This concept is used in this chapter to denote ICTs that are accessible to those living in both rural and urban community settings. It also refers to ICTs that are relevant, usable, responsive to communities’ needs, and accommodative of their existing ways of doing things as well as their ways of understanding, viewing, and interpreting the world.

The debate on community-compatible ICTs coincides with the thinking about sustainable development, which puts emphasis on people-centered, environmentally friendly, and participatory approaches to development. The basic argument is that with appropriate ICTs, the poor people stand a better chance of benefiting from the contributions of ICTs to development and poverty alleviation. In its general meaning, sustainability implies the capacity of something to continue for a long time (Batchelor & Norrish, 2002), with continued benefits or returns to those using it, in this case, ICTs. However, there is a strong critique on failure in most of the development initiatives to use the locally available resources, knowledge, and ideas. The relevance of ICTs in development initiatives is that they play a major

role in the transmission of information. Notable here is that information dissemination is a culturally based practice. It is, therefore, of utmost importance that those in the business of ICTs’ design and use take into account the close interaction between the contexts within which ICTs are introduced and the ICTs themselves. For those in the communities who adapt and adopt ICTs, it is suggested that being prepared to draw on the existing, indigenous knowledge technologies is a necessary condition for achieving community-compatible ICTs practices. This is meant to say that concern about community-compatible ICTs is, in a nutshell, a call for an understanding that there is potential for complementarity between the local environment and ICTs’ influences from elsewhere. This potential does not seem to have been adequately tapped, leaving ICTs to be seen as a modern invention that the indigenous people fail to understand and apply.

The literature reviewed for this chapter does push forward the distinction between “modern” ICTs and those that are traditional and have existed much longer. Experiences from many contexts of the world confirm this view by pointing to the fact that what are often referred to as simple technologies have been in existence for a long time. These include traditional musical instruments through which messages were transmitted, and tools and implements of art and painting from which we have learned so much about those societies. Among these are the most recent technologies upon which the new technologies have been built. In the African context, the radio is a good example here in its use of the airwaves just like the messengers of the chiefs who used to go to the top of the hill to announce to the community an important message. Both the radio and the messenger of the chiefs rely on the airwaves to transmit the messages. Dei (1999), for example, holds that different bodies of knowledge continually influence each other to show the dynamics of all knowledge systems (p. 111). This is meant to imply in this chapter that it should be expected that

some modern ICTs would have been informed by traditional technologies. New and old technologies can do well together.

There is evidence from research that indicates that many of the existing ICTs have their basis in traditional technologies. The radio has been given as an example. Consider the transition from AM radio to the technologically superior FM radio. After World War II, it was clear to industry participants that FM represented the future of radio. However, in spite of the victory of FM, AM radio has not vanished, operating alongside FM (Mendelson, 2001). Thus, many new technologies have some elements of compatibility with the old ones. Since traditional designs were responsive to community needs and environmental factors, we assume that both new and old technologies could be useful tools in addressing community problems such as the reduction of rural poverty. Some of the issues that are often pivotal and controversial when discussing issues of ICTs for poverty reduction are highlighted particularly in the context of the developing world.

KEY ISSUES IN ICTS AND POVERTY REDUCTION

The issues that can be termed key in the discussion of ICTs, particularly community-compatible ICTs, are many and diverse. One of the determining factors for an issue to be regarded as key in the discussion of ICTs is the context within which it is applied. In other words, one issue might be key in the context of Southeast Asia, but not be so much of an issue in the context of Southern Africa. This is simply because the needs and aspirations of people in the two contexts may not be exactly the same. In this chapter, the few issues selected for discussion are those that present themselves as general across regions of the world. Particular focus is made on the African context using Botswana as a point of reference. Among the issues are the following:

- General access to and use of ICTs
- The dilemma of devaluing African indigenous ICTs
- The expert-led belief in the use of ICTs
- The myths about ICT use and literacy
- Bureaucratic and political dimensions

There is a very close connection between the concept of community-compatible ICTs and the issue of the digital divide, which refers to the disparity in ICT diffusion and use between industrialized and developing countries, or indeed between the rich and poor, men and women, and urban and rural areas within individual countries (Souter, 2004). This divide has in “ironic ways put certain classes of people in touch with one another around the world and totally marginalized others” (p. 10). These digital divides are a reflection of deeper social, economic, and political divides. They have been part of a technological revolution (Gerster & Zimmerman, 2003). Thus, when a new innovation is introduced, the best way to assess its worth is to ask this crucial question: This is a revolution to whose benefit? Failure to answer this question is tantamount to defeating the very same benefits that ICTs are to bring to their users. A lack of compatibility of ICTs with community contexts is noted here as one of the contributing factors to the use of ICTs for social exclusion. The idea that is being advanced here is that ICTs have been applied in different parts of the world without due consideration of the importance of compatibility. Evidently, there has been limited reflection on how much impact ICTs would have on poverty if they were made compatible with community interests.

One of the main indicators for a lack of consideration of the issues of compatibility is the continuing lack of local content in the current application of ICTs at the community level. By local content of ICTs, it is meant “locally owned and adapted knowledge of a community, where a community is defined by its location, culture, history, language, interests and needs” (Gerster

& Zimmerman, 2003). For example, we need to consider the current move by the Botswana government to employ locally responsive ICTs. Botswana open-source software (BOSS), for instance, would be used by the Ministry of Education to determine the type of material to include in developing fully local educational software. To this end, financial estimates have been made through recommendations from *Maitlamo* (Mmegi, 2005). The concept of community-compatible ICTs is, therefore, viewed in this paper as an innovative idea through which improvements can not only be made on the types of technologies produced, but can also be made in the strategies for the effective application of these technologies. The next part of this chapter explores the relevance of this issue in the use of ICTs for poverty reduction.

General Access to and Use of ICTs

One of the reasons why the poor cannot reap the benefits that accrue from the use of ICTs is the problem of their limited access to these technologies. Access to ICTs for development is crucial because it is about access to information. In Botswana, for example, the rural and the remote-area dwellers do not have access to electricity and some of the infrastructure that is needed to support the use of new technologies. According to the Republic of Botswana's ICT policy document (2004), 37% of the households countrywide use electricity for lighting. Data also show that this number further falls to only 8% in rural and remote settlements. For computer ownership and Internet usage, the Botswana ICT policy reports a very low-level usage of 3 to 5%. This ownership is expected to be concentrated more in urban than rural areas, indicating that members of the remote communities are marginalized by ICTs to mainstream development efforts. Infrastructural limitations or inadequacies compound the problem of ICT access for the poor, most of whom are rural based. Their situation of poverty makes most sophisticated ICTs such as the Internet unaf-

fordable, with only few sections such as the mines and financial-service institutions making better use of ICTs. Thus, the use of ICTs, particularly in these communities, is sporadic. Just recently, in December 2005, the government of Botswana found it necessary to experiment with one of the deprived regions of Botswana, the Chobe district, by setting up a satellite dish for a radio station and the use of telephones. The number of people who responded to this was alarming, and many expressed disappointment at the end of the experiment. This is a case that indicates that many people who stay in the rural areas (mostly the poor) are deprived of basic things such as means for sharing information. Schilderman (n.d.) asserts that information enables the poor to increase their assets. Thus, when the poor are shut out of the world of information, they are put out of actions. The findings of research funded by Department for International Development (DIFD) and the World Bank and carried out in Peru, Sri Lanka, and Zimbabwe revealed the need to make information available for development by the poor. One of the key findings was that the poor do not seek information unless it is for a purpose: to meet a specific need, such as a need for social services, land, employment, and so forth (Schilderman, n.d.). Thus, they will use technology that addresses their life challenges and other needs.

While new challenges inevitably connect the poor to modern ICTs, generally, access to these new innovations is a farce for these people. It is their economic poverty that makes them great targets for using ICTs as economic boosters. Because rural communities lack certain necessary skills, technical and otherwise, and because they are on average less formally educated than urban communities, they miss out on the empowerment that comes with having information (Sebusang & Masupe, n.d.). When the Botswana government advocates for an informed and educated nation, as stated in its long-term vision, Vision 2016, the rural and the poor people are left out if nothing

is done to ensure that they reap the benefits of the ICTs for development. As of now, the rural communities in a number of African countries, Botswana included, do not have access to essential ICTs for development. Most ironically, 80% of the world's population has no access to reliable telecommunications, and the bulk of these are the poor peoples of the world. One third has no access to electricity, while there are more Internet account holders in London than there are in the whole of Africa (Heeks, 1999).

As a result of their limited access to modern ICTs, the poor continue to have gaps in information. Notably, the use of these ICTs is private-sector led and does not always focus on the needs of the poor. Where governments play a lead role in ICT provision, there are recorded cases of their reluctance to provide information that can empower the poor. For example, Schilderman (n.d.) reports that in Zimbabwe and Sri Lanka, ICT-based information is withheld from those living in informal settlements. As governments and the private sector fail to facilitate access to information for the poor through the use of ICTs, the poor have no choice but to continue to depend on traditional social networks for information, which are at times limiting.

It has been noted, however, that governments the world over have at least taken to acknowledging the role of ICTs as they give poverty reduction top priority as a challenge needing immediate attention. In the context of the Southern African Development Community (SADC), commitment to the use of ICTs to address development challenges was summarized by the executive secretary of the SADC. In his opening address at the conference of the International Telecommunication Union Economic Commission for Africa held in Botswana in the year 2004, he said that the harmonization of policies, the establishment of proper legal frameworks, and the development of predictable regulatory regimes are key to attracting private-sector participation in the development and expansion of networks to increase

access to ICTs. In addition to ICT policy, he said that infrastructure development and e-export are sine qua non for SADC to be transformed into an information-based region. As part of this context, Botswana is likely to be involved and be in step with regional and international ICT initiatives. It has hosted meetings and other activities of great importance, such as the Workshop on ICT Indicators for Africa in 2004 as well as the World Information Technology Forum in 2005. Botswana also participated in the World Summit on the Information Society (WSIS) meetings, particularly the second phase held in Geneva, Switzerland, in 2005. It is on the basis of these conventions that the president of Botswana, Mr. Festus Mogae, in his state-of-the-nation address at the first meeting of the fifth session of the eighth parliament (November 10, 2003), informed the nation that the top development priority for Botswana is the elimination of poverty. The country's Vision 2016 reflects this focus and goes further to indicate that ICT use is one of the core strategies for the reduction of poverty.

However, one cannot help but sympathize with the efforts that have been made so far in poverty reduction because they seem to be doing very little, leaving us with the fear that poverty is here to haunt the present and future generations. The recent *Botswana Millennium Development Status Report* (Republic of Botswana, 2004, p. 21) states clearly that "[d]espite its macroeconomic success, Botswana has a serious problem of poverty compared to countries of similar economic stature." Policies and program support for poverty reduction are reported to be strong in Botswana. The country alleges that 'a comprehensive system of social safety nets provides adequate welfare cover for the indigent,' yet poverty still lingers on. The 2004 *Millennium Development Status Report* acknowledges that all measures to reduce poverty 'translate in slow progress.' Perhaps Botswana needs to look critically at the ways in which it approaches its poverty-reduction campaigns. It is a well-known fact that in Botswana, ICTs are not

maximized like in other developing countries. In general, the current practices with the use of ICTs in a number of African countries have done very little to dispel the more subtle and yet influential attitudes that make access to ICTs difficult or impossible for the poor people. One issue worthy of attention that is closely connected to access to ICTs by the poor is discussed below: the dilemma of the devaluation of the indigenous ICTs in the context of Africa.

The Dilemma of Devaluing African Indigenous ICTs

Several decades have passed since a negative attitude swept across many countries: the devaluing of traditional African practices. In Botswana, the erosion of a traditional support mechanism as the economy modernizes perpetuates the situation of the poor as it is now. For example, there used to exist:

the Mafisa system, through which the poor family could get a small number of livestock, usually cattle from a better off family for the purposes of milking, draught power and possible seed...it is now difficult for poor families to barter their labor for draught power because cash is the dominant medium of exchange. (Republic of Botswana, 2004, p. 23)

The attitude described here also applies to the use of indigenous and locally based knowledge systems including the use of technology.

It is commonly known worldwide that people learn from their ways of living and common practices. They come up with unique indigenous technologies adapted and defined by their culture, environment, and needs. For example, Africans continue to use indigenous knowledge and techniques for food preservation, iron smelting, and the application of local medicines to humans and animals to cure diseases endemic to the community (Semali, 1999). Among terms used to refer

to these is the concept of indigenous technical knowledge. According to the National Research Foundation of South Africa, this is the complex set of knowledge systems and technologies existing and developed around specific conditions of indigenous communities and peoples of a particular area.

The African nations also continue to use community knowledge produced from local history and information. For example, “knowledge about flora and fauna” are important literacy skills that are critical to people’s survival (Semali, 1999, p.305). As Castle (cited in Semali, 1999) argues, whether the child’s habit is dominated by mountain, plain, river, or tropical forest, he or she learns new ways to control the environment, and its dangers, use, and fertility. Technological development in the context of traditional practices means that new knowledge and innovations are continuously developed by the local people as powerful driving forces for their survival. Thus, the richness of the poor should not be defined in terms of material possession or high education, but by their “capacity to generate new knowledge and by their ability to apply such knowledge successfully” (Walshok, 1995, p. 7). The type of knowledge referred to here is the one that derives its “origin or meaning not from an individual but a collective epistemological understanding and rationalization of the community” (Semali, 1999, p.307). This demonstrates the fact that indigenous knowledge for Africans, like for people in other regions of the world, is about what local people know and do, and what local communities have known and done for generations. In the context of Botswana, indigenous technical knowledge has been applied in agro-pastoral activities to sustain livelihoods in natural resource management and in rural development as we see it today. These include tools and equipment to transmit information, to convey messages through music, and to ferry people from one part of their communities to others. It also includes the whole embodiment of indigenous lifestyles and practices of knowledge

and information transmission and management as well as its preservation. Thus, to understand people as knowledge producers is of inestimable value. National leaders should acknowledge the fact that the poor themselves are capable of coming up with innovations to address their priority needs (Chambers, 1993). The creative breakthroughs coming from the poor people are a sign that indeed ICTs are being used by these people, and they can play a vital role in poverty reduction. It is not good to devalue local knowledge, but a combination of modern ICTs and traditional ones can make profound impact in the lives of the poor. In this way, the benefits of ICTs can be felt in all sectors of nations rather than in the urban areas only. Thorough research should be carried out to determine how traditional and modern ICTs can be used concurrently to speed up poverty-reduction activities. The question to address here is what the goal in using ICTs should be. Should it be to join the global flow through their use, or to use technologies that are relevant and responsive as poverty-reduction strategies?

As alluded to earlier, the inequalities relating to decisions about which types of ICTs to use, the accessibility of these technologies, and their overall ranking seem to have immensely contributed to the evident notion of expert-led ICTs. This expert-led notion influences the imbalances in terms of decisions about the use of ICTs. The leaders in these decision-making processes are the experts on ICTs. This concept of expert-led belief in the use of ICT is further explored in the following part of this chapter.

The Expert-Led Adoption and Use of ICTs

The use of ICTs is influenced to a greater extent by the ways in which the “educated” or experts think about these innovations. Walshok (1995), for example, contends that the effective use of technology depends on the three critical elements of “new discoveries, highly trained personnel,

and expert knowledge” (p. 8). This implies that before national leaders think of using ICTs as one of the national development strategies for poverty alleviation, they should question whether ICTs can function effectively in the absence of highly skilled individuals. Although the concept of a skill may imply the ability to generate information and use it for social and economic progress, the Western idea is that a skilled person is one who has undergone formal training, especially in academic institutions. This type of understanding has deep and pervasive implications for how the ICTs can be incorporated as tools for national development, especially for poverty alleviation. First and foremost, this type of thinking automatically disqualifies the poor’s capacity and initiatives in using ICTs. Educationally, the poor people are generally known for having limited or no formal or school-based education.

Where expert-driven ICTs are the norm, the poor are deprived of access to ICTs by some of the factors mentioned earlier, and thus they are reflected as people who cannot think for themselves under those conditions. They are considered unable to help themselves and therefore are in need of experts to assist them (Kroeker, 1995). This happens even between nation states where the economically advanced who are also ahead in terms of highly skilled person power control decisions about ICT use for the less-developed countries. Those who can afford to buy high-priced ICTs are also in a good position to determine who these experts should be. They have the power to influence the types of ICTs for poor people without stopping to analyze the knowledge bases of the poor and to use these as springboards for ICT use in poverty reduction.

The current picture pertaining to the use of ICTs is that it has successfully created a kind of mandarin culture for the haves. With this, it is as if ICTs have not, in principle, always been available (Gerster & Zimmerman, 2003). What is different is the pace at which the modern ICTs advance and change, which is much faster than the

traditional systems. This culture of the privileged can be broken into and used to benefit the poor people, especially if indigenous technologies are recognized and used together with the modern technologies. This would be the concept of community-compatible ICTs as applied in this chapter. It is important that national leaders should have respect for the use of local knowledge, experiences, and interests (Bergdall, 1993; Dean, 1999) because it provides them with opportunities to learn from the local practices. If, for example, the poor people are helped to develop confidence and efficiency in using ICTs, such a move may reduce their dependency on the governments. High-priced and expert-driven technologies might not be the best for poverty reduction if they have no relevance to the needs of the community. Community-compatible ICTs are suggested here because the authors believe that the educational status of the poor should not be used to deprive them of the opportunities to use ICTs. The poor in this regard, like in many other development initiatives, have proved to be in a better position to decide on relevant technologies because they “know best their own needs” (<http://www.hc-sc-.a/hppb/wired/community.html>).

However, we cannot rule out the existence of a close relationship between literacy and use of ICTs. This suggests that changes have to be made in the educational systems of countries such as Botswana in order to lay foundations for the effective use of ICTs for poverty alleviation in communities. In the revised national education policy, Botswana realizes the need to acknowledge the benefits of ICT innovations in education. This follows recommendations as contained in the Botswana draft policy on ICTs. The recommendation being made is that ICTs be introduced to children at an early age and also be mainstreamed into the curriculum so that children can have the benefits of technologies throughout their entire lives (Mmegi, 2005). Also suggested in this context is an ICT-specific syllabus at all educational levels. Poor people need guided ac-

cess to ICTs. If well perceived and appropriately employed as priority tools in the development of communities, ICTs can play a significant role in ensuring good-quality lives of the rural poor. Also, government-sponsored breakthrough ICT courses for the poor can be developed to give them a broader understanding of ICTs, why we use ICTs, and how modern ICTs can be used for their own development. ICTs-based expanded community participation in policy analysis and the discourse of human development and poverty reduction needs special attention, too.

The Myths about ICT Use and Literacy

The relevance of literacy and numeracy in modern ICT use cannot be denied. The concept of literacy as applied here covers the idea of information literacy, which is sometimes interpreted as a type of literacy that is also a critical one in the 21st century. This type of literacy is associated with information practices. It is an ideal type of literacy in the context of rapid technological changes. This idea of literacy is associated with information practices. It denotes the capacity of those receiving information to use it for their development. This raises the issue that if information cannot be managed and used, then it is not beneficial. It is in this regard that this chapter holds a view that “learning the mechanism of reading and writing is the touchstone that could liberate the poor and uneducated people everywhere from the bonds of ignorance, disease and hunger” (Coombs, 1985, p. 265). For example, in Botswana, literacy has been identified as a “prerequisite if Botswana’s other developmental objectives are to be met” (Maruatona, 1998, p. 11). This step has been taken after it was observed that illiteracy stood to hamper any effective national development efforts. Thus, within the context of ICTs, literacy is functional to the extent that people can develop mechanisms to use ICTs in coping with challenges and opportunities in their local environments. This

type of literacy is required to transform today's information society into tomorrow's learning society (Bruce, 1999) since it provides learning opportunities that enable people to effectively take advantage of the ICTs.

Even though it is an established fact that there is a direct link between adult literacy and socio-economic development, there is also evidence to suggest that the ability to use ICTs does not require high education, but functional literacy. Take the cell phone, for example; basic numeracy and literacy skills enable one to use this piece of technology. There are many instances when people with the basic literacy skills (low or no formal education at all) use this device in their own successful way. The same thing applies to the ability to operate a telephone or a radio. The most amazing thing is to see illiterate people being able to watch TV. These could be illiterate children or even adults in Botswana who to a very reasonable extent can understand the language being used or relate to the pictures they are watching. The overt social benefits of employing these technologies need not be underestimated. They include an elevated social status just from owning the technology. This presumably goes with a sense of being empowered and better able to take up the challenges of development in one's own terms. This view marries well with one of the critical issues being raised in this chapter, which is the fact that illiteracy should not be used to keep the poor from using ICTs.

Bureaucratic and Political Dimensions of ICT Use

In many African countries, the rural poor are unable to take control of their lives because of the structural, economical, political, and cultural conditions that oppress them. Such oppression is articulated through centralized bureaucratic structures that make participation by the locals in decision making very difficult to implement. In the absence of participation in its ideal form, and

also as a key principle in classical thinking about democracy, the communities are represented by the bureaucrats. In this process, the services that are delivered to them are not always in line with their real needs as target groups. For scientific and technological advances, Brynard (1996) opines that these top-down approaches have contributed to the creation of new problems instead of solving existing ones, especially because of the top-down thrust of the use of these technologies. The same is true for ICT adoption processes, which have a top-down thrust that many governments use to address issues of poverty alleviation.

Instead, these welfare approaches do very little to alleviate poverty. A significant feature of this approach is that it makes it difficult for poor people to take responsibility for their lives. The Botswana government acknowledges that welfarism translates into slow progress in poverty reduction (Republic of Botswana, 2004). A study (Lekoko, 2002) also supports the government's contention. In this case, it was the participants of the study, the community-based extension workers, who alluded to the ineffectiveness of the welfare approach. They refer to it as a "spoon-feeding" approach. A significant feature of this approach is that it makes it difficult for poor people to take responsibility for their lives; it encourages dependency. There clearly needs to be some initiatives that challenge the needy people to realize that they have power to change their circumstances. This applies most strongly to the use of ICTs in which communities usually play the roles of passive recipients as governments spearhead all the pilots and more long-term programs, starting with ICT policies. Thus, when ICTs are considered economic resources, a more participatory framework should be worked out. One challenge for national leaders in the developing world is to look closely at the use of technologies in the context of the local economic and social relations and determine how these processes could be made inclusive, despite the unresolved issue of how and when ICT use could be made beneficial to all in an equitable

way. Even though there is much debate about how and when ICTs can work, a timely and relevant use can be beneficial. It is important for national leaders to assess how modern ICTs can be adapted to local innovations and new challenges of the local communities.

Within the top-down approaches, bureaucratic interests often can distort the government's choice of technologies. In many instances, the governments, whose key players are the bureaucrats and politicians, assume themselves to be the sole producers of information and knowledge that is vital for development or poverty reduction. As a result of this, they play the roles of a middle person between the poor and those providing the technologies. The governments usually provide the technology on the basis of free grants or subsidies unrelated to the poor's real needs. An example that readily comes to mind is the use of technologies such as radios, which were provided by the government of Botswana in the 1970s to help in agricultural initiatives and in the tribal land grazing policy initiative as a process of social and economic transformation. Because the poor were not as convinced as the government that such technologies would work, some of the program experiences confirmed the view that inadequate participation by recipients of technologies may lead to poor adoption. Radios were used for other purposes other than the program, thereby distorting the economic value of the technologies.

In general, bureaucratic entities are biased toward large-scale, modern, expensive, and usually imported technologies. In the context of countries of the developing world, governments have limited budgetary power to supply the technologies to the poor. Community-compatible ICTs can, therefore, be viable alternative tools to address this problem. This is not meant to suggest that the communities should not have access to the sophisticated technologies that come in as part of development. However, it is a call for a certain degree of realism about what the key principles of sustainable development embrace. While the

central thesis of community-compatible ICTs is being advanced here, we also acknowledge the fact that discrepancies can exist between what the governments think about ICTs and their potential role in poverty reduction and what the local people may think. Where the poor do not appear as convinced as national leaders that certain ICTs can play a vital role in their development, such ICTs should not be imposed on them. The locals need to be convinced of their worth, be listened to on their concerns about these technologies, and be adequately involved in the reformulation of what could work in their context. Furthermore, they should have their capacities tapped and properly aligned with what is required for these technologies to make a positive impact, while at the same time attempts should be made to help people understand the technologies and to make them affordable.

CURRENT POVERTY-REDUCTION STRATEGIES

Countries worldwide are committed to joining the fight against poverty. This is evidenced by their leaders being signatories to the MDGs, which among other things commit countries to reducing by half the number of people living in extreme poverty by the year 2015: that is, reducing the proportion of people living on less than \$1 a day (http://www.unmillenniumproject.org/reports/goals_targets.htm). In all, 189 United Nations member states pledged to meet this goal. This was a sign that indeed national leaders worldwide are committed to reducing poverty in their respective countries. The president of Botswana, for example, referred to poverty as the greatest threat of all to our future welfare (Republic of Botswana, 2004). He bemoans societies that are divided between extremes of wealth and poverty. The statistics indicate that about 27% of the sub-Saharan African population lives in poverty. Some other regions, for example, South Asia (47%), record a higher

proportion (http://www.marxist.com/Globalisation/growing_world_poverty.html). Pockets of abject poverty are also in existence in developed nations. Central and Eastern Europe, for instance, record 2% of people living on less than \$1 a day (http://www.marxist.com/Globalisation/growing_world_poverty.html). The situation of poverty is, no doubt, a key challenge for all nations.

In recent years, some African leaders have realized the fallacy of using the welfare approach to fight poverty. For these countries, poverty-reduction strategies that are now devised go beyond compensation and distribution of schemes for the poor. National leaders are aware that there is a need to instill in the poor the spirit of self-worth so that they become aware of taking care of their own situation. The fundamental tenets of the poverty-reduction strategy for Botswana (perhaps not the best but the most accessible to authors) are given below to illustrate the nature and content of such strategies that are said to aim at aggressively fighting poverty.

To deal critically and creatively with the problem of poverty, strategies for the reduction of poverty have to be conceived in terms of the poor's social well-being, as well as the economic and political dimensions. The legal aspect should be an issue of concern. Africa is caught up in situa-

tions in which resources are scarce, unemployment is rising, high levels of illiteracy are difficult to break through, and infirmity is increasing. These situations make Africa a great target for foreign aid. The present situation is that many African countries receive economic and technical aid from rich and/or developed countries, and "this aid is not given free, for there is no aid without bait" (Mbiti, 1988, p. 223). Some African countries thus fall victim to the dos and don'ts of some foreign countries. The consequences of this should not be overlooked. Offering some aid should not mean that the providers should undermine African potentialities to develop their own knowledge of addressing their plight.

THE ROLE OF ICTS IN POVERTY REDUCTION

The adoption of the MDGs in 2000 has meant that countries started looking for effective means of fighting the poverty scourge. The national leaders seem convinced that ICTs can be used to counter the crisis of poverty, especially if they are linked to the complex economic, educational, political, and other challenges facing the poor. Those who see ICTs as catalysts in poverty reduction make a

Table 1. Strategies for poverty reduction in Botswana (Source: Republic of Botswana, 2004).

| The Instrument | Year | Objectives |
|---|------|---|
| National Poverty-Reduction Strategy | 2003 | <ul style="list-style-type: none"> • To link and harmonize antipoverty initiatives • To provide opportunities for people to have sustainable livelihoods through the expansion of employment opportunities and improved access to social investment • To monitor progress (regularly) against poverty |
| Revised National Policy for Rural Development | 2002 | <ul style="list-style-type: none"> • To reduce rural poverty • To promote sustainable livelihoods • To stimulate rural employment and income generation • To diversify the rural economy and reduce dependency on the government • To maintain and improve rural capital, increase agricultural productivity, and promote participation in development |

connection between the absence of ICTs and the high levels of poverty in some parts of the world such as Africa, which is recorded as having less than 0.6% of Internet users (<http://www.icconnect-online.org>). The discussion on the role of ICTs in poverty reduction is entered into bearing in mind an observation made by Heeks (1999): Like any generic technology, ICTs lend themselves to sweeping statements about what they can do for development.

Programs have been put in place in different countries of the world to show that indeed ICTs can make a positive contribution to the reduction of poverty and the achievement of a better quality of life for the poorest and marginalized groups. Evidence for this in the African context can be drawn from a study that was undertaken covering three countries—Mali, Uganda, and Tanzania—conducted in 2003 under the Building Digital Opportunities Program. This study has demonstrated that ICTs can be important tools for achieving improvements in people's lives in the context of MDGs (iConnect.offline, 2003). In reporting this discovery, a strongly held point of view is that for ICTs to be effective in playing a pivotal role in poverty reduction, they should not be “set apart as a minor part of any development activity” (p. 2); instead, they have to be an integral part of the development process. From this study, the areas seen to have potential for increased benefits from ICT use were health, livelihood, and governance, with a special focus on HIV/AIDS.

In the broad area of improved livelihoods through ICTs, there is evidence to suggest that the overall empowerment of communities is achieved as they engage in agricultural processes using ICTs. Communities are empowered through capacity-building programs with emphasis on face-to-face contacts. An empowered community through access to information is better able to overcome most of the impediments to participation. This has to be noted here, bearing in mind the fact that participation is central

to good governance. Worth noting, too, is the interrelatedness between all the areas in which ICTs have a potential to contribute to poverty reduction as mentioned above. ICTs are reported to have given communities a voice in development and poverty-reduction debates. This has to a great extent made it possible for their ideas to be better integrated in development initiatives. It is on record also that being able to participate contributes first and foremost to the betterment of self in all the domains of human development. Even in the debate on sustainable development, people's participation is acclaimed as one of the cornerstones for achieving this ideal.

There are those who hold a view that ICTs per se do not contribute to poverty reduction. They should be valued in as far as their capacity to support civil society is concerned. Rykert (1999, p. 184) says, “Technology in and for itself, will not solve problems. Ethical choices challenge us at every turn as we work for the goals of civic society. Local knowledge has much to contribute to when, why and how ICTs can be applied.”

The lesson learned from Rykert's (1999) contention is that technology should be applied for its potential to solve social problems. In his view, there are unanswered moral questions relating to effective ICT applications. Effective application, it is argued here, would be evidenced through combining old methods with new ones, sharing wisdoms, and learning from each other. It is the collective capacity, in the words of Rykert, that truly has impact.

Another factor that is likely to contribute to modern ICTs not making an impact on poverty reduction is the lack of the capacity by the poor to effectively apply ICTs to solve their poverty problems. Aside from knowledge and practical skills, it is argued by Heeks (1999) and others that even the trust and levels of confidence and security to use ICTs are lacking among the poor. This has been one of the major impediments for effective ICT use and for receipt of optimal benefits from the technologies by the poor. Incapacity here is used

in a very broad sense to include the poor people's lack of skills, trust, and ability to analyze risks and resources, and their lack of power to influence the direction of decisions. Those with this type of pessimism caution us as this chapter does about overoptimism toward ICTs as they are currently applied. In their view, the information that on the surface ICTs are said to effectively transmit... is a necessary resource for poverty alleviation but it is by no means a sufficient one.

The last impediment that this chapter will highlight relating to effective ICT use for poverty reduction is that of the capacity by the poor to manage the ICTs' generated information. No doubt, information generated by modern ICTs is immense in terms of volume and complexity, and therefore it is often also overwhelming not only for the poor but even for the most sophisticated users. It is most of the time context biased and not very organized, hence the general view that it should sometimes be used with caution, while applying special skills to decipher it for positive impact.

There is a generally held view that the poor do not have adequate skills to effectively manage this information (Rykert, 1999) and therefore they have not been able to adequately exploit the potential it holds for poverty reduction. This state of affairs, we would like to argue, will be significantly accentuated (to the disadvantage of the poor) by the rapid pace at which modern ICTs develop, change, and are redeveloped to suit the ever-changing trends and demands and challenges of development. This presentation questions the view held by those who "seem to behave as if it were possible to pluck ideas relating to ICTs, the types, uses, etc out of cultural contexts and treat them as independent technical facts" (Sillitoe, 1998, p. 228). For example, imported ICTs bring with them cultural biases that contribute to their being well received or not being well received. Sillitoe goes on to say, "we need to establish that it is dangerous to do this and demonstrate the importance of understanding environmen-

tal interactions and development opportunities within their socio-cultural contexts" (p. 228). We posit here that this is not possible because cultural influences are pervasive in every aspect of development.

CONCLUDING IDEAS AND RECOMMENDATIONS

Not too long ago, ICTs were considered marginal to the achievement of national economic growth. But a decade or so later, ICTs are considered a central part of development processes at the individual, national, regional, and international levels. There is evidence to suggest, however, that in the contexts of the developing world, more knowledge is still needed about the most effective ways of developing conducive environments for modern ICT use in poverty reduction.

There is a view that modern ICT use in general has, like development, fallen into a trap of trickle-down approaches with all their known limitations. Therefore, the poor and other disadvantaged groups have still not received the desired benefits. There are even those who argue that ICTs have increased the gaps, particularly in knowledge and information between the haves and have-nots. The viewpoint expressed in this chapter is that if modern ICTs have benefited the rich, there is no reason. They cannot benefit the poor but on one condition: that they are made compatible with community needs and environments.

Duly recognized is the fact that developing and less-developed countries are still less well equipped to exploit the potentials of ICTs for reduction of their poverty. One of the contributing factors to the ineffective use of ICTs in poverty reduction has been identified as the inability by these countries to effectively balance policies, and the evidently expensive investment options for ICTs against other socioeconomic objectives, for example, the MDGs. Suggested in this regard are policy priorities that aim to reduce factors

that inhibit the effective use of ICTs for poverty reduction. Some of the inhibiting factors as have been discussed in this chapter are inaccessibility to ICTs, limited capacities by the local communities to use the ICTs, and attitudes about modern ICTs as new inventions that the locals fail to understand. These have resulted in a failure to integrate traditional ICT systems into the new ones, and also inability to see ICTs and their use as part of a complex system of national development. Evidently, the relationship between ICTs and poverty reduction is not as clear cut a relationship as it is often assumed to be. It is suggested that a good starting point for the effective employment of ICTs in poverty reduction is to develop a full understanding of this relationship through multi-disciplinary research. This type of research will demonstrate the interactions between economic, social, political, and legal aspects of poverty.

Another critical issue raised in this chapter is that to assume that ICT use is of critical benefit when in fact it has had a similar marginalization effect as other developments is an oversimplification of issues. It is still very hard at this point to go into any convincing discussion of positive impact when the true relationships among all the factors have not been adequately ascertained, for example, through research (not even in the developed world). It is concluded, therefore, that many of the assumptions that underpin current thinking about the role of ICTs in development, in general, and poverty reduction in particular is based on intuition. There is only limited evidence from a narrow range of pilot projects to support these, and not from large-scale impact assessments carried out on a macroeconomic scale. Some authors have also argued that the benefits of ICTs are not in the short term, nor can they be easily isolated from the benefits derived from other factors in a given context.

For the developing world, a big issue is that of the affordability of ICTs by its evidently weak economies. The complicating factor in

this regard is that most of the ICTs that are used in this context are imported. They are not only imported, but they are accessed most of the time through foreign assistance. This has made it imperative for this presentation to argue for sustainable applications of ICTs in poverty reduction. For us, it is all the more reason why we believe community-compatible ICTs would be a better alternative because they would reduce the susceptibility of the business of accessing ICTs to all the factors of nonlocal production such as import duties, international market fluctuations, other types of taxes, and regulatory frameworks in the world of trade.

This chapter is concluded by affirming that consensus is growing on the potential positive contribution of ICTs to mainstream development. It has also been used to highlight the fact that the role of ICTs in poverty reduction cannot be limited to improvements in the state of economic deprivation. This is confirmed by Gerster and Zimmerman (2003), who hold that beyond economic benefits, ICTs increase levels of interactions between peoples of the world and therefore they are increasingly becoming a basic need.

REFERENCES

- Adeya, N. (2002). *Information and communication technologies in development*. Paper presented at the Conference on Global Equality: Rethinking ICTs in Africa, Asia and Latin America, Heerlen Maastricht, Netherlands.
- Akosah-Sarpong, K. (n.d.). African cultures in the age of globalization. *Expo Times*. Retrieved August 30, 2005, from <http://www.expotimes.net/pastissues/issue000524/saporng.htm>
- Batchelor, S., & Norrish, P. (2002). *Sustainable information and communication technology (ICT)*. Retrieved December 1, 2005, from <http://www.sustainableicts.org/Sustainable.htm>

- Bergdall, T. (1993). *Methods for active participation: Experience in rural development from east and central Africa*. Nairobi, Kenya: Oxford University Press.
- Brynard, D.J., (1996). Planning participatory approach, in Bekker, K. (Ed.), *Citizen participation in local government*. Pretoria: J.L. van Shaik.
- Bruce, R. (1999). Networking multimedia contents for education. *Russian Digital Library Journal* 2(3). Retrieved from: <http://www.elbib.ru/index.phtml?page=elbib/rus/journal/1999/part3/royan>.
- Bryceson, D. F. (1995). Wishful thinking: Theory and practice of western donor efforts to raise women's status in rural africa. In D. F. Bryceson (Ed.), *Women wielding the hoe*, (pp.201-222). Oxford: Berg Publishers
- Campfens, H. (1997). International review of community development theory and practice. In H. Campfens (Ed.), *Community development around the world* (pp. 11-46). Toronto, Canada: University of Toronto.
- Central Statistic Office, Botswana (1991). *Education Statistics 1991*. Gaborone: Government Printers
- Chambers, R. (1993). *Farmer first: Farmer innovation and agricultural research*. London Intermediate Technology Publications.
- Coombs, P.H. (1985). *The world crisis in education: The view from the eighties*. Oxford: University Press.
- Dean, M. (1999). *Governmentality: Power and rule in modern society*. London: Sage.
- Dei, G. J. (1999). Rethinking the role of indigenous knowledge in the academy. *The research network for new approaches to lifelong learning* (NALL), Working paper number 58
- Dei, G. (2002). Rethinking the role of indigenous knowledge in the academy. *International Journal of Inclusive Education*, 4(2), 111-132.
- Gerster, R., & Zimmerman, S. (2003). *Information and communication technologies for poverty reduction*. Switzerland: Swiss Agency for Development Corporation.
- Heeks, R. (1999). *Information and communication technologies, poverty and development*. Manchester: Institute for Development Policy and Management.
- iConnect Offline (2003). Applying knowledge to development. iConnect, Issue 10 October 2003. Retrieved July 3, 2006 from <http://www.iconnect-online.org>
- Johnson-Odim, C. (2002). *Africa in the information and technology age*. African Studies Association. Retrieved August 30, 2005, from http://www.africanstudies.org/asa_papercalltheme.html
- Kroeker, C. J. (1995). Individual, organizational, and societal empowerment: A study of the processes in a Nicaraguan agricultural cooperative. *American Journal of Community Psychology*, 23(5), 749-764.
- Lekoko, R. N. (2002). *Appraisal of Botswana extension agents' work and training experiences: Research-based*. FL: UPBLISH/Universal Publication.
- Maruatona, T. (1998). *The evaluation of literacy program in Botswana: A report to Botswana Notes and Records*. Gaborone, Botswana.
- Mendelson, H. (2001). *In time new and old technologies can thrive together*. San Jose Mercury News, July 2001.
- Mbiti, J. S. (1988). *African religious and philosophy*. London: Heinemann.
- Miller, J. G. (1978). *Living systems*. New York: McGraw-Hill.

- Mmegi, A. (2005, September 22). Getting ready for e-education. *Botswana Weekly Paper*, 139, B2.
- Mtshali, S. M. (2000). Monitoring and evaluation of women's rural development extension services in South Africa. *Development South Africa*, 17(1), 64-65.
- Muayle-Manenji, F. (2004). *The effects of globalization on culture in Africa in the eyes of an African woman*. Retrieved August 30, 2005, from <http://www.wcc-coe.org/wcc/what/jpc/ef-fglob.html>
- Ntsatsi, T. (2002). Botswana's quest for an information society, (Concept paper), *Botswana Human Development Report, 2002/3*, United Nations development Programme, Gaborone
- Pityana, N. B. (1999). The renewal of African moral values. In M. W. Makgoba (Ed.), *African renaissance: The new struggle* (pp. 137-148). Cape Town, South Africa: Mafube.
- Ramsamy, P. (2004). *Official opening address at the international telecommunication union/ United Nations economic commission for Africa regional workshop on ICT indicators for Africa held in Botswana*. Unpublished manuscript.
- Republic of Botswana. (2004). *Botswana millennium development status report 2004: Achievement, future challenges and choices*. Gaborone, Botswana: Tiger Design and Graphics.
- Republic of Botswana, President Task Force. (1997). *Long term vision for botswana: Vision 2016*. Gaborone: Government Printers.
- Roberts, E. B. (1991). *Entrepreneurs in high technology: Lessons from MIT and beyond*. New York: University Press.
- Rykert, L. (1999). New tools, same values: Information and communication technologies to support civil society. In *Civil society at the millennium* (pp. 179-192). CT: Kumarina and Press.
- Schilderman, T. (n.d.). *Can ICTs help urban poor access information and knowledge to support their livelihood?* Retrieved August 30, 2005, from <http://www.unhabitat.org/programmes/ifup/conf/Theo-Schilderman.pdf>
- Sebusang, S. (2001). *Making technology work for poor people*, (Seminar presentation), October 17, United Nations Development Programme and the Department of Economics, University of Botswana, Gaborone
- Sebusang, S., & Masupe, S. (n.d.). *ICT development in Botswana: Connectivity for rural communities*. Retrieved November 8, 2005, from <http://216.239.51.104/search?q=cache:zifCMVbuh2AJ:link.wits.ac.za/journal/j0401-sebusang-botswana.pdf+ICTs+in+Botswana++rural+areas&hl=en>
- Semali, L. (1999). Community as classroom: Dilemma of valuing African indigenous literacy in education. *International Review of Education*, 45(3-4), 305-319.
- Semali, L., & Kincheloe, L. (1999). *What is indigenous knowledge: Voices from the academy*. New York: Falmer Press.
- Sillitoe, P. (1998). The development of indigenous knowledge. *Current Anthropology*, 39(2), 223-252.
- Souter, D. (2004). *ICTs and economic growth in developing countries*. Retrieved July 4, 2005, from <http://www.oecd.org/dataoecd/15/54/34663175.pdf>
- Walshok, M. L. (1995). *Knowledge without boundaries: What America's research universities can do for the economy, the workplace, and the community*. San Francisco: Jossey-Bass.
- Wanyeka, I. M. (n.d.). *The development of community media in East and Southern Africa*. Nairobi, Kenya: Eco News Africa.

Wells, B. (2002). Women's voices: Explaining poverty and plenty in a rural community. *Rural Sociology*, 67(2), 235-254.

Wolf, N. & Wahab, B. (1996). The importance of indigenous organizations to the sustainability of contemporary Yoruba strip-weaving industries in

Iseyin, Nigeria. In P. Blunt & M. Warren (Eds.), *Indigenous organizations and development* (pp. 67-87). UK: SRP Exeter.

Zimmerman, M. A. (1995). Psychology empowerment: Issues and illustrations. *American Journal of Community Psychology*, 23, 581-600.

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, and M. Acevedo-Ruiz pp. 116-137, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.25

Interactions among Thai Culture, ICT, and IT Ethics

Pattarasinee Bhattarakosol
Chulalongkorn University, Thailand

ABSTRACT

Information is important to humans because without information, no task can be performed. Therefore, information and communication technology (ICT) was invented and implemented to serve the needs of people. This facility has both positive and negative impacts on Thai society. However, it is generally the information technology ethics of the user that determines the direction of use of the technology. This chapter presents the relations among Thai culture, ICT, and IT ethics, in which all impacts are considered and described. The discussion in this chapter indicates that there are various factors related to development of IT ethics, but the one main factor is family background. Thus, in order to increase the IT ethics of users in an ICT world, the proposed solution in this chapter is to create a strong family and instruct children in their religion. Although this method is long-term, the outcome is worth the wait.

INTRODUCTION

Information and communication technology (ICT) is a technology whose main activity is to make information accessible to communities using computer networks. ICT has experienced rapid growth and has become part of the human lifestyle all over the world, including Thailand. Since information is very important to people in many ways, computer scientists are trying to invent techniques to improve information transfer methodology to the point where people around the world can obtain information easily and quickly without boundaries. Consequently, most daily activities rely on ICT-based machines that perform quickly and perfectly.

Although computer scientists constantly are developing new technologies for ICT use, the results of using these technologies are still in the hands of people who use them. It is true that everything has two sides, as does ICT. If ICT is

applied to rights, or legal activities, the outcome can be expected to be positive to society; otherwise, its results may be negative.

Considering the fact that people are components of society and every society has a unique culture, one finds that culture in each society is what binds its members together. One significant part of the human culture is ethics. Although people in different communities have different cultures, what remains rather constant in each culture is that there is an ethical system that protects human rights.

As mentioned previously, human activities rely on information, but how the information is used depends on the IT ethics of the user. Since people have many chances to receive various kinds of information, some information may motivate users to violate their IT ethics in order to gain the highest benefits for themselves without being concerned with the negative outcome of these activities.

Thai culture and ethics have influenced Thai living styles for centuries, long before ICT was implemented. People carry on with their lives in accordance with what they have been taught by their ancestors. After ICT was implemented, Thai people had access to knowledge and information that were different from what they had been taught; this information is useful for their businesses and/or their lives. Moreover, ICT allows people to work anywhere, anytime, and whenever they want. Thus, the lifestyle of some Thais has started to change according to the information and convenience they have obtained through ICT.

The consequence of the changing life style of the Thai people may alter the ethics that they inherited from the past. Since Thai culture typically shows a significant connection with nature and since most activities belonging to Thai culture are related to religion, there is a possibility that the IT ethics of Thai people at the present time are influenced both by Thai culture and ICT. One might show this in a mathematical formula. If LE represents the level of IT ethics of a person, ETC

is the effects of Thai culture, $EICT$ is the effects of using ICT, and e is a small effect from environment, then the model of Thai IT Ethics can be formulated as $E = R(ETC, EICT, e)$, where $R()$ represents relation, which can be either function or nonfunction among parameters.

This chapter will focus on the impact of ICT on the IT ethics of the Thai people and their culture. Additionally, a solution to improve Thai IT Ethics in the cyberworld is suggested.

BACKGROUND

According to the Webster's dictionary, the word *culture* means the act of developing intellectual and moral facilities, especially through education, and it also can mean the integrated pattern of human knowledge, belief, and behavior that depends upon a person's capacity to learn and transmit knowledge to succeeding generations. Therefore, if the behavior of people in a society changes, it definitely will change the culture of that society.

Moor (1985) defines the meaning of computer ethics as follows: "Computer ethics identifies and analyzes the impacts of information technology upon human values like health, wealth, opportunity, freedom, democracy, knowledge, privacy, security, self-fulfillment, and so on." Considering the current roles of ICT, one finds that it has been implemented in every corner of human life. Although the original aim of developing ICT was for information transfer among organizations, this technology has been developed to support mankind in every activity everywhere. For example, people can communicate anywhere because of the development of mobile technology; people can exchange information because of the existing Internet. The ability to transfer and exchange information has enabled business units to improve their strength and increase their competitiveness.

Although ICT has been implemented all over the world, most people on the Internet expect that

other users will use the Internet under the same rules of ethics. Unfortunately, the consequences of using ICT are in the hands of the user. Thus, ICT usage can be classified both legal and illegal, depending on the objectives of the user. However, Mowshowitz (1978) said that the ethical judgment in using computers was based on the impacts through the organization. Additionally, searching for appropriate methods for ethical judgment and control in an organization must deal with the reality of the power of professionals.

In order to create a clear understanding of computer ethics, professional codes of ethics have been defined by various organizations. For example, a well-known code of ethics is the standard Ten Commandments based on Barquin (1992), which was announced by the Computer Ethics Institute. In 1998, the Association for Computing Machinery (ACM) also announced the ACM Code of Ethics and Professional Conduct, whose content is quite similar to the Ten Commandments by Barquin (1992). Moreover, another worldwide organization, the Institute of Electrical and Electronics Engineering (IEEE), announced the IEEE Code of Ethics for all engineers to follow, establishing a standard for ethical judgment.

Since information easily flows to all users, some users use it to commit crimes, while others use it for creating a good society. However, some users may use ICT without knowing that their actions are against the IT ethics rules, such as sending a tracking agent into other persons' computers or posting fake data on the Internet to cause confusion for others, and so forth. Therefore, in order to prevent unintentional crime, Solomon (1993) and Cappel and Windsor (1998) suggested that people should be provided knowledge about ethics in their professional training. However, the study of Cappel and Windsor (1998) has shown that ethical decision making is still dependent on professional experiences.

Since immoral uses of ICT have increased, the attitudes of people toward others have been altered. In the old days, people could live together

without guards or fences. Currently, we are living in an environment surrounded by high security systems, even though we are using the Internet at home. This indicates that people do not trust each other as in the old days.

Considering Thai culture in which people live with caring, sharing, and trust, we can see that the strength of community is bound up intimately with culture. Some influences upon Thai culture are from religion. According to their religion, people were taught to believe that causing harm to others is a sin, and consequently, they will go to hell after they die. However, has this culture been maintained, or has it been changed by the ICT world?

Since a part of Thai culture was established through the community's religion, and since the purpose of each religion is to teach people to be a good person for the society, rules in Thai culture are then consistent with the codes of ethics in IT. Thus, "What can Thai culture do for IT ethics?" is the next question that will be answered in this chapter. Nevertheless, if people use IT without ethics, serious damage will arise and will be hard to fix. Therefore, the next question to be answered is, "What would happen to ICT if there were no IT ethics?"

This chapter begins with a short description of Thai culture. The following sections then will discuss the relationship between Thai culture and IT ethics as well as how Thai culture can influence the actions of Thai users, or vice versa. Problems of using ICT without IT ethics will be stated, ending with a conclusion on the impact of ICT upon Thai culture. The last section will show the entire picture of interactions among Thai culture, ICT usage, and IT ethics.

THAI SOCIETY AND CULTURE

Thai culture has been around for more than 1,000 years. Hongladarom (1992) and Mahidol University (2002) referred that Thai culture can be

regarded as a combination of two great cultural systems: Chinese and Indian. Since religion is a significant part of Thai life, there is a high impact of religion upon Thai culture. In other words, religion in Thailand is the best representative of the culture of the Thai people. Figure 1 presents the relationship among Thai culture, society, and religion.

As mentioned by Phillips (1965), the Thai community is usually composed of a group of individualities bonded by their religion with small emotional commitment. Furthermore, Komin, (1990) stated, “The Thai social system is first and foremost a hierarchically structured society where individualism and interpersonal relationship are of utmost importance.”

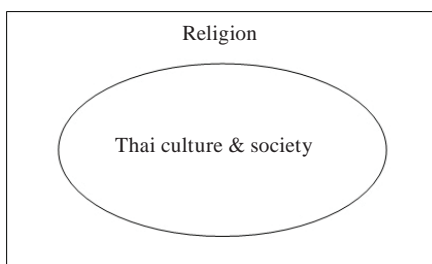
Although Thai culture is based on religion, the Thai character is not the same as other countries that believe in the same doctrine. Komin (1990) concludes that Thai character is reflected in the nine value clusters as follows:

1. **Ego Orientation:** Thai people usually have the highest ego value of being independent and of self-esteem. The ego for the Thai is very important and is always a main factor in any decision making. Maintaining “face” in society is an automatic action of a Thai in any situation.
2. **Grateful Relationship Orientation:** Thailand has been called the Land of Smiles. In

general, Thai people are friendly, sincere, and helpful, with deep reciprocal relationships. This grateful relationship value also is based on gratitude toward others. Thus, reciprocity of kindness, particularly the value of being grateful, is a highly valued characteristic trait in Thai society.

3. **Smooth Interpersonal Relationship Orientation:** The values of Thai society are different from Europeans, whose focus is usually on personal achievement. In Thailand, society is based on many different values, such as care and consideration, responsiveness to situations and opportunity, and politeness and humbleness. Currently, these characteristics help bind the economic gap of society in Thailand.
4. **Flexibility and Adjustment Orientation:** For a Thai, there is nothing to be serious about. Thai people hardly hold on to anything. This might be the influence of the Buddha’s statement that everything on Earth is impermanent, or empty. Additionally, the feeling of care and consideration also may be a reason to adjust oneself to the situation in order not to hurt others.
5. **Religio-Psychical Orientation:** Owing to the fact that more than 90% of the population in Thailand believes in Theravada Buddhism, it is obvious that Buddhism has a significant role in the Thai lifestyle.
6. **Education and Competence Orientation:** Thai society puts a high value on education. People who achieve a high level of education always obtain high respect from others. Education can be compared to a social ladder on which people climb to success and a firm social position.
7. **Interdependence Orientation:** In the rural area of Thailand, people in villages always help each other in any task, such as rice harvesting, wedding ceremonies, or the ordination day of anyone’s son in the village. Apart from Thai ego and smooth

Figure 1. Relationship among Thai culture, society and religion



interpersonal relationship, this characteristic helps Thai society to facilitate coexistence of various ethnic groups in Thailand.

8. **Fun-Pleasure Orientation:** This value relates to many other values already mentioned. The value of grateful relationship is the creation of pleasure for others. Additionally, the value of religio-psychical is the belief of emptiness and impermanence. Therefore, Thai people never take anything seriously like the Japanese. Thus, Thai people always smile, whether facing troubles or participating in parties. Smiling is a method to relieve negative pressure in one's mind. Moreover, this action can comfort the actor for another positive side of life.
9. **Achievement-Task Orientation:** A part of the Thai educational system is to push children for hard work. Teachers always eulogize students who are smart and highly responsible for their assignments. Moreover, teachers usually set up these students to be class leaders. Thus, this attitude is embedded in children's minds and reflected when these children grow up to be adults. Unfortunately, the fact is that the winner in society is the person who has good relationships with others, not a person who performs good work.

Besides these characteristics, there are some characteristics of Thai that have not been stated by Komin (1990), but they are stated by Soopatra Soupap (1975) in the article, "Thai Society and Culture." For example, Thais love gambling and risk taking, Thais never show disagreement and easily believe in things, they don't like others to be as good as themselves, and so forth. These characteristics lead to changes in Thai society when information and communication technology moves into their lives. Unfortunately, these changes also affect the level of IT ethics.

Soupap (1975) mentions that Thais like to do things easily. This appreciation stimulates some Thai people to create tools to support their tasks.

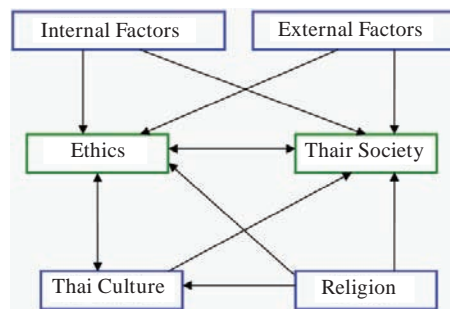
Thus, the need for making things easily can be counted as an internal factor for the change in Thai society. However, this change is a slow movement and, generally, does not turn over the normal lifestyle.

It is a fact that human life always changes, and external factors from different environments and different cultures can accelerate changes in society. Since Western people arrived in great numbers into Thailand, the rate of change has accelerated. Moreover, the direction of change also has been different from the past. At present, modern Thai society has been influenced by Western lifestyle in many areas, such as the education system, the economic system, commercialism, consumerism, arts, and entertainment.

Considering the model of Thai society, we find that the doctrine of every religion exerts a powerful influence on the behavior of the society. One worldwide acceptable behavior is ethics. This qualification of a human being usually is obtained from a strong belief in religious teachers. However, the ethics of a people also can be changed by both internal and external factors. Moreover, standards of ethics of the citizens can direct changes in society. A high standard of ethics leads to positive change; otherwise, the society will fall into trouble.

Referring to the details already mentioned, Thai society (*TS*) can be written as a model of

Figure 2. Relationships among Thai society, ethics (IT ethics), religion, culture, internal factors, and external factors



relations between ethics (E), religion (R), culture (C), internal factors ($IntF$), and external factors ($ExtF$); that is, $TS = R(E, R, C, IntF, ExtF)$. Since IT ethics is similar to general ethics in society, the model of Thai society in modern technology also is related to IT ethics and can be written as $=$, where E represents IT ethics.

Figure 2 represents the relationship among Thai society, ethics, religion, culture, internal factors, and external factors.

RELATIONSHIPS AMONG FACTORS

We learned from the previous section that there are links between IT ethics, Thai society, religion, culture, internal factors, and external factors. Since Thai society is a model of religion, Thai culture, internal factors, and external factors, the lines link between these parameters (boxes) have only one direction. Furthermore, there is a two-directional link between IT ethics and Thai society. This link means that when IT ethics of people change, the situation in the society, or the society, will change, or vice versa.

Due to the fact that IT ethics is highly related to religious belief and religious precepts that will never change, there is only one direction line link between IT ethics and religion. On the other hand, the edge between IT ethics and Thai culture is bidirectional, because when the culture changes, the level of ethics changes, and vice versa. The model of IT ethics is the reverse relation of Thai society, which can be represented as $E = R(TS, R, C, IntF, ExtF)$, where E is the level of IT ethics; TS represents Thai society; R and C represent religion and Thai culture, respectively; $IntF$ and $ExtF$ refer to internal and external factors. This relation is similar to the reverse relation of Thai society.

THE CHANGES

As society grows due to the increased activities of modern capitalism, every business also grows,

and human life becomes busier than normal. For example, shops have more customers to serve, schools have more students, and so forth. The daily lifestyle is not as easy as it used to be. Owing to the situation where a large amount of data must be computed in every organization in which manual calculation was the only method at the time, human error naturally occurred. Loss of benefits in the commercial world became a critical issue for business organizations. Frustrations in the working staff increased. Too much paper needed to be kept for reference, and so forth. Therefore, the computer system was invented to serve the fundamental needs of computation and data storing.

Some of the results of using a computer system in an organization are reduction in human error, increase in organization performance, and reduced space for paper storage. Additionally, the working staff is relieved of stress. Thus, the working environment is better. However, the data are still transferred manually.

Once the organization is well-organized by a computerized system, its service and productivity increase. Thus, an automatic data transferring system was another user requirement. Why is this so? Consider a system that has hundreds of documents to be distributed. If there is only one postal worker for this job, it would take many days to finish. A manual transferring system is not only slow, but it also may lose some documents along the way, or some receivers in the list may not receive the documents. These errors cause interruption in business processes and are not positive for the business organization.

As a means to reduce the errors mentioned, computer network technology was developed in order to link all computers together and to allow people on the network to transfer data freely. This system has a common name—information and communication technology (ICT). Thus, a revolution in data communication in society began.

At present, the modern Thai lifestyle relies on ICT to a large extent. Most of a Thai's daily life at work or at home depends on computers and

network facilities for information exchange and data communication. ICT provides facilities to its users until it seems like there is no boundary to its usage. Thus, ICT provides tools that were created by humans to support their tasks in the same way as other invented tools, except that the power of ICT is enormous and, hence, rather difficult to control.

Are all these changes the only changes in society? The answer is no. Another area of change that may not be obviously perceptible concerns human thought. In the early age, talks about works referred to functions to be performed but not to the question of who performed the functions. Now, talks about works do not consider functions to be processed, but people think first of the question, "Who will do the job? Then, functions to be performed will be assigned based on qualifications of the object that was assigned to perform those functions. This thought is the thought of objects.

This situation can be explained rather easily when we look at the development of computer language. Early programming languages, such as FORTRAN, COBOL, and PASCAL, are functional-oriented programming languages. The functional programming language supports the functional programming design; this means the design that concerns the functions to be performed by programs. Currently, functionally oriented technology is out-of-date, and organizations turn to use the object-oriented technology (OOT) instead.

The concept of OOT was based on things, which also can be called objects. The development process using OOT starts by defining objects in the developed system. These objects can be people, documents, equipments, and so forth. The second step is to define relationships among the objects, following the characteristics of each object, grouping objects under some constraints, and so forth. In the design process of OOT, the designers will start with the same process as the analysis process; that is, to define all necessary objects for the new system.

What does this change mean? The change from functionally oriented to object-oriented computer programming languages reflects the change of the human mind. But how? Usually, programming is a technique in which people pass on their thoughts into codes that force a computer to run jobs. The functionally oriented approach is not concerned with who will perform the tasks, while object-oriented programming does care about who must perform the tasks. Using a functionally oriented language, anyone can perform the tasks. This reflects a helping and sharing system. On the other hand, object-oriented languages reflect the different idea of independent and individual systems.

Thai society is an open one, and it has received ideas and influences from everyone with whom it comes into contact. Thai people love to follow others, especially now Europeans and Americans. Since one of the Thai characteristics is that they are people who love to do things easily (Soupap, 1975), using computers and ICT are, thus, favorite tools in modern Thai life. Many activities are performed by computers and ICT, such as e-banking, e-commerce, and e-learning.

According to the policy of the current Thai government, every task should be able to be transformed in the digital world, so all services will be fast and accurate with the right and completed documents in digital format (Bhattarakosol, 2003). Therefore, most government processes are transformed into the digital process under ICT facilities. This change makes Thai life more convenient; nonetheless, it is also a mirror reflecting that Thai society is also a busy society fully immersed in the cyberworld.

Once the digital system is applied in the Thai working environment, the concept of independent and individual system has been integrated into Thai society without awareness. Thai society is the same as other societies in the world. So, all businesses in Thailand, including government businesses, are expanding and changing their scales. Some Thais are struggling for survival in their work, having no time for their families.

A defect of working with computer applications is that every process must be in “right—authority,” “order,” and “rules.” Once a process is called without order or breaking a rule or without authority, then an error occurs. Thus, Thai staffs try to avoid these errors by not helping friends process their jobs.

Implementing ICT in Thai society, Thai citizens have chances to obtain knowledge from everywhere, anytime by themselves. Additionally, the chance to engage in discussions across countries is increasing. Thus, the Thai population has the opportunity to gain knowledge and experience different cultures via the Internet without having to attend classes.

In conclusion, Thai society has changed into a convenience society with a busy lifestyle. People are more independent, and, most importantly, family life has become looser.

IMPACT OF CHANGES—PROBLEMS

It is well known that human needs are unlimited; the desire of people is not limited only to necessary things, but they always want everything. These needs have pushed the development of ICT further and further with no end to serve these unending needs. Thus, ICT increases the power of mankind.

From the previous section, one can see that there have been many changes in society with ICT. These changes are as follows:

1. People are independent.
2. People are concerned with “object.”
3. People are smarter.
4. People have much freedom to exchange their thoughts through technology.
5. People’s lives depend on digital documents and equipments.
6. Human life is full of tools to support one’s work.
7. Family life is less important than work.

Consider the society model, $TS = R(E, R, C, IntF, ExtF)$, in which TS represents Thai society; E is the level of ethics; R and C represent religion and Thai culture, respectively; $IntF$ and $ExtF$ refer to internal and external factors. After ICT was implemented in Thai society, ICT become a new external factor in Thai society. Thus, the model of Thai society has been changed to be a convenience society with a busy lifestyle, independent, and most important, a looser family life.

Refer to the ethic model, $E = R(TS, R, C, IntF, ExtF)$, and Figure 2, in which E is the level of ethics, the relationships among parameters E , TS , and C are two-way relationships. Thus, when Thai society (TS) changes, the level of ethics (E) changes, and the culture (C) also is changed. Once these parameters are changed, problems may occur in the society. The impacts of changes are described next.

Impacts of Change in “Independence”

When society becomes a busy society, full of work and responsibilities, people have to concentrate on their lives more than others in order to survive. Although computers and ICT are fascinating tools for their work, there are some constraints of which users have to be aware.

Working with computers and ICT is not as simple as one might think. It requires “right,” “order,” and “rules.” “Right” means “authentication” and “authority.” A user cannot run applications without having the right to do so. Any computer applications usually authenticate their users before granting authority to run or use the program and data. Thus, each user must have the correct user name and password to log on to the system. These user names and passwords must be kept secret from other users, because whenever an error or any harm occurs in the system, the user name and password are used to identify the responsible person. For example, a student cannot use his or her login name and password to change

grades of the enrolled subjects, because students have no right to perform such a task. Therefore, the application will authenticate users before allowing them to enter any transactions.

“Order” means processes of applications that must be inputted in correct sequence; otherwise, the applications will not run properly or correctly. For example, users must enter the user name and password before pressing “Enter” to enter the system.

“Rules” are the constraints that are usually implemented under the requests of organizational managers. In order to perform some processes, some conditions must be validated and be true. For example, students cannot enroll in subjects without having taken prerequisites.

Looking back on Thai society, we find Thai people are always helpful to others. The normal situation in the past was that when a staff member (A) was sick, another staff member (B) would take care of A’s jobs. Unfortunately, according to “right,” “order,” and “rules,” people cannot help each other to perform the tasks because of fear of unexpected responsibility when errors occur. Therefore, when A gets sick, his or her job will be left for him or her until he or she returns. So, caring and sharing is wiped out from Thai society. This is an indicator that Thai culture has been changed in a negative way.

When computers are implemented and when most tasks are preformed by machines, quality management is applied to organizations in order to measure performance of working staff. Therefore, whenever evaluation indicates that the performance is lower than the expected investment cost, a reengineering and layoff process usually begins. Thus, people will do everything to maintain their positions; this includes corruption or being unfaithful to their responsibilities and their partners. Since ICT is an effective tool, performing fraud is easy, fast, and difficult to trace. Thus, using ICT to perform illegal tasks means that the ethics of IT users is decreasing.

Finally, the impacts of a change from dependence to independence can be concluded as negative in the change of culture and decreasing of ethics of IT users.

Impacts of Change in “Object Concerns”

According to the evaluation in the workplace, every task must be quantifiable in some way. This can be done, for example, by counting the number of papers to be printed or delivered, the number of hours to spend for a service, and so forth. These traditions create feelings of object concern more than mental concern.

The object concern strategy is the situation in which people focus only on the things or objects they need. The word *things* or *objects* refers to any tangible and intangible things, such as money, which is tangible; or sexual desire, which is intangible. The object concern is hardly aware of being right and wrong, but it focuses only on whether the demands were met properly or not.

The mental concern strategy is a situation in which people focus on the feelings of others, similar to Thai character in the past. The mental concern does not focus on objects or demands of a certain person, but it determines the right and wrong for the entire society. The defect of this strategy is that some requirements may not be served as needed, and the performance of the organization is lower than the expectation.

In the past, people usually worked with their hearts. Efficiency was measured by considering effort put on work, not the number of products. Therefore, forgiveness and understanding were the main mechanisms for organizational management. Unlike in the past, however, organizational management today is based on the number of benefits returned, which must be countable in some format, such as number of increased customers per year or number of girlfriends a man can have. Therefore, people are striving for objects to be counted.

Just like the previous issue, whenever people are concerned with objects or their needs more than with feelings of right and wrong, caring and sharing also decrease, because they are afraid of losing their objects to others, or they are afraid that their demands will not be met. Therefore, people may perform illegal actions in order to increase their objects or to serve their desires. An example of this is when the system of Orange prepaid mobile phones was hacked by a Thai teenager, who gained more than 100 million Baht (Thai Rath, 2005). Another case is that of a teenage girl who was raped by a man whom she had known only on the Internet (Kaosod, 2005). All of these actions indicate that IT ethics of people is missing, because they use ICT to serve their requirements without considering others or the law.

Impacts of Change in “Being Smart”

Every country wants its population to be smart, so an education system must be implemented in every corner of society. The Thai government also supports the implementation of an e-learning system to the entire country (Bhattarakosol, 2003). Information is distributed over the Internet, and people can access it via a modem at home or at the workplace. These channels support learning skills so that people can have much knowledge to perform their work without paying a fee.

One good thing about being smart is that people know how to serve their needs easily. However, this good point can be a big problem for society, because people might use their knowledge in the wrong way, to serve their desires. Thus, having good knowledge in technology is a double-edged sword that either can harm or support the society in which objectives are main factors for the outcome. The objective of using knowledge relies on the morality and ethics of a person. If a person is strong in ethics, the objective to apply the knowledge to society will be positive; on the other hand, it can cause negative results.

Impacts of Change in “Freedom to Exchange Their Thoughts”

The ability of ICT to expand the rate of distribution of information to the world means that various pieces of information are floating across societies. In the past, people usually stayed in their own communities and were taught the same model of life. Accepting different lifestyles is interesting and motivates change in society. These changes are both positive and negative. The positive changes are that people are able to find their roles or have an alternative lifestyle that supports their future and society. An example is the revolution in the Philippines in January 2001 caused by short message service (SMS), or text messaging. Citizens of the Philippines distributed SMS via mobile phones, allowing them to assemble and force President Joseph Marcelo Ejercito Estrada to resign and be arrested afterward (Ellis, 2001).

The facilities of ICT never have been limited. Thus, powerful ICT definitely increases human expectations. Therefore, the impact from ICT usage is very serious, as it could destroy an entire social or community system. Considering Thai culture, we find that Thai children usually are obedient to their parents. Thai society is a seniority society or hierarchical society in which older persons are given higher priority than the younger ones. Ethics and morality are taught to kids without question, and they usually believe what they have been taught. Once the new culture of freedom of mind spread into Thai society, children began bargaining with their parents. They acted against the normal culture and believed in equality without considering their responsibilities; they loved challenging their lives in abnormal ways. Therefore, teaching ethics to children is much more difficult because they will compare them to the actual world they see, and the question, “Why do we need ethics?” will always arise.

It is undeniable that the world is full of crime and that most of these crimes are uncontrollable,

especially digital crimes that are hardly detected and captured. These criminals can get away with their crimes, get rich, and be happy. This negative but true information is distributed throughout the Internet. Examples are used as models to be copied, because users on the Internet will feel that using ICT without ethics may bring about negative results to society, except to the person who used it. Once a person emulates the illegal process and gets away with it, others will follow the same path after knowing the technique.

In conclusion, if there is freedom for receiving information from the ICT world, a news filtering systems also should be used. Otherwise, the receivers can develop their behaviors in the opposite direction of the law. This indicates that the overload of information can cause a decrease in ethics.

Impacts of Change in “Digital and Equipments Dependencies”

According to the architecture of the ICT system, digital equipment is the most important part. Without this equipment, no communication can occur through the Internet. Since most information and functions of every organization are stored in digital systems called computers, the entire business functions rely on the completeness of the computers and their applications. Additionally, connections over the network also must be perfect; otherwise, the information transfer cannot be completed.

Considering the fact that a computer application is written by programmers and maintained by programmers and system administrators, the entire company actually is dependent on these groups. Since computers cannot work without coding, whether the program’s running codes are correct or incorrect depends on the correctness of codes. If programmers or system administrators are not faithful to their jobs, incorrect coding may exist and may cause critical loss for the company. Thus, the dependency of people on the

machine should be considered under the loyalty of persons.

Although there is no illegal function in the application, some fraudulent documents do exist. For example, a British man was captured by the Thai police because he created fake tickets for Scandinavian Airlines and sold them to tourists at half price (Matichon, 2005). These fake tickets were similar to the real tickets of Scandinavian Airlines, because he used the same technology to print them. Moreover, he used ICT to connect to the Scandinavian Airlines database and update the customer’s booking information.

So, the impacts of relying on digital documents and equipment may cause trouble in daily life when its functions are not performed correctly or when someone hacks into the system for his or her benefit. However, people remain in the digital world, while technicians are creating tools to protect all illegal processes. People cannot maintain trust or an easy mind, because they never know what will happen to their lives or their property.

What are the real effects of spending life in the digital world? As mentioned previously, people will be scared by the society around them because they will not be able to distinguish real or unreal documents, or they will not be able to trust the results from computer applications. Therefore, society is changed to an untrustworthy society.

Impacts of Change in “Tools”

In the modern world, organizations are computerized. Computers run applications to perform tasks for working staff. Since there are various kinds of demands, there are various applications invented for computers. The applications that people use to create their outputs and benefits are called *tools*.

Since computer technology is changing rapidly, various applications must be updated to suit the new invention and environment, such as the Microsoft operating system and its applications. These changes affect users because they need to

keep updating their knowledge in order to be able to run with the technological world. What will happen if the user's knowledge is obsolete? If the user's knowledge is out-of-date, it is possible that the user can be cheated by unfaithful technicians. Therefore, people must learn about tools and their technologies in order to protect themselves.

Consider the problems of computer viruses, which make it necessary to install virus detection systems on each machine. If the detection software is out-of-date, new viruses can attach themselves to the computer without protection, and serious damage can occur.

Generally, tools are good for users; they help users to perform tasks easily, accurately, and quickly with reliable results. Therefore, users count on these tools without worrying that someday the system may break down. Since applications perform all complicated tasks for the users such that they need not know how to solve it manually, when the system is down, officers may have problems. They cannot perform their jobs even with their knowledge.

Therefore, from the previous paragraphs, conclusions on the effects of using tools are: (1) people must update their IT system frequently; otherwise, they may not be able to perform some tasks; (2) without the knowledge of new technologies, people can be cheated easily; and (3) people do not know how to think or solve problems without tools.

How do these results affect society? It is quite obvious that a society of people with tools is lazy, as everything is dependent on tools; machine-dependent more than self-dependent or encouraging teamwork; and somehow extravagant in its spending money for new tools.

Impacts of Change in "Loose Family Life"

The last issue for impacts of change is about the situation of the family in modern society.

The family structure in Thailand or other Asian countries is that of close families; that is, family members (1) are close to each other, (2) respect elderly members, (3) are dependent, and (4) are considerate of others' feelings.

However, when ICT was implemented as a necessary tool, people became independent, self-centered, object-oriented, and careless. Therefore, most of the time, people spend time to serve their own needs more than sharing time with family members. Thus, relationships among family members are not as strong as the time without ICT.

In a new society in which technology leads the living styles, children in the big city usually are excessively self-confident; they receive too much information from the Internet, and their relationships with their parents are rather loose. Thus, these children have chances to make wrong choices for their lives. Additionally, these kids may not know what is right or wrong because (1) there is no one who teaches them at home, or (2) they believe in what they received from the real society or the Internet.

According to the previous paragraph, the level of ethics of children is decreasing because (1) children do not know the meaning of ethics, and (2) children do not see the importance of having ethics. When these children grow up to be adults, society will be full of adults with a low-level of ethics.

SOLUTIONS

When ICT is integrated into human life, many changes arise in society. These changes also affect the level of IT ethics of society members. It is hard to find the solution to solve problems of lack of IT ethics, because there are many causes of losing IT ethics.

Consider the model of the level of IT ethics, $E = R(TS, R, C, IntF, ExtF)$ in which E is the level of IT ethics; TS represents Thai society; R and C

represent religion and Thai culture, respectively; and *IntF* and *ExtF* refer to internal and external factors. To increase the level of IT ethics (*E*), parameters in the model must be changed in a positive direction. However, it is impossible to enforce every parameter to have a positive direction as needed. The obvious uncontrolled parameters are *IntF* and *ExtF*, which refer to internal and external factors. *IntF* is not able to be controlled because humans' needs usually are unbounded, while *ExtF* is obviously uncontrollable.

The remaining parameters are *TS* and *R* and *C*. Since *TS* is also dependent on *R* and *C*, the important factors are religion and Thai culture. According to the definition of Thai culture from Section 3, Thai culture is obtained or is a part of the religion of the people. Therefore, the only significant factor that can maintain a good level of IT ethics is to maintain the religion of the Thai citizen.

The belief of a child is a transferring process from the child's family. Thus, if society wants to maintain IT ethics in the ICT environment, the family in that society must be strong. The strength in the family maintains realizations of right and wrong of people. Children will trust and obey their parents or elderly members in the family. They will open their minds and learn about good and bad results from their guardians. Therefore, *IntF* and *ExtF* factors cannot lead these kids down on illegal path in the ICT environment.

Unfortunately, some children may not have parents and are brought up as orphans. Thus, they do not have a chance to learn from their parents about ethics or religion. Nevertheless, every child must go to school. Therefore, establishing a subject teaching about rules in religions is necessary in order to establish what is legal and illegal to kids. Once these kids grow up to be adults, society will consist of responsible adults, and society in the world of technology will develop in positive way.

WHAT WILL HAPPEN NEXT?

It is quite scary that the societies of the world are becoming societies of problems. Some examples from the statistical records of Fraud and Technology Crimes by 2002/03 British Crime Survey and 2003 Home Office Online Reports have classified technological crimes in various points, such as computer viruses, computer hacking, offensive messages and Web sites, and copyright theft. These crimes occur all over the world, and many techniques are invented to protect against those crimes.

The prevention methods can be classified in two categories: prevention by laws and prevention by technology. Prevention by laws is the announcement of codes of ethics from various institutes as well as statutes for property rights, e-commerce, and so forth. Applying codes of ethics and codified laws is one fundamental way to guide users in their actions. However, there is no social punishment. Unlike codes of ethics, laws are enacted by the government, and any breakers will be punished for their illegal actions. Unfortunately, in Thailand, these laws and codes still are not widely known, and many important laws concerning information technology ethics have yet to be drafted. In any case, the number of victims continues to increase.

The technological prevention method can be separated into two solutions. The first solution is to implement hardware to protect the system, such as implementing routers to filter the arriving packets before these packets enter the network of the organization. The second solution is to install software to protect the system from intruders, such as installing a firewall to protect the system from unauthorized users or installing virus protection software to protect and kill viruses on the system.

Consequently, the results of the changes and impacts of changes can be seen in the development of new laws and technologies. These developments

are performed to balance all changes and their effects. Thus, the society can be maintained on the object side.

Since society appears now to be full of crime, various patterns, and various approaches, people in the society usually do not maintain a peaceful life, because they have to be aware of things (visible and invisible) around them. Therefore, the mentality of mankind in the future may not be as happy as people in this age; this is a comment in the mental side.

In conclusion, there are possibilities that various developments in laws and technologies will arise to protect against technological crimes. Moreover, people in the future will live without trust and will be worried about being cheated. Therefore, satisfaction in life will be low. Furthermore, this trend is not suitable for living, because it is the same as the situation in business organizations in which the period of competition is 24 hours a day, seven days a week.

If the family system is altered, as recommended in the previous section, society slowly will turn back to be a pleasurable environment in which people can depend on others. However, adjustment in the family is not that simple, as there are many factors involved, and these factors mostly are uncontrollable. Therefore, the solution should be applied to a small community as a prototype and then should expand slowly to other communities. Additionally, the cooperation between families and schools must be well-maintained in order to support one another in creating good ethics. This process will take years to succeed, but starting now is better than not.

CONCLUSION

In this chapter, Thai culture is described, and factors related to it are also elaborated upon. Since Thai culture represents the religion of the people, and since ethics is related to Thai culture, ethics is also related to the religion. IT ethics is a part of

human ethics according to the use of ICT. Thus, there are interactions among IT ethics, ICT, and Thai culture. However, the belief in commandments of each religion relies on the family.

The consequences of implementing ICT into Thai society are both positive and negative. Unfortunately, the negative effects have caused problems for the entire world. These effects are caused by persons who ignore IT ethics. Even though new technologies, new methods, or codes of ethics are invented or installed to protect technological crime, it will not reduce crime. This indicates that the existing methods are not the right solutions to stop technological crime. Moreover, these methods are temptations for hackers and crackers to intrude upon the system.

In order to completely solve the problem of lack of IT ethics, the main reason for these effects must be solved. In this chapter, the main factor is family, and lack of IT ethics is the result of loose family life. Thus, IT ethics can be built up only when these family problems are solved.

Even though the proposed solution is not easy, it is not impossible. Starting in small communities is the first step to create a good society and ethics. As a result, people will have ethics, including IT ethics, no matter how much they are involved with ICT.

REFERENCES

Barquin, R. C. (1992). *In pursuit of a "ten commandments" for computer ethics*. Retrieved September 30, 2005, from www.brook.edu/its/cei/papers/barquin_pursuit_1992.htm

Bhattarakosol, P. (2003). IT direction in Thailand: Cultivating and e-society. *IT Professional. IEEE*, 5(5), 16-20.

Cappel, J. J., & Windsor, J. C. (1998). Comparative investigation of ethical decision making: Information systems professionals versus students. *ACM SIGMIS Database*, 29(2), 20-32.

- Ellis, E. (2001). How text messaging toppled Joseph Estrada. *Asia Buzz: Revolution*. Retrieved October 15, 2005, from <http://www.time.com/time/asia/asiabuzz/2001/01/23>
- Hongladarom, S. (1992). *Science, civil society, and Thai culture*. Retrieved October 9, 2005, from http://www.stc.arts.chula.ac.th/STC/papers/Science_Civil_Society.html
- Kaosod. (2005). Retrieved October 17, 2005, from http://www.thaitjobs.com/itnews_listitnews.asp?newsid=11919&ibcid=22
- Komin, S. (1990). *Psychology of the Thai people: Values and behavioral patterns*. Bangkok: National Institute of Development Administration, Research Center.
- Mahidol University. (2002). Retrieved October 9, 2005, from <http://www.mahidol.ac.th/thailand/culture.html>
- Matichon. (2005). Retrieved October 17, 2005, from http://www.thaitjobs.com/itnews_listitnews.asp?newsid=11465&ibcid=10
- Moor, J. H. (1985). What is computer ethics? In T. W. Bynum (Ed.), *Computers and ethics* (pp. 266-275). London: Blackwell.
- Mowshowitz, A. (1978). Computers and ethical judgment in organizations. In *Proceedings of the 1978 Annual Conference of ACM/CSC-ER*, New York (Vol. 2, pp. 675-683). New York: ACM Press.
- Phillips, H. P. (1965). *Thai peasant personality: The patterning of interpersonal behavior in the village of Bang Chan*. Berkeley: University of California Press.
- Solomon, R. (1993). *Ethics and excellence*. New York: Oxford University Press.
- Soupap, S. (1975). *Thai society and culture*. Retrieved October 17, 2005, from http://www.thaicov.org/resources/documents/thai_values.html
- Thai Rath. (2005). Retrieved October 17, 2005, from http://www.thaitjobs.com/itnews_listitnews.asp?newsid=11404&ibcid=18

This work was previously published in Information Technology Ethics: Cultural Perspectives, edited by S. Hongladarom, pp. 138-152, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 5.26

The Use of Information and Communication Technology for the Preservation of Aboriginal Culture: The Badimaya People of Western Australia

Katina Michael

University of Wollongong, Australia

Leone Dunn

University of Wollongong, Australia

Information and communication technology (ICT) has been applied successfully to numerous remote indigenous communities around the world. The greatest gains have been made when requirements are first defined by indigenous members of the community then pattern matched to an ICT solution.

ADOPTION OF ICT BY INDIGENOUS PERSONS IN VERY REMOTE AREAS

In Australia ICT adoption by indigenous communities in very remote areas is very low; at home in

2001 only three percent used a computer and one percent used the Internet (ABS, 2001). The cost of foregoing online services such as e-government, e-banking, e-procurement and e-employment is still perceived to be relatively low by indigenous communities. One could hypothesise that, for the greater part, government agencies have taken on the servicing of indigenous needs rather than encouraging communities to participate themselves. An application of ICT that could have particular usefulness for indigenous peoples is a system for cultural preservation.

ICT SOLUTIONS FOR THE PRESERVATION OF THE BADIMAYA CULTURE

The discussion below shows the potential uses of ICT in key areas fundamental to the continuing presence of the Badimaya culture. The Badimaya people traditionally occupied a large area around Lake Moore in Western Australia. Their language is classified as a member of the Karlu sub-group, of the southwest group of Pama-Nyungan languages.

Geographical Information Systems: The Portal Framework

A vector-based map in a geographic information system (GIS) could be used to show where different generations of the Badimaya lived and what languages are spoken today by their descendents. The interactive map, which could also serve as the portal front-end, would identify that the Badimaya people traditionally occupied a large area around Lake Moore, Ninghan Station and Paynes Find. Various map layers could pinpoint important sites, streets/paths/trails and traditional locations and provide additional information on each upon querying. Graduated thematic maps could also show that the Badimaya today are scattered in towns throughout the Murchison Region in Mullewa, Cue, Mingenew, Mt. Magnet, Yalgoo, Carnarvon and Meekatharra. Hotspots on the maps would allow users to trigger the selection of photographs of people, places and things from the region. Theme maps could also show which languages are spoken by various communities today, such as Watjarri, otherwise known as the “Murchison” or “Yamaay” language. The GIS could also be used to provide evidence for native title land claims.

Multimedia Clips: Content Management

The Badimaya people interviewed by Dunn in the 1980s were all concerned about the potential for the Badimaya language to become extinct. They were pleased to hear that their language was being recorded, as many feared that over time it would be entirely lost. Joe Benjamin (now deceased), who was acknowledged at the time of recording the language to be one of the last speakers, was the principal source for the material gathered. While a Badimaya dictionary including phonetic pronunciation was documented by Dunn (1982, 1989), multimedia footage of Badimaya speakers conversing has not been captured. In 1982 there were only about 50 people claiming Badimaya descent. Apart from Dunn, Douglas (1981) and Gratte (1968) have documented a few Badimaya nouns.

The lexicon compiled from these authors would act as a directory source to corresponding multimedia clips of Badimaya culture. These clips could even show sacred locations, people participating in traditional rituals and live song and dance performances. Today, most of the Badimaya live in remote towns and non-traditional communities, so providing them with access to multimedia recordings is important in helping them maintain a link with their traditional culture.

Digital Document Archives: Knowledge Management

Although written historical accounts of the Badimaya are scarce, surviving documents could be digitally scanned and made available for access to the community. The majority of material that remains today dates back to the mid-19th century when Europeans first had contact with the Badimaya. There was the Badimaya experience

with the missionaries during the 1840s, the pastoralists/explorers during the 1850s and the gold prospectors during the 1890s. Without a doubt, there are mixed perspectives of the benefits and costs of these periods to the Badimaya people. The Badimaya culture was under pressure to change, especially the use of language for communicating with the Europeans. Some have favourable impressions, others do not. Some believe that the interplay between the two cultures caused the Badimaya to fragment as a people, forcing families onto stations and children into non-traditional schools. In other descriptions, the Badimaya are said to have worked in partnership with prospectors in the goldfields.

Digital photographs from these periods — showing artwork, artefacts, people interacting at work and Badimaya in their natural surroundings — could be used to inform future generations. In addition, recordings of members of the community talking about the changes that took place over time, and recordings of myths and stories that have only survived through oral transmission, would be enriching to modern-day Badimaya people.

PRESERVING CULTURE TAKES MORE THAN ICT

Culture encompasses such things as language, art, music, food, spirituality, craftsmanship, history, ancestry and geography. The inherent problem with ICT is that while it is good at preserving tangible knowledge, it has difficulty with how to treat tacit knowledge. ICT output, no matter how well represented, is usually one-dimensional. Digital archiving of information (encompassing text, audio, graphics and video) is only the first step to cultural preservation. The second is placing the information in a meaningful knowledge management system where it can be accessed via community technology centres (CTCs): These

centres can be re-used by educational institutions and maintained by the community itself. The third step is in defining relationships around that content through various collaborative tools relying on wireless or other networks, of which email and bulletin boards are only the beginning. Herein lies another problem for ICT, that of confidentiality: There are obvious “secrets” that belong to initiated males and females, and these are only passed down orally to other selected members of the community.

Cultural preservation cannot be achieved by ICT alone: It requires the spiritual element behind the history to be actively reinvigorated into a community to make its presence felt in a long-lasting manner. Culture is something that is alive and ever-changing. In brief, it is not machinery that reforms society, repairs institutions, builds social networks or produces democratic culture; it is people who make this happen. What has been presented in this paper is a way forward. By getting communities involved in the development of applications, ICT adoption by its members is likely to follow, bringing with it myriad benefits.

REFERENCES

- ABS. (2001). *Use of information technology by aboriginal and Torres Strait Islander peoples*. Year book Australia. Retrieved November 14, 2005, from <http://www.abs.gov.au/Ausstats/abs@.nsf/94713ad445ff1425ca25682000192af2/b07e8e4c0161548ca256dea000539e3!OpenDocument>
- Douglas, W. (1981). Watjarri. In R. M. W. Dixon & B. J. Blake (Eds.), *Handbook of Australian languages* (vol. 2, pp. 196-272). Canberra, Australia: ANU Press.
- Dunn, L. J. (1982). *Badimaya: A Western Australian language*. Unpublished master's thesis, University of Western Australia.

The Use of ICT for the Preservation of Aboriginal Culture

Dunn, L. (1989). *Badimaya: A Western Australian language*. Monographs in Australian Linguistics, 17. Canberra, Australia: ANU Press.

Gratte, S. (1968). *Notes and tapes on the Badimaya language*. Geraldton, WA: Geraldton Historical Society.

This work was previously published in Information Technology and Indigenous People, edited by L. E. Dyson, pp. 170-174, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 5.27

ICT and the Orang Asli in Malaysia

Pauline Hui Ying Ooi
Intel Technology Penang, Malaysia

Orang Asli means the “Original People” in the Malay language. Nowadays, they are classified into three large groups: Senoi, Negrito and proto-Melayu, which further break down into various tribes. Although many still live in the rural areas, some youth have been fortunate enough to venture life in the city by pursuing higher education or seeking employment. A few information technology undergraduates from the Orang Asli community of Malaysia were interviewed via e-mail on the subject of information and communication technology (ICT) among the local indigenous peoples.

Senyeorita, Rubycca, Jeneta, Zue and Khairol were all born in Peninsular Malaysia. They came from different Orang Asli tribes, namely the Semelai, Temuan and Semai. The culture, lifestyle and beliefs of their communities had an impact in shaping their identities. Senyeorita described the Orang Asli people as shy due to limited exposure to the outside world. As for Khairol, having lived near the forests surrounded by nature, the Semelai

culture had shaped him to appreciate nature which gave him a feeling of harmony.

The Orang Asli in Malaysia are socio-economically and culturally marginalised, although most respondents felt that the development of indigenous peoples in Malaysia was fairly good considering Malaysia is one of the developing countries. Besides the digital divide, there are other issues which have led to an erosion of their cultural identity. The respondents stated that the land problem was one of the issues faced by the Orang Asli. Other major problems include the poor education system, health, poverty, sanitation and clean water supply. According to Khairol, some conservative Orang Asli were unwilling to accept development and disregard the significance of education for the younger generation. A high dropout rate also contributes to low participation in education among the Orang Asli children (Mokshein, 2004).

With regard to the digital divide, Jeneta explained that besides being computer illiterate,

the high cost of computer gadgets were among the technological issues faced by the Orang Asli. Rubycca also commented that it was impossible for the people to use the latest technology, as some of the villages do not even have basic necessities, including power supply and education. Khairol, Senyeorita and Zue agreed that the lack of exposure to ICT among the people could contribute to the wider technology gap.

ICT is a growing industry in Malaysia. Over the years, the industry has provided employment opportunities for its citizens, which also explicitly explains the increasing number of higher institutions offering ICT-related courses to encourage more students into this stream. While Zue, Senyeorita and Rubycca got involved in ICT because courses were offered at the university, Khairol and Jeneta chose ICT for other reasons. Jeneta was encouraged by her family and friends to get involved in ICT. Khairol was inspired by the rapid growth of technology globally, and he believed that ICT plays an important role in every aspect of life. In response to the opportunities offered by ICT to further the goals and interests of the Orang Asli community, the IT undergraduates were confident that it would improve the quality of life, knowledge and work performance of their people. ICT will also help to bridge the gap in education and economic status between Orang Asli and other ethnic races.

None of the respondents thought that ICT would pose a threat to their community. In fact, they were positive about the Orang Asli willingness to accept new technologies. However, Zue emphasized that the acceptance of technologies among the people without seeing it as a threat was greatly dependent on their exposure and the way technology was presented to them. Khairol said that some Orang Asli from the Semelai tribe were still unwilling to accept advancement in their lives because they assumed that it will threaten the chastity of Semelai people as well as the customs, culture, and beliefs of other com-

munities. All respondents said the potential ICT users among the Orang Asli community would possibly be the younger generations who received formal education.

The government, jointly with other organizations, has been organizing programmes to introduce ICT in rural areas. It is an ongoing process, which has ample room for development. Some of the suggestions given included giving workshops, presentations and seminars on ICT in Orang Asli villages as part of exposure measures, making ICT a core subject in school, supplying necessary equipment and a "One family one computer" campaign by introducing attractive packages. In 2003, it was reported that, with assistance from the United Nations Development Program and the Department of Orang Asli Affairs, Malaysia, the indigenous Temuan people in Pahang state were fortunate to have a solar power generator in their village. Although there was no school nearby, Temuan youngsters were learning how to read and write using solar powered computers. (Temuan take to technology transfer, 2003). Today, there are still several Orang Asli villages that are deprived of this privilege.

In conclusion, the indigenous peoples' involvement in information technology is still very small. Education is the primary factor that leads the community towards accepting information technology. However, other major problems such as poverty, a poor education system, health and sanitation should be overcome first before information technology is introduced to the indigenous community.

ACKNOWLEDGMENT

I would like to thank Senyeorita, Rubycca, Jeneta, Zue and Khairol for their participation and contribution to this case study. Special thanks to Dr. Laurel Dyson for her guidance and advice.

REFERENCES

Mokshein, S. E. (2004). *Education for sustainable development (ESD) in Malaysia: An overview.*

Putrajaya, Malaysia: Educational Planning and Research Division, Ministry of Education.

Temuan take to technology transfer. (2003, November 6). *The Sun*, 24.

This work was previously published in Information Technology and Indigenous People, edited by L. E. Dyson, pp. 55-57, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 5.28

Information and Communication Technology and Economic Development in Malaysia

Mohamed Aslam

University of Malaysia, Malaysia

ABSTRACT

Since the early 1990s, the government has emphasised the ICT sector as a new engine of growth and development. The Multimedia Super Corridor (MSC), which was developed in 1996, was regarded as a main vehicle and catalyst for ICT-sector development. Since there were many new institutions established by the government, it somehow had complicated and decreased efficiency in expanding the industry. ICT-related courses at public and private institutions were not developed well enough to meet the market demand. Consequently, the human factor, which was a major component for ICT development, was not fully utilised in research and development, therefore reliance on foreign technology remained

a critical issue. These have slowed the progress of ICT development. This chapter will discuss the ICT-sector development policy in a broad view and try to analyse critically to what extent the development of the ICT sector has contributed to economic development in Malaysia.

INTRODUCTION

In 1991, the Malaysian government launched Vision 2020, with one of its main goals for Malaysia to become a fully developed nation by the year 2020. En route to achieving this goal, the information and communication technologies had been identified as one of the key sectors to realize this goal. This sector has been regarded and empha-

sized as a new sector of future economic growth and development. The sector had been included in the *Sixth Malaysia Plan* (6MP) for development within 5 years from 1991 to 1995. However, a bold policy and the necessary infrastructure and environment for the development of ICT was developed during the *Seventh Malaysia Plan* (7MP, development period from 1996-2000). Under the *Ninth Malaysia Plan* (9MP, development period from 2006-2010), the government has almost doubled its allocation for the ICT sector to RM13 billion compared to RM7.8 billion in the *Eighth Malaysia Plan* (8MP, development period from 2001-2005)(Table 1). Part of the allocation, about RM3.7 billion (in 8MP, the amount was RM2.4 billion), will be used to boost ICT capacity in government agencies and bridge the digital divide between urban and rural agencies.

To strengthen ICT development, in 1996 the government had initiated and established the Multimedia Super Corridor (MSC) managed by the Multimedia Development Corporation (MDC). Since then, the MSC has grown into a thriving dynamic ICT hub, hosting more than 900 multinational foreign-owned and homegrown Malaysian companies focused on multimedia and communications products, solutions, services, and research and development (R&D). The government has planned for the second phase of MSC and four new cybercities, which will be developed under 9MP. The number of MSC-status companies is projected to grow from 1,421 as of 2004 to some 4,000 by 2010, and these are expected to create some 100,000 new jobs and generate about 1,400 new intellectual properties.

In order to support the country's ICT development plan and fulfill Vision 2020, the education system is in the process of being transformed to create a new generation of more creative and innovative Malaysians who are adept with new technologies and able to access and manage the information explosion. ICT-enabled smart schools act as a catalyst within this process. The first phase of implementation began in 1999 with 90 schools.

Also, to foster the ICT industry in the short term, tertiary education, particularly computer science and engineering faculties, has been restructured by not only focusing on hardware matters but also focusing on software development. This is to ensure human capital for the ICT industry in various specialities adequate to meet the demand.

In fact, the ICT sector has been a main industry and a main component of economic growth since the early 1970s. The introduction of export-oriented industries with emphasis on electrical and electronics (E&E) industries and supported by the heavy inflow of foreign direct investment (FDI) in the sector has expanded it. The expansion of the foreign-owned E&E industries has spilled over into the domestic economy, whereby many local support industries and IT-related firms have been developed. Consequently, the demand on labour for both skilled and unskilled workers has increased very significantly. The ICT industry's export performance has been increasing steadily over the years from RM35.3 billion in 1998 to about RM61 billion in 2005 (about 50% of the total manufacturing goods). Major export destinations were the traditional markets such as the USA, Japan, Singapore, and Hong Kong. On the other hand, domestic spending on ICT material reached RM36 billion in 2004. To enhance trade in the ICT sector, e-commerce trading has been promoted and developed.

With respect to the ICT industry, there are many issues that have emerged and worry policy makers. Too much emphasis on the ICT sector, particularly by the government and by the market, has created and increased unemployment for ICT graduates either at the first degree or certificate level, including diploma holders. This has somehow retarded the smooth development and progress of the ICT sector. The economic crisis from 1997 to 1999 has also slowed the ICT industry's development. Many companies that are ICT related, foreign as well as local, have closed operations and moved to China in particular. This is a cost to the economy. The government

has revised and further liberalized the investment incentives for the ICT industry to reattract old firms and attract new ones to be established in the country. The Third Industrial Master Plan, which was launched in August 2006, gave greater concentration on the ICT sector besides services related to the manufacturing sector.

Government Policies on ICT-Sector Development

The government has been committed to developing the ICT sector since the 6MP. It has established various agencies related to ICT, and each agency has introduced policies promoting ICT development within the jurisdiction of the particular agency, such as the Malaysian Institute of Microelectronic Systems (MIMOS), the National Information Technology Agenda (NITA), the National Information Technology Council (NITC), and the Ministry of Energy, Communications, and Multimedia (MECM; Table 2). Too many policies

were formulated by the federal government, and the agencies have somehow increased in redundancy and created inefficiencies in developing the ICT sector.

The seriousness of the government in promoting the ICT sector can be seen from the government's allocation for the sector. The government has increased allocation from RM2.125 billion under the 8MP to RM5.734 billion under the 9MP. The large amount of allocations is invested in the computerisation of ministries and government agencies. This huge amount of funds is in line with the government's plan to increase paperless transactions, reduce operating costs in the future, and speed up the processing of applications and any matters related to government. To meet the aims, the government has increased allocation to the e-government subarea of the MSC multimedia application from RM537.7 million in the 8MP to RM572.7 million under the 9MP, (Table 1). Another vital project is Bridging the Digital Divide, which also received a huge amount of

Table 1. Development expenditure and allocation for ICT-related programmes, 1996-2010 (RM million; Source: Government of Malaysia, 2001, p. 388; Government of Malaysia, 2006, p. 154)

| Programmes | 7MP | 8MP | 9MP |
|---|------------|------------|------------|
| Computerisation of Government Agencies | 1,641.8 | 2125.0 | 5,734.2 |
| Bridging the Digital Divide | 1,098 | 2,433.1 | 3,710.2 |
| Schools | 945 | 2,145.1 | 3,279.2 |
| Communications Infrastructure Service Provision Programme | 119.8 | 254.0 | 150.0 |
| Telecenters | 33.2 | 18.1 | 101.0 |
| ICT Training/Services | - | 15.9 | 180.0 |
| ICT Funding | | 1,125.6 | 1,493.0 |
| MSC Multimedia Applications | 1,824.9 | 1,153.1 | 1,100.5 |
| E-Government | 434.8 | 537.7 | 572.7 |
| Smart Schools | 401.1 | 363.9 | 169.8 |
| Telehealth | 400.0 | 91.8 | 60.0 |
| Government Multipurpose Card, etc. | 589 | 159.7 | 298.0 |
| MSC Development | - | 320.8 | 377.0 |
| ICT Research and Development | 300.0 | 727.5 | 474.0 |
| Other | 294.4 | - | - |
| Total | 5,159.1 | 7,885.1 | 12,888.9 |

government allocation. The allocation of the project has been increased from RM1.1 billion in the 7MP to RM3.7 billion in the 9MP. Even though the federal government allocation to ICT has increased over the years, the government's spending is about 6% compared to the global average government ICT spending of 15%.

Government Agencies and Policies on ICT Development

As mentioned, there are many agencies that have been developed by the government that have established a law related to ICT. Also, a trade association was formed among ICT firms (Table 2). In this section we will focus on the govern-

ment think tank on ICT, the National Information Technology Council, which was established in 1994. The NITC was responsible for formulating the National Information Technology Agenda, which was launched in 1996. NITA provides a comprehensive framework for ICT development. The primary objective of NITA is to ensure a coordinated and integrated approach in developing the ICT industry more systematically and also to transform the Malaysian society into a value-based knowledge society. The government has adopted NITA as a major strategy for national development and nation building through the ICT sector. NITA proposed a trisectoral smart partnership between the public, private, and community-interest sectors, where all parties win. A two-prong strategy of combining top-down and bottom-up approaches

Table 2. ICT sector: Institutional development (Source: MDC, 2003)

| Agencies | Function/Role |
|--|---|
| Malaysian Institute of Microelectronic Systems (MIMOS Berhad) | Established on January 1, 1985, then corporatised on November 1, 1996. Deals with research and development (wafer and chip technology). Plays a crucial role in developing ICT. An Internet service provider (Jaring). |
| National Information Technology Council (NITC) | Established in 1994. A government think tank. Advising and recommending policy on ICT development. |
| Ministry of Energy, Communications, and Multimedia (MECM) | Established on November 1, 1998. To develop the communications and multimedia industry based on the concept of the convergence of the telecommunications, broadcasting, and computing services. |
| Malaysian Communications and Multimedia Commission (MCMC) | Established on November 1, 1998. Responsible for regulating the broadcasting industries, ICT, and telecommunications in accordance to the Communications and Multimedia Act of 1998. A sole regulating authority for all communication and multimedia industries. |
| Multimedia Developed Corporation (MDC) | MDC was established to assist the government in developing and managing the MSC. A one-stop shop for investors. |
| Association of the Computer and Multimedia Industry Malaysia (PIKOM) | A voluntary self-funding trade association representing the ICT industry. The number of members is about 370 companies. Members control about 400 firms and represent about 80% of the total ICT trade in the country. |
| Legislation Supports | The Digital Signature Act of 1997, which governs electronic signatures. The Computer Crimes Act of 1997, which outlaws the fraudulent use of computers and other related cybercrime. The Electronic Government Act of 1997, which regulates communication within the public sector. The Multimedia Convergence Act of 1997, which streamlines communication, information, and broadcasting services. The Telemedicine Act of 1997, which allows for the promotion of medical services. The Communications and Multimedia Act of 1998, which facilitates the orderly development of the multimedia industries, in particular the contents industry, and replaces existing inadequate legislation. The Intellectual Property Protection Act of 1998, which protects copyright laws. |

for planning and implementation is recommended (refer to subsection on MSC).

The National ICT Framework under NITA is combining people (human resource), infrastructure (both hard and soft infrastructure), and applications and content (product) development. NITA places the human factor as the main element; all citizens need access to information in an equitable manner. The second element of infrastructure is seen in terms of both the hard and soft infrastructure. The hard infrastructure is the computer hardware and the relevant telecommunication components. The soft infrastructure includes databases, networks, laws, and regulations. The applications and content element emphasises the importance of developing applications in IT and encouraging local product development.

Under the 7MP, the government indirectly based its policy on ICT development on NITA. The policy formulated by the federal government under the 7MP was regarded as a concrete policy in promoting, developing, and expanding the ICT infrastructure, and to promote the extensive application of ICT and accelerate ICT usage in the various sectors of the economy. The document elucidates several national strategies on ICT as listed below:

- Develop a national plan to ensure a more systematic approach to manage the development of ICT through NITA and the Multimedia Super Corridor.
- Increase and enhance IT education and training.
- Expand and upgrade the communications infrastructure to increase accessibility.
- review laws and regulations to promote the growth of electronic communities and the development of a continuous learning environment.
- Promote the development of e-commerce, indigenous contents, and the local IT industry, especially the software and knowledge

products industries, to generate new growth opportunities.

- Review and improve the national innovation systems to generate R&D output capable of driving the knowledge economy.

Multimedia Super Corridor

Under the 7MP, the government established the Multimedia Super Corridor on August 1, 1996. The development of the MSC was the main outcome of NITA and the government policy in developing the ICT sector. The initiative of MSC came with a two-prong strategy. The strategies are to transform the Malaysian economy from one of manufacturing and primary commodities to software and services, and to create an ideal environment for global ICT companies to use as their regional hub and test bed, becoming a catalyst for a highly competitive cluster of homegrown ICT companies that can become world-class over time.

Development of the MSC is a government long-term project that was initiated to run from 1996 up to 2020. This long-term period is divided into three phases. The first phase covers 1996 to 2004, during which the government would develop the MSC area. The second phase covers 2004 to 2010. This phase will link the MSC to other cybercities in Malaysia. Finally, the third phase covers 2010 to 2020, during which the government hopes to realise the objective of transforming Malaysia into a knowledge society.

In the first phase, the government developed the MSC center, which is located south of the Kuala Lumpur City Center. Two smart cities, namely Putrajaya and Cyberjaya, were developed in the MSC. Putrajaya is the new seat of the federal government and administrative capital of Malaysia, where the concept of electronic government is introduced. Cyberjaya was planned as an intelligent city with multimedia industries, R&D centers, a multimedia university, and operational headquarters for multinationals using multimedia

technology for their worldwide manufacturing and trading activities. The MSC was built upon a 2.5- to 10-gigabit digital optical fibre backbone enabling direct high-capacity links to Japan, the USA, and Europe (MDC, 1996). The MSC was developed to attract world-class technology-led companies to Malaysia and to develop local industries; to create a multimedia utopia that offers a productive, intelligent environment within the multimedia value chain of goods and services that will be produced and delivered across the globe; to offer a place of excellence with multimedia-specific capabilities, technologies, infrastructure, legislation, policies, and systems for competitive advantage; to establish a center for invention, research, and other multimedia developments; and to create a global community living on the leading edge of the information society, and a world of smart homes, smart cities, smart schools, smart cards, and smart partnerships (MDC, 1996).

To ensure the realisation of the MSC, the government introduced the MSC Bill of Guarantees. Under the Bill of Guarantees, the Malaysian government commits the following to companies with MSC status:

- Provide a world-class physical and information infrastructure.
- Allow unrestricted employment of local and foreign knowledge workers.
- Ensure freedom of ownership by exempting companies with MSC status from local ownership requirements.
- Give the freedom to source capital globally for MSC infrastructure and the right to borrow funds globally.
- Provide competitive financial incentives (no income tax up to 10 years or an investment tax allowance of up to 5 years will be granted).
- Become a regional leader in intellectual property protection and cyberlaws.
- Ensure no Internet censorship.

- Provide globally competitive telecommunication tariffs.
- Tender key MSC infrastructure contracts to leading companies willing to use the MSC as their regional hub.
- Provide a high-powered implementation agency to act as an effective one-stop supershop.

The Multimedia Development Corporation, the agency that manages the MSC, is the one-stop shop for Malaysian and international companies that are prepared to set up operations within the MSC or otherwise contribute significantly and strategically to the MSC's development. A company seeking MSC status must fulfill three criteria. The company must (a) be a provider or a heavy user of multimedia products and services, (b) employ a substantial number of knowledge workers, and (c) be able to transfer technology and knowledge to Malaysia, or otherwise contribute to the development of the MSC and the Malaysian economy.

Since the development of the MSC in 1996 until 2000, there have been 326 companies that have received MSC status, and 192 of these companies are fully owned by Malaysians. In 2005, the number increased to 1,421 companies, of which 1,033 firms were fully locally owned and 349 firms were fully foreign owned. Since the early phase of the MSC produced remarkable results, the government plans to develop MSC's second phase (MSC II) under the 9MP. Under the second phase, the government plans to build new MSC cybercities in the states of Perak, Melaka, Johor, and Sarawak. The proposed development is expected to bring in 250 additional multinational companies (Government of Malaysia, 2006). The number of MSC-status companies is projected to increase from 1,421 in 2005 to 4,000 by 2010, generating 100,000 jobs nationwide and 1,400 intellectual properties.

Progress and an Assessment of ICT Development since the 1990s

Since the government introduced the national development and expansion of the ICT industry in 1996, it has been very committed and serious on the matter, and this can be seen by looking at the government expenditure, which has increased quite tremendously (Table 3). In terms of spending on ICT usage, the government expenditure has increased from RM159 million in 1990 to RM2.2 billion in 2005 (Table 3). The government policy and expenditure allocation has in turn accelerated private-sector expenditure on ICT. In 1995,

the total expenditure on ICT was RM1.3 billion. The figure increased to RM3.8 billion in 1995, to RM25.6 billion in 2000, and to about RM32.2 billion in 2005. The main industry that has increased expenditure significantly is the manufacturing sector; its expenditure has increased from 6% of the total economy expenditure in 1990 to about 45% in 2005. Other sectors that have increased the usage of ICT are wholesale and retail trade, transport and communications, finance and business services, and consumer spending on ICT products (Table 3).

Figures in parentheses are the percentage of expenditure of each sector of the total expenditure of the period.

Table 3. ICT expenditure by sector, 1990-2005 (RM million; Source: Government of Malaysia, 1996, p. 479; Government of Malaysia, 2001, p. 365; Government of Malaysia, 2006, p. 136)

| Sector | 1990 | 1995 | 2000 | 2004 | 2005 |
|---|---------------|-----------------|------------------|------------------|------------------|
| Agriculture | 26 (2.0) | 76 (2.0) | 200 (0.8) | 128 (0.4) | 138 (0.4) |
| Mining | 234 (18.0) | 380 (10.1) | 222 (0.9) | 224 (0.7) | 234 (0.7) |
| Manufacturing | 78 (6.0) | 494 (13.1) | 12,188 (47.5) | 13,652 (45.6) | 14,367 (44.6) |
| Utilities | 39 (3.0) | 266 (7.0) | 378 (1.5) | 430 (1.4) | 470 (1.5) |
| Construction | - | - | 112 (0.4) | 126 (0.4) | 135 (1.5) |
| Wholesale and Retail Trade | 91 (4.0) | 304 (8.1) | 1,585 (6.2) | 1,735 (5.8) | 1,870 (5.8) |
| Transport and Communications ¹ | 39 (3.0) | 114 (3.0) | 1,221 (4.8) | 1,581 (5.3) | 1,770 (5.5) |
| Finance and Business Services | 507 (39.0) | 1,026 (27.2) | 1,894 (7.4) | 2,563 (8.6) | 2,845 (8.8) |
| Government | 156 (12.0) | 380 (10.1) | 1,389 (5.4) | 1,981 (6.6) | 2,245 (7.0) |
| Consumers | - | 76 (2.0) | 6,314 (24.6) | 7,440 (24.9) | 8,104 (25.1) |
| Other Services ² | 130 (10.0) | 657 (17.4) | 140 (0.5) | 62 (0.2) | 70 (0.2) |
| Total | 1,300 | 3,773 | 25,643 | 29,922 | 32,248 |

Notes: ¹ Includes telecommunications services

² Includes businesses providing personal, repair, cultural, recreation and entertainment, health care, legal, educational, social, and professional services

Expenditure on ICT by consumers (society) has increased. Since 1995, it has increased by more than 7,000%. In 2005, consumers spent about RM8.1 billion on ICT-related products. The expansion of consumer expenditure on ICT-related products is clearly indicated in Table 4. The number of people who bought computers has increased from 0.8 million people in 1996 to about 5.7 million in 2005. Indicators of IT usage in society have increased from 50 per 1,000 people in 1996 to 218 per 1,000 people in 2005. In line with IT usage, Internet subscription by society has increased quite remarkably. Internet dial-up subscription also increased from 64,000 people to 3.7 million people in 2005 (Table 4). The Internet was first introduced in Malaysia in the mid-1990s with MIMOS as the sole provider of Internet service. In the late 1990s, the government liberalized the sector by allowing more network-based companies to provide Internet service. At present, there are six network-based companies that have been licensed to provide Internet service in the country, namely, MAXIS, DIGI, TT.DOT.COM, CELCOM, TELEKOM, and PRISMANET. However, only three network-based companies provide Internet service, namely, JARING (under MIMOS), TMNet (under TELEKOM), and

MaxisNet (under MAXIS). In terms of subscribers registered with JARING and TMNet, the number increased 10 times from 42,000 in 1995 to 425,320 in 1998, and reached about 1.68 million in 2002 (Yusuf & Radzi, 2003). In terms of users of the Internet, the number has increased from 30,000 in 1995 to 4.8 million in 2001 (Minges & Gray, 2002). The penetration rate has increased from 0.1% in 1991 to 20.2% in 2001 (Minges & Gray, 2002). A survey by the International Data Corporation in 1999 indicated that households constituted the largest group using the Internet, comprising 64% of total users, followed by users in the education and business sectors who comprised 24% and 12%, respectively (MDC, 2003). The survey also showed that subscribers were concentrated in the urban areas, particularly in the Federal Territory of Kuala Lumpur, Johor Bahru, Petaling Jaya, and Penang. The growing market of ICT in the country provides incentives for local firms to invest further in telecommunication. Currently, there are six licensed telecommunication companies in Malaysia, but only five in operation, providing telephony services. During 1996 to 1999, telecommunications operators upgraded and improved their services through investments in telecommunication infrastructure, comprising

Table 4. Selected ICT indicators (Source: Ministry of Finance, 2001, 2002, 2006)

| Indicator | 1996 | 1998 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|--|-------|-------|-------|-------|-------|--------|--------|--------|
| Telecommunications | | | | | | | | |
| Number of cellular phone subscribers (thousands) | 1,363 | 2,149 | 5,122 | 7,385 | 9,053 | 11,124 | 14,611 | 19,545 |
| Number of Internet dial-up subscribers (thousands) | 64 | 405 | 1,659 | 2,113 | 2,614 | 2,881 | 3,293 | 3,672 |
| Information Technology | | | | | | | | |
| Personal computers actively installed (millions) | 0.8 | 1.4 | 2.2 | 3.0 | 3.6 | 4.2 | 4.9 | 5.7 |
| Number of computers per 1,000 people | 50 | 60 | 94 | 125 | 145 | 166 | 192 | 218 |
| Broadband subscribers (thousands) | - | - | - | - | 19.3 | 110.4 | 252.5 | 490.6 |

fibre optics, satellites, and wireless technology. As a result, the backbone of the information superhighway was formed, which was capable of supporting extensive public, educational, and business applications. In addition, the country also registered a market penetration rate of 10 cellular phones for every 1,000 people, which was one of the highest in the developing world (MDC, 2003). The number of mobile phone customers is expected to break the 6 million mark or 250 for every 1,000 people by 2005 (MDC, 2003).

Investment and Export

The investment incentives such as tax breaks, MSC status, and capital allowance that have been provided by the government have managed to attract local and foreign capital into the ICT sector. In the broad category of the ICT sector, that is, the E&E sector, investment has increased from 39% of the total investment in 1996 to 40% in 2005. The electronics goods exported in 1996 was 62% of the total export of manufactured goods, with 34.1% coming from the semiconductor industry followed by electronics equipment and parts. In

2005, exports of E&E goods increased to 73.4% and semiconductor industries contributed about 32%, while 42% came from firms producing electronics equipment and parts (Table 5). Major export destinations were the traditional markets such as the USA, Japan, Singapore, and Hong Kong. Malaysia was a net exporter of ICT products worth RM28.3 billion in 2002 and RM33.8 billion in 2003 (Malaysian Industrial Development Authority [MIDA], 2005). Imports of ICT products, which consist of computers, servers, mainframes, and telecommunication equipment, totaled RM18.6 billion in 2002 and RM18.0 billion in 2003 (MIDA, 2005). Major imports for computers and computer peripherals were sourced from China, Singapore, and the USA, while telecommunications products were imported mainly from China, Japan, and Korea. Major import items were thermionic valves and tubes, parts for office machines, electrical apparatuses, and measuring, checking, and controlling instruments. The items most imported were thermionic valves and tubes, whose worth has increased from RM45.8 billion in 1997 to RM105.7 billion in 2005 (Ministry of Finance, 2006). The presence of foreign firms

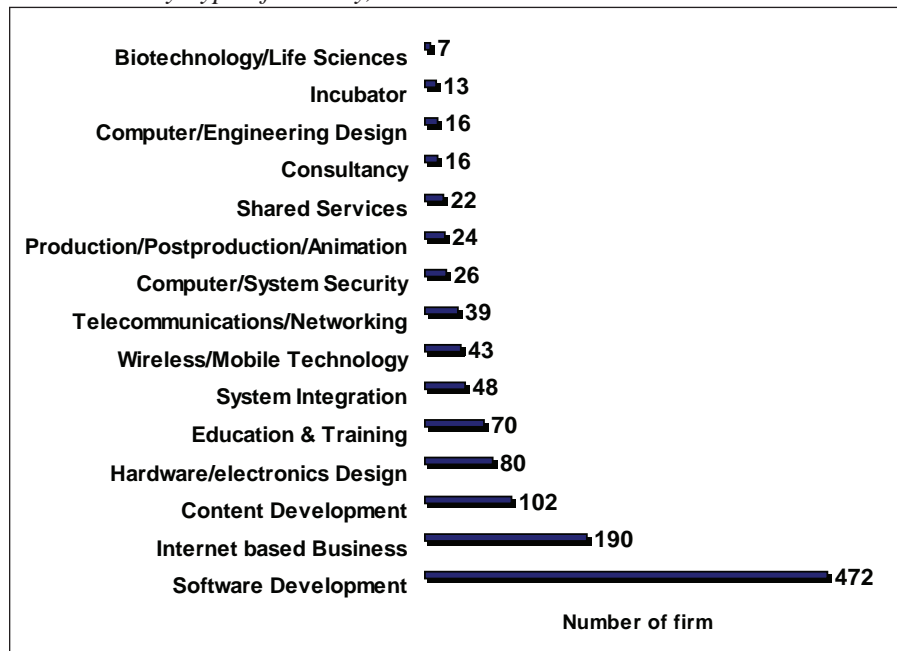
Table 5. Exports of ICT-related products (percentages; Source: Bank Negara Malaysia, 2006)

| Products | 1996 | 2000 | 2003 | 2005 |
|-----------------------------------|-------|-------|-------|-------|
| Electronics | 62.0 | 72.4 | 75.1 | 73.4 |
| Semiconductors | 34.1 | 30.9 | 38.2 | 31.8 |
| Electronics equipment & parts | 27.9 | 41.5 | 36.9 | 41.6 |
| | | | | |
| Electrical machinery & appliances | 38.0 | 27.6 | 24.9 | 26.6 |
| Consumer products | 19.1 | 11.5 | 8.8 | 8.1 |
| Industrial & commercial products | 10.1 | 10.3 | 9.1 | 10.2 |
| Industrial machinery & equipment | 8.2 | 5.5 | 6.1 | 7.3 |
| Household electrical appliances | 0.6 | 0.3 | 0.9 | 1.0 |
| | | | | |
| Total E&E exports (RM billion) | 104.3 | 230.4 | 222.9 | 282.8 |
| Percentage of total exports | 65.8 | 72.5 | 67.9 | 65.8 |

made Malaysia a net exporter of computers and computer peripherals valued at RM22.1 billion in 2002 and RM22.6 billion in 2003. Malaysia currently ranks third in the world for the production of HDD for desktop computers (MIDA, 2005).

In the case of investment in the MSC zone, the value increased from RM3.16 billion in 2001 to RM5.11 billion in 2005 (Table 6). As mentioned in the previous section, in 2005, the number of firms that were ICT related was 1,421; about 1,033

Figure 1. MSC-Status by Type of Activity, 2003



Source: Multimedia Development Corporation (MDC), 2005. www.mdc.com.my

Table 6. MSC indicators, 2001-2010 (Source: Government of Malaysia, 2006, p. 145)

| Category | 2001 | 2005 | 2010 |
|------------------------------|--------|--------|---------|
| MSC-status company (number) | 621 | 1,421 | 4,000 |
| Locally owned | 410 | 1,033 | - |
| Foreign owned | 198 | 349 | - |
| Joint venture (50/50) | 13 | 39 | - |
| Job creation (number) | 14,438 | 27,288 | 100,000 |
| Knowledge workers | 12,169 | 24,252 | - |
| Others | 2,269 | 3,036 | - |
| Investment (RM billion) | 3.16 | 5.11 | 12 |
| Revenue (RM billion) | - | 7.21 | 69 |
| Exports (RM billion) | - | 1.57 | 2.5 |
| R&D expenditure (RM million) | - | 670 | 1,000 |
| IPs registered (number) | - | 119 | 1,400 |

were fully locally owned while about 349 were fully foreign owned. There were more than 50 international world-class companies that received MSC status such as NTT, Fujitsu, IBM, Sun Microsystems, Microsoft, Oracle, Ericsson, Nokia, Siemens, and Dell. Until 2003, the activities of MSC-status firms range from software development, Internet-based business, and hardware and electronics design to education and training, as shown in Figure 1. The exports of the MSC-status firms were about RM1.57 billion in 2005. The revenue of the firms in the same year was about RM7.21 billion (Table 6). The firms involved in the research and development area had spent about RM680 million. The expansion of the industry has created jobs, from 14,438 in 2001 to 27,288 in 2005. The majority of workers that have been employed by the firms are knowledge workers (ICT).

Human Resource Development

The expansion of the ICT sector has increased demand on skilled and semiskilled workers or

knowledge workers. There are about 12 public institutions of higher learning, 7 polytechnics, and 154 private institutions offering courses on ICT and multimedia at the certificate, diploma, and degree levels. From 1995 to 2004, the total enrollment at these institutions was more than 80,000 students. In addition, industrial training institutes conduct ICT-related courses such as architectural computer-aided design (CAD), mechanical CAD, CAM (computer-aided manufacturing), and computer maintenance.

In a broad view, the employment of electrical and electronics engineers from 1995 to 2005 on average was about 4% of total employment. The employment of assistant engineers in the same field on average was about 10% of total employment (Table 7). According to statistics from the MDC, the estimated net demand for ICT manpower between 1998 and 2005 in five occupations (technical support, programmers, business/system analysts, software engineers, and systems/hardware engineers) was 108,000 while the supply was 104,000 (<http://www.mdc.com.my>). The total number of ICT workers was about 87,000 by the

Table 7. Employment of engineers (Source: Government of Malaysia, 1996, p. 121; Government of Malaysia, 2001, p. 95)

| Occupation | 1995 | 2000 | 2005 |
|--------------------------|----------------------------|----------------|----------------|
| Engineers | 55,254 ¹ (12.1) | 61,034 (10.4) | 108,400 (12.6) |
| Civil | 16,695 (3.6) | 20,711 (3.5) | 27,500 (3.2) |
| Electrical & Electronics | 15,759 (3.4) | 21,064 (3.6) | 38,600 (4.5) |
| Mechanical | 12,583 (2.7) | 16,082 (2.7) | 29,800 (3.5) |
| Chemical | 1,037 (0.2) | 3,177 (0.5) | 12,500 (1.5) |
| Engineering Assistants | 92,082 ² (20.1) | 143,220 (24.4) | 247,739 (28.9) |
| Civil | 25,971 (5.7) | 25,973 (4.4) | 71,401 (8.3) |
| Electrical & Electronics | 40,023 (8.7) | 65,353 (11.1) | 103,856 (12.1) |
| Mechanical | 18,706 (4.1) | 50,020 (8.5) | 67,073 (7.8) |
| Chemical | 1,425 (0.3) | 1,874 (0.3) | 5,409 (0.6) |

Notes: ¹ including unspecified engineers (8,509)

² including unspecified assistants (5,957)

end of 1998. The largest group was technical support with about 28,000 personnel or 32.2% of the total workforce, while the smallest group was software engineers with about 8,000 workers or 9.6%. Among the expertise and skills in demand are systems development and integration, operations management, R&D, software development, database management, and telecommunications networking. MDC notes that there is a labour shortage for technical support, programmers, and software engineers, but a surplus of business and systems analysts and systems and hardware engineers. On the other hand, the supply of ICT skilled and semiskilled workers from local higher learning education institutions from 1995 to 2005 was about 9,500 workers a year. By 2006, the total number of workers should exceed 104,500 workers. Therefore, the figures produced by the MDC are overestimated. With the total ICT graduates that are produced by public and private higher learning institutions, more than 30% of the graduates were unemployed by 2006.

The government realised that there is an increasing demand and shortage of certain skills in the ICT sector due to new developments in the ICT industry. However, the public and private institutions are slow in improving and developing new courses to meet the current demand. In general, the institutions offer a basic curriculum in ICT courses. To overcome the situation, the government, particularly the Ministry of Human Resource and the Ministry of Education, is trying to match the supply of skilled human resources with the needs of the ICT sector. Moreover, the government has encouraged more training courses provided by employers, as well as encouraging local higher learning institutions to embark on more courses related to ICT. The government set up the Human Resource Development Fund (HRDF) to provide reimbursements for ICT-based training (offered by ICT-related firms and private colleges) to ensure that there is continuous upgrading of

ICT knowledge and skills among the working population. During the period of 1996 to 1998, a sum of RM64.8 million or 14.6% of the total HRDF disbursements were utilised for ICT-based courses. In May 1998, the HRDF introduced the Training Scheme for Retrenched Workers. Under this scheme, a sum of RM846,000 was provided to finance 203 courses or 36% of the ICT courses approved at the certificate and diploma levels.

Figures in parentheses are the percentage of engineers (and assistants) of total employment.

CONCLUSION

ICT development, which was planned under the 6MP and embarked on since the 7MP, has produced overwhelming results. The impetus of the plan and policies were somehow retarded from 1997 to 1999 due to the impact of the financial crisis that hit in July 1997; however, the crisis has not stopped the federal government from achieving the ICT development plan. Since the 6MP, the development budget for the ICT-related sector has increased dramatically. The eagerness and seriousness of the government is evident in the national development report in terms of the increase of ICT usage in government services and in school. Furthermore, the government has received support from foreign firms. The investment by foreign firms that are ICT related has increased significantly. In fact, the overwhelming response from the local and foreign firms has encouraged the government to proceed to the second phase of MSC development and to develop a few more cybercities in selected states in Malaysia.

We do not deny that the development of the ICT sector, particularly through the development of the MSC, has induced the sector development in terms of investment, exports, and labour absorption. However, there are a few shortcomings in the development. First, the development of the

ICT sector has established many institutions with different policies and roles, and there were more than seven main rules and regulations related to ICT. In certain circumstances, roles of the agencies were overlapping each other, for instance, the roles of the MECM, MDC, and MCMC. Which agency has the right to approve and issue telecommunications licenses? Which agency handles rules and regulations, and which agency has the right to enforce rules that have been established? The government should streamline and provide clear guidelines, roles, and functions of the agencies that have been established to avoid any redundancy, attract more investors, and become more private-sector friendly. The second shortcoming is related to human resource development. The development of the ICT industry, for instance, in the software and hardware areas (Figure 1), requires high-skilled workers. Public and private institutions have produced an ample workforce for the sector; however, most of the MSC-status firms have employed foreign workers, subsequently creating unemployment for local ICT graduates, of which more than 30% were unemployed. The oversupply of ICT graduates is attributed to weak planning by the education ministry; furthermore, the curriculum of the ICT courses that are offered by the higher education learning institutions do not meet the market demand. Most institutions produced a workforce knowledgeable in how to handle and manage ICT rather than in how to create, invent, and develop a product. In other words, institutions produce a workforce with very low skills in producing products. This weakness in the education institutions has forced foreign firms to employ high-skilled labour from abroad.

Currently, there is a lack of research related to MSC and economic development. Most of the studies conducted produced a report rather than empirical data. Two of the main crucial issues with respect to MDC development are the market demand for ICT graduates and the ICT course

curriculum in public and private universities and colleges. The role played by foreign MSC-status firms in helping and developing the ICT industry in the country remains very much unclear. These issues should be explored further to gauge relevant indicators for future development.

REFERENCES

- Government of Malaysia. (1996). *Seventh Malaysia plan 1996-2000*. Kuala Lumpur, Malaysia: Percetakan Nasional Malaysia.
- Government of Malaysia. (2001). *Eighth Malaysia plan 2001-2005*. Kuala Lumpur, Malaysia: Percetakan Nasional Malaysia.
- Government of Malaysia. (2006). *Ninth Malaysia plan 2006-2010*. Kuala Lumpur, Malaysia: Percetakan Nasional Malaysia.
- Malaysian Industrial Development Authority (MIDA). (2005). *Performance of the manufacturing & related services sectors 2004*. Kuala Lumpur, Malaysia: Author.
- Minges, M., & Gray, V. (2002). *Multimedia Malaysia: Internet case study*. International Telecommunication Union (ITU).
- Ministry of Finance. (2001). *Economic report 2001/2002*. Kuala Lumpur, Malaysia: Percetakan Nasional Malaysia.
- Ministry of Finance. (2002). *Economic report 2002/2003*. Kuala Lumpur, Malaysia: Percetakan Nasional Malaysia.
- Ministry of Finance. (2006). *Economic report 2006/2007*. Kuala Lumpur, Malaysia: Percetakan Nasional Malaysia.
- Multimedia Development Corporation (MDC). (1996). *Investing in Malaysia's MSC: Policies, incentives & facilities*. Kuala Lumpur, Malaysia: Author.

Multimedia Development Corporation (MDC). (2003). *National report on the ICT sector in Malaysia*. Unpublished manuscript.

Yusuf, M., & Radzi, M. (2003). *A national initiative: Presenting a success story*. Unpublished manuscript, MSC Technology Center, Cyberjaya, Malaysia.

This work was previously published in Information Technology and Economic Development, edited by Y. Kurihara, S. Takaya, H. Harui, H. Kamae, pp. 46-58, copyright 2008 by Information Science Publishing (an imprint of IGI Global).

Chapter 5.29

Urban Information Systems in Turkish Local Governments

Koray Velibeyoglu

Izmir Institute of Technology, Turkey

INTRODUCTION

Since the end of 1980s, different sectors have implemented geographical information systems (GIS) in Turkey. A study on GIS market in Turkey indicates that municipalities are the primary customers (Gülersoy & Yigiter, 1999). One of the earliest GIS projects in Turkey began with the production of digital maps covering the boundaries of Istanbul Metropolitan Municipality in 1987. Since 1994, a rapid development process has occurred with the widespread diffusion of GIS especially in universities and large public sector organizations respectively. However, the early city-wide municipal GIS projects were initiated only after 1996 (Ucuzal, 1999). In recent years, a major change has occurred in the context of GIS projects from small-scale infrastructure projects to city-wide municipal GIS projects for three reasons:

1. After the devastating earthquake in Marmara region in 1999, people suffered from the lack of vitally important information, because

such information never existed or was never kept in a systematic way. The importance of accumulation and distribution of up-to-date and accurate data among city-wide organizations was recognized (Tecim, 2001);

2. Rapid development of Internet in Turkey in recent years encouraged the communication efforts within and among the organizations, and among people and organizations, and this triggered the need for inter-organizational GIS (Karas, 2001);
3. Initiatives supporting e-municipality and e-government, and transition from government to governance raised the importance of transparency, communication, and public accountability (Tüzün & Sezer, 2002). In this sense, the concept of “urban information system” (UIS) began to be popular in the context of local governments. At the time of publication, UIS was used as an umbrella term encapsulating all the efforts for an information system—whether GIS or LIS—or information technologies like the Internet within an integrated system that

is supposed to be performed in municipal operations in order to support organizational rationality.

Although so-called urban information systems were being marketed by vendors as the panacea for all problems, the implementation of large-scale information systems generally ended up with failure because information systems (IS) require large changes in the organization's existing structure. In the Turkish case, no municipality has been able to complete establishing a city-wide urban information system so far. Ankara, Istanbul, and Bursa are the cities, where implementation processes are still underway (Celik, 2002). Therefore, there needs to be case studies to address implementation problems of UIS and to evaluate the reasons behind the failures.

In this article, the emphasis will be given upon organizational and political aspects of UIS implementation that is critical for the success and failure of such systems. For this purpose, the approach adopted rests on the assumption that "the success or failure of IS projects is dependent on the degree of mismatch between the conceptions of these systems and the organizational realities into which it is introduced" (Heeks, 1999). In the rest of the article, based on Heeks's argument, the assessment of these gaps is evidenced in the case of Turkish metropolitan municipalities, and further evaluations are made guiding further projects and studies.

ORGANIZATIONAL CONTEXT OF INFORMATION SYSTEMS

Information systems today play a vital role in businesses, governments, and other organizations. Because they are so closely tied to organizations, it is necessary to closely understand the nature of organizational realities. Public sector organizations like municipalities are the single largest collector, user, holder and producer of informa-

tion. The work of these organizations is thus very information-intensive.

Municipalities are responsible for providing the basic urban services (i.e., infrastructure development, fire department operations, garbage collection, planning services, etc.) to the public that requires collecting accurate information about environment and efficient use of this data to perform municipal tasks. The capability for planning, programming and decision making in the municipalities is largely dependent on the collecting, storing, preserving and managing of the spatial information. Municipalities collect and manage both spatial data (i.e., district plan, base maps and cadastre maps) and non-spatial data (i.e., water-system revenues, environmental taxation and building permissions) in their operations. Almost 80% of total data exploited by municipalities are "spatial data". Thanks to advancing technology municipalities are increasingly using geographic information systems (GIS), management information systems (MIS), and the Internet to carry out municipal tasks and services more efficiently. By combining many of the municipal services into an urban information system, the aim is to obtain service unity, reduce service costs and increase revenues.

Information systems differ from information technologies in that they involve people and their actions. Further, they incorporate a set of rational structures, processes and even culture and strategies for the operation (Campbell & McGrath, 2003). Thus, changes in the organizational context are required for information systems to operate rationally.

Considerable declines in the price of information technologies and the increased capacities of technological innovations in supporting municipal tasks and services have increased the implementation of urban information systems (UIS) in Turkish municipalities. Although considerable resources were allocated for UIS projects, a great many "implementation failures" are experienced due to the lack of required interest during the implemen-

tation process. Despite the promise of supporting the organizational rationality, the aim of many UIS projects is to get prestige. Municipalities tend to favor large, complex UIS projects supported by generous funding. But the continually changing political context brings an end to the projects started because of prestige, but not supported by organizational rationality.

In this context, Heeks's ITPOSMO model, based on conception-reality gap assessment, allows a suitable framework to reveal the mismatch between the concept of hard-rational design of information systems and soft political realities of organizations.

ITPOSMO DIMENSIONS OF INFORMATION SYSTEM

Richard Heeks's (1999) model of conception-reality gap assessment is an effective technique, which helps to illuminate the causes of an implementation outcome in organizations (Kouroubali, 2002). According to Heeks, there are conception-reality gaps in implementation process of urban information systems. Successful adoption depends on the size of these gaps: "the larger the gap, the greater the risk of failure" (Heeks, 1999, p. 59). After a review of a number of case studies, he concludes that gaps between conceptions and reality can be classified into seven categories summarized by the I-T-P-O-S-M-O acronym:

- **Information:** Provided by the system versus actual information needs, and the extent to which the organization can access the information.
- **Technology:** Technological capacity required for participation and actual technology capacity of target organizations.
- **Process:** Technology features in relation to existing processes.
- **Objectives and values:** In accordance with the objectives and values incorporated in the

system in relation to objectives and values of users.

- **Staffing and skills:** How well the system fits with human capability requirements.
- **Management and structures:** How well the system fits within existing organizational structures.
- **Other resources:** How available resources such as time and money match with required ones (Heeks, 2001).

Heeks's model of conception-reality gap based on ITPOSMO dimensions has a great value for the following case study section for three reasons:

1. Conception-reality gap assessment is derived from world-wide examples of IS implementations particularly from the public sector organizations and those of many developing countries;
2. ITPOSMO model has the value to being able to examine the reasons why the introduction of information system projects in similar organizational settings results in a various degrees of success or failure;
3. A knowledge base consisting of ITPOSMO dimensions creates opportunities to share and communicate the reasons of success and failure of different cases systematically.

Further clarifications on the pros and cons of the technique are discussed by Heeks elsewhere (Heeks, 2003).

BURSA URBAN INFORMATION SYSTEM (BUIS)

As mentioned in the previous section, efforts to implement Urban Information Systems (UIS) in Turkish municipalities are in infant stages so there is value in carefully documenting implementation process. The Bursa Urban Information System

(BUIS) was selected for study for three specific reasons:

1. the relatively longer experience of urban information systems (since 1996) in this situation creates a greater chance to observe changes through time based on ITPOSMO dimensions;
2. the availability of more financial resources, and municipality's ready acceptance of the wider implementation of various technological systems;
3. the funding obtained through an international donation-loan, professional consultancy and feasibility study provided a significant impetus for a detailed investigation.

Development of BUIS Project

With automotive and major textile plants, and foodstuff industry, Bursa is one of the prime industrial centers in Turkey. With its current population of 1.6 million, the city is the fifth largest in Turkey. In 1987, Bursa was granted the status of a "metropolitan municipality", encompassing three district municipalities under its jurisdiction.

Bursa Metropolitan Municipality wanted to use UIS for the planning and management of this rapidly flourishing city. With such a motivation, they began BUIS project with a GIS feasibility study conducted by U.S.-based firm "Psomas and Associates" between 1994-1996. Funding for the feasibility study was through "Trade and Development Agency" (TDA), an arm of the United States Department of State. The study had four major steps: needs assessment, study tour, pilot project and feasibility study/implementation plan (Henstridge, 1999). Meanwhile, an international fund provided Bursa Metropolitan Municipality with a loan from the World Bank for the planning, reconstructing, improving and managing the water and sewerage system of the city. After the completion of feasibility study, Intergraph won

the bidding to design and to begin implementing Phase-1 of the project in 1996. In order to provide an interactive system management, Intergraph established a branch in Bursa for the implementation process. Permanent staff members from the Metropolitan municipality and district municipalities of Bursa were assigned for the control of the implementation process from 1996 to 1998. Aside from Intergraph, three different companies that specialize in different categories of data collection and processing signed a contract within the same period. Since 1999, BUIS had been fully operated by local "urban information system division", which was responsible for operating the system, supporting other departments in the organization, and coordinating inter-organizational data sharing among respected local organizations.

ITPOSMO Dimensions of BUIS

Based on the results of field study, interviews, and corresponding materials, Richard Heeks's ITPOSMO model was examined for BUIS.

Information

As a rapidly urbanizing metropolitan region, Bursa is undergoing tremendous infrastructure expansion with associated land titling, land registration and environmental projects. In the implementation phase-1 (1996-1998), the information needs of BUIS were projected and four different firms were commissioned to produce spatial data (i.e., base maps, cadastre maps, etc.) and attribute data (i.e., building details, household data) through surveys and digitization of maps. Then, an inter-organizational network was established. Covering three metropolitan-district municipalities in Bursa, The Cadastre and Title Deed Office, Turkish Telecom, Bursa Natural Gas Company, the BUIS implementation succeeded in the coordination of data management (BUIS, 2003). It also provided a software application

developed for 182 “muhtars” (selected headmen of the villages), connecting them to the main system by wide-area network.

The conception-reality gaps for were as follows:

1. there was an absolute need for accurate and up-to-date data in the heart of all information systems. There were some serious problems in the currency of the data that threatened the sustainability of the project: e.g., since the international funding options were not available after 1999 the heavy costs of information maintenance (46% of total BUIS expenditures) became more prone to the political choices of decision-makers;
2. there were serious inefficiencies in the provision of attribute data by respected local bodies: e.g., muhtars were expected to update the database once in a week. In reality, only 20% of them succeeded in operating properly (Erarslan, 1997); and
3. information systems require a clear information management strategy to fulfill the organizational needs and objectives rationally. Yet, the fact that the needs assessments could not be completed by each municipal unit, meant that features of the information systems largely fail to address to the needs and objectives of the organization.

Technology

The hardware and associated GIS software was provided in the implementation phase of the project with the support of international donors. Both software and hardware are currently operational to perform municipal tasks and services. There is also a fiber-optic network connection between all municipal divisions and corresponding district municipalities.

The conception-reality gap was relatively low for the technology dimension but some issues still need to be improved. These include the coordina-

tion of municipal tasks and inter-organizational communication between local bodies, and better provision of municipal services which were the major aims of the BUIS. The telecommunications infrastructure in Turkey, however, is somewhat limited, therefore there some problems occurred in the provision of Web-based services. There was not a fully established network system in and between local public sector organizations and this made the sharing of data more challenging.

Processes

As proposed in the feasibility study, “Urban Information System Division” was founded under the Directorate of Public Works to support functioning of municipal services, in-house production and maintenance of information. Many municipal units adjusted their working processes according to BUIS. For example, citizens’ demand for fixing and maintaining of infrastructure system via telephone service was converted into a “task sheet” by local system operator and transmitted to maintenance crews working in the field.

Conception-reality gap was also low for this dimension. Yet, the absence of office automation reduced the opportunity of fully integrated work process that BUIS may have offered.

Objectives and Values

The feasibility report assumed objectives of greater efficiency through increased revenue generated from property tax collection, effective provision of utility services, control of urban development, and delivery of emergency health, safety and police services with BUIS project.

Some of the system objectives mentioned earlier were achieved. On the other hand, there were some problems increasing the size of this gap:

1. an urban information system is a costly investment and may only be profitable in the long run. It requires a strong political

and individual commitment to fulfill the objectives of the organization. In this respect, such factors as the international consultants, project contractors leaving at the end of the phase-1 of the project with the expiration of their contracts, international donors withdrawing their support, and the mayor, the founder of the BUIS, not being re-elected, reduced the chance of wide spread adoption of the system;

2. In terms of values, there was a “communications gap” between politicians and BUIS administrators in the determination of current and future needs of BUIS.

Staffing and Skills

Feasibility study paid great attention to training of the staff for the successful system implementation. In this context, consultants provided a comprehensive training program included hardware, software, and training of system administrators, chief managers and system operators.

Staffing and skill gap was not important for the BUIS. Sufficient attention was given to continuous training of the staff in information technology. But innovative use of software packages and re-inventing them for specific operations remained relatively small. This was largely because of the problem of public sector employment policy that neither computer skills nor individual productivity was encouraged and rewarded by the administrative system.

Management System and Structures

The design of BUIS proposed strategy to develop an appropriate structure aiming to increase the effectiveness of the organization and its service to its clients or public.

Since BUIS had a city-wide basis, some obstacles were encountered in the sharing and pro-

duction of the data originating from the country’s legal and administrative system:

1. the majority of applications in the GIS market were insufficient to fully perform the responsibilities and coordination role of Metropolitan Municipalities to the digital environment (BUIS, 2003);
2. there was an ongoing challenge between local bodies of central administration and Metropolitan Municipality in the sharing of information. As vital source of BUIS, for instance, cadastre maps were not available free of charge for Municipal organizations; and
3. there was also a conflict between Metropolitan Municipality and associated district municipalities in conjunction with their political stances. In some cases, district municipalities may establish completely different software packages or operating systems that interrupt the city-wide coordination efforts and cause economic loss due to the incompatible data production and exchange. BUIS suffers largely from these issues and the gap was higher for this dimension.

Other Resources

For the BUIS case, donor-aid made the money available for the feasibility studies and phase-1 of the project. The time schedule for training and implementation of basic features of the system worked for the first stage as envisaged in feasibility study. Also, some revenues were gained through the marketing of spatial data and digital maps prepared by the BUIS staff (BUIS, 2003).

But significant budget cut-offs were experienced in the second phase due to the lack of political support and wider economic recession in the country. Therefore, the conception-reality gap was gradually increased.

CONCLUSION

The result of the study indicates that several ITPOSMO dimensions namely “information”, “objectives and values”, and “management structures and systems” seem critical and may lead to “sustainability failure” for BUIS. Broadly, 15 years of GIS experience in Turkish Municipalities confirms that urban information system (UIS) implementation was neither based on a well-designed information management strategy nor utilized in long-run due to the ever-changing political context. A UIS generally incorporates a significant set of rational structures, process, culture, professional strategies and involvement. For this reason, almost all of the implementations realized that failure to complete the pre-requisite conditions and careful management of implementation process may face failure (Pick, 2004).

There is no recipe for success that might be advised to other institutions. But, freezing some ITPOSMO dimensions, getting them smaller and simpler and finding solutions by bringing them closer to organizational realities may open the way leading to a more successful implementation (Heeks, 1999). In this sense, the approach of incrementalism can be applied to avoid over-ambitious UIS projects, which carry high risks of failure. This approach recommends organizations to concentrate on limited applications, which directly meet perceived organizational needs. Such an approach is less vulnerable to organizational and environmental changes and political instability which are very important in developing country context.

Studies in GIS implementation problems especially in developing countries should become a priority issue (Ramasubramanian, 1999). Yet, currently few studies focusing on the institutional dimension of the technology are demonstrated in recorded case studies. In the research pyramid of GIS studies (Obermeyer & Pinto, 1994), institutional issues should be given more attention.

As a result, the evidence obtained from Heeks’s ITPOSMO model could be suitably extended and updated. This study will hopefully lead to further studies which address the soft organizational realities (cultural, structural, political, people factors) of urban information systems.

REFERENCES

- BUIS. (2003). *Urban information system division’s annual report*. Bursa: Bursa Metropolitan Municipality.
- Campbell, B. R., & McGrath, G. M. (2003). The information system within the organization: A case study. In J. Cano (Ed.), *Critical reflections on information systems: A systematic approach*. Hershey, PA: Idea Group Inc.
- Celik, K. (2002). *Investigating and modeling of re-organization requirements in the municipalities for establishing the spatial urban information systems*. Paper presented at the GeoSpatial World 2002 Conference, Atlanta, Georgia.
- Erarslan, D. (1997). *Technological changes and planning trends in metropolitan Turkey: Integration of GIS methods with particular reference to the case of Izmir*. Unpublished Master Thesis, Middle East Technical University, Ankara.
- Gülersoy, N. Z., & Yigiter, R. (1999). *Evaluation of implementation potentials of information technologies in the urban planning process*. Paper presented at the 23rd Proceedings of World Planning Day, Istanbul.
- Heeks, R. (1999). Reducing the risk of information systems failure. In R. Heeks (Ed.), *Reinventing government in the information age*. London: Routledge.
- Heeks, R. (2001). *Understanding e-governance for development*. Manchester: Institute for Development Policy and Management.

Heeks, R. (2003). *Design-reality gap assessment: eGov risk assessment technique 2*. Retrieved March, 2004, from <http://www.e-devexchange.org/eGov/riskdrgap.htm>

Henstridge, F. (1999). *Turkey turns to U.S. experts in GIS*. Professional Surveyor Magazine.

Karas, I. (2001, November 13th-14th). *Internet and GIS*. Paper presented at the GIS Days in Turkey, Fatih Universitesi, Istanbul.

Kouroubali, A. (2002). *Structuration theory and conception-reality gaps: Addressing cause and effect of implementation outcomes in health care information systems*. Paper presented at the Proceedings of the 35th Hawaii International Conference on System Sciences, Hawaii.

Obermeyer, N. J., & Pinto, J. K. (1994). *Managing geographic information systems*. New York: The Guilford Press.

Pick, J. (2004). Costs and benefits of GIS in business (Chapter IV). In J. Pick (Ed.), *Geographic information systems in business*. Hershey, PA: Idea Group Publishing.

Ramasubramanian, L. (1999). GIS implementation in developing countries: Learning from organisational theory and reflective practice. *Transactions in GIS*, 3(4), 359-380.

Tecim, V. (2001, November 13th-14th). *A GIS based governance information system*. Paper presented at the GIS Days in Turkey, Fatih Universitesi, Istanbul.

Tüzün, G., & Sezer, S. (2002). *National report Turkey, Chapter 5: Governance*. Johannesburg: United Nations Development Programme (UNDP) and the Ministry of Environment.

Ucuzal, L. (1999). *GIS: A discussion on information systems and application development in central and local administrations*. Paper presented

at the Urban Information Systems Applications in Local Governments, Trabzon, Turkey.

KEY TERMS

Communications Gap: Relates to that part of the knowledge gap which can be attributed to miscommunications between the parties involved (i.e., IT designers understand technology but not the realities of governance. Officials and politicians understand the realities of governance but not the technology).

Geographic Information System (GIS): A GIS is a computerized system for the collection, storage, manipulation, and output of information that is spatially referenced (Obermeyer & Pinto, 1994).

Land Information System (LIS): A GIS specially designed for use with land information. Land rights, ownership, boundaries, utility, land cover, and zoning data are common layers and attributes in a LIS.

Non-Spatial (attribute) Data: Data that relate to a specific, precisely defined location. The data are often statistical but may be text, images or multi-media. These are linked in the GIS to spatial data that define the location.

Spatial Data: Any information about the location and shape of, and relationships among, geographic features, usually stored as coordinates and topology.

Sustainability Failure: An initiative that succeeds initially but then fails after a year or so.

Wide-Area Network (WAN): A computer network that spans a relatively large geographical area. Typically, a WAN consists of two or more Local-Area Networks (LANs). Computers con-

Urban Information Systems in Turkish Local Governments

nected to a WAN are often connected through public networks, such as the telephone system.

They can also be connected through leased lines or satellites.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, & X. Yu, pp. 709-714, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 5.30

Human Rights Movements and the Internet: From Local Contexts to Global Engagement

John Lannon

*AIB Centre for Information and Knowledge Management, Kemmy Business School, Ireland & the
Praxis Centre, Leeds Metropolitan University, UK*

Edward Halpin

School of Applied Global Ethics & the Praxis Centre, Leeds Metropolitan University, UK

ABSTRACT

This chapter looks at the impact of the Internet on the worldwide human rights movement, and examines the opportunities and pitfalls of the technology and its applications for human rights organisations. It argues that the technology is a useful tool in nongovernmental efforts toward worldwide compliance with human rights norms despite the new challenges it presents for human rights defenders and activists, particularly in the South. Conceptualising the movement as a collection of issue-based social submovements, it draws on social movement literature and examples from Africa to describe how the technology and its ap-

plications benefit the movement in six key areas of activity. The promises, pitfalls, and difficulties of Internet usage are discussed, with particular emphasis on censorship, surveillance and privacy, and the challenges they pose for human rights activists operating in a digital environment.

INTRODUCTION

The worldwide human rights regime has been growing in legal, political, and moral strength ever since the adoption of the Universal Declaration of Human Rights in 1948. But it was only after the end of the Cold War that human rights law and discourse became prominent in local, national,

and international agendas, and a growing array of professionalised, nongovernmental organisations (NGOs) began to appear (Rosenblum, 2000). Human rights defenders and local activist groups can now look to these for moral and material support, and they in turn can mobilise advocates around the world to act on behalf of victims of abuse and oppression. Through the collective efforts of these individuals and organisations, states and other actors have been forced toward greater accountability, institutional structures have been set up, and a vocabulary of liberation has been provided for people all over the globe.

Human rights activists everywhere share a commitment to compliance with human rights norms that transcend nationality and particular cultural values (Shelton, 2002). Granted, the origins of human rights discourse in a Western, liberal tradition is often seen as either undermining its universal value (Kennedy, 2002) or contributing to its ongoing manipulation (Abdul-Raheem, 2005). But antiuniversalism is refuted by arguments against genocide, slavery, racial discrimination, and other grave forms of abuse (Li, 1996), and by the widespread support that the major international human rights documents enjoy among the states of the world today (Perry, 1997). Certainly, particularities of context are important, and it is only when asserted within each country's tradition and history that human rights can become a reality (Tharoor, 1999). Thus, instead of allowing Western actors to set the agenda, local human rights movements in Africa and elsewhere need to "build sustainable legitimacy through local presence and work" (Abdul-Raheem, 2005).

Today, the international human rights regime encompasses institutional actors such as the United Nations (UN); national legal systems and human rights bodies; national and international criminal tribunals; quasi-governmental truth commissions; international, regional, national, and local (grassroots) NGOs; and academics,

lawyers, educators, and activists all over the world (Ball, Girouard, & Chapman, 1997). It is becoming increasingly diverse not only because of the worldwide heterogeneity of cultures, subcultures, and contexts in which it operates, but also because the initial preference given to civil and political rights in the "western doctrine of human rights" (Cassese, 1986, p. 297) has waned. Equal attention is now given to economic, social, and cultural rights, and efforts are being made to place these on national and international agendas. There are also new global challenges to contend with: the integration of markets, the shrinking of states, increased transnational flows of information and people, the spread of cultures of intolerance, the decision-making processes of global institutions like the World Bank and multinational corporations (Brysk, 2002), and international terrorism. In response to these, the human rights movement—the worldwide community of advocates and activists working for the promotion and protection of human rights—has extended, evolved, and diversified. The lines between it and other civil society movements have become blurred, and human rights discourse now permeates, and often underpins, peace, conflict resolution, development, environmental protection, gender, health, and many other areas of civic concern.

The human rights movement has been described as "one of the most potent of contemporary social movements" (Cohen & Rai, 2000, p. 7) based on its implied universal logic. As with other international movements to which similar logic can be applied (such as the environmental movement and the women's movement), subnational, national, and regional struggles are often considered tactical, not strategic, interventions. But while individuals and groups may share an intellectual or moral commitment to the abstract ideal of human rights, Charlesworth (2002) notes that the interests of particular groups and individuals can differ dramatically. The diversity of the actors involved, ranging from a UN high

commissioner to grassroots activists, renders attempts to analyse it as a single monolithic entity fraught with difficulty.

States are the primary accountable parties in cases of human rights abuses, and violator states rarely change their behaviour without serious, consistent pressure from other states (Burgerman, 1998). The role that transnational networks of human rights groups and activists play in applying this pressure is an important one. Globalisation creates new opportunities to challenge states “from above and below” (Brysk, 1993), and one way in which human rights networks do this is through the use of information and communication technologies.¹ Indeed, at the 2003 World Summit on the Information Society (WSIS), the UN commissioner for human rights noted that ICTs are crucial to improving the enjoyment of human rights such as freedom of expression, access to information, privacy, the right to an adequate standard of living, education, health, and development (Jorgensen, Lindholt, & Lindholt, 2004). The Internet is one of the most important of these tools.² Just as the fax machine became a key tool for the human rights movement in the 1980s (Hick, Halpin, & Hoskins, 2000), e-mail and the World Wide Web became important in the 1990s. Similarly in the early 21st century, blogging (the continuous posting of information to a Web site)³ created an enormous opportunity for the worldwide dissemination of information about human rights abuses.

This chapter looks at the impact of the Internet on the human rights movement as a whole, and examines the opportunities and pitfalls of the technology and its applications. We conceptualise the movement as a collection of issue-based social submovements, and draw on social movement literature to outline the advantages and disadvantages of Internet usage by component networks and organisations. We then examine how the technology and its applications benefit the human rights movement in six key areas of activity. Examples of products and ICT initiatives are included, with

an emphasis on work being undertaken in Africa and less developed countries.

While ICTs like the Internet have an important functional role in human rights movements, as many of the examples in this chapter show, their value can easily be overjudged and is frequently overhyped. Technology is only a tool, and ICTs are simply a means to an end for human rights organisations. Since one of the most important considerations is the way in which human rights organisations use these tools to manage information, we look at how the Internet helps organisations to manage this most valuable of resources.

The promises, pitfalls, and difficulties of Internet usage for the human rights movement are numerous and varied. While we discuss these in general, the related themes of censorship, surveillance, and privacy deserve particular attention. In the context of the ever-increasing counterterrorism measures being adopted by states, these represent particular challenges to human rights activists and freedom of expression.

In conclusion, we identify a number of key issues that will impact on how the human rights movement can reap the potential benefits of the Internet and other ICTs. It is particularly important to ensure that the technology is used to amplify the voices of the victims of human rights abuse and oppression, and it is in this context that new policies and initiatives should be viewed.

UNDERSTANDING THE HUMAN RIGHTS MOVEMENT

The most common approach to dealing with the diversity that exists within the human rights movement is to conceptualise it as a collection of issue-based social submovements that seek political and/or social transformation (Cohen & Rai, 2000). The child rights movement, indigenous peoples’ movements, and antitorture movement are all examples of how a particular category of rights has been internationalised by the estab-

ishment of a global regime seeking to regulate behaviour on an issue. Like all social movements (as defined by Diani, 1992), they are made up of networks of individuals, groups, and organisations who are formally independent, who understand themselves to have common interests, and who assume a common identity for at least some significant part of their social existence.

The study of social movements has benefited greatly from the application of a network perspective (Diani & McAdam, 2003; Friedman & McAdam, 1992; Gould, 1993). This is the approach taken by Burgerman (1998), who uses the concept of transnational issue networks developed in Keck and Sikkink (1998) to analyse human rights advocacy. She sees networks as single interconnected entities, operating at both international and domestic levels, and made up of individuals and agencies that are connected to each other by shared values, a common discourse, and dense exchanges of information and services. Transnational human rights networks can influence state practice through these exchanges, but for this to happen, domestic human rights activists and the “micro-sites of resistance to practices of power, often disarticulated with reference to the global” (Baxi, 2000, p. 35) must somehow keep their cause on the international agenda and provide information to their international allies (Burgerman, 1998).

While the big emancipatory human rights movements like the women’s rights movement and the gay rights movement are still in existence, there has been a greater tendency in recent years toward the formation of networks and movements around a single campaign, or with a specific objective. The international network that built up in support of the Ogoni people of Nigeria in the 1990s is a good example of this. The Ogoni, an ethnic minority living in the Niger River Delta region, were demanding increased political power, economic justice, and control over natural resources. The Movement for the Survival of the Ogoni People (MOSOP) organised the Ogoni

and brought world attention to their conflict with the Nigerian government and the international oil company Shell. MOSOP and international organisations such as Amnesty International, Human Rights Watch, Greenpeace, and Friends of the Earth worked together to support the Ogoni efforts and to provide support to human rights defenders inside the country (Bob, 2005).

In Africa, there are a number of understandings of the term social movement (Clarke Brill, 2005), all of which are in evidence in this example. The term is used to refer to broad movements like the human rights movement that work for change on an issue. It is also used to refer to a grouping of people who are not heavily involved with an organisation and who may not see themselves as activists; they are often people like the Ogoni who are faced with oppression in their own everyday lives. Finally, it is used to refer to particular organisations that have a strong representation of people who are oppressed, poor, or experiencing human rights violations first hand. MOSOP and the Treatment Action Campaign (TAC), a post-apartheid South African organisation that campaigns for greater access to AIDS treatment by raising public awareness of the issues involved, are good examples of these.

Within the global human rights movement, all of these movement types exist and interact in increasingly complex webs of movements within movements and networks within networks. For example, the child rights movement contains issue-related movements that focus on child labour, children in armed conflict, the sexual exploitation of children, and so on. It also contains global organisational movements like the Child Rights Information Network (CRIN; <http://www.crin.org>), which covers the broad issue of child rights but with a strategically limited scope of activities. CRIN disseminates information about the Convention on the Rights of the Child⁴ and child rights in general amongst NGOs, United Nations agencies, and other institutions. It has a membership of 1,550 organisations in over 125 countries

(Yates, 2005), amongst which there are divergent, and occasionally incompatible, information needs (Halpin, 2003a, 2003b). In this respect, it is typical of a growing number of organisations that service the information needs of the ever-expanding human rights community.

The number of international NGOs active in the area of human rights has increased substantially since the early 1990s (Ishay, 2005; Keck & Sikkink, 1998; Smith, 1997). Organisations like the membership-based Amnesty International (<http://www.amnesty.org>) mobilise transnational resources to act on a wide range of human rights abuses, and often set up their own internal issue-based networks. Others like OMCT, the World Organisation against Torture (<http://www.omct.org>) coordinate and support global networks of local, national, and regional NGOs fighting against specific forms of abuse.⁵ These international NGOs play a role in international policy networks and work with other like-minded NGOs to ensure their campaigns reach the widest possible audiences. There has been a trend toward increased connectedness of these international NGOs through the 1990s (Kaldor, Anheier, & Glasius, 2003), but formal collaboration between them is a relatively new development. For example, it was as recently as 1997 that the Association for the Prevention of Torture (APT) began organising meetings at its headquarters in Geneva to bring together international NGOs to improve the coordination of torture prevention, direct action, and rehabilitation. The broadest antitorture “coalition network” (Diani, 2003, p. 10) in existence today, CINAT (Coalition of International NGOs Against Torture), was only formed in 1999.

The international NGOs strive to bring international pressure to bear on states and to exert influence at the intergovernmental level. Because of the closer relationship that is developing between these NGOs and the United Nations, they are in a position to undertake research on issues under consideration by the Commission on Human Rights and other bodies; to assist in the drafting of

its decisions and resolutions; to supply verified, up-to-date data; and to act as intermediaries between the larger NGO community and the United Nations (Maran, 1998). They have a broad constituency and can impact directly and indirectly on national and international legislators, diplomats and officials, and the public at large. They also fulfill another important function, which is to reinforce grassroots NGOs and to support the development of domestic human rights movements. These tend to work locally and are less concerned with the potential of UN accreditation and lobbying than with the plight of people in their own area. They collect, record, and report information about what is happening in their own country. They also ensure that their societies are working toward long-term human rights protection by building and motivating local actors and networks to advocate for change, and they press governments to live up to their formal commitments. This is often done at great personal risk as human rights defenders draw unwanted attention to the illicit actions of the state or its agents, and seek to bring about unwelcome reforms.

THE IMPACT OF THE INTERNET ON SOCIAL MOVEMENTS

ICTs and especially the Internet have transformed the capacity of social movements to build coalitions and networks and to advocate for causes, principles, and other people (Hick & McNutt, 2002). They help to share information and place it within contexts while retaining editorial control over information content and external communication (Scott & Street, 2001). They also allow groups and organisations to mobilise beyond their constituency and to precipitate real-world activities. They can be cost efficient, and they allow for high impact without the need for major resources.

The Internet reduces the need for central communication and top-down information flows

within social movements, making it suited to a nonhierarchical structure (Selian, 2002; Wasserman, 2005). Using the Internet, action can be organised in a decentralised way, even across borders. This opens up opportunities for local organisations, giving them national, regional, or global reach and impact. The Internet also facilitates the convergence of divergent organisations with different goals and strategies (Cammaerts & Van Audenhove, 2003), something that is important in human rights movements. It also allows the creation of new network organisations in which smaller organisations pool their information, thus greatly increasing participants' access to information resources and outlets. News of crises can be spread very quickly to highly interested and energetic people, and there can be equally speedy support for the movement. This can create opportunities for spontaneous global, collective action to supplement planned activities on the ground.

The frequent underestimation of the importance of ICT-based networks by governments has made them excellent tools for undermining efforts at censoring information entering or leaving a country. One of the best examples of how movements can successfully bypass state control and communicate in a secure environment using ICTs are the ongoing efforts of Falun Gong practitioners to highlight human rights abuses in China. According to the Falun Dafa Information Centre in New York,⁶ more than 28,000 cases of serious human rights violations were reported up to March 2004.⁷ The majority of these were sent by e-mail or fax despite China's all-encompassing surveillance network (Garden Networks, 2004), and the media and information blockade imposed by the Chinese government in all cases relating to Falun Gong (Amnesty International, 2000; Srinivasan, 2004). Practitioners outside of mainland China have also been using the Internet to break through the country's great firewall and to communicate with practitioners inside the country; the tools and technologies used include

e-mail, chat rooms, peer-to-peer technologies,⁸ and proxy servers.⁹

However, despite the great promise they hold for social movements and networks, ICTs are no more than an "opportunity structure" (Cammaerts & Van Audenhove, 2003, pp. 8-9). As a means of communication, the Internet can assist activists to mobilise participation by augmenting existing communication methods and overcoming their limitations (Wasserman, 2005). However, the notion that it will bring about radical changes in the way social movements and organisations are ordered is questionable. Agre (2002) and other proponents of the amplification theory contend that the Internet changes nothing on its own, but that it can amplify existing forces, which may, in turn, bring about change. The Internet serves to enlarge and accelerate processes already in place in societies and organisations rather than create entirely new forces. Even Selian (2002), who presents a more utopian view of the power of new communication technologies to bring about social change (which she defines as the enhanced awareness and protection of human rights in the international system), concedes that the way in which power is governed and managed by those who control and regulate various communications apparatus is a decisive factor.

According to Manji, Jaffer, and Njuguna (2000), all technologies have a natural proclivity to amplify inequalities, and the Internet is no exception. By the middle of 2005, only 14.6% of the world's 6.4 billion people had access to the World Wide Web (Internet Usage Statistics, 2005). The global divide in access to information technology is currently widening, but Norris (2001) suggests that over time the gap is likely to shrink as in the case of older communication technologies like the telephone, radio, and television. However, she goes on to say that in relation to the worldwide social divide, which is about income, education, class, gender, and race, the Internet reflects and thereby reinforces, rather than transforms, society.

While ICTs are important for the global participation and visibility of marginalised groups such as resource-poor communities, indigenous peoples, immigrants, and refugees (Sassen, 2004), there are two necessary preconditions. One is the preexistence of social networks built through cross-border communities of activism and practice, academic sharing, migration, organisational links, and so on. The other is the availability of adequate technical infrastructure, applications, and expertise to make it happen. In fact, the latter is a three-stage problem (Surman & Reilly, 2003). First there is the fundamental problem of access: Adequate and reliable bandwidth is necessary, as is a computer with an Internet connection, an Internet café in which one is free from surveillance, or a cell phone with SMS (short-message service). Then there is the adoption and development of basic skills needed to use the technology. Finally there is appropriation or strategic use, where a movement turns the technology to its own purposes, making it its own.

Online networks promise and can deliver inclusion, but there is a need for more conscious and concerted attempts to develop online spaces that are interesting, informative, and inclusive. Web sites like Kubatana.net (<http://www.kubatana.net>), which allows Zimbabwean activists to provide information resources and perspectives on the current social and political situation in the country, are a valuable public space for civil society in general and human rights movements in particular. Described by Bev Clark (2005) as a “one stop shop for information,” it aims to improve access to human rights and civic information in Zimbabwe at a time of great political unrest. Global Voices Online (<http://cyber.law.harvard.edu/globalvoices/>) is another example; it is a nonprofit global citizens’ media project that uses a wide variety of technologies including Weblogs, wikis,¹⁰ podcasts,¹¹ online chats, and other techniques to bring attention to points of view from around the world.

Social movements have been making effective use of electronic mailing lists since the early

1990s. They have been used to promote causes and campaigns, to keep in touch with networks, to collaborate on projects, and to share information and experiences. They were also used, and continue to be used, to create a sense of solidarity and community. The Womenslink mailing list that linked women’s organisations in Northern Ireland and the Republic of Ireland (O’Donnell, 2001) was a case in point. But for many organisations, the time and costs involved in hosting and maintaining a list is still not feasible. For this reason, organisations that have the skills and capacity to host and maintain mailing lists and listservs¹² do so on behalf of smaller, less resourced groups. National and regional organisations like Kabissa (<http://www.kabissa.org>), which provides African organisations with accessible, affordable, and secure Internet services (including Website hosting and discussion groups) enable civil society organisations in less developed regions to use ICTs effectively. They host network mailing lists for organisations that want to facilitate and encourage information sharing or coalition building, and newsletter mailing lists for member organisations that simply want to send regular or irregular mailings to interested parties.

While e-mail, mailing lists, virtual communities, and other forms of computer-mediated communications can create new links, strengthen existing links within networks, and sometimes even facilitate the formation of new activist networks and discussion groups, they can also change the rules, the physical context, and the content of communication, and make cooperation agreements extremely fragile. Many of the success stories of online networks have happened when the primary focus was on sharing tactics, information, or other resources. For example, African gender groups have used ICTs very effectively to establish links and to share resources across geographical and cultural borders (Wasserman, 2005). This is helped by the efforts of regional networks like WOUNET, the Women of Uganda Network (<http://www.wougnet.org>),

which promotes the use of ICTs as a tool to help groups address gender issues collectively. But for long-term, close collaboration where building togetherness and confidence is important, face-to-face communication systems are still superior to computer-based alternatives. Nonetheless, the WOUNET experiences show that building capacities in ICTs can help expand the reach and activities of a network.

HOW HUMAN RIGHTS MOVEMENTS BENEFIT FROM THE INTERNET

Notwithstanding the limitations to its effectiveness within social movements, Hick et al. (2000) state and demonstrate in their book, *Human Rights and the Internet*, that “[t]he Internet is changing the operation of human rights organisations, their use of information, and the relationships between them” (p. 8).

Organisations are using it as a tool for their professional activities, but individual human rights activists and advocates are also using it to fight directly against abuse. The uses are numerous, varied, and often innovative as access to technology and training grows.

Information Dissemination

There are a number of identifiable and overlapping areas in which human rights movements can benefit from Internet usage. The first is information dissemination. Human rights workers and domestic grassroots groups use the Internet to supply rapid, accurate, and cheap information about human rights violations to as wide an audience as possible. The traditional media, especially radio and television, may be most effective in informing local communities of a human rights violation, but any mention of it in the traditional foreign media is likely to be in newspapers that appear several days after the event (Katz-Lacabe & Lacabe, 2000). The Internet, on the other hand,

can provide an almost instantaneous dissemination of news to a wide audience, thus helping the chances of attracting global attention and getting a faster international response to a human rights abuse. While human rights organisations continue to use the traditional media, the Internet also allows human rights activists to publish more of their information.

Shahjahan Siraj, a former online editor of *Banglarights.net* (<http://www.banglarights.net>), an independent Web portal that exposes and challenges discriminations and violations of human rights in Bangladesh, wrote that “ICT, [e]specially [the] Internet, used in collaboration with human rights activism, creates virtual alternative tunnels for the free flow of uncensored information within and out of [a] country” (Siraj, 2005, p. 26). In recent times, blogging has made it easier for human rights activists to disseminate information about abuses and to reach a potential audience of millions. Organisations like Human Rights Watch (<http://www.hrw.org>) and Global Voices Online provide numerous RSS feeds¹³ on human rights issues, usually classified according to theme and region, and updated several times daily.

All around the world, journalists and activists document and blog human rights abuses on a daily basis. Blogs like *Realidades Colombianas* (<http://lacoctelera.com/realidades>), which covers the guerrilla war, working conditions, freedom of the press, poverty, child labour, and other issues in Colombia, provide well-researched, critical reports on the happenings in the writer’s country. Others like *Sudan: The Passion of the Present* (<http://platform.blogs.com/passionofthepresent/>) are a resource for communities like those in Darfur who are experiencing daily suffering and oppression.

Blogs are particularly important in countries where the traditional press is under the control of the authorities. Human rights activists are using them to combat censorship and circulate independent news and information, and they have become a powerful tool for freedom of expres-

sion. They are easier to set up than a normal Web site, and can be adapted, configured, and altered without special expertise (although installation can be a little tricky). While organising content is not a problem, engaging the audience it reaches can be. To gain an international audience, the choice of blog community is important, as is the frequency and quality of posts, and the technology used to ensure the blog gets picked up by the main search engines. Nonetheless, content syndication, where a blog's author makes all or part of its contents available for posting on other Web sites, is becoming a far more efficient way of disseminating information than e-mail lists and electronic newsletters.

Locally, the Internet also assists in the distribution of information. For some grassroots human rights activists who find it difficult or dangerous to receive hard-copy reports, accessing them in electronic format can be an effective solution (Whaley, 2000), despite the fact that filtering and blocking techniques used by state authorities often make it difficult for human rights organisations to download or even display online information.¹⁴ Civil society information portals like Kubatana.net, which contains information that is accessible and relevant to local individuals and groups and is actively promoted, can increase the flow of information and news within a country where it is often difficult to access diverse views and opinions.

Taking Action

Disseminating information about human rights violations is the first step in human rights activism; the second and most essential step is action. The Internet is a good place for human rights organisations to encourage action, but it depends on timely and reliable information. Jamie Metzl highlighted this in the 1990s: "...accurate and timely information is an indispensable tool to human rights and an essential precondition for effective responsive action and the promotion of

human rights, whether by organisations, individuals, governments or international institutions" (Metzl, 1996, p. 706).

The Internet helps make the responsive action of human rights activists more effective in three ways. First, it is used to promote traditional forms of off-line action such as letter writing, home government lobbying, and so forth. Second, it has provided opportunities to develop new forms of online action. Third, it is an ideal medium for the sharing of tactics.

Electronic urgent-action mailing lists have been operated by organisations such as Derechos (<http://www.derechos.org>) and Amnesty International for many years. Their objective is to encourage people to send letters and faxes, and to make telephone calls to those responsible for human rights violations. As well as facilitating faster and cheaper distribution, these allow organisations to reach a wider range of international supporters and to issue targeted action appeals. They also allow recipients to take advantage of computer applications to draft letters and to send faxes.

Nowadays, Internet-based activism is becoming more popular than the traditional forms of action. E-mail is taking over as the preferred mode of response for human rights activists to urgent-action appeals. In a survey of key South African Amnesty International activists, conducted at a meeting in July 2004, 64% of the 28 respondents said they were most likely to respond to an urgent-action alert by e-mail, 23% said they would post a letter, and 9% said they would send a fax (Lannon & Halpin, 2005). Organisations like Amnesty, whose main support base is amongst those with access to new technologies, have had to take cognizance of this trend.

Legitimate human rights organisations also engage in other forms of cyberactivism¹⁵ or "normal, non-disruptive use of the Internet in support of an agenda or cause" (Arquilla & Ronfeldt, 2001, p. 241). They do this primarily by organising online petitions and e-mail actions targeting government authorities. Other more disruptive tactics, gener-

ally referred to as “hactivism” or electronic civil disobedience (Wray, 1999), are sometimes used by independent human rights activists or groups acting alone; these include tactics like the July 2005 virtual sit-in organised by the Electronic Disturbance Theater against anti-immigrant Web sites.¹⁶ However, these tactics raise questions about ethics and the limits of freedom of expression on the Internet, just as civil disobedience tactics like blocking a road do in the real world (Katz-Lacabe & Lacabe, 2000).

The Internet is also used by human rights organisations to share information on tactics. A good example is the online database set up by the New Tactics in Human Rights project (<http://www.newtactics.org/>). The project, led by a diverse group of international organisations and human rights practitioners, aims to promote tactical innovation and strategic thinking within the international human rights community. As well as the tactics database, they also provide an electronic newsletter for periodic updates and an online discussion forum in which human rights advocates can discuss their experiences.

Organising, Supporting, and Protecting Human Rights Defenders

A third benefit of the Internet in human rights work is that it helps to organise, support, and protect human rights defenders. It does this by providing a means of communication between human rights workers and NGOs that is cheap, instant, and easy to use. Front Line, an international foundation for the protection of human rights defenders (<http://www.frontlinedefenders.org/>), claim that people have been able to contact them from hiding using e-mail, and that the Internet has enabled them to get fast lobbying done in cases where people were imprisoned and in danger of being tortured. Indeed, part of their work is to provide technical assistance to human rights defenders in countries like Tunisia, where access to technology and freedom of association and expression

are scarce, so that they can record human rights violations and provide information quickly and directly when they are at risk (Lannon, 2002).

Human rights defenders face the same computer risks as other users, including virus attacks, equipment breakdown, difficult physical environments, spamming, and hacking. During a workshop on information technology, electronic communications, and security at Front Line’s 2003 Platform for Human Rights Defenders conference, participants highlighted the need for simple solutions to day-to-day problems like these. They also discussed how governments and other actors that are determined to undermine their work create problems for human rights defenders through surveillance, interception of e-mails, reading of computer files, deletion or distortion of information on Web sites, and identifying them as spammers to service providers (Front Line, 2003; Guerra, 2003).

One of the solutions developed to counteract these problems is the Martus human rights bulletin system (<http://www.martus.org/>). This is a free and open source technology tool that allows grassroots human rights defenders and activists to document human rights abuses quickly and securely. Anyone with basic experience of e-mail can record incidents; these are stored and replicated in multiple locations to safeguard against possible loss and attacks. Human rights groups can even decide what to make public and what should be kept private as they monitor and strive to reduce incidents of human rights abuse (Paik, 2005).

In Guatemala, where the widespread impunity for past human rights abuses has been seen as a major factor in a wave of new abuses, a number of NGOs have used Martus to help secure and protect information relating to events that took place during the pre-1996 civil war. Other projects include the Arizona Coalition against Domestic Violence’s compilation of reports of murder-suicides in domestic-violence disputes, and ongoing efforts by the Human Rights Commission in Sri

Lanka to monitor human rights violations in the north and east of the country.

Ultimately, what human rights defenders need is the ability to perform routine monitoring as this is more reliable than recording after a human rights crisis has exploded. New convergent technologies like mobile blogging and audio blogging (posting audio to a blog from a phone) have great potential in this area. Mobile blogs or “moblogs” that can be updated remotely from anywhere using a mobile phone or digital assistant can provide human rights defenders with the ability to record and disseminate information about human rights violations as they occur.

Finally, the importance of testimonies given or recorded by human rights defenders in advocacy work (McLagan, 2003) provides another basis for ICT usage. The use of testimonies grew in the 1990s, and with the advent of ICTs came new opportunities for recording and archiving. One of the more recent forms is video; footage has been used in courts, tribunals, legislative and executive bodies, and human rights commissions, as well as by the media and transnational organisations and solidarity networks. The online Witness archive (<http://www.witness.org/>) is one of the best sources of video advocacy material; it now consists of more than 1,000 hours of raw footage documenting a vast range of human rights abuses. Local human rights defenders in nearly 50 countries shot these, and they feature first-hand testimonies, interviews, and imagery about rights violations and conflict sites around the world.

Research and Analysis

The Internet is also a valuable research tool for human rights workers. Researchers now use it to retrieve information published by other organisations, to cross-check information with other research groups, and to make their own work available to the human rights community. Even for the general public, Web portals like Human Rights Internet (<http://www.hri.ca/>)

and Banglarights.net can be efficient sources of information on a region, country, or specific human rights issue.

The Web has also become a valuable source of information from local newspapers about background data on legal or economic questions, and about intergovernmental and governmental reports (Whaley, 2000). There is also a growing number of online repositories of human rights information, including databases and documentation centres¹⁶ that provide details of human rights treaties and conventions, case law collections, human rights impact assessment reports, and so on. Some, but not all, recognise that those wishing to access online resources may have limited technology and expertise; they may have unreliable or low bandwidth, or be working with old tools (such as an old version of a Web browser). Even still, attempts to survey what is available over the Internet can be a daunting task for human rights practitioners, given the amount of information and the breadth of online sources. Search engines and Web portals are now making the task of finding required information easier; dedicated human rights search engines like HURISEARCH (<http://www.hurisearch.org/>), which is hosted by the Swiss-based Human Rights Information and Documentation System International (HURIDOCS),¹⁷ provide a single access point to all human rights information published by organisations worldwide.

While search engines and Web portals have greatly improved the retrieval of published human rights information, the electronic exchange of data and information¹⁸ within the human rights community is less clear cut. In some cases there are nontechnical issues like confidentiality, privacy, and the safety of human rights defenders to keep in mind. In other cases there are tactical reasons why organisations are not willing to share information; it may form the basis for a report that is due for release at a later date, or there may be donor-driven demands to keep in mind. Sharing can sometimes be of great benefit; however, if

organisations telling the same story pool their information, they can build a more complete picture of an event and ultimately a more forceful case against the perpetrators.

The key to the successful sharing of data and information within the human rights community is the use of standards. Clarity and meaning is important when human rights information is being shared (Halpin & Hick, 2000); even the inconsistent use of terminology like *inhuman treatment* and *persecution* can be a problem. Language is the most obvious reason for inconsistency, but quite often the difficulty is that the information is not sensitive or relevant to the local culture. HURIDOCS and other organisations have done a lot of work to address this through the development of event reporting standards (Dueck, Guzman, & Verstappen, 2001a) and thesauri (Dueck, Guzman, & Verstappen, 2001b). As more and more of the available information is stored as digital resources, the use of embedded metadata¹⁹ with information about victims, types of abuse, places, and so forth becomes an important consideration.

Human Rights Education and Training

A fifth benefit of the Internet is in human rights education and training. Claude and Hick (2000) explain that human rights education is about more than information dissemination; it is helping people “to analyse the world around them, understand that human rights are a way to improve their lives and the lives of others, and to take action to prevent human rights violations” (p. 226). There has been a growing need and demand for training human rights organisations over the past number of years. As a result, there are now many examples of formal online human rights education programs where documents and lessons are provided online. Planned learning processes, centred around or supplemented by these, are designed to develop awareness of human rights

and the capacity to act to further human rights aspirations (CEDAL, 1996).

Human rights education is defined by Flowers (2000, p. 35) as “all learning that contributes to the knowledge, skills, and values of human rights.” It includes information dissemination, but it is a much more complex process that requires cognitive, emotional, and active learning (Mihir, 2004). Human rights education resource centres like the Human Rights Education Associates (HREA) Web site (<http://www.hrea.org/>) now go beyond the provision of teaching material for formal education and training of professional groups like the armed forces, human rights monitors, and health professionals. They also include online forums and links to other organisations and resources, and are designed to address the needs of nontraditional education sectors like community leaders and NGOs.

A collection of Web-based visual aids for human rights learning published online by HREA presents an interesting example of how the Internet can contribute to emotional learning.²⁰ It consists of an annotated compilation of photographs, paintings, drawings, prints, sculptures, and mixed media on human rights themes (Jawad, 2003), and was put together in order to further human rights learning through the viewing of such images and the environments in which violations take place. The images depict a variety of topics including war, genocide, child labour, and torture, and were created by people of all ages and nationalities.

Human rights education involves analysis through reflection on one’s own situation. The mere gathering of knowledge is not enough for this; there also needs to be an awareness-building process, day-to-day examples, experience, and reflection (Freire, 1995).²¹ A good example of how the Internet and other ICTs can be used to meet this challenge is Pambazuka News (<http://www.pambazuka.org/>), a weekly newsletter and platform for social justice in Africa. According to its editor, Firoze Manji of Fahamu (<http://www.fahamu.org/>), it is a response to the social divi-

sion “that prevents the experiences of the greater part of humanity from being heard, and which, therefore, under-nourishes the discourse of those who do not have access to the technology” (Manji, 2005, p. 13). It helps organisations to find information and to disseminate their own material online by organising it into categories that reflect the subjects of concern to the constituency (these include human rights, refugees and forced migration, women and gender, health and HIV/AIDS, and education). But, in keeping with the need for emotional and active learning, Pambazuka News has also become a tool for advocacy in Africa. As part of the campaign for the ratification of the protocol on the Rights of Women in Africa, for example, two special issues were produced profiling important aspects of the protocol. In 2004, it also exploited the potential of the growing mobile phone market for social change; a system was developed to enable mobile phone users to sign an online petition, and an SMS service was developed to send information on the protocol to people who wanted to subscribe to the service (Manji, 2005).

The informal human rights education that was traditionally supplied by the media is also being greatly enhanced by participation in online news-groups, chat groups, and various forms of civic journalism, including blogging. Marginalised and disadvantaged communities are now being supplied with human rights education materials from centralised online sources like Kubatana.net in Zimbabwe, or the Peoples Movement for Human Rights Education (<http://www.pdhre.org/>). The latter has even developed an innovative Human Rights Cities initiative to examine traditional beliefs, collective memory, and aspirations as related to the Universal Declaration of Human Rights.

Networking and Connectivity

Another very important benefit of the Internet for human rights movements is in networking.

Formally constituted networks can have their own Web site, giving members the opportunity to discuss and share information. Even mailing lists and newsletters like Pambazuka News can help create a sense of community with other human rights activists and facilitate joint projects with other like-minded individuals and organisations (Katz-Lacabe & Lacabe, 2000). They also provide the opportunity for discussion with experts or people in the human rights field who may have specific expertise or knowledge.

Human Rights Internet claims that it communicates by phone, fax, mail, and the Internet with more than 5,000 organisations and individuals around the world working for the advancement of human rights.²² While most of these will probably never engage in direct online communication with each other (not least because of the cost involved), there are plenty of international, regional, and national networks where online information flows between members are important. Networks like the Human Rights Network in Uganda (<http://www.hurinet.or.ug/>), whose mission is to build stronger linkages and cooperation between human rights groups, use the Internet as one of the mechanisms to achieve this. Interorganisational networks like these are nonhierarchical, and collectively and individually the members benefit from the increased exposure that a Web presence gives them.

Another aspect of the Internet that is proving to be of great benefit to some human rights activists and workers is Internet telephony or voice over IP (Internet protocol). One of the best-known service providers, Skype (<http://www.skype.org/>), provides a free program for making free calls over the Internet to anyone who also has Skype. This is a cheap and convenient way for activists to communicate, providing they have the bandwidth to support it. Without broadband access, however, its value is severely limited. Because the majority of the world’s population does not have broadband access, they do not get to make free calls (Burnett, 2005).

THE IMPORTANCE OF INFORMATION

While ICTs like the Internet have an important functional role in human rights movements, their value can easily be overjudged and is frequently overhyped. Technology is only a tool, and ICTs are just a means to an end for human rights organisations (Ball et al., 1997; Fleming, 2002; Manji, 2005). One of the most important considerations is the way in which these tools are used to manage information, since this is at the heart of what they do (Weyker, 2002). Coupled with the need to communicate, collaborate, and organise, it should provide the basis for ICT investment within human rights organisations.

The ability to access background information, training material, and other documentation online is an important asset to human rights organisations. From a network or movement perspective, being able to share information is equally important. Gauthier (2000) notes that in parts of the world where there is a lack of resources to set up and access traditional documentation centres, being able to feed data into online documentation centres where it can be analysed, classified, and redistributed means organisations are not working in isolation. To be usable, these centres must be well organised, of course, and ideally they should use standard formats to store and present information. HURIDOCS guidelines for recording information about human rights violations (Noval, 1993) are now being used by human rights and like-minded organisations all over the world, including large organisations like the UN High Commissioner for Refugees and the Council of Europe, NGOs like Amnesty International, and smaller groups. However, a lot more needs to be done to ensure consistent and effective management of human rights information throughout the movement.

While the Internet facilitates the gathering and dissemination of information, it does not help in its analysis. In fact, its use can contribute to another problem if the information is not managed properly: that of information overload. There is now more information available through which to build a campaign than ever before (Stoecker, 2000), but finding it, sifting it, evaluating it, and using it can be a time-consuming distraction. Search engines, Web portals, well-organised databases, and RSS aggregators all help, but for human rights organisations that have floods of electronic information pushed toward them, it is becoming increasingly necessary to “weed out or edit lower quality documents, ensure that action is coordinated, that the source is accurate, that follow-up is completed, and that processing is done effectively” (Sottas & Schonveld, 2000, p. 79).

When dealing with information online, reliability can also be a problem for human rights activists and organisations. The Internet environment lends itself particularly well to fabrication and distortion of information, anonymous information, and plagiarism (Chabanov, 2004; Dahlberg, 2001; Warnick, 1998). Some organisations might even be tempted to exaggerate the extent of human rights violations because of the competition for grants. There is even a concern that human rights data are viewed by some organisations as a private, commercial commodity to be used primarily for raising the organisations’ own fundraising potential (European Co-ordination Committee on Human Rights Documentation [ECCHRD], 2001). Because of this, the circulation of information in open networks is in some cases diminishing rather than growing.

A lack of objectivity can also be a problem with many online information sources. Blogs, for example, generally represent one person’s views, and while they often offer valuable commentary and insight into denials of human rights, their content cannot always be viewed as independent or impartial.

AUDIENCE BUILDING AND THE INTERNET: PROMISES AND PITFALLS

In Africa, the average cost of a local dial-up Internet account for 20 hours a month in 2005 was about \$60 (including call charges). This is higher than the average African monthly salary (Manji, 2005). Nonetheless, despite the high initial costs necessary for the purchase of equipment and the price of connecting to the telecommunications network, Gauthier (2000) saw the Internet as providing African human rights organisations with a new method for working under very difficult conditions.

There are a variety of service-provision options and alternatives for human rights NGOs seeking to take advantage of ICTs. One is e-riders (<http://www.eriders.net/>), an ICT consultancy solution for small, mission-focused NGOs that cannot afford a full-time technology support person.^x There are also projects that provide recommendations and software distribution based on a grassroots approach, such as NGO-in-a-Box (<http://www.ngoinabox.org>). This provides CD box sets of tools and materials based on the experiences of informed practitioners and field experts, and aims to tackle two primary issues: appropriate software selection, and access to such software and related documentation (Tactical Technology Collective, 2005).

One of the primary goals of NGO-in-a-Box is the promotion and distribution of free and open source software (FOSS) to the nonprofit sector. The free software concept, which refers to the user's freedom to run, copy, distribute, study, change, and improve the software (Lutfy, 2004), is based on the notion of adding to what others have done before. Like the human rights movement, it strives to remove restrictions on freedom, cooperation, and information sharing.

While ICTs, and in particular the Internet, are unrelated and irrelevant to the daily struggles of many poor and oppressed communities, they can

still be useful for representative NGOs. Wasserman (2005) indicates that for the TAC, an organisation that appeals to the middle class despite its roots in the poor communities, the Internet has been instrumental in establishing and maintaining an important support base. Using the Internet to reach elites means it can build capacity, even beyond activist circles. However, in giving some groups increased access to elites, transnational human rights networks, funding agencies, and other key players, the Internet can sometimes create a greater disparity between the ICT haves and the have-nots. Unlike their counterparts in the North who benefit greatly from the instantaneous flow of information over the Internet, the majority of the Southern hemisphere, and in particular sub-Saharan Africa, lags behind in terms of technological development. There, NGOs often have extremely limited access to telephone lines, let alone computers or international connections. Out of necessity, therefore, Southern NGOs often allow their larger Northern counterparts to set the agenda and make key decisions. Thus, while ICTs like the Internet aid collective decision making, they also serve to concentrate power within a few organisations that collect human rights information and transmit it between the local groups and the transnational community.

Another difficulty faced by human rights movements and organisations is information protection. According to the Benetech Institute (2001), which developed Martus, much of the data collected by human rights groups never reaches its full potential or intended audience because a large part of it is lost. Reasons for loss include confiscation or destruction, neglect, passage of time, and lack of resources within grassroots groups to document and communicate violations systematically and securely. Computers eliminate some of these but introduce other risks like equipment failure, user errors, computer viruses, power surges, and arson attacks. While training and support for grassroots groups is part of the solution, other measures such as off-site storage

must also be considered. Here again, the Internet becomes useful by providing the basis for software tools like Martus, which allows users to back up human rights data over the Internet to a secure server located in a different part of the world.

CENSORSHIP, SUIVEILLANCE, AND SECURITY

Given the sensitivity of much of what they possess and the threat it could pose to the authorities, human rights organisations in many parts of the world are vulnerable to deliberate external attack. These attacks can take the form of communications interception, monitoring of activities, or physical raids by state agents or others opposed to the organisation's work (Mobbs, 2002)

In a February 2002 *New York Times* article, the human rights writer Michael Ignatieff (2002) observed that since September 11, 2001, the strength and relevance of the human rights movement has been under threat. In the post-September 11 reshaping of international order, human rights has been disconnected from questions of national security (Wilson, 2005), and their protection has been demoted by states all over the world in the interests of a worldwide "war on terror." Freedom of expression has also suffered; while it was not in an ideal state before September 11, there has been a vast increase in detentions and domestic spying powers over the past 5 years, justified as a part of the war on terror (Bhagwat, 2005). In Syria, Iran, Zimbabwe, China, Uganda, Tunisia (which hosted the second phase of the World Summit on the Information Society in 2005), and scores of other countries, the authorities censor the media and impose restrictions curtailing freedom of access to information, freedom of association, and freedom of movement of human rights defenders. Even in countries of the democratised West, including the United Kingdom, Australia, and the United States (where it is now permissible for the authorities to request all kinds of personal

and private information), antiterrorism legislation severely restricts the freedom of speech of those who question or oppose government policy.

The expansion of counterterrorist activities has also accelerated the rise of a more bureaucratic cybercontrolled society (Ishay, 2005). Most authoritarian regimes now have the technical means to censor the Internet. Material deemed to be illegal or subversive is automatically blocked by filters in countries like Vietnam, where it is not possible to access Web sites that criticise the government, expose corruption, or talk about human rights abuses (Reporters Without Borders, 2005). While activists and bloggers are increasingly making use of the Internet, e-mail, and text messages to publicize human rights abuses, organise protests, and exchange political information and ideas, Human Rights Watch (2005) reports that in many countries like Iran, the government regularly detains and imprisons online journalists, bloggers, and Web-site administrators.

In environments like these, human rights organisations need to be particularly vigilant about their information security. As Mobbs (2002) notes, those seeking covert access to an organisation's information repositories will be often deterred by good access barriers because of the additional time required to circumvent them. However, when the state acts, it does not have this problem. It works openly and generally has the staff and specialist tools to gain access. Still, while securing an organisation's premises, computer room, storage devices, and data files does not provide protection, these access barriers can provide vulnerable NGOs with time to take other action, like calling legal assistance or alerting international solidarity networks.

Governments can also easily intercept electronic communications. They can do this by trapping transmitted information packets at publicly accessible Internet nodes through line tapping or disclosure by Internet service providers, or by intercepting the main lines that connect their country to the rest of the world. To protect

transmitted information and messages from being read or altered, encryption, a means of encoding information so that it cannot be decoded without a “key,” has become a necessary and seamless part of e-mail usage and Web browsing.^y However, there is now a real danger that the use of difficult-to-crack encryption technologies for the electronic transmission of information may be outlawed. Criminalizing the unauthorised use of these strong encryption products is a threat to the work of human rights organisations as the Internet becomes a more integral part of how they operate (Lane, 2000; Marthoz, 2002).

New tools and techniques are being developed and deployed to address the security needs of human rights defenders and groups. These include Web-based services to allow sending and receiving secure e-mails (Hushmail at <http://www.hushmail.com> is one example), proxy servers and anonymous Internet communication systems that protect Web browsers against Internet surveillance (such as Tor, <http://www.tor.eff.org>),^z and firewall tools to protect against unauthenticated access from the outside world.^{aa} Without these, activists working hard to secure human rights might actually be jeopardizing their cause as well as the safety of individuals they are trying to protect (Mladen, Guerra, & Young, 2002). Within the human rights movement, the cost of leaving information unprotected, or of transmitting communications without privacy and security, can often be very high.

CONCLUSION

Despite globalisation, ICTs, and the tremendous expansion of the human rights regime, international attention to human rights issues remain “spotty” (Bob, 2002). On the one hand, the Internet offers the potential to address this imbalance by providing grassroots organisations with the opportunity to create global awareness and strengthen their own efforts. On the other, the ability to exploit its

potential is linked to the infrastructure, resources, and skills at the organisation’s disposal, and the freedom they are allowed to exercise their own rights to organise and communicate.

Efforts to reduce the gap between communities who can make effective use of ICTs and those who cannot is seen as essential for development (United Nations Development Program [UNDP], 2002). In this context it can also be viewed as essential for the enjoyment of human rights, particularly economic and social rights. As these rights are inextricably linked to all other rights, including civil and political rights, the use of ICTs to increase civic engagement and to challenge oppressive and discriminatory state practices is also a fundamental component of development for all.

Internationally, the human rights movement has always been quick to explore new opportunities presented by ICTs. Human rights NGOs that enjoy widespread moral and financial support have, over the decades, used fax machines, e-mail, Web sites, and aggregated news feeds to disseminate targeted information, rally popular outrage, and bring pressure to bear on norm-violating governments. In open societies, human rights initiatives have benefited from the increased visibility provided by ICTs (Ishay, 2005). The fast, global spread of images of abuse in Abu Ghraib prison, Iraq, in April 2004 showed how new forms of information dissemination lead to international outrage and ultimately to effective pressure on the perpetrators of the abuse.

International network movements like CRIN and OMCT offer grassroots organisations online information, expertise, and solidarity. But for domestic movements of people living in poverty and experiencing human rights violations first hand, accessing these resources is not always easy. While ICTs make it possible to maintain links and share resources across geographical and cultural borders, NGOs need to be skillful at using limited bandwidth effectively. The difficulties are compounded by restrictions imposed on democratic social movements, and in particular

human rights movements, which have increased since September 11, 2001. Even when human rights defenders do manage to get online (often at great risk to themselves and those whose rights they are defending), it can be hard for them to be heard amongst all the “noise” in cyberspace. Knowing what to do with sensitive data, who to send communiqués to, and how and where to post information are all critically important. For groups who are working to build their cases, being able to access online information efficiently can be a major factor in how successful they are. Without the training and support that enable them to do all these effectively, attempting to use the Internet can be like walking into a marketplace blindfolded.

The international intergovernmental and non-governmental organisations have a role to play in helping grassroots human rights activists use the Internet effectively. They need to be cognizant of the resources that are at the disposal of their partners in developing countries: in their Website design and e-mail transmissions, as well as in their content management. They need to avoid crowding out the weaker participants in the online human rights networks, and to provide a space for everyone to contribute to the human rights discourse. The use of ICTs to communicate and inform implicitly favours the dominant voices of the North. For this reason alone the global human rights movement needs policies and initiatives that promote a more egalitarian use of ICT resources so that grassroots organisations and activists can ensure the movement remains relevant to their struggles.

Overall, the Internet helps human rights movements to bring greater pressure to bear on norm-violating actors. It does this through targeted information flows, and new and increased levels of activism. It allows more data to be gathered and recorded securely, and it provides access to background reports and information. It also presents greater opportunity for organisations to pool resources and to benefit from the experiences and

expertise of others in the movement. But organisations in the South need help in overcoming access, adoption, and appropriation problems. Developing expertise within local and regional NGOs on how to gather human rights data in a secure environment, analyse the data themselves, build their own databases, and exchange information if and when they wish to is crucial. It is also important that everyone in the human rights movement uses a common language to exchange human rights information; if everyone is using the same words, then data can be collected more efficiently, and information can be accessed more easily.

Organisations like HURIDOCs started working on standards for human rights event reporting in the 1990s. It now needs to be taken a step further by looking at new Internet technologies and opportunities for data gathering and information exchange. This includes the use of metadata to embed usable data into normal Web pages in order to link human rights information from sources all over the world. Using the right technologies, human rights organisations telling the same story with different information can potentially pool together their information and build a more complete picture of what is happening in any part of the world.

Ultimately, one of the keys to the effective use of the Internet by human rights organisations is the development of the necessary information management and research skills within the movement. What is important is not the technology; it is being able to define relevant information, to know how and where to seek it, and to have the capacities and skills to use it. Organisations should not base strategies on technology, but rather they should identify their information needs based on an understanding of what they can manage. The processes they put in place in support of strategic objectives should allow them to take advantage of technologies like the Internet, but the tools should not dictate the strategy.

Further research is required into whether or not technologies like the Internet have made a

difference to information and communications flows within human rights movements. One way to do this might be to look at new advocacy movements such as those working on rights issues surrounding HIV/AIDS and compare them to the pre-Internet movements like antitorture. Without question, there are other factors at play in determining the strategies and tactics adopted by these newer movements, but the role of the Internet is one that cannot be discounted.

REFERENCES

- Abdul-Raheem, T. (2005). Africa: The many challenges to human rights in Africa. *Pambazuka News*, 233. Retrieved December 19, 2005, from <http://www.pambazuka.org/index.php?id=30839>
- Agre, P. A. (2002). Real-time politics: The Internet and the political process. *Information Society*, 18(5), 311-331.
- Amnesty International. (2000). *People's Republic of China: The crackdown on Falun Gong and other so-called "heretical organizations."* Retrieved August 4, 2005, from [http://web.amnesty.org/aidoc/aidoc_pdf.nsf/Index/ASA170112000ENGLISH/\\$File/ASA1701100.pdf](http://web.amnesty.org/aidoc/aidoc_pdf.nsf/Index/ASA170112000ENGLISH/$File/ASA1701100.pdf)
- Arquilla, J., & Ronfeldt, D. (2001). *Networks and netwars: The future of terror, crime and militancy*. Santa Monica, CA: RAND.
- Ball, P., Girouard, M., & Chapman, A. (1997). Information technology, information management, and human rights: A response to Metzler. *Human Rights Quarterly*, 19(4), 836-859.
- Baxi, U. (2000). Human rights: Suffering between movements and markets. In R. Cohen & S. M. Rai (Eds.), *Global social movements* (pp. 33-45). London: The Athlone Press.
- Benetech Institute. (2001). *Martus: Human rights bulletin system. Summary*. Retrieved August 4, 2005, from http://www.benetech.org/download/Martus_1-Pager_Eng_070201.doc
- Bhagwat, N. (2005). *Freedom of expression in an era of state terror*. Paper presented at the Forum of Writers, Poets, Publishers and Human Rights Organizations at the Fourth Conference on Freedom of Expression, Istanbul, Turkey.
- Bob, C. (2002). Globalization and the social construction of human rights campaigns. In A. Brysk (Ed.), *Globalization and human rights* (pp. 133-147). Berkeley, CA: University of California Press.
- Bob, C. (2005). *The marketing of rebellion: Insurgents, media, and international activism*. Cambridge, United Kingdom: Cambridge University Press.
- Brysk, A. (1993). From above and below: Social movements, the international system, and human rights in Argentina. *Comparative Political Studies*, 26(3), 263-265.
- Brysk, A. (2002). Globalization and human rights: Transnational threats and opportunities. In A. Brysk (Ed.), *Globalization and human rights* (). CA: University of California Press.
- Burgerman, S. D. (1998). Mobilizing principles: The role of transnational activists in promoting human rights principles. *Human Rights Quarterly*, 20(4), 905-924.
- Burnett, P. (2005). Talking to the world for free, or talking at the world's expense. *Pambazuka News*, 230. Retrieved December 2, 2005, from <http://www.pambazuka.org/index.php?id=30400>
- Cammaerts, B., & Van Audenhove, L. (2003). *ICT-usage of transnational social movements in the networked society: To organise, to mediate and to influence* (No. ASCoR/TNO-STB). Amsterdam: EMTEL2 Key-Deliverable.

- Cassese, A. (1986). *International law in a divided world*. Oxford: Clarendon Press.
- CEDAL (Centro de Estudios Democráticos de América Latina). (1996). *Towards a pedagogy of human rights education*. Paper presented at the International Consultation on the Pedagogical Foundations of Human Rights Education, La Catalina, Costa Rica.
- Chabanov, S. (2004). *Information: An obstacle for human rights?* Retrieved December 27, 2004, from <http://www.eumap.org/journal/features/2004/infohr1/infohr2/>
- Charlesworth, H. (2002). Author! Author! A response to David Kennedy. *Harvard Human Rights Journal*, 15, 127-131.
- Clark, B. (2005). Kubatana.net: Creating a “one stop shop” for information. *i4d: Human Rights and ICTs*, 3(7), 15-16.
- Clarke Brill, M. (2005). Africa trip report: Exploring the emerging social movements in Africa at the Third African Social Forum. *Africa Action*. Retrieved February 24, 2006, from <http://www.africaaction.org/resources/page.php?op=read&documentid=855&type=6&issues=3>
- Claude, R. P., & Hick, S. (2000). Human rights education on the Internet: Its day has come. In S. Hick, E. F. Halpin, & E. Hoskins (Eds.), *Human rights and the Internet* (pp. 225-237). Houndmills: MacMillan Press Ltd.
- Cohen, R., & Rai, S. M. (2000). Global social movements: Towards a cosmopolitan politics. In R. Cohen & S. M. Rai (Eds.), *Global social movements* (pp. 3-17). London: The Athlone Press.
- Dahlberg, L. (2001). Computer-mediated communication and the public sphere: A critical analysis. *Journal of Computer-Mediated Communication*, 7(1). Retrieved September 17, 2006, from <http://jcmc.indiana.edu/vol7/issue1/dahlberg.html>
- Diani, M. (1992). The concept of social movement. *The Sociological Review*, 40, 1-25.
- Diani, M. (2003). Social movements, contentious actions and social networks: “From metaphor to substance”? In M. Diani & D. McAdam (Eds.), *Social movements and networks: Relational approaches to collective action* (pp. 1-18). Oxford, United Kingdom: Oxford University Press.
- Diani, M., & McAdam, D. (Eds.). (2003). *Social movements and networks: Relational approaches to collective action*. Oxford, United Kingdom: Oxford University Press.
- Dueck, J., Guzman, M., & Verstappen, B. (2001a). *HURIDOCS events standards formats: A tool for documenting human rights violations* (2nd Rev. ed.). Versoix, Switzerland: HURIDOCS.
- Dueck, J., Guzman, M., & Verstappen, B. (2001b). *Micro-thesauri: A tool for documenting human rights violations* (2nd ed.). Versoix, Switzerland: HURIDOCS.
- European Co-ordination Committee on Human Rights Documentation (ECCHRD). (2001). *Minutes of the 24th Meeting of the European Co-ordination Committee on Human Rights Documentation (ECCHRD)*. Retrieved August 4, 2005, from <http://www2.law.uu.nl/english/sim/library/ecchr/Minutes%20in%20pdf/minutes%2024.pdf>
- Fleming, S. (2002). Information and communication technologies (ICTs) and development in the south: Potential and current realities. *Electronic Journal on Information Systems in Developing Countries*, 10(1), 1-10.
- Flowers, N. (2000). *The human rights education handbook: Effective practices for learning, action, and change*. Minneapolis, MN: University of Minnesota, Human Rights Resource Center.
- Freire, P. (1995). *Pedagogy of hope, relieving pedagogy of the oppressed*. New York: Continuum.

Friedman, E. J., & McAdam, D. (1992). Collective identity and activism: Networks, choices, and the life of a social movement. In A. D. Morris & M. McClurg Mueller (Eds.), *Frontiers in social movement theory* (pp. 156-173). New Haven, CT: Yale University Press.

Front Line. (2003). *Coping with surveillance, electronic communications and security: Practical security measures for HRDs*. Paper presented at the Second Dublin Platform for Human Rights Defenders. Frontline: The International Foundation for the Protection of Human Rights Defenders, Dublin, Ireland.

Garden Networks. (2004). *Breaking through the "golden shield."* Retrieved December 27, 2004, from <http://www.eumap.org/journal/features/2004/infohr1/infohr2/>

Gauthier, J. (2000). The Internet in Africa: A turning point in the struggle for human rights? In S. Hick, E. F. Halpin, & E. Hoskins (Eds.), *Human rights and the Internet* (pp. 91-103). Houndmills: MacMillan Press Ltd.

Gould, R. V. (1993). Collective action and network structure. *American Sociological Review*, 58(2), 182-196.

Guerra, R. (2003). *Information technology, electronic communications and security*. Paper presented at the Second Dublin Platform for Human Rights Defenders. Frontline: The International Foundation for the Protection of Human Rights Defenders, Dublin, Ireland.

Halpin, E. F. (2003a). An evaluation of the Child Rights Information Network: Examining information management in a global NGO. Part 1. *Canadian Journal of Library and Information Science*, 27(3), 25-39.

Halpin, E. F. (2003b). An evaluation of the Child Rights Information Network: Examining information management in a global NGO. Part 2.

Canadian Journal of Library and Information Science, 27(4), 31-54.

Halpin, E. F., & Hick, S. (2000). Information: An essential tool for human rights work. In S. Hick, E. F. Halpin, & E. Hoskins (Eds.), *Human rights and the Internet* (pp. 238-250). Houndmills: MacMillan Press Ltd.

Hick, S., Halpin, E. F., & Hoskins, E. (Eds.). (2000). *Human rights and the Internet*. Houndmills: MacMillan Press Ltd.

Hick, S., & McNutt, J. (Eds.). (2002). *Advocacy, activism and the Internet*. Chicago: Lyceum Press.

Human Rights Watch. (2005). *False freedom: Online censorship in the Middle East and North Africa*. Author.

Ignatieff, M. (2002, February 5). Is the human rights era ending? *New York Times*, (late ed.), Section A, p. 25.

Internet usage statistics: The big picture. World Internet users and population stats. (2005). *Internet World Stats*. Retrieved August 4, 2005, from <http://www.internetworldstats.com/stats.htm>

Ishay, M. R. (2005). Promoting human rights in the era of globalization and interventions: The changing space of struggle. *Globalizations*, 1(2), 181-193.

Jawad, R. (2003). *Web-based visual aids for human rights learning*. Retrieved February 13, 2006, from <http://www.hrea.org/erc/Library/visualaids.htm>

Jorgensen, R. F., Lindholt, H., & Lindholt, L. (2004). *Information and communication technologies as human rights enablers*. Retrieved December 14, 2004, from <http://www.eumap.org/journal/features/2004/infohr/iactahre/>

Kaldor, M., Anheier, H., & Glasius, M. (2003). Global civil society in an era of regressive globalisation. In H. Anheier, M. Glasius, & M. Kaldor

- (Eds.), *Global civil society yearbook 2003* (pp. 3-33). Oxford, United Kingdom: Oxford University Press.
- Katz-Lacabe, M., & Lacabe, M. (2000). Doing human rights online: The Derechos cyberbirth. In S. Hick, E. F. Halpin, & E. Hoskins (Eds.), *Human rights and the Internet* (pp. 65-75). Houndmills: MacMillan Press Ltd.
- Keck, M. E., & Sikkink, K. (1998). *Activists beyond borders: Advocacy networks in international politics*. Ithaca, NY: Cornell University Press.
- Kennedy, D. (2002). The international human rights movement: Part of the problem. *Harvard Human Rights Journal*, 15, 101-125.
- Lane, G. (2000). Human rights and the Internet in Europe. In S. Hick, E. F. Halpin, & E. Hoskins (Eds.), *Human rights and the Internet* (pp. 116-128). Houndmills: MacMillan Press Ltd.
- Lannon, J. (2002). *Technology and ties that bind: The impact of the Internet on non-governmental organisations working to combat torture*. Unpublished manuscript, University of Limerick, Ireland.
- Lannon, J., & Halpin, E. F. (2005). *The evolution of human rights activism in the Internet age*. Paper presented at the Association of Internet Researchers. Internet Research 6.0: Generations, Chicago.
- Li, X. (1996). "Asian values" and the universality of human rights. *Report from the Institute for Philosophy and Public Policy*, 16(2). Retrieved September 25, 2006, from <http://www.publicpolicy.umd.edu/IPPP/li.htm>
- Lutfy, M. (2004). Free software for NGOs. *Virtual Activism E-Newsletter*, 12. Retrieved December 28, 2005, from <http://www.virtualactivism.org/articles/freesoftware-matthieu.htm>
- Manji, F. (2005). Human rights in South Africa: Harnessing ICTs for social justice. *i4d: Human Rights and ICTs*, 3(7), 12-14.
- Manji, F., Jaffer, M., & Njuguna, E. N. (2000). *Strengthening human rights organisations in Africa: Challenges of the new technologies*. Canada: International Development Research Centre (IDRC).
- Maran, R. (1998). The role of non-governmental organisations. In B. Dunér (Ed.), *An end to torture: Strategies for its eradication*. London: Zed Books.
- Marthoz, J.-P. (2002). *11 September 2001: The aftermath. Consequences on freedom of information*. Retrieved December 21, 2005, from http://www.unesco.org/webworld/points_of_views/050802_marthoz.shtml
- McLagan, M. (2003). Human rights, testimony, and transnational publicity. *The Scholar and Feminist Online*, 1. Retrieved December 21, 2005, from <http://www.barnard.edu/sfonline/ps/printmmc.htm>
- Metzl, J. F. (1996). Information technology and human rights. *Human Rights Quarterly*, 18(4), 705-746.
- Mihr, A. (2004). *Human rights education: Methods, institutions, culture and evaluation*. Institut für Politikwissenschaft, Otto-von-Guericke-Universität.
- Mladen, C., Guerra, R., & Young, J. (2002). Privacy and security: New technologies for NGOs. *Rights News Online*, 24(1). Retrieved September 25, 2006, from <http://www.columbia.edu/cu/humanrights/publications/publications.htm>
- Mobbs, P. (2002). *Participating with safety briefings no. 1: Introducing information security*. Association for Progressive Communications.
- Norris, P. (2001). *Digital divide: Civic engagement, information poverty and the Internet worldwide*. New York: Cambridge University Press.
- Noval, A. M. (1993). *HURIDOCS standard formats for the recording and exchange of bibli-*

graphic information concerning human rights. Versoix, Switzerland: HURIDOCS.

O'Donnell, S. (2001). Analysing the Internet and the public sphere: The case of Womenslink. *Javnost: The Public*, 8(1), 39-58.

Paik, S. (2005). Martus human rights bulletin system: Witness for social justice. *i4d: Human Rights and ICTs*, 3(7), 6-7.

Perry, M. J. (1997). Are human rights universal? The relativist challenge and related matters. *Human Rights Quarterly*, 19(3), 461-509.

Reporters Without Borders. (2005). *Handbook for bloggers and cyber-dissidents*. Author.

Rosenblum, P. (2000). Teaching human rights: Ambivalent activism, multiple discourses, and lingering dilemmas. *Harvard Human Rights Journal*, 15, 301-315.

Sassen, S. (2004). Local actors in global politics. *Current Sociology*, 52(4), 649-670.

Scott, A., & Street, J. (2001). From media politics to e-protest? The use of popular culture and new media in parties and social movements. In F. Webster (Ed.), *Culture and politics in the information age: A new politics?* London: Routledge.

Selian, A. N. (2002). *ICTs in support of human rights, democracy and good governance*. International Telecommunications Union.

Shelton, D. (2002). Protecting human rights in a globalised world. *Boston College International and Comparative Law Review*, 25(2), 273-322.

Siraj, S. (2005). ICT and human rights promotion in Bangladesh: Democratising force of ICT. *i4d: Human Rights and ICTs*, 3(7), 27-29.

Smith, J. (1997). Characteristics of the modern transnational social movement sector. In J. Smith, C. Chatfield, & R. Pagnucco (Eds.), *Transnational social movement and global politics: Solidar-*

ity beyond the state (pp. 42-58). Syracuse, NY: Syracuse University Press.

Sottas, E., & Schonveld, B. (2000). Information overload: How increased information flows affect the work of the human rights movement. In S. Hick, E. F. Halpin, & E. Hoskins (Eds.), *Human rights and the Internet* (pp. 76-88). Houndmills: MacMillan Press Ltd.

Srinivasan, S. (2004). *Blocking the truth: The Chinese government is sending up a satellite to block transmissions about Falun Gong*. Retrieved August 4, 2005, from <http://english.epochtimes.com/news/4-3-17/20365.html>

Stoecker, R. (2000). *Cyberspace vs face to face: Community organizing in the new millennium*. Paper presented at the COMM-ORG: The On-Line Conference on Community Organizing and Development.

Surman, M., & Reilly, K. (2003). *Appropriating the Internet for social change: Towards the strategic use of networked technologies by transnational civil society organizations*. Information Technology and International Cooperation Program, Social Science Research Council.

Tactical Technology Collective. (2005). *NGO-in-a-box Phase 2: Concept paper*. Retrieved December 21, 2005, from <http://ngoinbox.org/system/files?file=NGO-in-a-box-ConceptPaper2.pdf>

Tharoor, S. (1999). Are human rights universal? *World Policy Journal*, 16(4), 1-6.

United Nations Development Program (UNDP). (2002). *Driving information and communications technology for development: A UNDP agenda for action 2000-2001*. New York: Author.

Warnick, B. (1998). Appearance or reality? Political parody on the Web in campaign '96. *Critical Studies in Mass Communication*, 15(3), 306-324.

Wasserman, H. (2005). Connecting African activism with global networks: ICTs and South African social movements. *Africa Development*, 30(1 & 2), 163-182.

Weyker, S. (2002). The ironies of information technology: The opportunities and pitfalls of information technology for human rights. In A. Brysk (Ed.), *Globalization and human rights* (pp. 115-132). CA: University of California Press.

Whaley, P. (2000). Human rights NGOs: Our love-hate relationship with the Internet. In S. Hick, E. F. Halpin, & E. Hoskins (Eds.), *Human rights and the Internet* (pp. 30-40). Houndmills: MacMillan Press Ltd.

Wilson, R. A. (2005). Human rights in the "War on Terror." In R. A. Wilson (Ed.), *Human rights in the "War on Terror"* (pp. 1-36). Cambridge, United Kingdom: Cambridge University Press.

Wray, S. (1999). On electronic civil disobedience. *Peace Review*, 11(1), 107-111.

Yates, V. (2005). Child Rights Information Network (CRIN): "Right" from the beginning. *i4d: Human Rights and ICTs*, 3(7), 12-14.

ENDNOTES

¹ Information and communication technologies is a broad term, usually understood to encompass all the technologies that facilitate the processing and transfer of information and communication services.

² The Internet refers to both the technical infrastructure of worldwide digital networks, and the use to which this infrastructure is put. Current uses include, but are not limited to, sharing computer resources independently of location, distributing and accessing information via the World Wide Web, and communicating using electronic mail, distribution lists, and newsgroups.

³ A Weblog or blog is a personal Web site on which information is posted by an individual, as in a diary. Postings in a blog are typically arranged in chronological order, with the most recent additions at the top of the page. The activity of updating a blog is known as blogging.

⁴ The Convention on the Rights of the Child was adopted by the United Nations General Assembly Resolution 44/25 on November 20, 1989.

⁵ OMCT is the world's largest coalition of nongovernmental organisations fighting against arbitrary detention, torture, extrajudicial executions, forced disappearances, and other forms of violence. Its global network includes almost 300 local, national, and regional organisations.

⁶ Falun Gong is also known as Falun Dafa.
⁷ S. Chinn, Falun Dafa Information Centre, New York, personal communication, March 24, 2004

⁸ Peer-to-peer technologies refer to networks in which computers can share information without having to go through a third computer (server).

⁹ A proxy server is an intermediary between a Web user and the Internet. One of its main functions is to keep the user's local area network secure through the use of firewall software. It is also useful in cases where anonymity is needed since it hides the local network and user's identity.

¹⁰ A wiki is a collection of Web pages that can be created and edited by anyone through a browser. The term comes from the Hawaiian term *wiki wiki*, meaning rapidly.

¹¹ The term podcasting comes from an amalgam of Apple's *iPod* and *broadcasting*. It is a method of publishing files to the Internet and allowing the receipt of new files automatically using an iPod device. It is used mostly for audio files.

¹² A listserv is a communication tool that

offers its members the opportunity to post information, comments, or questions on predetermined topics and discussions to a large number of people at the same time. When something is posted to the listserv, it is distributed to all of the other people on the list.

¹³ RSS (really simple syndication) is a family of file formats for Web syndication of information links that is used by news Web sites and blogs. Internet users or other Web sites can subscribe to Web sites that provide RSS feeds of information of interest to them instead of browsing to find the information.

¹⁴ For a comprehensive description of censorship and how to circumvent it, see *Reporters Without Borders* (2005).

¹⁵ Alternatively called electronic advocacy, netactivism, and e-advocacy (Hick & McNutt, 2002)

¹⁶ A virtual sit-in consists of people using software that automatically requests a Web page over and over in an attempt to make the Web page unavailable to other users. According to the Electronic Disturbance Theater, over 27,000 people took part in the July 2005 action. See <http://www.thing.net/~rdom/ecd/ecd.html> (retrieved February 24, 2006).

¹⁷ A database is a collection of records held on a computer. It contains structured information organised in a consistent manner. A documentation centre, which may or may not be computer based, contains free-form text information. Databases are organised in such a manner as to facilitate searching for a particular record or set of records, whereas documentation centres rely on cataloguing and/or classification of documents to make information retrieval possible.

¹⁸ HURIDOCS is a global network that facilitates the handling, dissemination, and exchange of information by other human rights organisations. It functions as a decentralised

network in which human rights organisations can handle information according to their own requirements. It also develops tools and techniques for information handling and provides support for the establishment and maintenance of information systems and documentation centres by other organisations (<http://www.huridocs.org/>).

¹⁹ Data are raw materials that are used to produce information; information is data that has been organised, processed, and interpreted so one can draw conclusions and understand implications.

²⁰ Metadata are data about data. They describe how, when, by whom, and in what format data were recorded. Metadata are added in a Web page or stored in a database; they are available for searching but are not displayed.

²¹ See http://www.hrea.org/erc/Library/display.php?doc_id=1257&category_id=18&category_type=3 (retrieved February 13, 2006)

²² Cited in Mihr (2004)

²³ See <http://www.hri.ca/about/intro.shtml> (retrieved December 20, 2005)

²⁴ Ungana-Afrika, a South African service provider, is one example of an organisation providing e-rider solutions (<http://www.ungana-afrika.org/>).

²⁵ While the integrated use of encryption techniques such as pretty good privacy (PGP) can successfully hide the content of a message transmission, they do not always guarantee complete anonymity or protection. For example, most e-mail programs that use PGP will encrypt the message contents but not the details of the sender or recipient that are contained in the message header.

²⁶ Tor uses a concept known as “onion routing,” which takes the idea of proxy servers to an additional level of complexity. Each request made through an onion-routing network goes through 2 to 20 additional randomly selected

Human Rights Movements and the Internet

computers, making it difficult to discover what computer originated a request (taken from Reporters Without Borders, 2005).

²⁷ The security edition of NGO-in-a-Box (<http://security.ngoinabox.org>), prepared by Front Line Defenders and the Tactical

Technology Collective, includes most of these tools. This project provides a variety of FOSS to help organisations and individuals improve their computer and information management operations, stability, costs, and security.

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, and M. Acevedo-Ruiz, pp. 182-209, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.31

Learning IT: Where do Lectures Fit?

Tanya McGill

Murdoch University, Australia

Samantha Bax

Murdoch University, Australia

ABSTRACT

Lectures are the traditional method of content delivery in undergraduate information technology degrees, yet concerns have been raised about their effectiveness. This chapter addresses the role of lectures within information technology (IT) degree programs from a student perspective; it examines the factors that influence lecture attendance, and student perceptions of the usefulness of a variety of possible lecture activities. Overall, the results suggest that students see the lecturer as contributing significant value to their learning experience through the lecture setting. Students appear to value the expertise of the lecturer and find activities that can best make use of the lecturer's expertise the most useful. The results also suggest that students recognize the impor-

tance of active learning within the constraints of traditional learning settings.

INTRODUCTION

The traditional lecture is one of the most common forms of teaching, and has long been the primary method of formally introducing subject material to the student population (Kumar, Kumar, & Basu, 2002), as well as providing opportunities for lecturers to guide students on how to study the courses' content (Khan, 1997). Yet the lecture is also considered to be one of the least effective forms of instruction for students (Bligh, 1972; Felder, 1992; Johnston, Moffat, Sondergaard, & Stuckey, 1996). Some problems reported with the lecturing approach include that lectures can

promote passivity, feelings of isolation (Isaacs, 1994; Rosenthal, 1995) and boredom (Mukherjee, 2000). This could make them ineffectual as an approach to learning.

Despite these concerns and the increasing availability and popularity of online education (McCormick, 2000; Peffers & Bloom, 1999), the lecture is the traditional method of learning in undergraduate IT degrees and is still the standard for IT courses (Griffiths & Oates, 2003; Lynch & Markham, 2003). This raises the question of what the role of lectures can and should be within an IT degree program. The study described in this chapter meets Khan's (1997) call for more research on students' perceptions of the importance and benefits of attending lectures and explores the opinions of a group of IT students; examining the factors that influence their lecture attendance, and their perceptions of the usefulness of a variety of possible lecture activities.

BACKGROUND

The majority of on-campus IT students today are assumed to attend lectures, which provide the main method of introducing IT content to students. However, lecture attendance is rarely mandatory and varies from course to course, with anecdotal evidence suggesting that there is a trend towards lower attendance. This lower attendance may reflect students' dissatisfaction with lectures as a tool for learning, but may also reflect the changing nature of student life, with students facing many competing demands on their time and requiring flexibility in learning.

Many lecture sessions take the format of traditional 'talking head' lectures. One concern associated with the passivity a lecture can encourage is that students who are not actively participating (whether physically or mentally) have a reduced level of concentration after the first 10 to 15 minutes of a lecture (Stuart & Rutherford, 1978), after which the amount of information retained by the

student declines (Bligh, 1972). McKeachie (1986) reports that after a lecture, a student recalls 70% of the information presented in the first 10 minutes, but only 20% of the information presented within the last 10 minutes of lecture time.

Schank (1998) asserts that it is a difficult task to listen while someone else (i.e., the lecturer) talks, with the best case scenario being that a student will think about what has just been said, and then miss the points that follow in the lecture. What is required for learning to take place is for the student to stop listening and process what they have just heard before continuing with further points in the instruction (Rodger, 1995; Schank, 1998). Schank (1998, pg 23) goes so far as to state that, "lecturing is antithetical to learning."

In addition to problems with concentration and information retention, traditional lectures do not easily accommodate discussion, yet dialog and discussion are considered to be important elements in the promotion of higher-level cognitive processing (Mannison, Patton, & Lemon, 1994). Levels of effectiveness in learning are believed to be directly related to the participation of the student, with students tending to retain much more of the material when their engagement with it is high—that is, when they are active learners rather than passive members of an audience (Dale, 1969).

Not all lecture sessions are alike. Lecture sessions may be utilized in a number of ways. In addition to the traditional 'talking head' session, today's IT lecture can involve multimedia demonstrations (e.g., Fagin, 1994; Makkonen, 1998; Robling & Freiseben, 2000), interactive case study analysis (Mukherjee, 2000), role playing exercises (Lynch & Markham, 2003; McConnell, 1996) and in-class problem solving (Rodger, 1995), as well as more unorthodox lecturing approaches, such as class singing as suggested by Siegel (1999). What these approaches have in common is an attempt to introduce active learning to the lecture situation.

One of the most common modifications to the traditional lecture format has been online availability of lecture notes. To reduce the amount of time students spend taking notes and hence make time available for more active learning, many academics have advocated making lecture slides available online prior to the lecture (e.g., Wirth, 2003). However, concerns have been expressed that online availability of lecture notes promotes lower attendance to the detriment of students concerned (Hunter & Tetley, 1999; Khan, 1997; Roosenburg, 2002).

While ideas for teaching innovations abound, very little empirical evidence is available to support them. This chapter addresses the role of lectures within IT degree programs from a student perspective. It explores the opinions of a group of IT students, examining the factors that influence their lecture attendance, and their perceptions of the usefulness of a variety of possible lecture activities.

THE STUDY

This study was conducted by survey. Participants in the study were students enrolled in a second-year IT course at an Australian university. They had experienced at least 1 year of IT lectures already, and these lectures would have been in classes of various sizes with a wide variety of lecturers. Participants were recruited during the first lecture of the semester and completed a questionnaire on the spot. It was stressed that completion of the questionnaire was voluntary and that it formed no part of their assessment in the course.

The first part of the questionnaire collected background information about participants and information about their lecture attendance. The participants in the study were 113 students (78.8% male, 21.2% female), with an average age of 24 (minimum age of 18 and maximum age of 49). The students were from two campuses of the univer-

sity; 73.5% attended the larger main campus and 26.5% attended a smaller regional campus.

Students believed that they had attended around 80% of lectures during the previous semester, with a range from 5% to 100% attendance. Given anecdotal reports from academic staff who had previously taught this cohort of students, this average attendance figure might be an overestimate; however, it is consistent with figures reported by Hunter and Tetley (1999).

The second part of the questionnaire included questions that sought to determine the factors that influence whether students attend lectures. A list of factors that have been proposed to influence lecture attendance was provided and participants were asked to indicate if each factor influenced whether they attended lectures. The list of factors that have been proposed to influence lecture attendance was drawn from the literature (e.g., Hunter & Tetley, 1999; Isaacs, 1994; Khan, 1997; Roosenburg, 2002). Table 1 includes the list of factors.

The questionnaire also asked about student perceptions of the role of lecturers. The final questions asked students to rate the usefulness, in terms of their learning, of each of a list of possible lecture activities. This list was also drawn from the literature (e.g., Mannison et al., 1994; Mukherjee, 2000; Rodrigues & Atchison, 1996; Rosenthal, 1995; Wirth, 2003). The lecture activities were rated on a 5-point scale, where 1 was 'not useful' and 5 corresponded to the activity being 'extremely useful.' The Appendix contains a copy of the questions asked.

RESULTS AND DISCUSSION

Factors Influencing Lecture Attendance

Various factors have been proposed to influence lecture attendance. Clashes with other classes are an obvious one, because if a student has more

than one class scheduled for a particular timeslot, clearly they can be present only at one of them. The time of day in which a lecture is scheduled has been cited as a factor affecting lecture attendance by Khan (1997), who states that lectures timetabled for early morning or late afternoon appear to have a lower level of attendance. As discussed earlier, online availability of lecture notes is another factor that appears to affect lecture attendance, leading to a decrease in attendance as students have an alternative means of accessing at least some of the information provided in lectures (Hunter & Tetley, 1999; Khan, 1997; Roosenburg, 2002). The lecturer’s style of teaching has also been suggested as a factor influencing lecture attendance, with approximately 50% of students citing poor-quality lecturing as a reason for non attendance in Khan’s (1997) survey. The quality and accessibility of textbooks is another factor that has been suggested as a factor influencing attendance. It is considered that students will attend lectures to gain additional explanation and illustration of concepts presented within the text, especially if the textbook is difficult to understand or presents new or complex material.

Table 1 shows each of these factors ranked from most influential to least influential. Surprisingly, the style of the lecturer’s teaching was the most commonly cited determinant of lecture attendance (57.4%). This result is consistent with Khan’s (1997) comment that students will be attracted to well-prepared and delivered lectures that are engaging, easy to follow and relevant to

their studies. However, this result also implies that while the student may consider that a lecture adds value to his or her learning experience, if the style of the lecturer is not one that suits the student, attendance will fall.

The time of day at which the lecture is scheduled was ranked second (40.7%) among the five factors influencing lecture attendance. This appears to be consistent with Khan (1997), who noted that students prefer classes that are not scheduled during late afternoon or early morning.

Online availability of lecture notes was ranked third among the factors (32.4%) influencing lecture attendance. While not the most influential factor, online availability of lecture notes played a major role in influencing whether or not approximately one-third of the students attended lectures. This is consistent with the results of Hunter and Tetley’s (1999) study of the reasons for nonattendance of lectures. Nevertheless, a substantial proportion of students (67.6%) were not influenced by availability of online lecture notes and presumably believe that attending lectures can add further value to their learning experience.

Clashes with other classes were ranked fourth (30.6%). This relatively low ranking may result from careful lecture scheduling in the past, ensuring that a minimal number of classes are timetabled for the same timeslot for this cohort of students. However, a lecture at which some of this data was gathered was inadvertently scheduled to clash with two other classes during the semester, and this fact was noted by a number of students within the comments section of the survey.

Table 1. Ranked list of factors influencing lecture attendance

| Rank | Factor | No. responses citing factor | Percentage of responses |
|------|---|-----------------------------|-------------------------|
| 1 | Lecturer’s style of teaching | 62 | 57.4 |
| 2 | Time of day lecture scheduled | 44 | 40.7 |
| 3 | Online availability of lecture notes | 35 | 32.4 |
| 4 | Clashes with other classes | 33 | 30.6 |
| 5 | Quality and accessibility of the textbook | 22 | 20.4 |

The quality and accessibility of the textbook was the least-cited determinant of lecture attendance (20.4%). This may indicate that many students believe that the lecturer adds substantial value to the material available to them, regardless of the quality of the textbook. It may also be that attendance is influenced by a number of these factors in combination. For example, the quality of the textbook might not be such an influential factor if the related lecture notes are available online.

The results were further examined to determine whether gender, age or the campus a student attended had an influence on the factors determining lecture attendance. Possible differences due to gender, age or campus were explored using chi-square tests, as the variables were all measured on nominal scales. Significantly more male students than female students identified teaching style as an influence on their attendance ($\chi^2(1) = 5.004$, $p = 0.025$). One explanation for this is that female students are more likely to view lectures as adding value to their learning regardless of teaching style. However, an alternative explanation might be that lecture attendance meets other needs of female students, such as face-to-face interaction before and after the lecture presentation. No other gender differences were found.

Age appeared to have a significant effect on whether the time of day the lecture was scheduled influenced lecture attendance. Approximately 31% of the sample was at least 24 years old and these students were less influenced by the time of day at which the lecture took place ($\chi^2(1) = 10.137$, $p = 0.001$). It may be that older students, having made the decision to return to study, are more dedicated to completing the course than younger students, and so they will attend the lectures regardless of the time at which they are scheduled. Further research is required to confirm this possibility. No other age differences were observed, nor were any differences noted between the two campuses regarding factors that influenced students' attendance.

Students also identified other factors that might influence lecture attendance. These included the length of the lecture (the lecture for the course in which the survey was administered was at this time scheduled for a 3-hour block, and the majority of students were noted as being opposed to this) and the students' work commitments. However, several students noted that they would always attend lectures both as a preparation for the tutorial work and as an aid in staying up to date within the class, while others claimed laziness and lack of motivation as other factors influencing their attendance at lectures.

Role of the Lecturer

Students were asked to indicate whether they consider the role of lecturers to be 'to teach you' or 'to help you learn.' Despite being asked to select the statement that most accurately reflected their perceptions, a number of students selected both statements. Thus, 19.4% considered the role of lecturers to be to teach students, 51.9% considered it to be to help students learn and 28.7% considered the role of the lecturer to be that of both teaching and helping the student to learn. The results indicate that lecturers are increasingly considered to be guidance or learning support personnel, indicating that students at university have a heightened sense of responsibility for their own scholarship. Thus, student-centered learning appears to be a goal being accepted by university staff and students alike (e.g., Griffiths & Oates, 2003; Lynch & Markham, 2003; McConnell, 1996; Mukherjee, 2000; Rodger, 1995).

Possible differences in perceptions of the role of the lecturer due to gender, age and the campus attended were examined using the chi-square test. While the majority of students saw the role of lecturers to be primarily to help students learn, significantly more male students than female students ($\chi^2(2) = 7.507$, $p = 0.023$) still believed the role of lecturers is to teach students (25% of male students compared to 0% of female students).

Thus, female students appear to have accepted the responsibility for their learning more readily than male students. This is consistent with the gender difference in response to teaching style discussed above. That is, the lecture attendance of female students is less likely to be affected by their perception of the lecturer's teaching style.

No significant differences were noted between age groups for the perceived role of the lecturer. It thus appears that a student's view of the role of the lecturer does not significantly change as they mature. This result is surprising, given that older students might be expected to take a more mature and self-motivated approach to learning (Piccoli, Ahmad, & Ives, 2001).

A significant difference did exist however, between the two campuses of the university ($\chi^2(2) = 6.433, p = 0.040$). A much larger percentage of students attending the smaller regional campus (35.7%) considered that the role of the lecturer was to teach them, compared to 13.8% of the students at the main university campus. This result was surprising, as we had anticipated that students attending the larger, more anonymous lectures at the main campus would be predisposed to seeing their own role as a more passive one. However, the difference may be due to the students at the regional campus having a more traditional working class background, and hence being less familiar and comfortable with the technological innovations that tend to support student-centered learning.

Lecture Activity Usefulness

The final part of the questionnaire asked students to rate the usefulness, in terms of their learning, of each of a list of possible lecture activities. All suggested activities were ranked relatively high, indicating that students want more than just the traditional style of lectures. Table 2 shows each of the activities ranked by perceived usefulness.

The lecture activity identified as most useful to learning was practical demonstration. The fact that a number of students also specifically commented that they would like to see practical or 'real-life' applications of the theory covered within lectures provides further evidence of this. The importance of the use of real-world illustrations of course material has also been highlighted by Orngreen and Bielli (2002), Mukherjee (2000), and Rodrigues and Atchison (1996).

Reviewing of exam questions was ranked second in terms of usefulness as a lecture activity. This result may be related to the students' recognition that reviewing exam questions is a useful revision aid for the current lecture topic, particularly when having access to the knowledge of the lecturer while the revision activity is occurring. This result highlights how focused students are on passing courses. With increases in education costs, this is to be expected.

Coverage of the topic material was listed as the third most useful lecture activity. Despite the increased flexibility in approaches to study available to students, many appear to still consider the

Table 2. Perceived usefulness of lecture activities

| Rank | Lecture activity | Mean | SD | Min. | Max. |
|------|-----------------------------------|------|------|------|------|
| 1 | Practical demonstrations | 4.47 | 0.74 | 1 | 5 |
| 2 | Reviewing previous exam questions | 4.29 | 0.90 | 1 | 5 |
| 3 | Coverage of topic material | 4.12 | 0.88 | 1 | 5 |
| 4 | Questioning the lecturer | 3.78 | 1.04 | 1 | 5 |
| 5 | Class discussion | 3.64 | 1.06 | 1 | 5 |
| 6 | Videos/Multimedia | 3.58 | 1.04 | 1 | 5 |
| 7 | Small group activities/exercises | 3.49 | 1.05 | 1 | 5 |

lecture, and its related additional explanations and clarifications, as a valuable addition to their learning.

Questioning the lecturer was considered fourth in usefulness as a lecture activity. This is further evidence that students view the lecture as an opportunity to add value to their learning experience, and that the expertise of the lecturer is considered to be a significant addition to both their lecture time as well as to their education.

Class discussion was ranked fifth. This relatively low ranking of class discussion as a lecture activity can be explained by the fact that many IT classes are large (Johnston et al., 1996), and group discussion is impractical for large groups. Many students feel uncomfortable expressing themselves in a large public setting, and it is difficult to hear individual contributions within a large lecture theatre. In addition, in Australian universities, class discussion is traditionally an activity performed during tutorial classes. Thus, undertaking an activity already being completed within other learning sessions may not be considered by students to be a useful activity during lecture time. Despite this, Rodger (1995) reported on the value of class discussion in IT lectures, stating that, "Although less material is covered during class, students obtain a deeper understanding of this material and can expand on this understanding outside of class" (p. 278).

Use of videos and multimedia was ranked second lowest. Computer-based activities are perhaps perceived as activities that students can undertake on their own time. Thus, time during lectures could be better spent in activities that are less flexible time-wise and that can take advantage of the expertise of the lecturer while he or she is present. The lowest-ranked lecture activity was that of small group activities and exercises. This result might be explained by small group activities also being prevalent within tutorial classes, and thus the students may not consider this to be a useful addition to the lecture timeslot.

Overall, it appears that activities that provide access to the knowledge and expertise of the lecturer are those most valued during the lecture timeslot. However, it also appears that the students wish to have a greater control of these activities to ensure that the activities undertaken during lecture time suit their perceived needs.

The responses were further examined to determine if differences occurred in perceptions of the usefulness of the suggested lecture activities based on gender, age or the campus surveyed. This analysis was undertaken using independent sample t-tests. The results indicated that on average females overall ranked most of the activities as more useful than males (except for practical demonstrations). However, the only significant differences existed for small group activities/exercises ($t = 0.276$, $p = 0.007$) and questioning the lecturer ($t = 2.35$, $p = 0.021$). This may be an indication that females desire a more personalized approach to learning, relative to their male counterparts. However, more research is required to further explore this finding.

Videos and multimedia were seen as significantly more useful additions by students who were younger (younger than 24 years of age) ($t = 2.35$, $p = 0.021$). One explanation for this finding may be that younger students are more comfortable with the use of technology in education and, hence, perceive it to be more useful. However, future research is required to better clarify this finding.

The only significant difference in preference for lecture activities between campuses was that of class discussion ($t = -0.201$, $p = 0.047$), where the students attending the smaller regional campus indicated this as a more useful lecture activity. This difference can be explained by the fact that class discussion during lecture times is more feasible with the smaller class sizes of the regional campus.

CONCLUSION

The results of this research suggest that students can see the importance of attending lectures, and that they see the lecturer as contributing significant value to their learning experience through the lecture setting. Students appear to value the expertise of the lecturer, and wish to take advantage of this knowledge during lecture time. Thus, despite the influence of the lecturer's teaching style on attendance, the activities that can best make use of the lecturer's expertise are those most preferred to be undertaken during the lecture timeslot.

It also appears that the role of the lecturer is perceived as more than just that of a teacher. Many students have adopted a student-centered view of education and perceive the role of the lecturer as facilitating their learning. The results of the study also suggest recognition of the importance of active learning within the constraints of traditional learning settings. Active learning has received attention among both trainers and academics for its role in aiding learning (Mukherjee, 2000) and encouraging students to become self-directed learners throughout their lifetimes (Meyers & Jones, 1993). Therefore, it should be a goal of all lecturers to involve active learning in their lectures.

This chapter attempted to explore the role of lectures within IT education. As discussed above, many students do see the importance of attending lectures, and see the lecturer as contributing significant value to their learning experience through the lecture setting. However, if lectures are to continue to play a role in IT education, they must facilitate active learning in ways that are appropriate for the size and nature of the course. Given the prevalence of online availability of lecture notes, and the flexibility this provides to students, lecturers must ensure that lecture sessions provide added value. They must provide varied opportunities for students to take advantage of the lecturer's expertise, and

also encourage students to become active and self-directed learners.

REFERENCES

- Bligh, D. A. (1972). *What's the use of lectures?* Hammondsworth: Penguin.
- Dale, E. (1969). *Audio visual methods in teaching.* New York: Holt, Rinehart, Winston.
- Fagin, B. (1994). Two years of "The Digital World": Portable courseware for technological literacy. *SIGCSE Bulletin*, 26(1), 97-101.
- Felder, R. (1992). How about a quick one? *Chemical Engineering Education*, 26(1), 18-19.
- Griffiths, G., & Oates, B.J. (2003). Lecture-free teaching for systems analysis: An action research study. *Proceedings of the 2003 Informing Science + Information Technology Education Joint Conference*, June.
- Hunter, S., & Tetley, J. (1999). Lectures. Why don't students attend? *Cornerstones: What We Value in Higher Education*, 1-8.
- Isaacs, G. (1994). Lecturing practices and note-taking purposes. *Studies in Higher Education*, 19(2), 203-216.
- Johnston, R., Moffat, A., Sondergaard, H., & Stuckey, P. (1996). Low-contact learning in a first year programming course. *Proceedings of the 1st Australasian Conference on Computer Science Education* (pp. 19-26).
- Khan, S. (1997, February). Why don't they come to the lecture? In *Learning Through Teaching: Proceedings of the 6th Annual Teaching Learning Forum*, Perth, Australia (pp. 163-165).
- Kumar, A., Kumar, P., & Basu, S.C. (2002). Student perceptions of virtual education: An exploratory study. In M. Khosrow-Pour (Ed.),

- Web-based instructional learning* (pp. 132-141). London: IRM Press.
- Lynch, K., & Markham, S. (2003). The winds of change: Students' comfort level in different learning environments. *SIGCSE Bulletin*, 35(3), 70-73.
- Makkonen, P. (1998). WWW-based presentations as a complementary part of conventional lectures in the basics of informatics. *SIGCSE Bulletin*, 30(3), 162-165.
- Mannison, M., Patton, W. & Lemon, G. (1994). Interactive teaching goes to uni: Keeping students awake and learning alive. *Higher Education Research and Development*, 13, 35-47.
- McConnell, J. J. (1996). Active learning and its use in computer science. *SIGCSE Bulletin*, 28, 52-54.
- McCormick, J. (2000). The new school. *Newsweek*, 135(17), 60-62.
- McKeachie, W. J. (1986). *Teaching tips*. Lexington: D.C. Health & Co.
- Meyers, C. & Jones, T. B. (1993). *Promoting Active Learning: Strategies for the College Classroom*. San Francisco: Jossey-Bass.
- Mukherjee, A. (2000). Effective use of in-class mini case analysis for discovery learning in an undergraduate MIS course. *Journal of Computer Information Systems*, 40(3), 15-23.
- Orngreen, R., & Bielli, P. (2002). Learning with multimedia cases in the information systems area. In M. Khosrow-Pour (Ed.), *Web-based instructional learning* (pp. 242-251). London: IRM Press.
- Peppers, K., & Bloom, S. (1999). Internet-based innovations for teaching IS courses: The state of adoption, 1998-2000. *Journal of Information Technology Theory and Application*, 1(1), 1-6.
- Piccoli, G., Ahmad, R., & Ives, B. (2001). Web-based virtual learning environments: A research framework and a preliminary assessment of effectiveness in basic IT skills training. *MIS Quarterly*, 25(4), 401-427.
- Robling, G., & Freiseben, B. (2000). Experiences in using animations in introductory computer science lectures. *SIGCSE Bulletin*, 32(1), 134-138.
- Rodger, S. H. (1995). An interactive lecture approach to teaching computer science. *SIGCSE Bulletin*, 27(1), 278-282.
- Rodrigues, C. & Atchison, M. (1996). A case-study based approach to assessment of systems design and implementation. *Proceedings of the 1st Australasian Conference on Computer Science Education* (pp. 95-102).
- Roosenburg, A. (2002). *Attention, attendance sliding away*. Retrieved July 1, 2004, from www.cavelierdaily.com/CVarticle.asp?ID=12944&pid=895
- Rosenthal, J. (1995). Active learning strategies in advanced mathematics classes. *Studies in Higher Education*, 19(2), 223-228.
- Schank, R.C. (1998). Horses for courses. *Communications of the ACM*, 41(7), 23-25.
- Siegel, E.V. (1999). Why do fools fall into infinite loops: Singing to your computer science class. *SIGCSE Bulletin*, 31(3), 167-170.
- Stuart, J., & Rutherford, R. (1978). Medical student concentration during lectures. *The Lancet*, 2, 514-516.
- Wirth, M.A. (2003). E-notes: Using electronic lecture notes to support active learning in computer science. *SIGCSE Bulletin*, 35(2), 57-60.

APPENDIX

1. How old are you? _____ Years
2. What gender are you?
 - Female
 - Male
3. Do you normally attend lectures?

| | | | | | |
|---------------|---|---|---|---|---------------|
| <i>Rarely</i> | | | | | <i>Always</i> |
| 1 | 2 | 3 | 4 | 5 | |
4. Approximately what percentage of your lectures did you attend last semester? _____ %
 - Clashes with other classes
 - Time of day
 - Whether lecture notes could be downloaded
 - Lecturer's style of teaching
 - Quality and accessibility of the textbook
 - Other (add as many as you like)

5. What factors influenced whether you attended lectures? (tick all that apply)
 - To teach you
 - To help you learn
 - Other (add as many as you like)

6. Which of the following statements more accurately reflects your perception of the role of a lecturer?
 - To teach you
 - To help you learn
 - Other (add as many as you like)

7. Please rate the usefulness of each of the following lecture activities in helping your learning.

| | <i>Not useful</i> | | | | <i>Extremely useful</i> |
|-------------------------------------|-------------------|---|---|---|-------------------------|
| | 1 | 2 | 3 | 4 | 5 |
| Detailed coverage of topic material | 1 | 2 | 3 | 4 | 5 |
| Practical demonstrations | 1 | 2 | 3 | 4 | 5 |
| Videos/multimedia | 1 | 2 | 3 | 4 | 5 |
| Class discussion | 1 | 2 | 3 | 4 | 5 |
| Small group activities/exercises | 1 | 2 | 3 | 4 | 5 |
| Questioning the lecturer | 1 | 2 | 3 | 4 | 5 |
| Reviewing previous exam questions | 1 | 2 | 3 | 4 | 5 |

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 99-111, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 5.32

Information Technology Certification: A Student Perspective

Tanya McGill

Murdoch University, Australia

Michael Dixon

Murdoch University, Australia

ABSTRACT

Certification has become a popular adjunct to traditional means of acquiring information technology (IT) skills, and employers increasingly specify a preference for those holding certifications. This chapter reports on a study designed to investigate student perceptions of both the benefits and risks of certification and its importance in obtaining employment. Certification was perceived as an important factor in achieving employment and students undertaking it anticipate that it will lead to substantial financial benefits. Yet, higher salaries are not seen as the most important benefit of certification. The potential benefits that students believe are most important relate to 'real-world' experience. The respondents were aware of the possible risks of certification but did not appear to be overly concerned about them.

INTRODUCTION

Certification has become a popular adjunct to traditional means of acquiring IT skills, and increasing numbers of job advertisements specify a preference for those holding certifications. Certification intends to establish a standard of competency in defined areas. Unlike traditional academic degrees, certifications tend to be specific to narrow fields or even to individual products. They are designed to provide targeted skills that have immediate applicability in the workplace.

Vendors such as Microsoft and Cisco Systems dominate the vendor-specific certification market worldwide, with qualifications such as the Microsoft Certified Systems Engineer (MCSE), Cisco Certified Network Associate (CCNA) and Cisco Certified Internetwork Expert (CCIE). Vendor-neutral certifications, such as those provided

Information Technology Certification

by the Institute for Certification of Computing Professionals (ICCP), the Computer Technology Industry Association and the Disaster Recovery Institute, also play a role. It has been reported that there are more than 300 IT certifications available and that approximately 1.6 million people have earned approximately 2.4 million certifications (Nelson & Rice, 2001), and no doubt these figures have already increased dramatically. Gabelhouse (2000) quoted an IDC Inc. report that found that the IT training and testing industries had revenues of \$2.5 billion in 1999 and were expected to reach \$4.1 billion by 2003.

Vendors create certifications as a way of promoting widespread adoption of their products and technologies, but they have also become important for educational institutions in attracting students and placing graduates (Brookshire, 2000). This chapter explores the perceptions of students who are undertaking courses of study that can lead to certification. It reports on a study designed to investigate student perceptions of both the benefits and risks of certification and its importance in obtaining employment.

Benefits of Certification

Numerous benefits have been proposed to result from IT certification. As Nelson and Rice (2001) note, many of the claims of benefits have originated in the brochures and Web sites of certification agencies; however, there also seems to be a wider recognition of their importance. The major benefits that have been claimed can be categorized as relating to employers, educational institutions and students (i.e., potential employees). The major benefit for employers is believed to be the provision of more capable employees (Ray & McCoy, 2000), and one in eight IT job advertisements have been found to mention certifications (Clyne, 2001; Nelson & Rice, 2001). Some support for the benefit of employee certification to employers is provided in a study by IDC Inc. (1999), which found that 92% of managers surveyed said they

realized all or some of the benefits they expected from their certified employees. The major benefits to employers accruing from certified employees were:

- Greater knowledge and increased productivity;
- A certain level of expertise and skill;
- Improved support quality;
- Reduced training costs; and
- Higher morale and commitment.

The major benefit proposed for educational institutions is the opportunity to extend program content and to have an increased assessment capability (Ray & McCoy, 2000). Institutions that successfully offer certifications can become known for their expertise in these areas and attract more students and employers for their graduates (Brookshire, 2000). Student performance on certification exams also provides additional and generalizable measures of student competencies.

The greatest benefits of certification are believed to exist for students (Ray & McCoy, 2000). Marketability is proposed as a major benefit. Students are marketable if their programs of study contain content considered valuable by employers. For example, holders of Cisco certifications should have substantial experience as network administrators, designers and troubleshooters on real networks. Higher salaries are also commonly cited as a benefit, and there is evidence to support this. A survey conducted by *Certification Magazine* (Gabelhouse, 2000) reported that on average certification resulted in a 12% increase in income. This study also reported varying values for different certifications. For example, an MCSE led to an average increase in income of 12.6%, a Cisco CCNA to a 16.7% increase and a Novell CNA to a 13.3% increase. However, Alexander (1999) speculates that increased supply of people with the most popular certifications (such as MCSE) means diminished value in the marketplace. Other proposed benefits associated with increases in

marketability and salary include increased self-confidence and credibility (Karr, 2001).

Risks Associated with IT Certification

Despite these benefits, various concerns have been expressed about the current popularity of IT certification. Ray and McCoy (2000) identify the heavy involvement of vendors as an issue for concern, citing the absence of unbiased neutral groups for determining content, creating exams and authorizing examiners. They also recognize that the rapidly changing knowledge base might mean that certification is not of lasting value. Wilde (2000) also highlights the fact that some certifications do not require practical or real-world experience, thus limiting the claims of usefulness.

As IT certifications are increasingly offered by universities and colleges, concerns have been raised that academics might be uncomfortable with the loss of control over content that arises when certification exams determine the content of courses and academic programs (Nelson & Rice, 2001; Ray & McCoy, 2000). Academics might also be uncomfortable with the pressure to maintain their own proficiency levels and certification status.

Given the increasing pervasiveness of certification in the IT profession, more research is needed to verify the benefits of IT certification and to determine the importance of the proposed risks.

THE RESEARCH PROJECT

The exploratory study reported on in this chapter contributes to the need for further research on the risks and benefits of IT certification by investigating student perceptions of both the benefits and risks of certification, focusing particularly on Cisco certification. This research was con-

ducted by survey. Participants in the study were students enrolled in several electronic commerce, telecommunications management and IT courses at an Australian university. Students who have successfully completed these particular courses can also pursue Cisco certification as the courses make use of the Cisco curriculum. Participants were recruited during class and completed a questionnaire on the spot. It was stressed that the completion of the questionnaire was voluntary and that it formed no part of their assessment in the course.

The questionnaire was designed to be easy to read and understand, and to require no more than 10 minutes to complete. The questionnaire contained four main groups of items. The first section asked about:

- Age;
- Gender;
- Amount of previous work experience (both total and IT experience); and
- Whether the skills provided by their degree are those employers require.

The second group of questions related to the perceptions of the participants about the importance of industry certification for employment. Those participants who were not currently working in the IT industry were first asked to rate the importance of industry certification for obtaining their initial IT employment. This item was measured on a 5-point scale, ranging from (1) 'Not Important' to (5) 'Vital.' They were then asked to indicate how much higher (as a percentage) than the average graduate starting salary they believed their starting salary would be if they obtained various certifications. The list of certifications included those currently available to participants and several other popular certifications (see Table 2 for the list).

Those participants who were currently working in the IT industry were instead asked to rate the importance of industry certification for getting

ahead in their current employment. This question also used a 5-point scale, ranging from (1) ‘Not Important’ to (5) ‘Vital.’ They were then asked to indicate how much they thought their salary (as a percentage) would increase if they obtained the various IT certifications.

The third group of questions related to participants’ perceptions of the importance of various proposed benefits of seeking certification. A list of 11 benefits proposed for IT certification was developed from the literature on IT certification (e.g., Alexander, 1999; IDC Inc., 1999; Karr, 2001; Nelson & Rice, 2001; Otterbourg, 1999). Each potential benefit was rated for importance on a 5point scale, ranging from (1) ‘Not Important’ to (5) ‘Very Important’ (see Table 3 for the list).

The fourth group of questions related to participants’ perceptions of the importance of various concerns about certification. A list of potential risks of reliance on IT certification was drawn from the literature on certification (e.g., Nelson & Rice, 2001; Ray & McCoy, 2000; Wilde, 2000). Participants rated each potential risk for importance on a 5-point scale, ranging from (1) ‘Not Important’ to (5) ‘Very Important’ (see Table 5 for the list).

There were 145 participants in the study, with an average age of 23.4 years (with a range from 18 to 48). Twenty-one (14.5%) were female and 124 (85.5%) were male. The gender proportions in

this study are consistent with the low representation of females in IT courses around the world (Downes & Hobbs, 2000; Fitzsimmons, 2000; Klawe & Leveson, 1995). The majority of participants were at the undergraduate level (89.7%), with approximately 10% at post-graduate level. Participants who had previously been employed had on average 5.8 years’ work experience, of which 3.4 years were in the IT industry. Table 1 summarizes some of the background information about the participants.

RESULTS AND DISCUSSION

Benefits

IT certification was perceived as very important both for obtaining initial IT employment and for getting ahead if currently employed in the IT industry. The average importance rating given to IT certification by those not currently employed in IT was 4.09 (out of 5) and 3.75 (out of 5) for those currently employed in the IT industry (see Table 2 below). These perceptions of students who were not yet certified are consistent with results of a survey of 470 IT contractors described by Alexander (1999). In that study, 83% of the contractors believed that IT certifications were

Table 1. Background information about participants

| | Number | Percentage |
|--|--------|------------|
| Gender | | |
| Male | 124 | 85.5 |
| Female | 21 | 14.5 |
| Degree level | | |
| Undergraduate | 130 | 89.7 |
| Postgraduate | 15 | 10.3 |
| Work experience* (mean = 5.8 years) | | |
| No | 75 | 51.7 |
| Yes | 70 | 48.3 |
| * Work experience includes both IT and non-IT experience | | |
| IT work experience (mean = 3.4 years) | | |
| No | 97 | 66.9 |
| Yes | 48 | 33.1 |

either ‘very important’ or ‘somewhat important’ to their prospects for career advancement. Thus, student perceptions of the importance of certification appear to be consistent with industry perceptions. The majority of student participants in the current study also believed that the studies they were undertaking would provide the skills required by employers (yes: 64.5%, not sure: 32.4%, no: 2.8%).

In general, participants perceived that obtaining IT certification would lead to clear financial benefits. The average increases that students

who were not currently working in the IT industry believed they would receive from obtaining certification ranged from a high of 25.27% for CCNP certification down to 18.87% for CCNA certification (see Table 2). The range of increases anticipated by participants was very large, with some suggesting that no increase would result, up to a maximum of 100% for all of the certifications. This wide range of responses suggests that this group of participants did not have a good sense of the value of these certifications in the marketplace. It would be reasonable to expect

Table 2. Perceived importance of certification

| | N | Mean | SD | Min. | Max. |
|--|-----|-------|-------|------|------|
| Importance of certification for initial job | 119 | 4.09 | 1.00 | 1 | 5 |
| Importance of certification for current job | 24 | 3.75 | 1.26 | 1 | 5 |
| Anticipated percentage increase in starting salary (if not currently in IT employment) | | | | | |
| CCNA certification | 99 | 18.87 | 21.46 | 0 | 100 |
| CCNP certification | 97 | 25.27 | 23.85 | 0 | 100 |
| Security certification | 96 | 22.88 | 21.61 | 0 | 100 |
| Wireless certification | 95 | 21.27 | 21.95 | 0 | 100 |
| Unix certification | 96 | 21.47 | 20.55 | 0 | 100 |
| MCSE certification | 98 | 19.77 | 21.26 | 0 | 100 |
| Anticipated percentage increase in salary if currently in IT employment | | | | | |
| CCNA certification | 19 | 6.32 | 4.96 | 0 | 15 |
| CCNP certification | 20 | 16.60 | 14.30 | 0 | 50 |
| Security certification | 20 | 19.20 | 23.31 | 0 | 100 |
| Wireless certification | 19 | 10.68 | 10.19 | 0 | 30 |
| Unix certification | 18 | 16.72 | 23.37 | 0 | 100 |
| MCSE certification | 18 | 9.28 | 14.90 | 0 | 60 |

Table 3. Benefits of certification

| Rank | Benefits | N | Mean | SD | Min. | Max. |
|------|---|-----|------|------|------|------|
| 1 | Practical experience with real networking tasks | 143 | 4.57 | 0.60 | 2 | 5 |
| 2 | Experience with real equipment | 143 | 4.55 | 0.62 | 2 | 5 |
| 3 | Widely recognized qualification | 142 | 4.39 | 0.71 | 1 | 5 |
| 4 | Greater knowledge/skill | 143 | 4.29 | 0.64 | 2 | 5 |
| 5 | Able to apply for the increasing number of jobs that require certification | 143 | 4.19 | 0.75 | 1 | 5 |
| 6 | Obtaining a formal marketable qualification | 143 | 4.11 | 0.85 | 1 | 5 |
| 7 | Academics that teach certifications must be certified, so you can be confident of their knowledge | 143 | 4.08 | 0.84 | 1 | 5 |
| 8 | Higher salaries | 143 | 4.00 | 0.88 | 1 | 5 |
| 9 | Increased credibility | 143 | 3.99 | 0.77 | 1 | 5 |
| 10 | Increased self-confidence | 143 | 3.89 | 0.97 | 1 | 5 |
| 11 | Flexibility of study because of online curriculum | 142 | 3.62 | 0.97 | 1 | 5 |

this result for those certifications not currently available to participants as part of their program of study. But more surprising for the CCNA and CCNP, these certifications are readily available to the participants, and the potential financial benefit resulting from them could be assumed to have influenced their decisions to undertake the courses being surveyed. This lack of knowledge about the financial value of certification is also reflected in the large number of participants who did not provide answers to these items (approximately 20% did not respond to at least one of the questions about salary). Instructors have a major role to play in providing up-to-date information about employers' needs and likely outcomes of obtaining certification. The instructors need to be highly accessible and ensure that their knowledge of the marketplace that graduates will enter remains current so they can help guide students (McGill & Dixon, 2003).

Those participants who were currently working in the IT industry also anticipated financial gains from certification, but the average percentage gains they suggested were lower than those anticipated by students not working in the IT industry. The percentage increases anticipated by those who were currently employed were consistent with the figures available from surveys, such as the one conducted by *Certification Magazine* (Gabelhouse, 2000), suggesting that employed students have realistic expectations. There was also a narrower range of responses provided, suggesting less confusion about likely financial outcomes resulting from certification. Presumably, those working in the IT industry would have received better-quality information, as they would have access to IT work colleagues; whereas those without IT work experience might have been receiving information from a pool of people with perhaps limited direct IT industry experience (McGill & Dixon, 2003).

Table 3 presents the average perceived importance of each potential benefit of IT certification. The ratings of benefits are ranked by perceived

importance. All benefits were ranked relatively highly, with averages above the midpoint of the scale. The two most highly ranked benefits were practical experience with real networking tasks, and experience with real equipment. Almost 97% of the respondents considered practical experience with real networking tasks to be important or very important. This finding reflects that the participants were primarily undertaking Cisco certifications. Wilde (2000) comments that Cisco Systems has the most 'realistic' certification program, requiring those undertaking certification to perform real tasks, using real equipment. Wilde also raises concerns that some certifications do not emphasize practical skills.

The third-ranked perceived benefit in terms of importance was having a widely recognized qualification. IT certifications are global and enable those who have them great flexibility in terms of obtaining employment around the world. The fourth-ranked benefit was greater knowledge and skill. It appears that the intrinsic value of the knowledge and skill obtained during certification is perceived as important beyond the job-related benefits that can result.

The fifth- and sixth-ranked proposed benefits relate to the role of certification in improving opportunities to obtain jobs. The ability to apply for the increasing number of jobs that require certification was ranked fifth, and obtaining a formal marketable qualification was ranked sixth. Improving employment opportunities is clearly important to those who undertake certification, but the higher rankings of practical experience and improving knowledge and skill suggest that employment is not the sole motivation for undertaking certification. The perceived importance of practical experience obtained goes beyond just improving marketability.

Confidence in the knowledge of those who teach certification programs was ranked as the seventh most important benefit. While having knowledgeable instructors is clearly important (with an average of 4.08 out of 5), the relative

ranking perhaps suggests that students perceive those who teach them to be well qualified for the job regardless of whether the unit of study involves a certification and hence requires instructor certification.

Higher salaries were ranked eighth in terms of importance. While potential salaries perhaps receive the most publicity in terms of benefits to holders of certifications, this ranking suggests that salary is not the major driving factor for students. The ninth- and tenth-ranked benefits relate to the importance of certification for how students see themselves. Increased credibility and self-confidence did not appear to be major reasons for undertaking certification. The lowest ranked of the proposed benefits was the flexibility of study enabled because of online curriculums. While certification providers, such as the Cisco Networking Academies, pioneered delivery of quality e-learning material, online materials are now routinely available to IT students whether or not they are attempting certifications (McCormick, 2000; Peffer & Bloom, 1999), thus reducing the perceived importance of this benefit.

Several themes appear to emerge from the examples of benefits that have been proposed. To determine the number and nature of factors underlying the various benefits identified from the

literature, a principal components factor analysis with varimax rotation was performed in SPSS 11.5 using the data from the 145 respondents. Three factors with eigenvalues of greater than one emerged, indicating the existence of three underlying dimensions (see Table 4 for factor loadings).

Examination of the benefits associated with each factor led to naming the factors as follows:

- **Marketability benefits:** Which relate to desirability in the eyes of employers
- **Personal benefits:** Which relate to the impact of the certification on the way in which students perceive themselves and to the ease of their study
- **Learning benefits:** Which relate to intrinsic fulfillment from the type of learning.

These factors summarize the major types of benefits that students anticipate will accrue from certification

Risks

Table 5 presents the average perceived importance of each of the potential risks of or concerns about

Table 4. Factor loadings of benefits

| | Marketability Benefits | Personal Benefits | Learning Benefits |
|---|------------------------|-------------------|-------------------|
| Experience with real equipment | 0.10 | 0.18 | 0.90 |
| Practical experience with real networking tasks | 0.21 | 0.18 | 0.89 |
| Obtaining a formal marketable qualification | 0.75 | 0.13 | 0.26 |
| Greater knowledge/skill | 0.48 | 0.13 | 0.52 |
| Higher salaries | 0.76 | 0.28 | 0.06 |
| Widely recognized qualification | 0.71 | 0.27 | 0.20 |
| Flexibility of study because of online curriculum | 0.12 | 0.78 | 0.16 |
| Increased credibility | 0.34 | 0.78 | 0.16 |
| Increased self-confidence | 0.17 | 0.80 | 0.19 |
| Able to apply for the increasing number of jobs that require certification | 0.60 | 0.46 | 0.11 |
| Academics that teach the Cisco curriculum must be certified, so you can be confident of their knowledge | 0.43 | 0.53 | 0.06 |
| Percent of variance explained | 24.04% | 23.20% | 18.99% |

Table 5. Risks of certification

| Rank | Risks | N | Mean | SD | Min. | Max. |
|------|---|-----|------|------|------|------|
| 1 | The rapidly changing knowledge base might mean that the certification is not of lasting value | 138 | 3.91 | 0.82 | 1 | 5 |
| 2 | The absence of an unbiased neutral group for creating exams and approving examiners | 139 | 3.58 | 0.78 | 1 | 5 |
| 3 | The absence of an unbiased neutral group for determining content | 140 | 3.49 | 0.81 | 1 | 5 |
| 4 | Heavy involvement of vendors | 139 | 3.47 | 0.81 | 1 | 5 |
| 5 | Academics might be uncomfortable with the pressure to maintain their own proficiency levels and certification status | 138 | 3.34 | 0.79 | 1 | 5 |
| 6 | Academics might be uncomfortable with the thought that certification exams determine content of courses and academic programs | 138 | 3.30 | 0.79 | 1 | 5 |

IT certification. The ratings of risks are ranked by perceived importance. The average importance ratings for the risks are mostly well below those of the benefits discussed above. So while the participants were conscious of the potential risks, they did not appear to be overly concerned about them.

The highest-ranked risk was that the rapidly changing knowledge base might mean that certification is not of lasting value. IT has been changing rapidly over a long period, and this rate of change is likely to continue or increase (Benamati & Lederer, 2001; Fordham, 2001). Organizations find it difficult to obtain personnel with the appropriate knowledge and skills to meet the growing demands for IT services (Doke, 1999), and this has contributed to the desirability of certified employees, as they provide a way for employers to obtain a pool of employees with up-to-date skills. However, the rapidly changing knowledge base also means that certification may not be of enduring value, and means that recertification is necessary. Gabelhouse (2000) found that 75% of certification holders shoulder some of the costs of certification, with 45% paying for everything themselves. If regular recertification is required, the costs and investments of time can become prohibitive.

The middle-ranked group of risks relate to the potential for bias in certification. The second-

ranked risk was the absence of an unbiased neutral group for creating exams and approving examiners, and the third-ranked risk was the absence of an unbiased neutral group for determining content. The fourth-ranked risk was heavy involvement of vendors. While vendor-neutral certifications do exist, most certifications are linked to vendors, and this has been raised as an issue of concern (Ray & McCoy, 2000). Again, students appear to be aware of the issue, but not overly concerned about it. They appear to accept the central role of vendors in the IT industry.

Concerns have been raised by several authors (Nelson & Rice, 2001; Ray & McCoy, 2000) that academics might not be comfortable with the loss of control over content that occurs because of the role of certification exams. They might also be uncomfortable with the pressure to maintain their own proficiency levels and certification status. Not surprisingly, these are the two lowest-ranked concerns of the students surveyed in this study.

CONCLUSION

IT certifications are a popular adjunct to traditional means of preparing for a career in IT. Many educational institutions offer a range of IT certifications. This study explored the perceptions of

students currently undertaking courses of study that could lead to IT certification. Certification was perceived as an important factor in achieving employment, and students undertaking it anticipate that it will lead to substantial financial benefits. Yet, higher salaries are not seen as the most important benefit of certification. The potential benefits that students believe are most important relate to the 'real-world' experience that is part of some certifications. They also value the potential improvements in knowledge and skill to which certification should lead.

Those respondents who were currently working in the IT industry had realistic perceptions of the likely salary increases available once certification was obtained, but those students with no IT experience appeared to overestimate the potential financial benefits. Instructors should ensure they have current information about salaries and employers' skill requirements so they can help guide students.

The respondents were aware of the possible risks of certification, but did not appear to be overly concerned about them. The issue considered most important was the potential for the rapidly changing knowledge base to mean that certification is not of enduring value.

Obtaining IT certification has become an important consideration for the IT profession. More research is needed to understand the benefits of IT certification and to determine the importance of the proposed risks. The study reported on in this chapter has provided a starting point, but future research should extend it to holders of IT certifications and to employers.

REFERENCES

- Alexander, S. (1999). Sorting out certifications. *Computerworld*, December 13.
- Benamati, J. & Lederer, A.L. (2001). Coping with rapid changes in IT. *Communications of the ACM*, 44(8), 83-88.
- Brookshire, R.G. (2000). Information technology certification: Is this your mission? *Information Technology, Learning, and Performance Journal*, 18(2), 1-2.
- Clyne, M. (2001). Employee recruitment & retention – certification's role. *Professional Certification Magazine*. Retrieved July 9, 2003, from <http://www.procortcom.com>
- Doke, E.R. (1999). Knowledge and skill requirements for information systems professionals: An exploratory study. *Journal of IS Education*, 10(1), 10-18.
- Downes, S. & Hobbs, V. (2000, November 9-12). An exploratory study of the representation and performance of females in Information Technology at Murdoch University. *Proceedings of the International Information Systems Education Conference (ISECON)*, Philadelphia.
- Fitzsimmons, C. (2000). Doing IT for themselves. *Information Age*, April.
- Fordham, D.R. (2001). Forecasting technology trends. *Strategic Finance*, 83(3), 50-54.
- Gabelhouse, G. (2000). *CertMag's salary survey*. Retrieved July, 9, 2003, from www.certmag.com/issues/dec00/feature_gabelhouse.cfm
- IDC Inc. (1999). *Benefits and productivity gains realized through IT certification*. Retrieved July, 9, 2003, from www.ecertifications.com/idcrep_it-cert.html
- Karr, S.S. (2001). IT certification pays off. *Financial Executive*, December, 60-61.
- Klawe, M. & Leveson, N. (1995). Women in computing where are we now? *Communications of the ACM*, 38(1), 29-35.
- McCormick, J. (2000). The new school. *Newsweek*, 135(17), 60-62.

Information Technology Certification

McGill, T. & Dixon, M. (2003). How do IT students stay up to date with employer's skill requirements. In T. McGill (Ed.), *Current issues in IT education* (pp. 144-152). Hershey, PA: IRM Press.

Nelson, M.L. & Rice, D. (2001). Integrating third party-certification with traditional computer education. *The Journal of Computing in Small Colleges*, 17(2), 280-287.

Otterbourg, S.D. (1999). Cisco Systems and Hewlett-Packard prepare the workforce for the future. *Education + Training*, 41(3), 144-145.

Peppers, K., & Bloom, S. (1999). Internet-based innovations for teaching IS courses: The state of adoption, 1998-2000. *Journal of Information Technology Theory and Application*, 1(1), 1-6.

Ray, C.M. & McCoy, R. (2000). Why certification in information systems? *Information Technology, Learning, and Performance Journal*, 18(1), 1-4.

Wilde, C. (2000). Demand for IT pros drives vendor certification growth: But multiple-choice tests aren't always a true measure of skills and experience. *Information Week*, September 25, 214.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 203-215, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 5.33

The Effects of Human Factors on the Use of Web-Based Instruction

Sherry Y. Chen

Brunel University, Middlesex, UK

ABSTRACT

Web-based instruction is prevalent in educational settings. However, many issues still remain to be investigated. In particular, it is still open about how human factors influence learners' performance and perception in Web-based instruction. In this vein, the study presented in this chapter investigates this issue in a Web-based instructional program, which was applied to teach students how to use HyperText Markup Language (HTML) in a United Kingdom (UK) university. Sixty-one master's degree students participated in this study. There were a number of interesting findings. Students' task achievements were affected by the levels of their previous system experience. On the other hand, the Post-Test and

Gain scores were positively influenced by their perceptions and attitudes toward the Web-based instructional program. The implications of these findings are discussed.

INTRODUCTION

Web-based instruction is prevalent in educational settings. The value of Web-based instruction lies in the capabilities of hypermedia, which permit significant flexibility in the delivery of non-linear course material (Khalifa & Lam, 2002). Students are allowed to learn in their own way—to determine their own path through the material available (Barua, 2001)—and to learn things at their own pace (Chen, 2002). However, the freedom offered

by Web-based instructional programs may come with a problem, because flexibility increases complexity (Ellis & Kurniawan, 2000). Learners are forced to determine their own learning strategies and, therefore, will differ in their perceptions and approaches to learning. In particular, some learners who lack the skills of independent learning may find this difficult and become confused (Last, O'Donnell, & Kelly, 2001), so they may forget what they have already covered, and miss important information (McDonald, Stodel, Farres, Breithaupt, & Gabriel, 2001). This suggests that not all students will appreciate the flexibility and freedom offered by the Web and that human factors, therefore, are important issues to be considered in the development of Web-based instruction programs.

In this vein, the study reported in this chapter aims to investigate how human factors influence students' reactions to a Web-based instruction program. The chapter begins by building a theoretical framework to present the relationships between Web-based instructional programs and individual differences. It then describes an empirical study of students' learning experiences in a Web-based instructional program. Subsequently, the design implications are discussed based on the findings of this empirical study.

THEORETICAL FRAMEWORK

Web-Based Instruction

Over recent years, the World Wide Web (Web) has been becoming a useful tool for information distribution (Sridharan, 2004). In particular, there is an increase in use of the Web for instruction (Evans, 2004). Web-based instruction provides a number of advantages, among which dynamic interaction and flexible schedule are two key items. In terms of dynamic interaction, Web-based instruction presents an enormous amount of information through various interconnections

that offer students a rich exploration environment. The development of Web-based instruction provides learners with many opportunities to explore, discover and learn in theory according to their individual needs. Students can create individualized learning paths to reach the desired goals, move at their own speed and retrieve additional information as needed (Hui & Cheung, 1999). There is a shift away from didactic instruction to discovery of information (Smaldino, 1999). This approach is in line with the constructivist philosophy of learning, where the learner is encouraged to interact with the environment to construct individual knowledge structure (McDonald et al., 2001).

With regard to flexible schedule, Web-based instruction allows learners to read course content through a computer network at any time and at different places (Chang, Henriquez, Honey, Light, Moeller, & Ross, 1998). Burton and Goldsmith (2002) found that such a flexible schedule makes Web-based instruction appealing to students, including the convenience of not having to be on campus during the week, to easily arrange personal commitments and to take courses around work schedules. This type of learning may be particularly beneficial to individuals who live in remote places (Daugherty, 1998). Individuals living in remote areas can have access to the same course content as those living in big cities. This is why many educators have tried to develop a distance learning program on the Web. As pointed out by Clark and Lyon (1999), Web-based instruction has been predicted to be the future of all types of distance learning programs.

However, these advantages may come with a price. Power and Roth (1999) reported that Web-based instruction is more dynamic and flexible than other learning material, but it creates new challenges related to the effect on learners' comprehension. Ng and Gunstrone (2002) indicated that although students had positive perceptions to self-based learning provided by Web-based instruction, the unstructured nature of the Web

made some students need more time to search information. Quintana (1996) stated that while students gained the advantage of flexibility in time, pace and distance with Web-based instruction, many students, on the other hand, felt isolated, lack of motivation, or lack of support and feedback consequently to drop out of the course. Hedberg, Harper, and Corrent-Agostinho (1998) indicated that some students are still working to come to grips with a new and difficult way of learning. They exemplify the concern by asking for more incentive, more time, more structure and more guidance. These studies provide evidence that not all types of students appreciate being given freedom in their learning processes. In particular, students who need more guidance through the learning process may meet an increased number of problems in using Web-based instructional programs. To address this limitation, Web-based instruction should be developed to support the unique needs of each individual learner (Carter, 2002). Only when their needs are identified can developers of programs effectively enhance functionality and increase learners' satisfaction (Ke, Kwakkelaar, Taic, & Chenc, 2002). Therefore, understanding of learners' individual differences arguably becomes an important consideration in the development of Web-based instruction programs.

Human Factors

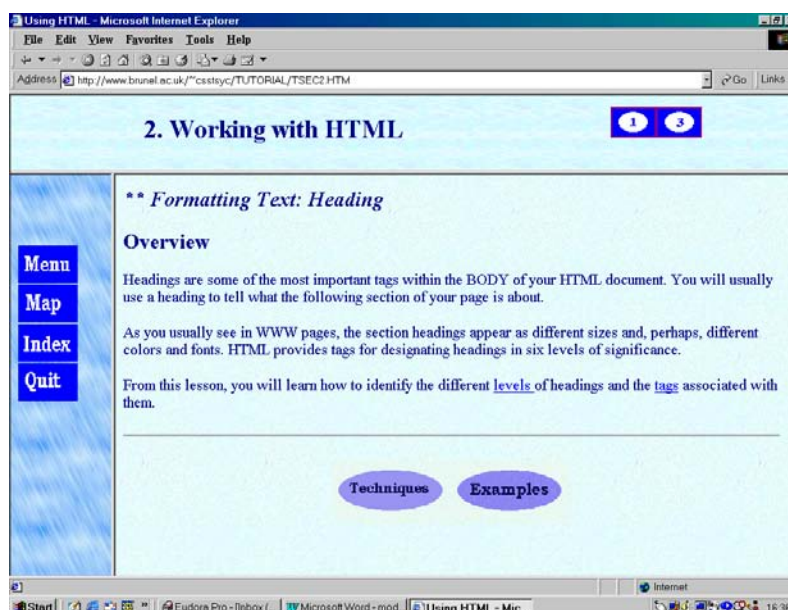
Human factors play an important role in learning. Individuals differ in traits such as skills, aptitudes and preferences for processing information, constructing meaning from information and applying it to real-world situations (Jonassen & Grabowski, 1993). The effects of human factors on students' task performance in a computer-based learning environment have been a growing research area (Wang & Jonassen, 1993; Ke et al., 2002). Among all human factors, gender differences (Ford & Miller 1996), domain knowledge (Mitchell, Chen, & Macredie, 2005) and system experience (Reed

& Oughton, 1997; Chen & Ford, 1998) have been recognized as especially relevant factors to users' interaction with the Web. In terms of gender differences, previous research indicates that gender differences influence users' navigation strategies in Web-based instruction. Schwarz (2001) found that females and males request different kinds of support when locating particular information. Male users need a larger frame of reference, while female users ask procedural directions. The other study by Roy and Chi (2003) indicated that males tended to navigate in a broader way than females. They also found that males tended to perform more page jumps per minute, which indicates that they navigate the information space in a nonlinear way.

In respect of domain knowledge, research suggested that less knowledgeable users experienced more disorientation problems in Web-based instruction (Last et al., 2001). This may be due to the fact that they are unfamiliar with the subject matter of the text, so they cannot rely on prior knowledge to help them structure it. On the other hand, more knowledgeable users may experience fewer navigation problems because their greater grasp of the conceptual structure of the subject matter can enable them to impose structure on the Web (McDonald et al., 2001). In regard to system experience, novices and experts demonstrate different attitudes toward the use of Web-based instruction. Liaw (2002) found students' experience using the Internet to be a good predictor of their computer and Web attitudes. Furthermore, Torzadeh and Van Dyke (2002) found the transition from low experience to high experience could improve Internet self-efficacy.

Results from these studies suggest that human factors play an important role in the use of Web-based instruction programs. These studies also indicate that further empirical works are needed to identify the learners' different preferences, and their results may help to guide the development and evaluation of Web-based instructional programs. This chapter presents such a study, which

Figure 1. Screen design of the HTML tutorial



aims to examine how human factors influence students' reactions to a Web-based instructional program.

RESEARCH DESIGN

Web-Based Instruction Program

The Web-based instructional program, which was used to give an HTML tutorial, began by giving an introduction to the learning objectives and explaining the available navigation approaches provided in the instructional program. The contents were divided into three sections: (1) What is HTML? (2) Working with HTML, and (3) Relations with Standard Generalized Markup Language (SGML) and the Web. Section 2 is the key element of the Web-based instructional program, which covers 12 sub-topics of HTML authoring. Each sub-topic was further split into

five parts, comprising (a) overview, (b) detailed techniques, (c) examples, (d) related skills, and (e) references. Information was presented in 82 pages using texts, tables, an index and maps.

As shown in Figure 1, the screen was divided using frames. In the top frame was a title bar showing the section name being viewed and the other available section buttons. In the left frame were the Main Menu, Index, Map and Quit buttons. The right frame displayed the main content for each section, including topic buttons and text-based hypertext links.

In terms of navigation control, the Web-based instruction program took advantage of the features of non-linear learning and provided students with freedom of navigation. Topics and sub-topics could be studied in any order. In other words, students were allowed to decide their own navigational routes through the subject matter. Three types of navigation control were available in this tutorial, as shown in Table 1.

Table 1. Three types of navigation control

| Control | Purposes | Tools |
|------------------|--|--|
| Sequence Control | To allow students to decide the sequence of subjects to be learned | <ul style="list-style-type: none"> • <i>Subject Maps</i>: to show all topics and sub-topics in a hierarchical way • <i>Keyword Index</i>: to list keywords in an alphabetical way • <i>Back/Forward</i>: to see the page previously visited |
| Content Control | To allow students to control the selection of the contents they wish to learn | <ul style="list-style-type: none"> • <i>Section Buttons</i>: to choose three sections of the main content • <i>Main Menu</i>: to present main topics • <i>Hypertext Links</i>: to connect relevant concepts |
| Display Control | To allow students to choose one of several display options that cover the same concept | <ul style="list-style-type: none"> • <i>Display Options</i>: to include overview, examples and detailed techniques, and so forth |

Pre-Test and Post-Test

Examining students’ learning outcome in theoretical knowledge was conducted by using a Pre-Test and Post-Test methodology. The students were evaluated with the Pre-Test to examine their levels of prior HTML knowledge, and with the Post-Test for assessing learning achievement. Both tests were presented in paper-based formats and included 20 multiple-choice questions. Only one correct answer was provided among the multiple choices provided in each question. The formats of the questions were similar, with only the specific subject of the question being modified. The questions covered all three sections of the Web-based instruction program, from basic concepts to advance topics.

Students were allotted 20 minutes to answer each test and were not allowed to examine the content presented in the program at the same time. Students’ learning outcome was assessed by:

- **Post-Test score:** Each student’s score on the Post-Test, ranging from 0 to 20 to identify general learning performance
- **Gain score:** Score difference between the Pre-Test and Post-Test, to measure improved learning performance by taking the HTML tutorial.

Task Sheet

Students were assigned to do a practical task, which involved constructing a Web page using Notepad to measure learning outcome on the real skills that they had learned. The practical task entailed 10 key areas (e.g., creating hypertext links, changing background colors, formatting text, etc.). A printed task sheet was given to the students that described the detailed features of the Web page to be completed. The students were allowed to decide the order in which they attempted to complete the task activities on the sheet, and could look at the content of the HTML tutorial simultaneously.

One and a half hours were allocated for each student to complete the task. The starting and end times for each student were recorded. Students’ task achievement was evaluated by:

- **Task score:** A score consisting of summing items successfully completed, on a 0-10 scale
- **Task time:** The total time spent for completing the tasks.

Exit Questionnaire

The questionnaire was divided into two parts. The first part sought information regarding bio-

The Effects of Human Factors on the Use of Web-Based Instruction

graphical data relating to the student and his or her experience of using computers, the Internet and HTML. The second, which was the main focus, consisted of three open-ended questions and 47 closed statements to collect students' responses to the Web-based instructional program. It took students approximately 20 minutes to respond to all questions.

The open-ended questions were related to students' opinions about the strengths and weaknesses of the HTML tutorial and the barriers that they met. Students were requested to express their opinions in their own words. Enough space was provided for them to write down their opinions. The closed statements were designed to collect information about students' comprehension, preferences, and satisfaction or dissatisfaction with the Web-based instructional program. It included five sections: (1) level of understanding; (2) content presentation; (3) interaction styles; (4) functionality and usability; and (5) difficulties and problems.

Each closed statement could be classed as either "in favor" or "not in favor" of the program. The number of 'favored' statements was almost equal to the 'not-favored' statements (20 favored statements and 27 not-favored statements), in an attempt to reduce bias in the questionnaire. All statements used a five-point Likert Scale consisting of: 'strongly agree'; 'agree'; 'neutral'; 'disagree'; and 'strongly disagree.' Students were required to indicate agreement or disagreement with each statement by placing a check mark at the response alternative that most closely reflected their opinion. Their perceptions and attitudes were measured by:

- **Positive perceptions:** the total score for all favored statements of the Exit Questionnaire with the same Likert Scale
- **Negative attitudes:** The total score for all not-favored statements of the Exit Questionnaire with the same Likert Scale.

Table 2. Distribution of participants

| | Male (N=32) | Female (N=29) | Total (N=61) |
|----------------------------|-------------|---------------|--------------|
| Computer Experience | | | |
| <i>None</i> | 0 | 0 | 0 |
| <i>Little</i> | 0 | 0 | 0 |
| <i>Average</i> | 9 | 11 | 20 |
| <i>Good</i> | 12 | 10 | 22 |
| <i>Excellent</i> | 10 | 9 | 19 |
| Internet Experience | | | |
| <i>None</i> | 0 | 0 | 0 |
| <i>Little</i> | 0 | 0 | 0 |
| <i>Average</i> | 12 | 10 | 22 |
| <i>Good</i> | 9 | 12 | 21 |
| <i>Excellent</i> | 10 | 8 | 18 |
| HTML Authoring | | | |
| <i>None</i> | 8 | 7 | 15 |
| <i>Little</i> | 9 | 11 | 20 |
| <i>Average</i> | 6 | 7 | 13 |
| <i>Good</i> | 8 | 5 | 13 |
| <i>Excellent</i> | 0 | 0 | 0 |

Procedure

All participants took part in the study in the same room at the same time, and they all interacted with the Web-based instructional program accessed using Microsoft’s Internet Explorer. The participants were asked to do the following activities:

1. Take the Pre-Test to ascertain levels of prior knowledge of HTML
2. Interact with the Web-based instructional program (i.e., HTML Tutorial)
3. Do a practical task, which involved constructing a Web page using HTML
4. Complete the Post-Test to identify learning performance
5. Fill out a paper-based exit questionnaire to describe their personal details and reflect on their opinions of the Web-based instructional program.

Data Analyses

To investigate how human factors influence student learning in the Web-based instructional program, the data obtained from Pre- and Post-Tests, practical tasks and the exit questionnaire were used to conduct statistical analyses to identify students’ learning experience. T-test was applied to examine the gender differences, and ANOVA was used to identify the differences among different levels of prior knowledge. In addition, Pearson’s correlation was employed to find the relationships between students’ learning performance and their perceptions and attitude. A significance level of $P < .05$ was adopted for the study. In addition, the

mean scores are employed to describe the learning outcome for each individual group.

DISCUSSION RESULTS

The participants (N=61) consisted of master’s students at Brunel University’s Department of Information Systems and Computing. Despite the fact that the participants volunteered to take part in the experiment, the sample is evenly distributed in terms of gender and system experience. There were 32 males and 29 females. The computer experience and Internet experience reported by the participants ranged from average to excellent on a five-point scale. Their familiarity with the subject content, *HTML authoring*, ranged from none to good. As shown in Table 2, there is the similar proportion of computer and Internet experience and HTML authoring in both male and female groups.

Table 3 describes the students’ overall learning performance. In terms of perceptions and attitudes, a majority of students (78%) felt that the Web-based instruction program was useful and they liked the Web treatment of the content.

Tasks vs. Tests

As indicated in Section 3, students needed to be assessed by both practical task and paper-based tests. It is important to note that both task and tests were markedly different. The distinctions between them are similar to those between open-book examination and closed-book examination. The practical task was completed in “open-book”

Table 3. Overall learning outcomes

| | Post Test | Gain Score | Task Score | Task Time |
|------|-----------|------------|------------|-----------|
| Mean | 10.4 | 7.7 | 6.5 | 46.5 |
| SD | 1.8 | 0.9 | 1.6 | 6.8 |

The Effects of Human Factors on the Use of Web-Based Instruction

examination style, with the students building their Web pages while being guided by the task sheet. The practical task could be completed successfully without recourse to memory by applying knowledge read from the screen at the particular time it was needed. On the other hand, the Post-Test looked like a closed-book examination, as it was a multiple-choice factual test that entailed recalling knowledge from memory and was completed after learning using the Web-based instructional program. These differences can also be associated with those between *procedural knowledge* and *declarative knowledge*. Derry (1990) distinguishes between these two, procedural being “knowledge how,” and declarative being “knowledge that.” Procedural refers to knowledge of how to do things, while declarative refers to knowledge about the world and its properties (McGilly, 1994). Practical tasks refer to procedure knowledge of how to use HTML, while paper-based tests refer to declarative knowledge about the properties of HTML.

Another interesting finding is that the students’ task scores were affected by the levels of their previous Internet experience and HTML authoring (Table 4). On the other hand, there were positive relationships between the students’ perceptions and attitudes and their Post-Test ($P < .05$) and Gain scores ($P < .01$). In other words, the students who had more positive perceptions toward the Web-based instructional program could obtain better Post-Test and Gain scores than those who had more negative attitudes toward the program.

This implied that performance on the practical task of applying procedural knowledge could be promoted by prior system experience in using the Internet and HTML authoring, but it would not be affected by the matching or mismatching of instruction with students’ preferences. Conversely, the ability to recall declarative knowledge appears to have been facilitated mainly by matching instructional presentation with learners’ preferences, but it is not influenced by

Table 4. Task score and prior knowledge

| Internet Experience | Excellent | Good | Average | Little | None |
|----------------------------|-------------------|-------------|----------------|---------------|-------------|
| Mean | 8.2 | 6.9 | 4.3 | N/A | N/A |
| SD | 1.9 | 1.6 | 0.7 | N/A | N/A |
| Significance | P < .01 | | | | |
| HTML Authoring | Excellent | Good | Average | Little | None |
| Mean | N/A | 8.4 | 7.2 | 6.0 | 4.2 |
| SD | N/A | 1.8 | 1.3 | 0.7 | 0.3 |
| Significance | P < .05 | | | | |

Table 5. Gender differences in learning outcomes

| | Post Test | Gain Score | Task Score | Task Time |
|---------------------------|-------------------|-------------------|-------------------|-------------------|
| Gender Differences | | | | |
| Female | | | | |
| Means | 12.4 | 9.3 | 4.5 | 35.5 |
| SD | 1.9 | 1.1 | 0.6 | 3.8 |
| Male | | | | |
| Means | 8.5 | 6.2 | 8.6 | 56.4 |
| SD | 0.8 | 0.7 | 1.8 | 7.8 |
| Significance | P < .01 | P < .05 | P < .01 | P < .01 |

prior system experience of using the Internet and HTML authoring.

Gender Differences

There were interesting correlations between the students' learning performance and their gender differences. Female students performed better than male students in the Post-Test. Conversely, the male students outperformed the female students in the practical task (Table 5). As indicated earlier, the differences between the Post-Test and practical task can be related with those between *declarative knowledge* and *procedural knowledge*. It implies that female students are better at acquiring declarative knowledge rather than procedural knowledge. Conversely, male students are skilled at gaining procedural knowledge instead of declarative knowledge.

For learning attitudes, the male students were patient in completing the task. On the other hand, the female students felt nervous doing the tasks, and some of them (N = 10) gave up doing the tasks within 15 minutes. In addition, the female students needed more guidance than the male students did. The female students tended to ask for instruction from the tutor, instead of trying to correct errors by themselves. These findings are in line with some previous studies, which found that males showed more interest in using and learning about computers while females reported fear of using computers and feeling helpless around them (Shashaani, 1994; Koch,

1994). For this phenomenon, educators should help female students build their confidence in facing the challenge of using computers, instead of giving too detailed instructions. In addition, educational settings should ensure that instructional programs should not place any students at a disadvantage due to their gender differences (Owen & Liles, 1998).

Prior Knowledge

Through analyzing students' prior knowledge, one thing seems evident: For doing practical task, students who had greater experience of using the Internet or HTML authoring seemed able to look for relevant information in an efficient way. Conversely, students who were lacking prior knowledge of the subject content needed more time to decide the learning paths for completing the task (Table 6). It seemed that students' existing knowledge did influence their interaction with the Web-based instructional program. These findings arguably supported results from previous studies (Shih & Gamon, 1999; Gay, 1986), which found there was a positive relationship between learner control and prior knowledge.

Expert learners who had an adequate amount of prior knowledge on the subject felt familiar with the interface and the contents of the Web-based instructional program, so they were confident about being more active when navigating the Web-based instructional system. On the other hand, novice learners might not be aware of the

Table 6. Prior knowledge and task time

| Task Time | | | | | |
|---------------------|-----------|------|---------|--------|------|
| Internet Experience | Excellent | Good | Average | Little | None |
| Mean | 39.2 | 44.5 | 54.4 | N/A | N/A |
| SD | 5.5 | 6.1 | 8.1 | N/A | N/A |
| Significance | P<.05 | | | | |
| HTML Authoring | Excellent | Good | Average | Little | None |
| Mean | N/A | 31.4 | 41.9 | 50.5 | 61.2 |
| SD | N/A | 3.2 | 4.3 | 5.9 | 7.3 |
| Significance | P<.05 | | | | |

best order to read the material or what the most important information was. Therefore, it is important to provide novice learners with an initial phase of orientation relating to both interface and domain contents (Linard & Zeillger, 1995). One way to do this is by providing visual paths, which can be displayed by means of cues to indicate how far students are along a path or by giving some conceptual description for the possible sequences. An alternative method is to provide good labels for the pages. Labels that clearly indicate the role of a particular page may help novices successfully decide the appropriate coherent path (Lewis & Polson, 1990).

Learning by Doing

In this Web-based instruction program, students were asked to do a practical task (i.e., designing a Web page with HTML). A significant number of students (44%) reported that doing the task was a useful way of helping them to set a focus in the Web-based instructional program. From this 44% of students, 52% of them obtained Post-Test scores above the average (=10.4) and 63% of them demonstrated more positive perceptions to the Web-based instructional program. These results implied that “learning by doing” could assist some students to set their effective learning strategies. As indicated by Smith and Parks (1997), tasks serve to simulate “goal directed” browsing in such a way that learning performance can be enhanced.

On the other hand, a few students (30%) reported that doing the task hindered their learning. They found that they lost other important information they needed to learn because they were concentrating on doing the task. From these 30% of students, 58% of them obtained Post-Test scores below the average and 54% of them showed more negative attitudes toward the Web-based instructional program. This raises some interesting questions for further studies: (a) whether task activities can facilitate promoting students’

learning performance in a Web-based instructional program; and (b) what the relationships are between students’ attitudes and their learning patterns as reflected in a Web-based instructional program with and/or without setting tasks.

CONCLUSION

The aforementioned findings provide evidence that Web-based instructional programs may not be suitable for all learners as an instructional methodology. Instructors must be aware of individual differences, such as gender and levels of prior knowledge possessed. Some learners—for example, novice learners—may need greater support and guidance from instructors, while others may be able to follow Web-based instructional programs relatively independently. Thus, instructors should not assume that every student would benefit equally from Web-based instructional programs in educational settings. There remains the need for guidance to ensure that all learners attain their learning potential.

Implementing Web-based instructional programs is a complex process composed of interactions among students, instructional content and the features of Web-based instructional programs. It is important for educational settings to have a good plan in advance. Instructors should remain cautious about making a sweeping decision to convert entire curricula onto Web-based instructional programs. The goals of such a process should be weighed against potential problems (e.g., alienating certain learners). To avoid alienating a certain group, instructors should continue to incorporate a number of different teaching strategies into their lectures. In addition, this transition requires time for the student and time in the classroom to acquaint students with Web-based instructional programs. This is especially the case for students who have difficulties in independent learning; there is a need to let them have a longer time for this shift. With this issue in mind, such innovation

in teaching and learning will be more meaningful and valuable.

This study has shown the importance of understanding individual differences in the development of Web-based instructional programs, but it was only a small-scale study. Further studies need to be undertaken with a larger sample to provide additional evidence. The other limitation is that this study adopted self-developed Pre- and Post-Tests, so the reliability and validity of these tests are questionable. Therefore, testing and modification of the tests are needed in the future. There is a need to conduct future research that would examine the impact of other individual differences, such as cognitive styles, cultural background or domain knowledge. Such research should also be conducted within a more sophisticated multimedia Web-based instructional program, including the presentation of animation and video. It would be interesting to see how individual differences influence student learning in multimedia Web-based instructional programs. The findings of such studies could be integrated to build robust user models for the development of personalized Web-based instructional programs that can accommodate individual differences.

REFERENCES

- Barua, S. (2001). An interactive multimedia system on "Computer Architecture, Organization, and Design." *IEEE Transactions on Education*, 44, 41-46.
- Burton, L., & Goldsmith, D. (2002). *Students' experience in online course: A study using asynchronous online focus groups*. Newington: Connecticut Distance Learning Consortium.
- Carter, E. W. (2002). Doing the best you can with what you have: Lessons learned from outcomes assessment. *Journal of Academic Librarianship* 28, 36-41.
- Chang, H.H., Henriquez, A., Honey, M., Light, D., Moeller, B., & Ross, N. (1998). *The Union City story: Education reform and technology students' performance on standardized tests*. New York: Center for Children and Technology.
- Chen, S.Y. (2002). A cognitive model for non-linear learning in hypermedia programmes. *British Journal of Educational Technology*, 33, 449-460.
- Chen, S.Y., & Ford, N.J. (1998). Modelling user navigation behaviours in a hypermedia-based learning system: An individual differences approach. *International Journal of Knowledge Organization*, 25(3), 67-78.
- Clark, R., & Lyons, C. (1999). Using Web-based training wisely. *Training*, 36(7), 51-61.
- Daugherty, M., & Funke, B.L. (1998). University faculty and student perceptions of Web-based instruction. *Journal of Distance Education*, 13(1), 21-39.
- Derry, S. J. (1990). Learning strategies for acquiring useful knowledge. In B.F. Jones & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 347-379). Hillsdale: Lawrence Erlbaum Associates.
- Ellis, R. D., & Kurniawan, S.H. (2000). Increasing the usability of online information for older users. A case study in participatory design. *International Journal of Human-Computer Interaction*, 12(2), 263-276.
- Evans, C., Gibbons, N.J., Shah, K., & Griffin, D.K. (2004). Virtual learning in the biological sciences: Pitfalls of simply putting notes on the Web. *Computers and Education*, 43, 49-61.
- Ford, N., & Miller, D. (1996). Gender differences in Internet perceptions and use. *Aslib Proceedings*, 48, 183-192.
- Gay, G. (1986). Interaction of learner control and prior understanding in computer-assisted video

- instruction. *Journal of Educational Psychology*, 78(3), 225-227.
- Hedberg, J.G., & Corrent-Agostinho, S. (2000). Creating a postgraduate virtual community: Assessment drives learning. *Educational Media International*, 37(2), 83-90.
- Hui, S., & Cheung, K.P. (1999). Developing a Web-based learning environment for building energy efficiency and solar design in Hong Kong. *Solar Energy*, 67(1-3), 151-159.
- Jonassen, D.H., & Grabowski, B.L. (1993). *Handbook of individual differences, learning, and instruction*. Hillsdale: Lawrence Erlbaum Associates.
- Ke, H., Kwakkelaar, R., Taic, Y., & Chenc, L. (2002) Exploring behavior of e-journal users in science and technology: Transaction log analysis of Elsevier's ScienceDirect OnSite in Taiwan. *Library & Information Science Research*, 24(3), 265-291.
- Khalifa, M., & Lam R. (2002). Web-based learning: Effects on learning process and outcome. *IEEE Transactions on Education*, 45, 350-356.
- Koch, M. (1994). No girls allowed! *Technos*, 3, 14-19.
- Last, D.A., O'Donnell, A.M., & Kelly, A.E. (2001). The effects of prior knowledge and goal strength on the use of hypermedia. *Journal of Educational Multimedia and Hypermedia*, 10(1), 3-25.
- Lewis, C., & Polson, P.G. (1990). Theory-based design for easily learned interfaces. *HCI*, 5, 191-220.
- Liaw, S.-S. (2002). An Internet survey for perceptions of computers and the World Wide Web: Relationship, prediction, and difference. *Computers in Human Behavior*, 18, 17-35.
- Linard, M., & Zeillger, G. (1995). Designing navigational support for educational software. *Proceedings of Human Computer Interactions* (pp. 63-78).
- McDonald, C. J., Stodel, E. J., Farres, L. G., Breithaupt, K., & Gabriel, M. A. (2001). The demand-driven learning model: A framework for Web-based learning, the Internet and higher education, 4(1), 9-30.
- McGilly, K. (1994). *Classroom lesson: Integrating cognitive theory and classroom practice*. Cambridge: MIT.
- Mitchell, T. J. F., Chen, S. Y., & Macredie, R. D. (2005). Hypermedia learning and prior knowledge: Domain expertise vs. system expertise. *Journal of Computer Assisted Learning*, 21, 53-64.
- Ng, W., & Gunstone, R. (2002). Students' perceptions of the effectiveness of the World Wide Web as a research and teaching tool in science learning. *Research in Science Education*, 32(4), 489-510.
- Owen, M. B., & Liles, R. (1998). *Factors contributing to the use of Internet by educators*. Retrieved from <http://outreach.missouri.edu/netc98/manuscripts/owen-liles.html>
- Power, D. J., & Roth, R. M. (1999). Issues in designing and using Web-based teaching cases. *Proceedings of the Fifth Americas Conference on Information System (AMCIS 1999)* (pp. 936-938).
- Quintana, Y. (1996). *Evaluating the value and effectiveness of Internet-based learning*. Retrieved from www.crim.ca/inet96/papers/c1/c1_4.htm
- Reed, W. M., & Oughton, J. M. (1997). Computer experience and interval-based hypermedia navigation. *Journal of Research on Computing in Education*, 30, 38-52.
- Roy, M., & Chi, M. T. C. (2003). Gender differences in patterns of searching the Web. *Journal of Educational Computing Research*, 29, 335-348.

Schwarz, J. (2001). *Lost in virtual space: Gender differences are magnified*. Retrieved October 15, 2002, from www.washington.edu/newsroom/news/2001archive/06-01archive/k061301.html

Shashaani, L. (1994). Gender differences in computer experience and its influence on computer attitudes. *Journal of Educational Computing Research*, 11(4), 347-367.

Shih, C., & Gamon, J. (1999). *Student learning styles, motivation, learning strategies, and achievement in Web-based courses*. Retrieved from <http://iccel.wfu.edu/publications/journals/jcel/jcel990305/ccshih.htm>

Smaldino, S. (1999). Instructional design for distance education. *Techtrends*, 43(5), 9-13.

Smith, & Parks. (1997). *Virtual hierarchies and virtual networks: Some lessons from hypermedia*

usability research applied to the World Wide Web. Retrieved December 4, 1998, from <http://ijhcs.open.ac.uk/smith/smith-nf.html>

Sridharan, K. (2004). A course on Web languages and Web-based applications. *IEEE Transactions on Education*, 47(2), 254-260.

Torkzadeh, G., & Van Dyke, T.P. (2002). Effects of training on Internet self-efficacy and computer user attitudes. *Computers in Human Behavior*, 18, 479-494.

Wang, S. R., & Jonassen, D. H. (1993, April). *Investigating the effects of individual differences on performance in cognitive flexibility hypertexts*. Annual Meeting of the American Educational Research Association. Atlanta, GA.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 19-35, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 5.34

Exploring the Rhetoric on Representing the User: Discourses on User Involvement in Academia and the IT Artifact Product Development Industry

Netta Iivari

University of Oulu, Finland

ABSTRACT

Users should be involved in information technology (IT) artifact development, but it is often difficult and rare, especially in the development of commercial IT artifacts for external use. This paper critically examines discursive construction of user involvement in academia and in the IT artifact product development industry. First, three academic discourses on user involvement are identified. Then, discursive construction of user involvement is explored in four IT artifact product development organizations, in which user involvement is indirect and labeled as usability work. Five discourses on usability work are identified. They are related to the academic discourses on user involvement, and some of them are criticized (Asaro, 2000) as “forms of technological colonialism,” merely “silencing the users” instead

of “giving them a voice.” It is recommended that especially the human-computer interaction (HCI) community should carefully reflect on what kinds of discourses on user involvement it advocates and deems as legitimate.

INTRODUCTION

This paper critically examines discursive construction of user involvement¹ both in academia and in industry; more specifically, in IT artifact² product development organizations, developing commercial IT artifacts for external use. Therefore, the focus is on the development context, a central research area in both information systems (IS) (Lyytinen, 1987) and HCI literature (Grudin, 1996). The focus is limited to the product development context (as contrasted with custom IS

development), which is a less studied context in IS research, but is the context in which the field of HCI emerged. In product development, commercial IT artifacts are typically developed for a large user population in a situation in which the users might be not known until the product is in market (Grudin, 1991a, 1991b; Keil & Carmel, 1995; Symon, 1998).

However, the product development context should also be considered a critical, even though a very challenging, context for user involvement. IT artefacts, whether developed in a custom IS or product development context, always condition, enable, facilitate and shape social practices. Altogether, they constitute the rules and resources available for human action (Grint & Woolgar, 1997; Orlikowski & Robey, 1991; Suchman & Trigg, 1991). Also, HCI literature highlights that IT artifacts impose new ways to work, which may be only implicitly designed, but anyhow delivered through the solution. However, an explicit redesign should always be carried out (Beyer & Holtzblatt, 1998; Cooper, 1999; Rosson & Carroll, 2002). Also in the product development context, development—explicitly or implicitly—constitutes the boundaries for the users' work practices, and in constituting the boundaries, an interest in the users seems critical.

Indeed, it has been widely accepted in both IS and HCI literature that users should be involved while developing IT artifacts. Participatory Design (PD) especially has been influential in emphasizing active user participation (Greenbaum & Kyng, 1991; Schuler & Namioka, 1993). In IS research, user participation has been a central topic for decades, currently legitimately labeled as an “old, tired concept,” which, however, needs revisiting (Markus & Mao, 2004). The field of HCI has addressed the importance of user involvement in approaches such as usability engineering (UE) and user-centered design (UCD) (Bannon, 1991; Cooper & Bowers, 1995; Gould & Lewis, 1985; Karat, 1997). However, in HCI, user involvement has traditionally been accomplished by “rep-

resenting the user” in development (Cooper & Bowers, 1995). This paper focuses on the rhetoric on “representing the user” in IT artifact product development organizations. The responsibility to “represent the users” is assigned to a group of specialists called, for example, usability/human factors/UE/UCD specialists in the literature (e.g., Aucella, 1997; Bias & Reitmeyer, 1995; Bødker & Buur, 2002; Borgholm & Madsen, 1999; Fellenz, 1997; Grønbaek et al., 1993; Mayhew, 1999b; Mrazek & Rafeld, 1992; Tudor, 1998; Vredenburg, 1999). The “representation work” carried out by the “user surrogates” is labeled usability work, in which user involvement is informative or consultative (Damodaran, 1996) at the most. Users comment on predefined design solutions or act as providers of information and objects of observation, but they do not actively participate in the design process nor do they have decision-making power regarding the design solution (Carroll, 1996; Damodaran, 1996).

I adopted a critical poststructuralist approach informed by Foucaultian tradition³ for the analysis of discourses on user involvement in IT artifact development. I critically examine discourses on usability work, referring to the ways usability work is constructed in practice—in the case organizations involved in this study, but also in academia—in the literature addressing usability work and, more generally, user involvement. Regarding the construction of user involvement in academia, it has been argued that user involvement is a very vague concept and there is a variety of views of what user involvement is and how it should be accomplished (Asaro, 2000; Carroll, 1996; Kujala, 2003). Furthermore, the influential role of academic communities in imposing meanings and particular “truths” to the social world has been emphasized (Clarke, 2001; Cooper & Bowers, 1995; Bloomfield & Vurdubakis, 1997; Finken, 2003; Foucault, 1972; Weedon, 1987). Some studies (Cooper & Bowers, 1995; Finken, 2003) have already examined HCI and PD in the Foucaultian spirit as discourses constructing

their objects of study (e.g., the users and the user interface) in particular ways and at the same time legitimizing their existence. This paper continues their work, but adds new insights by reviewing more recent literature and incorporating a product development perspective in the analysis.

Regarding user involvement in practice, existing literature has already warned that user involvement may be used only as a buzzword or weapon for achieving surprising or even paradoxical ends (Beath & Orlikowski, 1994; Catarci et al., 2002; Hirschheim & Newman, 1991; Howcroft & Wilson, 2003; Kirsch & Beath, 1996; Newman & Noble, 1990; Nielsen, 1999; O'Connor 1995, Robey & Markus, 1984; Symon, 1998). Some studies on discourses (e.g., Alvarez, 2002; Bloomfield & Vurdubakis, 1997; Nielsen, 1999; Sarkkinen & Karsten, 2005) have already analyzed discourses in IT artifact development, criticizing them for mainly reinforcing management agendas and goals. However, these studies have been carried out in the custom IS development context. There is a clear lack of both empirical studies and studies on discourses on user involvement in the challenging product development context. Therefore, this paper takes a step towards filling that gap by utilizing a poststructuralist approach informed by Foucauldian tradition. This approach has also gained increasing attention in IS research during recent years (Brooke, 2002; Clarke, 2001; Stahl, 2004), and empirical studies on discourses relying on Foucaultian tradition have proliferated (e.g., Doolin, 1999; Edenius, 2003; Sayer & Harvey, 1997; Thompson, 2003), even though none of them address discourses on user involvement in the challenging IT artifact product development context.

The paper is organized as follows: The next section outlines the poststructuralist approach utilized in this research effort. The third section identifies academic discourses on user involvement in both IS and HCI literature. The fourth section outlines the interpretive research approach utilized in the empirical part of this research

effort, the cases involved in this study, and the procedures of data gathering and analysis. The fifth section presents the discourses on usability work identified in the empirical material. The discourses are related to particular organizational settings, but also to the wider discursive field in which the academic IS and HCI communities participate and contribute. The final section discloses the central observations of the paper, discusses their implications and outlines paths for future work.

POSTSTRUCTURALIST APPROACH

I rely on a critical poststructuralist approach informed by Foucaultian tradition⁴ in the analysis of discourses on user involvement. Within this approach language, subjectivity and power are central notions. Language is in a critical position: It is assumed that language does not represent reality, but produces it. It is maintained that all prevalent definitions are constructed in language. Furthermore, different languages and different discourses using the same language produce different kinds of realities (Weedon, 1987, 2004). Discourses are “certain ways of speaking” that “systematically form the objects of which they speak” (Foucault, 1972, p. 49). Foucault highlights the importance of power in the analysis of discourses. Knowledge and power are both articulated in discourses (Foucault, 1972; Weedon, 2004). Discourses also compete with each other and struggle over meanings in language. There is a quest to disseminate the preferred understandings of the world (Fairclough & Wodak, 1997; Foucault, 1972, Weedon, 1987).

Discourses are both socially constructed and socially constructive. Discourses construct our identities and our objects of knowledge (Fairclough & Wodak, 1997; Weedon, 2004). Poststructuralism assumes subjectivity to be fragile, contradictory and constantly constituted

in discourses (Weedon, 1987, 2004). Discourses offer individuals subject positions that must be occupied if participating in the discourses (Foucault, 1972, pp. 118-119; Foucault, 1980). People are continuously persuaded as subjects in the discourses that constitute individuals as “subjects of a certain kind.” However, people do not only adopt the discourses and the subject positions offered to them, but the discourses can also be questioned and challenged (Weedon, 1987, 2004). Nevertheless, some discourses are more available and influential than others. On the other hand, one needs to acknowledge also that access to the discourses might be limited, and not all individuals have the right to participate in a discourse (Foucault, 1972; Weedon, 1987).

Based on this discussion, guidelines for the analysis of discourses on user involvement are outlined. First, it is important to analyze the formation of objects. One needs to analyze the statements that constitute the objects (e.g., users and the practice of involving them) in discourses. One needs to focus on “certain ways of speaking” that exclude other ways. Foucault maintains that “everything is never said” and “few things are said of the totality.” Therefore, one needs to concentrate on statements that have emerged excluding others. Second, one needs to analyze the subject positions individuals must occupy to take part in a discourse—both as speakers and as listeners (i.e., subject positions offered to and adopted by the researchers and practitioners advocating user involvement, involving the users or being involved as users). Discourses invite people as subjects into the discourses. However, it is also important to acknowledge that access might be limited and only a limited amount of individuals may be allowed to adopt the subject position and consequently participate in the discourse. The analyst needs to ask: Who has the right to speak, the ability to understand, access to the discourses and the capacity to invest the discourse in decisions, institutions, practices? (Foucault, 1972, 1980).

DISCOURSES ON USER INVOLVEMENT IN ACADEMIA

As mentioned, it is widely accepted that users should be involved while developing IT artifacts, but there is considerable confusion about the concept of user involvement, which can range from active user participation to the involvement of users as only providers of information and objects of observation (Asaro, 2000; Barki & Hartwick, 1994; Carroll, 1996; Cavaye, 1995; Karat, 1997; Kujala, 2003). First, HCI literature on user involvement that addresses the challenging product development context is reviewed.

The Practical HCI Discourse

Cooper and Bowers (1995) have analyzed HCI literature as a discourse, and show how HCI legitimizes its existence by constructing its objects—users and the user interface—in particular ways. They separate a first wave and a second wave of HCI discourses. The first wave of HCI discourse used a “compassionate rhetoric to advocate user-centered design”: HCI was needed since it “represents the users,” who form an ignored group in systems design and computer science. In some texts, even a “political and war discourse” was used—HCI was needed to fight for the users. However, “crisis rhetoric” emerged in the beginning of the 1990s. This second wave of HCI discourse did not criticize the designers⁵ or the computer scientists, but the first wave of HCI discourse (Cooper & Bowers, 1995, pp. 48-57). HCI was accused of not producing useful results. Furthermore, HCI was criticized of postulating users only as “human factors,” not as ‘human actors’; that is, as active agents working and using the computer systems in particular settings (Bannon, 1991). It was criticized that HCI should involve the users, not only represent them. Claims for more user involvement and for contextual inquiries were expressed (Bannon, 1991; Cooper & Bowers, 1995; Rosson & Carroll, 2002). Interest

also emerged related to the place of HCI in the design process and to the relationship between HCI and designers. Cooper and Bowers (1995) argue that currently there is a trend in HCI to empower the designers who are postulated as users of HCI. They claim HCI is always empowering someone, but there has been a shift from users to designers (Cooper & Bowers, 1995).

Next, recent HCI literature addressing user involvement in organizations is reviewed. This literature consists of very practical HCI textbooks and articles addressing issues such as how to “design quality HCI” and “make your organization user-centric.” This discourse is labeled as a *practical HCI discourse*. The speaker is positioned as a *consultant* and a *change agent*, offering advice on this quest. This discourse constitutes usability work, in which user involvement is indirect⁶. There are to be “user surrogates” (called usability specialists from now on) “representing the users in development” (Aucella, 1997; Bias & Reitmeyer, 1995; Cooper 1999, Fellenz, 1997; Grønbaek et al., 1993; Mrazek & Rafeld, 1992; Nielsen 1993, Tudor, 1998; Vredenburg, 1999); that is, direct user involvement is not within the scope of this discourse. Usability specialists are offered a subject position of *a user surrogate representing (if not fighting for) the user in development*. However, this has proven to be very challenging—the position of the usability specialists is articulated as problematic (Aucella, 1997; Bias & Reitmeyer, 1995; Borgholm & Madsen, 1999; Gould & Lewis, 1985; Mayhew, 1999a, 1999b; Rosenbaum et al., 2000). Some even label their work as a “battle” (e.g., Bloomer & Croft, 1997; Mulligan et al., 1991) to highlight the challenge. All said, the legitimacy of this discourse is established this way.

Another position assigned to usability specialists is that of *a user surrogate involving the designers*, by manipulating and seducing them to “buy into usability work.” The designers are postulated as a very important target group (Aucella, 1997; Bloomer & Croft, 1997; Bekker

& Vermeeren, 1996; Boivie et al., 2003; Cooper, 1999; Grudin, 1991b; Fellenz, 1997; Mayhew, 1999a, 1999b; Mrazek & Rafeld, 1992; Muller & Carey, 2002; Nielsen, 1993; Seffah & Andreevskaia, 2003; Tudor, 1998; Vredenburg, 1999) who should be involved in usability work (Aucella, 1997; Billingsley, 1995; Bloomer & Croft, 1997; Fellenz, 1997; Gardner, 1999; Tudor, 1998). They should be involved early so the activities affect the design (Aucella, 1997; Gardner, 1999; Grudin, 1991a, 1991b; Muller & Czerwinski, 1999). Altogether, project teams should “buy into usability” (Aucella, 1997; Mrazek & Rafeld, 1992) and the teams should perceive usability specialists as team members and allies (Bias & Reitmeyer, 1995; Fellenz, 1997; Mayhew, 1999a, 1999b; Muller & Carey, 2002; Rosenbaum et al., 2000). As one can see, Cooper and Bowers (1995) succeeded in predicting this trend of “HCI empowering the designers instead of the users.”

In addition, usability specialists are to act as *user surrogates, producing guidelines, tools, methods and processes that prescribe usability work*. The literature highlights creation of documentation of best practices, methods and techniques for usability work (Aucella, 1997; Bekker & Vermeeren, 1996; Fellenz, 1997; Mayhew, 1999b; Muller & Czerwinski, 1999) and integration of usability work into the formal development process (Boivie et al., 2003; Butler, 1996; Fellenz, 1997; Mayhew, 1999a, 1999b; Nielsen, 1993; Vredenburg, 1999) as important. Furthermore, usability specialists are positioned as *change agents that address many different target groups*—management, documentation, training, marketing, different kinds of change and improvement efforts—in their organization. Management’s commitment is postulated as an important criterion for success (Beyer & Holtzblatt, 1998; Bias & Reitmeyer, 1995; Billingsley, 1995; Boivie et al., 2003; Cooper, 1999; Grudin, 1991b; Fellenz, 1997; Mayhew, 1999b; Mrazek & Rafeld, 1992, Nielsen, 1993). A high-level champion allows usability work to have authority, autonomy and access to develop-

ment (Beyer & Holtzblatt, 1998; Billingsley, 1995; Boivie et al., 2003; Nielsen, 1993). Furthermore, usability specialists should be perceived as allies of different kinds of improvement initiatives in organizations (Bloomer & Croft, 1997; Mayhew, 1999a). In addition, marketing, training and documentation should be addressed and cooperation initiated. In all, usability specialists should be able to tailor their message and present their results in languages that each target group understands (Beyer & Holtzblatt, 1998; Billingsley, 1995; Bloomer & Croft, 1997; Cooper, 1999; Hutchings & Knox, 1995; Grudin, 1991b; Mayhew, 1999a, 1999b; Rosenbaum et al., 2000; Seffah & Andreevskaia, 2003).

In all, usability specialists are supposed to seduce and manipulate a multitude of stakeholder groups to “buy into usability.” The literature argues that usability work should be “sold” into organizations (Mayhew, 1999a, 1999b). Presentation of the things done and the results achieved is recommended (Aucella, 1997; Beyer & Holtzblatt, 1998; Cooper, 1999; Mayhew, 1999b; Muller & Czerwinski, 1999; Rosenbaum et al., 2000; Tudor, 1998). One should also be able to show the benefits achieved (Cooper, 1999; Mayhew, 1999a, 1999b; Rosenbaum et al., 2000). The business perspective is highlighted (Beyer & Holtzblatt, 1998; Bloomer & Croft, 1997; Cooper, 1999; Fellenz, 1997; Mayhew, 1999a, 1999b; Rosenbaum et al., 2000)—usability work should make sense from the business perspective and be related to key business goals (Beyer & Holtzblatt, 1998; Bloomer & Croft, 1997; Cooper, 1999; Fellenz, 1997). Consideration of costs and benefits is also recommended, since cost-benefit tradeoffs may play a major role in the adoption of usability work (Mayhew, 1999b; Nielsen, 1993; Vredenburg et al., 2002). Resources should be well planned and budgeted (Aucella, 1997; Mayhew, 1999b; Nielsen, 1993) to assure that usability work does not increase development costs and time (Bloomer & Croft, 1997; Nielsen, 1993).

Altogether, a competitive advantage and competitiveness in the marketplace achievable through usability work are emphasized. “Selling usability work into organizations” by highlighting the business point of view and cost benefit analyses, and by using the language that sales, marketing and management understand, is advocated. Within this discourse, an ideology of managerialism is evident; management goals are constructed as the main motivator for usability work. The discourse emphasizes profit maximization, work intensification and successful implementation achievable through usability work (c.f., Asaro, 2000; Hirschheim & Klein, 1989; Spinuzzi, 2002).

The Reflective PD Discourse

However, the practical HCI discourse on usability work is by no means the only discourse advocating user involvement in IT artifact development. There is literature in proximity to HCI, but clearly separating itself from “mainstream HCI.” In this literature, critique is addressed to “traditional HCI methods,” especially usability testing. It is criticized for restricting understanding of problems, limiting dialog, inhibiting cooperation between designers and users, having a weak impact on design, and advocating neutrality and objectivity (Bannon, 1991; Beyer & Holtzblatt, 1998; Borgholm & Madsen, 1999; Buur & Bagger, 1999; Bødker & Buur, 2002; Carroll, 1996; Cooper, 1999; Gardner, 1999; Kyng, 1994; Löwgren, 1995). Therefore, this literature separates itself from non-reflective, objectivist HCI and positions itself within the PD tradition, even though acknowledging there might be a need for some kind of “facilitators” (usability specialists, researcher designers) between users and designers.

This literature argues for more cooperative work and reflection related to design practice. The literature maintains that design should be seen as cooperative work, in which people with different competencies appreciate each other and

jointly create new work practices. Design needs to be seen as a creative and communicative process involving “mutual reciprocal learning” and “design by doing.” Usability specialists need to support everyone’s participation and make everyone comfortable in participating (Anderson & Crocca, 1993; Beyer & Holtzblatt, 1998; Blomberg & Henderson, 1990; Brun-Cottan & Wall, 1995; Buur & Bagger, 1999; Bødker & Buur, 2002; Bødker & Iversen, 2002; Bødker et al., 2000; Gadner, 1999; Kyng, 1994, 1998; Löwgren, 1995; Rosson & Carroll, 2002). Furthermore, emphasis should be on reflection and improvisation. It is argued that PD should not consist of applying decontextualized methods. Instead, professionalism, reflection and creativity are important. One should reflect on methods and challenge their assumptions. One should ask: Why do we do PD and where do we want to take it? (Anderson & Crocca, 1993; Bansler & Bødker, 1993; Beyer & Holtzblatt, 1998; Bødker & Buur, 2002; Bødker & Iversen, 2002; Clement & Van den Besselaar, 1993; Cooper, 1999; Löwgren, 1995; Löwgren & Stolterman, 1999; Thoresen, 1993).

This discourse is labeled as *reflective PD discourse* in which the participatory and cooperative nature of the design process is highlighted. Furthermore, the focus is on creation of new work practices—a term that makes a distinction with HCI, which mainly aims at developing *usability*. The speakers within this discourse have adopted the subject position of a *reflective research designer*. This discourse legitimizes its existence by differentiating itself from objectivist, non-reflective HCI (and IS). In this discourse, users are positioned as skillful partners in the design process. The usability specialists, if needed at all, are positioned as “*reflective facilitators of cooperation and reflection among users and designers*.”

This discourse has a clear background in the tradition labeled as the PD or cooperative design tradition (i.e., Greenbaum & Kyng, 1991; Schuler & Namioka, 1993). Finken has analyzed this coop-

erative design tradition as a discourse constructing its objects of study in particular ways and at the same time legitimizing its existence. Finken shows that this discourse constitutes IT artifact development, users and (researcher) designers in a specific way divergent from other traditions. The tradition constructs itself as empowering and other traditions (functional, socio-technical) as hegemonizing—serving the needs of the management. The cooperative design tradition postulates organizations and IT artifact development as conflict-laden, and researcher designers on the side of the oppressed. They should act as advocates of democracy. Design, on the other hand, is postulated as cooperative work that necessitates mutual reciprocal learning. Reality is postulated as socially constructed. Users and researcher designers are positioned as experts whose cooperation as equal partners is needed (Finken, 2003). However, cooperative design in Finken’s article includes both developments during the 1990s (i.e., Greenbaum & Kyng, 1991) and the Scandinavian trade unionist tradition (term derived from Hirschheim et al., 1997; Iivari & Hirschheim, 1996), on which cooperative design tradition is based. However, clear differences can be revealed between the Scandinavian trade unionist and cooperative design traditions, even though the latter is an outgrowth of the former. These differences are discussed next.

The Critical IS Discourse

The Scandinavian trade unionist tradition has been postulated as a very critical and management-hostile tradition in IT artifact development. This tradition focused on workplace democracy and trade union involvement in the development of IT artifacts. The tradition had a strong Marxist flavor and relied on the notion of conflict between capital and labor (Asaro, 2000; Bjerknes & Bratteteig, 1995; Bansler, 1989; Bansler & Kraft, 1994; Clement & Van den Besselaar, 1993; Hirschheim et al., 1997; Iivari & Hirschheim, 1996; Kraft

& Bansler, 1994; Kyng, 1998; Spinuzzi, 2002). The goal of user involvement was democratic empowerment of the users, which maintains that workers should be able to participate in decision-making in their workplace (Clement, 1994). However, in recent years, political issues have decreased in importance and the current outgrowth of this tradition has been labeled as PD or cooperative design. During this trajectory, the focus has shifted from industrial democracy to the cooperative design process, from political to ethical and from structured institutions (trade unions) to situated, local action, even though the ethical responsibilities of the designer still remain as important (Asaro, 2000; Bansler & Kraft, 1994; Beck, 2002; Bjerknes & Bratteteig, 1995; Blomberg & Henderson, 1990; Bødker, 1996; Clement & Van den Besselaar, 1993; Gärtner & Wagner, 1996; Kraft & Bansler, 1994; Hirschheim et al., 1997; Iivari & Hirschheim, 1996; Kyng, 1998; Robertson, 1998; Spinuzzi, 2002).

Related to this discussion, one can argue that the *reflective PD discourse* in which the participatory and cooperative nature of the design process is highlighted clearly bases its argument on the current cooperative design tradition, and in this discourse political issues have decreased importance. On the other hand, in some studies in IS literature, the political issue clearly endures. First, studies criticizing user involvement only as a buzzword or a weapon (Beath & Orlikowski, 1994; Hirschheim & Newman, 1991; Howcroft & Wilson, 2003; Kirsch & Beath, 1996; Newman & Noble, 1990; Nielsen, 1999; Robey & Markus, 1984; Symon, 1998) can be interpreted to employ a critical stance. Many studies also highlight the influence of politics and conflicts in IT artifact development (Alvarez, 2002; Bansler & Bødker, 1993; Beck, 2002; Bjerknes & Bratteteig, 1995; Bødker, 1996; Gärtner & Wagner, 1996; Hirschheim & Klein, 1994; Howcroft & Wilson, 2003; Kirsch & Beath, 1996; Newman & Noble, 1990; Nielsen, 1999; Sarkkinen & Karsten, 2005;

Symon, 1998). Of these studies, some have adopted a clearly trade unionist, management-hostile position (Bjerknes & Bratteteig, 1995; Gärtner & Wagner, 1996; Howcroft & Wilson, 2003). Related to this, it is also argued that IS researchers, instead of defining better IT artifact development methodologies and accepting the managerialist agendas of IT artifact development, should carefully analyze this conflictual and political context and question the agendas (Howcroft & Wilson, 2003). One should focus on dominance, power, marginality and exclusions both in IT artifact development and use (Beck, 2002).

This discourse is labeled as a *critical IS discourse*, in which the speaker is positioned as a *warrior, partisan or emancipator* (Hirschheim & Klein, 1989) fighting on the side of the oppressed against the oppressors. Workers are viewed as oppressed and in need of emancipation. Usability specialists are offered no position within this discourse, since users need to be active agents in the design process, having power to make decisions regarding the design solution (Damodaran, 1996). They are not to be “represented.” Altogether, this discourse clearly relies on a critical tradition; conflict between capital and labor and emancipation of the workers is emphasized (c.f., Asaro, 2000; Hirschheim & Klein, 1989; Spinuzzi, 2002).

However, in this literature, the target of criticism is not HCI, but IS literature (as well as apolitical PD); traditional systems development methodologies (“prescriptive IS literature”) relying on functionalist paradigm (Hirschheim & Klein, 1989; Kirsch & Beath, 1996) as well as capitalist approaches and methods claiming to involve or empower users/workers popular especially in North America (Asaro, 2000; Bansler & Craft, 1994; Beck, 2002; Beath & Orlikowski, 1994; Carmel et al., 1993; Hirschheim & Newman, 1991; Kraft & Bansler, 1994; Kyng, 1998; Robertson, 1998; Spinuzzi, 2002) are under attack. They are accused of being apolitical, neglecting the role of conflict and only serving management

goals (Asaro, 2000; Bansler & Bødker, 1993; Beck, 2002; Beath & Orlikowski, 1994; Bjercknes & Bratteteig, 1995; Hirschheim & Newman, 1991; Howcroft & Wilson, 2003; Finken, 2003; Kirsch & Beath, 1996; Newman & Noble, 1990; Spinuzzi, 2002).

This section identified three academic discourses on user involvement: a practical HCI discourse, reflective PD discourse and critical IS discourse. The practical HCI discourse is discussed in detail, since the empirical part of this paper focuses on user involvement in the product development context, and user involvement in this context is “mainstream HCI usability work.” The critical IS discourse, on the other hand, provides an interesting contrast to the practical HCI discourse identified. Finally, the reflective PD discourse can be argued as “building a bridge” between the academic communities of IS and HCI, since in both communities extensive interest in PD emerged during the 1990s and abundant references to PD have been made. However, the list of discourses on user involvement is by no means exhaustive; there is a multitude of discourses on user involvement to be identified in both HCI and IS literature. Nevertheless, these discourses all construct user involvement in coherent and yet divergent manners—there is a set of rules defining what is legitimate to say about user involvement within each discourse. Furthermore, the discourses offer distinct subject positions for the speakers (HCI and IS researchers) and the listeners (users, usability specialists and designers). However, it needs to be remembered that discourses are always fluid—“their edges are not demarcated and the researchers do not cluster around a prototype, but instead gather at the crossroads” (Deetz, 1996, p. 199).

Next, while discourses on user involvement are reviewed in a set of IT artifact product development organizations, they are also contrasted with the discourse on user involvement identified in this section.

RESEARCH DESIGN

Research Approach

In the empirical part, a case study method is utilized to examine “a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups or organizations). The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used” (Benbasat et al., 1987, p. 370). This method is recommended if little is known about the investigated phenomenon or current perspectives have little empirical evidence, conflict with each other or with common sense (Eisenhardt, 1989). Related to user involvement in the product development context, the challenging nature and the lack of empirical studies have already been brought up.

More specifically, this research effort is an interpretive case study in which we assume that our knowledge of the world is gained through social constructions, and we attempt to understand and make sense, not explain in the predictive sense. The focus is on meanings attached to the studied phenomenon. Theories are used only as sensitizing devices (Denzin & Lincoln, 2000; Klein & Myers, 1999; Walsham, 1995). An interpretive case study method, thus, is suitable for studying how user involvement is constructed in the challenging and currently empirically weakly explored product development context. This is needed also since it has been shown that a variety of meanings can be associated with user involvement in practice. Therefore, in focus are the meanings attached to user involvement in the discourses, in which the organizational members participate and contribute.

Furthermore, the focus on discourses emphasizes that this research is not about “true facts” about what user involvement is, how it is carried out and why it is carried out, but about critically

analyzing and revealing how “truths” are constructed in the cases. The adopted epistemological stance is labeled as “weak social constructivism.” Social constructivism rejects a naive realist view of representation “that assumes meanings” are fixed entities that can be discovered. “A weak version assumes that there might still be better and worse interpretations, but a strong version rejects even that, maintaining that “truth” is always produced by particular interpreters and should always be analyzed with suspicion (Schwandt, 2000, pp. 197-200). I view the empirical material to represent a process of reality construction. Then, the material is not assumed to “tell the truth,” but it tells how the “natives” are trying and willing to represent “their truth.” However, I don’t go far in reflecting on my role as a producer of these results (truths) and as an interpreter with particular biases. Therefore, the label “weak” is needed.

Case Description

The cases are four product development units (case units A-D) from four IT artifact development companies. Units A and D are organizational units of large global corporations, units B and C of small- to medium-size enterprises (SMEs). Access to the units was gained through a research project about facilitating usability work in IT artifact development organizations in which the units participated. The units all had a strong background in usability work and/or an interest in facilitating it.

Unit A has “a few years” background in usability work. There are four usability specialists in the unit. Usability work in unit B has been part of development for more than 10 years. There was a group of usability specialists in the unit, but only one was left at the time of the study. Unit C has very little background in usability work. There is one usability specialist in the unit. She has carried out usability work mainly as student work. Finally, usability work in unit D has been in a central position since the establishment of the

unit. There is a group of professional, experienced usability specialists in the unit.

The cases were chosen for theoretical reasons to provide examples of polar types in the sense that units A and D are parts of large, global corporations, while units B and C are parts of small IT artifact development companies. In addition, the units’ backgrounds in usability work clearly differed, from more than 10 years (B) to only a couple of years (A) to almost no experience at all (C).

The practical ways of involving the users resembled the consultative and informative types in all the case units. The users did not participate nor did they have decision-making power in the design process. The usability specialists “represented them in development.” The usability specialists had carried out customer visits (interviewed and observed the users) and evaluated design solutions by using methods such as laboratory usability testing, paper prototyping and different kinds of usability inspection methods. Users were involved as providers of information and objects of observation (c.f., Bannon, 1991).

Data Gathering

The research material was gathered over a period of 3 years. Process data related to usability work was continuously gathered. Process data refers to the “stories about what happened and who did what when—that is, events, activities and choices ordered over time” (Langley, 1999, p. 692). The material was gathered while conducting process assessments in the units and while supporting the units in the facilitation of usability work by offering workshops and training. In the process assessments, units’ personnel were interviewed about their ways of working in a selected project, and it was examined whether usability work was carried out in the projects. The research team also had regular meetings with the personnel. The minutes of the meetings, assessment reports and all e-mail correspondence were saved for the

Exploring the Rhetoric on Representing the User

purposes of research. The research team also kept field notes after each joint event.

In addition, contextual data was gathered from the units. We experimented with multiple methods for data gathering to gain grounded insights and to clarify the meanings attached to the phenomenon studied (Benbasat et al., 1987; Denzin & Lincoln, 2000; Eisenhardt, 1989). First, we experimented with organizational culture surveys and gathered quantitative data from the units. Afterwards, we interviewed personnel and gathered feedback from survey results. We interviewed both the usability specialists and people whose work is directly related to the units' core mission. In the interviews, we discussed the context for and the process of usability work. An interview results report was produced. Afterwards, we organized workshop sessions in which we discussed and evaluated the interview results. The results report was updated after the sessions. Finally, we organized additional workshop sessions in which the results gained through the different techniques for data gathering were compared and contrasted with the results of the other units. In addition, before the workshop sessions, we went

through all the memos, e-mails, field notes and assessment reports produced. From this material we listed all usability activities carried out in the units, all reported problems related to the activities and all preferences expressed for future actions. We presented this material to allow the participants to also comment on that material. Therefore, the technique of member checking was utilized extensively. Data gathering related to the case units is summarized in Table 1.

Data Analysis

Analysis of qualitative data is a difficult and not much codified phase in interpretive research. Qualitative research that imitates the positivist tradition aims to make qualitative research rigorous; and formalized, rigorous qualitative methodologies have been defined. However, interpretive research seeks for emic meanings held by the people within the cases studied. Researchers typically have a large amount of qualitative data that is not mechanically manipulable. In addition, analysis is always a creative process: The insights and imagination of the researcher

Table 1. Summary of data gathering and case units

| Unit | Process Data | Contextual Data | Description of the Unit |
|------|---|--|---|
| A | Process assessment documentation, unit's internal documentation, memos and e-mails, field notes, interviews | Organizational culture surveys, interviews, workshop 1, workshop 2 | IT artifact product development unit of a large global corporation, a few years' background in usability work |
| B | Process assessment documentation, unit's internal documentation, memos and e-mails, field notes, interviews | Organizational culture surveys, interviews, workshop 1, workshop 2 | IT artifact product development unit of a SME, background in usability work for more than 10 years |
| C | Process assessment documentation, unit's internal documentation, memos and e-mails, field notes, interviews | Organizational culture surveys | IT artifact product development unit of a SME, very little background in usability work |
| D | Process assessment documentation, unit's internal documentation, memos and e-mails, field notes | Organizational culture surveys, interviews, workshop 1, workshop 2 | IT artifact product development unit of a large global corporation, many years' background in usability work |

are always needed (Denzin & Lincoln, 2000; Eisenhardt, 1989; Klein & Myers, 1999; Langley, 1999; Walsham, 1995). Altogether, interpretive practice is always artistic, political and creative (Denzin & Lincoln, 2000). However, interpretive research also aims at generalizations and abstractions. It is argued that the particularities in empirical data should be related to more abstract categories and concepts (Klein & Myers, 1999). Generalizations in interpretive research can be of different types, but generally one can state that they are “explanations of particular phenomena derived from empirical interpretive research in specific ... settings, which may be valuable in the future in other organizations and settings” (Walsham, 1995, p. 79).

Regarding data analysis in this research effort, I viewed the material as discourses adopted, adapted, produced and reproduced by the personnel of the case units. I searched for recurrent themes in the material—on the level of language use—related to usability work, paying special attention to who says what, why and when. We critically examined the material over and over again to reveal the construction of meanings related to the usability work in each unit. The focus was on systematic ways of language use related to usability work, as well as on subject positions occupied by the speakers that constitute the speakers as subjects “of a certain kind” in relation to usability work. Afterwards, similarities and differences in language use were identified between the cases. Altogether, the systematic ways of language use and the associated subject positions emerged from the empirical material after several rounds of reading through the material.

DISCOURSES ON USER INVOLVEMENT: IN INDUSTRY

Usability Work as a Tradition

First of all, it was evident that all the case units emphasized that “taking the users into account”

is important. In unit A, the manager has strongly emphasized this, as in other units, also:

When 2 years ago I went to (another) unit to present myself, they asked me how many usability people there is in our unit. I said 20; the whole team. (Laughing) They started crying in the (other) team. ... I don't even doubt; I'm sure our group has a positive attitude towards this job. (Manager, A)

The path has been smoothed a lot probably because management has had such a positive attitude and has marketed this thing (usability work). (Usability specialist, A)

Unit B is positioned as a “pioneer” in usability work by the management:

From the viewpoint of the image of the company, one of our goals is to be a pioneer. (Executive, B)

This is visible also in the way the usability issues have been acknowledged. We were the first ones who started it. It's not only related to the technology. (Manager, B)

Also unit C is argued as having “this kind of culture”:

Our products are easy to use from the point of view of the users. So it (user-centeredness) has been there, even though not systematically. ... We have tested, not usability, but similar kinds of things. We have had these; representatives of customers have gone through these and thought about these issues. And ergonomics and things like that have been a starting point for industrial design. It is a kind of culture in this firm. (Manager, C)

Finally, usability work is positioned as “our bread and butter” in unit D:

Exploring the Rhetoric on Representing the User

We have this general rule that the specification is to be carried out by using user-centered methods. ... This should be our bread and butter, user-centered design methods and usability. (Usability specialist, D)

The whole unit should have it as a kind of guiding light (usability as our bread and butter) that directs all our efforts. (Project manager, D)

Management in all the case units highlights the importance of usability work; that is, they are positioned as friendly allies that appreciate usability work. This discourse illustrates that in the case units, the importance of “usable products” and user orientation have been acknowledged—as is the case also in HCI literature, in which “the rhetoric on representing the user,” as mentioned, has been crucial as a whole for the legitimacy and identity of the field (Cooper & Bowers, 1995). However, the critical IS discourse warns us that user involvement might be used only as a slogan or buzzword (e.g., Catarci et al., 2002; Hirschheim & Newman, 1991; Kirsch & Beath, 1996; Nielsen, 1999; Symon, 1998; Tudor, 1998). From this viewpoint, this discourse can be suspected of being only rhetoric without any aim to actually involve the users. However, next we will review arguments that offer motives for assigning usability work such a central position.

Usability Work as an Image Factor and a Selling Argument

Within the second discourse, meanings influenced by a clearly business-oriented viewpoint are assigned to usability work. Usability work is deemed useful since it can be used as an image factor and a selling argument—it can be used to address and manipulate the customer. In unit B, both the usability specialists and managers acknowledge this:

I think [user-centeredness] has been a selling argument and a thing that we have had, but not

necessarily the competitors. We have been most progressive in this respect. (Team leader, B)

If we talk about our strengths as a company, we don't talk only about customer-centeredness, but we say we have this competence; we have behavioral scientists, research and cooperation with universities. ... Because this is quite exceptional. (Executive, B)

This applies also in unit C:

Eric (manager) told me the basic reasons why we would participate [in the facilitation of usability work]. We need to be more convincing in the eyes of the customer. That way, we could dictate some things, for example UI (user interface) issues. The project would offer facts which could enable us to do that. ... Improvement of our company's image is one of the main reasons why we participate in this project. (Usability specialist, C)

Customers do not know what is good for them. The company has to convince the customers that the company knows better. One way to do that is to appeal to the fact that the company participates in the university project dealing with usability issues. This might give authority to the company in relation to the customer. (Field notes, C)

Also in IS literature, user involvement has been constructed as useful in overcoming resistance and ensuring acceptance (Nandhakumar & Jones, 1997)—the customers as well as the users need to be convinced that the “company knows better.” Within this discourse, the capitalist management orientation is evident: Profit maximization and a competitive advantage achievable through user involvement (Asaro, 2000; Spinuzzi, 2002) are highlighted. Related to this, this discourse can be criticized as a “realization of Scandinavians' worst fears” (Spinuzzi, 2002), since the original aim of user involvement—democratic empowerment of the oppressed worker (Clement, 1994)—is totally missing. On the other hand, the practical HCI

discourse clearly advocates this kind of discourse while emphasizing the business benefits achievable through usability work (Beyer & Holtzblatt, 1998; Bloomer & Croft, 1997; Cooper, 1999; Feltenz, 1997; Mayhew, 1999a, 1999b; Rosenbaum et al., 2000).

From the managerial point of view, this seems to be a tempting discourse on usability work, positioning the speaker as a “business and profit-oriented utilizer of usability work.” From the usability specialists’ viewpoint, on the other hand, this can be seen as a discourse to utilize as a change agent, “selling usability work into the development organization” (Bloomer & Croft, 1997; Mayhew, 1999a; Rosenbaum et al., 2000).

However, one can also criticize this discourse as being mere rhetoric without any aim to actually involve the users. The usability specialists of unit B acknowledge this risk:

I admit that it is valued here—my and Ellen’s (both former usability specialists) work is valued in this firm—but it is like: ‘it’s enough that you are here (laugh).’ It is like mere talk was enough. (Team leader, B)

The fact that the team (of usability specialists and graphical designers) existed created an illusion that usability issues are taken care of. There were people who took care of these issues and had knowledge about these issues, but the knowledge didn’t necessarily have any contact with the end product or how it was developed. (Graphical designer, B)

Also, the usability specialists of unit D discuss the risk of usability work becoming only a useful managerial buzzword:

We have been wondering about this, about this bragging related to user-centeredness, because it isn’t realized in every project. (Usability specialist, D)

“Total user experience” or other fancy keywords like that are used, but the question is: How are we going to achieve them? How do we prove that the outputs are like that? ... There is no monitoring of whether we produce quality designs or fancy total user experiences (laugh), whatever that means. (Usability specialist, D)

Usability Work as a Waste of Time and Money

The discourses do not necessarily glorify usability work. In some case units, some personnel have adopted a very negative standpoint related to usability work. In unit A, usability work is positioned as contributing merely to the “finishing touch,” involving “useless speculation”:

Projects always have limited resources and one must decide whether to invest in the finishing touch [usability] or in bugs and functionality. (Designer, A)

Yes, sure, sometimes it feels like the usability issues become kind of useless speculation. ... Sometimes usability work is overemphasized. If we are in a hurry, it might be that we don’t have time for these speculations. (Designer, A)

Also, in unit C usability work has been criticized as useless, since it is time-consuming and incapable of producing concrete, visible results:

Of the cooperation, Pete [designer] mentions that as a result something concrete and visible needs to appear. Usability activities have not resulted in that so far. (Field Notes, C)

Our designers considered usability work as useless. (Usability specialist, C)

Rick [manager] again suspects the suitability of user-centered design. Last time he raised doubts about whether the requirement specifications

Exploring the Rhetoric on Representing the User

(produced by a usability team) are complete: Have all exceptions and requirements been taken into account? Now he argues that paper prototyping seems to have too many loops and users; when can you stop? (Field Notes, C)

Finally, in unit D, usability work has been condemned “burdensome, delaying and dull”:

There is some unwillingness to carry out usability tests, because usability activities are perceived to be burdensome and dull. (Usability specialist, D)

[Usability specialists are perceived as] kind of delayers. (Graphic designer, D)

Yes, delayers who fuss over minor issues and pay attention to irrelevant issues. (Project manager, D)

Altogether, within this discourse usability work is condemned to be inefficient and time-consuming. This is quite alarming, and apparently a problem acknowledged also by the HCI community, since the practical HCI discourse warns that one should assure that usability work does not increase development costs and time (Bloomer & Croft, 1997; Nielsen, 1993), and cost-benefit tradeoffs may play a major role in the adoption of usability work (Mayhew, 1999b; Nielsen, 1993; Vredenburg et al., 2002).

Financial issues, particularly, are brought up as hindering usability work:

It is problematic to get money and the permission from the projects to do this, it's not easy to get permission to spend money on doing usability. (Manager, A)

Another important issue is that one should be able to show the benefits achieved (Cooper, 1999; Mayhew, 1999a, 1999b; Rosenbaum et al., 2000). Unit C especially has placed strong emphasis on

concrete results and on money spent in achieving them:

The company is expecting some concrete advantages [from usability work] to appear. ... The product should be more usable, and there should be clear savings in money and an increase in sales. (Manager, C)

When we were making the budget for this year, the question was, 'why spend resources on this [usability work]?' It costs money when people participate in this; they spend time on that. What can you get out of this? ... This type of questioning exists and it is good, because it all comes down to money and resources. We have limited resources and must have clear arguments. (Manager, C)

In this particular case, the financial reasons eventually led the organization to even abandon usability work:

When compared to the costs, one can raise a question that what has been received? The company has spent much more money on UI design than what was planned. ... Eric [manager] says the company has moved backwards: In the beginning, this [usability work] was a big thing, but now the situation is that soon nothing is done. Eric asks Rick [manager]: Has usability become a curse word? (Field Notes, C)

According to Eric, Rick has decided that no user-centered design activities will be carried out in the new product development project. ... Due to the bad reputation it currently has, the term 'usability' will not be mentioned for a while. (Field Notes, C)

The personnel responsible for IT artifact development—the designers and their managers—position themselves as sceptics in relation to usability work, condemning it as useless unless proven otherwise. The arguments of the practi-

cal HCI discourse highlighting the importance of designers' and managers' "buy in" (Aucella, 1997; Bloomer & Croft, 1997; Fellenz, 1997; Mayhew, 1999a; Rosenbaum et al., 2000) can also be read as an implicit fear of the existence of this discourse.

Usability Work as a Controllable and Measurable Quality Improvement

However, insofar as usability work is viewed as useful, it can still be constructed by relying on different kinds of discourses. One possibility is to adopt a discourse that constructs usability work as a controllable, measurable quality improvement effort that should and could be treated like other large-scale quality improvement efforts in organizations. This was the case in unit A, in which it is assumed that usability work should be carried out by "controlling projects to do quality work." As mentioned, in unit A, "it is problematic to get money and permission from the projects to spend money on doing usability." The discussion proceeded as follows:

Yes, if we think of these things separately. But if we think of it from the viewpoint of our everyday job, the question is that do we get permission to do quality work (laugh)? (Usability specialist, A)

Yes, do they allow us to stop the projects from wasting their time and effort (laughing)? ... I don't think that in the long run usability work costs a lot in the projects. (Manager, A)

"Doing usability" refers to "doing quality work" that stops projects from "wasting their time and effort." This discourse postulates usability work as improving the design process (Nandhakumar & Jones, 1997)—as improving the quality of the process and the product. Furthermore, it is assumed that controlling and monitoring is needed:

When you bring usability orientation into an organization, you have to be a police in the beginning. The designers don't have the knowledge needed in their head, and you have to act as a police. (Usability specialist, A)

Here we have a quality organization which perceives quality within a rules-oriented approach. Numerical things are highlighted; bugs and stuff like that. We have quality plans and we report the bugs and follow the projects. ... We have these control mechanisms, and they are very powerful. If you try to compete with them, and you are not in the control mechanisms, then you are left out. Because these control mechanisms set the pressures. (Usability specialist, A)

Controlling, constant controlling and monitoring, it's part of normal project work. Maybe it comes from there, the monitoring. I don't know whether you think this way, but if the usability work can be measured and controlled, then it's more natural, then it's just part of your job. (Team leader, A)

The usability specialists have labeled themselves as a "mommy mob"⁷ (Usability specialist, A) reflecting their will to control "the projects to do quality work."

Also in unit D, the usability specialists position usability work as "doing quality work" and, more specifically, "real research":

We should have more research orientation and quality. Related to quality, the workers and the [usability] specialists have started demanding that it should be monitored and there should be orderliness. We have also made proposals with other specialists, related to the ways we should work here. (Usability specialist, D)

If we design, we should do it in some rational way. ... I think we should be able to produce something rational, carry out relevant research through which we could say: 'Yes, this is how it

Exploring the Rhetoric on Representing the User

goes.' *We should produce something new and verifiable.* (Usability specialist, D)

A project manager states that the projects should always be able to state that "we had real users involved in this, there is real research in the background, these relations are correct" (Project manager, D). Related to this, controlling and monitoring are necessary, since:

If [usability work] is not demanded, guess what happens? People don't do it, because it is too burdensome. Why would people do things in a difficult, burdensome way if they can do it more easily? (Usability specialist, D)

Our managers should say that it is stated in our strategies that in the future we will carry out these kinds of initiatives and our competence in usability should be on a high level. And now we will together to start to fix it. (Project manager, D)

Within this discourse, written work descriptions are seen as useful, as is also suggested by the practical HCI discourse: Documentation of best practices (Aucella, 1997), a description of the methods and techniques for usability work (Fellenz, 1997) and a formal development process with usability work included (Fellenz, 1997; Mayhew, 1999a) are recommended. In unit A, a software process model with usability work included has been produced and is deemed helpful in integrating usability work into "normal project work":

Now, when the new process is being implemented, now those [usability activities] are planned, and then you have permission to do them and time to do them. They are included in the schedules. (Team leader, A)

Also in unit D, the specialists, as mentioned, have produced "proposals related to ways of working in the unit."

This discourse was evident in units A and D.

These units are parts of large, global corporations. In unit A, not only the usability specialists, but also the designers and managers, participated in it. However, in unit D the situation is different. The usability specialists were the only ones postulating usability work this way. Furthermore, they seemed to utilize this discourse in positioning the other stakeholder groups—designers and managers—in a morally subordinate position; managers are postulated as "not demanding enough," designers as "careless" and "having no arguments behind their decisions":

Management has not understood to demand quality which, together with the lowering of the competence level, has resulted in degradation of usability. (Usability specialist, D)

In some [projects] there are 'staid researchers,' research-oriented people, and in some other projects there are these 'careless designers.' ... This 'research gang' questions existing things and wants to examine things. On the other hand, these designers like to do things that are fun. They don't have, like, arguments, behind their decisions. (Usability specialist, D)

Usability Work Through Persuading, Marketing and Manipulating

Finally, this discourse on usability work is distinctive in its view of usability work as a phenomenon that should be sold to the IT artifact development preferably by "sneaking in, in secret." This discourse, as well as the previous one, positions usability specialists as the ones "empowering the designers," but these discourses attach clearly divergent meanings to this "empowering." In the former discourse, usability work was constructed as "controlling and monitoring," while in the latter discourse usability work means "sneaking in, in secret." This can be accomplished, for example, through the usability specialists employing influential positions:

I think it is very important from the point of view of user-centeredness that our manager is a usability specialist, that there is this kind of competence. We can avoid a lot of unnecessary work, because our manager makes the decisions. We can trust her; we don't have to question her decisions. ... This user-centered viewpoint kind of affects other things in secret. I think it is strategically very important that a usability specialist was nominated as a manager who can make the decisions regarding the product. (Team leader, B)

Within this discourse, usability specialists act as change agents who address many different target groups and tailor their message to languages that each target audience understands (Bloomer & Croft, 1997; Mayhew, 1999a; Rosenbaum et al., 2000):

[Knowledge of user-centeredness] spreads through my and Ellen's [both former usability specialists] personalities, what we are able to tell about it. We forcefully talk about user-centeredness when [sales and marketing] want to hear what we do. (Team leader, B)

Here the discussions between development and marketing, they happen through me [former usability specialist]. The designers don't discuss directly with marketing and marketing doesn't contact the designers directly. I function as a mediator. (Manager, B)

However, designers are postulated as the most important target group (Aucella, 1997; Bloomer & Croft, 1997; Fellenz, 1997; Mayhew, 1999a) who should buy in to usability and perceive usability specialists as allies (Aucella, 1997; Fellenz, 1997; Mayhew, 1999a; Rosenbaum et al., 2000):

This is not only a few people's job, but everyone should understand what user-centeredness means and how much should I apply those principles

and in which part of my job. ... I think it is better that everyone knows a little about it rather than us having a dozen usability specialists and rest of the personnel know nothing about it; because this situation is a battlefield. Or, there should be a designer and a usability specialist doing things together all the time. But in this situation, the designer becomes a usability specialist almost naturally. (Team leader, B)

Doing things together is the most effective way to teach. It is much more efficient than to produce fancy guidelines for how things ought to be done, at least for part of our personnel. Some people might be good in following written work descriptions, but they are quite rare here. (Manager, B)

It is argued that “representing the user” is accomplished through the usability specialists actively cooperating with the designers, who otherwise might ignore the results of usability work. In this quest, the controlling and monitoring strategy is condemned as ineffective.

Only the personnel from case unit B participated in this discourse, and even in this unit it was only the usability specialists who participated in it. This is quite natural, since the aim is to “sneak in, in secret.” However, personnel from units A and D are familiar with this discourse, but they could not offer a success story related to it. In unit A, there is a “long way to go”: “If we aim at all our designers actively carrying out usability work in projects, we still have a long way to go” (Manager, A). Regarding addressing other organizational units, short lectures have been given by the usability specialists, but it is maintained that “this work is extremely painful and a persevering job. You must proceed slowly and take small steps. You can't change the direction of a ship of this size very fast” (Manager, A).

In unit D it is maintained that if “usability is everybody's responsibility, then it's nobody's responsibility:

Exploring the Rhetoric on Representing the User

Our boss wants us all to be usability people, that there lives inside us all a small usability specialist. ... But then it is nobody's responsibility. It is everybody's responsibility and, therefore, nobody's responsibility. (Usability specialist, D)

Furthermore, the usability specialists are not keen on the idea of selling their work inside their organization:

All work we do should be marketable inside our company. ... Management says: Go and sell your work. But they are sitting in the ivory tower, from which it is much easier to see where to sell it. ... In practice, when you present your work to [other units in the company], they don't care whether you have used [a UCD method] or just invented everything. ... It is a big effort to sell this work to people who don't understand it. Very rare people even bother to find out what [a UCD method] means in practice. (Project manager, D)

Therefore, this discourse was adopted only in unit B. Nevertheless, this discourse has a clear resemblance to the practical HCI discourse. The manipulative, seductive strategy has already been recommended—the ones introducing usability work should act as change agents and seduce and manipulate other people to “buy into usability” (Billingsley, 1995; Beyer & Holtzblatt, 1998; Bloomer & Croft, 1997; Cooper, 1999; Hutchings

& Knox, 1995; Mayhew, 1999a, 1999b; Rosenbaum et al., 2000; Rosson & Carroll, 2002). However, only in unit B do the usability specialists maintain having succeeded in this quest.

DISCUSSION

Summary of the Results

This paper has examined discourses on usability work in IT artifact product development organizations. Through analysis of empirical, qualitative material, five discourses on usability work were identified. The discourses construct usability work and the position of usability specialists in different ways in the case units. The differences are summarized by mapping the discourses on usability work identified with the particular units in which they emerged, as illustrated in Table 2.

The usability specialists in unit A employ the position of a controlling “mommy mob” “fighting for the user”; the designers have condemned usability work as a waste of time and money, but at the same time, the controlling, monitoring, measuring approach to usability work is accepted as a working solution. The usability specialists in unit B are positioned as seductive change agents “sneaking in, in secret.” The uses of usability work as an image factor and a selling argument

Table 2. Summary of the discourses on usability work in the case units

| Usability work as... | Unit A | Unit B | Unit C | Unit D |
|---|-----------------------|-------------------------|--------|-----------------------------|
| Tradition | x | x | x | x |
| Selling argument and image factor | | x | x | x |
| Waste of time and money | x | | x | x |
| Controllable and measurable quality improvement program | x | | | x |
| Persuading, marketing, manipulating | | x | | |
| Usability specialists as ... | Controlling mommy mob | Seductive change agents | — | Demanding staid researchers |

are acknowledged, granting usability work some legitimacy—especially at the executive level. However, subtle ways of working are needed in this unit to influence and manipulate a multitude of stakeholder groups to “buy into usability”. Also in unit C, usability work is appreciated as a selling argument and an image factor, but the discourse of the personnel responsible for technical development overrode in this context, and “usability became a curse word”. Therefore, usability specialists currently employ no position in this unit. Finally, the usability specialists in unit D are positioned as “staid researchers demanding more quality and control.” Also in this unit, usability work is utilized as a managerial tool for improving the image of the unit. In addition, designers are a hindering stakeholder group condemning usability work as a waste of time and money. In unit D, however, the usability specialists offer the “careless designers” and “not demanding enough managers” a morally subordinate position.

This observation may be related to the notion of power, a prominent theme in Foucault’s writings. The designers in case units A, C and D utilize a discourse constituting usability work as a waste of time and money. In unit A, a controlling and monitoring strategy is, nevertheless, accepted as a working solution, but in unit C, the usability specialists clearly have “lost the battle.” All in all, one could argue that the discourses the usability specialists utilize are typically submissive, figuring out ways and strategies for involving (empowering) the designers, who do the “real work here” (Manager, A) and whose contribution is “always needed” (Team leader, B).

If you think of the personnel of our unit, we have SW (software) developers who think that the SW development is the only real job in here. Even our respected usability specialist thinks this way, not to speak of our manager. (Manager, A)

In unit D, however, the usability specialists offer the “careless designers” and “not demanding

enough managers” a morally subordinate position. The notion of “usability work as bread and butter” grants the usability specialists an influential position in this unit. Nevertheless, except for unit D, one could argue that the usability specialists do not seem to employ very influential positions in the IT artifact development and are, due to this, also in desperate need of “rhetoric on representing the user that legitimizes their existence.”

Relationship to Academic Discourses

It was argued that these discourses can be related to wider discursive fields in which both the HCI and IS communities participate and contribute. As mentioned, existing literature has made us aware that user involvement might be used only as a buzzword and a slogan (e.g., Catarci et al., 2002; Hirschheim & Newman, 1991; Kirsch & Beath, 1996; Nielsen, 1999; O’Connor 1995). The first discourse assigning usability work a central position in every case unit might be viewed as relating to the same phenomenon. Furthermore, the other identified discourses indicate that this important position has not been fully realized. Especially the second discourse—which constructs usability work as useful, since it can be used as an image factor and a selling argument—warns us that within this discourse the management goals may be the main (sole?) motivator for usability work. Usability work is useful for the company in making more profit and improving the image of the company. Furthermore, the third discourse that condemns usability work as a mere waste of time and money implies that this “tradition of user-centeredness”—even though highlighted by the management—is not very strong. The designers are unwilling to accept usability work, and the benefits of usability work must be realized before it will be accepted. The financial reasons had led one unit to even abandon usability work.

The fourth and fifth discourses, however, illustrate that in the other three case units usability

work has survived further. These discourses show, nevertheless, that it can be postulated in different ways. Usability can be constructed as a measurable, controllable quality criterion that should be aimed at through the usability specialists—acting as policemen—controlling and monitoring the projects “to do quality work.” In this case, the focus is on the quality of both the process and the product. On the other hand, usability work can also be viewed as a phenomenon to be sneaked in, in secret. The designers are seen as an important target group and they are supposed to become “usability specialists” “in secret,” by “doing things together” with the usability specialists. The usability specialists should also aim at employing influential positions in their units for their competence to also be “sneaked in, in secret” and so they can “sell usability” to a multitude of target groups in their company.

Altogether, these discourses on usability work bear a clear resemblance to the *practical HCI discourse* identified earlier. Within the discourses, user involvement is constituted as indirect, and usability specialists are offered a subject position of a user surrogate representing (if not fighting for) the users in development. However, the case units differ in terms of other subject positions offered to these user surrogates. They might also be positioned as change agents involving a multitude of other stakeholder groups (designers, managers, marketing, sales ...) by seducing and manipulating them to “buy into usability” or as controlling and monitoring “prescribers” impos-

ing guidelines and processes on development. In either case, the resemblance to the existing HCI discourse is still evident. The empirical findings are summarized next in relation to the subject positions offered to usability specialists in the practical HCI discourse (see Table 3).

The *reflective PD discourse*, on the other hand, was argued as “building a bridge” between the academic communities of IS and HCI. In both communities, extensive interest in PD has emerged during the 1990s. Recent HCI textbooks advocating user involvement (e.g., Beyer & Holtzblatt, 1998; Mayhew, 1999b; Rosson & Carroll, 2002) refer directly to PD literature and suggest more participative design. This reference to PD literature, however, has been criticized, since either PD is only mentioned, not actually expected (e.g., in Mayhew, 1999b), it is interpreted only as a technical method improving the design process (Carroll, 1996) or it is interpreted to refer merely to prototyping and, all in all, suggested merely to achieve management goals (especially Beyer & Holtzblatt, 1998, according to Spinuzzi, 2002). Regarding this discourse in practice, the empirical results do not support the notion that “participative design” has been realized in industrial settings. Participative user involvement was not articulated in the discourses that the members of the case units participated in and contributed to.

Next, the *critical IS discourse*, relying on an ideal of democratic empowerment of the skilled worker and on the view of them as active agents in the design process, which is political and full

Table 3. Subject positions of the practical HCI discourse in the case units

| Usability specialist as ... | Unit A | Unit B | Unit D |
|--|--------|--------|--------|
| User surrogate representing the user | x | x | x |
| User surrogate involving the designer • Controlling and monitoring the designer • Seducing the designer | x | x | x |
| User surrogate as change agent targeting, manipulating and involving marketing, sales, management and so forth | | x | |

of conflicts that need to be acknowledged, is contrasted with the discourses on usability work identified from empiria. In doing so, the results achieved within this study can be seen as very alarming. From the viewpoint of the critical IS discourse, some of the discourses on usability work can be interpreted to be in stark contrast with the original aim of user involvement. Within these discourses, the goal of usability work is expressed in terms that appeal to management; they highlight the money-making and money-saving aspects of usability work. Usability work is seen as helping the projects to “do quality work” and “get it right the first time”—usability work is constructed as useful for money-saving purposes. On the other hand, usability work is highlighted as a selling argument and image factor for making more profit. This discourse especially can be criticized for being overtly capitalist, and even labeled as a “misuse of user involvement.” The management goal of “convincing the customer” by appealing to usability work might even be viewed as a way of “silencing the users” (Asaro, 2000), instead of “giving them a voice.”

Altogether, this type of capitalist orientation related to usability work identified in the product development context might be viewed as a “realization of Scandinavians” (trade unionists) worst fears (Spinuzzi, 2002), totally neglecting the original aim of user involvement; that is, democratic empowerment of oppressed workers. Related to this, it is also acknowledged that “empowerment” and “involvement” can be used only as rhetorical tools that try to conceal that IT artifacts are always developed to serve management goals. “Involvement” may actually mean exclusion and marginalization rather than empowerment of the ones who are oppressed (Howcroft & Wilson 2003, O’Connor 1995). Particularly when user “involvement” is only indirect, it is a question mark whether and how users could be “emancipated” or empowered in the democratic sense, even though these user surrogates are “representing them in the development.”

User involvement can also be criticized of only serving technological colonialism (Asaro, 2000). Just like anthropologists—who served the interests of colonial control while producing representations of other exotic, primitive cultures who were not able to contribute or argue against these authoritative representations (Clifford & Markus, 1986)—the designers (and the usability specialists) produce representations of users and at the same time serve the interests of technological colonialism: They represent the users for the sake of management goals—for the purposes of money making and money saving in the IT artifact development companies (c.f., Asaro, 2000). Furthermore, if users participate in the process, they are contributing to the production of these texts—the representations of themselves. From this viewpoint, user involvement can be seen as a way of silencing the users—users cannot reject the system anymore, since they have participated in the process. However, users are never equally equipped to produce these texts or to participate in the development, due to which the “technological elites”—like the anthropologists—ultimately have the authority to produce the representations of the technologically illiterate, “primitive,” “exotic” other (c.f., Asaro, 2000). In the case units, the users were not active participants who produced representations of themselves, due to which they were not “silenced” in this sense. However, in one case unit, the designers were not producing representations of the users either and even refused to take into account the representations produced by the usability specialists. Management, nevertheless, was “silencing the users” (and the customers) by appealing to usability work.

Relevance to Practice

This type of critical studies can be argued to lack relevance to practice, which seems to be a very important goal in both IS and HCI research. However, as a defense for this type of studies, one might argue that relevance can be achieved

in many ways. For example, researchers can act as the conscience of society (Lee, 1999), and they can reshape the practitioners' thinking and actions in the longer perspective (Lyytinen, 1999)—also, these issues have been interpreted to be relevant to practice. Therefore, critical examinations of user involvement in IT artifact development should be considered useful in the sense of highlighting the risk of user involvement becoming only a buzzword and a slogan whose acceptance and utilization is totally dependant on short-term financial motivators. Related to this, the influential role of academic communities is also emphasized (Cooper & Bowers, 1995; Finken, 2003; Foucault, 1972; Weedon, 1987). It is recommended that the HCI community especially should carefully reflect on what kinds of discourses on user involvement it advocates and deems as legitimate.

All in all, this paper provides help in answering questions such as, “What kind of animal is this (and should it be)?” related to research on “user involvement,” and “What kind of animal are you (and should you be)?,” which addresses both the researchers analyzing, advocating and prescribing user involvement in IT artifact development, and the practitioners developing IT artifacts, involving the users in development or being involved as users in development. The practitioners especially, who assume a subject position of a “user surrogate” “representing the user” in IT artifact development can reflect on the other subject positions offered to them. In the practical HCI discourse, these practitioners have also been positioned as “user surrogates,” monitoring and controlling or seducing and manipulating the designers, or as change agents selling usability work to a multitude of stakeholder groups in their organization. As an addition to these subject positions, the critical IS and reflective PD discourses provide alternative subject positions that, nevertheless, could be occupied by these “user surrogates,” those being a “warrior, partisan or emancipator fighting on the side of the users against the oppressors,” or a “reflective facilitator of cooperation among users and designers.”

Paths for Future Work

Altogether, it has been argued that especially in the IT artifact product development context, the ethical issues should eventually be acknowledged (Adam & Light, 2004). Therefore, regarding paths for future work, I would recommend studies that critically analyze literature on user involvement from the viewpoint of the ethical assumptions they advocate. In addition, studies that analyze our representational practices and articulations of our authority (c.f., Clifford & Markus, 1986) in the studies on user involvement are recommended. In this study, I have not reflected on these issues; that is, the reflection on my representational practices is lacking. This type of study could ask: Who has the authority to interpret user involvement in organizations? How is this authority articulated in the text? How does the writer's voice situate and pervade the accounts? What is excluded, and are voices silenced? And finally: Why are these stories produced in the first place? On a more practical level, empirical studies on user involvement in the product development context are also recommended. Contextual factors affecting user involvement (and more particularly, usability work) should be examined. In addition, the voice of the users, a voice clearly silenced in this paper, should be heard also in the IT artifact product development context. Finally, studies that critically examine power, politics, marginality and exclusion (c.f., Beck 2002) in the IT artifact product development context are warmly recommended.

REFERENCES

Adam, A., & Light, B. (2004, June 14-16). Selling packaged software: An ethical analysis. *Proceedings of 12th European Conference on Information Systems (ECIS 2004)*, Turku, Finland.

- Alvarez, R. (2002). Confessions of an information worker: A critical analysis of information requirements discourse. *Information and Organization*, 12(2), 85-107.
- Anderson, W. L. & Crocca, W. T. (1993). Engineering practice and codevelopment of product prototypes. *Communications of the ACM*, 36(4), 49-56.
- Asaro, P. M. (2000). Transforming society by transforming technology: The science and politics of participatory design. *Accounting, Management and Information Technologies*, 10, 257-290.
- Aucella, A. (1997). Ensuring success with usability engineering. *Interactions*, May & June.
- Bannon, L. (1991). From human factors to human actors: The role of psychology and human-computer interaction studies in system design. In Greenbaum & Kyng (Eds.), *Design at work. Cooperative design of computer systems*. Hillsdale: Lawrence Erlbaum.
- Bansler, J. (1989). Systems development research in Scandinavia: Three theoretical schools. *Scandinavian Journal of Information Systems*, 1, 3-20.
- Bansler, J. P., & Bødker, K. (1993). A reappraisal of structured analysis. *ACM Transactions on Information Systems*, 11(2), 165-193.
- Bansler, J. P., & Kraft, P. (1994). Privilege and invisibility in the new work order: A reply to Kyng. *Scandinavian Journal of Information Systems*, 6(1), 97-106.
- Barki, H., & Hartwick, J. (1989). Measuring user participation, user involvement, and user attitude. *MIS Quarterly*, 59-81.
- Beath, C., & Orlikowski, W. (1994). The contradictory structure of systems development methodologies: Deconstructing the IS-user relationship in information engineering. *Information Systems Research*, 5(4), 350-377.
- Beck, E. E. (2002). P for political. Participation is not enough. *Scandinavian Journal of Information Systems*, 14(1), 77-92.
- Bekker, M. M. & Vermeeren, A. P. O. S. (1996). An analysis of user interface design projects: Information sources and constraints in design. *Interacting with Computers*, 8(1), 112-116.
- Benbasat, I., Goldstein, D. K., & Mead, M. (1987). The case study strategy in studies of information systems. *MIS Quarterly*, September, 368-386.
- Benbasat, I., & Zmud, R. (1999). Empirical research in information systems: The practice of relevance. *MIS Quarterly*, 23(1), 3-16.
- Beyer, H., & Holtzblatt, K. (1998). *Contextual design: Defining customer-centered systems*. San Francisco: Morgan Kaufmann Publishers.
- Bias, R., & Reitmeyer, P. (1995). Usability support inside and out. *Interactions*, April, 29-32.
- Billingsley, P. (1995). Starting from scratch: Building a usability program at Union Pacific Railroad. *Interactions*, October, 27-30.
- Bjerknes, G., & Bratteteig, T. (1995). User participation and democracy. A discussion of Scandinavian research on system development. *Scandinavian Journal of Information Systems*, 7(1), 73-98.
- Blomberg, J., & Henderson, A. (1990). Reflections on participatory design: Lessons from the Trillium experience. *Proceedings of CHI90* (pp. 353-359). New York: ACM Press.
- Bloomer, S., & Croft, R. (1997). Pitching usability to your organization. *Interactions*, November & December, 18-26.
- Bloomfield, B., & Vurdubakis, T. (1997). Visions of organization and organizations of vision: The representational practices of information systems development. *Accounting, Organizations and Society*, 22(7), 639-668.

Exploring the Rhetoric on Representing the User

- Boivie, I., Åborg, C., Persson, J., & Löfberg, M. (2003). Why usability gets lost or usability in in-house software development. *Interacting with Computers, 15*, 623-639.
- Borgholm, T., & Madsen, K. H. (1999). Cooperative usability practices. *Communications of the ACM, 42*(5), 91-97.
- Brooke, C. (2002). What does it mean to be “critical” in IS research? *Journal of Information Technology, 17*, 49-57.
- Brun-Cottan, F., & Wall, P. (1995). Using video to re-present the user. *Communications of the ACM, 38*(5), 61-71.
- Butler, K. A. (1996). Usability engineering turns 10. *Interactions, January*, 59-75.
- Buur, J., & Bagger, K. (1999). Replacing usability testing with user dialogue. *Communications of the ACM, 42*(5), 63-66.
- Bødker, S. (1996). Creating conditions for participation: Conflicts and resources in systems development. *Human-Computer Interaction, 11*(3), 215-236.
- Bødker, S., & Buur, J. (2002). The design collaboratorium—A place for usability design. *ACM Transactions on Computer-Human Interaction, 9*(2), 152-169.
- Bødker, S., & Iversen, O. (2002). Staging a professional participatory design practice. Moving PD beyond the initial fascination of user involvement. *Proceedings of the 2nd Nordic conference on Human-computer interaction (pp. 11-18)*. New York: ACM Press.
- Bødker, S., Nielsen, C., & Petersen, M. G. (2000). Creativity, cooperation and interactive design. *Proceedings of DIS 2000*, 252-261.
- Carmel, E., & Sawyer, S. (1998). Packaged software development teams: What makes them different. *Information Technology & People, 11*(1), 7-19.
- Carmel, E., Whitaker, R. D., & George, J. F. (1993). PD and joint application design: A transatlantic comparison. *Communications of the ACM, 36*(4), 40-48.
- Carroll, J. M. (1996). Encountering others: Reciprocal openings in participatory design and user-centered design. *Human-Computer Interaction, 11*(3), 285-290.
- Catarci, T., Matarazzo, G., & Raiss, G. (2002). Driving usability into the public administration: The Italian experience. *International Journal of Human-Computer Studies, 57*, 121-138.
- Cavaye, A. L. M. (1995). User participation in system development revisited. *Information & Management, 28*, 311-323.
- Clarke, R. (2001). Social semiotic contributions to the systemic semiotic workpractice framework. *Sign Systems Studies, 29*(2), 587-605.
- Clement, A. (1994). Computing at work: Empowering action by ‘low-level users.’ *Communications of the ACM, 37*(1), 52-63.
- Clement, A., & Van den Besselaar, P. (1993). A retrospective look at PD projects. *Communications of the ACM, 36*(4), 29-37.
- Clifford, J., & Marcus, G. (1986). *Writing culture: The poetics and politics of ethnography*. Berkeley: University of California Press.
- Cooper, A. (1999). *The inmates are running the asylum: Why high-tech products drive us crazy and how to restore the sanity*. Indianapolis: Sams.
- Cooper, C., & Bowers, J. (1995). Representing the users: Notes on the disciplinary rhetoric of human-computer interaction. In Peter J. Thomas (Ed.), *The social and interactional dimensions of human-computer interfaces* (pp 48-66). Cambridge: Cambridge University Press.
- Damodaran, L. (1996). User involvement in the systems designs process—A practical guide for

- users. *Behaviour & Information Technology*, 15(16), 363-377.
- Deetz, S. (1996). Describing differences in approaches to organization science: Rethinking Burrell and Morgan and their legacy. *Organization Science*, 7(2), 191-207.
- Denzin, N. K., & Lincoln, Y. S. (2000). Introduction: The discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 1-29). Thousand Oaks, CA: Sage Publications.
- Doolin, B. (1999, December 13-15) Information systems, power, and organizational relations: A case study. In P. De & J. I. DeGross (Eds.), *Proceedings of the 20th international conference on information systems* (pp. 286-290), Charlotte, NC.
- Edenius, M. (2002). Discourse on e-mail use. In E. H. Wynn, E. A. Whitley, M. D. Myers, & J. I. DeGross (Eds.), *Global and organizational discourse about information technology* (pp. 73-89). Boston: Kluwer Academic.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532-550.
- Fairclough, N., & Wodak, R. (1997). Critical discourse analysis. In T. A. van Dijk (Ed.), *Discourse as social interaction. Discourse studies: A multidisciplinary introduction* (Vol. 2, pp. 258-284). London: Sage Publications.
- Fellenz, C. B. (1997). Introducing usability into smaller organizations. *Interactions*, September/October, 29-33.
- Finken, S. (2003). Discursive conditions of knowledge production within cooperative design. *Scandinavian Journal of Information Systems*, 15, 57-72.
- Foucault, M. (1972). *The archaeology of knowledge and the discourse on language*. New York: Pantheon Books.
- Foucault, M. (1980). *The history of sexuality. Volume 1: An introduction* (R. Hurley, trans.). New York: Vintage Books.
- Gardner, J. (1999). Strengthening the focus on users' working practices—Getting beyond traditional usability testing. *Communications of the ACM*, 42(5), 79-82.
- Gould, J. D., & Lewis, C. (1985). Designing for usability: Key principles and what designers think. *Communications of the ACM*, 28(3), 300-311.
- Greenbaum, J., & Kyng, M. (Eds.) (1991). *Design at work. Cooperative design of computer systems*. Mahwah: Lawrence Erlbaum Associates.
- Grint, K., & Woolgar, S. (1997). *The machine at work. Technology, work and organization*. Cambridge: Polity Press.
- Grudin, J. (1991a). Interactive systems: Bridging the gaps between developers and users. *IEEE Computer*, 24(4), 59-69.
- Grudin, J. (1991b). Systematic sources of suboptimal interface design in large product development organizations. *Human-Computer Interaction*, 6, 147-196.
- Grudin, J. (1993). Obstacles to participatory design in large product development organizations. In D. Schuler & A. Namioka (Eds.), *Participatory design: Principles and practices* (pp. 99-122). Mahwah: Lawrence Erlbaum Associates.
- Grudin, J. (1996). The organizational contexts of development and use. *ACM Computing Surveys*, 28(1), 169-171.
- Grønbak, K., Grudin, J., Bødker, S., & Bannon, L. (1993). Achieving cooperative system design: Shifting from a product to a process focus. In D. Schuler & A. Namioka (Eds.), *Participatory design: Principles and practices* (pp. 79-98). Mahwah: Lawrence Erlbaum Associates.
- Gärtner, J., & Wagner, I. (1996). Mapping actors and agendas: Political frameworks of systems

- design and participation. *Human-Computer Interaction, 11*, 187-214.
- Hirschheim, R., Iivari, J., & Klein, H. (1997). A comparison of five alternative approaches to information systems development. *Australian Journal of Information Systems, 5*(1), 3-29.
- Hirschheim, R., & Klein, H. (1989). Four paradigms of information systems development. *Communications of the ACM, 32*(10), 1199-1216.
- Hirschheim, R., & Klein, H. (1994). Realizing emancipatory principles in information systems development: The case for ETHICS. *MIS Quarterly, March*, 83-109.
- Hirschheim, R., & Newman, M. (1991). Symbolism and information systems development: Myth metaphor and magic. *Information Systems Research, 2*(1), 29-62.
- Howcroft, D., & Wilson, M. (2003). Paradoxes of participatory practices: The Janus role of the systems developer. *Information and Organization, 13*, 1-24.
- Hutchings, A. F., & Knox, S. T. (1995). Creating products—Customer demand. *Communications of the ACM, 38*(5), 72-80.
- Iivari, J., & Hirschheim, R. (1996). Analyzing information systems development: A comparison and analysis of eight IS development approaches. *Information Systems, 21*(7), 551-575.
- Karat, J. (1997). Evolving the scope of user-centered design. *Communications of the ACM, 40*(7), 33-38.
- Keil, M., & Carmel, E. (1995). Customer-developer links in software development. *Communications of the ACM, 38*(5), 33-44.
- Kirsch, L. J., & Beath, C. M. (1996). The enactments and consequences of token, shared, and compliant participation in information systems development. *Accounting, Management, & Information Technologies, 6*(4), 221-254.
- Klein, H. K. & Myers, M. D. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. *MIS Quarterly, 23*(1), 67-94.
- Kraft, P., & Bansler, J. (1994). The collective resource approach: The Scandinavian experience. *Scandinavian Journal of Information Systems, 6*(1), 71-84.
- Kujala, S. (2003). User involvement: A review of the benefits and challenges. *Behaviour & Information Technology, 22*(1), 1-16.
- Kyng, M. (1994). Scandinavian design: Users in product development. *Proceedings of CHI 1994* (pp. 3-9). New York: ACM Press.
- Kyng, M. (1998). Users and computers: A contextual approach to design of computer artifacts. *Scandinavian Journal of Information Systems, 10*(1&2), 7-44.
- Langley, A. (1999). Strategies for theorizing from process data. *Academy of Management Review, 24*(4), 691-710.
- Lee, A. S. (1999). Rigor and relevance in MIS research: Beyond the approach of positivism alone. *MIS Quarterly, 23*(1).
- Lyytinen, K. (1987). Different perspectives on information systems: Problems and solutions. *ACM Computing Surveys, 19*(1), 5-46.
- Lyytinen, K. (1999). Empirical research in information systems: On the relevance of practice in thinking of IS research. *MIS Quarterly, 23*(1), 25-28.
- Löwgren, J. (1995). Applying design methodology to Software development. *Proceedings of Designing Interactive Systems (DIS '95)* (pp. 87-95). New York: ACM Press.
- Löwgren, J., & Stolterman, E. (1999). Design methodology and design practice. *Interactions, January/February*, 13-20.

- Markus, M. L., & Mao, Y. (2004). User participation in development and implementation — Updating an old, tired concept for today's IS contexts. *Journal of the Association for Information Systems*, 5(11-12), 514-544.
- Mayhew, D. J. (1999a). Business: Strategic development of usability engineering function. *Interactions*, September-October, 27-34.
- Mayhew, D. J. (1999b). *The usability engineering lifecycle: A practitioner's handbook for user interface design*. San Francisco: Morgan Kaufmann Publishers.
- Mrazek, D., & Rafeld, M. (1992). Integrating human factors on a large scale: Product usability champions. *Proceedings of CHI'92* (pp. 565-570). New York: ACM Press.
- Muller, M. J., & Carey, K. (2002). Design as a minority discipline in a software company: Toward requirements for a community of practice. *Proceedings of CHI 2002*, 1(1), 383-390. New York: ACM Press.
- Muller, M. J., & Czerwinski, M. (1999). Organizing usability work to fit the full product range. *Communications of the ACM*, 42(5), 87-90.
- Mulligan, R. M., Altom, M. W., & Simkin, D. K. (1991). User interface design in the trenches: Some tips on shooting from the hip. *Proceedings of CHI'91* (pp. 232-236). New York: ACM Press.
- Nandhakumar, J., & Jones, M. (1997). Designing in the dark: The changing user-developer relationship in information systems development. *Proceedings of ICIS 1997* (pp. 75-86).
- Newman, M., & Noble, F. (1990). User involvement as an interaction process: A case study. *Information Systems Research*, 1(1), 89-113.
- Nielsen, J. (1993). *Usability engineering*. Boston: Academic Press.
- Nielsen, S. (1999). Talking about change: An analysis of participative discourse amongst IT operations personnel. *Proceedings of 10th Australasian conference on information systems*, 691-702.
- O'Connor, E. (1995). Paradoxes of participation: Textual analysis and organizational change. *Organization Studies*, 16(5), 769-803.
- Orlikowski, W., & Iacano, C. (2001). Research commentary: Desperately seeking the "IT" in IT research—A call to theorizing the IT artifact. *Information Systems Research*, 12(2), 121-134.
- Orlikowski, W. J., & Robey, D. (1991). Information technology and the structuring of organizations. *Information Systems Research*, 2(2), 398-427.
- Pollock, S., & Grudin, J. (1994). Organizational obstacles to interface design and development: Two participant-observer studies. *ACM Transactions on Computer-Human Interaction*, 1(1), 52-80.
- Robertson, T. (1998). Shoppers and tailors: Participative practices in small Australian design companies. *Computer Supported Cooperative Work*, 7, 205-221.
- Robey, D., & Markus, M. L. (1984). Rituals in information system design. *MIS Quarterly*, March, 5-15.
- Rosenbaum, S., Rohn, J. A., & Humburg, J. (2000). A toolkit for strategic usability: Results from workshops, panels, and surveys. *Proceedings of CHI 2000. CHI Letters*, 2(1), 337-344.
- Rosson, M. B., & Carroll, J. (2002). *Usability engineering: Scenario-based development of human-computer interaction*. San Francisco: Morgan-Kaufman.
- Sarkkinen, J., & Karsten, H. (2005). Verbal and visual representations in task redesign: How different viewpoints enter into information systems design discussions. *Information Systems Journal*, 15(3), 181-211.

Sayer, K., & Harvey, L. (1997). Empowerment in business process reengineering: An ethnographic study of implementation discourse. In K. Kumar & J. I. DeGross (Eds.), *Proceedings of the 18th international conference on information systems* (pp. 427-440), Atlanta, GA.

Schuler, D., & Namioka, A. (Eds.) (1993). *Participatory design: Principles and practices* (pp. 41-78). Mahwah: Lawrence Erlbaum Associates.

Schwandt, T. A. (2000). Three epistemological stances for qualitative inquiry: Interpretivism, hermeneutics, and social constructionism. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 189-214). Thousand Oaks, CA: Sage.

Seffah, A., & Andreevskiaia, A. (2003, May 3-10). Empowering software engineers in human-centered design. *Proceedings of the 25th IEEE International Conference on Software Engineering*, Portland, OR.

Spinuzzi, C. (2002). A Scandinavian challenge, a US response: Methodological assumptions in Scandinavian and US prototyping approaches. *Proceedings of SIGDOC 2002* (pp. 208-215).

Stahl, B. C. (2004, August 6-8). Whose discourse? A comparison of the Foucauldian and Habermasian concepts of discourse in critical IS research. *Proceedings of the 10th Americas Conference on Information Systems*, (pp. 4329-4336), New York, NY.

Symon, G. (1998). The work of IT system developers in context: An organizational case study. *Human-Computer Interaction*, 13(1), 37-71.

Thompson, M. (2002). ICT, power, and development discourse: A critical analysis. In E. H. Wynn, E. A. Whitley, M. D. Myers, & J. I. DeGross (Eds.), *Global and organizational discourse about information technology* (pp. 347-343). Boston: Kluwer.

Thoresen, K. (1993). Principles in practice: Two cases of situated participatory design. In D. Schuler & A. Namioka (Eds.), *Participatory design: Principles and practices* (pp. 271-288). Mahwah: Lawrence Erlbaum Associates.

Tudor, L. (1998). Human factors: Does your management hear you? *Interaction*, January & February.

Vredenburg, K. (1999). Increasing ease of use—Emphasizing organizational transformations, process integration, and method optimisation. *Communications of the ACM*, 42(5), 67-71.

Vredenburg, K., Mao, J, Smith, P.W. & Casey, T. (2002). A survey of user-centered design practice. In D. Wixon (Ed.), *Proceedings of conference on human factors in computing systems: Changing our world, changing ourselves* (pp. 471-478). New York: ACM Press.

Walsham, G. (1995). Interpretive case studies in IS research: Nature and method. *European Journal of Information Systems*, 4(2), 74-81.

Weedon, C. (1987). *Feminist practice and post-structuralist theory*. Oxford: Basil Blackwell Ltd.

Weedon, C. (2004). *Identity and culture: Narratives of difference and belonging*. New York: Open University Press.

ENDNOTES

¹ The term involvement is preferred over participation, since participation is interpreted to refer exclusively to actual, direct participative activities (c.f., Hirschheim, 1985), while in the product development context user involvement is mainly indirect.

² IT artifacts are defined (Orlikowski & Iacano, 2001) as “bundles of material and

cultural properties packaged in some socially recognizable form, such as hardware and/or software” (p. 121).

³ Another widely used tradition would have been the Habermasian tradition, but it has been argued that Foucauldian tradition focuses on “real discourses” and on critical examination of the formation of objects and “truths,” revealing hidden and tacit assumptions (Stahl, 2004), which is also the aim of this paper. The Habermasian tradition is well suited for “normative explication of the validity and acceptability of discourses” (Stahl, 2004, p. 4331) through the construct of “ideal speech situation.” The aim of this paper is not to identify the shortcoming of real speech situations in relation to “an ideal speech situation.”

⁴ This description relies on the description of “feminist poststructuralism” outlined by Weedon (1987).

⁵ Designer refers to the “legion of technical and analytical specialists who put together computer systems” (Greenbaum & Kyng, 1991, p. 20).

⁶ In HCI, the traditional goal of this work has been the development and ensuring of “usability,” but a recent trend has been to extend this work to cover also the development and ensuring of “usefulness” (e.g., Beyer & Holtzblatt, 1998; Cooper, 1999; Rosson & Carroll, 2002).

⁷ A “mommy mob” is a label the usability specialists in unit A use of themselves, referring to a (largely) female group of usability specialists trying to control and monitor the designers.

This work was previously published in International Journal of Technology and Human Interaction, Vol. 2, Issue 4, edited by B.C. Stahl, pp. 54-83, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.35

E–Government Practices in Regional Context: Turkish Case

Derya Altunbas

Canakkale Onsekiz Mart University, Turkey

Elif Karakurt Tosun

Uludag University, Turkey

ABSTRACT

This chapter introduces the importance of the Information and Communication Technologies on the regional development in Turkey. Socio-economic transformation can be done with the efficient service opportunities in regions that have different growth rates. Specially, some regions have migration problems for economic and employment reasons in Turkey. Growth poles are a typical development style for Turkey. Therefore, less developed regions should have more advantage from national economic programs. In this chapter, included in Regional development programs of Turkey in the context of Information and Communication Technologies. The objective of this chapter is to point out importance of

improvements of Information and Communication Technologies and e-government programs in Turkey. At this time, it is defined the role of e-government programs on social, economic and political structures of the regions in Turkey.

INTRODUCTION

Network economies which arise with the development of Information and Communication Technologies (ICTs) have caused unavoidable transformation of the paradigm in the social dimension. This is the transformation that has harmonized the information revolution and Information Society. This socioeconomic transformation effects directly the shape of the administration,

the working mechanisms of the state, the level of economic development, and the relationships of the citizen.

The transformation of ICTs offers different alternatives to countries that are efficient and produces service opportunities for their citizens on social, economic, political, and cultural platforms. Specially with this transformation, underdeveloped countries and developing countries could find opportunities of supply by using their resources efficiently, similar to the developed countries.

Beside the potential of minimization of differentiations at development among the countries, regional differentiations are also removed in a country which is another function of ICTs. At the same time, it has given opportunities that are distributed equally among the citizens of a country. In this study, the basic hypothesis is depending on the idea that ICTs can act as instruments for governments to remove the differentiations of development either among different countries or within each country. However, efficient use of this instrument depend directly on the current socioeconomic conditions of the country. This study examined a few cases on efficient use of the e-government system in Turkey. In this framework; first of all, government decisions are analyzed that were used in the regional policy, including development planning decisions about underdeveloped areas or the regions with priority of development. Secondly, it has tried to assess the level of ICTs in Turkey. Finally, it analyzed the effects of ICTs on the socioeconomic life in the regions that have priority for development.

REGIONAL DEVELOPMENT: DEFINITION AND TERMINOLOGY

Differentiations of development can be based on differentiations of capital and skilled labor investment in certain regions that accumulate imbalances apart from the different geographical conditions in a country (Ozturk, 2001). So, re-

gional planning must include social and economic needs of the citizens when making settlements for inhabitants. Therefore, the aim of the regional planning should be to increase the social and economic welfare of people and at the same time improve the condition of physical living place or working place.

It has been observed that the interregional balanced development in industrialized countries is decreasing the income inequalities, source spending, and harmful effects of the industrialization in more developed regions. But, underdeveloped or developing countries are mostly determining which strategical point is suitable as the starting point of development and deciding whether strategical public investments will make it possible or not (Gurbuz, 2001).

There are two functions to perform in regional planning. First, regional planning must be efficient to increase the country's economic development. In this view, when the settlement system is establishing and decision of infrastructure is taking place, each decision must be efficient enough for betterment of the economy or at least able to create additional positive effects. Second, the function of regional planning is a tool for preventing regional differentiations. In this context, regional planning seems like a mechanism of use to reverse the unequal development in the country (Tekeli, 1981). The aims of the regional development should ensure that (Gurbuz, 2001):

- Regional imbalance is decreased.
- Each source and economic activity must be compatible in delivering within the geographical regions.
- Source of the region must be properly evaluated.
- Regional development must be dispersed in the country.
- Healthy growth in the region must be promoted.
- Interregional distribution of the industry must be balanced.

- Less developed regions should have more advantage from the national economic development programs.

Furthermore, there are three principles in development policies. They are social revenues, growth poles, and citizen participation. Each of them complement each other (Akder, 2003; Gurbuz, 2001; Kurt, 2003; Tavgac, 2001). The social revenue principle is a short term process and is not economical, but at the same time long term application gives economic benefit to underdeveloped regions. This type of investment must be made by governments (Dinler, 1998). The Growth Poles principle is applicable to the industries that have motor effects in the regions in one or more points of the country. With this investment in the region, the importance of the region is increased and differentiation emerges. This type of development has poles effect on the country's economy. The principle of citizen participation in development policies suggests that if a region's inhabitants have effective participation in policy making, the country will experience success in regional economic and social development.

REGIONAL DEVELOPMENT PROGRAMS IN TURKEY

For regional development programs in Turkey this study has covered two periods of time: before planning and after planning periods. From 1923-1963 is the "before planning" time period. In this period there were not many systematical programs for regional development because the country's overall regions had underdeveloped characteristics. After 1960, the State Planning Organization (SPO) was established for preparing regional planning making (Regional Development Specialization Commission Report, 2002). There are Eight National Development Plans and each of them was prepared to each five years until today. In the regional context, there are some chosen

pilot regions for development at the beginning of the first National Development Planning period. Several different development plans were completed during these periods, such as Eastern Marmara Planning Project, Zonguldak Project, Antalya Project and Çukurova Projects. At the beginning of seventh National Development Plan, some larger regional scale projects were planned in Turkey. They are Eastern Anatolian Project, South-Eastern Anatolian Project, Eastern Black Sea Regional Growth Planning, Zonguldak Bartın Karabük Regional Growth Project and Yeşilirmak Sphere Growth Project. The aim of Regional Development Projects in Turkey is to minimize the regional differentiation, to encourage private sector, to develop infrastructure of the transportation, to increase the facilities of health and education, to increase productivity of agriculture, and to increase employment rate. During this period, there were no recommendations about the development of information and knowledge technologies that relate to the regional context. The reason is that they were taken before the 7th Five Years Development Plan. Most of the regional development projects were in a preparatory stage from 1996-2000. In fact, since October 4, 2001, the E-Turkey Action Plan was integrated with the Europe+ Action Plan. However, in Turkey, programs on the knowledge and Information Technologies develop faster than adoption of regional development application. Thereby, it has been realized that, development rate of knowledge and Information Technologies must be in sequence to the development rate of the investments for these technologies to reach each region in Turkey. A few of the cases are discussed here.

Eastern Anatolian Project (State Planning Organization, 2000)

This project includes 16 cities in the east region of Turkey, covering 158.972 km.² The population of the region is 6,147,603 as per the 2000 census.

Table 1. Cities of Eastern Anatolian Regional Project

| Cities | Population | Annual population increase rate (%) | Gross Domestic Product per person (Dollar) | Socio-economic Development of cities (81 inside in Turkey) | Socioeconomic Development Index |
|----------|------------|-------------------------------------|--|--|---------------------------------|
| AĞRI | 528 744 | 19.03 | 568 | 80 | -1.28116 |
| ARDAHAN | 133 756 | -20.22 | 842 | 74 | -1.07318 |
| BİNGÖL | 255 395 | 2.51 | 795 | 76 | -1.12469 |
| BİTLİS | 388 678 | 16.33 | 646 | 79 | -1.15736 |
| ELAZIĞ | 572 933 | 13.97 | 1074 | 36 | -0.10131 |
| ERZİNCAN | 315 806 | 5.38 | 1158 | 58 | -0.49288 |
| ERZURUM | 942 340 | 10.52 | 1061 | 60 | -0.53286 |
| HAKKARİ | 235 841 | 31.28 | 836 | 77 | -1.13956 |
| IĞDIR | 168 634 | 38.43 | 855 | 69 | -0.89089 |
| KARS | 327 056 | -8.43 | 886 | 67 | -0.81944 |
| MALATYA | 853 658 | 19.22 | 1417 | 41 | -0.22627 |
| MUŞ | 453 654 | 18.63 | 578 | 81 | -1.43956 |
| TUNCELİ | 93 584 | -35.58 | 1584 | 52 | -0.40003 |
| VAN | 877 524 | 31.96 | 859 | 75 | -1.09297 |

Source: State Planning Organization, 2006; State Statistical Institute, 2003; Dağ, 2002

Table 2. Cities of South Eastern Anatolian Project

| Cities | Population | Annual population increase rate (%) | Gross Domestic Product Per Person (Dollar) | Socio-economic Development of Cities (81 inside in Turkey) | Socio-economic Development Index |
|------------|------------|-------------------------------------|--|--|----------------------------------|
| ADIYAMAN | 623,811 | 19.98 | 918 | 65 | -0.77647 |
| BATMAN | 446,719 | 26.09 | 1,216 | 70 | 0.90456 |
| DİYARBAKIR | 1,364,209 | 21.84 | 1,313 | 63 | -0.66993 |
| GAZİANTEP | 1,293,849 | 24.72 | 1,593 | 20 | 0.46175 |
| KİLİS | 114,724 | -12.65 | 1,817 | 54 | -0.41175 |
| MARDİN | 705,098 | 23.34 | 983 | 72 | -0.98944 |
| SİİRT | 264,778 | 8.40 | 1,111 | 73 | -1.00644 |
| ŞANLIURFA | 1,436,956 | 36.10 | 1,008 | 68 | -0.83158 |
| ŞIRNAK | 354,061 | 30.10 | 638 | 78 | -1.13979 |

Source: State Planning Organization, 2006; State Statistical Institute, 2003

E-Government Practices in Regional Context

The regional area is 20.4% of the total area of Turkey and the population is 11.03% of the total of Turkey. The 16 cities that fall in this region are ranked in comparison to Turkey's 81 cities (see Table 1), according to socioeconomic factors.

South Eastern Anatolian Project (<http://www.dpt.gov.tr/bgyu/bkp/gap.html>)

This project has components comprising the development of agricultural infrastructure, industrialization, education, health, and other sectors. Beside the transportation opportunities, in this project dams were built on the Dicle and Firat rivers, and hydroelectric power plants were installed, including some irrigation facilities. In this context it can be seen as a multi dimensional project. Table 2 shows its ranking.

Eastern Black Sea Regional Growth Planning

This project is third of the regional development projects. This region's people have the least portion of income in Turkey. Because of low income and fewer employment opportunities there was

a migration problem in this region. Cities in the region and their socioeconomic ranking can be seen in Table 3.

Zonguldak Bartın Karabük Regional Growth Project

The economy is especially dependent on agriculture and the coal mining establishment in this region. Population was 1.024879 million in 2000 and the population was 0.015 % of Turkey's population. The annual increase rate of this region's population is -8.416 % (2.17 % is for all of Turkey). This region has annual migration of 1.7% in comparison to other parts of the Turkey. Table 4 shows this region's socioeconomic ranking.

Yeşilirmak Sphere Growth Project (<http://www.dpt.gov.tr/bgyu/bkp/ye-silirmak.html>)

In the Sphere River, there is erosion and environmental pollution. Some problems were there due to the overflowing and water pollution, too. With the project of Yeşilirmak Sphere Growth Project the most suitable land use and economic benefits were searched. Ecological equilibrium

Table 3. Eastern Black Sea cities included in the regional growth planning

| Cities | Population | Annual population increase rate (%) | Gross Domestic Product per person (Dollar) | Socio-economic development of cities (81inside in Turkey) | Socio-economic Development Index |
|-----------|------------|-------------------------------------|--|---|----------------------------------|
| ARTVİN | 191,934 | -10.33 | 2,137 | 43 | -0.26018 |
| BAYBURT | 97,358 | -9.75 | 1,017 | 66 | -0.80176 |
| GİRESUN | 524,010 | 4.7 | 1,443 | 50 | -0.36696 |
| GÜMÜŞHANE | 186,953 | 10.18 | 1,075 | 71 | -0.92501 |
| ORDU | 887,765 | 7.10 | 1,064 | 62 | -0.64489 |
| RİZE | 365,938 | 4.8 | 1,897 | 37 | -0.17840 |
| TRABZON | 979,295 | 20.74 | 1,506 | 38 | -0.18582 |

Source: State Planning Organization, 2006; State Statistical Institute, 2003

Table 4. Cities of Zonguldak Bartın Karabük of the Regional Growth Project

| Cities | Population | Annual population increase rate(%) | Gross Domestic Product per person (Dollar) | Socioeconomic development of cities (81 inside in Turkey) | Socioeconomic Development Index |
|-----------|------------|------------------------------------|--|---|---------------------------------|
| ZONGULDAK | 615,599 | -6.01 | 2,969 | 21 | 0.44906 |
| BARTIN | 184,178 | -11.11 | 1,061 | 55 | -0.41550 |
| KARABÜK | 225,102 | -8.13 | 1,587 | 27 | 0.21332 |

Source: State Planning Organization, 2006; State Statistical Institute, 2003

Table 5. Cities of Yeşilirmak Sphere Development Project

| Cities | Population | Annual population increase rate (%) | Gross Domestic Product per person (Dollar) | Socioeconomic development of cities (81 inside in Turkey) | Socioeconomic Development Index |
|--------|------------|-------------------------------------|--|---|---------------------------------|
| AMASYA | 365,231 | 1.65 | 1,439 | 39 | -0.18591 |
| ÇORUM | 597,065 | -1.92 | 1,654 | 46 | -0.32761 |
| SAMSUN | 1,203,681 | 3.59 | 1,680 | 32 | 0.08791 |
| TOKAT | 828,027 | 14.15 | 1,370 | 61 | -0.59010 |

Source: State Planning Organization, 2006; State Statistical Institute, 2003.

is the base issue in this project, and by making economic land use planning management of the natural resources and following the nature accurately it has tried to decrease the differentiation of development within the other regions. This project has contributed to the country's economy, and the population's welfare has improved in the region (see Table 5 for ranking).

E-GOVERNMENT CONCEPTUAL EVALUATION

In the 21st century, the transformation of Information Technologies plays an important role

for the transformation of relationships between government and society. The public management process runs more efficiently through effective participation of citizens using Information Technologies. Within this context it has emerged as the e-government model at the management level. In this model, citizens are able to express their opinions about the administration to public clearly and easily to impact the local or national administration processes in their country. Electronic government can be defined as the government services and duties that belong to the government and must be made available without cutting; and they should be carried out with the mutual participation of citizens in a safe atmosphere within

the electronic Information Technologies (State Planning Organization, 2005c). At the same time, it is important to perform the services, rather than technologies. The government should not only perform electronic shape of services to citizens, but also prepare to use them (Yıldırım & Karakurt, 2004). In another view, e-government system is used to process the public institutions, support the public services, and develop the capacity of citizens. However, some academicians reject the definition of the easiest way to reach to deliver services because it seems too narrow and simple. As a matter of fact, the use of ICTs is not only limited within the Internet or Web sites, but at the same time there are geographical knowledge systems, the tools that are used institutional efficiency and helps public decision makers (Yıldız, 2003; Uckan, 2003).

E-Government Objectives and Practice Areas

In e-government processes, all the services and duties to citizens given by the government must be equal, fast, safe, and efficient. In this process not only does technological renewal happen, but at the same time renewal of the government structure for citizens occurs. Public institutions, local administrations, and other institutions in the public sector, private institutions, and citizens benefit from this opportunity (State Planning Organization, 2005c). Targets of the e-government practices are:

- Visual clarity in the state.
- Fastest process for citizens and government relationship.
- More participation at each level of public administration.
- Citizens lives must be easier when the government gives public services to them.
- More effective working atmosphere in the units of public services.

- Information entirety must be provided and prevented to abuse it.
- Data and work repetition must be prevented and knowledge flow must be provided among the institutions.
- Bureaucracy must be decreased.
- Citizens must have the opportunities by benefiting from public services in all day.
- Public services must be accessible and widespread.
- In public service production and the consumption process, participating citizens must be supported, and their desires or tendencies must be evaluated efficiently.
- Institutions of the state must work to be productive and rational.

The Role of E-Government on Social, Economic, and Political Development

Renewal of the social, economic, and political platforms by utilizing the development of ICTs is most important for developing countries like Turkey. The development process will be faster and easier at each economic platform and, therefore, economic productivity will increase and costs of processes will decrease. However, it is more important to decrease the costs and increase the productivity in the context of the global economy to protect countries' competition power. Specially, if a country has scarce sources as developing countries, thereby using the existing sources more efficiently, the production sector can find more important place in global competitive conditions. Using the ICTs intensively, acceleration will also be created in the social platform. It can be possible with these technologies to increase the quality of life of each person's isochronal throughout the country. However, to achieve this aim, the education program needs to be reframed, at first. Thus, social development should be considered initially, so that underdeveloped regions

and people living in those regions are able to find opportunities for establishing a higher level of standard in their work. By using ICTs the political arena can benefit, too. In this way, perception of the government and citizenship is changed, and participation of the citizens to administration process acts efficiently. Thus, democracy is also realized. Therefore, reliance of the government and citizen is constructed (Turkey Information Foundation Association of Turkey Information Industrialists and Businessmen, 2004). A few of the benefits of the information and communication technologies in the social structure are given below:

- Behavior of public services is changed.
- Brings transformation in perceptiveness about administration.
- Bureaucracy is decreased.
- Cost of management is decreased due to the decreased use of files.
- Productivity increases.
- Effective and efficient services are given.
- E-democracy moves into the country.
- Tax revenues are increased.
- Accessibility to the information will be easier for people.
- Each person will be responsive to the world and participate in the country's development processes.
- Administrative participation process for citizens increases.
- Shorter time is needed to reach information at grass roots.
- Service costs will be minimized at all level for the citizens.
- Quality of education will be increased.
- Employment possibilities will increase.
- E-commerce will create new tools for innovative projects with least cost and fast dissemination.
- Connectivity among the establishments and business houses will be renewed.

E-Government Programs in Turkey

Objectives

After realizing that Europe needs benefit from the opportunities of the new economy, and especially what the Internet brings, the European Council prepared an Action Plan that was decided to be supported and developed by the European Commission in December 1999, not only to decrease the distance between Europe and the U.S., but also to decrease the imbalance among regions of Europe (European Commission, 1998, 2000). Within the European Union, the Middle and East European Countries' high level Committee on Information Society was given responsibility to compose an Action Plan similar to E-Europe, at the Information Society European Ministers International Conference organized in Varshova during in May 2000. This enterprise was primarily called an "E-Europe-like Action Plan" and afterward named "E-Europe+." Later on, the European Council assembled in Lizbon in March 2000 and determined an objective to make Europe the most competitive and dynamic information based economy of the world (Cayhan, 2002). Main objectives of these initiatives are to:

- Provide faster, cheaper, and secured Internet infrastructure
- Cheaper and faster Internet for everybody
- Faster Internet for students and researchers
- Secured nets and intelligent cards
- Increased investment for people and their capacity development
- Prepare European youth for digital age
- Labour power for information economy
- Participation of everybody in the information economy

Encourage the use of Internet to speed up:

E-Government Practices in Regional Context

- E-Trade
- E-Government: Communication for public services
- Online health
- European digital contents for global nets
- Intelligent transportation system

After achieving the objectives determined by the 2002 Action Plan for E-Europe, European Union Countries determined long term objectives for themselves and prepared the continuation of the previous “E-Europe 2005 Action Plan.” The aim of this new plan is to provide contemporary public service for private investigators, to increase productivity, to create suitable conditions for new jobs, and to give the opportunity for everyone to participate in the global Information Society. Furthermore, the goals of E-Europe 2005 (Communication From The Commission To The Council of The European Parliament, 2002) are to provide contemporary online public services, such as:

- E-Government
- E-Knowledge
- E-Health

However, it has been found that, dynamic e-work conditions provide the following benefits, such as:

- Competitive price
- Secured information infrastructure

While using E-Europe 2002 Action Plan for themselves, EU countries prepared E-Europe+ Action Plan for nominees in order to provide them an opportunity to achieve the same social transformation. It has been planned for the candidate countries to achieve these objectives till the end of the year 2003. By the E-Europe+ Action Plan, it is aimed for candidate countries to speed up their economic renewal, to support their institutional development, to develop their power for

general competition and prepare plans for those deserving special conditions. According to this plan, the candidate countries agreed on political determination for four main objectives until the end of 2003. These four objectives are:

- To speed up the formation of the basis of information.
- To provide cheaper, faster, and a more-secured Internet.
- To provide investment for human research.
- To inspire Internet usage.

Before proceeding to discuss an e-government practice in Turkey, authors would like to focus on Turkey’s transformation processes, which are structurally illustrated in Table 6.

E-TURKEY TRANSFORMATION PROCESS

Turkey as a candidate country of the European Union, after agreement with the E-Europe+ Action plan, started working towards formation of an e-Turkey Action Plan parallel to the E-Europe+ Action Plan under the coordination of the Prime Ministry Counselorship since October 2001. For this purpose, 13 different working groups have been assembled comprised of private and civil social establishment representatives. At the end of an 18 month study of these groups, an Action Plan has been prepared and presented to the European Union with a situation determining First Midreport in May 2002. Furthermore, it has been decided that the preliminary conditions determined as the objectives of Turkish e-transformation programs have to be achieved. This preliminary determination is to speed up the main procedures of the Information Society:

- To provide appropriate priced communication services for everybody.

Table 6. Work phases that Turkey performed

| Related Institutions | Work | Year |
|---|--|----------------------|
| ULAKBIM | Research net will be priority: National research nets will be developed in order to provide appropriate data for researchers and students in candidate countries by using MED foundations over more powerful nets. | Till the end of 2002 |
| MEB, YOK, DTM, TUBITAK, TSE, private sector | General security of online processes will be increased: Cooperation among public/private sector on information basis and dependence to each other will be formed, partners will be educated about technological criminology and security, basic specifications for intelligent cards to be developed and security will be established. Common strategies for expanding the usage of intelligent cards will be developed and put into practise. | |
| UBAK, TELECOMMUNICATION INSTITUTION (TK), RTUK | Telecommunication sector will be liberated: Internet service will be appropriate for everybody, and arrangements will be completed. | Till the end of 2003 |
| DPT, GAP Management, National treasury, Private sector, TK | Increasing support will be given on development of projects and Information Society; primarily in less developed regions. | |
| DTM, ETKK, Nongovernmental Organizations KOSGEB | Usage and recognition of electronic signature and studies for basis of e-trade will be accelerated. | |
| Ministry of Health, TT, Private sector | European Public health nets and databases will be established, infrastructure for health thematic will be developed. | |
| MEB, YOK, TBD | Expanded usage of a European certificate about basic Information Technologies will be promoted | Till the end of 2004 |
| Ministry of Justice, DTM, ETKK, organizations of consumers, private sector, nongovernmental organizations | Reliance for e-trade among consumer groups and industry cooperation will be increased Appropriate attempts will be formed and efficient codes will be supported. | |
| UBAK, Ministry of Public Works, KGM, TT, TK | Development Plans, especially for highway infrastructure and intelligent transportation services, will be prepared. | |
| MEB, UBAK, TK, TT, TISSAD | Every school, student, and teacher will be able to use Internet: Support services and educational sources will be established. Educational curriculum and methods of teaching will be made dependent on ICTs. | Till the end of 2006 |
| Ministry of Working and Social Security, working institution, Chambers of occupation, Nongovernmental Organizations | Appropriate education for finding jobs for people unemployed for a long time will be given | |
| Ministry of Working and Social Security, UBAK, TK, Management of the defectives, YOK, Private sector | Design of standards for the handicapped ones will be improved for access of Information Technologies. For excellence on this issue, national centers nets will be formed. | |
| Prime Ministry | Online data will be provided about legal, cultural, environmental, and traffic information. Online access to basic public services, easy online administrative procedure for commercial sector e-signature among public will be supported, and e-market for bids for the public contracts will be formed. | |

E-Government Practices in Regional Context

- To attract European Union about the Information Society.

At this level the agreement dates for adaptation criteria will be given to the European Union that have been determined by meetings under the Turkish Scientific Research Institute (TUBITAK) secretaryship and in coordination with the European Union General Secretaryship and Ministry of Foreign Affairs (TUBITAK, 2002). According to the determined outline, Turkey has to meet all these criteria in 2006. Depending on this date of agreement, the European Mediterranean Partnership (MEDA) projects will end in 2006 (Cetin, Aydogan & Ertugrul, 2002).

To enhance the processes further, the Turkish Telecommunication Company has been given responsibility to develop the e-government portal in coordination with the State Planning Organization under guidance of the Council of Ministers on January 25, 2005 (State Planning Organization, 2005b). Previous to this, the State Planning Organization Counselorship was responsible for coordination, observation, evaluation, and direction of the E-Transformation Turkey Project as the Chairmanship of Information Society.

The goals, institutional structure, and application principles of the E-Transformation Turkey Project were delivered by a printed notice on February 27, 2003 (State Planning Organisation, 2005b). The Emergency Action Plan, E-Transformation Turkey Project is being held in three phases. These are (Ilter, 2000; State Planning Organisation Information Society Department, 2004):

- Phase one is comprised of preparation and review of the existing situation, especially for e-Turkey; and similar efforts will be evaluated. In this phase, report on recommendations based on applications of good examples in Turkey will be prepared.
- E-Transformation National Action Plan will be prepared in the second phase.

- In the third phase, the Action Plan will be put into practise. Report on observation of applications of the plan will be delivered to State Planning Organization Counselorship (State Planning Organization, 2002; Ulusoy & Karakurt, 2003).

As per the project under Turkish National Information Main Plan (TUENA), the cost price for the infrastructure is calculated to be \$35 billion and under this project each of the citizen could reach national information infrastructure by 2010. It is foreseen that 14 billion of this amount will be spent for infrastructure, and \$21 billion for output units like computers, Web, TV, and so forth.

It has been observed that among macroeconomic policies, e-government investments have a priority as far as the E-Transformation Turkey Project is concerned. However, it is stated that among the projects in practice, the ones which can be adopted to the E-Transformation Turkey Project will have priority parallel to sectoral and regional priorities (State Planning Organization, 2005c). Moreover, about e-government studies, it is stated that e-government services will be established holistically instead of individual institutional approaches. In this manner, it is mentioned that bureaucracy and other problems emerging from recessive connection among institutions will be decreased.

E-GOVERNMENT PRACTICES IN TURKEY

With the Primeministry circular on December 4, 2003 (State Planning Organisation, 2005b), the application of the E-Transformation Turkey Project Short Term Action Plan had started an organizational structure. The Ministries of Industry and Commerce, Transportation, Education, Health, Justice and State Planning Organization, Institute of Turkey Standardization, Association of

Turkey Information and Communication worked together in coordination for the Short Term Action Plan during 2003-2004. From a legal perspective, "Having Knowledge Law" on 24th April 24, 2004 and "Electronic Signature Law" on July 23, 2004 came into effect and rules and regulations on electronic signatures were in operation beginning January 6, 2005 (State Planning Organisation, 2005b).

In addition to these, there is an important tool for transformation of Information Society working in Turkey, that is, "The Project of E-Transformation in Turkey." Targets of this project are development of social welfare, efficient use of investments, effective use of information to decrease the cost of services, and increased international competition. In this context, policies and strategies are being taken. Technical infrastructure and safety of information, education, human resource, legal infrastructure, standardization, e-management, e-health, and e-commerce are taken as a base for the process of transformation. The Board of Directors of "E-Transformation of Turkey" has prepared the Document of Transformation Policy for Information Society. In that document, it is recommended that public institutions and civil society institutions should work together. Furthermore, in the document the most important thing which has been raised is e-government. In this context, studies have already started and important steps have been achieved by the state. For example, literacy rates and Internet use have increased. In this framework, the Ministry of Education and Turkish Telecommunication Company has developed a protocol. According to the protocol, 42,534 schools throughout the country could have Asymmetric Digital Subscriber Lines by the end of 2005. At the same time, 58,900 schools are to have computers and Internet connections. By this time, 578,800 teachers were educated by using the computer as an educational tool. Another project has been launched in the e-government context that aims to increase numerical illiterate people that exist in the public institution.

In the framework of the E-Transformation Turkey Project, the tendency of investment in public institution for ICTs has increased. In 2002, under the National Investment Program, 203 projects were taken with 286,013 billion TL (158.8 million US\$); in 2003 for 204 projects 369,321 billion TL (208.6 million US\$) were allocated; in 2004 for 211 project 451,181 billion TL (281.3 million US\$) budget was given; and in 2005 for 200 projects 626, 253 YTL (388.4 million US\$) was disbursed. It has been observed that, in this area investment for public services increased by 16.6% from 2002 to 2003, by 8.4% from 2003 to 2004 and in 2005 special investment was made in education. At the Investment Program about ICTs cost of the project investments was 2,088,708,000 YTL (1,295,725 US\$) in 2005. The rates of it inside the total public investment is 2.9% in 2002; 3.0% in 2003; 3.8% in 2004; and 3.9% in 2005 (Odabas, 2005; State Planning Organization, 2005a).

In August 25, 2005, there were 6,722 Internet hosts in Turkey that belonged to institutions providing public services. Distribution of them, especially belong to the central administration. These are 3,029 for central administration (gov.tr), 1,001 for local administration (bel.tr), 2,372 for primary and secondary schools (k12.tr), 186 for university or institute (edu.tr), 8 for military service (mil.tr), and 126 for security (pol.tr) (State Planning Organization, 2003; TUBITAK, 2002). Figure 1 shows the distribution of subdomains of .tr and it can be observed that .com remains at the top with 48,136 hosts.

Usually, land phone, mobile phone and Internet penetration are being accepted as the basic indicators of ICT. Surprisingly, it was found that in Turkey, only in 2002, 10,000 people had new subscriptions for phones, but it was decreased in 2003. Mobile phone subscription growth was fast especially in recent years, that is, looking at the period of 1994 until today. In 2003, it had reached to approximately 27.9 million subscribers in Turkey. In this ranking, Turkey has ranked as sixth among the European Union member countries. Internet

E-Government Practices in Regional Context

Figure 1. Distribution of the name servers according to the subdomain names

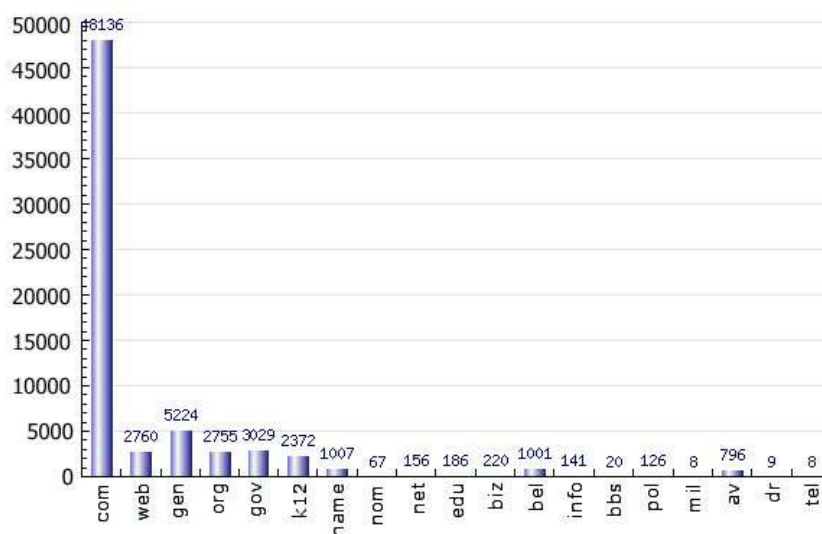


Table 7. Infrastructure of information technologies in different countries of the world

| COUNTRIES | PC/100 | Internet PC/10000 | Online population % | Phone/100 | Mobile/100 | TV/1000 |
|---------------|--------|-------------------|---------------------|-----------|------------|---------|
| USA | 59 | 2,928 | 62 | 70 | 37 | 847 |
| Australia | 47 | 844 | 53 | 53 | 45 | 639 |
| New Zealand | 36 | 901 | 46 | 50 | 40 | 501 |
| Singapore | 48 | 438 | 50 | 49 | 68 | 348 |
| Norway | 49 | 1,009 | 54 | 73 | 70 | 579 |
| Canada | 39 | 769 | 47 | 68 | 29 | 715 |
| England | 34 | 281 | 55 | 57 | 67 | 645 |
| Holland | 40 | 1,017 | 54 | 61 | 67 | 543 |
| Denmark | 43 | 627 | 55 | 75 | 61 | 585 |
| Germany | 34 | 248 | 35 | 60 | 59 | 580 |
| Sweden | 51 | 671 | 70 | 68 | 71 | 531 |
| Finland | 40 | 1,023 | 48 | 55 | 73 | 64 |
| Israel | 25 | 288 | 17 | 1 | 70 | 318 |
| Brazil | 4 | 52 | 7 | 18 | 14 | 316 |
| Italy | 21 | 178 | 33 | 48 | 74 | 486 |
| Arab Emirates | 13 | 176 | 33 | 42 | 59 | 294 |
| Írland | 37 | 296 | 33 | 43 | 67 | 456 |
| Kuwait | 12 | 18 | 8 | 24 | 25 | 491 |
| Argentina | 5 | 73 | 11 | 21 | 16 | 289 |
| Lebanon | 5 | 23 | 9.0 | 20 | 19 | 352 |
| TURKEY | 4 | 11 | 6 | 28 | 25 | 286 |

Source: U.N. (2002)

use is also increasing year by year in Turkey. In 2003, the Internet users in Turkey increased by 5.8% in comparison to 31.1% in the European Union; in 2002, Internet users increased to 7.1% in Turkey, while there was a 35.7% increase in the European Union; and in 2003 Turkey's Internet user growth rate was 8.48%, while the European Union rate was 38.50% (Oruc & Arslan, 2002). Table 7 shows a few ICT indicators and they have been compared with other countries.

Furthermore, in the report on "Global Information Technology," prepared by the World Economic Forum, there are ranked countries related to transformation of information technology. In this ranking, technical infrastructure remains an important indicator as compared to service performance and development. Technical production ability and legal regulations criteria are also taken into account. Turkey's placement in this ranking within the countries is given in Table 8. Table 9

Table 8. Basic indicators related to the ICTs in Turkey

| | 2003 | 2004 | 2005 |
|--|--------|--------|--------|
| Capacity phone switchboard (thousand people) | 21.163 | 21.006 | 21.106 |
| Phone subscribers (thousand people) | 18.917 | 19.125 | 19.000 |
| Concentration of phone subscriber (%) | 26.8 | 26.7 | 26.2 |
| Mobile subscribers (thousand people) | 27.925 | 34.708 | 43.000 |
| Concentration of mobile subscriber (%) | 39.5 | 48.5 | 59.3 |
| Internet users (thousand people) | 6.000 | 10.000 | 15.000 |
| Concentration of internet users (%) | 8.5 | 14.0 | 20.7 |
| Wide band users (thousand people) | 100 | 500 | 1.500 |
| Cable TV Subscribers(thousand people) | 1.044 | 1.127 | 1.250 |
| Market length (in billions/dollars) | 10.3 | 11.9 | 13.8 |

Source: State Planning Organization, 2005.

Table 9. E-Readiness preparation to information society in different countries

| 2002-2003 | | | 2003-2004 | | |
|--------------------|-----------|-------|---------------------|-------------|-------|
| RANK | COUNTRIES | POINT | RANK | COUNTRIES | POINT |
| 1 | Finland | 5.92 | 1 | USA | 5.50 |
| 2 | USA | 5.79 | 2 | Singapore | 5.40 |
| 3 | Singapore | 5.74 | 3 | Finland | 5.23 |
| 4 | Sweden | 5.58 | 4 | Sweden | 5.20 |
| 5 | Iceland | 5.51 | 5 | Denmark | 5.19 |
| 6 | Canada | 5.44 | 6 | Canada | 5.07 |
| 7 | England | 5.35 | 7 | Switzerland | 5.06 |
| 8 | Denmark | 5.33 | 8 | Norway | 5.03 |
| 9 | Taiwan | 5.31 | 9 | Australia | 4.88 |
| 10 | Germany | 5.29 | 10 | İceland | 4.88 |
| ... | ... | ... | ... | ... | ... |
| 50 | TURKEY | 3.57 | 56 | TURKEY | 3.2 |
| Total 82 countries | | | Total 102 countries | | |

Source: State Planning Organisation, 2005b; World Economic Forum, 2005

E-Government Practices in Regional Context

provides an e-readiness comparison, Table 10 gives an overview on computer ownership since 1994 with a target indicator in 2015, and Table 11 gives an overview on Internet users from 1999 with a target of 20,000 in 2005.

E-GOVERNMENT APPLICATION STUDIES IN THE CONTEXT OF REGIONAL DEVELOPMENT IN TURKEY

The searching of following a definite policy in the field of science and technology and the formation of this matter started with a planned period and TUBITAK was founded in 1963 during the first Five Year Development Plan (1963-67); the Second Five Years Plan (1968-1973); the Third Five Years Plan (1973-1977); and the Fourth Five Years Plan (1979-1983) were successfully implemented. Thus, Five Five Year of Development Plans were prepared and the technological improvements and the

technology transfer regions were included in this plan. The fourth Five Year Development process dealt with the policies of technology, and it was foreseen that the policies of technology should be considered as a whole structure with employment and investment policies. The same subjects are also mentioned in the latest, the eighth Five Year Development Plan in 2004 (State Planning Organization, 2002).

In the context of the European Union Adaptation process, the studies about Turkey's communication and information fields are also increased. On October 4, 2001, the studies on formation of E-Turkey Action Plan were started in coordination with the E-Europe Action Plan under the Prime Ministry's Councillor. By January 25, 2005, the responsibility was given to the Turkish Telecommunication Company e-government portal under the coordination of the State Planning Organization. In this way, the projects of information and communication of Turkey have been carried out rapidly. These projects are carried out in such a

Table 10. Computer ownership in Turkey

| YEAR | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | TARGET 2015 |
|---------------------------------|------|------|------|------|------|------|------|------|------|-------------|
| Computer Ownership | 790 | 920 | 1100 | 1300 | 1700 | 2200 | 2500 | 2700 | 3000 | 14100 |
| Computer ownership for each 100 | 1.3 | 1.49 | 1.1 | 2.31 | 5.16 | 11.6 | 22.2 | 26.6 | 33.5 | 17.2 |

Source: State Planning Organisation & United Nations Mukim Coordinatorship, 2005

Table 11. Internet users in Turkey

| YEAR | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | TARGET2015 |
|-------------------------------|------|-------|-------|-------|-------|--------|------------|
| Internet users for each 100 | 900 | 1,500 | 2,500 | 4,000 | 6,000 | 10,000 | 22,000 |
| Internet using for each 100 % | 1.35 | 2.22 | 3.65 | 5.76 | 8.52 | 14.01 | 27.0 |

Source: Turkish Telecommunication Company, 2005

way that entails the whole country. In other words, none of the existing projects could avoid the digital division in socioeconomically less developed regions (Cetin, Aydogan & Ertugrul, 2002).

However, in accordance with the aims of regional development, no special work regarding the communication and information was confirmed in the projects which were started during the period of the Seventh Five Year Development Plan. These projects are Eastern Anatolian Project, South-Eastern Anatolian Project, Eastern Black Sea Regional Development Project, Zonguldak Bartın Karabük Regional Growth Project, and Yeşilirmak Sphere Growth Project; and they are working with the following objectives to:

- Increase the income and the employment per person.
- Reform the income distribution inside the regional areas.
- Widen the activities which will speed up the developments.
- Acquire the long term continuing development by protecting the natural resources and the capacity of the region.
- Provide the continuation of development.
- Improve (develop) the subregional centers as industrial and service centers.
- Improve the private sector.
- Increase the opportunities of employment.
- Increase the agricultural productivity.
- Develop the manufacturing sector related with agriculture.
- Increase the indicators of health and education up to the level of country's average.
- Increase the inside-region and outside-region connectivity.
- Prepare the practice devoted to human improvement.
- Form a filter against the East-West immigration.

In Turkey, related to ICTs projects, it is seen that the required infrastructure projects are be-

ing planned by choosing pilot regions which are developed socioeconomically throughout the country, instead of preparing special projects for undeveloped or underdeveloped regions. The reason for this is, when compared to various countries worldwide, the infrastructure of data processing in Turkey is quite insufficient. And what is more the Turkey prefers; by applying all these projects initially in order to use those experiences in socioeconomically developed regions. After realization for these regions then transmit them to the underdeveloped regions of the country. By using this method, implementation will be less expensive and, at the same time, the results will be reached in a short period in terms of ICTs. However, these may be applicable for government run initiatives.

In Turkey, the relationship between information and knowledge technologies and regional development was weak until 2000. After the E-Turkey Action Plan that is related to the E-Europe+ Action Plan to constitute e-transformation, Turkey has been trying to complete faster organizational, legislation and infrastructure works. In this period of time Turkey has moved forward working about knowledge society importantly, in order to decrease the knowledge disparities within the society. The primary target of Turkey is to transform to an Information Society in the next five years (San, 2005).

In the Preliminary National Development Plan (2004-2006), long term knowledge society strategies have been included that will be completed by 2023 (State Planning Organization, 2003). Turkey will also update the programs of the institutions according to the 2006-2008 program that included regional, national, and international improvements and demands. Besides this, it is implied that the development of the information in the areas of transportation, education, health, agriculture, industry, mining, and manufacturer sectors have been taken into account in the framework of knowledge and information technologies, and infrastructures will be developed throughout

the country (State Planning Organization, 2005a). According to the report on the e-transformation in Turkey 2006, it is determined that knowledge and information technologies have focused primarily on investment in e-government. These investments will be distributed with balance among the regions. To realize this, apart from the central administration, local administrations, non-governmental organizations, universities, private sector entrepreneurs, and local unions will be included in some projects. This will be done firstly, to realize regional development and secondly, to achieve a high rate of welfare succession on the global platform. However, within the perspective of these targets, it is important to have e-strategy. Turkey has the aim to complete the infrastructure in relation to the e-strategy to be included in the first 15th rank on knowledge economy in the world by 2015 (State Planning Organization, 2005c). It is also important to realize governance along with this aim. Nongovernmental organizations, local administrations, and professional institutions will be included to work to achieve this aim. At the same time, to increase qualified people and to widen remote education, programs will be applied in the e-strategy. Specifically, this will create new employment facilities in underdeveloped regions, income levels will be increased, competition power will be strengthened, necessary technical infrastructure systems will be established all over the country, and legislation will be accomplished.

RESULT AND EVALUATION

In this document, it is analyzed that Turkey has used the ICTs in the undeveloped areas in order to provide the socioeconomic escalation as summarized as follows:

- According to the Census 2000, Turkey, having the population of 67,844,903, with a rate of 18.34% population increase, and national

income of US\$4,744 per person (according to the 2005 data), is included as one of the developing countries. However, there are regions differing from each other in the concept of socioeconomic development.

- In Turkey, various policies have been produced since 1963 (the planned period) in order to develop the socioeconomically backward regions. State Planning Organisation has been responsible for this to provide the coordination and to activate the projects.
- In Turkey, the targets of the regional development policies are to minimize the socioeconomic differences among regions, to improve the private sector, to complete the infrastructure of transportation, to increase the education and health services, to increase the productivity of agriculture, to increase employment, and to increase the income per person.
- Recently, Turkey has accelerated the programs in the field of ICTs in order to compete with the other countries in the global aspect and to get benefit from the positive values resulting from the differences in the ICTs. As Turkey is a candidate country for the European Union membership and as the European Union is giving importance to the projects on ICTs, it is important for Turkey to carry out similar projects.
- On October 4, 2001, the project on formation of an E-Turkey Action Plan was started in coordination with the E-Europe Action Plan under guidance of the Prime Ministry's Councillor. On January 25, 2005, Turkish Telecommunication Company started implementing the E-government Portal under the coordination of the State Planning Organisation. Similarly, the Information Society Department Presidency was founded in the structure of SPO which is responsible for the coordination, observation, evaluation, and the orientation of the E-Transformation Turkey Project.

- When compared to various other countries of the world the infrastructure of data processing in Turkey is at the bottom levels. It has been found that, one of the most important problems about the usage of ICTs is the digital division. This is due to low income status of each individual in the country.
- The programs regarding the ICTs in the country are applied in the pilot regions where the results of the projects are supplied with a lower cost and in a shorter time.
- In a developing country like Turkey, use of ICTs in socioeconomic and social development is a great opportunity, but regarding the use, in terms of time and funding, it is quite insufficient. Turkey cannot properly take this opportunity as an advantage, unless every kind of project has been practiced in educational, legal, political, economical, and social aspects in order to increase the ability to compete with other countries in the global aspect and to use the ICTs effectively within the country.

Turkey has a young and dynamic population and this is an advantage to e-transformation. If there is an integration between the regional development projects and knowledge and information technologies development, regional migration tendencies will be decreased and the population will be employed in the regions. In conclusion, with knowledge and information technologies, differentiation or polarization of the regions will be prevented and certain socioeconomic levels will be reached in all the regions of Turkey.

REFERENCES

Akder, H. (2003). *Regional inequality and rural poverty in Turkey: Human development approach*. Ankara, Turkey: State Planning Organization Press. Retrieved June 29, 2006, from <http://www.>

tesev.org.tr/projeler/yoksulluk_bolgesel_metin_tebliğ2.php

Cayhan, E. (2002). E-Government in European Union. In *Proceedings of the National Information Economy and Management Conference* (pp. 315-332), University of Sakarya Press.

Cetin, H., Aydogan, O., & Ertugrul, Z. (2002). *E-Turkey condition analysis and solution proposals*. Ankara, Turkey: Telecommunication Institute Publications.

Communication from the commission to the council the european parliament. (2002, August 28). E-Europe 2005: An information society for all action plan to be presented in view of the Sevilla European Commission. The Economic and Social Committee Of Regions.

Dag, R. (2002). *Development of eastern and south eastern regional: Marco politics of regional development*. Ankara, Turkey: State Planning Organization Press.

Dinler, Z. (1998). *Regional Economy*. Bursa, Turkey: Ezgi Publications.

European Commission. (1998). *Public sector information: A key resource for Europe*. Green Paper on Public Sector Information in the Information Society, COM 585.

European Commission. (2000, June 19-20). *E-Europe 2002: An information society for all*. Action Plan Prepared By The Council and the European Commission For Feira European Council.

Gurbuz, B. (2001). *Planning of rural development: Example of brusa administrative province and district keles*. Unpublished doctoral dissertation, University of Uludag, Bursa.

Ilter, G. (2000). *Government and Internet strategies*. Retrieved June 29, 2006, from <http://www.edevlet.net/eTurkiye/devletveinternet.pdf>

Kurt, M. (2003). *Development of Turkey economy for a model proposal: Foundation of knowledge*

development. Retrieved June 29, 2006, from http://www.bilgiyonetimi.org/cm/pages/mkl_gos.php?nt=551

Odabas, C. (2005). Strategic Administration and E-Government. *Periodical of Sayistay*, 1, 83-93

Oruc, E., & Arslan, S. (2002). *Prevention of numerical gap: Strategic plan*. Ankara, Turkey: Telecommunication Institute Press. Retrieved June 29, 2006, from http://www.tk.gov.tr/Yayin/Raporlar/pdf/Sayisal_Ucurumun_onlenmesi.pdf

Ozturk, N. (2001). *Regional development in Turkey and south eastern anatolian project*. Unpublished doctoral dissertation, University of Uludag, Bursa.

Regional Development Specialization Commission Report. (2002). *Eighth five year of development plan*. Ankara, Turkey: State Planning Organization Press.

San, M. (2005). *Knowledge management at development planning and institutional knowledge politic model for state planning organization*. Ankara, Turkey: Management Information Center Department Presidency Press.

State Planning Organization. (2000) *Eastern Anatolian Project*. Ankara, Turkey: State Planning Organisation Press.

State Planning Organization. (2002). *AR-GEAR-GE group work report*, Second Science Council of Turkey. Ankara, Turkey: State Planning Organization Press.

State Planning Organization. (2003). *Turkey Republic Forepart of National Development Plan*. Ankara, Turkey: State Planning Organization Press.

State Planning Organisation Information Society Department. (2004, January). Information economy strategies and politics of information society in Turkey, 22. Working Group: Outline Report of Information Society and Information Economy.

In *Proceedings of the Izmir Economy Conference*. Ankara, Turkey: State Planning Organisation Information Society Department Press.

State Planning Organisation & United Nations Mukim Coordinatorship. (2005). *Turkey Millennium Year Development Aims Report*. Ankara, Turkey: State Planning Organisation Press. Retrieved June 29, 2006, from http://www.un.org.tr/undp_tur/docs/mdg/binyil05.pdf

State Planning Organization. (2005a). *Middle term program 2006-2008*. Ankara, Turkey: State Planning Organization Press. Retrieved June 29, 2006, from <http://ekutup.dpt.gov.tr/program/2006-2008pdf>

State Planning Organisation. (2005b). *E-Transformation Turkey Project 2005 action plan*. Ankara, Turkey: State Planning Organisation Information Society Department Presidency Press. Retrieved June 29, 2006, from <http://www.bilgitoplumu.gov.tr/2005EP/2005EylemPlani.pdf>

State Planning Organization. (2005c). *E-Transformation Turkey Project with information and communication about technologies subjects in 2006 year programme*. Ankara, Turkey: State Planning Organization Press.

State Planning Organization. (2006a). Retrieved June 29, 2006, from <http://www.dpt.gov.tr/bgyu/bkp/gap.html>

State Planning Organization. (2006b). Retrieved June 29, 2006, from <http://www.dpt.gov.tr/bgyu/bkp/yesilirmak.html>

State Statistical Institute. (2003). Retrieved June 29, 2006, from <http://www.die.gov.tr>

Tavgac, G. (2001). *Inter regional development policy in Turkish development plans*. Unpublished master's dissertation, University of Uludag, Bursa.

Tekeli, İ. (1981). *Regional politics in period of Four plan and space differentiation of economic*

growing. *Periodical of ODTÜ Gelişme*. Ankara, Turkey.

TUBITAK. (2002). *Turkey information society: Strategic country [TUENA Declaration]*. Retrieved June 29, 2006, from <http://www.tuena.tubitak.gov.tr/basin/basin-5-haziran.pdf>

Turkey Information Foundation Association of Turkey Information Industrialist and Businessmen. (2004). *E-Transformation Turkey Executive Committee short term action plan of information society strategic plan preparation*. İstanbul, Turkey: Turkey Information Foundation Association of Turkey Information Industrialist and Businessmen Press.

Turkish Telecommunication Company. (2005). *The statistics of Turkish telecommunication*. Ankara, Turkey: Turkish Telecommunication Company Press.

Uckan, Ö. (2003). *E-Government, E-Democracy and Turkey*. İstanbul, Turkey: Literatür Publications.

Ulusoy, A., & Karakurt, B. (2003). Necessity of transition to e-government in Turkey. In *Proceedings of the National Information Economy and Management Conference*, University of Kocaeli, Turkey.

U.N. (2002). *Benchmarking e-government: A global perspective*. United Nations.

World Economic Forum. (2005). Retrieved June 29, 2006, from <http://weforum.org>

Yıldırım, H., & Karakurt, E. (2005). E-Government and applications. *Periodical of Isguc*, 6(1). Retrieved June 29, 2006, from <http://www.isguc.org>

Yıldız, M. (2003). *Evaluation and general of view of electronic (E)-Government theories and applications*. Contemporary Public Administration I. İstanbul, Turkey: Nobel Publication.

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 282-304, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.36

Information Security in Small Businesses

Kishore Singh

University of KwaZulu-Natal, South Africa

ABSTRACT

This chapter discusses the impact of security in small and medium enterprises. It views the development of a security policy in serious light and come up with some recommendations on how this can be handled.

INTRODUCTION

The management of information security and security related events has become an issue commanding ever-increasing attention from the various professions attending to the information needs of organisations using ICT¹ (Von Solms, 2001). The basic need of developing secure information systems (IS), however, continues to remain unfulfilled. This is because the focus continues to remain on the means of delivery

of information (i.e., the technology (Galliers, 1993)). Management continues to believe that information security and related problems can be solved by technical means (Vermeulen & Von Solms, 2002). The responsibility of information security is entrusted to the technical department without proper, direct, and continuous support from executive management. The net result is that technology is used to solve the information security problem without a total, comprehensive solution (Von Solms & Von Solms, 2004).

This chapter describes the contribution made by small businesses² to the South African economy, reviews some of the current literature in information security, and examines some of the more recent (2002 to 2004) survey statistics describing the state of information security in organisations. This chapter is aimed at academics, information security researchers, information security practitioners, and owners of small

businesses that make use of computer-based information systems. Additionally, any student of information security that needs to understand the fundamentals of effective information security implementation in small businesses will find this chapter useful.

SMALL BUSINESS PROFILE

South Africa has a thriving small business sector supported by a network of financial and non-financial service providers. By enabling people to meet their basic needs for survival, small businesses play an important role in economic development. It has been proven in many parts of the world that the small business sector stimulates economic growth, redistributes wealth, and creates jobs. The latter being particularly important within the context of the reality that large corporations' demand for labour does not increase in proportion to their growth (Ntsika, 2002).

According to Ntsika (2002), some of the reasons why small businesses in South Africa have become an important target for policy makers are: (1) they can easily absorb excess labour capacity as compared to other sectors, (2) the cost of creating a job is lower than in the large

businesses, (3) they create more competitive markets, (4) they can easily and quickly adapt to changing consumer tastes and trends, (5) they often use local recycled resources, (6) they provide opportunities for entrepreneurs, and those who are unemployed, under-employed, or retrenched, (7) they allow workers with limited or no skills or training to learn these on the job, (8) they are often sub-contracting by large enterprises thereby providing flexibility to production processes, and (9) they play an important role in innovation.

Classification and Distribution of Small Businesses

For the purpose of this chapter, enterprises in South Africa have been categorized according to the definitions provided in the National Small Business Act (NSBA, 1996). Table 1 summarises the NSBA (1996) classification of small businesses.

The National Small Business Act (NSBA, 1996, p. 34) additionally distinguishes a small business using the following three criteria: (1) total full-time equivalent employees (<100, with the exception of mining and quarrying; and manufacturing (<200), (2) total annual paid turnover (figures vary according to sector), and (3) total gross asset value (figures vary according to sector).

Table 1. Classification of small businesses source (Adapted from the National Small Business Act 1996)

| Category | Characteristic |
|----------------|---|
| 1. Survivalist | income generated is less than the poverty line, there are no paid employees and the asset value is minimal |
| 2. Micro | turnover is less than the VAT registration limit, they are not formally registered and employ between 1- 4 people, excluding the entrepreneur |
| 3. Very small | operate in the formal market and have access to modern technology |
| 4. Small | a secondary co-ordinating management structure is in place with some form of managerial level coordination |
| 5. Medium | further decentralization of decision-making, a more complex management structure and further division of labour are evident |

Growth of Small Business Sector

During his State of the Nation Address (2004), the South African president stated that South Africa would continue to focus on the growth and development of a modern “first economy” in order to generate resources to meet the challenges of its underdeveloped “second economy.” He added that further expansion of small and medium enterprise will be a contributing factor and promised to help increase the market share of small businesses (Mbeki, 2004).

Prior to the official launch of the Small Enterprise Development Agency (SEDA), the Deputy Minister of Trade and Industry commented that small businesses have an important role to play in the economy. The minister added that further development of the small business sector will assist in economic growth, job creation, and reduction of poverty in South Africa (SEDA, 2004).

Contribution to Economy

South Africa’s small business sector is the backbone of the national economy and currently employs over 50% of the workforce and accounts for over 35% of the GDP (Ntsika, 2004). According to Ntsika (2002), the contribution of small businesses in 2001 to GDP was 36.1%, up from 32.7% in 1995. Small businesses accounted for at least half of GDP in the agricultural and construction sectors and more than 40% of GDP in the trade, catering, and accommodation, as well as the transport, storage, and communication sectors.

In 2002, small businesses employed 68.2% of people employed in the private sector, as opposed to 44% in 1995 and 53.9% in 2001. Small enterprises constituted the most significant small business employer, (accounting for 21% of total small business employment), followed by medium-sized (18% of total small business employment) enterprises and micro enterprises (17% of total small business employment).

The largest provinces in economic terms are Gauteng, Kwazulu-Natal, and Western Cape, which jointly account for 69% of South Africa’s GDP. Some 60% of all enterprises and 70% of all small businesses are concentrated in these three provinces. Small business distribution in these three provinces is Gauteng (38.4%), Kwazulu-Natal (18.4%), and the Western Cape (13.4%) (Ntsika, 2002).

Small Businesses and Technology

According to Pratt (2002), small businesses have benefited from new technologies that have decentralized computing and telecommunications. In the past only large corporations could acquire the sizable capital required for commerce that depended upon mainframe computers and other costly business equipment. However, since the 1980s, the advent of inexpensive personal computers have enabled small firms to compete with larger businesses. First, the cost of equipping a home office has dropped significantly and the capabilities of business tools have improved. Second, the Internet, is transforming the way people work, live, and conduct business. E-mail, the Internet, and the cell phone offer connections that extend globally from any location--an office building, a home office, a car, or boat (e.g., Amazon.com, initially started out in a home basement, has since taken over the online book market from Barnes and Noble). Individuals now have access to information and to markets on a 24x7 basis (Pratt, 2002).

Small businesses, by their very nature, are able to adapt to change faster than large businesses. Small businesses are the fastest changing sector of business (SBA, 1999a). Small businesses are embracing the use of Internet technologies and e-commerce as a way to leverage their limited resources and to reach an expanded customer base. According to SBA (1999b), small home-based businesses represent more than 18% of

all homes with personal computers, and of all home-based businesses in the United States, 60% use personal computers to conduct their business activities (Pratt, 2002).

According to SBA (1999b), the rate of Internet connectivity among small businesses rose from 21.5% in 1996 to 41.2% in 1998 to 61% in 1999. The percentage of small businesses with a World Wide Web (WWW) presence was 35% in 1999. Of those small businesses with a Web site, 78% were motivated to develop one in order to reach new and potential customers. One third of small businesses currently perform business transactions using their Web site. Small businesses that use the WWW have higher annual revenues than those that do not, averaging about one million U.S. dollars per year more (SBA, 1999b).

Small businesses often initiate technological innovation, the use of business applications, the use of personal computers, and the Internet (Oliver, 2000). The personal computer and Internet support smaller businesses and allow them to match big-business efficiencies, thereby enhancing their ability to communicate with suppliers and customers, lower costs, and expand markets (Oliver, 2000). Innovative entrepreneurs (early adopters) use technology and the Internet as a way to market niche products and reach distant customers in ways that were not available in the past. As a result, of this adoption of technology, structural changes are required industrial organization.

Petkov, Fry, Petkova, and D'Onofrio (2003) state that small businesses need technology in order to succeed. Some of these technologies could be used to solve the problems of smaller businesses and to accumulate knowledge for improvement of their services. Lubbe (2004) states that investment in IT has an impact on the competitiveness of small and medium organisations. As a result, small businesses are beginning to spend a higher percentage of their turnover on IT; however Lubbe (2004) goes on to state that the biggest limitation to ICT implementation in small businesses was that 80% of them did not know how to use ICT

correctly. Additionally, the biggest mistake that small businesses made in implementing ICT was that they did not understand that they cannot do everything themselves.

From the discussion in the preceding paragraphs, the author concludes that ICT adoption and an Internet presence are emerging as powerful tools for business success. As more small businesses show successful use of ICT, other small businesses will be motivated to adopt these technologies and practices. Embracing ICT and the Internet are critical factors that will determine a small businesses market share in the future. Those small businesses that ignore or hesitate to implement new technologies will be doing so at their own risk (Pratt, 2002).

Small Businesses and Crime

Berger (1981) affirms that security, in general, is a problem for small businesses. A small business does not have the business base across which to spread the cost of security personnel or technologies. Additionally, he concludes that businesses with more than 100 employees are better able to afford a security officer or manager on staff. Chelimsky, Jordan, Russell, and Strack (1981) recognize that small businesses suffer more from crime than larger businesses and bear a greater proportion of loss as a result of crime than other businesses. The author therefore concludes that those least able to protect themselves—the small business sector—are targeted more often, and the consequences are often more serious.

According to Chelimsky et al. (1981), insurance companies attribute approximately 30% of business failures to internal theft. A 20-year old analysis of white collar crime conducted by Berger (1981) confirms that internal theft by employees surpasses the incidents of shoplifting, hold-ups, and burglary collectively.

Small businesses continue to embrace new technologies resulting in the computerization of many business processes (Pratt, 2002). As a

result, they have become potentially more vulnerable to internal theft. This is particularly true with regards to theft of money, which is the most threatening crime to small business (Doney, 1998). Most small businesses aren't large enough to have security experts on staff (Keogh, 1981), yet the potential result of computer-based crime can be catastrophic (e.g., business failure, financial, and personal liability). Studies described in Doney (1998) indicate that the average loss experienced by a business is about ten times higher when a crime is committed with the assistance of a computer as compared to when committed without it.

According to Pratt (2002), the issues that arise in the move of small businesses to electronic commerce include the cost of establishing and maintaining an Internet presence and security issues associated with online transactions. Of the security-related concerns, the predominant one is that of fraud. The concern over fraud is expected to be amplified by security concerns related to digital cash, as that medium becomes common.

Most small businesses are managed by the owner with only basic management structures (if any) in place (NSBA, 1996). A survey conducted by Lubbe (2004) established that one-half of small business owners do not have any idea of what ICT entails nor how it should be used. It is therefore a reasonable conclusion that by embracing new technologies without correct investigation, implementation, or incomplete understanding of the technology itself, small business owners are exposing themselves to a risk environment and are unable to set up and maintain a suitable level of information security without expert assistance. Additionally, a survey conducted by PriceWaterHouse Coopers (ISBS, 2004) determined that, more than 50% of businesses in the United Kingdom think that information security incidents will continue to increase in the future, despite their high confidence in existing security controls. How then can small business

practitioners deal with the ever-increasing threat to information security?

Initial attacks of computer-based information systems were aimed at specific organisations, primarily large corporate enterprises. Although smaller firms were attacked, most small firms could somewhat depend on "security through obscurity" (Panko, 2004, p. 10). Today, most attacks are equivalent of firing guns into the crowds. This implies that every computer attached to a telecommunications network has an equal opportunity of being compromised (Panko, 2004).

Lubbe (2004) verifies that a security gap exists between current and required security practices in small businesses. This gap did not appear as a result of the absence of a shared vision. Instead, according to Lubbe (2004), there was an agreement between big business and small business respondents about the importance of certain security tasks and security skills. Many of these security tasks, however, received low importance scores from small business practitioners.

REVIEW OF INFORMATION SECURITY LITERATURE

This section reviews some of the current literature in the subject of information security and provides a background to the problem of information security in small businesses.

Definition of Information Security

Security relates to the protection of valuable assets against loss, misuse, disclosure, or damage (ITGI, 2001). Security related problems occur because of the need to balance two important yet conflicting goals viz. (1) the goal of providing access to resources and (2) the goal of preserving confidentiality, integrity, and availability (Mehta & George, 2001).

Tsujii (2004) defines information security as a process for establishing a complete system of

social fundamentals that links and coordinates technologies, administration, and management techniques, legal and social systems, and information morals. This, he states, will improve usability and efficiency, enhance security and privacy, and lead to a reduction in monitoring and surveillance over system users. Finne (1998) suggests that when information is misused, lost, or threatened it is as a result of insufficient information security.

The United States National Institute of Standards and Technology (NIST, 1995, p. 5) offers the following definition of information security

“The protection of information system assets (including hardware, software, firmware, information/data and telecommunications) against various threats and attacks in order to preserve the integrity, availability, and confidentiality of these systems.”

A desirable outcome of security is thus the reliability and preservation of system conditions and functions. Confidentiality, integrity, and availability (CIA) are regarded as the three components of information security (Tsuji, 2004). These concepts are summarized in Table 2.

Williams (2001) states that the concept of security relates to the protection of valuable information assets. The data or information must be protected against harm from threats leading to its loss, inaccessibility, alteration, or wrongful disclosure. The main objective of information

security is to protect the interests of those relying on information, and the systems that deliver the information, from damage resulting from failures of availability, confidentiality, and integrity (Williams, 2001).

The IT Governance Institute (ITGI, 2001) confirms that information security objectives are met when: (1) information is observed by or disclosed to only those who have a right to know (confidentiality), (2) information is protected against unauthorised modification (integrity), and (3) information is available and usable when required, and the systems that provide it can appropriately resist attacks and recover from failures (availability).

The COBIT security baseline (COBIT, 2004) ascertains that the relative priorities and significance attached to confidentiality, integrity, and availability varies according to the value and type of information and the context in which it is being used. For example, integrity of management information is important to a business relying on critical strategy-related decisions, and integrity of online shopping is very important to a home user. Furthermore, the amount of protection afforded to a system depends on the likelihood of a security incident occurring and the level of impact the incident will have should it occur (COBIT, 2004).

The definition of information security adopted in this chapter is as specified in NIST (1995), for example:

Table 2. Confidentiality, integrity, and availability (Adapted from Tsujii, 2004)

| Component | Description |
|--------------------|--|
| 1. Confidentiality | Only a person who has permission to access particular information can access it. |
| 2. Integrity | Information and its associated processing methods are authentic and complete. |
| 3. Availability | The ability of authorised users to access information and related assets reliably whenever necessary is preserved. |

Information security is the protection of information system assets³ against various threats and attacks in order to preserve the confidentiality, integrity, and availability of these systems.

Importance of Information Security

COBIT (2004) establishes that ICT has become an integral part of everyday business and private life, and dependency on information systems is constantly growing. New technologies have emerged that allow unprecedented functionality but introduce new risks and environments that are harder to control (e.g., wireless technology, mobile computing, and integration of technologies (i.e., multimedia). Increased dependency on ICT by individuals and organisations alike implies that the impact of system failures is magnified. Whether the incident happens to a home user (e.g., relying on online banking) or an enterprise (e.g., relying on online customers), security incidents have a real impact. With the proliferation of communication networks, individuals are justified in being concerned about the privacy of their personal information and organisations need to protect the confidentiality of corporate data, while promoting electronic business (COBIT, 2004).

According to ITGI (2001), ICT can generate many direct and indirect benefits, and as many direct and indirect risks. These risks have led to a gap between the need to protect systems and the degree of protection applied. The gap is caused by (1) extensive use of technology, (2) increased interconnectivity of systems, (3) elimination of distance, time, and space as constraints, (4) rapid technological change, (5) decentralized management and control, (6) increase in unconventional electronic attacks against organisations, and (7) external factors such as legislative, legal, and regulatory requirements, or technological developments.

New risk areas that could have a significant impact on critical business operations, have emerged. These include: (1) increasing require-

ments for availability and robustness, (2) growing potential for misuse and abuse of ICT affecting privacy and ethical values, and (3) external dangers from hackers, leading to denial-of-service and virus attacks, extortion and leakage of corporate information (ITGI, 2001).

New technology provides the potential for dramatically enhanced business performance hence, improved and demonstrated information security can add real value to any organisation (small or large) by contributing to interaction with trading partners, closer customer relationships, improved competitive advantage, and protected reputation (ITGI, 2001). Technology can also enable new and easier ways to process electronic transactions and generate trust (ITGI, 2001). However, the ensuing increase in technical complexity has led to new and more complex risks (COBIT, 2004).

Von Solms (1998) notes that in the early days (pre-personal computer period), securing computing environments required few technical and physical mechanisms. With the advent of the personal computer (PC) and multi-processors, a number of additional technical security measures became necessary (e.g., user identification, authentication, authorization, and access control to data). Nevertheless, a precise information security policy ensured that the entire environment was controlled and secured, to an acceptable level, by the organisations personnel (Von Solms, 1998).

As organizations connect their communication networks to the Internet or to the networks of their business partners, it is no longer possible to maintain precise control over their ICT systems and users, and consequently information security in general. The information security policy, which dictates the behaviour of users within an organization, has no influence on any users outside the organization. Therefore, it is imperative for individual organizations to protect their own ICT environments satisfactorily since technologies such as EDI,⁴ the Internet, and EFTPoS⁵ enable organizations to exchange information electronically, and inadequate protection on one side may

have negative consequences on the other side (Von Solms, 1998). It can be potentially harmful to any organisations reputation if business partners or potential business partners label the organisation as having inadequate information security.

Blatchford (1998) notes that severe business uncertainty can result from systems that are vulnerable and that poor information security can have adverse economic impacts on individuals, organizations, and society in general. Von Solms (1996) suggests that a stage is being reached where an organisations potential business partners will require proof of adequate information security. Failure to provide such evidence may result in the inability to attract new business and the potential loss of some existing business partners. Mitchell, Marcella, and Baxter (1999) confirm this by stating that information security breaches can have a devastating effect on an organisation. He notes that the loss of confidential information (proprietary product information, client data, and business plans) can result in the loss of customers and credibility and eventually reduced profitability. He goes on to say that while management processes, policies and technologies exist to protect corporate information, evidence continues to suggest that companies are either unaware of the scale of the threats, or are not taking steps to protect information.

As businesses begin to increasingly adopt and depend on the Internet and ICT to increase their bottom lines, concerns over security and related issues will continue to be listed as top challenges hindering increased earnings potential and expansion of market shares (Garg, Curtis, & Halper, 2003). In addition to the growth of e-commerce, laws such as the Electronic Communications and Transactions Act (ECT, 2002) stipulate that comprehensive safeguards must be deployed in order to protect the security, privacy, and confidentiality of personal and corporate information.

Thomson and von Solms (1998) claim that even though technological progression has contributed to the development of information security

management, an emerging issue in information security is the change in the profile of the end-user. End-user tasks are no longer limited to simple data capture. Due to increasing competition from rival businesses, managerial end-users require access to information on a "must have now" basis. Additionally, these end-users often develop their own small systems to interpret and manipulate data. This increase in sophistication of the end-user combined with the need to grant them access to the information they require means that it is no longer possible to maintain effective information security with physical and technical controls only (Thompson et al., 1998).

A partial review of information security survey statistics (AusCERT, 2004; BCMS, 2003; E-Crime, 2004; ISBS, 2004) was conducted next in order to offer evidence to support (1) the importance of ensuring effective information security and (2) the increasing incidence of information security breaches in organisations. The results of the review are stated in the following paragraphs.

The 2004 E-Crime Watch Survey (E-Crime, 2004), conducted by *Carnegie Mellon University Software Engineering Institute's CERT® Coordination Centre*, showed a significant number of organizations reporting an increase in electronic crimes (e-crimes) and network, system or data intrusions. Forty-three percent of respondents reported an increase in e-crimes and intrusions when compared to the previous year (2003) and 70% reported that at least one e-crime or intrusion was committed against their organization. Respondents declared that e-crime cost their organizations approximately US\$666 million in 2003. This increase in electronic crimes over the previous year demonstrates the need for organizations to develop coordinated efforts between their ICT and information security departments to maximize defence and minimize e-crime impact.

The Australian Computer Crime and Security Survey (AusCERT, 2004) conducted by the *Aus-*

tralian High Tech Crime Centre and the *Australian Federal Police* showed a definite increase in the number of organisations experiencing electronic attacks (49%) in the last 12 months, when compared to the previous year (42% in 2003). The survey also indicated that a considerably higher percentage of organisations experienced harmful externally sourced attacks (88%) than harmful internally sourced attacks (36%). This trend continues to demonstrate that organisations connected to the Internet are at a higher risk than those that are not and these organisations appear to be finding it more difficult to prevent externally sourced attacks.

The Information Security Breaches Survey (ISBS, 2004) conducted by the *UK Department of Trade and Industry* and *PriceWaterHouse Coopers* highlighted the continuing increase in the number of UK businesses suffering a security breach. Seventy-five percent of all companies and almost all large companies had at least one security incident in the last year (2004). Overall, 33% of all UK businesses and 66% of large businesses had a serious security breach. This was an increase from just under 50% in 2002. The survey results also suggested that large businesses were more successful at repelling attacks. For the smaller businesses, 1 probe in 50 resulted in a breach of their defences as compared to less than one probe in a hundred for the larger businesses.

No comparable survey data exists that uniquely profiles the entire spectrum of South African businesses. However, in the first ever Business Continuity Management Survey ZA (BCMS, 2003) conducted by *KMPG* and *BMI-TechKnowledge*, 74% of the respondents indicated that their biggest concern was information security breaches. It must, however, be noted that this survey only sampled South African businesses with an annual turnover of between R100 million to R30 billion.

In the preceding paragraphs, a partial review of information security survey statistics was conducted. The year-on-year figures provide

substantial evidence that information security breaches are on the increase. These figures provide conclusive evidence that (1) provision of effective information security is essential for an organisations continued existence, and (2) information security continues to remain a problem for many organisations. Witman (2004) supports this conclusion when he states that information security is a difficult task that requires complex interdependencies between organisations and work units in order to establish and maintain a systems security.

The foregoing discussions have offered evidence that reiterates the importance of information security. The benefits accruing from providing adequate and effective information security include (but are not limited to) increased profitability, larger market share and, most importantly, trust amongst business partners.

Definition of Threats and Vulnerabilities

An overview of the risk environment in which information systems operate is presented next. Information systems are susceptible to many threats and vulnerabilities that can cause various types of damage resulting in significant losses. The effects of these threats vary considerably: some affect the confidentiality or integrity of information while others affect the availability of a system (NIST, 1995).

A threat is the potential for a particular threat-source to successfully exercise a particular vulnerability. A threat-source is defined as any circumstance or event with the potential to cause harm to an ICT system. A vulnerability is a weakness that can be accidentally triggered or intentionally exploited. A threat-source does not present a risk when there is no vulnerability that can be exercised. In determining the likelihood of a threat, one must consider threat-sources, potential vulnerabilities, and existing controls (Stoneburner, Goguen, & Feringa, 2002). It is

the author's conclusion that protection should be against threats that can exploit vulnerabilities. If vulnerabilities exist but there are no threats to exploit them, then little or nothing is gained by providing the protection.

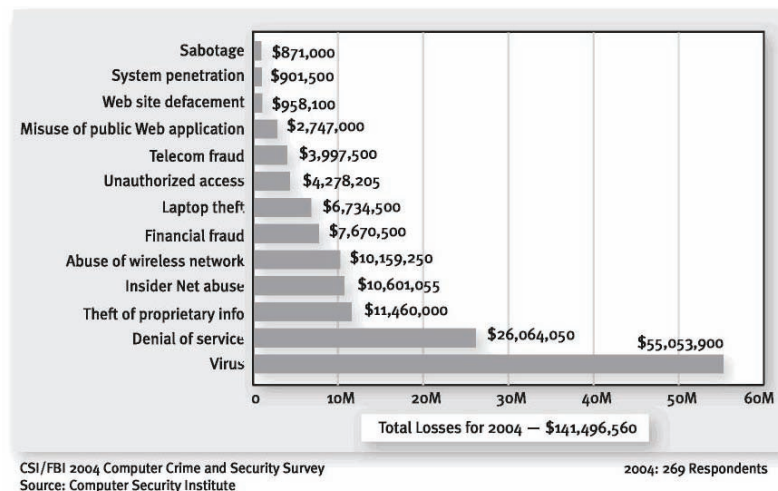
Cisco (2001) identifies several threat-sources and provides some motivations why security crimes are committed. According to this white paper, sources of threats to information security include; organized criminals, cyber terrorists, industrial spies, foreign countries in conflict with targeted nations, disgruntled employees, and amateur hackers. Each of these groups has different motivations and poses a different type of threat and the damage caused can range from simple file integrity errors to total destruction of entire information systems. Some of the reasons why hacking and intrusions occur are: (1) organized criminals are economically motivated and seek information that can be sold or used to extort money from victims, (2) terrorists are politically and/or religiously motivated, (3) industrial spies are seeking competitive information, (4) disgruntled employees want to do damage to systems or obtain information to embarrass their

employer or former employer, and (5) amateur hackers are attempting to prove their abilities (Cisco, 2001). Figure 1 gives a typical list of the threats experienced and the cost (US\$) incurred by each type of threat in 2004 (CSI, 2004).

According to Figure 2, virus infections accounted for the largest portion of losses (approx. \$55.05 million). In ISBS (2004), 70% of organizations surveyed suffered a virus infection, thus confirming the CSI (2004) finding. These results are further confirmed by MessageLabs (2005) where the finding is that at least one in every 34.95 email messages (during January 2005) contained a virus and this number continues to rise. This number is disturbing as 99% of all firms surveyed by CSI (2004) implement antivirus software.

Other incidents identified by CSI (2004) were denial-of-service (approx. \$26.06 million); theft of proprietary information (approx. \$11.46 million); insider net abuse (approx. \$10.6 million); abuse of wireless network (approx. \$10.16 million); financial fraud (approx. \$7.67 million); laptop theft (approx. \$6.74 million); unauthorized access (approx. \$4.28 million); telecom fraud (approx. \$3.98 million); misuse of public Web application (approx. \$2.74 million); web site defacement (approx. \$958,100); system penetration (approx. \$901,500); and sabotage (approx. \$871,000).

Figure 1. Categories of security threats and associated costs (U.S. dollars) (Adapted from CSI, 2004)



\$2.75 million); Web site defacement (\$958,100); system penetration (\$901,500); and sabotage (\$871,000). Although these statistics pertain to U.S.-based organisations, it is a reasonable conclusion that worldwide trends will follow similar patterns. A review of some information security survey statistics (AusCERT, 2004; BCMS, 2003; E-Crime, 2004; ISBS, 2004) was undertaken and this confirmed the author's conclusion.

Protecting ICT systems has never before been more important. Organisations today are facing a wide range of threats to their information assets. Any organisation that suffers an information security incident must be able to identify *who* did *what* and *when* they did it. By better understanding the potential threats and vulnerabilities, an organisation can implement a number of procedures in order to raise the level of its information security and reduce the likelihood of security related incidents.

Information Security Investment

The concept of investment has one purpose and that is to generate a return. This return is seen in the form of capital, time, and both tangible and intangible benefits (Tsiakis & Stephanides, 2005).

In support of Tsiakis et al. (2005), in 1995, Murray, (cited in Anttila, Kajava, & Varonen, 2004, p. 1), declared that "*information security should pay, it should not cost*"; as the common belief at the time was that information security was unproductive and only incurred an extra financial burden on organisations.

Prior to making information security investment decisions, facts about assets (i.e., information, software, hardware, and systems), vulnerabilities, and the probability of breaches (and damages) need to be analysed. An evaluation needs to be done in order to find the best possible security solution (Tsiakis et al., 2005). Lubbe (1997) supports this conclusion by declaring that the evaluation of technology investments is

imperative due the increasingly strategic nature of the impact of technology on organisational performance.

A key factor in getting value from security is to ensure that technology investments protect the right assets. The financial returns gained from a successful implementation of security should justify the cost of security in terms of enabling the business. An organisation needs to assess security investment against the probability that a loss producing security incident will occur and multiply that by the impact that the problem will create (Tsiakis et al., 2005). Pipkin (2000) notes that the costs of implementing information security measures must be compared to the value of the information being protected and the consequences of incurring a security breach due to non-implementation of adequate security measures.

Investment decisions regarding information security should consider (1) the frequency of security breaches, (2) the cost of security breaches, and (3) investment in information security measures. Gordon and Loeb (2002) proposed a model to determine the optimal amount an organisation should invest in information security mechanisms. In their model, the amount to invest in security is taken as an increasing function of the level of vulnerability of the information being protected. The results of their research are summarised next:

- The optimal amount to invest in information security depends on the specific form of the security breach but should not exceed 37% of the expected loss due to the breach.
- There are no simple procedures to determine the probabilities of threat and their associated vulnerabilities.
- There are no simple procedures to determine the potential loss from information security breaches.

Cavusoglu, Mishra, and Raghunathan (2004) suggested the following additional approaches to

determine the optimal investment in information security:

- The fear, uncertainty, and doubt (FUD) strategy. This approach is used by information security vendors to sell security solutions.
- The cost of deploying security. This approach asks the question, “What is the most I can get for \$X,⁶ given that I am going to spend \$X?”
- Indirect estimation of dollar value costs associated with security breach announcements, such as the loss in market value (e.g., share price).
- Traditional risk or decision analysis framework. In this approach, the expected loss is computed once risks, potential risks and their likelihood of occurrence are identified.

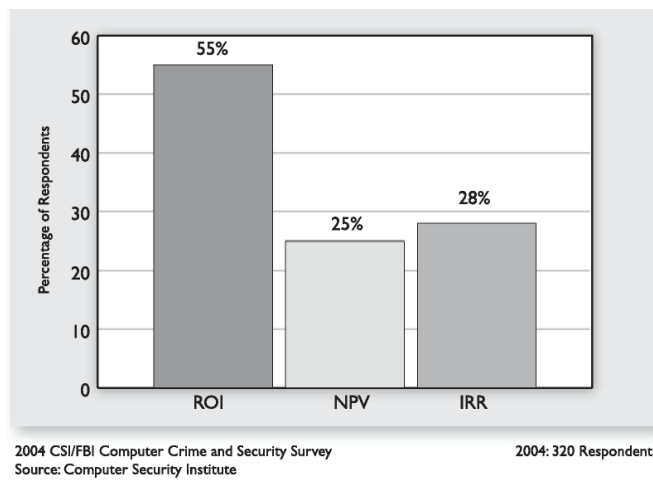
Managers responsible for information security are increasingly required to justify their budget requests in purely economic terms. There has been considerable interest in using financial metrics used to justify and evaluate investments in information security (CSI, 2004). Figure 2 confirms this assumption.

Figure 2 illustrates that 55% of organizations use return on investment (ROI)⁷ as a metric, 28% use internal rate of return (IRR) and 25% use net present value (NPV). Although numerous metrics are available, ROI has emerged as the method preferred by most organisations.

Return on security investment (ROSI) is the most recent catchphrase that economists are using to characterize the value of security investments. Despite the fact that defining ROSI is difficult, security practitioners need to understand the variables that define ROSI and assign dollar values to quantities that are inadequately defined (SBQ, 2001).

It is apparent that information security management is a demanding task; however assessing the value of security technologies is an essential requirement in effectively managing information security. Various techniques and tools are available to the practitioner of information security. However, the economic perspective stresses that, while some investment in information security is good; more security is not always worth the cost. Hence, it is the author’s belief that, the amount that an organisation spends on information security

Figure 2. Percentage of organisations using financial metrics to quantify information security investments (Adapted from CSI, 2004)



will typically be far less than the expected loss from a security incident.

Impact of Information Security Breaches

No information security breach is good, but the impact of some incidents is considerably worse and more difficult to measure than that of others. There's always some financial aspect to security related incidents and organisations intent on not being victimised must pay a price as information security measures come at a price (Gordon & Richardson, 2004).

Every organisation (small or large) must understand the costs associated when information security is breached. Farahmand, Navathe, Sharp, and Enslow (2003) notes that the cost of an information security incident must be measured in terms of the impact on the business and, identical incidents in different organisations of the same industry could have different costs. The impact may be financial, in the form of immediate costs and losses, but the more serious incidents are those that have hidden costs associated with them. Furthermore, they (Farahmand et al., 2003) associate the following losses with information security breaches: (1) the brand image, public reputation, and the goodwill in the market place, (2) the financial value of business transactions, (3) public and customer confidence in the accuracy and fraud-resistance of business transactions, (4) the ability to maintain revenue cash flow in a timely manner, (5) the ability to resolve disputes beyond reasonable doubt, and (6) the ability to meet the requirements of regulators.

Cavusoglu (2002) states that public announcement of information security breaches are negatively associated with the market value of the affected organisations. He notes that compromised organisations lose approximately 2.1% of their market value within two days of the security incident and smaller organisations appear to be penalised more than larger ones when a

security breach occurs. This means that smaller organisations must keep in mind the importance of information security for their survivability.

Campbell, Gordon, Loeb, and Zhou (2003) examined the market reaction to newspaper reports of information security breaches at publicly traded U.S. corporations. Potential costs identified with security breaches were (1) lost business (immediate and long term as a consequence of negative reputation effects), (2) activities associated with detecting and correcting breaches, and (3) potential legal liability. They observed that survey data on the cost of information security breaches was limited since many organisations are unwilling or unable to quantify their losses. They concluded that there is some evidence of an overall negative stock market reaction to announcements of information security breaches and these announcements affect the future economic performance of the affected organisations. They also found that all types of information security breaches did not have similar economic impacts. There was no significant market reaction to breaches not relating to confidentiality (e.g., denial-of-service attacks); however, a significant reaction to violations of confidentiality (e.g., breaching a customer database) was noted. It was also noted that many of the non-confidential incidents (e.g., virus attacks) received more publicity and affected more organisations than the confidential incidents. Nevertheless, stock market reaction was not determined by the level of media publicity.

Garg et al. (2003), conducted a study that extended to include investor reactions to information security incidents on security vendors. They concluded that the share price of security vendors responded positively to information security breaches, with increases of 0.9% to 3.3% on average for all incidents. The reason given for this situation was the perception of investors that attacks would result in an overall increase in security spending by all organisations (and not just the affected ones).

Many information security surveys (e.g., AusCERT, 2004; BCMS, 2003; CSI, 2004; E-Crime, 2004; ISBS, 2004) also use the cost of a security incident as a measure of its overall impact. However, it is evident that this is a difficult question to answer (e.g., Campbell et al., 2003; Garg et al., 2003; Farahmand et al., 2003; Cavusoglu, 2002). It has been shown that security breaches can have many different impacts. Direct cash expenditure is only one of these. Other costs, such as time spent investigating and responding, also need to be included. Some, such as the cost of business disruption or damage to reputation, are hard to quantify. The author concludes that every organisation (small or large) must understand the costs associated when their information security is breached and that breaking down the cost of security breaches into its component parts can assist in this process.

Information Security Management

A fundamental issue that arises in discussions about information security is that of responsibility. A reasonable answer is that information security ought to be the responsibility of anyone who can affect the security of the system although specific duties and responsibilities of individuals and business units may vary (NIST, 1995).

Birman (2000) states that information security is more than a technical issue, and could even have strategic as well as legal implications. It is therefore important that information security is evaluated at management level and is integrated into the processes of the business. An organisations' executive management must be involved in and be constantly informed of the effectiveness of the information security strategies implemented as they (management) are ultimately responsible (1) to the shareholders and (2) for compliance with applicable laws and regulations (Posthumus & von Solms, 2004; Von Solms, 1996). Entrust (2004) encourages the implementation and acceptance of an information security management framework.

These actions, according to Entrust (2004), protect business information, improve the efficiency of the business and ensure that the business meets its legal requirements. Hong, Chi, Chao, and Tang (2003) state that an organisation should establish and maintain a documented information security management system. Organisations should examine the environment, familiarise themselves with security standards, define the scope of information security and assess the risk and control in order to develop an information security management system.

Straub and Welke (1998) declare that information security continues to be ignored by executive management and despite the seriousness of risk from security breaches; many organisations are either completely or insufficiently protected. If the threat is so clear then why is this so? Information security needs executive management support in order to succeed and to create a security-oriented culture in any organisation (Kankanhalli, Teo, Tan, & Wei, 2003; Siponen, 2001; Whitman & Matford cited in Witman, 2004; Williams, 2001). Goodhue and Straub (1991) note that managerial concern about information security is a function of (1) risk inherent in the industry, (2) the extent of the effort already taken to control these risks, and (3) individual factors such as awareness of previous system breaches.

In a study conducted by Mitchell et al. (1999), in 50% of the companies' surveyed, responsibility for information management was placed with the IT department while in only 25% responsibility was with senior management. Only 5% had a dedicated information security manager responsible for corporate information and most (57.5%) had the same person responsible for information security and information management. This study highlights the fact that in most organisations the management of information security continues to be placed within the IT function. IT managers continue to be responsible for managing and securing electronic information and it appears that information security is viewed as a technology

problem to be dealt by the technology people. It is this attitude that is responsible for gaps in an organisations information security chain of defences.

In most organisations information security is the result of an evolutionary process and although a proliferation of technology has been implemented to provide security, the approach used does not appear to have been systematic (Anttila et al., 2004). If an organisation does not have clear guiding principles or ideas for information security, the measures applied are very likely followed mechanically, leading to an ineffective implementation of security. Information security must be related to business performance and the final responsibility lies directly with the organisations' executive management.

Philosophy for Developing Information Security

NIST (1995) describes eight principles that are essential to developing an effective information security program in any organisation (small or large). These principles (see below) assist the information security practitioner in understanding how information security supports the mission of the organisation. Support for the NIST (1995) principles is provided in (e.g., DTI, 2004; OECD, 2002; Posthumus & Von Solms, 2004; Swanson & Guttman, 1996).

The eight principles that are essential to the development of an effective information security program are (NIST, 1995):

- **Information security must support the mission of the organization:** By selecting and applying appropriate techniques, information security aids the organization's mission by protecting its physical and financial resources, reputation, legal position, employees, and other tangible and intangible assets. Occasionally, information security may be seen as counter productive due to
- **Information security must support the business:** Information security is not an end in itself, but a means to an end. Rules and procedures imposed on users, however, it must be emphasized that these (rules and procedures) do not exist for their own sake but to protect important assets. Information security should, therefore, be viewed as a means to an end and not the end itself.
- **Information security is an integral element of business management:** ICT assets are often crucial to supporting the mission of an organization (refer to the previous) and protecting them can be as critical as protecting other organizational resources, however, including security considerations in the management of ICT does not completely eliminate the possibility that these assets will be harmed. Ultimately, business managers must decide on the level of risk they are willing to accept (taking into account factors such as the cost of security controls and whether an organisations ICT assets are linked to an external partner).
- **Information security must be cost effective:** The costs and benefits of security should be carefully examined in both monetary and non-monetary terms to ensure that the cost of controls does not exceed expected benefits. Security should be appropriate and proportionate to the value of and degree of reliance on the information systems and to the severity, probability, and extent of potential harm. Security must be seen as *smart business practice* and by investing in security measures; an organization can reduce the frequency and severity of information security-related losses.
- **Information security responsibilities and accountability must be made explicit:** Depending on the size of the organisation, assignment of responsibilities may be internal or may extend across organisational boundaries. However, every organisation (small or large) can prepare a document that states organisational policy and makes

explicit information security responsibilities.

- **System owners have information security responsibilities outside their own organizations:** If a system has external users, its owners have a responsibility to share appropriate knowledge about the existence and general extent of security measures so that other users can be confident that the system is adequately secure.
- **Information security requires a comprehensive and integrated approach:** Providing effective information security requires a comprehensive approach that considers a variety of areas both within and outside of the information security field. This comprehensive approach extends throughout the entire information life cycle.
- **Information security must be periodically reassessed:** Computers and the environments they operate in are dynamic. Security is *never* perfect when a system is implemented, procedures become outdated over time, new ways are constantly being discovered to intentionally or unintentionally bypass or subvert security, and changes in the system or the environment can create new vulnerabilities. All of these issues make it necessary to periodically reassess an organisations information security.
- **Information security is constrained by societal factors:** Security measures should be selected and implemented with recognition of the rights and legitimate interests of system users. This many involve balancing the security needs of information owners and users with societal goals. However, rules and expectations change with regard to the appropriate use of security controls. These changes may either increase or decrease security.

As more organizations share information electronically, a common understanding of what

is needed and expected in securing information assets is required. The principles discussed in the preceding paragraphs address information security from a high-level viewpoint. These principles are intended to guide security practitioners in developing effective information security programs for organisations (small & large).

Designing and Implementing Information Security

As organisations develop, previous methods of communication can become less effective. Informal understandings and discussions can prove insufficient. Legal and regulatory pressures increase as companies expand. Providing the entire company with clear, concise, internal governance can bring real benefits in terms of efficiency as well as a means of reducing information risk (DTI, 2004b).

A policy is an expression of intent. An information security policy must provide clear direction and be supported by management for the implementation and maintenance of information security. To be effective the policy must be relevant, accessible, and understandable to all intended users throughout the organisation (DTI, 2004b).

According to DTI(2004b), Lichtenstein(1997), Microsoft (2005), and WatchGuard (2004), an information security policy is an important document to develop while designing an information system. The security policy begins with the organization's basic commitment to information security formulated as a general policy statement. The policy is then applied to all aspects of the system design or security solution. The policy identifies security goals (e.g., confidentiality, integrity, availability) that the system should support and these goals guide the procedures, standards and controls used in the design of the information security architecture. The policy must also define critical assets, perceived threats, and security-related roles and responsibilities.

Although each organization's security needs are unique, most security policies address common elements. Due to the dynamic nature of the ICT environment an information security policy is never set in stone, rather it is a living document. The SANS Institute (SANS, 2005) recommends that the following elements be included in a security policy:

- **Objectives:** Clearly states the reason the security policy exists
- **Scope:** Identifies the people and systems affected by the policy
- **Protected Assets:** identifies the assets that the policy protects (e.g., e-mail servers, databases, and Web sites)
- **Responsibilities:** Identifies the groups or individuals responsible for implementing the conditions of the policy
- **Enforcement:** Discusses the consequences of violating the policy
- **Remote access policy:** Outlines acceptable methods for remotely connecting to the internal network (e.g., whether employees are allowed to connect to the network from their home computers)
- **Information protection policy:** Provides guidelines to users on the processing, storage, and transmission of sensitive information
- **Virus protection policy:** Provides requirements for the use of antivirus software as well as guidelines for reporting and containing virus infections
- **Password policy:** Provides guidelines for how user-level and system-level passwords are managed and changed
- **Firewall security policy:** Describes, in general, how firewalls are configured and maintained, and by whom

Once the organisational security policy has been created, the next step is to establish the information security plan. While the policy defines

the goals, the plan determines the steps that need to be taken to implement information security. Information security is not a separate task but an overlapping association of technologies, people, policies, and processes. The plan coordinates the whole security effort to match the organisations' security policy and ensures that there are no gaps (Microsoft, 2005).

The four steps in developing an information security plan (Lichtenstein, 1997; Microsoft, 2005; WatchGuard, 2004) are:

- **Assess:** The current state of security, identify critical assets, predict threats, and determine exposure for each asset
- **Plan:** For risks, noting that the objective is not to eliminate all risk regardless of cost but to minimise risks
- **Execute:** Check for adequacy, obtain participant feedback, modify plan if required and implement the plan
- **Monitor:** Research new threats as they become evident, modify the plan when changes occur (e.g., personnel changes) and perform ongoing maintenance (e.g., antivirus definition updates)

There is no silver bullet to the information security problem. Modern information systems are complex and dynamic and no simple solutions exist to completely protect organisational information assets. To be effective, security solutions must work together, and in harmony, to secure the critical assets of the organisation. Implemented solutions should be powerful, scalable and adaptable in order to effortlessly incorporate new functionality to meet emerging threats.

REVIEW OF INFORMATION SECURITY SURVEY STATISTICS

Kabay (2001) notes that no one can be expected to give reliable answers pertaining to questions

on information security. He adds that the two fundamental difficulties preventing the development of accurate statistics are: (1) the problem of detection and (2) the problem of reporting. The first problem is that an unknown number of crimes (of all kinds) are undetected because some frauds are discovered long after they have occurred. The second problem deals with reporting of security related crimes. Even if crimes are detected, few are reported in a way that allows systematic data

collection. This belief is based in part on the unquantified experience of information security professionals who have conducted interviews of their clients, and it turns out that only about ten percent of the attacks against computer systems revealed in such interviews were ever reported to any kind of authority or to the public.

On the basis of Kabay (2001), it follows that, even though the methodology used by information security surveys (e.g., AusCERT, 2004; BCMS,

Table 3. Summary of respondents from small and large businesses

| Survey | Respondents | Small Businesses (aggregate % employees) | Large Businesses (aggregate ¹ % employees) |
|------------------|-------------|---|--|
| 1. CSI 2004 | 494 | 19% | 81% |
| 2. ISBS 2004 | 1001 | 52% | 48% |
| 3. AusCERT 2004 | 240 | 15% | 85% |
| 4. E-Crime 2004 | 500 | 15% | 85% |
| 5. CSI 2003 | 530 | 18% | 82% |
| 6. AusCERT 2003 | 214 | 52% | 48% |
| 7. Deloitte 2003 | 175 | none | 100% |
| 8. CSI 2002 | 503 | 16% | 84% |
| 9. ISBS 2002 | 1000 | 80% | 20% |
| 10. AusCERT 2002 | 95 | 39% | 61% |

Table 4. Survey comparison: Summary of security breaches experienced (Source: Compiled from each of the listed surveys)

| Survey | Security Breach Experienced |
|------------------|--|
| 1. CSI 2004 | 53% experienced a security incident in the past 12 months. |
| 2. ISBS 2004 | 74% experienced a security incident in the past 12 months. |
| 3. AusCERT 2004 | 49% experienced a security incident in the past 12 months. |
| 4. E-Crime 2004 | 70% experienced a security incident in the past 12 months. |
| 5. CSI 2003 | 56% experienced a security incident in the past 12 months. |
| 6. AusCERT 2003 | 42% experienced a security incident in the past 12 months. |
| 7. Deloitte 2003 | 39% experienced a security incident in the past 12 months. |
| 8. CSI 2002 | 60% experienced a security incident in the past 12 months. |
| 9. ISBS 2002 | 44% experienced a security incident in the past 12 months. |
| 10. AusCERT 2002 | 67% experienced a security incident in the past 12 months. |

2003; CSI, 2004; E-Crime, 2004; ISBS, 2004) may be imperfect and should not be taken as the absolute representation of the state of information security; they do however provide valuable data on the relative frequencies and severities of various security threats.

This section reviews ten of the more recent (2002 to 2004) information security surveys in order to determine the state of information security in organisations (small and large). Performing a meta-analysis of the surveys would be difficult because the questions asked differ both in content and method from survey to survey and because the results were developed and reported in different ways. Nevertheless, it was apparent that there were several common findings, which form the basis of this review.

The size of the organizations represented in each of the surveys, as measured by the number of employees, is given in Table 3. The table gives the total respondents for each survey and divides the organisations into small and large businesses as per the definition of small businesses adopted for this research.

Each of the surveys specifically asked if the respondents had experienced any security breaches in the previous year. Table 4 shows the specific survey data, with the numbers ranging from 39% to 74%. When examined chronologically, the overall trend is that security breaches are increasing.

Another frequently asked question related to the monetary loss resulting from information security breaches. Nine of the ten surveys provided some quantification of the monetary losses associated with information security incidents. Table 5 shows the survey results.

As can be seen by the reported data, the ability or willingness of the respondents to quantify losses is limited at best. Most of the surveys approached this area of questioning from the point of view of how much damage had been done in aggregate. As a result, the losses reported include average costs per serious incident (ISBS, 2004) to total losses per annum (CSI, 2004).

Nine of the surveys asked respondents what their most important security concerns were. These concerns are viruses, denial-of-service,

Table 5. Survey comparison: Financial loss

| Survey | Amount of Loss Reported |
|-----------------|---|
| 1. CSI 2004 | Total losses for the 54% able to quantify: \$141,496,560 |
| 2. ISBS 2004 | The average cost of a serious security incident was approximately £7,000 to £14,000. For large companies, the equivalent cost was approximately £65,000 to £190,000. |
| 3. AusCERT 2004 | Total losses for the 57% able to quantify: AU\$15,921,064 |
| 4. E-Crime 2004 | Of the 68% that tracked monetary losses the following breakdown was given: 3% - \$10 million 5% - \$1 million to \$9.9 million 5% - \$500,000 to \$999,999 11% - \$100,000 to \$499,999 26% - Less than \$100,000 50% - Don't know amount |
| 5. CSI 2003 | Total losses for the 48% able to quantify: \$201,797,340 |
| 6. AusCERT 2003 | Total losses for the 58% able to quantify: AU\$11,800,783 |
| 7. CSI 2002 | Total losses for the 44% able to quantify: \$455,848,000 |
| 8. ISBS 2002 | The average cost of a serious security incident was approximately £30,000 |
| 9. AusCERT 2002 | Total losses for the 80% able to quantify: AU\$5,781,300 |

some form of theft (ranging from data to equipment), misuse of systems and unauthorised access (hacking) appear in almost all of the top five rankings.

The statistics confirm that information security breaches continue to rise annually. The data examined provides evidence that: (1) information security continues to remain a problem for many organisations and (2) the provision of effective information security is essential for an organisations continued existence. As more organisations continue to suffer from information security incidents and the associated financial losses, understanding the information security problem becomes essential in security planning and development of effective information security, especially for small businesses.

CHAPTER SUMMARY

Information security is defined as the protection of information system assets against various threats and attacks in order to preserve the confidentiality, integrity, and availability of these systems. Modern society is significantly dependent on IT and there is little likelihood that this will change in the future. As globalization continues to advance and electronic civil disobedience increases in volume and efficacy, the implementation of effective information security continues to become an area of concern for academics, information security researchers, information security practitioners and management of organisations (small and large). It is essential that all stakeholders are aware of security threats and trends and take appropriate steps to provide adequate protection of information system assets.

Early research in information security (1970s and 1980s) treated information security as something tangible and concrete. Security was seen as a means to protect tangible assets and consisted purely of providing a security fence around information processing activities. However, security

cannot be viewed as a disjoint sequence of activities nor is it just a sequence of “locks and keys” in the prevention of adverse events. As organisations have evolved and organisational structures are becoming more flat and decentralised in nature, a new vision for addressing information security concerns has emerged. This vision, which is the key to effective information security in the new millennium, must be aligned with social groupings and behaviour and include a substantial human component. This paradigm shift provides an excellent motivation and platform for holistic research into the information security crisis.

Information security research has predominantly been positivist in its approach. Phenomenological or interpretivist research is almost entirely absent. Historically, much of the analysis into the problems of, and solutions to, information security has been quantified against highly structured questionnaires. This method has bounded the discussion and preconditioned the answers and the resulting metrics are often given a factual status that they do not deserve. The fundamental limitation on the applicability of these findings is that generalisations in the field of information technology and security are difficult to justify due to the diversity of systems installed in organisations. A phenomenological approach to information security research would certainly be advantageous as it would attempt to bridge a gap between man and machine and in doing so would provide a holistic view of the problem domain, rather than a simplistic and one-dimensional explanation.

Studies conducted by Kotulic and Clark (2004) involving diverse organisations (small and large) indicate that information security research is one of the most intrusive types of organisational research, and that there is a general mistrust of anyone attempting to gain data about information security practices in organisations. It is nearly impossible to extract information of this nature from businesses without a major supporter.

A critique of several non-academic surveys on information security was done in order to create some baseline of data from which to perform this research. The findings of the critique were that: (1) information security breaches continue to rise annually, (2) the surveys were entirely quantitative in their approach, (3) the targeted audience were primarily large businesses with only a small percentage (if any) of small businesses participating, (4) information security continues to remain a problem for many organisations, and (5) the provision of effective information security is an essential aspect of a organisations (small and large) success and continued existence. Historically, some small businesses have been included in surveys on information security (see Table 2-3) however; South African small businesses are noticeably absent. Even though this is the case, the researcher believes that the reported findings are also applicable to small businesses in South Africa. Support for this belief is provided by Kabay (2002) who states that the basic reasons why we care about information security remain the same in every organisation (small or large).

Some concerns uncovered by the author during the literature search are: (1) small businesses are trying to do everything by themselves (without enlisting expert assistance) and (2) small businesses are frequently exposed to crime, (especially technology related crimes). The rationale is that they (small businesses) do not have the base across which to spread the costs of hiring security experts or implementing expensive security-related technologies. Additionally, the researcher has discovered that academic and non-academic studies in information security have concentrated primarily on large organisations. Possible reasons for this state of affairs are that: (1) large businesses can make a greater contribution to the economy and (2) that large businesses have bigger budgets and therefore can spend more on information security and security research. Many researchers are of the opinion that what

is good for large businesses is also applicable to small businesses. This view is based on the incorrect assumption that research conducted in large businesses can be applied directly to small businesses. Consequently, this biased viewpoint has resulted in small businesses being excluded from information security research. Although information security attacks and breaches make no distinction in the size of the organisation (small and large are equally at risk), the small business practitioner has to recognise and manage information security risks without the resources available to larger businesses. Throughout this literature search, however, it has been found that models of information security developed for large businesses are simply forced onto small businesses without recognising the fact that small businesses are not just little big businesses.

With regard to small businesses, the findings reveal that this sector is rapidly growing and is making significant contributions to the economy. Furthermore, small businesses are embracing ICT and the Internet to gain competitive advantage, market share, and access to new markets, solve business problems, and to accumulate knowledge for improvement of services. Innovative entrepreneurs are also using technology and the Internet as a means to market niche products and to reach distant customers. The above-mentioned reasons provide excellent justification for developing and building capacity regarding academic research into the information security crises facing small businesses.

There is no silver bullet to the information security problem in small businesses. Information security requires a firm grounding in academic theory in order to be effective. Security cannot be gained by installing a gadget, no matter how good it is. Security is a process that must be woven into the corporate culture of every organisation (small or large), with due attention to the ever-changing landscape of threats, vulnerabilities and risks. Any models or guidelines developed must

be relevant and take cognisance of the fact that small businesses are unique and that they have their own focus and drivers when dealing with the information security problem.

CONCLUSION

The contribution of this chapter is twofold. First, it presents the current research directions in information security. It identifies the trend that information security research is moving away from a narrow technical viewpoint to a broader managerial perspective. Although a multitude of research and data exists in the field of information security, the literature indicates that information security research is restricted to large organisations. While academic research has investigated different perspectives of information security, it has been found that most of the studies looked at specific issues with little or no attempt being made to obtain a complete view of information security. Additionally, academic researchers have concentrated on information security in large organisations and presume that these findings are compatible with small businesses. Most researchers also rely on standards bodies (e.g., ISO,⁸ BSI,⁹ NIST¹⁰) to develop frameworks on which information security research is based.

Second, this chapter recognises the fact that the use of a phenomenological approach for understanding information security is still at a theory building stage. The literature search found practically no case studies that used a qualitative approach for evaluating information security. Almost all the studies on information security were based on the positivist paradigm. This highlights the need for interpretivist empirical research to develop a set of management guidelines for investigating and implementing effective information security practices in small businesses.

REFERENCES

- Anttila, J., Kajava, J., & Varonen, R. (2004, August). Balanced integration of information security into business management. In *Proceedings of the 30th EUROMICRO Conference* (pp. 558-564).
- AusCERT. (2004). *Australian computer crime survey 2004*. Retrieved February 17, 2005, from <http://www.auscert.org.au/download.html?f=114>
- Berger, D.L. (1981). *Security for small businesses*. Woburn, MA: Butterworth Inc.
- Birman, K. P. (2000). The next generation internet: Unsafe at any speed. *IEEE Computer*, 33(8), 54-60.
- Blatchford, C. (1998, December). Computer controls—diffusion into the smaller firm: (A qualitative research study: Part 1). *Computer Fraud & Security*, 1998(12), 13-17.
- Blatchford, C. (1999, January). Computer controls—Diffusion into the smaller firm: (A qualitative research study: Part 2). *Computer Fraud & Security*, 1999(1), 14-19.
- Business Continuity Management Survey (BCMS). (2003). *Business continuity management survey ZA 2003*. KPMG. Retrieved February 1, 2005, from http://www.kpmg.co.za/download/bcssurvey_03.pdf.
- Campbell, K., Gordon, L. A., Loeb, M. P., & Zhou, L. (2003). The economic cost of publicly announced information security breaches: Empirical evidence from the stock market. *Journal of Computer Security*, 11(2003), 431-448. IOS Press.
- Cavusoglu, H. (2002). *The economics of information technology (IT) security*. Presented at the 8th Americas Conference on Information Systems. Doctoral Consortium.

- Cavusoglu, H., Mishra, B., & Raghunathan S. (2004, July). A model for evaluating IT security investments. *Communications of the ACM*, 47(7), 87-92.
- Chelimsky, E., Jordan, F. C., Russell, L. S., & Strack, J. R. (1979). *Security and the small business retailer*. Washington DC: Government Printing Office.
- Cisco Systems (Cisco). (2001). *Economic impact of network security threats*. White paper. Cisco Systems Inc. Retrieved April 16, 2004, from <http://www.cisco.com/go/security>
- COBIT Security Baseline (COBIT). (2004). *COBIT security baseline—an information security survival*. Retrieved February 17, 2005, from <http://www.isaca.org>
- Computer Security Institute (CSI). (2004). *CSI/FBI 2004 computer crime and security survey*. Retrieved January 27, 2005, from http://www.gocsi.com/forms/fbi/csi_fbi_survey.jhtml
- Dhillon, J., & Backhouse, G. (1999). *Working towards principles for information security management in the 21st century*. Research paper. London: LSE Computer Security Research Centre.
- Doney, L. D. (1998, May-June). The growing threat of computer crime in small businesses. *Business Horizons*, 41(3), 81-87.
- DTI. (2004). *Information security: A business guide to using the Internet*. UK Department of Trade and Industry. Retrieved March 18, 2005, from <http://www.dti.gov.uk/bestpractice/technology/security.htm>
- DTI. (2004b). *How to write an information security policy*. UK Department of Trade and Industry. Retrieved March 18, 2005, from <http://www.dti.gov.uk/bestpractice/technology/security.htm>
- E-Crime Watch Survey (E-Crime). (2004). *2004 e-crime watch survey*. Retrieved January 31, 2005, from <http://www.cert.org/archive/pdf/2004eCrimeWatchSummary.pdf>
- Electronic Communications and Transactions Act (ECT). (2002). *Electronic Communications and Transactions Act No. 25 of 2002*. South Africa Government Online. South African Parliament. Retrieved January 15, 2005, from <http://www.info.gov.za/gazette/acts/2002/a25-02.pdf>
- Entrust. (2004). *Information security governance: An essential element of corporate governance*. Retrieved January 17, 2005, from http://itresearch.forbes.com/detail/RES/1082396487_702.html
- Farahmand, F., Navathe, S. B., Sharp, G. P., & Enslow, P. H. (2003). Managing vulnerabilities of information system to security incidents. *Communications of the ACM*, 348-354.
- Finne, T. (1998). A conceptual framework for information security management. *Computers & Security*, 17(4), 303-307.
- Galliers, R. (1993). Research issues in information systems. *Journal of Information Technology*, 8(2), 92-98.
- Garg, A., Curtis, J., & Halper, H. (2003). Quantifying the financial impact of IT security breaches. *Information Management & Computer Security*, 11(2), 74-83, MCB UP.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory*. Chicago: Aldine Inc.
- Goodhue, D. L., & Straub, D. W. (1991, January). Security concerns of system users: a study of perceptions of the adequacy of security measures. *Information & Management*, 20(1), 13-27.
- Gordon, L. A., & Loeb, M. P. (2002, November). The economics of information security investment. *ACM Transactions on Information and System Security*, 5(4), 438-457.
- Gordon, L. A., & Richardson, R. (2004, January). Infosec economics new approaches to improve

your data defenses. *Network Computing*, 4, 67-70.

Hong, K., Chi, Y., Chao, L. R., & Tang, J. (2003). An integrated system theory of information security management. *Information Management & Computer Security*, 11(5), 243-248. MCB University Press.

Information Security Breaches Survey (ISBS). (2004). *Information security breaches survey 2004*. PriceWaterHouse Coopers and UK DTI. Retrieved February 3, 2005, from http://www.pwc.com/images/gx/eng/about/svcs/grms/2004Technical_Report.pdf

IT Governance Institute (ITGI). (2001). *Information security governance: guidance for boards of directors and executive management*. Retrieved February 2, 2005, from http://www.isaca.org/Content/ContentGroups/ITGI3/Resources1/Information_Security_Governance_Guidance_for_Boards_of_Directors_and_Executive_Management/infosecurity.pdf

Kabay, M. E. (2001). *Studies and surveys of computer crime*. Retrieved February 1, 2005, from http://www.securitystats.com/reports/Studies_and_Surveys_of_Computer_Crime.pdf

Kabay, M. E. (2002). *What's important for information security: A manager's guide*. Retrieved February 1, 2005, from <http://www2.norwich.edu/mkabay/infosecmgmt/mgrguidesec.pdf>

Kankanhalli, A., Teo, H., Tan, B. C. Y., & Wei, K. (2003). An integrative study of information systems security effectiveness. *International Journal of Information Management*, 23, 139-154.

Keogh, J. E. (1981). *The small business security handbook*. Englewood Cliffs, NJ: Prentice-Hall.

Kotulic, A. G., & Clark, J. G. (2004). Why there aren't more information security research studies. *Information & Management*, 41, 597-607.

Lichtenstein, S. (1997). Developing Internet security policy for organizations. In *Proceedings of the 30th Annual Hawaii International Conference on System Sciences*. Computer Society.

Lubbe, S. (1997). *The assessment of the effectiveness of IT investments in South African organizations*. PhD dissertation. University of Witwatersrand.

Lubbe, S. (2004). *The use of IT in small businesses: Efficiency and effectiveness in South Africa*. (Paper submitted to SAJEMS for publication).

Mbeki, T. (2004, February 6). *State of the Nation Address of the President of South Africa, Thabo Mbeki*. Houses of Parliament, Cape Town.

Mehta, M., & George, B. (2001). *Security in today's e-world*. Presented at the 8th Americas Conference on Information Systems.

MessageLabs. (2005). *E-mail threats (virus intercepts)*. Retrieved March 23, 2005, from <http://www.MessageLabs.Com/Emailthreats/Default.Asp>

Microsoft. (2005). *Security guide for small business*. Retrieved March 18, 2005, from <http://www.microsoft.com/smallbusiness>

Mitchell, R. C., Marcella, R., & Baxter, G. (1999). Corporate information security management. *New Library World*, 100(5), 213-227.

National Small Business Act (NSBA). (1996). *National Small Business Act No. 102 Of 1996*. South Africa Government Online. South African Parliament. Retrieved January 15, 2005, from <http://www.info.gov.za/acts/1996/a102-96.htm>

Ntsika Enterprise Promotion Agency (Ntsika). (2002). *State of small business development in South Africa Annual Review 2002*. Retrieved January 21, 2005, from <http://www.ntsika.org.za/publications/AnnualReview2002.pdf>

Ntsika Enterprise Promotion Agency (Ntsika). (2004). *Ntsika study series: Small business*

training case studies (Vol. 1). Retrieved March 2, 2005, from <http://www.ntsika.org.za/publications/studyseries1.pdf>

OECD Guidelines (OECD). (2002, July 25). *OECD guidelines for the security of information systems and networks: Towards a culture of security*. Recommendations of the OECD Council, 1037th session.

Oliver, R. W. (2000). *The future of small business: Trends for a new century*. Sponsored by American Express, IBM, and National Small Business United in cooperation with RISEbusiness.

Panko, R. R. (2004). *corporate computer and network security* (International ed.). Prentice Hall.

Petkov, D., Fry, G. S., Petkova, O., & D'Onofrio, M. (2003). *Assisting small information technology companies identify critical success factors in Web development projects*. Presented at the 9th AMCIS.

Pipkin, D. (2000). *Information security: Protecting the global enterprise*. Prentice-Hall.

Posthumus, S., & Von Solms, R. (2004). A framework for the governance of information security. *Computers & Security*, 23, 638-646.

Pratt, J. H. (2002). *E-biz: Strategies for small business success*. Retrieved March 9, 2005, from <http://www.sba.gov/advo/research/rs220tot.pdf>

Remenyi, D., & Williams, B. (1995). Some aspects of methodology for research in information systems. *Journal of Information Systems*, (10), 191-201.

Secure Business Quarterly (SBQ). (2001). Return on security investment. *Secure Business Quarterly*, (Q4).

Siponen, M. T., (2001, June). Five dimensions of information security awareness. *Computers and Society*, 24-29.

Small Business Administration (SBA). (1999a). *Small business administration frequently asked*

questions. Retrieved March 9, 2005, from <http://www.sba.gov>

Small Business Administration (SBA). (1999b). *E-commerce: Small businesses venture online*. Retrieved March 9, 2005, from http://www.sba.gov/advo/stats/e_comm.pdf

Small Enterprise Development Agency (SEDA). (2004). *Establishment of Seda on December 13, 2004 marks new era in small enterprise sector*. South African Government, Department of Trade and Industry. Media release. Retrieved January 21, 2005, from <http://www.dti.gov.za/article/articleview.asp?current=1&arttypeid=1&artid=779>

Stoneburner, G., Goguen, A., & Feringa, A. (2002, July). *risk management guide for information technology systems. Recommendations of the National Institute of Standards and Technology* (NIST Special Publication 800-30). US Dept of Commerce.

Straub, D. W., & Nance, W. D. (1990, March). Discovering and disciplining computer abuse in organisations: A field study. *MIS Quarterly*, 45-60.

Straub, D. W., & Welke, R. (1998, December). Coping with systems risk: security planning models for management decision making. *MIS Quarterly*, 441-469.

Swanson, M., & Guttman, B. (1996, September). *Generally accepted principles and practices for securing IT systems* (NIST Special Publication 800-14). US Dept of Commerce.

SANS Institute (SANS), The. (2005). *The SANS Institute Security Policy Project Web Site*. Retrieved March 28, 2005, from <http://www.sans.org/resources/policies>

Thomson, M. E., & Van Solms, R. (1998). Information security awareness: Educating your users effectively. *Information Management & Computer Security*, 6(4), 167-173, MCB UP.

Tsiakis, T., & Stephanides G., (2005). The economic approach of information security. *Computers & Security*, 24(2), 105-108.

Tsujii, S. (2004, November). Paradigm of information security as interdisciplinary comprehensive science. In *Proceedings of the 2004 International Conference on Cyberworlds (CW '04)*.

U.S. National Institute of Standards and Technology (NIST). (1995). *An introduction to computer security: The NIST handbook* (NIST Special Publication 800-12). U.S. Department of Commerce. Retrieved January 31, 2005, from <http://csrc.nist.gov/publications/nistpubs/800-12/handbook.pdf>

Warren, M. J. (2003). Security practice: Survey evidence from three countries. *Logistics Information Management*, 15(5/6), 347-351, MCP UP.

WatchGuard. (2004). *A practical guide for better security*. Retrieved April 16, 2004, from <http://www.watchguard.com>

Webster, J., & Watson, T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, 26(2).

Vermeulen, C., & Von Solms, R. (2002). The information security management toolbox—taking the pain out of security management. *Information Management and Computer Security*, 3(10), 119-125, MCP UP.

Williams, P. (2001, September 1). Information security governance. *Information Security Technical Report*, 6(3), 60-70.

Witman, P. D. (2004). Information security and shared leadership. In *Proceedings of the 7th Annual Conference of the Southern Association for Information Systems*.

Von Solms, B. (2001, May 1). Corporate governance and information security. *Computers & Security*, 20(3), 215-218.

Von Solms, B., & Von Solms, R. (2004). The 10 deadly sins of information security management. *Computers & Security*, 23(5), 371-376.

Von Solms, R. (1996). Information security management: The second generation. *Computers & Security*, 15(4), 281-288.

Von Solms, R. (1998). Information security management (1): Why information security is so important. *Information Management and Computer & Security*, 6(4), 74-177, MCP UP.

ENDNOTES

- ¹ Information and communications technology (ICT) represents all application and support systems *including* computer hardware, software and communications networks.
- ² A definition of small businesses is provided in the National Small Business Act (NSBA, 1996).
- ³ Information system assets include hardware, software, firmware, information/ data and telecommunications.
- ⁴ EDI refers to *electronic data interchange*.
- ⁵ EFTPoS refers to *electronic funds transfer at point of sale*.
- ⁶ \$ refers to US\$. The author uses US\$ (and not localized currency values) in order to provide an international perspective on costs.
- ⁷ The terms ROI and ROSI are taken to have the same meaning in the context of this research.
- ⁸ International Standards Organisation
- ⁹ British Standards Institute
- ¹⁰ National Institute of Standards and Technology

This work was previously published in Managing Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 241-276, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.37

Impact of Organisational Intranets on Profitability in Organisations

Udo Richard Averweg

eThekwini Municipality and University of KwaZulu-Natal, Durban, South Africa

ABSTRACT

Organisations are being forced to invest heavily in the deployment of information systems (IS) to obtain value and benefit in the new knowledge-based environment. Organisational intranets are being used as the platform for developing and deploying critical business applications to support business operations and managerial decision-making across the Internet-worked enterprise. Executive Information Systems (EIS) grew out of the information needs of executives. Web-based technologies are causing a revisit to existing information technology (IT) implementation models, including those for EIS. Some technologies include intranet, Internet, extranet, e-commerce business-to-business (B2B), e-commerce business-to-consumer (B2C), wireless application protocol (WAP), including other mobile technologies. The author conducted a survey of 31 well-established

organisations in KwaZulu-Natal, South Africa, which successfully implemented EIS. A validated survey instrument was administered to an EIS stakeholder in each organisation surveyed to rank Web-based technologies in order of their perceived impact on EIS implementation in organisations surveyed. The author reports that an organisational intranet has the highest level of impact on EIS implementation in organisations surveyed in KwaZulu-Natal, South Africa. Given this impact, justifying investment in such IS and IT should be carefully evaluated and quantified.

INTRODUCTION

Organisations are being forced to invest heavily in the deployment of information systems (IS) to obtain value and benefit and to stay competitive in the new knowledge-based environment. Manage-

rial tasks in organisations typically require more collaborative work than day-to-day operational tasks (Abraham & Seal, 2001). Abraham and Seal (2001) report that an intranet facilitates the communication behaviour between individuals who have to accomplish a task together. Giesecke (2001) foresees that creating information will become a team process. Communication is facilitated because the intranet provides the platform to integrate communication tools (e.g., electronic mail) as well as information sharing mechanisms (e.g., databases and file servers). Information technology (IT) investment uses certain of an organisation's resources. It makes it easier for people in managerial roles to make use of IT to carry out their work. Users in organisations are demanding that the IS used by the organisation should be more efficient and effective (Wessels, 2003). The use of the intranet becomes integral to the success of the managerial functions in the organisation.

Intranets are being used as the platform for developing and deploying critical business applications to support business operations and managerial decision-making across the Internet-worked enterprise (O'Brien, 2000). Many applications are designed to interface with and access existing organisation databases and legacy systems so that employees (within the organisation) can access and run such applications using Web browsers from anywhere on the network whenever needed. O'Brien (2000) reports that some intranet-using organisations are in the process of Web-enabling operational and managerial support applications including executive information and decision support. One theme in information communication technology (ICT) management theory is the effect of IT investment on the risk of managers in the IT-using industry and this serves as a backdrop. Although IS expenditure is regarded as risky and costly, many IS investments appear to go ahead without the use of formal investment appraisal and risk management techniques (Ward, 1996). The impact of organisational intranets on executive information

systems (EIS) implementation in organisations is a focus of this chapter.

ORGANISATIONAL INTRANETS

An intranet (or internal Web) is a network architecture designed to serve the internal information needs of an organisation using Web (Internet) concepts and tools (see, for example, Cortese, 1996). Turban, Rainer, and Potter (2005) indicate that an intranet is a private network that uses Internet software and TCP/IP protocols. Defined technically, intranets are the application of Internet technology (and specifically the World Wide Web service) for a prescribed community of users (Scheepers & Rose, 2001). An intranet is a network designed to serve the internal informational needs of an organisation, using Internet concepts and tools (Turban, McLean, & Wetherbe, 2004).

Organisations can use Internet networking standards and Web technology to create intranets (Laudon & Laudon, 2000). It provides similar capabilities, namely inexpensive and easy browsing, communication, and collaboration (Turban & Aronson, 1998) and are used solely for intraorganisational communication activities and information flow (Abraham et al., 2001).

Intranets can create networked applications that can run on many different kinds of computers throughout an organisation (Laudon et al., 2000). Typical intranet applications include:

- Publishing corporate documents
- Providing access to searchable directories (e.g., telephone and address lists)
- Publishing corporate, departmental and individual pages
- Providing access to groupware applications
- Distributing software
- Providing electronic mail
- Transacting with other organisational computer-based IS
- Organisation-wide information searches

- Providing a consistent user interface
- Data warehousing and decision support access

Turban et al. (1998) and Turban et al. (2004) note that intranets have the power to change decision-making processes, organisational structure, and procedures and help re-engineer organisations. Strom (1996) reports that much information on intranets is available directly on the Web. The use of intranets is increasing rapidly not only as an internal communication system, but also as a facilitator of e-commerce (Turban, McLean, & Wetherbe, 1999). Robinson (1996) suggests that intranets can be applied to enhanced knowledge sharing and group decision and business processes. Information that is most frequently included in intranets *inter alia* includes data warehouse and decision support access (Chabrow, 1998). Many organisations have benefited from use of the intranet Web-based technology and have made their organisations more efficient (Sprout, 1995). KPMG Consulting (2002) reports that organisations are focusing strongly on internal communications projects (such as intranets). It is the differences in governance and communication that enables some organisations to success and flourish where others fail.

EXECUTIVE INFORMATION SYSTEMS

EIS grew out of the development of IS to be used directly by executives and used to augment the supply of information by subordinates (Srivihok, 1998). An EIS is a computer-based system that serves the information needs of top executives (Turban et al., 2004). For the purposes of this chapter, EIS is defined as “a computerized system that provides executives with easy access to internal and external information that is relevant to their critical success factors” (Watson, Houdeshel, & Rainer, 1997). EIS are an important element of the information architecture of an organisa-

tion. EIS is a computer-based technology that is designed in response to executives’ specific decision-making needs (Turban et al., 2005). Turban (2001) suggests that EIS capabilities are being “embedded in BI.” All major EIS and information product vendors now offer Web versions of the tools designed to function with Web servers and browsers (PricewaterhouseCoopers, 2002). Business intelligence is a broad category of application and techniques for gathering, storing, analysing, and providing access to data to help users in organisations make better decisions and strategic decisions (Oguz, 2003).

With the increasing amount of IT investment and substantial evidence of failures (Remenyi & Lubbe, 1998), many managers and researchers feel that IS justification and evaluation has become a key management issue. The old argument that it is not necessary to justify the investment in IS because they are strategically important to stay “in business” is being questioned (Wessels, 2003). EIS has become a significant area of business computing and there are increasing amounts of money invested by organisations in EIS development projects (Kaniclides & Kimble, 1995) and the subsequent operation (use) of these systems (Belcher & Watson, 1993; Millet, Mawhinney, & Kallman, 1991). For example, in October 1997 the largest water utility in South Africa, Rand Water, took a decision to build an EIS (based on Oracle products) and invested ZAR4,5 million in revamping its IT infrastructure to support that deployment (Harris, 2000). In the current business environment where senior managers and decision-makers are held more accountable to their shareholders and investors for their investment decisions, there is a need for using generally accepted techniques and methods to justify IS investment decisions. For a survey of the state of EIS implementations in organisations in South Africa, see, for example, Averweg, Erwin, and Petkov (2004).

Web-based technologies are causing a revisit to existing IT implementation models, including EIS (Averweg, Petkov, Erwin, & Moolman,

2003). Web-based tools “are very much suited” to executives key activities of communicating and informing (Pijpers, 2001). With the emergence of global IT, existing paradigms are being altered which are spawning new considerations for successful IT implementation (Averweg & Erwin, 2000).

BACKGROUND AND GOAL OF THE RESEARCH

Intranet technology is essentially a pull technology and intranet use is largely voluntary (Lyytinen, Rose, & Welke, 1998). Computer or IS usage has been identified as the key indicator of the adoption of IT by organisations (Suradi, 2001). Igbaria and Tan (1997) report that system usage is an important variable in IT acceptance since it appears to be a good surrogate measure for the effective deployment of IS resources in organisations. Lu and Gustafson (1994) report that people use computers because they believe that computers will increase their problem solving performance (usefulness) and they are relatively effort free to use (ease of use). From the available literature, there is little evidence to suggest that the impact of Web-based technologies on EIS implementations has previously been investigated. This creates a platform for conducting such research. User acceptance of IT has been a primary focus in IT implementation research (Al-Gahtani, 2001). Researchers in the field rely on the theories of innovation diffusion to study implementation problems. Davis’ (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) technology acceptance model (TAM) is based on the diffusion of innovation model. TAM is a well-respected model of IT adoption and use (Al-Gahtani, 2001).

As the usage of IT increases, Web-enabled information technologies can provide the means for greater access to information from disparate computer applications and other information resources (Eder, 2000). These Web-based technologies

include intranet, Internet, extranet, e-commerce business-to-business (B2B), e-commerce business-to-consumer (B2C), wireless application protocol (WAP), and other mobile technologies. The focus of this chapter is on organisational intranets. There exists a high degree of similarity between the characteristics of a “good EIS” and Web-based technologies (Tang, Lee, & Yen, 1997).

The technology for EIS is evolving rapidly and future systems are likely to be different (Sprague & Watson, 1996). EIS is now clearly in a state of flux. As Turban (2001) notes, “EIS is going through a major change.” There is therefore both scope and need for research in the particular area of future EIS implementations being impacted by organisational intranets as executives and business end-users need systems that provide access to diverse types of information that form part of information age economies. Emerging (Web-based) technologies can redefine the utility, desirability, and economic viability of EIS technology (Volonino, Watson, & Robinson, 1995). Damsgaard and Scheepers (1999) describe intranet technology as a multi-purpose, rich networked, and malleable in terms of its application. As with all other investments, management must make a conscious decision to invest in a particular IS. Decisions to invest (or not invest) will influence the future of the organisation. With the absence of research efforts on the impact of organisational intranets on EIS implementation in South Africa, this research begins to fill the gap with a study of selected organisations in KwaZulu-Natal, South Africa, which have implemented EIS.

RESEARCH METHOD AND DATA GATHERING

The questionnaire was validated using expert opinion. It was based on previous instruments used in published research papers. Particular attention was given to Straub’s (1989) guideline of a

pre-test for the technical validation of the research instrument. This validation included the use of “previously validated instruments wherever possible” (Straub, 1989). Watson and Frolick (1993) note that numerical information comes from the questionnaire. The findings of the author’s survey will be based on the survey instrument.

As a preamble to the interview, the classification of the various types of IS and the distinguishing characteristics of EIS were discussed with each interviewee. A working definition of EIS (as used earlier in this chapter) was also given. This preamble to the actual interview meant that the interviewee was properly focused on the EIS in the organisation. The author’s survey instrument consists of three parts:

- **Section 1** deals with an organisation’s demographics. Questions were extracted from the Roldán (2000) EIS questionnaire, translated from Spanish to English and adapted for the author’s survey. The measurement of demographic variables of interest is consistent with prior research in sociology and organisational behaviour (Venkatesh & Morris, 2000).
- **Section 2** deals with the attributes of the organisation’s EIS. Questions were extracted from the Roldán (2000) EIS questionnaire, translated from Spanish to English and adapted for the author’s survey.
- **Section 3** deals with how an interviewee perceives specific Web-based technologies impacts the organisation’s EIS implementation. The selected Web-based technologies are (1) intranet; (2) Internet; (3) extranet; (4) e-commerce: business-to-business (B2B); (5) e-commerce: business-to-consumer (B2C); (6) wireless application protocol (WAP) and other mobile technologies; and (7) any other Web-based technologies.

Pre-testing a survey instrument is common practice. Roldán and Leal (2003) report that their

“instrument was pre-tested with consultants and business and IS professors.” A similar process was undertaken and experienced by the author who solicited expert opinion for additions, modifications, and/or deletions to the survey instrument. A pilot study was conducted to ensure that the interview schedule was clear, intelligible, and unambiguous. In order to evaluate the initial questionnaire design, an executive who uses EIS and four academics participated in separate field tests. One Spanish academic with EIS research interests commented “Very interesting.” Their comments led to a refinement of the questionnaire instrument. Their contributions are gratefully acknowledged. The survey instrument was submitted to three EIS software vendors (Cognos, JD Edwards (amalgamated with PeopleSoft, which is now part of Oracle) and ProClarity) in South Africa. A senior employee (e.g., managing director) from each vendor independently furnished some suggestions regarding the survey instrument. Some appropriate suggestions were adopted by the author and incorporated in the survey instrument.

There are six major metropolitan Councils in South Africa. Ethekwini Municipality Area (EMA) is the most populous municipality in South Africa (SA2002-2003, 2002). EMA’s geographic area size is 2,300 km² with a population of 3.09 million citizens (Statistics South Africa, 2001). During 2004, eThekweni Municipality was voted the best performing municipality in South Africa (Makhanya, 2004; Mthembu, 2004). The author’s survey of organisations in KwaZulu-Natal, which have implemented EIS, is confined to organisations in the EMA. It is acknowledged that some organisations may have implemented more than one EIS. In those cases and for this study, only the latest EIS implementation is used in the author’s survey.

Some studies suggest that EIS should not only be accessed by executive users (see, for example, Rai & Bajwa, 1997; Volonino et al., 1995). Salmeron (2001) notes EIS as the technology for

information delivery for all business end-users. Kennedy (1995) and Messina and Sanjay (1995) report that EIS have spread throughout organisations. It is evident that EIS requires continuous input from three different stakeholder groups (known as constituencies):

- EIS executives/business end-users
- EIS providers (i.e., persons responsible for developing and maintaining the EIS)
- EIS vendors or consultants

All constituencies are surveyed in the author's data sampling. The sample was selected using the unbiased "snowball" sampling technique. Cooper and Emory (1995) state that this technique has found a niche in applications where respondents are difficult to identify and are best located through referral networks. A formal extensive interview schedule was compiled and used for the semi-structured interviews. Interviews were conducted during May-June 2002 at the interviewee's organisation.

DATA ANALYSIS AND INTERPRETATION OF THE RESULTS

From the 31 interviews conducted using the author's survey instrument, 31 completed questionnaires were analysed. A tally of the responses to question 1.1-1.5 (Section 1) and question 2.1, 2.3, and 2.5-2.13 (Section 2) was made. Where there was a null (or blank) response recorded, this null (or blank) response was excluded from the respective tally. Frequency tables were constructed for each tally. For the responses to question 2.2 and 2.4, the data was arranged, sorted and frequency tables constructed. Such approaches are common in EIS research (see, for example, Kaniçlıdes & Kimble, 1997; Meneely & Pervan, 1994; Roldán & Leal, 2003; Salmeron, Luna, & Martinez, 2001). As Meneely and Pervan (1994)

report, the questionnaire data was analysed using basic statistical methods including frequencies. The author adopted a similar descriptive statistical process.

Demographics of Organisations Participating in Study

From a tally of interviewees' responses to question 1.1, the organisations participating in the study belongs primarily to the manufacturing (22.6%) and financial services (19.5%) sectors. (See Table 1) The prominence of these two sectors is reported in the Spanish EIS survey by Roldán and Leal (2003). The corresponding Spanish activity sector percentages are manufacturing (37.1%) and banking/financial services (24.3%).

From a tally of interviewees' responses to question 1.2, the gross annual turnover in South African Rands of organisations surveyed is given in Table 2. One respondent was unsure of his organisation's turnover and was not able to give a response to question 1.2. This null response was not included in Table 2. From Table 2, 27 (90.0%) of the organisations surveyed were large enterprises in the EMA. One organisation surveyed had an annual "sales for the year exceeding R12 bn" (Butcher, 2002).

From a tally of interviewees' responses to question 1.3, the number of permanent employees in organisations surveyed is given in Table 3. From Table 3, 20 (64.5%) of these organisations had more than 500 employees. This percentage compares favourably with the Spanish EIS survey percentage of 71% (Roldán et al., 2003).

From a tally of interviewees' responses to question 1.4, the number of years of existence of organisations surveyed is given in Table 4. From Table 4, 28 (90.3%) of organisations surveyed have existed for more than a decade. This suggests that these organisations are well-established in the EMA. The surveyed organisation which existed for less than five years was from the Information Technology Services sector (see Table 1).

Impact of Organisational Intranets on Profitability in Organisations

Table 1. Activity sector list of organisations surveyed which have implemented EIS

| Activity Sector | Number of Activity Sectors in survey sample and associated percentage of total sample surveyed (N=31) |
|---------------------------------|---|
| Agriculture | 1 (3.2%) |
| Catering | 1 (3.2%) |
| Construction and Automotive | 1 (3.2%) |
| Education | 1 (3.2%) |
| Electrical Power Distribution | 1 (3.2%) |
| Financial Services | 6 (19.5%) |
| Food Processing | 1 (3.2%) |
| Information Technology Services | 2 (6.5%) |
| Manufacturing | 7 (22.6%) |
| Medical Scheme Administrators | 1 (3.2%) |
| Public Administration | 1 (3.2%) |
| Public Transportation | 1 (3.2%) |
| Publishing | 1 (3.2%) |
| Retail | 2 (6.5%) |
| Software Development | 1 (3.2%) |
| Warehousing and Distribution | 2 (6.5%) |
| Water Distribution | 1 (3.2%) |
| TOTAL | 31 (100.0%) |

Table 2. Gross annual turnover of organisations participating in study

| Gross annual turnover (in South African Rands) | Number of organisations in survey sample and associated percentage of total sample surveyed (N=30) |
|--|--|
| More than 500 Million | 16 (53.3%) |
| Between 100 and 500 Million | 8 (26.7%) |
| Between 20 and 100 Million | 3 (10.0%) |
| Between 5 and 20 Million | 0 (0.0%) |
| Between 1 and 5 Million | 3 (10.0%) |
| Less than 1 Million | 0 (0.0%) |
| TOTAL | 30 (100.0%) |

From a tally of interviewees' responses to question 1.5 the classification of organisations surveyed is given in Table 5. Table 5 suggests that the existence of EIS in organisations is not

limited to a single organisational classification. As EIS differ considerably in scope and purpose "the primary purpose of the system will change from one organization to another" (Roldán et al.,

2003). In the case of the Foreign enterprise classification, both organisations were locally based (South African) but wholly owned by their respective overseas (based in Germany and Switzerland) parent organisations.

Interviewee names and their corresponding organisation names were recorded against question 1.6. These are not reported in this chapter. From the recorded responses to question 1.7, an inventory of interviewee’s job titles was compiled. These are also not reported in this chapter. Some interviewees had identical job titles (director, managing director, regional manager, and systems analyst). Twelve (38.7%) interviewees held IT positions in organisations surveyed. Earl (1996) suggests that if IS implementation is left to IS professionals and users alone, the investment is rarely recouped.

From an interviewee’s response to question 1.8, the author objectively classified respondents into one of three stakeholder groups: EIS executive/business end-users, EIS providers and EIS vendors or consultants. The three EIS constituencies and number of surveyed respondents and associated percentages per constituency are given in Table 6. Most research of IT acceptance and use does not distinguish senior executives as a separate group (Pijpers, 2001).

From an analysis of interviewee’s responses to question 1.8, 29 respondents indicated that they were EIS users in their organisations. Two respondents reported that they were EIS implementers.

This concludes the analysis and findings of the interviewee’s responses to Section 1 of the author’s survey instrument. Interviewees’ responses to

Table 3. Number of permanent employees in organisations participating in study

| Number of permanent employees in organisation | Number of organisations in survey sample and associated percentage of total sample surveyed (N=31) |
|--|---|
| More than 5,001 employees | 6 (19.5%) |
| Between 2,001 and 5,000 employees | 5 (16.1%) |
| Between 501 and 2,000 employees | 9 (29.0%) |
| Between 251 and 500 employees | 5 (16.1%) |
| Between 51 and 250 employees | 5 (16.1%) |
| Less than 51 employees | 1 (3.2%) |
| TOTAL | 31 (100.0%) |

Table 4. Number of years that organisations, which participated in the study, have existed

| Number of years that the organisation has existed | Number of organisations in survey sample and associated percentage of total sample surveyed (N=31) |
|--|---|
| More than 25 years | 25 (80.6%) |
| Between 10 and 25 years | 3 (9.7%) |
| Between 5 and 10 years | 2 (6.5%) |
| Less than 5 years | 1 (3.2%) |
| TOTAL | 31 (100.0%) |

Impact of Organisational Intranets on Profitability in Organisations

Table 5. Classification of organisations participating in study

| Classification of organisation | Number of organisations in survey sample and associated percentage of total sample surveyed (N=31) |
|---------------------------------------|---|
| Public listed | 11 (35.5%) |
| Public non-listed | 3 (9.7%) |
| Government or quasi-government body | 6 (19.3 %) |
| Foreign enterprise | 2 (6.5%) |
| Private company | 9 (29.0%) |
| TOTAL | 31 (100.0%) |

Table 6. EIS constituencies and number of interviewees surveyed per constituency

| Stakeholder groups (constituencies) | Number of respondents surveyed and associated percentage of total sample surveyed (N=31) |
|--|---|
| EIS executives/business end-users | 20 (64.5%) |
| EIS providers | 7 (22.6%) |
| EIS vendors or consultants | 4 (12.9%) |
| TOTAL | 31 (100.0%) |

Table 7. Current EIS situation in respondent's organisation

| Current situation of EIS in respondent's organisation | Number of respondents surveyed and associated percentage of total sample surveyed (N=31) |
|--|---|
| Based on the evaluation, the EIS has been accepted and is under development and implementation | 3 (9.7%) |
| The EIS is operational and in use by executives/business end-users | 27 (87.1%) |
| EIS failure (where the latest EIS implementation has been successful) | 1 (3.2%) |
| TOTAL | 31 (100.0%) |

question in Section 2 of the survey instrument are now analysed and discussed.

EIS in Respondent’s Organisation Participating in Study

Roldán et al. (2003) surveyed organisations whose EIS were “operative or in an implementation stage sufficiently advanced.” From a tally of interviewees’ responses to question 2.1, the current (i.e., during the interview period) EIS situation in the respondent’s organisation is given in Table 7. From Table 7, one EIS implementation failure was reported by a respondent. This failure was ascribed to the most *recent* EIS implementation. In the Pervan and Phau (1997) EIS survey of organisations in Australia a similar experience

was reported—“only one of the organisations had experienced complete failure, in which the system had fallen into disuse.”

From the 27 operational EIS and in use by executives/business end-users (see Table 7) in organisations surveyed, a tally of interviewees’ responses to question 2.2 is given in Table 8. Two respondents were not able to report the time taken before the EIS was in use by executives/business end-users. They stated “EIS in use before I joined the company.” Their null responses are not included in Table 8.

From Table 8, the average time taken before the EIS was in use by executives and business end-users is 9.01 months. This compares favourably with the Roldán et al. (2003) average time of 8.53 months. Salmeron et al. (2001) report that

Table 8. Time taken before EIS was in use by executives/business end-users

| For operational EIS, time taken before EIS was in use by executives/business end-users | Tally and associated percentage of the time taken as reported by respondents in sample surveyed (N=25) |
|--|--|
| 3 days | 1 (4.0%) |
| 10-15 days | 1 (4.0%) |
| 14 days | 1 (4.0%) |
| 1 month | 2 (8.0%) |
| 2 months | 1 (4.0%) |
| 2-3 months | 1 (4.0%) |
| 3 months | 2 (8.0%) |
| 3-6 months | 3 (12.0%) |
| 5 months | 1 (4.0%) |
| 6 months | 2 (8.0%) |
| 8 months | 2 (8.0%) |
| 12 months | 3 (12.0%) |
| 15 months | 1 (4.0%) |
| 18 months | 1 (4.0%) |
| 24 months | 2 (8.0%) |
| 36 months | 1 (4.0%) |
| TOTAL | 25 (100.0%) |

Impact of Organisational Intranets on Profitability in Organisations

the development of an EIS (in Spain) usually takes 6-12 months. These average times should be considered long term when compared with previous studies (Watson, Rainer, & Koh, 1991; Watson, Rainer, & Frolick, 1992; Park, Min, Lim, & Chun, 1997), which could negatively affect the users' acceptance of the system (Young & Watson, 1995).

From a tally of interviewees' responses to question 2.3 (more than one answer could be given), the applications for which the EIS is used in organisations surveyed is given in Table 9.

Research has found that the accessibility of information is more important than its quality in predicting use (O'Reilly, 1982). Access to updated online information is a basic characteristic of EIS (Houdeshel & Watson, 1987; Martin, Brown, DeHayes, Hoffer, & Perkins, 1999). Pervan and Phua (1997) report that the ability to access current

status information, such as performance reports, is the main feature most highly used by executives in obtaining the day-to-day information needed for their decision-making. From Table 9, the two highest scoring (see shaded areas) EIS applications used in respondents' organisations confirms the Australian EIS survey findings. Jones (2002) notes, "Executives need to be able to draw upon corporate knowledge and make decisions based on hard facts, not assumptions." The value of an intranet for managing knowledge is largely dependent on the calibre of the content and tools it provides to its users and their ultimate application in the organisation's business operations (Hall, 2001). An IS investment can either have a negative effect, a positive effect or no effect on the objectives of an organisation and these effects can be of a long-term duration.

Table 9. Applications for which EIS is used in organisations surveyed

| EIS applications used in respondent's organisation | Tally and associated percentage of the number of applications reported by respondents in total sample surveyed (N=31) |
|--|---|
| Office automation activities | 5 (16.1%) |
| Access to current status information | 22 (71.0%) |
| Access to projected trends of the organisation | 23 (74.2%) |
| Querying corporate and external databases | 16 (51.6%) |
| Performing personal analysis | 16 (51.6%) |
| Measuring key performance indicators | 1 (3.2%) |

Table 10. EIS users in organisations surveyed

| EIS user statistics in organisations (N=27) | |
|---|-----|
| Minimum number of EIS users reported | 6 |
| Maximum number of EIS users reported | 700 |
| Mode | 20 |
| Mean | 54 |
| Standard deviation | 134 |

From the 27 operational EIS and in use by executives/business end-users (see Table 7) in organisations surveyed, the EIS user statistics of interviewees' responses to question 2.4 is given in Table 10.

The EIS user statistics for *all* interviewee's responses (31 organisations surveyed) to question 2.4 is given in Table 11. The mean number of EIS users per organisation in both samples (see shaded areas in Tables 10 and 11) is similar.

Roldán et al. (2003) report that "the average number of users in all organisations studied is 75.93 persons." This figure is significantly higher than the author's means of 54 (N=27) and 50 (N=31) in Tables 10 and 11 respectively. A possible explanation for this is that in the Spanish survey, three organisations surveyed each had more than

400 users. One of these three organisations had a total of 1,800 EIS users. In the author's research, the largest number of reported EIS users in one organisation was 700. Roldán et al. (2003) suggest that it would therefore be more appropriate to take into account the mode values. They report "the number of 20 users as a measure of the central trend." This mode corresponds exactly to the author's survey results given in Tables 10 and 11.

From a tally of interviewees' responses (more than one answer could be given) to question 2.5, the hierarchical employee levels where EIS is used in organisations surveyed is given in Table 12. Liang and Hung (1997) report that in their survey of organisations in Taiwan, middle-level managers are primary EIS users (78.94%) "but lower-level managers (24.58%) are also popular." From Table

Table 11. EIS users in organisations surveyed

| EIS user statistics in organisations (N=31) | |
|--|-----|
| Minimum number of EIS users reported | 2 |
| Maximum number of EIS users reported | 700 |
| Mode | 20 |
| Mean | 50 |
| Standard deviation | 126 |

Table 12. Hierarchical employee levels where EIS is used in organisations

| Hierarchical employee level where EIS is used in organisation | Tally and associated percentage of the number of employee levels reported by respondents in total sample surveyed (N=31) |
|--|---|
| Managing director/ chief executive officer | 14 (45.2%) |
| Director (or delegated) | 18 (58.1%) |
| General manager | 20 (64.5%) |
| Senior operations manager | 19 (61.3%) |
| Middle manager | 24 (77.4%) |
| Line manager | 14 (45.2%) |
| Business end-user | 12 (38.7%) |
| Financial consultants | 1 (3.2%) |

Impact of Organisational Intranets on Profitability in Organisations

12, middle managers show significant higher EIS use levels (77.4%) than top managers (managing director/chief executive officer (45.2%) and director (58.1%)). This middle manager use level (77.4%) corresponds with the Liang et al. (1997) survey but is higher than the Roldán et al. (2003) middle manager survey result of 68,6%. While Roldán et al. (2003) report a “close similarity” between EIS use by middle managers (68.6%)

and EIS use by managing directors (70.0%), this similarity is not evidenced by the author’s findings in Table 12. There is a significant use difference between these two hierarchical levels. Furthermore Roldán et al. (2003) report that “21.4% of organizations declare that they have other users’ below the line manager hierarchical level.”

From Table 12 there are 12 (38.7%) business end-users and one (3.2%) financial consultant

Table 13. Functional areas where EIS is used in organisations

| Functional area where EIS is used in organisation | Tally and associated percentage of the number of functional areas reported by respondents in total sample surveyed (N=31) |
|--|--|
| Finance | 20 (64.5%) |
| Planning | 10 (32.3%) |
| Marketing | 20 (64.5%) |
| Sales | 16 (51.6%) |
| Personnel | 5 (16.1%) |
| Production/ Operations | 12 (38.7%) |
| Entire Organisation | 7 (22.6%) |

Table 14. Functional areas where EIS is used in organisations

| Types of information held by EIS in organisation | Tally and associated percentage of the number of types of information as reported by respondents in total sample surveyed (N=31) |
|---|---|
| Strategic planning | 11 (35.5%) |
| Inventory management/suppliers | 10 (32.3%) |
| “Soft” information | 4 (12.9%) |
| Finance | 28 (90.3%) |
| Business/Sales | 23 (74.2%) |
| Trade/Industry | 4 (12.9%) |
| Human resources | 9 (29.0%) |
| Quality | 7 (22.6%) |
| External news services | 1 (3.2%) |
| Production | 8 (25.8%) |
| Competitors | 3 (9.7%) |
| Stock exchange prices | 1 (3.2%) |

below the line manager hierarchical level. The total percentage (41.9%) of these EIS users is significantly higher than the Roldán et al. (2003) survey. This tends to suggest that the degree of EIS diffusion to lower organisational hierarchical levels and use by these levels in organisations surveyed in South Africa, is on par with organisations surveyed in Taiwan but is significantly higher than experienced by organisations in Spain. As Liang et al. (1997) note, a “reason for this may be the extension of EIS to everybody information systems.” EIS are becoming less strictly defined to support professional decision-makers throughout the organisation (Turban et al., 1998). Turban et al. (1998) state that “there is now increasing number of tools designed to help functional managers (finance, marketing); these tools are integrated with EIS.”

From a tally of interviewees’ responses to question 2.6 (more than one answer could be given), the functional areas where EIS are used in organisations is given in Table 13. The highest scoring functional areas are Finance (64.5%) and Marketing (64.5%). The lowest scoring functional area is Personnel (16.1%). Table 13 shows that the functional areas where EIS are used in organisations surveyed are quite broad. Similar broad findings are reported by Liang et al. (1997) in organisations surveyed in Taiwan. One must ensure that the cost of the technology is able to justify its usage (Agarwal, Higgins, & Tanniru, 1991).

From a tally of interviewees’ responses to question 2.7 (more than one answer could be given), the different types of information held by an EIS in an organisation is given in Table 14. From Table 14, Financial information (90.3%) appears as the most important item followed by Business/Sales (74.2%) and then Strategic Planning (35.5%). In the Roldán et al. (2003) survey, the three highest ranking types of information held by an EIS in an organisation were commercial and sales information (89.2%), financial information (65.7%) and production information

(55.7%). While previous research studies agree in presenting these three types of information (sales, financial, and production) as the most relevant ones (Allison, 1996; Kirlidog, 1997; Thodenius, 1995) the author’s findings partially support these findings with business/sales (74.2%) and finance (90.3%) types of information. Holding strategic planning information in EIS in organisations in South Africa appears to have a higher importance than holding production information. Wessels (2003) conducted a survey about IS investment decisions in organisations in South Africa and found that 66.0% of respondents stated that they justified their investment on strategic reasons.

Watson et al. (1996) recognise that executives require “soft” information (often provided informally) for decision-making. Soft information is “fuzzy, unofficial, intuitive, subjective, nebulous, implied, and vague.” Watson et al. (1996) found that soft information was used in most EIS but the author’s findings (12.9%) do not support this. One possible explanation is that it is often policy not to allow unsubstantiated rumours into IS without a reference to a source and tagged by the individual entering the information (Turban et al., 1998). In the justification of investing in IS and the process of making decisions (whether to invest in a new IS or not), “soft” factors also need to be incorporated (Hinton & Kaye, 1994).

From Table 14 it can be observed that the information that appears predominantly in EIS has an internal characteristic (Preedy, 1990). External information obtains low response levels: trade/industry (12.9%), external news services (3.2%), competitors (9.7%) and stock exchange prices (3.2%). Roldán et al. (2003) report similar low response levels. Salmeron et al. (2001) note that “it is surprising that external information is so seldom included in Spain.” Intranets and knowledge sharing can assist to “capture, organise, store, and transmit” source material from which an individual may acquire knowledge (Gundry & Metes, 1996). An IT investment decision is a process of filtering and distilling often com-

Impact of Organisational Intranets on Profitability in Organisations

plex data, information, and knowledge to levels manageable to the human mind (Bannister & Remenyi, 2000).

From a tally of interviewees' responses to question 2.8 (more than one answer could be given), how information is held by EIS in an organisation is given in Table 15. From Table 15, information is generally presented by products (71.0%), operational areas (64.5%) and geographical areas (58.1%). Roldán et al. (2003) report similar findings for operational/functional areas (62.9%), products (61.4%), and geographic areas (52.9%). Roldán et al. (2003) note that "information according to processes ranks quite low, existing in only 20%

of participating entities." From Table 15, there is a striking commonality with the author's finding of 19.4%. This situation was highlighted by Wetherbe (1991) as one of the traditional IS problems for top managers (i.e., these systems are considered as functional systems rather than being considered as systems crossing functions).

From a tally of interviewees' responses to question 2.9 (more than one answer could be given), the different types of sources of information that support an EIS in an organisation are given in Table 16. One of the capabilities or characteristics of EIS is the filtering, organisation, and consolidation of multiple data sources. This quantitative data stems

Table 15. How information is held by an EIS in an organisation

| How information is held by EIS in organisation | Tally and associated percentage of how information is held as reported by respondents in total sample surveyed (N=31) |
|--|---|
| By products | 22 (71.0%) |
| By projects | 5 (16.1 %) |
| By operational areas | 20 (64.5%) |
| By geographic areas | 18 (58.1%) |
| By strategic business units | 10 (32.3%) |
| By processes | 6 (19.4%) |
| By key performance areas | 14 (45.2%) |
| By company | 11 (35.5%) |
| By customers | 1 (3.2%) |

Table 16. Sources of information that support EIS in an organisation

| Sources of information that support EIS in organisation | Tally and associated percentage of sources of information as reported by respondents in total sample surveyed (N=31) |
|---|--|
| Corporate databases | 25 (80.6%) |
| Individuals | 12 (38.7%) |
| Operational databases | 20 (64.5%) |
| External databases | 8 (25.8%) |
| Documents or reports | 7 (22.6%) |
| Internet, intranet or extranet | 5 (16.1%) |

Table 17. Approaches taken for EIS development in organisations

| Approach taken for EIS development in organisation | Tally and associated percentage of approach taken for EIS development as reported by respondents in total sample surveyed (N=31) |
|--|--|
| In-house development using existing software tools | 6 (19.4%) |
| In-house development with critical EIS features developed initially and optional features added over time, using existing or commercially purchased software tools | 9 (29.0%) |
| Fully developed by vendor | 7 (22.6%) |
| In-house development with assistance from vendor | 12 (38.7%) |

from corporate databases (80.6%) and operational databases (64.5%). Data aggregation is to integrate data from various sources to provide critical information requested by decision-makers (Liang et al., 1997). A significant advantage of using an intranet involves its facilitation of decentralised decision-making (Van der Merwe, 2001). This occurs because everyone has access to information and there is no reliance on a limited number of employees who have access to different types of information from different departments within the organisation.

As previously discussed, Table 14 reflects that the information that appears predominantly in EIS has an internal characteristic. Table 16 reflects that a significant majority of the information came from internal sources. External sources have a low presence: external databases (25.8%) and Internet, intranet, or extranet (16.1%). This trend towards internal sources supports the results obtained in previous research studies (Basu, Poindexter, Drosen, & Addo, 2000; Kirlidog, 1997; Roldán et al., 2003; Watson et al., 1991; Watson et al., 1992). In the opinion of Salmeron et al. (2001) “the extent to which information coming from the environment is included in the EIS of Spanish big businesses should reach higher figures, due

to the fact that all elements that currently form economy are interrelated”. Given the presence of Web-based technologies and from Table 16 it is therefore somewhat surprising that the Internet, intranet and extranet rank as the lowest source of information which support an EIS in the organisations surveyed in the EMA. One of the contributions of the Web has been streamlining and co-coordinating the internal communication structure of organisations by using the Web as a standard (Abraham and Seal, 2001).

System justification implies first an evaluation and then the activity of justification, showing that the IS is appropriate for the particular business context (Remenyi, Money, & Twite, 1995). From a tally of interviewees’ responses to question 2.10, the approach taken for EIS development is given in Table 17. In-house development with assistance from the vendor (38.7%) was the most common approach taken. A “piece meal” strategy where in-house EIS development with critical features was conducted initially then operational features added over time using existing or purchased software tools was most preferred (33%) by organisations surveyed in Australia (Pervan et al., 1997). From Table 17, a similar pattern (29.0%) was evidenced in organisations surveyed in South Africa.

Impact of Organisational Intranets on Profitability in Organisations

Roldán et al. (2003) report a “low number of cases in which the systems have been developed with software produced by the organization itself (5.7%).” In the author’s survey, in-house development using existing software tools is somewhat higher (19.4%). A possible explanation is that some organisations surveyed may not yet have migrated from their first (in-house developed) EIS.

Pervan et al. (1997) report that for organisations surveyed in Australia, only 17% of EIS were developed in-house with assistance from a vendor/consultant. Roldán et al. (2003) report in-house development with assistance from the vendor (47.1%) as the most common approach taken in organisations surveyed in Spain. From Table 17, it can be seen that while this approach is taken by organisations surveyed in South Africa, the occurrence is slightly less. Many organisations do not perform evaluations or cost benefit analysis on there is and those who do sometimes report mixed or confused results (Remenyi et al., 1995).

From a tally of interviewees’ responses to question 2.11 (more than one answer could be given), the distribution of the market amongst vendors of EIS tools used in organisations surveyed is reflected in Table 18.

One respondent indicated that his organisation *only* used in-house developed software. This response was therefore not included in Table 18. From Table 18, Cognos is the most frequently (60.0%) reported commercially packaged EIS software tool. Cognos has 2.5 million users at 18,000 customers in 120 countries and its business intelligence solutions are available from more than 3,000 worldwide partners and resellers. See <http://www.cognos.com>

Pervan et al. (1997) report that “Pilot was the most popular choice with 26%, followed by Powerplay with 16%” in organisations surveyed in Australia. Roldán et al. (2003) found that “Commander from Comshare (39.1%), DSS Agents from MicroStrategy (21,9%), Forest & Trees from

Table 18. Distribution of market amongst vendors of EIS tools according to responses

| Name of commercially purchased EIS software tools and/or ERP software with EIS features | Tally and associated percentage of commercially purchased EIS software tools and/or ERP software with EIS features as reported by respondents in total sample surveyed (N=30) |
|---|---|
| Business Objects | 2 (6.7%) |
| Cognos | 18 (60.0%) |
| Crystal Enterprise | 1 (3.3%) |
| Holos | 1 (3.3%) |
| Hyperion | 3 (10.0%) |
| JDEdwards BI | 4 (13.3%) |
| Lotus Notes | 3 (10.0%) |
| Oracle | 4 (13.3%) |
| Pilot | 2 (6.7%) |
| ProClarity | 1 (3.3%) |
| SAP/EIS | 1 (3.3%) |
| MIMMS | 1 (3.3%) |
| MISYS | 1 (3.3%) |
| BI Query | 1 (3.3%) |

Table 19. Frequencies of EIS use in organisations

| Frequency of EIS use in organisation | Tally and associated percentage of EIS use in organisation as reported by respondents in total sample surveyed (N=31) |
|---|---|
| Very rarely or not at all | 1 (3.2%) |
| Rarely (a few times per month) | 1 (3.2%) |
| Occasionally (a few times per week) | 1 (3.2%) |
| Sometimes (about once per weeks) | 1 (3.2%) |
| Fairly regularly (several times per week) | 4 (12.9%) |
| Regularly (once a day) | 12 (38.7%) |
| Frequently (several times per day) | 13 (41.9%) |

Platinum Technology (15.6%), and Focus/EIS from Information Builders (10.9%)” were the popular EIS software tools in organisations surveyed in Spain. From Table 17 and the Australian and Spanish survey findings, it appears that little use is made of ERP software with EIS features. EIS products “tend to be included in larger software systems, becoming a module integrated in quite a few ERP systems such as SAP” (Roldán et al., 2003). However, the author’s findings suggest that there is a strong *usage* preference for commercially purchased EIS software tools (as opposed to ERP software with EIS features) by organisations surveyed in South Africa. Usage of ERP software with EIS features appears to be minimal in organisations surveyed in South Africa.

From a tally of interviewees’ responses to question 2.12 (more than one answer could be given), the frequency of EIS use in organisations surveyed is given in Table 19. This EIS use measure was self-reported by respondents. Although previous research suggests that self-reported frequency measures are appropriate as relative measures (Blair & Burton, 1987), they should not be regarded as precise measures of actual use frequency (Davis et al., 1989).

From Table 19, frequent (several times per day) and regular use of the EIS were reported by a total of 25 (80.6%) respondents (see shaded area

in Table 19). In the survey of EIS applications in Taiwan, Liang et al. (1997) state that “over half of the respondents reported using their systems every day. Twenty-two percent used the system very often.” Liang et al. (1997) report that organisations with EIS “rely heavily on their systems for support decision making.” In the author’s survey, some respondents reported different EIS use frequencies during the month (e.g., higher EIS use during month end). One respondent stated, “First week of month is a lot busier. Towards end of the month not more than an hour.” An EIS has the effect of multiplying the frequency of use (Palvia, Kumar, Kumar, & Hendon, 1996).

The low EIS use frequencies can be ascribed to the fact that three EIS implementations in organisations are currently under development and implementation (see Table 7). Despite this, Davis (1989) notes that users are often willing to cope with some difficulty of use in a system that provides critically needed functionality. System use is the most crucial aspect of EIS operation.

From the responses to question 2.14, a smorgasbord of some interviewee’s comments is now given. Twenty-nine interviewees expressed a positive personal expectation to the success of the EIS implementation in their organisations. Some interviewee comments recorded were “Positive,” “Very optimistic,” “We knew it would be a suc-

cess from our previous history,” “I though the guys would really go for it,” “Had a very high expectation of success,” “We had nothing. We believed it would sort out all our problems,” “I knew it would be successful because we had done a lot of research,” and “I knew it would work as we were reliant on the mainframe.”

One interviewee’s response was neutral with a reply “Can’t comment. Before my time.” Another interviewee “thought it would fail...had old style managers who were not into new kinds of things... things have now changed.” Perlman (1986) notes that overcoming inherent human conservatism associated with any change is crucial. The right determination is seen as a key to EIS success (Salmeron, 2001).

From a synthesis of interviewees’ responses to question 2.15, the first author identified that 27 interviewees reported the most recent EIS implementation in their organisation as successful, three interviewees reported partially success, and one interviewee reported failure with his organisation’s most recent EIS implementation.

For the 27 successful organisations, some interviewee comments recorded were “Yes, definitely growing now,” “Yes, it was successful due to the ease of implementing the Cognos product. It is very scalable. We staged the implementation,” “Absolutely, yes!” “Oh, yes. Without a doubt,” “To a large degree it achieved what we had originally set out to achieved,” “Successfully implemented but not widely used,” and “Yes, once up and running.”

For the partially successful EIS implementations some interviewee comments recorded were “It has not yet been completed...serious mindset to get rid of” and “thought it would be successful but needed executive team buy-in.” Support from senior management is considered to be the most critical issue affecting EIS operation (Kaniclides et al., 1997).

For the not successful (i.e., failure) EIS implementation in response to question 2.16, the interviewee stated for the latest EIS implementation

his organisation had “tried to pilot a project ... but there were some political reasons for its failure.” Politically motivated resistance from executives is a highly rated factor affecting the success of EIS development (Kaniclides et al., 1997). Kaniclides et al. (1997) note that politically driven tactics can originate from both executives designated as initial users of the system and those regarded as potential future users of the system. This scenario appears to be present in the organisation, which the interviewee reported that the latest EIS implementation had not been successful. Furthermore, there seemed to exist an interest in letting the EIS system fail rather than a lack of interest in system success. A similar finding was reported by Poon and Wagner (2001) in organisations surveyed in Hong Kong.

There is little information available to assist practitioners regarding the question of how to minimise the risk of EIS failure (Watson et al., 1991). Watson and Glover (1989) carried out a study of 21 EIS failures. From their findings, they identified the following factors that contribute to the EIS failure: inadequate or appropriate technology, failure of the system to meet user needs, lack of executive commitment and executive resistance to technology. In the Pervan et al. (1997) study of EIS failures in organisations surveyed in Australia, inadequate or appropriate technology was reported as being the major EIS failure factor. During the author’s interview of the respondent who reported his most recent EIS implementation as not successful, the interviewee cited that “there were some political reasons for its failure.” At first glance this finding appears to be inconsistent with the Watson et al. (1989) and the more recent Pervan et al. (1997) studies.

A further investigation reveals that in the Pervan et al. (1997) study, “with only 16% of organisations having EIS that are in full operation, this may be the reason for political problems being rated the least important.” Pervan et al. (1997) note that “this issue may increase in significance as more organisations progress from the evaluation

stage to the operational stage in the near future.” During the author’s survey, the respondent who reported his most recent EIS implementation as not successful *had* progressed from an EIS evaluation stage to the operational stage. Consequently, the author’s findings do not appear to be inconsistent with the Pervan et al. (1997) study. Willcocks (1996) suggest that the high failure rates of new IS in organisations stems from the fact that there is a wide gap between the level of investments in IS and an organisation’s ability to achieve the necessary benefits from such investments. Most organisations do not formally evaluate their investment in IS (Wessels, 2003).

From the responses to question 2.15 for successful and partially successful EIS implementations in organisations surveyed, some interviewee’s comments are now given. “Software had to be user friendly...the way that we had done our reporting did not display well...our MD wants to look at something more visual,” “a very clear understanding of user requirements is necessary because they don’t know what they want,” “the ease of extracting the data...must be very easy and flexible,” “...the buy-in was already there,” “that we can use our data for analysis,” “management support,” “the immediate access to data, drill down, KPIs to customers and products,” “presents answers in a presentable way...user-friendly,” “reliable, timeliness, and flexibility,” “accurate, timeous, relevant to what’s happening in business at moment...also ease of use,” “needed to be backed by management to be successful,” “needed an executive sponsor,” “stable technology,” and “data integrity.”

Rockart and DeLong (1988) observed several factors in organisations which appear to be the most important for effective EIS implementation. Some factors which Rockart et al. (1988) report as critical to a successful EIS implementation, are a committed and informed executive sponsor, an operating sponsor, appropriate IS staff, appropriate technology, management of data, clear link to business objectives, management

of organisational resistance, and management of system evolution spread. Pervan et al. (1997) report that these factors will be refined by other researchers as the EIS field evolves. While there is no consensus on the “ingredients for EIS success” (Paller & Laska, 1990) there appears to be a strong degree of commonality between the identified factors and interviewee’s comments. The process of evaluating IT is the application and absorption of a range of input information which includes data, evaluation techniques, personal experience, personal knowledge, corporate or departmental politics, personal decisions and intuition (Wessels, 2003). This concludes the analysis and findings of the interviewee’s responses to Section 2 of the author’s survey instrument. Interviewees’ responses to questions in Section 3 of the survey instrument are now analysed and discussed.

LEVEL OF IMPACT OF WEB-BASED TECHNOLOGIES ON EIS IMPLEMENTATION

From Section 3 of the author’s survey instrument, a tally, and associated percentage of the perceived degree to which specific Web-based technologies impacted a respondent’s EIS implementation is given in Table 20. The shaded area in Table 20 suggests that there is little (if any) perceived impact by Web-based technologies on EIS implementation in organisations surveyed in KwaZulu-Natal.

Table 20 shows that only seven (22.5%) of organisations surveyed reported that the organisational intranet significantly impacted their EIS implementation. From a managerial perspective, intranet technology’s cost, flexibility, and wide spectrum of uses does render it an attractive IT in the organisational environment (Scheepers et al., 2001). The level of impact by the Internet on EIS implementation is slightly lower with six (19.4%) of organisations surveyed reporting that the Internet had significantly impacted their EIS

Impact of Organisational Intranets on Profitability in Organisations

Table 20. Tally and associated percentage of the expected degree to which specific Web-based technologies impacted respondent's EIS implementation

| Web-based technology | The degree to which Web-based technologies impacted respondent's EIS implementation (N=31) | | | | | EIS implementation | |
|-----------------------------------|--|-------------|-----------------|-----------|---------------|--------------------|-------------|
| | Not at all | Very little | Somewhat little | Uncertain | Somewhat much | Very much | Extensively |
| Intranet | 17 (54.8%) | 2 (6.5%) | 2 (6.5%) | 0 (0.0%) | 3 (9.7%) | 4 (12.9%) | 3 (9.6%) |
| Internet | 21 (67.7%) | 1 (3.2%) | 1 (3.2%) | 0 (0.0%) | 2 (6.5%) | 3 (9.7%) | 3 (9.7%) |
| Extranet | 24 (77.4%) | 1 (3.2%) | 2 (6.5%) | 1 (3.2%) | 1 (3.2%) | 2 (6.5%) | 0 (0.0%) |
| E-commerce (B2B) | 28 (90.4%) | 1 (3.2%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 1 (3.2%) | 1 (3.2%) |
| E-commerce (B2C) | 26 (83.9%) | 1 (3.2%) | 1 (3.2%) | 0 (0.0%) | 2 (6.5%) | 0 (0.0%) | 1 (3.2%) |
| WAP and other mobile technologies | 29 (93.6%) | 1 (3.2%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 1 (3.2%) |
| Portal | 26 (83.8%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 2 (6.5%) | 2 (6.5%) | 1 (3.2%) |

implementation. While 24 (77.4%) of the organisations surveyed reported the extranet had no impact on their organisation's EIS implementation, the balance of the data sample (22.6%) reported different degrees of impact. Turban et al. (2004) note that the use of extranets is rapidly increasing due to the large savings in communication costs that can materialise. The author reported relatively low-level impact by the extranet on EIS implementations in organisations surveyed, and this may be an avenue for further investigation. The Internet, intranet, and extranets can be used in various ways in a corporate environment in order to gain competitive advantage (Turban et al., 2004). As a mission critical corporate tool, Internet technology has to support all the core business functions and it must do this more effectively and economically than is possible using other concepts and tools (Van der Merwe, 2001). The Internet provides global access and is the conceptual start of both intranets and extranets (Askelson, 1998).

The results show that the vast majority (90.4%) of respondents reported that e-commerce (B2B) had not impacted EIS implementation in organisation surveyed. A slightly lower result (83.9%) was reported for e-commerce (B2C). One possible explanation for e-commerce (B2B) and (B2C) low impact levels is that the software development tools are still evolving and changing rapidly. E-commerce is a rapidly evolving area that is continuing to penetrate into new application areas (Hawryszkiewicz, 1999). Another possible reason is it is difficult to integrate the Internet and e-commerce software with some existing applications and databases. However, Ciborra and Hanseth (1998) suggest that intranet technology may even emerge without a grand plan in the organisation.

WAP and other mobile technologies have no (93.6%) or very little (3.2%) impact on EIS implementations. Of the seven Web-based technologies given in Table 20, WAP and other mobile

technologies have the *least* impact (combining “Somewhat much,” “Very much,” and “Extensively”) on EIS implementation in organisations surveyed. Only one respondent (3.2%) reported that WAP and other technologies had extensively impacted the EIS implementation in her organisation. A possible explanation for this result is that the EIS consultant was technically proficient in WAP technologies.

From Table 20, three interviewees reported that their organisation’s EIS implementations were significantly impacted (“Very much” and “Extensively”) by portal technologies. This is noteworthy as the portal technology impact on EIS implementations (9.7%) is higher than the extranet (6.5%), e-commerce (B2B) (6.4%), e-commerce: (B2C) (6.4%) and WAP and other technologies (3.2%) impacts. For a discussion of the impact of portal technologies on EIS implementation in organisations, see Averweg et al. (2004).

Combining the results (“Somewhat much,” “Very much,” and “Extensively”) for each of the seven Web-based technologies, Table 21 gives a descending ranking order of the levels of impact on EIS implementations. From the selected Web-based technologies, intranets have the highest level of impact on EIS implementation in organisations surveyed in KwaZulu-Natal. Organisational intranets are envisioned as platforms for organisational knowledge management (Davenport & Pruzak, 1998). This information is particularly

useful for IT practitioners in the planning of future EIS implementations. The key point is that an organisational intranet utilizes Internet and Web-based technologies to conduct internal communication and collaboration activities within an organisation and provides a level of integration and access.

This concludes the analysis and findings of the interviewee’s responses to Section 3 of the author’s survey instrument. Some concluding remarks will now be given.

CONCLUDING REMARKS

Ezingard et al. (1998) report that in their survey, more than half of the respondents did not formally list the benefits expected of their IT and IS investment but justified the investment as an “act of faith.” Intranet technology calls into question some of our traditional IT implementation wisdom and presents new challenges for seeking to implement the technology (Balasubramanian & Bashian, 1998; Scheepers, 1999). Consequently, approaching an EIS implementation with a traditional mindset or using existing implementation models may be short-sighted. Emergent processes require new modelling methods and technologies to build successful systems that support them. The advent of the organisational application of Internet-based technologies (especially intranets),

Table 21. Descending rank order of impact levels of Web-based technologies on EIS implementation

| Rank | Web-based technology | Tally and level of impact on EIS implementations |
|------|-----------------------------------|--|
| 1 | Intranet | 10 (32.2%) |
| 2 | Internet | 8 (25.9%) |
| 3 | Portal | 5 (16.2%) |
| 4 | Extranet | 3 (9.7%) |
| 5 | E-commerce (B2C) | 3 (9.7%) |
| 6 | E-commerce (B2B) | 2 (6.4%) |
| 7 | WAP and other mobile technologies | 1 (3.2%) |

now marks the ubiquitous computing paradigm that weaves together a complex array of existing ICT into one rich medium (Dahlbom, 1996).

There is a need to identify crucial differences in existing IT implementation models that enable some organisations to success with their IT investment where others have failed. Developers must be aware of emerging trends in the organisational intranet market to create systems that will be able to incorporate the latest technological developments and new methods of information delivery and presentation. Organisations need to build connections between information and organise it in ways that most individuals can navigate through choices for themselves. As the use of Web-based technologies in the distribution of internal information in organisations in KwaZulu-Natal, South Africa becomes more widespread, it is envisaged that future EIS implementations will be further impacted by organisational intranets. Given this impact, justifying investment in such IS and IT should be carefully evaluated and quantified.

REFERENCES

- Abraham, D. M., & Seal K. C. (2001). CLASIC: Collaborative layered system using intranet capabilities. *Logistics Information Journal*, 14(1), 99-107.
- Agarwal, R., Higgins, C., & Tanniru, M. (1991). Technology diffusion in a centralized MIS environment. *Information & Management*, 20, 61-70.
- Allison, I. K. (1996). Executive information systems: An evaluation of current UK practice. *International Journal of Information Management*, 16(1), 27-38.
- Al-Gahtani, S. S. (2001, June 4-6). The applicability of the technology acceptance model outside North America: An empirical test in the Arab World. In *BITWorld 2001 Conference Proceedings*, American University in Cairo, Cairo, Egypt.
- Askelson, K. (1998). *Extranets; all part of the third wave*. Retrieved December 15, 2004, from <http://www.itfac.co.uk/chartech/issue73/page6.htm>
- Averweg, U., Erwin, G., & Petkov, D. (2004, October 4-6). A survey of the state of executive information systems in organisations in South Africa. In *Proceedings of the South African Institute of Computer Scientists and Information Technologists Conference (SAICSIT-2004)*, Stellenbosch, Western Cape, South Africa (pp. 216-220).
- Averweg, U., Petkov, D., Erwin, G., & Moolman, H. (2003, December). Impact of portal technologies on EIS implementations in organizations in KwaZulu-Natal. *South African Journal of Information Management*, 5(4). Retrieved November 24, 2006, from <http://www.sajim.co.za/default.asp?to=peer1vol5nr4>
- Averweg, U. R. F., & Erwin, G. J. (2000, November 1-3). Executive information systems in South Africa: A research synthesis for the future. In *Proceedings of the South African Institute of Computer Scientists and Information Technologists Conference (SAICSIT-2000)*, Cape Town, South Africa.
- Balasubramanian, V., & Bashian, A. (1998). Document management and Web technologies: Alice marries the mad Hatter. *Communications of the ACM*, 41(7), 107-115.
- Bannister, F., & Remenyi, D. (2000). *Value perception in IT investment decisions*. Retrieved December 15, 2004, from <http://is.twi.tudelft.nl/ejise/vol2/issue2/paper1.html>
- Basu, C., Poindexter, S., Drosen, J., & Addo, T. (2000). Diffusion of executive information systems in organizations and the shift to Web

- technologies. *Industrial Management & Data Systems*, 100(6), 271-276.
- Belcher, L. W., & Watson, H. J. (1993). Assessing the value of CONOCO's EIS. *MIS Quarterly*, 17(4), 239-253.
- Blair, E., & Burton, S. (1987). Cognitive processes used by survey respondents to answer behavioral frequency questions. *Journal of Consumer Research*, 14, 280-288.
- Butcher, C. (2002, May). SPAR: Striving for excellence. *Professional Management Review*, 18-20.
- Chabrow, E. (1998, October). Instruments of growth. *InformationWeek*, 5. Retrieved November 24, 2006 from <http://www.informationweek.com/703/03ssgro.htm;jsessionid=MLOUBEFC04BVAQSNLPSKHSCJUNN2JVN?queryText=Instruments>
- Ciborra, C. U., & Hanseth, O. (1998). From tool to gestell: Agendas for managing the information infrastructure. *Information, Technology & People*, 11(4), 305-327.
- Cooper, D. R., & Emory, C. W. (1995). *Business research methods*. Richard D. Irwin, Inc.
- Cortese, A. (1996, February 26). Here comes the intranet. *Business Week*, 3464, 76-84.
- Dahlbom, B. (1996). The new informatics. *Scandinavian Journal of Information Systems*, 8(2), 29-48.
- Damsgaard, J., & Scheepers, R. (1999). Power, influence, and intranet implementation: A safari of South African organizations. *Information, Technology & People*, 12(4), 333-358.
- Davenport, T. H., & Pruzak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston: Harvard Business School Press.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 3(3), 319-342.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- Earl, M. J. (1996). Putting information technology in its place: A polemic for the nineties. *Journal of Information Technology*, 7, 100-108.
- Eder, L. B. (2000). *Managing healthcare information systems with Web-enabled technologies*. Hershey, PA: Idea Group Publishing.
- Ezingard, J. N., Irani, Z., & Race, P. (1998). Assessing the value and cost implications of manufacturing information and data systems: An empirical study. *European Journal of Information Systems*, 7(4), 252-260.
- Giesecke, M. (2001). The end of the author. *Deutschland*, E6(3), 54-55, June/July.
- Gundry, J., & Metes, G. (1996). *Team knowledge management: A computer-mediated approach*. Retrieved December 15, 2004, from <http://www.knowab.co.uk/wbeteam>
- Hall, H. (2001). Input-friendliness: Motivating knowledge sharing across intranets. *Journal of Information Science*, 27(3), 139-146.
- Harris, L. (2000). Rand Water derives bottom-line benefits from EIS. *E-Business or Out of Business*, an Advertising Supplement compiled and published by Computing S.A., TML Business Publishing, Pinetown, South Africa, 28-29.
- Hawryszkiewicz, I. (1999). *Workspace networks for knowledge sharing*. Retrieved December 15, 2004, from <http://ausWeb.scu.edu.au/aw99/papers/hawryszkiewicz/paper/html>
- Hinton, C. M., & Kaye, G. R. (1994). The hidden investments in information technology: The role

- of organizational context and system dependency. *International Journal of Information Management*, 16(6), 413-427.
- Houdeshel, G. S., & Watson, H. J. (1987). The Management Information and Decision Support (MIDS) system at Lockheed-Georgia. *MIS Quarterly*, 11(1), 127-140.
- Igbaria, M., & Tan, M. (1997). The consequences of information technology acceptance on subsequent individual performance. *Information & Management*, 32(3), 113-121.
- Jones, B. (2002, July 22). Automating balanced scorecards mobilises resources. *Computing S.A.*, 22(27), 19.
- Kaniclides, T., & Kimble, T. (1995). A framework for the development and use of executive information systems. In Lourens (Ed.), *Proceedings of GRONICS '95*, Groningen, The Netherlands (pp. 47-52).
- Kaniclides, T., & Kimble, T. (1997). *Assessing the relative importance of factors affecting executive information systems success* (Rep. No. YCS283). Department of Computer Science, University of York, UK.
- Kennedy, D. H. (1995). Everybody's information systems? *Management Accounting London*, 73(5), 4.
- Kirlidog, M. (1997). Information technology transfer to a developing country: Executive information systems in Turkey. *OCLC Systems & Services*, 13(3), 102-123.
- KPMG Consulting. (2002, May). Reality bites. *The second annual report on e-business in the UK*.
- Laudon, K. C., & Laudon, J. P. (2000). *Management information systems* (6th ed.). Upper Saddle River, NJ: Prentice-Hall.
- Liang, T. P., & Hung, S. Y. (1997). DSS and EIS applications in Taiwan. *Information Technology & People*, 10(4), 303-315.
- Lu, H. P., & Gustafson, D. H. (1994). An empirical study of perceived usefulness and perceived ease of use on computerized support system use over time. *International Journal of Information Management*, 14(5), 317-329.
- Lyytinen, K., Rose, G., & Welke, R. (1998). The brave new world of development in the Internet computing architecture (InterNCA): Or how distributed computing platforms will change systems development. *Information Systems Journal*, 8, 241-253.
- Makhanya, P. (2004, December). eThekwini voted best metro in SA. *The Mercury*, p. 10.
- Martin, E. W., Brown, C. V., DeHayes, D. W., Hoffer, J. A., & Perkins, W. C. (1999). *Managing information technology: What managers need to know*. Upper Saddle River, NJ: Prentice-Hall.
- Meneely, J., & Pervan, G. P. (1994). Factors that contribute to the successful use of executive information systems. In Shanks and Arnott (eds), *In Proceedings of the 5th Australasian Conference on Information Systems* (Vol. 1, pp. 170-189), Monash University, Melbourne, Australia.
- Messina, F. M., & Sanjay, S. (1995). Executive information systems: Not just for executives anymore! *Management Accounting*, 77(1), 60-63.
- Millet, I., Mawhinney, C. H., & Kallman, E. A. (1991). Alternative paths to EIS. *DSS-91, International Conference on Decision Support Systems*, Manhattan Beach, CA (pp. 50-61).
- Mthembu, B. (2004, December 10). eThekwini voted top dog for service. *Daily News*, p. 3.
- O'Brien, J. A. (2000). *Introduction to information systems: Essentials for the Internetworked enterprise* (9th ed.). Boston: Irwin McGraw-Hill.
- O'Reilly, C. A. (1982). Variations in decision makers' use of information sources: The impact of quality and accessibility of information. *Academy of Management Journal*, 25(4), 756-771, December.

- Oguz, M. T. (2003, May 31). Strategic intelligence: Business intelligence in competitive strategy. *DM Review*. Retrieved October 5, 2004, from <http://dmreview.com>
- Paller, A., & Laska, R. (1990). *The EIS book*. Homewood, IL: Dow Jones-Irwin.
- Palvia, P., Kumar, A., Kumar, N., & Hendon, R. (1996). Information requirements of a global EIS: An exploratory macro assessment. *Decision Support Systems*, 16(2), 169-179.
- Park, H. K., Min, J. K., Lim, J. S., & Chun, K. J. (1997). A comparative study of executive information systems between Korea and the United States. Seoul, Korea: Dept. of Telecommunications Systems Management, Sangmyung University. In J. J. Cano (Ed.), *Critical reflections on information systems: A systemic approach*. Hershey, PA: Idea Group Publishing.
- Perlman, A. H. (1986). Building a successful executive information system. *Infosystems*, p. 66.
- Pervan, G., & Phua, R. (1997). A survey of the state of executive information systems in large Australian organisations. *The Australian Computer Journal*, 29(2), 64-73.
- Pijpers, G. G. M. (2001). Understanding senior executives' use of information technology and the Internet. In Anandarajan & Simmers (Eds.), *Managing Web usage in the workplace: A social, ethical, and legal perspective* (pp. 1-19), Hershey, PA: Idea Group Publishing.
- Poon, P., & Wagner, C. (2001). Critical success factors revisited: Success and failure cases of information systems for senior executives. *Decision Support Systems*, 30(4), 393-418.
- Preedy, D. (1990). The theory and practical use of executive information systems. *International Journal of Information Management*, 10, 96-104.
- PricewaterhouseCoopers. (2002). *Technology forecast: 2002-2004. Volume 1: Navigating the Future of Software* (Document No. TC-01-12). Menlo Park, CA: PricewaterhouseCoopers Technology Centre.
- Rai, A., & Bajwa, D. (1997). An empirical investigation into factors relating to the adoption of EIS: An analysis for collaboration and decision support. *Decision Sciences*, 18(1), 939-974.
- Remenyi, D., & Lubbe, S. (1998). Some information systems issues in South Africa and suggestions as to how to deal with them. In S. Lubbe (Ed.), *IT investment in developing countries: An assessment and practical guideline*. Hershey, PA: Idea Group Publishing.
- Remenyi, D., Money, A., & Twite, A. (1995). *Effective measurement and management of IT costs and benefits*. London: Butterworths.
- Robinson, T. (1996, November 18). Intranet 100: The revolution is here. *InformationWeek*, 106-108. Retrieved November 24, 2006 from <http://www.informationweek.com/606/06rev.htm;jsessionid=MLOUBEF04BVAQSNLPSKHSCJUNN2JVN?queryText=Intranet>
- Rockart, J. F., & DeLong, D. W. (1988). *Executive support systems the emergence of top management computer use*. Homewood, IL: Dow Jones-Irwin.
- Roldán J. L. (2000). *Sistemas de información ejecutivos (EIS): Génesis, implantación y repercusiones organizativas*. Unpublished thesis, Universidad de Sevilla, Spain.
- Roldán, J. L., & Leal, A. (2003). Executive information systems in Spain: A study of current practices and comparative analysis. In Forgionne, Gupta, & Mora (Eds.), *Decision making support systems: Achievements and challenges for the new decade* (pp. 287-304), Hershey, PA: Idea Group Publishing.
- SA2002-2003. (2002). *South Africa at a glance*. Craighall, South Africa: Editors Inc.

- Salmeron, J. L. (2001). EIS evolution in large Spanish businesses. *Information & Management*, 1968, 1-10.
- Salmeron, J. L., Luna, P., & Martinez, F. J. (2001). Executive information systems in major companies: Spanish case study. *Computer Standards & Interfaces*, 23, 195-207.
- Scheepers, R. (1999, August 21-22). Key role players in the initiation and implementation of intranet technology. In *Proceedings of IFIP TC8 WG 8.2, New Information Technologies in Organizational Processes: Field Studies and Theoretical Reflections on the Future Work*, St Louis, MO.
- Scheepers, R., & Rose, J. (2001). Organizational intranets: cultivating information technology for the people by the people. In Dasgupta (Ed.), *Managing Internet and intranet technologies in organizations: Challenges and opportunities* (pp. 1-20), Hershey, PA: Idea Group Publishing.
- Sprague, R. H., Jr., & Watson, H. J. (1996). *Decision support for management*. Upper Saddle River, NJ: Prentice-Hall.
- Sprout, A. (1995, November 27). The Internet inside your company. *Fortune*, 161-168. Retrieved November 24, 2006 from http://money.cnn.com/magazines/fortune/fortune_archive/1995/11/27/208032/index.htm
- Srivihok, A. (1998). *Effective management of executive information systems implementations: A framework and a model of successful EIS implementation*. PhD dissertation. Central University, Rockhampton, Australia.
- Statistics South Africa. (2001). *Census 2001 digital census atlas*. Retrieved December 15, 2004, from <http://gis-data.durban.gov.za/census/index.html>
- Straub, D. W. (1989). Validating instruments in MIS research. *MIS Quarterly*, 13(2), 147-166.
- Strom, D. (1996). *Finding the right intranet technologies to buy*. Retrieved December 15, 2004, from <http://www.strom.com/pubwork/intranet.html>
- Suradi, Z. (2001, June 4-6). Testing technology acceptance model (TAM) in Malaysian environment. In *BITWorld 2001 Conference Proceedings*, American University in Cairo, Cairo, Egypt.
- Tang, H., Lee, S., & Yen, D. (1997). An investigation on developing Web-based EIS. *Journal of CIS*, 38(2), 49-54.
- Thodenius, B. (1995, April 20-22). The use of executive information systems in Sweden. In *CEMS Academic Conference—Recent Developments in Economics and Business Administration*, Wirtschaftsuniversität, Wien, Austria.
- Turban, E. (2001, October 7). California State University, Long Beach, and City University of Hong Kong, USA. *Personal communication*.
- Turban, E., & Aronson, J. (1998). *Decision support systems and intelligent systems*. Upper Saddle River, NJ: Prentice-Hall.
- Turban, E., McLean, E., & Wetherbe, J. (1999). *Information technology for management*. New York: John Wiley & Sons.
- Turban, E., McLean E., & Wetherbe, J. (2004). *Information technology for management. transforming organizations in the digital* (4th ed.), Hoboken, NJ: John Wiley & Sons, Inc.
- Turban, E., Rainer, R. K. Jr., & Potter, R. E. (2005). *Introduction to information technology*. Hoboken, NJ: John Wiley & Sons, Inc.
- Van der Merwe, A. (2001, September). Managing intranets to improve knowledge sharing. *South African Journal of Information Management*, 3(2). Retrieved November 24, from <http://www.sajim.co.za/default.asp?to=student4vol3nr2>
- Venkatesh, V., & Morris, M. G. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS Quarterly*, 24(1), 115-139.

- Volonino, L., Watson, H. J., & Robinson, S. (1995). Using EIS to respond to dynamic business conditions. *Decision Support Systems*, 14(2), 105-116.
- Ward, J. (1996). *Information systems: delivery business value?* Paper presented at the Business Information Technology Conference, Manchester, UK.
- Watson, H. J., & Frolick, M. N. (1993). Determining information requirements for an executive information system. *MIS Quarterly*, 17(3), 255-269.
- Watson, H. J., & Glover, O. H. (1989, December 4). Common and avoidable causes of EIS failure. *Computerworld*, 90-91.
- Watson, H. J., Houdeshel, G., & Rainer, R. K. Jr. (1997). *Building executive information systems and other decision support applications*. New York: John Wiley & Sons.
- Watson, H. J., O'Hara, M. T., Harp, C. G., & Kelly, G. G. (1996). Including soft information in EISs. *Information Systems Management*, 13(3), 66-77.
- Watson, H. J., Rainer, R. K., & Koh, C. E. (1991). Executive information systems: A framework for development and a survey of current practices. *MIS Quarterly*, 15(1), 13-30.
- Watson, H. J., Rainer, R. K., & Frolick, M. N. (1992). Executive information systems: An ongoing study of current practices. *International Information Systems*, 1(2), 37-56.
- Wessels, P. (2003, June). Justifying the investment in information systems. *South African Journal of Information Management*, 5(2). Retrieved November 24, 2006 from <http://www.sajim.co.za/default.asp?to=peer4vol5nr2>
- Wetherbe, J. C. (1991). Executive information requirements: Getting it right. *MIS Quarterly*, 15, 50-65.
- Willcocks, L. (1996). *Investing in information systems*. Oxford, UK: Chapman and Hall.
- Young, D., & Watson, H. J. (1995). Determinates of EIS acceptance. *Information & Management*, 29(3), 153-164.

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 44-78, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.38

Training Sequences and their Effects on Task Performance and User Outcomes

Clive Sanford

Aalborg University, Denmark

Anol Bhattacharjee

University of South Florida, USA

ABSTRACT

This chapter introduces the concept of information technology (IT) training sequences and examines how sequencing of conceptual and procedural training impact IT task performance, user satisfaction and users' self-efficacy. Using assimilation theory, we develop four hypotheses related to training sequences. These hypotheses were then tested in a database design context using a quasi-experimental study involving student subjects. Empirical results demonstrate improved far-transfer and near-transfer task performance and higher self-efficacy for subjects trained in the conceptual-procedural sequence

vs. the reverse sequence, though user satisfaction was not significantly different between the two sequences. Implications for IT training research are discussed.

INTRODUCTION

As IT has been widely adopted by firms as a potent means of improving task performance and user productivity in today's IT-dominated workplace, such adoption has also imposed substantial pressure on firms to continuously train internal users in the knowledge and skills needed to use these systems effectively. Despite innovations

in the training domain, such as computer-based, CD-based and online training, the core issue still remains how training programs should be structured to improve IT users' knowledge retention and task performance given predefined technologies, tasks and potential users (Davis & Bostrom, 1993).

Several approaches to IT training have been proposed in the literature, such as instruction-based vs. exploration-based training (Davis & Bostrom, 1993), applications-based vs. construct-based training (Olfman & Bostrom, 1991), and conceptual vs. procedural training (e.g., Olfman & Mandviwalla, 1994; Santhanam & Sein, 1994). Of these, the last taxonomy seems to have gained the broadest acceptance. *Conceptual training* is a "top-down" approach where IT users are trained in the nature and associations of semantic objects required for comprehending and solving a problem, while *procedural training* is a "bottom-up" approach focusing on action-plan sequences that users should learn to complete specific tasks. Because of the direct and immediate applicability of procedural knowledge in specific task situations, procedural training has emerged as the approach of choice for many corporate IT training programs (Atlas, Cornett, Lane, & Napier, 1997).

Prior research on conceptual and procedural training has compared the relative effects of these approaches on IT task performance, reporting mixed results (e.g., Olfman & Mandviwalla, 1994; Santhanam & Sein, 1994). However, researchers tend to agree on the importance of both forms of training. Santhanam and Sein (1994) note that procedural training is more useful when the target system is easy to operate; however, these users tend to perform poorly on novel tasks. They also note, "conceptual training is likely to provide a better opportunity for a user to form a coherent mental model compared to procedural training" (p. 382). Elaborating the gaps in extant IT training research, Olfman and Mandviwalla (1994, p. 407) state, "some *combination* of concepts and procedures is needed ... It is the relative quantity

and *sequencing* of the two kinds of content that has not been fully established" (emphasis added).

Defining *training sequence* as the ordering of conceptual and procedural training, the objective of this study is to examine whether the conceptual-procedural sequence improves IT task performance and user outcomes, such as satisfaction and self-efficacy, compared to the reverse sequence. Though the importance of training sequences was noted by Olfman and Mandviwalla (1994), to date, empirical analysis of such sequences has remained unexplored in the IT training literature. The idea of training sequences, however, has some support in learning theory (Glaser, 1990) and instructional design theory (Reiguluth & Stein, 1983), where leading proponents have long advocated that user training be conducted in a holistic manner to include both conceptual and procedural components. The rationale is that this strategy integrates two complementary forms of knowledge (concepts and procedures) that are both required for the performance of many complex organizational tasks.

To examine the above research objective, we draw on Ausubel's (1978) assimilation theory in the educational psychology literature to develop four research hypotheses relating training sequences to near- and far-transfer IT task performance (defined later), user satisfaction and user self-efficacy. These hypotheses are then tested empirically via a quasi-experimental laboratory study in a database design context. Results of the analysis confirm that the conceptual-procedural training sequence improves task performance and self-efficacy more than the reverse sequence, though user satisfaction is not significantly different between the two sequences.

The rest of this chapter proceeds as follows: The next section formulates research hypotheses by drawing on assimilation theory and prior IT training research. The third section describes experimental research design, subjects, treatments and measurement. The fourth section describes statistical data analysis techniques and results.

The fifth section discusses the study's key findings, limitations and implications for research and practice.

THEORY AND RESEARCH HYPOTHESIS

Assimilation Theory

The individual learning process is presumed to proceed in three stages (Mayer, 1981). In the reception stage, learners acquire new information from the external environment and store it in their short-term memory. The short-term memory is a temporary and limited-capacity storage space where information is stored as distinct entities (instead of integrated knowledge structures). Next, in the availability stage, learners search their long-term memory for knowledge structures (or "schemas") potentially related to the new information. The long-term memory is a permanent and virtually unlimited storage space for classifying, organizing and archiving information using preexisting or new schemas. Finally, in the activation stage, the new information is transferred from the short-term memory to appropriate knowledge structures or "anchors" in the long-term memory, where it is mapped and integrated with prior schemas and preserved for future use.

Assimilation theory defines two types of human learning: meaningful learning and rote learning (Ausubel, 1978). *Meaningful learning* (or assimilation) occurs when learners relate, connect and integrate new information with that already stored in existing knowledge structures or schemas in their long-term memory. In contrast, *rote learning* (or memorization) occurs when learners store new information in their short-term memory in a disjointed manner, without integrating that information within schemas in their long-term memory. While rote learning requires the completion of only the reception stage in Mayer's (1981) three-stage learning process,

meaningful learning occurs only when all three stages are completed.

Rote learned information, such as procedural rules, is often useful in performing tasks that are simple, routine or structurally similar to that of the learning context (termed *near-transfer tasks*), but provides little assistance in performing novel, creative or structurally dissimilar tasks (*far-transfer tasks*). Further, this information is difficult to retain over the long term because of its lack of organizing structure. Being stored in the short-term memory, it is also susceptible to interference from new information. However, meaningfully learned information residing in the long-term memory is often useful in performing novel, dissimilar or far-transfer tasks, is temporally stable and is retained for a longer period of time (Davis & Bostrom, 1993). Moreover, meaningful learning takes advantage of the knowledge already possessed by the learner, which is purportedly the single most important driver of individual learning (Ausubel, 1978).

Many organizational IT tasks, such as transaction processing and electronic mail (e-mail) usage, are of the near-transfer type, requiring users to learn procedural know-hows, such as event sequences and screen layouts. However, other tasks, such as decision-making and executive planning, are of far-transfer type, requiring conceptual know-whats, such as what-if analysis and ad hoc data mining. Complex knowledge work, such as system development, often involve both components, in that the designers should not only learn near-transfer details such as program coding, application program interfaces and integrated development environment (IDE) features that are easily transferable across projects, but also less transferable far-transfer knowledge, such as requirements planning, systems analysis and integration test planning. Hence, successful comprehension and performance of such tasks are best supported by a combination of conceptual and procedural approaches, which we call a "training sequence."

Prior research have compared conceptual vs. procedural training for Windows accessories (Write and Paintbrush) (Olfman & Mandviwalla, 1994) and the VAX e-mail system (Santhanam & Sein, 1994), and found no significant difference in effects between the two approaches. Though these studies contrasted training *approaches*, no studies to date have empirically studied training *sequences*. Further, prior research has mostly focused on relatively simple IT tasks, such as e-mail or spreadsheet usage, where training sequence may have marginal impact. As described next, training sequences are likely have a greater impact on more complex tasks of the type examined in this study (database design).

IT Training Sequences

In complex IT tasks requiring both conceptual and procedural knowledge, do users perform better if they are trained conceptually first, then procedurally, vs. the reverse sequence? Assimilation theory suggests that training sequences are not commutative and that the two sequences have differential effects on users' ability to retain and apply knowledge (Ausubel, 1978). In the conceptual-procedural sequence, the knowledge structures or schemas developed during initial conceptual training provide a meaningful context or "ideational scaffolding" (Ausubel, 1978) for interpreting and assimilating action-plan details acquired later, aiding near-transfer task performance. In contrast, in a procedural-conceptual sequence, lack of mental schemas during initial procedural training may hinder appropriate "anchoring" of concepts during subsequent conceptual training, hurting far-transfer task performance. Anderson (1995) noted that some users may be able to infer conceptual knowledge from procedural details learned earlier. However, we argue that such inference is more likely for simple (primarily procedural) IT tasks/technologies, such as e-mail or word processor usage, but less so for

more complex tasks, such as database design or system development, requiring substantial levels of both conceptual and procedural knowledge. Training sequences, therefore, are expected to be more relevant in the performance of complex IT tasks (i.e., IT-based knowledge work).

In the conceptual-procedural sequence, the need for assimilative schemas or "advance organizers" (e.g., high-level ideas, diagrams, abstracts) was highlighted by Ausubel (1978), who found that learners' recall of ambiguous textual content improved significantly when an organizing title was provided prior to the actual textual material, while the organizing title had no effect on subjects' learning or retention if presented after the learner had read the text. Likewise, Reigeluth and Stein (1983) recommended designing instructional content as "elaborative sequences," where the general concepts are presented first, followed progressively by differentiated levels of procedural details and specificity. Hence, we hypothesize:

- H1: IT users trained in a conceptual-procedural sequence perform *near-transfer* IT tasks better than those trained in a procedural-conceptual sequence.
- H2: IT users trained in a conceptual-procedural sequence perform *far-transfer* IT tasks better than those trained in a procedural-conceptual sequence.

Though task performance is the primary dependent variable of interest to corporate IT trainers and managers, we also examine two user-related outcomes – user satisfaction and self-efficacy—that are increasingly being viewed as key motivators of user learning/training circumstances. *Satisfaction* refers to users' affective evaluation of their own task performance, and *self-efficacy* is the cognitive belief in their ability to perform similar tasks in the future. Bandura's (1986) social cognitive theory provides theoretical support for

the self-efficacy construct, which is theorized to be directly related to satisfaction and future task performance. Empirically, Yi and Davis (2003) demonstrate that post-training software self-efficacy is related to intermediate-term and long-term task performance; Compeau and Higgins (1995) justify the linkage between IT training and self-efficacy; and Compeau, Higgins and Huff (1999) validate the association between self-efficacy and affect (e.g., satisfaction). Following a meta-analysis of the training literature, Colquitt, LePine and Noe (2000) show that pre-training self-efficacy positively impacts motivation to learn, which in turn affects post-training self-efficacy and task performance.

Most users tend to favor procedural training because of its technology-focused and hands-on nature and its ability to quickly initiate a user to a specific task at hand. Carroll and Rosson (1987) contend that users prefer learning quick procedures that can help them get started with system usage and thereby minimize the “IT productivity paradox,” rather than “waste” their time understanding concepts. Since procedural-conceptual sequence initiates users to procedural training faster, users are more likely to be satisfied with this sequence than with the reverse sequence. In contrast, self-efficacy should be higher for the conceptual-procedural sequence, because as these users perform near-transfer and far-transfer tasks better (per assimilation theory); they gain confidence in their ability to perform similar tasks in the future. Hence, we hypothesize:

- H3: IT users trained in a conceptual-procedural sequence experience *lower* satisfaction with IT task performance than those trained in a procedural-conceptual sequence.
- H4: IT users trained in a conceptual-procedural sequence experience *higher* self-efficacy regarding their IT task performance than those trained in a procedural-conceptual sequence.

Control Variables

Extraneous variables that can potentially confound the above hypotheses can be grouped into four categories: (1) technology attributes, (2) training context (e.g., trainer, setting), (3) task attributes, and (4) trainee attributes (individual differences). The first three categories can be partially controlled via appropriate research designs; for example, by employing a single IT (technology attributes); a common training approach, duration and trainer for all sessions (training context); and common IT tasks (task attributes). We control for individual differences by adding prior IT experience and attitude toward IT as control variables in our study, for reasons described below.

Users’ prior IT experience may be an alternative source of assimilative schemas (as opposed to conceptual training) driving the meaningful learning process (Santhanam & Sein, 1994). Ex ante availability of such schemas in long-term memory (from prior experience) can help more experienced IT users anchor and assimilate new procedural information without additional conceptual training. Programmers already familiar with one programming language often find it easier to learn a second similar language, because they can assimilate the procedural details (e.g., syntax) of the second language within schemas (e.g., branching, iteration, arrays) acquired from the first. In contrast, lack of such schemas may force relatively novice or inexperienced users to rely on rote learning for retaining procedural details for near-transfer task performance. Prior IT experience, therefore, can confound the impact of training sequence on near-transfer task performance and is included in this study as a control variable.

IT users’ task performance may also be confounded by their attitude (affect) toward IT tasks (Bostrom, Olfman, & Sein, 1990; Olfman & Pitsatorn, 2000). Users with positive attitudes (e.g., enthusiastic users) often put in more effort

in task performance, irrespective of their prior conceptual and/or procedural training, resulting in improved task performance. In contrast, users with negative attitudes (e.g., less motivated users) may be reticent to put forth their best effort despite extensive prior training, leading to poor performance. In order to tease out the effect of IT training sequences on task performance, we include attitude as a second control variable.

RESEARCH METHODOLOGY

Experimental Design, Subjects and Treatments

A quasi-experimental laboratory study (see Figure 1) using student subjects was conducted in a database design context to empirically test our four research hypotheses. Entire class sections were randomly assigned to one of the two treatment groups (conceptual-procedural or procedural-conceptual training sequence); hence the quasi-experimental design. A mixed-model research design was employed, where (1) different subjects experience different treatments, and (2) all subjects experience each treatment (Myers, 1977). An explicit control group (with no treatment) was not required, since each group acted as a control for the other group. All treatments were administered by the same instructor, using a combination of lectures, discussions, in-class exercises and graded assignments.

Subjects for this study were drawn from undergraduate and graduate students (approximately 50% in each category) enrolled in four sections of a database management class at a large public university. The subject pool had a mean age of 26 years, full-time work experience of 3.7 years, computer-related work experience of 2.8 years, and database usage (but not design) experience of 0.9 years. Forty-one percent of these subjects were previously or currently employed in the IT industry, being somewhat representative of the

target population of IT professionals. Though student and non-student subjects may differ in their intrinsic motivation toward learning database design, we attempted to control for this difference by including subjects' attitude as a covariate in our research design. Further, our use of student subjects was consistent with much prior IT training research (e.g., Ahrens & Sankar, 1993; Davis & Bostrom, 1993; Santhanam & Sein, 1994).

The database design task was selected because this is a typical example of a complex IT task that included elements of both conceptual and procedural knowledge, which rendered it well to the research objectives of this study. Though this particular task has seen very limited use in prior IT training research (one exception being Ahrens and Sankar, 1993), it is a fairly common task domain for real-life IT professionals and hence, was deemed appropriate.

Prior to the experimental treatments, subjects were administered a short pre-treatment questionnaire soliciting demographic information, prior work experience (general and IT related) and attitude toward learning database design. For the next 3 weeks, about half of the subject pool (Group A in Figure 1) received conceptual training on database design, while the other half (Group B) received procedural training. The conceptual training focused on abstracting a conceptual data model from a textual narrative of users' data needs, documented in the form of an entity-relationship diagram (ERD). This training included: (1) identifying data objects (entities), (2) specifying relationships between entities, (3) identifying attributes for each entity, and (4) establishing relationship cardinalities (e.g., one-to-many, subtype-supertype, mandatory-optional). Procedural training focused on converting an existing ERD into a logical data model (LDM) (a set of third normal form relations or tables for relational implementation) using procedural rules. Specific activities included: (1) mapping entities into relations, (2) specifying primary keys, (3) normalizing relations into third normal form, and

Figure 1. Research design

| | Week 0 | Weeks 1-3 | Weeks 4-6 | Week 7 | |
|---------|------------------|-----------------|-----------------|--------------------|-------------------|
| Group A | O _{PRE} | X _{CT} | X _{PT} | O _{FT+NT} | O _{POST} |
| Group B | O _{PRE} | X _{PT} | X _{CT} | O _{FT+NT} | O _{POST} |

Legend: O_i = Observations (questionnaires: PRE, POST;
tasks: near transfer [NT], far transfer [FT])
X_i = Training (conceptual [CT], procedural [PT])

(4) specifying relationships using foreign keys or associative relations.¹ For weeks 4-6, the training approach (and content) was reversed for the two groups, so that Group A subjects received procedural training and Group B received conceptual training. Each 3-week training period ended with an in-class database design exercise intended to help subjects internalize their recent learning experience, which was graded and returned to the subjects. On the 7th week, subjects were asked to complete an in-class database design task that involved both far- and near-transfer components (i.e., design an ERD and LDM from a given user narrative), following which, they recorded their post-training satisfaction and self-efficacy in a post-treatment questionnaire.

Construct Measurement

Training sequence (independent variable) was manipulated via treatment assignment. Prior IT experience and attitude (control variables) were measured via the pre-treatment questionnaire. Among dependent variables, IT task performance was assessed by three independent judges, and IT user satisfaction and self-efficacy were assessed perceptually using the post-treatment questionnaire. A combination of fill-in, Likert-scale, semantic differential and externally evaluated measures were employed to reduce common methods bias. Scale items were adapted from pre-validated measures, appropriately modified

for the database design context, and are listed in Appendix A.

Prior IT experience was assessed using three fill-in questions that asked subjects the number of years they had worked with (1) computers, (2) databases, and (3) programming (item means were 2.8, 0.9 and 1.2 years, respectively). Databases and programming are two typical functional domains of IT tasks, and thus were considered appropriate for this scale. The overall experience measure was computed as the average of these three items.

Attitude was measured using three seven-point semantic differential items anchored between adjective pairs: (1) extremely bad ... extremely good, (2) extremely desirable ... extremely undesirable, and 3) strongly dislike ... strongly like. These items were adapted from Mathieson (1991) and reworded to relate specifically to the database design context.

Near-transfer and far-transfer task performances were evaluated by a panel of three independent judges. The panel consisted of one teaching faculty, one research faculty and one graduate assistant experienced in database design. A diverse panel was purposely chosen to reduce potential judgment biases among judges. However, to ensure consistency in judges' performance assessment, assessment rules were discussed and agreed upon prior to actual grading.² Each judge assigned a score of 1 (completely incorrect), 2 (mostly incorrect), 3 (about half-correct), 4 (mostly correct) and 5 (completely correct) for each task,

which were later averaged across judges for an overall score for that task. External assessment helped avoid subjectivity often inherent in self-reported performance measures.

Satisfaction, referring to subjects' overall emotional state following IT task experience, was assessed using three seven-point semantic differential items from Bhattacharjee (2001). These items were anchored between adjective pairs: (1) extremely dissatisfied ... extremely satisfied, (2) extremely frustrated ... extremely contented, and (3) extremely terrible ... extremely delighted. A fourth item in the original scale (extremely displeased ... extremely pleased) was dropped because of its semantic proximity with the first item.

Self-efficacy was measured using five seven-point Likert-scaled items (anchored between "strongly disagree" and "strongly agree") taken from Compeau et al.'s (1999) computer self-efficacy scale. These items examined subjects' confidence in their ability to design databases (1) without help from anyone, (2) using only database manuals for reference, (3) using only an online help facility for assistance, (4) if adequate time is available to complete the tasks, and (5) if someone can be reached for assistance. Compeau's scale had five additional items that were not applicable to our study, given that we were measuring post-usage self-efficacy (while Compeau et al. measured pre-usage self-efficacy), and thus were dropped from our scale.³

DATA ANALYSIS AND RESULTS

Pilot Study

Since IT experimental studies are often plagued with inadequate treatments, unreasonable tasks (for target subjects) and unclear instrumentation (Jarvenpaa, Dickson & DeSanctis, 1985), a pilot study was conducted prior to the actual empirical study to examine these issues. This study in-

involved 19 undergraduate subjects, 10 of whom were trained using the conceptual-procedural sequence, while the remaining nine were trained in the reverse sequence. Subjects completed the near-transfer and far-transfer tasks and the pre- and post-questionnaires as shown in Figure 1. In addition, they were asked to comment on the reasonableness of tasks, the adequacy of the preceding training, and the clarity and understandability of scale items.

Subjects confirmed that the assigned far-transfer and near-transfer tasks were indeed reasonable (most scores ranged between 3.5 and 4.5 on a 5-point task performance scale) and that a 3-week training duration for each task type was adequate for acquiring the necessary database design skills for performing these tasks. However, based on their inputs, some of the scale items and task descriptions were slightly reworded to improve understandability. Since IT task performance was a key dependent variable in this study, we also examined correspondence between judges' ratings of this variable using Pearson's correlation coefficients. This statistic ranged between 0.61 and 0.72 for pairs of judges, with a mean correlation of 0.67. All correlations were significant at $p < 0.01$, indicating a high level of agreement between judges.

Finally, effect size estimates (means and standard deviations) obtained from the pilot study was used to estimate optimal sample sizes required to detect the hypothesized effects in the main study. Power calculations based on a two-sample, normal, equal variance distribution, desired statistical power of 0.80 and significance level of 0.05 yielded a minimum sample size of 52 to detect the hypothesized far- and near-transfer task performance effects. To be on the safe side, we decided to target a desired sample size of 100.

Instrument Validation

The final empirical study consisted of a total of 121 subjects. This subject pool consisted of 59

Training Sequences and their Effects on Task Performance and User Outcomes

graduate and 62 undergraduate students. Sixty subjects were trained using the conceptual-procedural sequence and 61 subjects were trained in the reverse sequence. Comparison of means tests revealed that the two treatment groups were not significantly different with respect to age (means 25.35 and 25.94 years, $t=0.88$, $df=138$), prior work experience (means 3.41 and 3.82 years, $t=0.77$), prior computer-related work experience (means 2.61 and 2.71 years, $t=0.21$) and prior database usage experience (means 0.70 and 0.99 years,

$t=1.09$), assuring equivalency between groups. Approximately equal-sized treatment groups also improved the statistical power of our analysis (described later).

The first step in our statistical data analysis was to examine the psychometric properties (validity and reliability) of scale items. For this purpose, the three perceptual scales in this study—IT user attitude, satisfaction and self-efficacy—were factor analyzed using the principal components technique with direct oblimin rotation (oblique

Table 1. Scale reliabilities and validities

| Scale Item | Mean | Std. Dev. | Factor Loadings (Direct Oblimin Rotation) | | |
|---------------------------------|------|-----------|---|---------------------|-------------------------|
| | | | Factor 1 (Self-Efficacy) | Factor 2 (Attitude) | Factor 3 (Satisfaction) |
| ATT1 | 5.78 | 1.30 | 0.07 | 0.90 | -0.08 |
| ATT2 | 5.89 | 1.16 | 0.12 | 0.89 | 0.08 |
| ATT3 | 5.93 | 1.11 | 0.02 | 0.90 | -0.01 |
| SAT1 | 5.22 | 1.45 | 0.23 | -0.01 | 0.84 |
| SAT2 | 5.31 | 1.58 | 0.19 | -0.04 | 0.94 |
| SAT3 | 5.11 | 1.58 | 0.21 | 0.06 | 0.92 |
| SE1 | 4.94 | 1.67 | 0.94 | 0.10 | 0.14 |
| SE2 | 4.90 | 1.69 | 0.93 | 0.07 | 0.15 |
| SE3 | 5.14 | 1.60 | 0.87 | 0.10 | 0.02 |
| SE4 | 4.98 | 1.71 | 0.86 | -0.03 | 0.27 |
| SE5 | 5.02 | 1.47 | 0.33 | 0.10 | 0.58 |
| Eigenvalue | | | 4.51 | 2.43 | 1.97 |
| Variance extracted | | | 40.95% | 22.10% | 17.86% |
| Cronbach alpha (reduced scales) | | | 0.92 | 0.88 | 0.91 |

Table 2. Group means and standard deviations

| | Means (Standard Deviations) | | |
|--------------------------------|------------------------------|------------------------------|-----------------|
| | Conceptual-Procedural (N=60) | Procedural-Conceptual (N=61) | Overall (N=121) |
| Near-transfer task performance | 4.57 (0.46) | 4.09 (0.54) | 4.33 (0.55) |
| Far-transfer task performance | 4.31 (0.37) | 3.79 (0.45) | 4.04 (0.49) |
| Satisfaction | 5.13 (1.41) | 5.29 (1.42) | 5.21 (1.41) |
| Self-efficacy | 5.30 (1.40) | 4.68 (1.56) | 4.99 (1.51) |

Note: Far- and near-transfer task performance was assessed on 5-point scales (by external judges); satisfaction and self-efficacy was assessed on 7-point Likert scales (by subjects).

rotation was chosen because the scales were expected to be correlated). Prior IT work experience was excluded from this analysis since it consisted of three self-reported fill-in items. Three factors were identified based on a visual examination of the scree plot and a minimum eigenvalue criterion of 1.0, which respectively extracted 41%, 22%, and 18% of the total variance (cumulative variance of 81%). Item factor loadings, along with item means and standard deviations, are listed in Table 1.

For convergent validity, hypothesized scale items should have factor loadings exceeding 0.60 on their underlying scales (SAS Institute, 1990). This condition was met by all items in the attitude and satisfaction scales, and four out of five self-efficacy items, except SE5 (“... if I can call someone for help”). For discriminant validity, cross-factor loadings (on other scales) should be less than 0.30 (SAS Institute, 1990). This condition was also met by all items except SE5. In light of the above problems, item SE5 was dropped from the self-efficacy scale. Cronbach alpha for the remaining scales were 0.88 for attitude, 0.91 for satisfaction and 0.92 for self-efficacy—all exceeding the minimum of 0.80 required for confirmatory research.

Inter-rater reliability for IT task performance (rated by three judges) was assessed by pooling

together the near-transfer and far-transfer task performance scores and examining Pearson correlations between pairs of judge ratings. All correlations were significant at $p < 0.01$ (two-tailed), and the mean correlation was 0.713. High agreement between judges was proof of the quality of this measure.

Hypotheses Testing

Means and standard deviations of aggregated dependent variables for the overall sample and for each treatment group are listed in Table 2. Group A (conceptual-procedural sequence) experienced higher far- and near-transfer task performance means on Week 7 (4.31 and 4.57, respectively, on 5-point scales) than Group B (procedural-conceptual sequence) (3.79 and 4.09, respectively), as expected from Hypotheses H1 and H2. Satisfaction was lower and self-efficacy was higher for Group A (5.13 and 5.30, respectively, on 7-point scales) compared to that of Group B (5.29 and 4.68, respectively), in accordance with Hypotheses H3 and H4. Hence, the directionality of empirically observed effects is consistent with theory.

The multiple analysis of covariance (MANCOVA) technique, followed by univariate analysis of covariance (ANCOVA) for each dependent

Table 3. MANCOVA results

| | Hotelling's Trace | Wilks' Lambda | F-statistic | p-value | Power* |
|---------------------|-------------------|---------------|-------------|---------|--------|
| Intercept | 3.50 | 0.22 | 99.87 | 0.00 | 1.00 |
| Treatment Group | 0.41 | 0.71 | 11.59 | 0.00 | 1.00 |
| Prior IT Experience | 0.06 | 0.94 | 1.76 | 0.14 | 0.52 |
| Attitude | 0.02 | 0.98 | 0.48 | 0.75 | 0.16 |

Design: Dependent variables = Intercept + Treatment group + Prior IT experience + Attitude
 Dependent variables: Far-transfer task performance, Near-transfer task performance, Satisfaction, Self-efficacy – all measured at time T₃
 Hypotheses DF was 4 and error DF was 114 in all cases.
 *Power estimated using $\alpha=0.05$.

Training Sequences and their Effects on Task Performance and User Outcomes

Table 4. ANCOVA results

| | Sum Squares | DF | F-statistic | p-value | Power* |
|---|-------------|-----|-------------|---------|--------|
| Hypothesis H1: Dependent variable=Near-transfer task performance; Supported | | | | | |
| Intercept | 62.03 | 1 | 247.95 | 0.00 | 1.00 |
| Treatment Group | 6.73 | 1 | 26.89 | 0.00 | 0.99 |
| Prior IT Experience | .47 | 1 | 1.87 | 0.17 | 0.27 |
| Attitude | .17 | 1 | 0.69 | 0.41 | 0.13 |
| Error | 29.27 | 117 | | | |
| Hypothesis H2: Dependent variable=Far-transfer task performance; Supported | | | | | |
| Intercept | 54.03 | 1 | 318.96 | 0.00 | 1.00 |
| Treatment Group | 7.77 | 1 | 45.88 | 0.00 | 1.00 |
| Prior IT Experience | 0.03 | 1 | 0.20 | 0.65 | 0.07 |
| Attitude | 0.33 | 1 | 1.92 | 0.17 | 0.28 |
| Error | 19.82 | 117 | | | |
| Hypothesis H3: Dependent variable=Satisfaction; Not Supported | | | | | |
| Intercept | 94.98 | 1 | 47.02 | 0.00 | 1.00 |
| Treatment Group | 0.73 | 1 | 0.36 | 0.55 | 0.09 |
| Prior IT Experience | 1.49 | 1 | 0.74 | 0.39 | 0.14 |
| Attitude | 0.02 | 1 | 0.01 | 0.92 | 0.05 |
| Error | 236.36 | 117 | | | |
| Hypothesis H4: Dependent variable=Self-efficacy; Supported | | | | | |
| Intercept | 78.99 | 1 | 35.52 | 0.00 | 1.00 |
| Treatment Group | 10.76 | 1 | 4.84 | 0.03 | 0.59 |
| Prior IT Experience | 0.28 | 1 | 0.13 | 0.72 | 0.06 |
| Attitude | 0.53 | 1 | 0.24 | 0.63 | 0.08 |
| Error | 260.23 | 117 | | | |
| Design: Dependent variable = Intercept + Treatment group + Prior IT experience + Attitude | | | | | |
| *Power estimated using $\alpha=0.05$. | | | | | |

variable, was used to examine whether the above differences were significant. This approach was appropriate, since our independent variable (training sequence) was categorical, the four dependent variables (far- and near-transfer task performance, self-efficacy and satisfaction) were interval-scaled, and covariates (prior IT experience and pre-training attitude) were also interval-scaled. Per the multivariate central limit theorem, two-group comparison analysis is robust to violations of the multivariate normality and equality of variance/covariance assumptions for

large samples (> 20 per group), as was the case in our study.⁴

MANCOVA was performed using the general linear model approach; the results are presented in Table 3. Four multivariate significance tests were performed: Hotelling's Trace, Wilks' Lambda, Pillai's Trace and Roy's Largest Root test.⁵ Each test reported a significant treatment effect (training sequence), with an F-statistic of 11.59 ($p<0.01$) and statistical power close to 1.00, confirming a multivariate treatment effect of training sequence on four dependent variables: far-transfer task

performance, near-transfer task performance, satisfaction and self-efficacy. The covariates, prior IT experience and attitude, had non-significant effects (p -values of 0.14 and 0.75, respectively) on the dependent variables; however, these lack of effects may have been masked by low power (presumably due to small effect sizes).

Results of follow-up univariate ANCOVAs (tests for individual hypotheses) are reported in Table 4. These results indicate that the treatment effect was significant for near-transfer task performance ($F=26.89$, $p<0.01$) when controlled for users' pre-treatment IT experience and attitude. Coupled with the higher mean for Group A (4.57) than for Group B (4.09) (see Table 2), this indicates that the conceptual-procedural training sequence resulted in significantly better near-transfer task performance than the procedural-conceptual sequence. Likewise, the significant treatment effect for far-transfer task performance at time T_3 ($F=45.88$, $p<0.01$) combined with the higher mean for Group A (4.31) than that of Group B (3.79), demonstrates the superiority of the conceptual-procedural training sequence in far-transfer task performance. Hence, Hypotheses H1 and H2 were both supported. Note that the statistical power of both effects equaled or exceeded 0.99, providing high confidence in our empirical findings.

Post-training satisfaction was expected to be significantly lower for Group A than for Group B (Hypothesis H3), while the reverse effect was expected for self-efficacy (Hypothesis H4). In conjunction with the self-efficacy means (5.30 and 4.58 for Groups A and B, respectively), ANCOVA results supported H4 ($F=4.84$, $p=0.03$), though the statistical power of this test was lower than desired (0.59). However, H3 was not supported ($F=0.36$, $p=0.55$), despite the group means for satisfaction being in accordance with the stated hypothesis (5.13 and 5.29 for Groups A and B, respectively), indicating that satisfaction may not differ significantly across training sequences. Even if users value procedural training more than conceptual training, the above results indicate that

they may be indifferent to whether the procedural training is received earlier or later in the training sequence. Implications of these findings are discussed in the next section.

DISCUSSIONS AND CONCLUSION

Key Findings and Implications

The goal of this study was to examine whether conceptual-procedural or procedural-conceptual training sequence was most effective in achieving the best IT task and user outcomes. Drawing from assimilation theory (Ausubel, 1978), we postulated that a conceptual-procedural training sequence can provide better near-transfer task performance, far-transfer task performance and user self-efficacy but lower user satisfaction than a procedural-conceptual sequence. These hypotheses were empirically tested using a quasi-experimental study of 121 subjects in a database design context, while controlling for subjects' pre-treatment attitude and IT experience.

Assimilation theory predicted that the conceptual-procedural sequence is better for near-transfer and far-transfer task performance because prior conceptual training creates mental schemas that help assimilate procedural details during subsequent procedural training. Since IT users trained in the conceptual-procedural sequence experience better task performance, they gained confidence in their ability to perform similar tasks and, hence, increased their self-efficacy. In contrast, the reverse sequence was expected to be more satisfying, because users can directly relate to action-plan knowledge gained during the procedural training but not necessarily to the abstract schemas acquired during conceptual training.

Our empirical findings supported the predicted effects for far- and near-transfer task performances and user self-efficacy, but not for user satisfaction. The satisfaction mean was slightly higher for procedural-conceptual sequence as expected, but

this difference was non-significant. Hence, procedure-first IT training programs, often employed to maximize user satisfaction, are marginally useful in enhancing satisfaction while adversely impacting near-transfer and far-transfer task performance and self-efficacy. Instead, scarce training resources are best utilized in designing training programs where conceptual training precedes (rather than follows) procedural training, especially for complex IT tasks involving both conceptual and procedural knowledge.

Limitations of the Study

Like most experimental studies, this study is not without limitations. First, one may question whether the study's findings, inferred using student subjects, are generalizable to the general population of IT users because of differences in intrinsic motivation between the sample and the population. However, the mean work experience of 3.7 years and mean computer-related work experience of 2.8 years make our sample somewhat representative of the target population. Further, many of our subjects were also employed in the local IT industry at the time of the study. The key difference between student subjects and the IT workforce at large is often prior IT experience, which was controlled for in this study.

Second, though our post-test-only design alleviated several threats to internal validity—such as pre-test/post-test sensitization, statistical regression (toward the mean), and subject mortality—it may still have been susceptible to novelty effect (subjects' newness of database design task), Hawthorne effect (subjects' awareness that they were participating in an experiment) and Rosenthal effect (the researcher's physical proximity to subjects during task performance) (see Huck, Cormier, & Bounds, 1974).

Third, since we used both undergraduate and graduate students in our sample, one may argue whether these two groups were systematically different in their response patterns. Graduate

students tend to be older and have more work experience than undergraduate students, and may even demonstrate a more positive attitude toward IT learning. We eliminated these concerns by controlling for prior IT experience and pre-training attitude in our research design. The F-statistics and p-values of these effects (see Table 4) suggest that even if undergraduates differed from graduate students on these dimensions, such differences did not significantly influence their task performance or personal outcomes.

Finally, it may be questioned whether our findings, based on a database design task, can be generalized to other types of IT tasks. A database task was chosen in this study because of its combination of conceptual and procedural content typical of most complex IT tasks. While this is different from simpler and more procedurally oriented tasks examined in prior training research (e.g., e-mail or spreadsheet usage), we expect our findings to be generalizable to other complex tasks, though this assertion cannot be validated without additional studies. Further, we expect task complexity to moderate the effects of training sequences on task and user outcomes, which is also left open for future research.

Contributions for Research and Practice

The study makes several important contributions for IT training research and practice. First, it introduces the concept of IT training sequences and describes how training sequences should be structured for optimal task and user outcomes. For IT tasks that require both conceptual and procedural knowledge, we demonstrate that conceptual training should precede procedural training, so that IT users can form conceptual schemas prior to assimilating action plan sequences using these schemas. Even if the conceptual-procedural training sequence marginally decreases user satisfaction, it is still preferable by virtue of its positive impacts on near-transfer and far-transfer task

performance and user self-efficacy. For practitioners, this finding offers some guidelines on how to allocate scarce training resources for the best outcomes. For researchers, this study empirically validates the expectation from prior research that conceptual training prior to procedural training helps form better mental models (e.g., Santhanam & Sein, 1994) and extended this logic to demonstrate its effects on task performance and user outcomes.

Second, this study was one of the earliest to examine multiple types of training outcomes. Specifically, we examine two task outcomes (near-transfer and far-transfer task performances) and two user outcomes (self-efficacy and satisfaction), and demonstrate that these constructs do not necessarily covary. We did not fully explore the theoretical linkages between these outcomes, but this presents an opportunity for future researchers to extend the current study.

Finally, while prior studies examined training involving simple IT tasks/technologies such as e-mail, spreadsheet or word processing usage, this study was one of the earliest focusing on complex IT tasks, such as database design, typical of today's knowledge-based work. Appropriate training sequence is more critical in the latter context, given its higher conceptual and procedural knowledge requirements. As IT tasks/technologies become more complex, it will be important to broaden our range of training contexts to examine areas such as database design. Further, consideration of task complexity may help reconcile some of the mixed empirical findings reported in prior training research and build a cumulative body of knowledge in this area.

REFERENCES

- Ahrens, J. D., & Sankar, C.S. (1993). Tailoring database training for end users. *Management Information Systems Quarterly*, 17(4), December, 419-439.
- Anderson, J. R. (1995). *Cognitive psychology and its implications* (4th ed.). New York: Freeman.
- Atlas, R., Cornett, L., Lane, D.M., & Napier, H.A. (1997). The use of animation in software training: Pitfalls and benefits. In M. Quinoñes & A. Dutta (Eds.), *Training for 21st century technology: Applications of psychological research*. Washington, DC: American Psychological Society.
- Ausubel, D. (1978). *Educational psychology: A cognitive view* (2nd ed.). New York: Holt, Reinhart & Winston.
- Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs: Prentice Hall.
- Bhattacharjee, A. (2001). Understanding information systems continuance: An expectation-confirmation model. *Management Information Systems Quarterly*, 25(3), 351-370.
- Bostrom, R.P., Olfman, L., & Sein, M.K. (1990). The importance of learning style in end-user training. *Management Information Systems Quarterly*, 14(1), 101-119.
- Carroll, J. M., & Rosson, M. B. (1987). Paradox of the active user. In J. M. Rosson (Ed.), *Interfacing thought: Cognitive aspects of human-computer interaction*. Cambridge: Cambridge Press.
- Colquitt, J. A., LePine, J. A., & Noe, R. A. (2000). Toward an integrative theory of training motivation: A meta-analytic path analysis of 20 years of research. *Journal of Applied Psychology*, 85(5), 678-707.
- Compeau, D. R., & Higgins, C.A. (1995). Application of social cognitive theory to training for computer skills. *Information Systems Research*, 6(2), 118-143.
- Compeau, D. R., Higgins, C. A., & Huff, S. (1999). Social cognitive theory and individual reactions to computing technology: A longitudinal study. *Management Information Systems Quarterly*, 23(2), 145-159.

- Davis, S. A., & Bostrom, R. P. (1993). Training end users: An experimental investigation of the roles of the computer interface and training methods. *Management Information Systems Quarterly*, 17(1), 61-85.
- Glaser, R. (1990). The reemergence of learning theory within instructional research. *American Psychologist*, 45(1), 29-39.
- Huck, S. W., Cormier, W. H., & Bounds, W. G. (1974). *Reading statistics and research*. New York: Harper Collins.
- Jarvenpaa, S. L., Dickson, G. W., & DeSanctis, G. (1985). Methodological issues in experimental IS research: Experiences and recommendations. *Management Information Systems Quarterly*, 9(2), 141-156.
- Johnson, R. A., & Wichern, D. A. (2002). *Applied multivariate statistical analysis* (5th ed.). Upper Saddle River: Prentice Hall.
- Mathieson, K. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research*, 2(3), 173-191.
- Mayer, R. E. (1981). The psychology of how novices learn computer programming. *ACM Computing Surveys*, 13, 121-141.
- Myers, J. (1977). *Fundamentals of experimental design* (2nd ed.). Boston: Allyn and Bacon.
- Olfman, L., & Bostrom, R. P. (1991). End-user software training: An experimental comparison of methods to enhance motivation. *Journal of Information Systems*, 1(4), 249-266.
- Olfman, L., & Mandviwalla, M. (1994). Conceptual versus procedural software training for graphical user interfaces: A longitudinal field experiment. *Management Information Systems Quarterly*, 18(4), 405-426.
- Olfman, L., & Pitsatorn, P. (2000). End-user training research: Status and models for the future. In R.W. Zmud (Ed.), *Framing the domains of IT management*. Cincinnati: Pinnaflex Educational Resources.
- Reigeluth, C. M., & Stein, F. (1983). The elaboration theory of instruction. In C. Reigeluth (Ed.), *Instructional design theories and models*. Hillsdale: Lawrence Erlbaum Associates.
- Santhanam, R., & Sein, M.K. (1994). Improving end-user proficiency: Effects of conceptual training and nature of interaction. *Information Systems Research*, 5(4), 378-399.
- SAS Institute Inc. (1990). *SAS/Stat users guide* (Vols. 1 and 2). Cary, NC: Author.
- Yi, M. Y., & Davis, F. D. (2003). Developing and validating an observational learning model of computer software training and skill acquisition. *Information Systems Research*, 14(2), 143-169.

ENDNOTES

- ¹ To conserve space, the training script is not provided here, but is available from the authors on request.
- ² To avoid possible confounding between near-transfer (LDM) and far-transfer (ERD) task performance, since the former followed the latter, LDM was evaluated based on subjects' depiction of ERD, even if the ERD was incorrect.
- ³ The five dropped items were: (1) "if I have never used a software package [performed similar tasks] like it before," (2) "if I had only seen someone else using it before trying it myself," (3) "if someone else had helped me get started," (4) "if someone showed me how to do it first," (5) "if I had used similar packages before this one to do the same job." These were not relevant in our context since subjects have already seen the instructor perform similar tasks during the

training process, had been shown how to perform such tasks by the trainer, and had gotten started on (and completed) similar tasks during the training process.

⁴ Multivariate central limit theorem states that test statistics in two-group analysis can be assumed to be normally distributed if: (1) the samples are drawn randomly, (2) the groups are independent, and (3) the groups are large (> 20) (Johnson & Wichern 2002, p. 282-283). Tests of multivariate normal-

ity and equality of variance/covariance of sample data are required to assure normal distribution of test statistics only if the samples are small or more than two groups are being considered, or the independent variable is continuous or interval-scaled.

⁵ Results from Pillai's and Roy's tests were similar to that from Hotelling's and Wilks' tests and, hence, are not reported in Table 3.

APPENDIX A: MEASUREMENT ITEMS

Training Sequence:

Manipulated via experimental treatment (conceptual-procedural versus procedural-conceptual).

Prior IT Experience (fill-in):

EXP1. Number of years of experience working with computers: _____ years

EXP2. Number of years of experience working with databases: _____ years

EXP3. Number of years of programming experience: _____ years

Attitude (seven-point semantic differential scale):

ATT1. I strongly (dislike...like) the idea of learning about database design.

ATT2. Learning about database design is an extremely (bad...good) idea.

ATT3. Learning how to design databases is an extremely (undesirable...desirable) idea.

Task Performance (five-point assessment scale):

Assessed independently by three judges.

Satisfaction (seven-point semantic differential scale):

SAT1.I am extremely (dissatisfied...satisfied) with my overall performance in this assignment.

SAT2.I am extremely (frustrated...contented) with my overall performance in this assignment.

SAT3.I feel extremely (terrible...delighted) with my overall performance in this assignment.

Self-Efficacy (seven-point Likert scale):

SE1. I can now design databases even if there is no one around to help me.

SE2. I can now design databases using only database manuals for reference.

SE3. I can now design databases using only online help facility for assistance.

SE4. I can now design databases if I have enough time to complete the task.

SE5. I can now design databases if I can call someone for help if needed

(dropped).

APPENDIX B: FINAL DATABASE DESIGN TASK

Prepare (1) an entity-relationship diagram (ERD), (2) a logical data model as a set of third normal form (3NF) relations reflecting the data and relationships of the following narrative. Your ERD should contain appropriate cardinality and mandatory/optional symbols. Your logical data model should have appropriate primary (identifier) and foreign keys, referential integrity constraints, and associative relations.

A cable television (CTV) company desires a database to manage customer data. CTV offers three services (monthly charges in parentheses): (1) Basic (\$30), (2) Movie Channels A, B, or C (\$15 per channel), and (3) Children's Channel (\$10). In addition, it rents two types of equipment (serial numbers and monthly charges in parentheses): (1) Decoder (1237810, 484965, 319542; \$5 per decoder), and (2) Remote (432, 947, 376; \$4 per remote). Two typical customers are:

Training Sequences and their Effects on Task Performance and User Outcomes

Account Number: 101
John Lamb
123 Lanai Court
Gotham City, NY 10023
Phone: 203-247-5195
Service: Basic, Movie Channel B
Equipment: Decoder(1237810), remote
control(947)

Account Number: 102
Mary Jones
4443 8th Ave
Gotham City, NY 10043
Phone: 203-232-6243
Service: Basic, Children's Channel
Equipment: Decoder (319542)

The following business rules apply to this company:

- Each customer is assigned one account number only, which can be used for multiple services.
- The company can have a service that has no assigned customers.
- The company maintains an inventory of equipment, which may or may not be used.
- It is possible for a customer to have established service without any assigned equipment.

This work was previously published in Integrating Information & Communications Technologies into Classroom, edited by L. To-me, pp. 112-134, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.39

CareerQuesting: Evaluating Web-Based Resources for Interesting Girls in STEM Careers

Karen F. White
Purdue University, USA

Mara H. Wasburn
Purdue University, USA

ABSTRACT

This paper develops an educational strategy to foster the interest and persistence of middle school girls in science, technology, engineering, and mathematics (STEM) careers using existing Web sites. Criteria are specified that enable middle school teachers to evaluate Web sites that can serve as supplemental learning activities within prescribed curricula. In particular, these criteria help evaluate sites that provide materials appealing to both boys and girls. This allows teachers to adopt them without concern that they are providing an unfair advantage to girls.

INTRODUCTION

In September 2001, the Council on Competitiveness, a group of industrial, university, and labor leaders whose mission is elevating national competitiveness to the forefront of national consciousness, launched the Building Engineering and Science Talent (BEST) initiative. It is described on the Council Web site as a public-private partnership “to identify the most effective strategies for building a more diverse science, engineering, and technical workforce and to bring best practices to communities nationwide” (Council on Competitiveness, 2004). One of the first reports to emerge from the BEST program begins:

There is a quiet crisis building in the United States — a crisis that could jeopardize the nation’s pre-eminence and well-being. The crisis has been mounting gradually, but inexorably, over several decades. If permitted to continue unmitigated, it could reverse the global leadership Americans currently enjoy. (Jackson, 2004)

This report goes on to cite “the gap between the nation’s growing need for scientists, engineers, and other technically skilled workers, and its production of them.”

The literature refers to a “leaky” pipeline of female talent, leading to “under-representation” of women in the STEM professions. Much research documents this problem, tracing attitudes and behaviors of girls from elementary school through graduate studies and employment. The studies reflect a clear gender distinction at all ages (Freeman, 2004; Jones, Howe, & Rua, 2000), showing that as girls grow older, there is steady decline in the number expressing interest in STEM subjects, and a corresponding decline in the numbers of women entering higher levels of study. Numerous programs proposed, and implemented over the past decade to improve gender equity in STEM education and workforce. These programs aim to provide information and other support for women and girls, allowing them to make better informed decisions with respect to their educational activities and career planning (AAUW, 2004; National Science Foundation, 2003). Given the proliferation of such efforts, some measurable effect on “entry and persistence” of women into these professions should be expected. However, data do not indicate substantial gains (Freeman, 2004; Huang, Tadese, & Walter, 2000).

The apparent failure of these programs may be due to a failure to implement or adopt them broadly. In light of recent political pressure to improve standardized testing scores, teachers must devote most of their time to the specific curriculum requirements. They may lack the time to locate and evaluate additional resources to ad-

dress such gender equity issues, or may lack the budget to adopt commercially available resources. Even when appropriate materials are available for little or no cost, such as those on Web sites for many gender-equity programs, teachers may not understand how or when to use them (Furuta et al., 1999; March, 1997).

Web site-based resources are often developed as part of informal experience to be used as a supplement to regular classroom activities. However, it is unlikely that students will seek out these resources on their own. Additionally, research suggests that only a small percentage of teachers believe it is appropriate to address gender-equity concerns in the typical classroom (Bullock, 1997). Those who do may not have support of the school administration to adopt programs perceived to benefit only girls (Posnick-Goodwin, 2005).

The goal of this paper is to identify a set of criteria for use by teachers in evaluating existing Web sites with the potential for increasing interest and persistence of middle school girls in STEM fields. In particular, the criteria emphasize materials that might appeal to both boys and girls, allowing teachers to adopt them without concern that they are providing an unfair advantage to girls.

REVIEW OF THE LITERATURE

There are many alternative explanations for why women continue to avoid STEM professions. Early studies cited difficulties in mathematics and science, or avoidance of these subjects by girls as the main concern. Girls entered college level studies without adequate preparation for STEM fields, and so avoided them. Programs designed to stimulate interest in mathematics and science (GirlTech.org, 2004), to make them entertaining and appealing to girls, were offered as a means of addressing this problem. Some recent research has indicated that skills development programs have, in fact, been successful, and that girls are

participating equally in middle school and high school studies in science, mathematics, and technology, then entering college studies without the skill gap observed in the early 1990's (Clewell & Campbell, 2002; Freeman, 2004). If this is true, then other influences must be responsible for the continued absence of females involved in college degree programs, or seeking employment in STEM fields.

Often, studies report that girls' and women are choosing other fields of study because they are "not interested" in STEM subjects (Morgan, Isaac, & Sansone, 2001). The problem may be explained as being linked to gender stereotypes, (Seymour, 1998) leading girls and young women to dismiss certain jobs as too "masculine." Educational materials, books, and Web sites, typically address such stereotypical thinking by providing "virtual" role models for girls through biographies of female scientists and engineers. Alternately, there are Web sites devoted to increasing interest in, or raising awareness of, STEM careers as exciting and challenging, with the intention that young girls will then aspire to these in spite of the stereotypes. These resources highlight scientific and engineering specialties thought to appeal more strongly to females. Many such programs include a substantial Web site component, providing a mechanism for distribution of educational resources for use by students, teachers, and even parents.

Informal vs. Formal Educational Strategies for Gender Equity in STEM

While Web sites may have some beneficial effects, some research indicates that girls would benefit more from increased *curricular integration* of science, technology, and math (BEST, 2004). For Web-based materials to be effective, the target audience must be directed toward to the resources, or alternatively, exhibit a strong interest in the subject in order to seek them out (Millar & Shevlin,

2003). Given that one goal shared by most of the Web sites is to "develop" interest, it follows that the target audience in this case is not inclined to find these sites independently. The medium itself has connotations of being too technical, and girls are assumed to have no interest in computers (Hanson, 2002).

The Gender & Science Digital Library (GSDL) project has addressed the needs of teachers seeking to provide an "interactive collection of high-quality, gender-equitable science, technology, engineering and mathematics (STEM) resources for K-12, higher education (community college and university), women's studies, teacher preparation programs, and informal learning environments" (EDC, 2004). Materials accessed on the GSDL Web site have been reviewed for quality, providing the user with confidence in their use. The site serves as a clearinghouse for materials, providing a description referencing the basic content and aims of the material, appropriate age groups, and other relevant information (Hanson, 2002). However, the primary goal of the GSDL project is to make available this type of resource. The site does not clearly provide guidance as to how or when to access these resources, or in what context, except to the extent that the referenced materials do so.

Also, the GSDL project attempts to learn more specifics regarding what teachers are looking for in Web-based resources, as part of their *Digital Libraries: Effective Access* project for STEM educators. A preliminary report available online (Sucher, 2003) describes survey results showing that a significant number of the STEM educators surveyed (86 percent) had not received training in equity in STEM education. Further, one-half of the teachers surveyed had not received training and were not interested in such training (Sucher, 2003, p. 38).

The overwhelming number of projects and Web sites available produces some confusion concerning which would be best for a particular need. Teachers noted that they relied on some of

their regular professional reading (educational journals or newsletters) or colleagues to reference good Web sites (Sucher, 2003). The GDSL study focused on “effective access,” and participants were asked to “select the top three challenges faced in seeking and using Web-based resources.” Seventy-one percent responded that the time it takes to locate resources was the primary concern. When participants were asked, “How long do you typically spend looking for educational resources on the Web?” Sucher (2003) reports slightly more than two-thirds replied, with some amounts up to 10 hours per month.

PROCEDURES

The AAUW (2004) report provided a key insight with respect to the development of this project, in terms of how Web sites and electronic resources might retain the advantages of “informal” education, yet maintain the accessibility and structure afforded by the classroom. The report summarized 416 projects in terms of subject content (science, technology, engineering, or math related, or some combined subject elements).

Of the four “STEM subjects,” science received the greatest attention, with 196 of the 416 programs citing science content as a primary subject matter. The lowest representation was for engineering programs, with only 64 programs claiming engineering as a focus. In addition, in spite of the funded programs’ fundamental commitment to gender equity, a significant number of programs (approximately 40 percent) served both boys and girls

The AAUW report further highlighted the characteristics of each subject emphasis. In this, technology focused programs were singled out for three unique characteristics. First, every technology-focused program specified at least some kind of goal for the program, while some programs in science, engineering, and mathematics omitted this. More than two-thirds of these had a goal to

“increase student engagement with technology” and one-third including goals of career awareness or gender equity awareness. Second, one-third of these were school-based (which was the highest percentage of school-based programs of all the STEM subjects). Finally, in comparison to the other STEM subjects, technology projects seemingly provided a unique opportunity for interdisciplinary focus, with 71 percent combining technology activities with science, engineering, or mathematics content.

Taken together, these findings indicate that “technology” as the focus of program subject matter provides a vehicle compatible with achievement of other learning goals. Further, 10 of the 17 Web-based programs were in the subject area of technology. Thus, technology was selected as a subject focus uniquely suitable to the purpose of the directed project, to facilitate the use of existing Web-based resources in the classroom setting

In moving forward with the second stage of the project, and the final analysis to identify appropriate Web sites or Internet tools for inclusion in the Web site, it was necessary to provide some criteria for evaluation of the candidates in terms of the potential learning experience and ease of incorporation into the regular curriculum. A review and analysis of three previous studies on evaluation of gender-equitable software and programs, each focusing on a different aspect of “assessment issues” with respect to gender equity programs, was undertaken:

- Gender & Science Digital Library (GSDL)
- Building Engineering & Science Talent (BEST)
- GirlsTech (from The Douglass Project)

The Gender & Science Digital Library (GSDL) project addressed the needs of teachers seeking to provide an “interactive collection of high-quality, gender-equitable science, technology, engineering and mathematics (STEM) resources for K-12, higher education (community college and

university), women's studies, teacher preparation programs, and informal learning environments" (EDC, 2004). Materials accessed on the GSDL Web site have been reviewed for quality, providing the user with confidence in their use. The site serves as a clearinghouse for materials, providing a description referencing the basic content and aims of the material, appropriate age groups, and other relevant information (Hanson, 2002). However, it does not clearly provide guidance as to how, when, or in what context to access these resources.

The Web site for the BEST initiative specifically notes its emphasis on programmatic results: "BEST sought to convene the nation's respected practitioners, researchers and policymakers and identify 'what's working' across the country to develop the technical talent of under-represented groups in pre-K through 12, higher education, and the workplace" (BEST, 2004). The BEST program goal is to encourage adoption of programs that have extensive research studies supporting effectiveness. However, the end list of resources did not provide any that would be readily accessible to a teacher involved in preparing lesson plans.

The GirlsTech investigators created a framework for evaluating the appeal of Web sites, CD-ROMs, and other electronic information resources to young women. This framework, called "The GirlsTech Model," was developed by analyzing library and information science and gender studies research, and through original theoretical work. Consequently, resources selected using the GirlsTech Model can encourage young women to increase their use of Web sites and related technology, thereby increasing their computer experience and confidence and making computer and technology professions more appealing career options (The Douglas Project, 2003). This template addresses how to interact with technology, and is more concerned with "attractiveness" and improving attitudes of girls toward the STEM subject by making the experience more enjoyable.

Given budgetary constraints of most schools, it is necessary to focus on Web site resources that are free of charge, and yet provide high quality materials. Therefore, some of the government-funded projects were considered as primary candidates for inclusion (AAUW, 2004; National Science Foundation, 2003). These sites will provide free or low cost materials, with associated government financial support to ensure continued access and maintenance.

Evaluation of CareerQuesting Resources

None of the three evaluation protocols reviewed actually would serve the purpose of this project as originally designed. The GSDL tool is perhaps the most useful, but it is overly detailed to facilitate curriculum development. The GirlsTech approach to "gender specific" criteria attempts to generalize "female" preferences in a categorical manner to enhance "enjoyment" or engagement but does not necessarily address the effectiveness of resources. In practice, the GirlsTech tool also failed to identify a substantial pool of resources that were more than "average" with respect to some of the key "female friendly" factors. Finally, the BEST template is the only one that strongly emphasizes programmatic effectiveness, and attempts to impose a strict definition of success (using rigorous investigative assessment of student outcomes). However, this approach fails to provide a sufficient pool of accessible (and affordable) materials, unlike the GSDL, for which one criterion of any resource selected for inclusion is that it be readily available via the Internet at no cost to users.

The literature review on gender-specific issues in career selection also identified four key elements that the chosen resources or activities should emphasize:

1. Career Information and Exploration — career specific information offered at a point

Table 1. Summary of CareerQuesting evaluation elements

| |
|---|
| <p>General Content and Media Criteria Pre-Screen</p> <p>Domain: Contains subject matter in the domains of natural sciences, pure or applied, mathematics, engineering, or technology.</p> <p>Grade level: Middle school students, appropriate for classroom use.</p> <p>Access/ Availability: Readily available, via the Internet, at no cost, with clear means of ongoing support and funding. Minimal use of advertising (may acknowledge corporate sponsors) Easy to use, clear directions and functionality, utilizes only content and tools available on the site or commonly available and accessible to the public.</p> <p>Functionality: Must meet minimum design and technical support criteria commonly expected of Websites and multimedia, including good page layout and navigational design.</p> <p>Final Evaluation elements</p> <p>Gender Equity Criteria *</p> <ol style="list-style-type: none"> 1. Consistent with general principles of gender equity/inclusivity 2. No specific programmatic goals for STEM diversity <p>Gender-Specific Criteria for Media and Software *</p> <ol style="list-style-type: none"> 1. Career Information 2. “Real world” application/ Contextuality 3. Relevance/ Personal Identification- 4. Social Connectivity/ Collaboration <p>Pedagogical Criteria</p> <ol style="list-style-type: none"> 1. Technology use 2. Standards and credibility 3. Versatile Use 4. Flexibility 5. Interdisciplinary <p><i>* If practical, the materials can be integrated with other resources or adapted to compensate for a lower score in these areas.</i></p> |
|---|

Table 2. Template for evaluation of CareerQuesting Web sites

| General Content and Media Criteria Pre-screen | | | | | | | | | | | | | | |
|--|---|------------|---------|-----------------------|--|---|-----------------------------|---|-------------------------------|--|---|---|-------------|---|
| Domain: Natural sciences, pure or applied, mathematics, engineering, or technology. | | | | | | | | | | | | | | |
| 1. Yes (+5) 2. No (-5) | | | | | | | | | | | | | | |
| Grade level: Middle school students, appropriate for classroom use. | | | | | | | | | | | | | | |
| 1. Yes (+5) 2. No (-5) | | | | | | | | | | | | | | |
| Access/ Availability: Readily available via the Internet at no cost; clear means of ongoing support and funding. Minimal use of advertising. Easy to use, clear directions and functionality, utilizes only content and tools available on the site or commonly available and accessible to the public. | | | | | | | | | | | | | | |
| 1. Yes (+5) 2. No (-5) | | | | | | | | | | | | | | |
| Functionality: Meets minimum design and technical support criteria commonly expected of Web sites and multi-media, including good page layout and navigational design. | | | | | | | | | | | | | | |
| <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Ranking</th> <th>Weighted Score</th> </tr> </thead> <tbody> <tr> <td>1= 1st quartile (site ranks in top quartile) 5</td> <td></td> </tr> <tr> <td>2= 2nd quartile</td> <td>0</td> </tr> <tr> <td>3= 3rd quartile -</td> <td>2</td> </tr> <tr> <td>4= 4th quartile ranking (site ranks in lowest quartile) -</td> <td>5</td> </tr> </tbody> </table> | | | Ranking | Weighted Score | 1= 1 st quartile (site ranks in top quartile) 5 | | 2= 2 nd quartile | 0 | 3= 3 rd quartile - | 2 | 4= 4 th quartile ranking (site ranks in lowest quartile) - | 5 | | |
| Ranking | Weighted Score | | | | | | | | | | | | | |
| 1= 1 st quartile (site ranks in top quartile) 5 | | | | | | | | | | | | | | |
| 2= 2 nd quartile | 0 | | | | | | | | | | | | | |
| 3= 3 rd quartile - | 2 | | | | | | | | | | | | | |
| 4= 4 th quartile ranking (site ranks in lowest quartile) - | 5 | | | | | | | | | | | | | |
| Web sites or other Internet materials to be considered for inclusion in the “Career Questing” resource guide will be evaluated according to the following criteria. Each site will be rated with respect to the factors listed as follows: | | | | | | | | | | | | | | |
| <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Score</th> <th>Evaluation Guidelines</th> </tr> </thead> <tbody> <tr> <td>“Poor” C</td> <td>contains no aspects of desired criteria, or inadequate in functionality or content.</td> </tr> <tr> <td>“Below Average”</td> <td>Materials have few desired elements or factors listed. Materials considered for inclusion <u>only</u> if there is necessary functionality or content not available otherwise.</td> </tr> <tr> <td>“Average”</td> <td>Site consistent with similar resources. For gender-specific criteria, preference given to resources that can be directly adopted with minimal modification</td> </tr> <tr> <td>“Above Average”</td> <td>The resource or website conforms in most respects to the desired criteria, or does provide a sound foundation for adaptation to meeting the criteria.</td> </tr> <tr> <td>“Excellent”</td> <td>Materials are exemplary with respect to the desired criteria, and are acknowledged as such by experts and/or educators.</td> </tr> </tbody> </table> | | | Score | Evaluation Guidelines | “Poor” C | contains no aspects of desired criteria, or inadequate in functionality or content. | “Below Average” | Materials have few desired elements or factors listed. Materials considered for inclusion <u>only</u> if there is necessary functionality or content not available otherwise. | “Average” | Site consistent with similar resources. For gender-specific criteria, preference given to resources that can be directly adopted with minimal modification | “Above Average” | The resource or website conforms in most respects to the desired criteria, or does provide a sound foundation for adaptation to meeting the criteria. | “Excellent” | Materials are exemplary with respect to the desired criteria, and are acknowledged as such by experts and/or educators. |
| Score | Evaluation Guidelines | | | | | | | | | | | | | |
| “Poor” C | contains no aspects of desired criteria, or inadequate in functionality or content. | | | | | | | | | | | | | |
| “Below Average” | Materials have few desired elements or factors listed. Materials considered for inclusion <u>only</u> if there is necessary functionality or content not available otherwise. | | | | | | | | | | | | | |
| “Average” | Site consistent with similar resources. For gender-specific criteria, preference given to resources that can be directly adopted with minimal modification | | | | | | | | | | | | | |
| “Above Average” | The resource or website conforms in most respects to the desired criteria, or does provide a sound foundation for adaptation to meeting the criteria. | | | | | | | | | | | | | |
| “Excellent” | Materials are exemplary with respect to the desired criteria, and are acknowledged as such by experts and/or educators. | | | | | | | | | | | | | |
| Score Ranking: Each of the relative scores was assigned a weighting value as follows: | | | | | | | | | | | | | | |
| <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Score</th> <th>Weight</th> </tr> </thead> <tbody> <tr> <td>Excellent +</td> <td>5</td> </tr> <tr> <td>Above Average</td> <td>+3</td> </tr> <tr> <td>Average</td> <td>0</td> </tr> <tr> <td>Below Average</td> <td>-3</td> </tr> <tr> <td>Poor -</td> <td>5</td> </tr> </tbody> </table> | | | Score | Weight | Excellent + | 5 | Above Average | +3 | Average | 0 | Below Average | -3 | Poor - | 5 |
| Score | Weight | | | | | | | | | | | | | |
| Excellent + | 5 | | | | | | | | | | | | | |
| Above Average | +3 | | | | | | | | | | | | | |
| Average | 0 | | | | | | | | | | | | | |
| Below Average | -3 | | | | | | | | | | | | | |
| Poor - | 5 | | | | | | | | | | | | | |
| Score Range | High | Low | | | | | | | | | | | | |
| Gender Equity Criteria | 10 | -10 | | | | | | | | | | | | |
| Gender Specific Criteria | 20 | -20 | | | | | | | | | | | | |
| Pedagogical Criteria | 20 | -20 | | | | | | | | | | | | |

Table 3. Web site and WebQuest scoring sheet

Resource: _____ URL: _____

| Criteria | Description | SCORE |
|---|--|-------|
| Gender Equity Criteria | | |
| Gender equity/ Inclusivity | Content and activities suitable for both boys and girls. Resources should portray balanced images and content with respect to the participation of men and women, boys and girls in related activities, and be inclusive of other “underrepresented” groups. | |
| Programmatic goals for STEM diversity | No strict requirement for explicit gender equity focus, but the materials or Web sites should conform to best practices for engagement of student interest and building enthusiasm for understanding and application of STEM skills. | |
| Gender-Specific Criteria for Media and Software | | |
| Career Information and/or “Real world” application | Content linked to inspirational content on related careers, specific career exploration component that addresses issues relevant to student interests, or which highlights the real-world applications of the technology or subject matter. | |
| Relevance/ Personal Identification | Web site should provide students with a chance to experiment and apply technology in ways that relate to their own interests or allow them to leverage additional talents and interests. | |
| Social Connectivity/ Collaboration | Will provide elements allowing for collaborative interactions between students, or can be integrated with other sources add opportunities for students working together. | |
| Contextuality | Content is provided along with background or history, supplemental information on application is provided. If this is not provided, within the site or resource, can the material be integrated with other content to frame and present the activity or experience? | |
| Pedagogical Criteria | | |
| Technology use | Interactive content, increases student engagement with technology, development of fundamental technology use skills. | |
| Standards and credibility | Content will meet highest standards of scientific and technical credibility, and will be endorsed/produced by a reputable source. | |
| Versatile Use | Materials or tools allow for customization of the activity or applications Can be adapted or customized for use in different class setting or curriculum content. | |
| Flexibility | Preferences will be given to sites that provide a general purpose experience, where skills can be applied in a variety of other contexts, including general application of technology to problem solving, etc. Provide opportunity for students to exercise basic skills and processes creatively. | |
| Interdisciplinary | Preference will be given to technology related activities that integrate other STEM related content, including mathematics, physical sciences, and engineering. | |

Table 4. Web site and WebQuest rankings

| Web sites | Pre-screen Ranking | Gender Equity Criteria | Gender Specific Media Criteria | Pedagogical Criteria | Overall |
|------------------------------------|--------------------|------------------------|--------------------------------|----------------------|---------|
| Kidz Online | 1.00 | 1.00 | 0.90 | 1.00 | 0.97 |
| USA Today Education-- Career Quest | 0.91 | 0.80 | 0.55 | 0.60 | 0.71 |
| Career Voyages | 0.91 | 0.80 | 0.45 | 0.60 | 0.68 |
| Project Cybercareers | 0.77 | 0.60 | 0.65 | 0.80 | 0.72 |
| Ohio Math Works | 1.00 | 0.80 | 0.90 | 1.00 | 0.94 |
| GM--GMability | 1.00 | 0.80 | 0.65 | 0.80 | 0.82 |
| NASA Quest | 1.00 | 0.80 | 0.80 | 0.75 | 0.85 |
| Invention at Play | 1.00 | 1.00 | 0.70 | 1.00 | 0.92 |
| GetTech.org | 1.00 | 0.80 | 0.55 | 1.00 | 0.85 |
| eCybermission | 1.00 | 1.00 | 0.65 | 0.90 | 0.88 |
| | | | | | |
| WebQuests | | | | | |
| Who am I? Career Webquest | 0.45 | 0.80 | 0.65 | 0.70 | 0.63 |
| Martin William's Career Webquest | 0.55 | 0.30 | 0.30 | 0.45 | 0.42 |
| Futurequest | 0.55 | 0.80 | 0.45 | 0.45 | 0.53 |
| CyberScience Magazine | 0.77 | 0.60 | 0.55 | 0.55 | 0.63 |
| NetForce Webquest | 0.77 | 0.50 | 0.75 | 0.09 | 0.76 |
| Dr. B's Atlantis Quest | 0.55 | 1.00 | 0.75 | 1.00 | 0.79 |

- where the girls have not internalized a negative perception of STEM subjects
2. **Personal Identification and Relevance** — students may perceive that technology is not something that they need to learn more about because they have no personal need to do so. If they can find ways to use technology that benefit them directly in their daily lives, they are more motivated to learn and master the basic skills necessary to use it.
 3. **Real World Application and Context** — allowing girls to acquire basic technical skills or a knowledge base to enhance their sense of competence in STEM-related activities.
 4. **Social Interaction and Teamwork** — STEM or technology education should emphasize the potential for working with others to solve problems, including application of technology to further communication and social relations.

Together, these should provide a foundation for students to exercise their talents and creativity in a scientific or technical outlet, and find the experience to be both enjoyable and rewarding.

It is important to emphasize that each of these elements will also benefit all students, not just girls, providing an opportunity to encourage less technically inclined boys to develop these same competencies, and further broaden the pool of skilled workers in technology and related fields. Levine argues that the classroom must focus more on work-life readiness, giving students the tools they need to be productive and effective in their careers (Levine, 2005, pp. 10-11).

The emphasis of the *CareerQuesting* resources is upon providing the students with the learning experiences that will engage them in the process of career exploration and selection. Unlike resources explicitly targeted to girls, teachers and administrators have a clear and compelling motivation to provide students with this kind of career preparation experience.

The final section of the tool included a two-stage review, with a preliminary screen that focused on the key elements of accessibility and content suitable for general classroom use. Each of the resources identified was evaluated using the pre-screening questions. In particular, the Web sites should be easy to use without excessive adaptation of materials, available at no cost, and the materials should be appropriate for a diverse student population. A summary of the evaluation criteria appears in Table 1.

The highest possible pre-screen score is 22, with a preferred score of 15 or above. If an electronic resource met the pre-screening criteria, it was further evaluated. The resource must have met at least "Average" standards with respect to the listed criteria, with preference given to with highest scores. A template for evaluation of the *CareerQuesting* Web sites is presented in Table 2.

Web Sites and WebQuests

The search results were divided into two broad resource categories, Web sites and WebQuests. WebQuests are Web-based constructivist lesson formats that present a problem or series of tasks to be addressed by students using suggested Web-based resources for research (Dodge, 2005). If a site passed the initial pre-screening, it was subjected to the final review process using the Web site and WebQuest Scoring Sheet presented in Table 3.

The search results were divided into two broad resource categories, Web sites and WebQuests. The final selection of recommended resources proceeded to identify the "top 10." The rankings of those Web sites and WebQuests are shown in Table 4.

Best Overall Web Site

- **Kidz Online - Tech Training** (<http://www.kidzonline.org/TechTraining/>) — Best met the criteria specified. It includes extensive technical education resources on subjects ranging from animation to Web page creation. There are lesson plans for nearly every subject from English and Language Arts to Science and Technology Education. The materials are intended for students from 6th to 12th grade. Technology skills are highlighted in nearly every area.

Best Career Planning Web Sites

Three Web sites were chosen to provide alternatives for career exploration tools (these Web sites are explicitly devoted to career exploration or planning activities).

- **USA TODAY Education Career Quest** (<http://www.usatoday.com/educate/careers/>)

CareerQuesting

careers.htm)—A general career exploration resource.

- **Career Voyages – Welcome** (<http://www.usatoday.com/educate/careertech/index.html>) — Contains valuable content, but may be more suitable for slightly older students.
- **Projects CyberCareers Home** (<http://www.nwct.org/projects/cybercareers/default.asp>) — A general career exploration resource.

Best Technical Sites

Three Web sites were chosen as the best sources of in-class technical assignments to foster interest in STEM subject matter. These Web sites are primarily considered as resources for technical assignments and application of technology, building of technical skills, but in some cases included elements of career exploration as well.

- **Ohio Math Works** (<http://www.ohiomathworks.org/>) — A high-quality resource focusing on development of quantitative skills and real-world application of mathematics, with elements of career exploration.
- **GM - GMability Education 5-8** (<http://www.ohiomathworks.org/>) — Emphasizes technical subjects and engineering related careers.
- **Welcome to NASA Quest!** (<http://quest.arc.nasa.gov/index.html>) — Significant classroom and educational resource support.

Best General Education Resources

Three Web sites were chosen as general-purpose Web sites for teachers to find lesson plans or ideas for class assignments. These sites have interac-

tive content or game-like activities for students. Resources focus on more involved, longer-term activities.

- **Lemelson Center Presents Invention at Play** (<http://inventionatplay.org/>)—Focuses on creativity and having fun with technology and basic science or engineering skills.
- **GetTech.org (also Getsmarter.org Home)** (<http://www.getsmarter.org/index.cfm>) — Provides online game-like activities, along with tutorial or quiz-applications.
- **Welcome to eCYBERMISSION** (<http://www.ecybermission.com/index.cfm>) — A resource for a team-competition activity with more than average involvement and lesson plan development. Other competitions often focus on “math drills” or robot building, or similar activities that are either more like trivia contests or are somewhat remote from daily life. Projects focus on “working to solve problems in your community.” Also, the competition is directed toward for teams of 6th to 9th grade students, making it more likely that students will find the projects more interesting and relevant.

WebQuests were the subject of a separate search and evaluation process, to find specific examples that embody key elements of the *CareerQuesting* functionality. Since these are designed by teachers for their own use, they provide a very flexible resource for classroom use.

Best for Career Exploration

Each of the following is a well-developed career exploration activity. The FutureQuest activity includes a group task to allow for student collaboration on the project. There are links to several good interactive resources for career interest testing and assessment as well:

- **Who Am I? Career WebQuest** (<http://home.sullivan.k12.il.us/teachers/lawson/webcareers.htm>)
- **Martin Willams's Career WebQuest** (<http://home.sullivan.k12.il.us/teachers/lawson/webcareers.htm>)
- **FutureQuest** (<http://www.pvpusd.k12.ca.us/teachweb/twidwell/FutureQuest.html>)

Best for Technical Skills

Each of the following WebQuests focuses on assignments to learn Web page construction skills or use of the Internet for research.

- **Cyber Science Mag** (<http://projects.edtech.sandi.net/kearny/cybermag/index.html>) — Suitable for use in general English/composition courses and journalism, or as part of science and technical education classes.
- **NetForce** (http://www.geocities.com/lukasaurus_smith/) — Group assignment structure makes this useful for teamwork and collaboration activities.
- **Dr. B's Internet Research Guide: Atlantis Quest** (<http://drb.lifestreamcenter.net/Lessons/Atlantis/index.htm>) — Group assignment structure makes this useful for teamwork and collaboration activities.

RECOMMENDATIONS AND CONCLUSIONS

The purpose of this paper was to identify criteria for use by teachers in evaluating Web site resources with potential for increasing interest and persistence of middle school girls in STEM fields. The tool is not intended to be understood as a model of psychometric rigor. Rather, it offers a framework for evaluation based on the research literature, and can be modified and weighted according to classroom need. In particular, the tool

was used to identify general-purpose materials that might appeal to both boys and girls, allowing teachers to adopt them without concerns that they are providing an unfair advantage to girls.

Resource selection should be validated using an independent review process to establish quality standards for all resources. It may be necessary to make some modification of the tool, since in finalizing the list of Web sites for inclusion as recommended resources, it was apparent that the final selection process remained difficult. This was especially true in the decisions as to whether or not a particular Web site met the requirement that a resource be from a reputable source with evident means of funding or support. It is possible to argue that some of the resources selected as recommended resources did not fully meet this standard.

This was particularly the case with government and non-profit sources. Generally, both met the reputation requirement but the funding element was difficult to evaluate. Most of the non-profits, such as universities, were dependent on money from federal grants. Some of the resources selected were part of government initiated educational reform, and thus were subject to policy changes that would eliminate a particular program or Web site. For corporate resources, funding was not seen as an issue, but corporate outreach and community involvement policies could shift dramatically, and a particular Web site might be eliminated.

It is important that the *CareerQuesting* resources be established as effective in encouraging girls and boys to identify and seriously consider challenging, rewarding, and enjoyable career opportunities in technical fields. To that end, the outcomes of using each of the selected resources in the classroom should be systematically evaluated. The goal is to prepare students for what Levine (2005) terms “work-life readiness”:

A sizable hunk of a child's success is measured by her ability to comply, to learn what she is expected to learn, and to do what she's told to do. An adult

must be able to chart her own road maps. *The odyssey leading into adulthood can be a lonely and harsh voyage, especially if a startup adult is naive and uninformed, if he's never learned to be a mapmaker.* (Levine, 2005, p. 10)

While the resources do focus on attracting girls to technical or STEM subjects, career exploration remains as the central concern. The intent of the *CareerQuesting* model is that students will be taught to be “mapmakers” as part of the regular curriculum. A quest usually refers to a long journey of discovery and learning, with a person seeking an important goal or treasure at the end. Students need a map for this inevitable “career” quest each must embark upon. They need to know how to make such a map, and how to use the map. The goal of evaluating Web sites is to provide teachers with better access to some of the best tools and resources to help create a generation of mapmakers that includes girls as well as boys.

REFERENCES

- AAUW. (2004). *Under the microscope: A decade of gender equity projects in the sciences*. Retrieved March 12, 2004, from <http://www.aauw.org/research/underthemicroscope.pdf>
- Battle, A., & Wigfield, A. (2003). College women's value orientations toward family, career, and graduate school. *Journal of Vocational Behavior*, 62, 56-75.
- BEST. (2004, April). *What it takes: Pre-K design principles to broaden participation in science, technology, engineering, and mathematics*. Retrieved September 28, 2004, from http://www.bestworkforce.org/PDFdocs/BESTPre-K-12Rep_part1_Apr2004.pdf
- Bullock, L. (1997). Efficacy of a gender and ethnic equity in science education curriculum for preservice teachers. *Journal of Research in Science Teaching*, 34(10), 1019-1038.
- Butler, M. (1999). Factors associated with students' intentions to engage in science learning activities. *Journal of Research in Science Teaching*, 36(4), 455-473.
- Clewell, B., & Campbell, P. (2002). Taking stock: Where we've been, where we are, where we're going. *Journal of Women and Minorities in Science and Engineering*, 8(3,4), 255-284.
- Council on Competitiveness. (2004). *Council on competitiveness Website: Worldclass workforce initiatives*. Retrieved November 1, 2004, from <http://www.compete.org/>
- Dodge, B. (2005). *The WebQuest page*. Retrieved December 5, 2004, from <http://webquest.sdsu.edu/>
- EDC. (2004). *GSDL Web site, FAQ*. Retrieved April 12, 2004, from <http://gsdl.enc.org/>
- Education Development Center. (2004). *GSDL Web site*. Retrieved April 12, 2004, from <http://gsdl.enc.org/>
- Freeman, C. (2004). *Trends in educational equity of girls & women: 2004* (No. NCES 2005-016). Washington, DC: U.S. Government Printing Office. U.S. Department of Education, National Center for Education Statistics.
- Furuta, R., Shipman, III, F., Hsieh, H., Francisco-Revilla, L., Karadkar, U., Rele, A., et al. (1999). *Using the Internet in the classroom: Variety in the use of Walden's Paths*. Paper presented at the ED-MEDIA 99: World Conference on Educational Multimedia, Hypermedia, and Telecommunications, Seattle, Washington.
- Gaskell, P., Hepburn, G., & Robeck, E. (1998). Re/presenting a gender equity project: Contrasting visions and versions. *Journal of Research in Science Teaching*, 36(8), 859-876.

- GirlTech.org. (2004). *Girl Tech Web site*. Retrieved February 1, 2004, from <http://www.girltech.org/>
- Hanson, K. (2002, October 3-6). *Space aliens? Women, ICTs, and gender-equitable electronic resources*. Paper presented at the Association of Women in Development(AWID) Conference, Guadalajara, Mexico.
- Huang, G., Taddese, N., & Walter, E. (2000). *Entry and persistence of women and minorities in college science and engineering* (No. NCEES 2000-601). Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- Jackson, S. (2004). *The quite crisis: Falling short in producing American scientific and technical talent*. Retrieved October 25, 2004, from http://www.bestworkforce.org/PDFdocs/Quiet_Crisis.pdf
- Jones, M., Howe, A., & Rua, M. (2000). Gender differences in students' experiences, interests and attitudes toward science and scientists. *Science Education*, 84(2), 180-192.
- Levine, M. (2005). *Ready or not, here life comes*. New York: Simon & Schuster.
- March, T. (1997). *Working the Web for education*. Retrieved February 15, 2004, from <http://www.ozline.com/learning/theory.html>
- MentorNet. (2004). Retrieved April 12, 2004, from <http://www.mentornet.net/>
- Millar, R., & Shevlin, M. (2003). Predicting career information-seeking behavior of school pupils using the theory of planned behavior. *Journal of Vocational Behavior*, 62, 26-42.
- Morgan, C., Isaac, J., & Sansone, C. (2001). The role of interest in understanding the career choices of female and male college students. *Sex Roles*, 44(5,6), 295-320.
- NASA. (2004). *Women of NASA Web site*. Retrieved February 1, 2004, from <http://quest.arc.nasa.gov/women/intro.html>
- National Science Foundation. (2003). *New formulas for America's workforce: Girls in science and engineering* (No. nsf03207). Washington, DC: National Science Foundation.
- Packard, B., & Nguyen, D. (2003). Science career-related possible selves of adolescent girls: A longitudinal study. *Journal of Career Development*, 29(4), 251-263.
- Posnick-Goodwin, S. (2005, March). In the march toward gender equity, girls surge forward, but boys fall back. *California Educator*, 9.
- Seymour, E. (1998). *The role of socialization in shaping the career-related choices of undergraduate women in science, mathematics, and engineering majors*. Paper presented at the Choices and Successes: Women in Science and Engineering, New York.
- Sucher, Y. (2003, March). *Digital libraries: Effective access survey of STEM educators, preliminary summary of survey results*. Retrieved October 1, 2004, from http://www2.edc.org/GDI/homepage_SR/Prelim_Report_March2003.doc
- The Douglas Project. (2003). *GirlsTech: Girls, science, and technology*. Retrieved April 2, 2004, from <http://girlstech.douglass.rutgers.edu/>
- WITI. (2004). *Women in Technology International Web site*. Retrieved February 1, 2004, from <http://www.witi.com/>

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 2, Issue 3, edited by L. Tomei, pp. 45-59, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.40

Feeling Welcome: Internet Tourism Marketing Across Cultures

Wolfgang George Arlt
University of Applied Sciences, Germany

ABSTRACT

If used in a proper way, the Internet can be a powerful cross-cultural incoming tourism communication tool. This chapter examines to what extent the opportunities are utilized which are offered in the virtual sphere to extend across physical and cultural distances a welcoming hand to potential visitors from far-away source markets. The discussion is based on the results of a study about the non-german language Web sites of Central European DMOs, conducted in 2002 and updated in 2006, and the results of a study of German-language Web sites of non-European NTOs and DMOs, conducted in 2005. It can be shown that an increase in multilingual Web sites within the period under review can be

recognized, but that an increase in cross-cultural awareness of the providers of such Web sites is still lacking.

INTRODUCTION

“Tourism destinations are probably one of the most difficult “products” to market, involving large numbers of stakeholders and a brand image over which a destination marketing manager typically has very little control.” (Palmer, 2004, p. 128) In the 21st century, both the expectations as well as the actual experiences are informed by all kind of communication received via media beforehand and by interpretation through different kinds of “cultural mediators” (Ooi, 2002), which influ-

ence and shape the “tourists gaze” (Urry, 2002), especially in international tourism.

These complex processes are only accessible for the tourism industry in a very limited way, as images are not simply the result of promotions put forward by companies or destinations (Goodall & Ashworth, 1988). The brand image for example of Arab countries for European tourists can be traced back to the Orientalism (Said, 1978) fortified by Flaubert and French painters like Delacroix, Decamps, and Fromentin (Lemaire, 2000). The way these countries are portrayed in the news in a situation of increased fears of terrorism also will influence the image. Peer-group information and the travellers own experiences play an often even more important role here, forming the image according to the descriptions by friends and colleagues who have actually been there and on the background of own former visits to foreign countries.

Nevertheless, some degree of influence of the brand building based on “image” by the responsible destination marketing organization is possible and in fact an important part of the marketing strategy for a given destination (Chon, 1991). This influence is growing with the “otherness” of the destination (Bieger, 2002). The degree of otherness is perceived in the same way as distances are perceived in tourism—not in kilometres, but in accessibility, including accessibility in a cultural and lingual sense. The less well-known, the more exotic a destination is, the greater the chance to influence the image through tourism marketing activities. One important tool for such long-range marketing activities in the 21st century is undoubtedly the Internet.

If used in a proper way, the Internet can be a powerful cross-cultural incoming tourism communication tool. This chapter examines to what extent the opportunities are utilized which are offered in the virtual sphere to extend across physical and cultural distances a welcoming hand to potential visitors from far-away source markets. The discussion is based on the results

of a study about the non-german language Web sites of Central European destination marketing organizations (DMOs), conducted in 2002 and updated in 2006, and the results of a study of German-language Web sites of non-European national tourism organizations (NTOs) and DMOs, conducted in 2005. It will be found that an increase in multilingual Web sites within the period under review can be recognized, but that an increase in cross-cultural awareness of the providers of such Web sites is still lacking.

TOURISM AND INTERNET MARKETING

Within a single decade, the Internet has developed from an obscure network for scientists into an indispensable daily tool for about 16% of the world population. The number of Internet users, doubling from approximately 500 million in 2001 (Globalreach, 2005), to more than a billion in 2005 (Internet World Statistics, 2006), has surpassed the number of international travels, which grew from 684 million to 808 million border-crossings in the same period (WTO, 2006).

Not counting the 2% of Internet users both in Africa and in Oceania, roughly one third each of the global Internet users are located in the USA, in Asia and in the Europe respectively. In 2000, English was still the mother tongue of 50% of all Internet users. By 2006, the user community can be divided by languages into three almost equal parts, having English, another European or an Asian language as their respective mother tongues. Comparing the situation in 2001 and in 2006, English lost ground dramatically especially to Chinese and to “smaller” languages, documenting the fact that the Internet has outgrown its mainly North American beginnings.

Travel and tourism is one of the major fields of Internet usage. In terms of sales, tourism products like air tickets, hotel rooms and last-minute packages for domestic and short-haul tourism are

Feeling Welcome

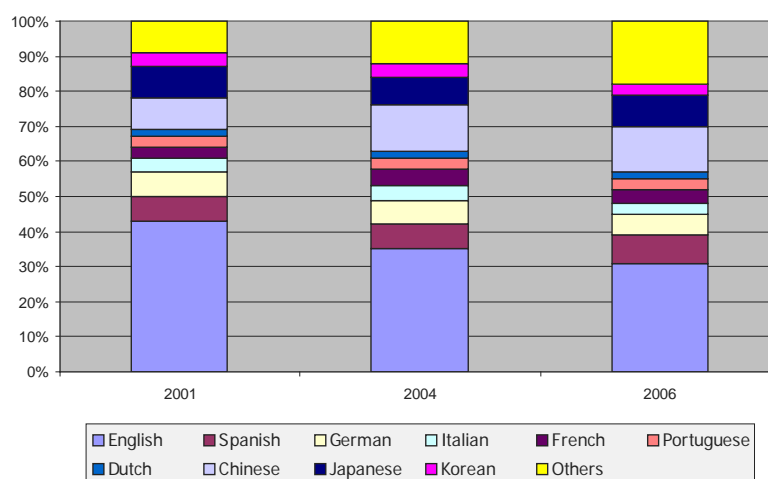
the most common products sold via the Internet except books. Here the Internet's main function is to act as a booking machine. In 2002 online travel sales reached US\$27 billion in the North American and 8 billion € in the European mar-

ket, capturing 14% and 5% of the total market respectively (Marcussen, 2003). For 2005, the European market expanded to 25 billion € (10%) (Marcussen, 2006). The total value of online travel sales worldwide reached US\$49 billion

Table 1. World Internet users by mother tongue 2001-2006 in % (Sources: September 2001 data: GlobalReach, 2001; November 2004 and March 2006 data: Internet World Statistics, 2006)

| Language | 2001 | 2004 | 2006 |
|-------------|-------------|-------------|--------------|
| English | 43 | 35 | 31 |
| Spanish | 7 | 7 | 8 |
| German | 7 | 7 | 6 |
| Italian | 4 | 4 | 3 |
| French | 3 | 5 | 4 |
| Portuguese | 3 | 3 | 3 |
| Dutch | 2 | 2 | 2 |
| Chinese | 9 | 13 | 13 |
| Japanese | 9 | 8 | 9 |
| Korean | 4 | 4 | 3 |
| Others | 9 | 12 | 18 |
| Total users | 505 million | 801 million | 1022 million |

Figure 1. World Internet users by mother tongue 2001-2006 in % (Sources: September 2001 data: GlobalReach, 2001; November 2004 and March 2006 data: Internet World Statistics, 2006)



in 2005 and climbed further to US\$65 billion in 2005 (eMarketer, 2005), not the least fuelled by no-frill airline ticket sales.

Internet marketing has, as has been recognized by the industry, a number of advantages against other media:

- Reduced costs compared to advertisement and promotional activities
- Easier to update than brochures and pamphlets
- Easier and cheaper to handle compared to telephone hotlines
- 24-hour availability of information (Douglas & Mills, 2004; Mills & Morrison, 2002)

For Incoming tourism, especially for long-haul leisure travel, the dominant usage and the main advantage of Internet Web sites is quite different. Decision-making for travel requires qualified information and confidence, making the Internet first of all an image-building tool, important to help deciding whether to go to a specific new destination, to stay for a shorter or longer period, or to use specific services of a company at the destination. Incoming tourists, especially when not travelling to neighbouring countries, are by necessity less spontaneous. Perceived images will therefore play a more important role in their decision for or against travelling to certain destinations or using certain services, whereas online booking will be less relevant in a situation of unfamiliarity with the destination.

New incoming tourists are not easy to target. Established, major markets can be reached via sending information to known customers, by traditional public relations work, fair attendance, advertisements, and so on. These measures are however costly, time- and effort consuming and typically do not reach minor—or underestimated—markets. Potential visitors from new source markets can be more easily targeted by a dedicated Web site, which can be found by the customer wherever he or she lives. No other medium can

beat the Internet as the cheapest, most convenient and most efficient way to address these potential customers in distant countries, belonging to different cultures.

What culture and cultural differences mean, especially for tourism, is a topic of hot debate (Reisinger & Turner, 2003; Trompenaars & Hampden-Turner, 1998). Hofstede (2001) defines culture as “collective programming of the mind which distinguishes the members of one group or category of people from those of another” (p. 9). and, according to Paul A. Herbig, “over 450 definitions of the word culture exist” (Herbig, 1998, p. 11). However, this is not the place to enter the “relevance of culture” debate, as at least the existence of cultural differences is not disputed in the tourism literature.

A differentiation of the classical “guest-host” interrelation scheme (Smith, 1989) should be introduced here. Marion Thiem (1994) developed the thinking tool of four different tourism cultures. Extending the well-known distinction of Goffman (1959) of the front stage and the backstage of a destination, she points out the difference between the daily-life cultures of the travellers home region and the specific culture of travellers away from home, which differs considerably from the daily-life culture in factual behaviour as in self-perception. Similarly the inhabitant of the destination also has a daily-life culture as well as another culture which is the one shown to the tourists purposely, being it as a “genuine fake” (Brown, 1996) or a “mediated authenticity” (Ooi, 2002). The form of this presented culture might also be different for different target markets.

For cross-culture tourism marketing—online as well as offline—this communicated culture has to be adapted to each source market culture accordingly, stressing common points or explaining local culture in terms which relate to the source culture and are therefore easier to understand and probably more sympathetic to the receiver. In international business the seller is expected to adapt to the buyer, this is the “Iron Rule #1” for

Feeling Welcome

cross-culture marketing, according to Gesteland (2002, p. 15).

For the cross-culture Internet marketing of destinations and attractions this author proposed in an earlier study an expansion of this “Iron Rule” to three “Golden Rules,” namely that the potential customer/visitor has to be able to:

- **Find the online information**
- **Understand the online information**
- **Feel comfortable about the way it is presented** (Arlt, 2005)

The technical problem of finding has become smaller with the availability of better global search engines. Still a domain address which is neither a .com-address nor a top-level domain of the targeted market (for instance .de, .at., .ch in the case of German-speaking customers) and/or a non-intuitive address like “www.aspureasitsgets.com” or “www.fac.de” will make it harder for the user to locate the Web site. Keywords in the language of the target markets and links from other, local Web sites will enhance the visibility of the Web site.

Understanding starts with language. As stated above, only a third of all Internet users share a common mother tongue, English, even though many Internet users are able to understand English to different degrees. However, information given on a Web site conveys not just the facts, it also shows respect and attention paid to the speakers of other languages—or the lack of it. To make visitors feel welcome, to make them feel that “they thought about me,” providing information in the mother tongue of the visitors will make a huge difference in supporting a positive bonding beyond the mere availability of useful facts. According to Forrester Research, Web site visitors stay twice as long on a local language Web site compared to an English Web site (De Palma, 1998). “Even customers who speak English prefer sites that offer their local language as well as local product selections, relevant payment options, and

localized versions of customer service” (Torris, 1999). Toru (1998) and Auh (1998) underline the importance of multilingual sites for Japan and Korea. Kralisch and Mandl (2006) point out that even for bilingual speakers of a ‘smaller’ language “the use of their native tongue can represent an additional service that discriminates a product from others by enhancing its value/perception” (p. 2). This statement is supported by their research which shows clear preferences by users for native language Web sites if given a choice.

Besides the question of the usage of different languages, would-be visitors from afar will in many cases request information that is much too obvious for local users to be mentioned. Few Chinese will need to be informed about the fact that the shops are open seven days a week in China; for a German this might be a useful reminder helping to shape their travel plans. Illustrations and webcams can provide additional useful non-verbal information, providing information like the dressing style of the locals, architectural features, daily life behaviour etc. which will elude the attention of members of the local culture but provide useful insights for viewers with different cultural backgrounds.

To make potential visitors feel comfortable is the most complicated but also most rewarding part of cross-culture internet marketing. To provide the address of a German-speaking dentist for potential German visitors may need a bit of extra research, but to provide this information will put to rest one of the many worries of potential German visitors to an overseas destination and will help to turn anxiety into pleasant anticipation. Colours and symbols have different meanings in different cultures. Web sites overflowing with colours and moving graphic objects may look interesting and cute to some visitors but confusing, kitschy or even offending (Becker, 2002) to others. An Asian Web site which uses colours perceived as “typical Caribbean” will mystify the European Web site visitor. The expected carriers of trustworthy information will vary—they will have to

be “authorities” for visitors from more hierarchical orientated societies and peer group members for individualistically moulded visitors.

“You cannot not communicate, especially across cultures,” Paul Watzlawick stated 40 years ago (Watzlawick, Beavin, & Jackson, 1967). While such a comment probably overstates the communication problem, destination Web sites that obviously do not care about foreign, especially non-English speaking tourists by not providing useful information, or providing static or outdated pages for them are in danger of sending a signal to such potential visitors that suggests: “You are not welcome here.”

MEASURING THE CROSS-CULTURAL SERVICE QUALITY OF TOURISM WEB SITES

Many tourism sites, especially of NTOs and DMOs, cannot use online sales as a measurement, as they typically do generate little or no revenue of their own (Tierney, 2000). Nevertheless, the evaluation of the effectiveness of their Web sites is needed to learn about the relation between cost and effect, to facilitate continuous improvements and to compare the performance of the site with its competitors and industry peers (Morrison, Taylor, & Douglas, 2004).

Studies on Web site evaluation have been conducted for a decade with the emergence of agreed methods for Web site evaluation. Murphy, Forrest, Wotring, and Bryner (1996); Murphy, Forrest, and Wotring (1996); and Kasavana, Knutson, and Polonowski (1997) can be counted among the pioneers of Web site evaluation, concentrating on hotels and restaurants. Among the first evaluations for tourism Web sites are the studies of Hanna and Millar (1997) and of Cano and Prentice (1998). A list of major Web site evaluation studies is provided in Morrison et al. (2004, p. 241). All these studies rely on different forms of content analysis with

different features and characteristics evaluated, mostly executed by just one expert.

With a few exceptions (e.g., Donthu, & Yoo, 1998; Furrer, Liu, & Sudharshan, 2000; Okazaki, 2004; Tsiriktsis, 2002), most surveys have given little attention to the special requirements of Web sites crossing linguistic and—more importantly—cultural borders. However, Sigala and Sakellariadis (2004) have tried to use Hofstede’s cultural dimensions to developed global rules for culturally aware Web site design. Schegg, Steiner, Frey, and Murphy (2002) include language use as part of a “value-added service” within their five dimensions, the other four being service processes, customer relationships, creating trust and cybermarketing. Douglas and Mills (2004) mention “glocalisation” and the need “... to communicate in the language of the visitor thus opening the international gateway to the local products and services.” (p. 277). The appeal that “the results of studies focusing on the cross-cultural differences in online search behavior ... should be incorporated into Web site designing process to capture every cultural market segment since the Internet targets are worldwide” (Jang, 2004, p. 45) is seldom translated into criteria for Web site evaluation. Even so, implicit cultural values are part of any evaluation when for instance “uncluttered” Web pages are seen as an asset of any Web site regardless of the targeted audience (Morrison et al., 2004, p. 250).

THE PRESENT RESEARCH: RESULTS OF TWO STUDIES

The two studies presented here are based on earlier research of the author in cross-culture Internet marketing, starting originally outside the field of tourism. Through a series of studies on cross-culture Internet marketing in tourism, for instance about the multilingual and multicultural content of the regional British Tourist Board Visitor Web

Feeling Welcome

sites, eight groups of criteria were developed and refined, taking into account different research approaches found in the literature (Arlt, 2001, 2002a, 2000b, 2003, 2005).

Points were given for 65 weighted criteria under the headings of “accessibility,” “languages,” “technical quality,” “design quality,” “international content,” “target group specific content,” “topicality,” and “interactivity.”

Visibility, technical quality, design quality and target group specific content made up the first cluster, each evaluated with a maximum of 100 achievable points awarded. The other four criteria, that is, language, specific content, topicality and interactivity were awarded a 50% higher weighting, as these aspects have been found in earlier studies to be especially responsible for the evaluation of the usage of the opportunities of virtual cross-cultural communication. Each criterion was evaluated with a maximum of 150 achievable points. Altogether a maximum of 1,000 points could be achieved.

Even though the main topic of the research was cross-cultural marketing, visibility, technical, and design quality were included as “[i]t seems imperative that any holistic Web site evaluation approach must have at its foundation an assessment of the technical details of the site design. Insufficient attention to site design and search engine positioning greatly reduce the value of good content and sound marketing.” (Morrison et al., 2004, p. 246)

For each criterion 80% of all possible points (80 and 120 points respectively) were awarded according to five to eight sub-criteria each (see Appendix A). The other 20% of each criterion were awarded for special outstanding offers, making it possible to award single achievements not included in the sub-criteria. For each sub-criterion the full points or a fraction could be awarded.

The first study using the methods described above was conducted in March 2002, with an update done in April 2006. It analysed the internationality of the official tourism Web sites of

60 DMOs in Germany, Austria and the German-speaking part of Switzerland. The selection was done in the following way: For Germany, the 30 cities and communities with the highest numbers of foreign overnight stays according to the German national statistics (Statistisches Bundesamt, 2001) were selected, provided that they offered any foreign language content on their tourism Web sites. Accordingly, twelve destinations could not be evaluated, including three out of the dozen of most foreign-visited destinations (Düsseldorf, Medebach, and Gunderath), and destinations down to the No. 43 on the list, Boppard, entered the evaluation process. Similarly, for Austria the 15 communities with the highest number of foreign overnight stays were selected according to the national statistics (Statistik Austria, 2002). In Austria only one destination (Mittelberg) had to be dropped because it did not offer any foreign language content. For Switzerland, only destinations in the German-speaking part of the Swiss Confederation were used, excluding ski resorts like St. Moritz and Klosters and cities like Berne and Geneva. As no ranking for foreign overnight stays is provided, all destinations being named on www.myswitzerland.com as important international destinations were chosen, provided that they had more than 20,000 inhabitants, were located in the German speaking Cantons of Switzerland and offered foreign language content. Many of these destinations failed on the last criterion, offering content only in German even though they are visited by many Swiss and foreign guests speaking other languages. In the end, 15 destinations could be evaluated for German-speaking Switzerland.

The Austrian capital Vienna emerged as overall winner and the only destination that reached very good marks (890/1000) in this study. Five other destinations could claim a good result with more than two thirds of the points available, namely Zurich, Saalbach-Hinterglemm, Berlin, Innsbruck, and Sölden. Four out of the six best Web sites were provided by Austrian communities,

whereas in Germany and Switzerland only the respective biggest city could achieve a satisfactory score. Three Swiss, five Austrian, and 11 German destinations were awarded more than half of the maximum number of points, nine other destinations achieving more than 400 points and a “passed” mark.

No less than 26 mainly German and Swiss destinations, almost half of all Web sites evaluated, failed to reach even 40% of the possible points and must be regarded as providing a rather negative brand image to non-German speaking potential visitors (for the list of all 60 cities see Appendix B).

The main problems could be summarized as follows:

- Many important destinations did not provide any non-German content at all, ignoring the information needs of the 98% of mankind not speaking German.
- Foreign language content was offered in most cases in English only. Online content in other languages was rare, even when printed information was available in other languages.
- Almost all Web sites showed a lack of consistency. Positive or original solutions in one part contrasted with erroneous or lacking offers in other parts. Coincidence or arbitrariness played a big role: for example, links often led to German language content without warning or explanation.
- The major advantages of Internet communication, topicality and interactivity were seldom used. Especially information about upcoming events, which is less easy to find for potential visitors in other countries, was not translated. Foreign language content was often outdated, even when the German content was up-to-date.
- Very rarely non-German pages of the Web sites evaluated used interactive elements like newsletters, guestbooks, or instantly downloadable information. The opportunities to get information about the visitors to the Web site were almost totally ignored, as were the chances to get in contact with foreign media or travel company representatives in international source markets. Offering pictorial current information by using webcams to show daily life in a destination in real-time was seldom used.
- A check of the quality of the foreign language content at regular intervals is obviously almost never done. Broken links and very outdated information were found much more often on the non-German than on the German content pages.
- An adaptation to special source markets and their interest and culture was seldom found. Special navigation, different colours, additional content, and so on were lacking. Information was not offered with a customer orientation. For example maps showing the location of the destination within Europe, information about foreign language church services, addresses of mosques, and so on were almost never provided. Target-group specific content proved to be the least developed part, with just eleven out of the 60 evaluated Web sites reaching more than half of the total points awarded.
- The fact that tourism and holidays should be connected to fun and happiness was communicated only by some of the Austrian Web sites. On the German and Swiss-German pages old buildings instead of smiling visitors, art historians lectures instead of specific ambience and complicated feedback forms instead of photographs of the contact person clearly dominated.
- Especially negative impressions were given by English-language parts of Web sites which seemed to have been abandoned long ago. In addition, some DMOs openly refused to send out information material to addresses outside the home country. Visitors

Feeling Welcome

were further angered on many Web sites by sentences like “For more information please consult the German pages” or very bad translations obviously done by a non-native speaker.

After four years, the Web sites were revisited. Out of the top 10 Web sites of 2002, Vienna still remained clearly the best international DMO Web site in German-speaking Europe, with now 14 languages and adapted content for most of them. The second-placed Zurich still offers a technically excellent Web site, however with only English content and little interactivity. Saalbach-Hinterglemm, Sölden, and Lech kept their lively style, by creating the infrastructure for a foreign language community, by taking care to provide foreign language texts also for webcam explanations, and so on. Berlin and Bremen now offer 10 languages each, with special content added especially for the FIFA World Cup 2006, whereas Innsbruck and Baden-Baden in April 2006 still included content on their Web sites about the possibility to visit the Christmas markets of 2005. Trier offered an up-to-date international Web site with different content versions for different target groups, putting for example information about the Karl Marx museum on the Chinese language homepage only. Leipzig, the number 11 of the 2002 study as best East German city also added content for the FIFA World Cup 2006 and even provides as a rare treat links to the homepages of its sister cities.

Out of the four German and Austrian cities among the top 12 international destinations, which did not provide any foreign language content on their Web sites in 2002, only Düsseldorf had improved its offer by 2006. However, even though Düsseldorf is still the no. 6 of the international destinations in Germany, only a partial English Web site is offered. Current events are still only provided in German and some links, leading for instance to the important Caravaggio exhibition to be held later in 2006, are not working.

The bottom 10 destinations of 2002 continued to show many shortcomings. Bonn still expected visitors to understand “*Zur englischen Startseite*” (to the English homepage) as the description of the button to click to get to some English—non-current—content. St. Gallen, Schaffhausen, Rudesheim, Solothurn, and Brunnen showed no improvement with information up to two years old and no information on events in foreign languages. “If you understand a little German you might find some useful information on our site” the Schaffhausen site states rather frankly.

Neustift provides information in seven languages but on a Web site done in a rather amateurish way. Real improvements were shown only by the two big German city Web sites of Frankfurt and Köln. Both include more languages now, Köln even offers a Chinese-German language guide and multi-language news provided by Deutsche Welle (German International Radio). However, both Web sites showed still a limited interactivity, a confusing embedding of international into German content (Köln) and a German sense of humour (Frankfurt): “Please note that we only offer this service (events calendar) in German due to the large amount of topical information available.”

To summarise, after four years more languages are used, but almost no improvement in intercultural skills are displayed. The big German cities are getting a push from the FIFA World Cup 2006. Some small destinations keep their advantage in international customer orientation, many others still do not give much thought to their international visitors and provide English language content only out of a sense of duty but without any enthusiasm or professionalism or even insight into the gains that can result from it.

For the second study presented here, which was conducted in August/September 2005, the opposite approach was used. This time German-speaking tourists were chosen as the target group to answer the question: how are non-European destinations using targeted Web sites to lure Ger-

man-speaking tourists to their shores? The choice of German was based—besides the background of the researcher—on the fact that German-speaking people are both prolific Internet users and ardent international travellers.

In the three mainly German-speaking countries Germany, Austria and Switzerland, Internet usage is above 55%, resulting in 62 million Internet users, representing almost 7% of the world Internet population against the fact that only 2% of the world population speaks German (Globalreach, 2005). At the same time, German-speaking tourists are responsible for no less than 15% of all international tourism expenditure. Germany, as the number one tourism spending nation in 2004 was the source of US\$71 billion tourism spending outside Germany. Austrian and Swiss travellers added another 11 and US\$9 billion respectively in their international spending (UNWTO, 2006). If segmented by languages, German-speaking tourists with US\$91 billion expenditures represent by far the biggest purchasing power in international tourism after tourists from English-speaking countries. Even if taking into consideration that about 80% of the German-speaking outbound travellers stay within Europe, US\$18 billion for the remaining 20% inter-continental travellers still represent an out-of-continent tourism purchasing power equalled only by US citizens.

The culture of German-speaking people can briefly be described in Hofstede terms as showing very high uncertainty avoidance levels, very low power distance levels, medium high individuality and masculinity levels, and rather short-term orientation. This results, speaking very generally, in a pronounced interest in planning on the basis of clear and extensive information, the wish to find out by themselves rather following advice, to see “behind the curtain,” and a rather high wish for security as well as education. These characteristics are more pronounced in long-haul leisure tourists who tend to be better educated and/or older than the average German-speaking traveller (Hofstede, 2001).

For the 2005 study, 500 Web sites of NTOs and DMOs of national and regional destinations as well as important cities and well-known attractions, relevant for German outbound tourism, were visited. The destinations and attractions were selected by using statistics from the German National Tourism Board and through analysis of major German tour operators’ catalogues. To mirror the search behaviour of German tourists, only Web sites recognisable as the “official” Web sites of the destinations and attractions were considered, not Web sites of third parties or private partner companies in Central Europe. Geographically all areas outside Europe were considered, including the Americas, Asia, Africa and Oceania. As the whole world minus Europe was taken as the chosen research area, obviously no comprehensive study was possible. The 500 Web sites chosen do, however, reflect an important part of the information interests of German-speaking intercontinental tourists.

The content analysis of the Web sites was conducted in two steps. In a first step, all Web sites were checked for possible German-language content. A minimum of two pages German-language content was set as a minimum level, to eliminate Web sites that offer no more than a few welcoming sentences. Out of the total sample, 50 Web sites could be identified which offer more than one page of German-language content. In a second step, the remaining 50 Web sites were analysed twice by a group of students of the University of Applied Sciences in Stralsund and by the author in August/September 2005, using a standardized evaluation form. Results were compared and discussed in a panel meeting.

The study revealed again a widespread disregard of cross-culture Internet marketing. Many major non-European tourist destination and almost all major non-European tourist attractions do not have any German-language content at all. Within the 50 analysed Web sites with German-language content, practically all major mistakes possible in cross-cultural Internet marketing could be found.

Feeling Welcome

Accordingly even the Web site with the most favourable evaluation for its German-language content, www.australia.com, could secure only 67% of the maximal points possible. Only seven Web sites returned results above 60% of the possible points, with another 13 above 50%. 30 out of 50 Web sites (60%) did not reach half of the achievable points, risking to rather annoy visitors to the Web site than to inspire them to visit their destination or attraction (all results can be found in Appendix C).

The strengths of the Web site could be found mainly in those criteria that are relatively independent from cultural differences: visibility, technical quality and overall design quality. The weaknesses were found in the core cross-culture criteria, showing a lack of knowledge of and/or a disregard in cross-cultural Internet marketing.

Some common mistakes and omissions, ordered according to the criteria evaluated are as follows:

- **Visibility:** Without an intuitive and/or local URL, German language metatags and extensive linkage, many Web sites failed to show up in Google.de or Google.com searches. Offers to bookmark the Web site or to list the page as the user's homepage were almost never made.
- **Language:** Many Web sites were done by professional agencies, using native German speakers as translators. Some however obviously used their own personnel to create rather funny, if unassuring texts. Only the top performers offered all information in translation, most giving only a partial translation, often with German-labelled links, which lead without warning to pages in English or other languages. Opportunities to create bonding and empathy by comparing proverbs in German and in the local language, relating descriptions of sights to German fairy tales, poems, and so on were not used at all.
- **Technical quality:** Technically most Web sites were of a quite good standard. Even so, sitemaps were often missing and search functions frequently not working. Generally speaking, functionality is the area with the least problems, here the Web agencies producing the Web sites have their core competence.
- **Design quality:** Most Web sites had a professional-looking design. However, a customization towards preferences of different user groups was nowhere to be found. For German preferences many Web sites appear to be too overloaded with information, not well enough ordered in the presentation of the information and simply too kitschy. The top performers offered not only automatic language recognition but also a function to change to other languages, important for German speaking users entering the Internet from a computer whilst already in the destination or in a third country.
- **Specific content:** Specific content is the area where most omissions were found. Information was generally simply translated without taking into account the target group's specific interests. Frequently information, which is self-evident for locals, was not provided for visitors who may not have known about it. Specifically, access information and maps showing the location within the greater region were often missing, as were webcams. More specifically, information about German language services in the country, from guided tours to bakeries to doctors to libraries with German newspapers was almost never provided. Such information is not only of factual value—indeed many such facts are only needed after arrival—but also serve to reassure visitors that such services are available when they are needed. The German obsession with planning and predictability is not catered for.

- **Target group specific content:** One of the strengths of Internet information provision is the possibility to include many extra areas for special interest. A certain amount of information was provided by most Web sites on outdoor activities and local food. However, information for business travellers or students looking for internships, press releases, and so on was seldom to be found. Many countries or cities have twinning or other spartnership arrangements with German localities. Sometimes also associations of destination-born persons now living in Germany exist. These existing connections could be used to support the arising bonding possibilities; however, this opportunity is missed in most cases.
- **Topicality:** The second-most important difference between a guidebook and a Web site is the possibility to include up-to-date information on the Web site. Potential visitors can be guided towards specific events, festivals, and so on which might strengthen their decision to travel to the destination or to stay longer than otherwise planned. As many long-haul travellers have fixed return-date flights, such information needs to be communicated well before departure to the destination. Web sites which do not show the date of the last update, sometimes giving an event for “November” without mentioning the year, can annoy visitors. Some Web sites had German-language versions that seemed to be never updated, showing event calendars several years old.
- **Interactivity:** The most important difference between a guidebook and a Web site is the possibility to interact with the visitors and potential customers. Brochures can be offered as .pdf-files for instant download, newsletters give the opportunity to communicate on a regular base, ePostcards help

to spread the URL of the Web site, games give reasons for repeat-visits to the Web site. Providing the opportunity for users who have already been to the destination to put peer information on the Web site themselves, to report about their best experiences, or to upload their favoured snapshots, are readily used when offered. Likewise a “matching tool” to find potential fellow travellers, peer-group ratings for specific services and attractions or links to customers’ blogs make all the difference between “advertisement” and real information, especially for users from Hofstedian low power-distance societies like Germany, Austria or Switzerland. Unfortunately, in the field of interactivity only very few of the analyzed Web sites showed any creativity.

CONCLUSION

The results of the two studies discussed here show the prevailing problems of adequate use of the Internet as a communication and marketing tool for inbound tourism. Most German, Austrian and Swiss-German DMOs are offering no more than a slimmed English version of their Web sites without the crucial elements of topicality and interactivity. Likewise, designers of non-European Web sites for German-language speaking potential customers fail to understand the importance of communicating to the customer and potential visitor in his or her own language, in his own way and style, taking into account specific interests and characteristics. The importance of facilitating communication with and among customers from a specific culture in their own terms is still clearly underestimated, even though this could be used as a crucial brand image building tool. As a result even most of the Web sites that are providing German language content are technically working well but fail to transfer a positive specific image

to such a large and affluent source market as the German-speaking countries.

Effective Internet communication across cultures is about much more than having a static Web site with some pages translated word by word into another language or simply betting on the language abilities and cultural adaptability of potential visitors. To improve the communication quality is not mainly a financial question but rather a question of customer orientation. By allowing customers to voice their wishes and ideas about the style and content of the Web site both online and while they are staying in the destination can provide the customers' point of view needed to customize the Web site successfully.

Cross-cultural Internet tourism marketing is a powerful instrument to support inbound tourism. In 2006, NTOs and DMOs spend more time and money on providing multi-language static information on their Web sites than they did a few years earlier, but the missing topicality, interactivity and content customization that often occurs is however endangering the positive brand image building effect for potential visitors with different cultural backgrounds. More efforts are needed to convey the message that visitors from all source market can feel truly welcome.

REFERENCES

- Arlt, W. (2001). *Internationalizing your companies' Web site*. Paper presented at MediaMit Congress, Munich, Germany.
- Arlt, W. (2002a). *Internet as cross culture marketing-tool for inbound tourism. A comparison of non-German language Web sites of German, Austrian, and Swiss-German tourism promotion institutions*. Paper presented at Leisure Futures Conference, Innsbruck, Austria.
- Arlt, W. (2002b). *Internet as a cross culture incoming tourism communication tool*. Paper presented at Wales Tourism Alliance Conference, Cardiff, Wales.
- Arlt, W. (2003). Connecting with cultures. *Locum Destination Review*, 11, 43-46.
- Arlt, W. (2005). A virtual Huanying, Selamat Datang and Herzlich Willkommen!—The Internet as a cross cultural promotional tool for tourism. In C. Haven-Tang, & E. Jones (Eds.), *Tourism SMEs, service quality and destination competitiveness: International perspectives* (pp. 325-336). Wallingford: CAB International.
- Auh, T.-S. (1998). *Promoting multilingualism on the Internet: Korean experience*. Paper presented at UNESCO INFOethics '98, Monaco.
- Becker, S. A. (2002). An exploratory study on Web usability and the internationalization of US e-businesses. *Journal of Electronic Commerce Research*, 3(4), 265-278.
- Bieger, T. (2002). *Management von destinationen*. München: Oldenbourg.
- Brown, D. (1996). Genuine fakes. In T. Selwyn (Ed.), *The tourism image: Myths and myth making in tourism* (pp. 33-48). Chichester: John Wiley & Sons.
- Cano, V. & Prentice, R. (1998). Opportunities for endearment to place through electronic "visiting": WWW homepages and the tourism promotion of Scotland. *Tourism Management*, 19(1), 67-73.
- Chon, K. (1991). Tourism destination image modification process: Marketing implications. *Tourism Management*, 12 68-72.
- de Mooij, M. (2005). *Global marketing and advertising. Understanding cultural paradoxes* (2nd ed.). Thousand Oaks: Sage.
- DePalma, D. A. (1998). *Strategies for global sites*. Cambridge, MA: Forrester.

- Donthu, N., & Yoo, B. (1998). Cultural influences on service quality expectations. *Journal of Service Research, 1*(2), 178-186.
- Douglas, A., & Mills, J. E. (2004). Staying afloat in the tropics: Applying a structural equation model approach to evaluating national tourism organization Web sites in the Caribbean. In J. Mills, & R. Law (Eds.), *Handbook of consumer behavior, tourism and the Internet* (pp. 269-294). Binghamton: Haworth Hospitality Press.
- eMarketer. (2005). *Online travel worldwide report 2005*. Retrieved April 2006, from <http://www.emarketer.com>
- Furrer, O., Liu, B. S., & Sudharshan, D. (2000). Culture and SQ perceptions: Basis for cross-cultural market segmentation and resource allocation. *Journal of Service Research, 2*(4), 335-371.
- Gesteland, R. R. (2002). *Cross-cultural business behavior* (3rd ed.). Copenhagen: Copenhagen Business School Press.
- Globalreach. (2002). *Online language populations*. Retrieved November 2002, from <http://www.glreach.com>
- Globalreach. (2005). *Online language populations*. Retrieved September 2005, from <http://www.glreach.com>
- Goffman, E. (1959). *The presentation of self in everyday life*. New York: Doubleday.
- Goodall, B., & Ashworth, G. (Eds.) (1988). *Marketing in the tourism industry: The promotion of destination regions*. London: Croom Helm.
- Hanna, J. R. P., & Millar, R. J. (1997). Promoting tourism on the internet. *Tourism Management, 18*(7), 469-470.
- Haven-Tang, C., & Jones, E. (2005). *Tourism SMEs, service quality and destination competitiveness: International perspectives*. Wallingford: CAB International.
- Herbig, P. A. (1998). *Handbook of cross-cultural marketing*. Binghamton: Haworth Press.
- Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations* (2nd ed.). Newbury Park: Sage.
- Internet World Statistics (Ed.). (2006). *World Internet usage and population statistics*. Retrieved April 2006, from <http://www.internetworldstats.com/stats>
- Jang, S. (2004). The past, present, and future research of online information search. In J. E. Mills & R. Law (Eds.), *Handbook of consumer behavior, tourism and the Internet* (pp. 41-50). Binghamton: Haworth Hospitality Press.
- Kasavana, M. L., Knutson, B. J., & Polonowski, S. J. (1997). Netlurking: The future of hospitality Internet marketing. *Journal of Hospitality & Leisure Marketing, 1*(1), 31-44.
- Kralisch, A. & Mandl, T. (2006). Barriers to information access across languages on the Internet: Network and language effects. In *Proceedings of the Hawaii International Conference on System Sciences (HICSS-39)*, Track 3.
- Lemaire, G.-G. (2000). *L'univers des Orientalistes*. Paris: Edition Menges.
- Marcussen, C. H. (2003). *Trends in European Internet distribution / Trends in the US online travel market 2000-2002*. Denmark: Centre for Regional and Tourism Research. Retrieved August, 2003 from <http://www.crt.dk/uk/staff/chm/trends.htm>
- Marcussen, C. H. (2006) *Trends in European Internet distribution of travel and tourism services*. Denmark: Centre for Regional and Tourism Research. Retrieved April, 2006 from <http://www.crt.dk/uk/staff/chm/trends.htm>
- Mills, J. E., & Law, R. (Eds.). (2004). *Handbook of consumer behavior, tourism and the Internet*. Binghamton: Haworth Hospitality Press.

Feeling Welcome

- Morgan, N., Pritchard, A., & Pride, R. (Eds.). (2004). *Destination branding. creating the unique destination proposition* (2nd ed.). Oxford: Elsevier.
- Morrison, A. M., Taylor, J. S., & Douglas, A. (2004). Web site evaluation in tourism and hospitality: The art is not yet stated. In J. E. Mills & R. Law (Eds.), *Handbook of consumer behavior, tourism and the Internet* (pp. 233-252). Binghamton: Haworth Hospitality Press.
- Murphy, J., Forrest, E. J., & Wotring, C. E. (1996). Restaurant marketing on the Worldwide Web. *Cornell Hotel and Restaurant Administration Quarterly*, 37(1), 61-71.
- Murphy, J., Forrest, E. J., Wotring, C. E., & Brymer, R. (1996). Hotel management and marketing on the Internet: An analysis of sites and features. *Cornell Hotel and Restaurant Administration Quarterly*, 37(3), 70-82.
- Okazaki, S. (2004). Do multinationals standardise or localize? The cross-cultural dimensionality of product-based Web sites. *Internet research: Electronic Networking Applications and Policy*, 14(1), 81-94.
- Ooi, C.-S. (2002). *Cultural tourism & tourism cultures*. Copenhagen: Copenhagen Business School Press.
- Palmer, A. (2004). The Internet challenge for destination marketing organizations. In N. Morgan, A. Pritchard, & R. Pride (Eds.), *Destination branding. Creating the unique destination proposition* (2nd ed.). Oxford: Elsevier.
- Reisinger, Y., & Turner, L. W. (2003). *Cross-cultural behaviour in tourism. Concepts and analysis*. Oxford: Butterworth-Heinemann.
- Said, E. (1978). *Orientalism*. New York; London: Pantheon Books.
- Schegg, R., Steiner, T., Frey, S., & Murphy, J. (2002). Benchmarks of Web Site design and marketing by Swiss hotels. *Information Technology & Tourism*, 5(2), 73-90.
- Selwyn, T. (Ed.). (1996). *The tourism image: Myths and myth making in tourism*. Chichester: John Wiley & Sons.
- Sigala, M. (2004). Reviewing the profile and behaviour of Internet users: Research directions and opportunities in tourism and hospitality. In J. E. Mills, & R. Law (Eds.), *Handbook of consumer behaviour, tourism and the Internet* (pp. 93-104). Binghamton: Haworth Hospitality Press.
- Sigala, M., & Sakellaridis, O. (2004). Web users' cultural profiles and e-service quality: Internationalization implications for tourism Web sites. *Information Technology and Tourism*, 7(1), 13-22.
- Smith, V. L. (Ed.). (1989). *Hosts and guests: The anthropology of tourism* (2nd ed.). Philadelphia: University of Pennsylvania Press.
- Statistik Austria. (Ed.). (2002). *Statistisches Jahrbuch 2002*. Wien: Statistik Austria.
- Statistischen Bundesamtes. (Ed.). (2000/2001). *Tourismus in Zahlen 2000/2001*. Bonn: Statistisches Bundesamt.
- Thiem, M. (2001). Tourismus und kulturelle Identität. *Aus Politik und Zeitgeschichte*, 47, 27-46.
- Tierney, P. (2000). Internet-based evaluation of a tourism Web Site effectiveness: Methodological issues and survey results. *Journal of Travel Research*, 39(2), 212-219.
- Torris, T. (1999). *The best of Europe's e-commerce*. Cambridge, MA: Forrester.
- Toru, N. (1998): *Multilingualism on the net*. Paper presented at UNESCO INFOethics '98, Monaco.
- Trompenaars, F., & Hampden-Turner, C. (1998). *Riding the waves of culture* (2nd ed.). New York: McGraw-Hill.

Tsikritsis, N. (2002). *Does culture influence Web site quality expectations? An empirical study*. Paper presented at the Decision Sciences Institute 2002 Annual Meeting.

Urry, J. (2002). *The tourist gaze* (2nd ed.). London: Sage.

Watzlawick, P., Beavin, J. H., & Jackson, D. D. (1967). *Pragmatics of human communication*. New York: Norton.

UNWTO United Nations World Tourism Organisation. (2006). *Facts and figures*. Retrieved April 2006, from <http://www.world-tourism.org/facts/menu.html>

APPENDIX A: CRITERIA AND SUB-CRITERIA WITH MAXIMUM ACHIEVABLE POINTS

| | |
|--|------------|
| 1. Visibility | 100 |
| URL intuitive | 10 |
| Links to other Web sites | 10 |
| Recognizable as official page | 10 |
| Google.de Rank 1-20 („x Tourismus“) | 10 |
| In Google.de under URL-Name | 10 |
| .de/at/ch address | 10 |
| Metatags in source code | 10 |
| Metatags in German | 10 |
| Special Visibility (e.g., bookmarking) | 20 |

| | |
|-------------------------------------|------------|
| 2. Language | 150 |
| Level of German translation quality | 30 |
| Additional other language 1 | 10 |
| Additional other language 2 | 10 |
| Additional other language 3+ | 10 |
| German version easy to find | 10 |
| German version full translation | 10 |
| First page German | 10 |
| Quality of German language used | 30 |
| Special Language (e.g., proverbs) | 30 |

| | |
|--|------------|
| 3. Technical quality | 100 |
| Loading time short | 20 |
| Screen size optimized | 10 |
| Functioning Sitemap | 10 |
| No special browser needed | 10 |
| Functioning Search function | 10 |
| Functioning Quickfind/Shortcut | 10 |
| Functioning Flash w/ Skip function | 10 |
| Special technical quality (e.g., downloads for software) | 20 |

continued on following page

| | |
|--|------------|
| 4. Design quality | 100 |
| Design quality according to German taste and expectations | 30 |
| Navigation simple | 15 |
| Design adapted for diff. versions | 15 |
| Design meeting regional style image | 10 |
| Links easy recognizable | 10 |
| Special design quality (e.g., automatic language recognition changeable) | 20 |

| | |
|---|------------|
| 5. Specific content | 150 |
| Extent of information in German | 15 |
| German language further information | 15 |
| German language guiding offered | 15 |
| Map with location in the country/region | 15 |
| Map with location in the continent | 15 |
| Access information from Germany | 15 |
| Working Webcam | 15 |
| Working weather report | 15 |
| Special specific content (e.g., German associations in the destination) | 30 |

| | |
|--|------------|
| 6. Target Group specific content | 100 |
| For German tour operators | 10 |
| Information Nature/Hiking | 10 |
| Information local/special food | 10 |
| Information for Journalists | 10 |
| Information for Internships | 10 |
| Information for business travellers | 10 |
| Information public Internet access | 10 |
| Information German church services | 10 |
| Special target group specific content (other than above) | 20 |

| | |
|---|------------|
| 7. Topicality | 150 |
| General information up-to-date | 20 |
| Current events | 30 |
| Information about last site actualization | 10 |
| German and other language versions same level of topicality | 20 |
| Prices quoted in Euro | 10 |
| Special bargain offers | 15 |
| Specific current information (snow, wind, festivals) | 15 |
| Special topicality (e.g., real-time information feeds) | 30 |

continued on following page

Feeling Welcome

| 8. Interactivity | 150 |
|---|------------|
| Functioning contact e-mail | 15 |
| Functioning e-mail Form | 15 |
| Functioning E-Shop | 15 |
| Mailing of Information material to Germany possible | 10 |
| Brochures for download (pdf) | 15 |
| Subscription offer for Newsletter | 20 |
| Functioning Guestbook/Chat in Germany | 15 |
| Functioning E-Postcards | 15 |
| Special interactivity | 30 |

APPENDIX B: RANKING OF 2002 STUDY

| Rank | Destination | Points |
|------|----------------------|--------|
| 1 | Wien | 890 |
| 2 | Zürich | 745 |
| 3 | Saalbach-Hinterglemm | 710 |
| 4 | Berlin | 695 |
| 5 | Innsbruck | 675 |
| 6 | Sölden | 670 |
| 7 | Baden-Baden | 645 |
| 8 | Bremen | 640 |
| 9 | Lech | 640 |
| 10 | Trier | 615 |
| 11 | Leipzig | 610 |
| 12 | Gstaad | 600 |
| 13 | Regensburg | 585 |
| 14 | Rothenburg | 580 |
| 15 | Salzburg | 565 |
| 16 | Zell am See | 560 |
| 17 | Scuol | 555 |
| 18 | Hamburg | 550 |
| 19 | Heidelberg | 545 |
| 20 | Nürnberg | 545 |

| Rank | Destination | Points |
|------|-----------------------|--------|
| 21 | Essen | 540 |
| 22 | Engelberg | 535 |
| 23 | Ischgl | 525 |
| 24 | Stuttgart | 500 |
| 25 | Tux | 500 |
| 26 | Luzern | 465 |
| 27 | Wiesbaden | 460 |
| 28 | Garmisch-Partnkirchen | 445 |
| 29 | Aachen | 435 |
| 30 | Mayrhofen | 430 |
| 31 | Mainz | 425 |
| 32 | St. Anton | 420 |
| 33 | Würzburg | 420 |
| 34 | Bad Ragaz | 415 |
| 35 | Karlsruhe | 395 |
| 36 | Eben/Maurach | 390 |
| 37 | Seefeld | 385 |
| 38 | Lübeck | 375 |
| 39 | Gersau | 370 |
| 40 | Kirchberg | 360 |

continued on following page

| Rank | Destination | Points |
|------|-------------|--------|
| 41 | Zug | 355 |
| 42 | Boppard | 350 |
| 43 | Basel | 340 |
| 44 | Braunwald | 330 |
| 45 | Mannheim | 325 |
| 46 | Augsburg | 315 |
| 47 | München | 315 |
| 48 | Hannover | 305 |
| 49 | Winterberg | 295 |
| 50 | Dresden | 280 |

| Rank | Destination | Points |
|------|--------------|--------|
| 51 | Brunnen | 265 |
| 52 | Köln | 260 |
| 53 | St. Gallen | 255 |
| 54 | Schaffhausen | 250 |
| 55 | Solothurn | 240 |
| 56 | Frankfurt | 235 |
| 57 | Andermatt | 220 |
| 58 | Neustift | 220 |
| 59 | Rüdesheim | 215 |
| 60 | Bonn | 200 |

APPENDIX C: DESTINATIONS, WEB SITES, AND ACHIEVED POINTS OF 2005 STUDY

| Destinations | Web sites | Points achieved |
|---------------------|---|-----------------|
| Australia | http://www.australia.com | 670 |
| Trinidad & Tobago | http://www.visitnt.de | 660 |
| Canada | http://www.travelcanada.ca | 650 |
| Korea | http://german.tour2korea.com | 635 |
| Costa Rica | http://www.visitcostarica.com | 630 |
| Peru | http://www.peru.info | 620 |
| Morocco | http://www.tourism-in-morocco.com | 615 |
| Japan | http://www.jnto.go.jp | 590 |
| New York City (USA) | http://www.nycvisit.com | 590 |
| St. Lucia | http://www.stlucia.org | 585 |
| Hong Kong | http://www.discoverhongkong.com | 580 |
| Israel | http://www.goisrael.de | 575 |
| Taiwan | http://www.taiwan.net.tw | 575 |
| Bahamas | http://bahamas.de | 565 |
| Hawaii (USA) | http://www.gohawaii.com | 560 |
| Québec (Canada) | http://www.bonjourquebec.de | 555 |
| New Zealand | http://www.newzealand.com | 540 |

continued on following page

Feeling Welcome

| | | |
|---------------------------|---|-----|
| Malaysia | http://www.tourism.gov.my | 530 |
| Tasmania (Australia) | http://www.discovertasmania.com.au | 530 |
| Seychellen | http://www.aspureasitgets.com | 515 |
| Thailand | http://www.tourismthailand.org | 495 |
| Mexico | http://www.visitmexico.com | 490 |
| Nova Scotia (Canada) | http://novascotia.com | 485 |
| Singapore | http://de.visitsingapore.com | 485 |
| Serengeti Park (Tanzania) | http://www.serengeti.org | 480 |
| Turkey | http://www.reiseland-türkei.info | 465 |
| India | http://www.india-tourism.com | 465 |
| Fiji | http://www.bulafiji.de | 450 |
| Pennsylvania (USA) | http://www.pcvb.org | 445 |
| South Africa | http://www.southafrica.net | 440 |
| Jamaica | http://www.visitjamaica.com | 435 |
| Florida (USA) | http://www.visitflorida.com | 430 |
| Namibia | http://www.namibiatourism.com.na | 430 |
| Tunisia | http://www.tunisietourisme.com.tn | 405 |
| Costa Rica | http://www.costarica.tourism.co.cr | 400 |
| Yucatan (Mexico) | http://www.mayayucatan.com | 400 |
| Kerala (India) | http://german.keralatourism.org | 395 |
| Western Australia | http://www.westernaustralia.com | 380 |
| China | http://www.fac.de | 365 |
| La Reunion | http://www.la-reunion-tourisme.com | 365 |
| Merida (Mexico) | http://www.merida.gob.mx | 365 |
| Myanmar | http://www.myanmar-tourism.com | 365 |
| Belize | http://www.travelbelize.org | 360 |
| Brazil | http://www.turismo.gov.br | 360 |
| Florida Keys (USA) | http://www.fla-keys.com | 350 |
| Puerto Rico | http://www.gotopuertorico.com | 325 |
| Maldives | http://www.visitmaldives.com | 275 |
| Vancouver (Canada) | http://www.tourismvancouver.com | 265 |
| Iguacú Waterfalls | http://www.fozdoiguacu.pr.gov.br | 250 |
| Edmonton (Canada) | http://www.edmonton.com | 240 |

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper; pp. 314-338, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 5.41

ICT and the Travel Industry: Opportunities and Challenges for New Zealand Travel Agents

Vladimir Garkavenko

Waiariki Institute of Technology, New Zealand

Simon Milne

Auckland University of Technology, New Zealand

ABSTRACT

This chapter focuses on the impact of the ICT on the travel industry with a focus on the New Zealand travel agent (TA) sector. We present key findings from a longitudinal study of TA businesses conducted during 2000-2004. These findings are compared and contrasted with information gathered from in-depth interviews with consumers. The study explores major pressure factors on TA businesses: direct airline-consumers sale, introduction of the Internet, and the emergence of the well-informed consumer. The research also establishes that there is great variation in the extent to which travel agents use the advantages associated with new technology

and how New Zealand travel agents perceive ICT. We argue that in such a crucial moment of disintermediation and the fight for the consumer, TA will need to implement more aggressive advertising policies with a strong emphasis on their professional advice, personal financial reliability, and time-saving attributes for clients.

INTRODUCTION

The evolution and impact of information and communication technologies (ICT) is a dominant issue in the tourism business today. Tourism is an information intensive industry. There are three main waves of technological development

that have characterised ICT influence in tourism enterprises: computer reservation systems (CRS), global distribution systems (GDS), and the Internet. The Internet makes information accessible to consumers, and therefore establishes a direct link between the consumer and the supplier. As a result, the traditional travel distribution channel is changing rapidly. A major feature of this change is described as disintermediation: when the principal bypasses intermediaries such as travel agents. A lot of researchers and business experts suggest that the threat of disintermediation is imminent and that the trend is irreversible (Bloch & Segev, 1996; Harrington & Power, 2001; O'Brien, 1999; Prideaux, 2001).

Travel agents (TAs) are considered to be particularly vulnerable to disintermediation. ICT replaces the core competencies of the intermediaries which include transaction processing (ticketing and settlement) and information provision (raw product information as provided by suppliers). The disintermediation phenomenon is particularly pronounced in the relationship between airlines and travel agents. To minimize the risk of disintermediation and to improve business performance, travel agents need to reposition themselves and review their core strategies to compete efficiently in the changing business environment. It is argued that an intermediary will only survive in a distribution channel to which it adds value. The overall tendency can be described as a shift towards consumers rather than the principals. Some newly created travel agencies act purely in cyberspace while others try to act as the new intermediaries—infomediaries—aiming to help consumers to analyse and integrate information. Research into the travel agency sector by academics has focused on the need for travel agents to adopt strategies that enable them to compete in an ever-changing technological environment. There has, however, been little research outside European and North American settings.

The main objective of the chapter is to analyze the impact (challenges and opportunities) of ICT

and the Internet in particular on the New Zealand travel agent sector as an example. The specific foci of the chapter are:

- What do New Zealand travel agents (TAs) perceive to be major impacts on their businesses?
- An analysis of the disintermediation process as a result of ICT introduction and adoption using the example of travel agents relationships with airlines
- How do TAs perceive ICT?
- How does the consumer perceive the role of a travel agent in the Internet era?
- How should New Zealand travel agents reposition themselves to compete successfully?

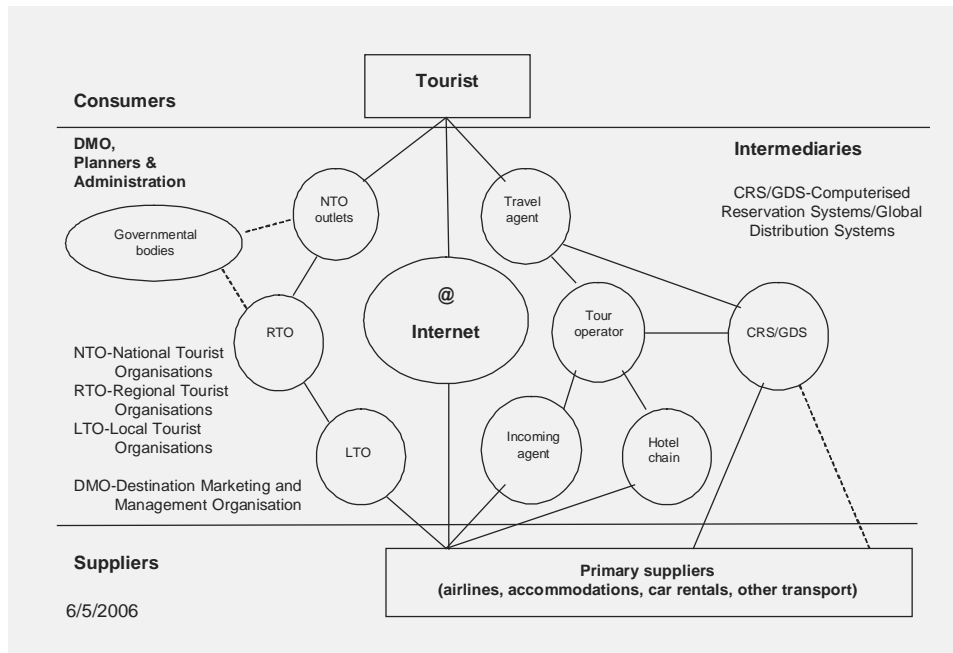
We present the results of a five year study of the New Zealand TA market. Consecutive in-depth interviews were held with TAs from the Auckland region in 2000 and then in 2003. The main issues and problems of the modern TA business environment were identified and conceptualised. The theoretical assumptions formulated on the basis of the received data were tested in a national online survey of TA businesses in 2004. To verify the congruency of the TA and consumer perception of the TA role in the modern environment, in-depth interviews were held with consumers.

BACKGROUND

Tourism is an information-intensive industry. For each traveler there are numerous messages and pieces of information to be exchanged: itineraries, schedules, payment data, destination and product details, and passenger information. Fast, efficient exchange of information between the players in the industry is essential for efficient distribution, sales and customer service (Figure 1).

This information dependence has placed the industry at the forefront of ICT adoption (Mason

Figure 1. Model of tourism information flows (Source: Werthner & Klein, 1999, p. 8)



& Milne, 2002). A most dramatic change for the tourism industry came in the 1980s with the introduction of central reservation systems (CRS). CRS increased the power of the airlines in the distribution channel and dramatically altered the balance of power in the wholesale travel market (Poon, 1993). The Internet and electronic commerce is the next major wave of technological change which is influencing the industry.

Tourism Industry: Changes in Distribution Channels

The Internet and electronic commerce developments in the late 1990s, and the adoption by tourism of the prime business to business (B2B) and business to consumer (B2C) applications, has changed the industry and has shifted the traditional way tourism and travel products are distributed (Buhalis, 1998; O'Connor, 1999; O'Connor and

Frew, 2002). Increasingly, consumers can undertake their entire tourism product search and booking online and, therefore, the role of intermediaries has been changing dramatically. The Internet is widely used as a means to deliver up-to-date content. As a result, it has created the conditions for the emergence of a wide range of new tourism eMediaries. Tourism suppliers (particularly airlines, car rentals, and hotel chains) have taken advantage of the new opportunities and developed e-commerce applications by allowing users to directly access their reservation systems. This includes single supplier provisions, such as British Airways, Marriott Hotels, and Avis, as well as multi-supplier Web pages that have emerged to support airlines in their efforts to reach the consumer directly (e.g., www.orbitz.com).

In addition, several destinations have developed destination management systems to distribute their smaller properties and to present

the destination as a holistic entity. A number of Web-based TAs also have emerged (Expedia.com, Travelocity.com) whilst off-line agencies have developed their online provision. Internet portals (Yahoo, Altavista, Excite) and vertical portals (or vortals) also have developed online travel distribution, often by sourcing their travel contents from external online agents and suppliers. Media companies, including newspapers and television networks, have gradually integrated their off-line with their online provision and have expanded to include e-commerce capabilities on their sites. Online last minute agencies have emerged to enable distressed inventory to be distributed efficiently.

According to Palmer and McCole (1999), the “most important structural change that could be brought about by the Internet is disintermediation wherein principals bypass the intermediary and sell directly to end-users” (p. 37). This phenomenon is especially pronounced in the relationship between airlines and travel agents. Travel agencies have always played a key role in the outsourcing of airline sales. The passage of the Airline Deregulation Act of 1978, accompanied by liberalization of many of the bilateral aviation agreements between the U.S. and other countries during the 1980s, brought about more competition and increasingly complex fare structures (Trethewey & Oum, 1992). Both of these changes favored the use of travel agents by prospective passengers. In 1976, 40% of the airline tickets issued in the USA were written by travel agents; by 1985 this proportion had increased to more than 80% (Trethewey & Oum, 1992).

Traditionally, the travel distribution role has been performed by outbound travel agencies, tour operators (TOs) and inbound travel agents or handling agencies (Buhalis & Laws, 2001) (Figure 1). They have been supported by computer reservation systems, global distribution systems or tour operators’ videotext systems (leisure travel networks (Bordat, 1999; Karcher, 1997). These traditional electronic intermediaries, particularly

GDSs, progressively consolidated their position to four major systems, namely SABRE, AMADEUS, GALILEO, and WORLDSPAN (Karcher, 1996; WTO, 1995).

ICT Adoption by Airlines

The development of the World Wide Web represents a major opportunity for airlines (American Airlines, 2000; Buhalis, 2000a, b; Smith & Jenner, 1998). Airlines quickly have adapted to the potential opportunities associated with e-commerce (both B2B and B2C). Since the mid-1990s most airlines have offered Web sites, which not only inform consumers about basic fare and schedule information, but also enable itinerary building, fare construction, and reservations. This enables the development of marketing strategies focused on building direct relationships with customers (Buhalis, 2000b; French, 1998).

The Internet has revolutionised the airline business. Online booking revenue is forecast to rise to over 11% of the total in Europe by 2008 from just over 4% in 2003, according to Jupiter Research (*The New Zealand Herald*, 2004).

As a result of airlines ability to communicate directly with consumers, several structural changes in the industry have emerged. Airlines have reduced their commission rates significantly (i.e., from 10-12% to 7%), while they also have introduced “commission capping” (e.g., \$10 per ticket). In addition, electronic ticketing and ticketless travel have gradually reduced both distribution and labour costs.

Airlines are increasingly dealing directly with their corporate customers, bypassing the agency entirely. For example, Continental, which derives over 50% of its revenues from business travellers, has established net fares for its corporate customers. Such fares, which are widespread in the USA, involve major discounts on published tariffs paid directly to the corporate customer. In these arrangements, carriers bypass the corporation’s agency entirely, paying it no commissions. The

agency is then left to derive its income from travel management service fees it charges the corporation.

There is also a rapid increase in Internet-generated bookings amongst U.S. and European low cost carriers. The majority of low cost carriers' online sales are on their own Web site whereas the full-service carriers' rely more heavily on online travel agents such as Travelocity and Expedia (Alamdari, 2002).

ICT Impact on the Travel Agent Sector: Challenges and Opportunities

ICT have enabled travel agencies to build complicated itineraries in minutes, while they provide up-to-date schedules, prices and availability data. The proliferation of CRSs and GDSs has also provided an effective reservation mechanism which supports travel agencies in obtaining information, making reservations and issuing travel documents for the entire range of tourism products efficiently and at a fraction of the cost if these processes were undertaken manually (Vasudavan & Standing, 1999; Wardell, 1998).

It has been noted by some researchers that despite having used ICT for some time now, the vast majority of travel agents have not yet managed to take full advantage of ICT capabilities (Buhalis, 1999, 2000b). This is the result of a certain shortage of strategic vision in ICT usage as well as a reluctance to invest in new technology. Low profit margins and a traditional reluctance to invest in assets have deprived agencies of a wide range of critical tools that have prevented them from taking full advantage of emerging ICT. This results in a relatively low level of technology integration, and thus less information is available to support strategic and tactical decision-making. In addition, it results in a low level of management and operational integration, which does not allow agents to capitalise on information for efficient operations, integrated customer service

and development of partnerships with suppliers and institutional buyers (Buhalis, 1999, 2000b).

The Internet has introduced challenges for travel agencies. Agents not only have to match the availability of information and reservation capabilities of the Internet, but they also need to provide great value when serving consumers who have access to available information. In addition, traditional travel agencies need to compete with several ICT-based newcomers, such as Expedia, Travelocity and the Internet Tourism Network, which enable consumers to have access to information and make online bookings (Buhalis, 1999, 2000b; Modahl, 2000; O'Connor, 1999).

The high dependence of travel agencies on information and communication in order to perform their role, in combination with their reluctance to take advantage of emerging technology, places traditional agencies in an extremely vulnerable position (Bloch & Segev, 1996; Garkavenko, Bremner, & Milne, 2003; Garkavenko & Milne, 2004; Poon, 1993; Richards, 1995). A "threatened intermediaries (or disintermediation) hypothesis" was introduced by Malone, Yates, and Benjamin (1987) who used the term "electronic brokerage effect" for the phenomenon. The hypothesis essentially describes the reduction or elimination of the role of retailers, distributors, brokers and other middlemen in transactions between the producer and the customer (Atkinson, 2001). One common vision of the electronic marketplace is an ideal electronic market in which consumers interact directly with producers, as manufacturers internalize activities that traditionally have been performed by intermediaries (Sarkar, Butler, & Steinfield, 1995, 1998). Although entire channel layers may not be eliminated, there could be significant shifts in power from one channel layer to another (Vassos, 1996). According to Porter (1999), the Internet is going to lead to the demise of a lot of intermediaries.

There also is a threat to travel agents' "standard products": the processing of transactions (ticketing and settlement) and the supply of raw

product information from suppliers (O'Brien, 1999). These roles will increasingly be replaced by technology as suppliers provide standard product information, electronic ticketing, and electronic funds transfer services directly to the customer. For instance, some traditional travel agents in the U.S. have reported a 10 to 20% decline in business as customers switch to online ticket purchasing (Taylor, 1998).

There are different opinions regarding the plausibility of disintermediation in the context of the travel industry. Most commentators would probably agree that the pre-Internet position of TAs is unsustainable (UNCTAD, 2000), and that TAs who fail to take advantage of the Internet are faced with a real threat. Yet, it has been pointed out that there is little empirical evidence to support any arguments and predictions relating to the future role of middlemen in the travel distribution channel (Anckar, 2003; Palvia & Vemuri 1999).

Drawing on data from surveys of managers and travel consultants of Australian travel agencies, Standing, Borberly, and Vasudavan (1998) and Vasudavan and Standing (1999) forecast that many high street retail TAs will be eliminated over the next few years. However, in a series of exploratory studies using survey data it was found that even experienced Internet users have trouble producing satisfactory travel arrangements through self-booking services (Anckar & Walden, 2000, 2002), so there may be a delayed effect in the take-up of alternatives to high street retailers.

Based on an exploratory survey among industry experts, Licata (2001) presented findings indicating that more conventional forms of distribution, such as global distribution systems (GDS) and high street shops, are likely to be bypassed or that their roles will change dramatically: Nearly all (97%) of the respondents in Licata's study agreed or strongly agreed with the statement that the Internet will be the most prominent distribution channel in five years; the corresponding figures being 20% for high street shops and 27% for GDS. Yet, the majority (70%) of the respondents

also agreed that the disintermediation of the traditional distribution channel is avoidable, and that reintermediation is a more probable outcome (Licata, 2001).

Schmitz (2000) also pointed out that the disintermediation hypothesis is too simplistic, seeing its interpretation of intermediation as a single service rather than a number of different services. Sarkar et al. (1995, 1998) argue that the case for the elimination of intermediaries as a result of e-commerce is based on a questionable assumption, concluding that more, rather than fewer intermediaries (mainly new players, cybermediaries) will be involved in electronic markets (Giaglis, 1999).

Chircu and Kauffman (1999) propose an "IDR cycle," a recurrent pattern of intermediation, disintermediation, and reintermediation, arguing that traditional non-technological middlemen will be able to reintermediate in the long run. Werthner and Klein (1999) argue that evidence of a reintermediation process can already be seen as traditional intermediaries adjust their services offering to the needs and opportunities of an electronic sales channel. Giaglis (1999) envisaged three major scenarios for electronic intermediaries: disintermediation, reintermediation (the emergence of online subsidiaries of traditional intermediaries), and cybermediation (the emergence of new entrants with intermediary functions). The authors call attention to the fact that electronic markets are still far from reaching a state of maturity, and maintain that it is extremely difficult to predict the market structure of the future and the type of intermediation that will dominate in any given market.

Internet booking is not a panacea for the whole tourism industry (WTOBC, 2001). By retaining the human touch and specialising wisely, smaller offline travel agencies can reach a reasonable level of profitability. In the agents favour are a number of unique services that dot.com travel companies and airline Internet portals have difficulty offering. These include:

- The person-to-person nature of retail travel agency businesses
- The ability of agents to offer and explain complex fare options to clients
- Agents are able to discuss the advantages and disadvantages of destination selection.
- Clients have the option of developing long-term personal relationship with agents.
- Agents can develop specialist knowledge of specific destinations. (Prideaux, 2001, p. 224)

TAs must analyse what strategies they can follow to sustain their role as middlemen. There are two directions that agents can take in this quest (Tse, 2003). The first is to improve their efficiency by repositioning themselves as low-cost agents through the Internet. Another alternative is to develop a different business model that adds value to a travel experience. Providing travel advice, enhancing customer satisfaction, and building bookings with other related services are just some of the many options travel agents need to consider to fight this trend of disintermediation. To survive, the agents should reintermediate themselves as being able to provide personal services. TAs must invest in deep learning about their target customers' preferences to find out what would most satisfy them (Tse, 2003).

The New Zealand Travel Market

The New Zealand tourism market is certainly not immune to the changes outlined above. The Travel Agents' Association of New Zealand has stated that never before has the industry experienced a period of such turbulence and change (TAANZ, 2001b). In addition to the growth of the Internet, shifts in airline ownership, the disappearance of some carriers from the New Zealand market, commission cuts, and evolving consumer demand and expectations are fundamentally altering the ways in which NZ TAs conduct business (TAANZ, 2001b).

Tension between travel agents and Air New Zealand has been growing. The airline has poured large sums of money into creating a new Web site which was designed to increase the number of Internet based bookings and sales (www.airnz.co.nz). The airline has adopted the concept of paperless travel throughout its domestic network (Kennedy, 1997). In July 2002, Air New Zealand cut its fares by up to 28% for its one-class, no-meal Air NZ Express. The price to the consumer is lower if booked over the Internet. Air New Zealand has removed a 4% commission for each domestic ticket sale (Aronson, 2002a). Travel agents have responded by launching a campaign against Air New Zealand commission cuts (Aronson, 2002b; *The New Zealand Herald*, 2002).

The impact of these changes is not hard to see. According to TAANZ, 60% of processing by New Zealand TAs is airfare related (TAANZ, 2001a) and the bulk of this involves Air New Zealand. Over the past four years, the number of travel agents in New Zealand has plummeted. TAANZ noted that the number of travel agents within their organisation dropped to 470 by 2004 from the 1999 figure of 626 (*The New Zealand Herald*, 2000). By some estimates, around two agencies were closing their door each week in 2000 (Scherer, 2001).

New Zealand agents also face challenges from principals other than Air New Zealand. In a move similar to the North American Orbitz initiative, Zuji.com launched its Web site in the Asia Pacific region in 2001. Zuji.com has 16 members, including Japan Airlines, Qantas, Singapore Airlines, United, and China Airlines. Utilising the technology of the major GDS, SABRE, the portal allows the consumer direct access to systems that were previously the domain of travel agents alone. It also should be noted that there are, like the Orbitz case, serious legal challenges to the operation (Griffin, 2002).

With very high use of Eftpos and ATM technology, as well as with high Internet connection and Hi-Tech electronic ownership, New Zealand

seems to have all the advantages for successful online business development. However, according to Deloitte Touche Tohmatsu (2000), New Zealand businesses, including those in the travel industry, are laggards in ICT adoption.

Although there are no firm figures on the total number of establishments in the NZ TA sector the total number of current TA employees can be estimated at 4800 with approximately 800-900 shops around New Zealand. TAANZ members employ 3610 staff in 533 locations. The biggest NZ travel agencies are TAANZ members except for Flight Center (approx. 1000 employees), Travel Centers (22 shops, 120 staff), Harvey World Travel (53 shops, 150 staff), STA travel (15 branches, 70 employees).

Research on the NZ Travel Agent Sector

The investigation of the New Zealand TA sector and its changes in response to ICT introduction are identified as the purpose of this study. Primary data collection started with semi-structured interviews with TA and industry specialists to identify the main issues facing the New Zealand TA sector. The research then proceeded with a follow-up of semi-structured interviews to refine the findings regarding the main issues and to investigate the evolution of TA perceptions, attitudes and relationships. This allows us to formulate theoretical assumptions regarding the TA business environment in the information era. A fully-structured online questionnaire was designed and implemented to verify the assumptions made on the basis of the in-depth interviews.

The presented study adopts qualitative methods. Qualitative analysis is part of the naturalistic method of inquiry, which assumes that reality is continually changing and that human social phenomena are so complex that it is impossible to discover anything approximating a scientific law (Oppenheim, 1992; Silverman, 2004). A goal of qualitative research is to locate the understand-

ing of a phenomenon within the context of other phenomena.

In-depth interviews with TA and industry specialists were adopted as a means of collecting data. It is well accepted that in-depth interviews are applied to enhance the knowledge of just-emerging, under-researched phenomenon (Oppenheim, 1992). Until the researcher is relatively clear on what is to be studied and how, the objective of the interview should be discovery and enhanced understanding of the phenomena. Such an understanding is derived from data grounded in the informants' experience—what they say about what they did, how they felt, or what they thought. Such a theory development objective demands an emergent design for the research process—one that is fluid and adaptable as concepts and relationships are revealed in the course of data collection, analysis, and interpretation. Unlike survey or experimental research that demands the investigator's intervention prior to data collection through the precise creation of a questionnaire, qualitative methods such as in-depth interviews involve the researcher as an interpreter mostly during and after data collection (Oppenheim, 1992).

In-Depth Interviews 2000-2001

Interviews were held with 20 senior management or owners of TA in the Auckland region by the New Zealand Tourism Research Institute during 2000-2001. A sampling method was adopted that enabled the researchers to include a cross-section of travel agent operations, including corporate/business, leisure specialists, franchise/chain retail operations, small independent enterprises, and wholesalers. The Auckland region was chosen because the city is New Zealand's major entry and departure point for tourists. Interviews with TAs were designed to elicit information on an agent's particular market, key competitive pressures, evolving relationships with airlines, the use of ICT, relationships with consumers, and main survival

strategies. Interviewees were asked whether they thought that their customers have changed with time, and if they believe consumers are ready to buy travel products online.

Research conducted in 2000 on New Zealand TA revealed that processes of disintermediation, especially driven by the national carrier Air New Zealand, were a major concern (Garkavenko et al., 2003; Garkavenko & Milne, 2004). Commission cuts by the national carrier Air New Zealand were a major focus of attention for most of those interviewed along with direct sales through the airline's upgraded Web site. The major pressure factors were identified by TAs as commission cuts and direct sale of principals to consumers (Figure 2).

In-Depth Interviews 2003-2004

The aim of the follow-up interviews was to refine the formulation of the main issues of the New Zealand travel agent market and formulate theoretical assumptions regarding the changes and main pressure factors facing this sector. In common with the 20 interviews held in 2000, a sampling method was adopted in 2003-2004 that included a cross-section of travel agent operations.

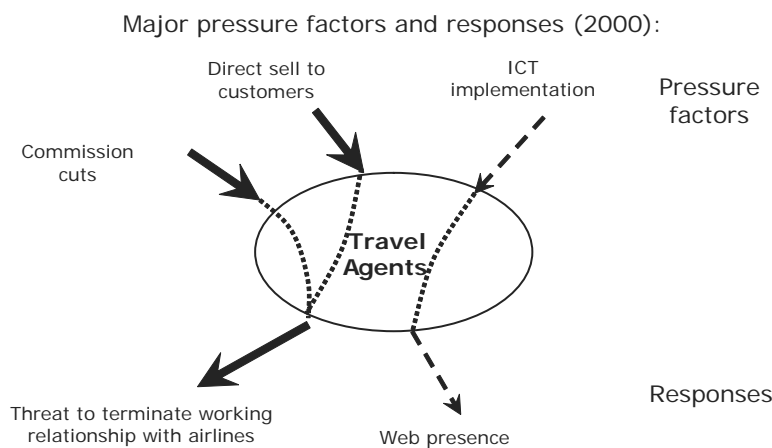
Interviews were carried out with 25 retail travel agents, owners, wholesalers, senior management, and travel sector experts in the greater Auckland region to investigate their perceptions of the effects of the changing business environment.

Interestingly, neither commission cuts, nor direct Web-based sales by airlines, were on the list of major threats in the 2003 follow-up in-depth interviews with Auckland region TAs. Given that 60-85% of profits of those interviewed are still air-fare related it appears that New Zealand TAs have begun to find ways to build a healthier relationship with the majority of airlines.

Although no single concept underpinned respondents' views of ICT importance, there were a number of recurrent themes. The Internet and other ICT are considered as commodities rather than strategic means for survival. Only one interviewee mentioned the Internet and intelligent agent software in particular as tools for adding value. No other respondents mentioned ICT as an enabling factor. Further discussion identified that interviewees don't particularly know how ICT can add value to their product, or how specialised software can make their work more efficient.

The 2003 interviews with New Zealand TA also revealed that ICT in general and the Internet

Figure 2. Major pressure factors on TA businesses and TA responses (Source: 2000 survey interviews by authors)



in particular are not perceived as a major threat to TA businesses. One of the interviewees said: “Consumers research on the Internet, and then they come to us to do bookings. It will come that they will be confident to book, but not at this stage. At this stage it is not a huge impact on what we do.” Indeed, a Travel Agents Association of New Zealand representative recently said that travellers who book through the Internet are a different clientele from those who use an agent (*Newstalk ZB News*, 2004).

National Online Survey 2004

When main issues of the TA sector and their evolution were identified and refined, a fully-structured national online questionnaire was designed and implemented. Over 120 TA businesses participated in the survey, the main aim of which was to check the following assumptions that were formulated from the analysis of in-depth interviews with New Zealand TAs:

- Commission cuts by airlines, suppliers selling directly to the consumer, the Internet and emergence of the more knowledgeable

consumer have a great impact on the TA market in NZ

- ICT and the Internet in particular are not perceived as a strategic tool by NZ TAs
- Main survival strategies are: alliances, shift to consumers, niche marketing

The national online survey of TA businesses in 2004 refined the notion of how TAs perceive major pressure factors and ICT impact on the industry (Figure 3). The findings showed that TAs perceive commission cuts, direct principal sales to consumers, the Internet, and the emergence of a new more informed consumers, as well as terrorism and health threats as major pressure factors on their businesses. In general there is much more recognition of ICT as a pressure factor after 2003.

These data reveal that there is great variation in the extent to which TAs exploit the advantages of new technologies. As has been pointed out by Gamble, Chalder, and Stone (2001) and other researchers, the major barrier in relation to new technologies seems not to be technological capacity, but uncertainty surrounding the demand for online travel and the possible resultant disinter-

Figure 3. Major pressure factors on the TA businesses and TA responses (Source: National Survey by authors)



mediation effects on the traditional travel agent. The national online survey established that TAs in big cities, especially Auckland, perceive ICT as a strategic tool. They invest in ICT earlier and that is why they do not perceive the emergence of the informed customer as a threat to their businesses.

As with Tse's work (2003), two key tendencies in TA survival strategies are identified. One tendency is a low-budget orientation, especially pronounced in franchises with high turnover (called by one interviewee "the McDonalds of travel") and small TAs catering for specific ethnic and social groups. One interviewee noted that the latter sell tickets with as little as a 2% margin to establish themselves on the market. A second business model is to focus on adding value to travellers' experiences. For example, some businesses add value to the travel product by providing expert advice regarding destinations, bundling airfare bookings with other related services such as visa support and organizing overseas working experience. One of the interviewees noted: "We will become smarter. The days of sitting in your agency and waiting for people to come in are gone."

Perhaps most importantly, the national survey revealed a greater emphasis on the competitive problems associated with the emergence of better-informed and more ICT savvy consumers. It is interesting to follow the evolution of TA perceptions of consumers during the 2000-2001 and 2003-2004 studies. This evolution can be described as a progression from a perception of the consumer as "non-skilled," "not ready to buy online" to "more informed," "more sophisticated." A lot of TAs now find that consumers come to them with a solid knowledge of their destination and ticket/hotel prices retrieved from the Internet.

The general feeling remains that the consumer is still not quite ready to buy travel products through the Internet (especially those which involve long-haul/complex itineraries). It was acknowledged that the majority of arrangements for

domestic and one-point trips will be done online in the near future. However, it was emphasised that there will be still some categories of travellers that will use TAs even for simple itineraries. Online services and information searching are still perceived as very complex, chaotic and time-consuming.

In simple terms these findings reveal that the consumers themselves are, in many respects, becoming the main 'competitors' with TAs, in terms of gathering information and searching for destination-related knowledge. One of the interviewees noted that to survive "TA have to be able to have access information 'cleverer' and 'quicker' than they [*consumers*] do. Then we will be able to charge for this." There is a general understanding that TAs should be orientated to consumers. However, customer-relationship management strategies vary considerably. None of the respondents reported being 100% satisfied with the quality of their current customer management data. Only one TA that works with several niche markets has a well-developed customer relationship strategy and an established customer database. This particular TA looks after individual customers' post-trip follow-up, as well as sending newsletters plus providing personalised services and detailed knowledge of specific destinations.

For one TA who specializes in Eastern Europeans living in NZ, success has been based on an intimate knowledge of his clients' psychology and language, and thus of their specific needs and demands. The specific product for such a group includes not just tickets, but visa support and other immigration services. In this case the TA does not have any functional customer database, relying on word of mouth in a small, relatively tight-knit, community.

TAs continue to play a vital role in the tourism distribution system. Research shows that TA are a more frequently utilised external information source by international travellers from almost all EU member states (Gursoy & Umbreit, 2004). The success of TAs relies on their ability to provide

products that suits clients' needs and wants. An understanding of those needs and wants, coupled with deep product knowledge are implicit in this assertion.

Consumer expectations and perceptions of the modern travel agent are an important element in the complex TA business environment. This is a reality that often determines the success of a TA in the disintermediation context. Gursoy and Chen (2000) and Gursoy and Umbreit (2004) state that there are national-culture differences in consumer's search and booking of travel products. These authors established that the European Union consists of distinctive segments of consumers that prefer brochures and TAs in search and booking, or the Internet, TV/radio and minitel. It therefore is relevant to find some specific characteristics of the New Zealand travel product consumer to determine if this is so in the local market.

The Pacific Asia Travel Association (PATA, 2004) reported that TAs were the most popular information source for overseas-bound New Zealand travellers. The Internet is becoming more popular in information searching with 11% of respondents using this tool. TAs were the most popular booking channel for outbound tourists in New Zealand. Only 9% of travellers booked their trips online. Nevertheless New Zealanders are frequent and skilled computer users. The Computer Industry Almanac estimates that there were 2.34 million Internet users in New Zealand in 2004 (European Travel Commission-New Media Review, 2004). In August 2001, Nua reported that 44% of New Zealand's Internet users went online to plan or book overseas holidays, up from 23% in 1999. The percentage was lower for online planning of domestic holidays, however 28% of online New Zealanders did go online to plan or book domestic holidays, up from only 10% in 1999.

Subsequent Research

While there have been some studies on the demand side of the New Zealand TAs market (Gamble et al.,

2001; Oppermann, 1998) these have not adopted an in-depth approach to understanding consumer perspectives. To embrace the complexity of the multifaceted characteristics of the TA business environment, the present research adopted a qualitative approach based on a "double-sided" analysis of TA services that included both TA and consumer's in-depth interviews. Twenty in-depth interviews with consumers were conducted.

A convenience sample was used for the consumer interviews. Rather than following a random selection routine, professionals and white-collar workers who travel regularly (two to three times a year) were approached. When selecting consumers, respondents were pre-screened and only those who use the Internet on a regular basis were asked to participate. The argument for pre-screening is that those customers who are familiar with the Internet and use it on the regular basis would have a choice between using the Internet or a travel agent in their trip preparation. The interviews mainly focused on the use of the Internet in trip planning and preparation, the (dis)advantages of using a TA for trip preparation, and the consumer's perceived role of TAs in the modern era.

The aim of the in-depth interviews with consumers was to identify their attitude towards TAs in the modern Internet era. It was found that travellers are pragmatic in choosing which channel to book through—looking for where they can get the best deal (Tse, 2003). This reflects previous findings on service attributes of travel agencies in New Zealand (Oppermann, 1998). Oppermann pointed out that differences in perceptions of the importance attached to service vary between TAs and clients/potential clients. Attributes rated highly by consumers were not considered in the same light by travel agents. The most highly rated service attribute for consumers was that the "agents give clients the best deal" and for travel agents it was "agent is courteous and friendly." Similarly, in our study there was a discrepancy between TA and consumer perceptions of quality service: during in-depth interviews TAs men-

tioned more “personalised service,” “specific product catering,” and consumers were talking more about a “better deal,” and “flexibility,” or “financial responsibility.”

The research findings also reveal that there is a gap between customer expectations and customer perceptions of the services provided by travel agents. The ideal travel agent is expected to be a professional who gives the best deal in term of prices, and has intimate destination-related knowledge. The perceived role of TAs is as a transaction facilitator and not as an information source or adviser. There is a tendency among consumers to look for information online and use a TA only for bookings and financial transactions.

The findings further show that consumers perceive competitive pricing, flexibility in arrangements and personal financial responsibility as being crucial factors when choosing/using a TA. If TAs are to survive—and thrive—in the years to come, it is important that they address the issue of what matters most to consumers. Interestingly, another study regarding online relationships examined the importance of trust in accommodation bookings in New Zealand (Fam, Foscht, & Collins, 2004).

Perceptions of the main service attributes by TA and by consumers are compared and summarized in Table 1.

It appears that considerably improved computer and Internet skills are expected by consumers from TA, and at the same time the national survey revealed that most TA respondents realise

that these factors are very important for their business progress and survival. Similarly, both consumers and TA recognise that consumers are often very knowledgeable about the travel product. On the other hand, consumers named “personal financial responsibility,” “finding a better deal” and “flexibility” as the main service attributes they look for in a TA. TAs however were talking more about “personalised service,” and “added value” as the main attributes. Consumers also see the role of TAs in the Internet era almost exclusively as “transaction facilitators.” They also were quite suspicious regarding the professionalism of TAs. While many TAs are ready to charge their customers for the services they provide there, was a great deal of hesitation regarding TAs fees among interviewed consumers.

It appears that the mainstream consumer is hesitating and can be convinced by aggressive marketing to buy travel products either online or through TAs. These findings have very important implications for TAs. If the Internet becomes more user-friendly there is no doubt that more and more consumers will purchase online. TAs will need to implement more aggressive advertising policies with a strong emphasis on their professional advice, personal financial responsibility (including the bond system), time-saving attributes, and intimate knowledge of destination. TAs also need to develop their Internet skills to compete with their customers when searching for information/best deals.

Table 1. Congruency and discrepancies in consumers’ and TAs’ perception of quality services (Source: Authors)

| Coincidences | Discrepancies |
|---|--|
| <ul style="list-style-type: none"> • TA should be more skillful in computer usage • Consumer is the main TA competitor for the travel information | <ul style="list-style-type: none"> • Main attributes of the quality service • Role of TA • Fees for TA services |

THE “SUCCESS MIX” FOR NEW ZEALAND TRAVEL AGENT BUSINESSES

The New Zealand travel agent sector is represented mainly by SMEs; almost half of them are independent or family operated. It appears that ICT adoption by New Zealand TAs is less advanced than in the USA or Europe. There is a great deal of hesitation regarding the use of ICT as a strategic tool. While the Web presence of New Zealand TAs increased considerably from 2001-2004, many are still more interested in using cyberspace for marketing rather than as a core component of overall business strategy. There are no giants in New Zealand cyberspace like Expedia or Travelocity. Indeed, online travel has proved a difficult business for local operators venturing on the Web. Local provider Travel.co.nz lost more than \$2 million in revenue of \$20 million in the year 2003.

Overall, it appears that the reintermediation process is the reality for the average New Zealand travel agency. First of all, the national survey of 2004 revealed the considerable heterogeneity of NZ TA businesses in perceived pressure factors, attitudes towards technology, relationship with the consumer, and business success. The major differences were found not between franchises and independent TAs as was expected, but between TAs from Auckland and other major cities, and those from small towns. Early recognition of the ICT impact on their businesses, and recognition of the fact of emergence of the “new” consumer gave some TA business, especially in Auckland a market advantage.

TAs that perceive their business situation as better or much better compared with three years ago point out that excellent customer service is a big part of their advantage. They recognised reasonably early that with ICT accessibility to all parties in the distribution channel the way to survive is to become a customer representative and to add value to services. TAs recognise that

there is a need to improve their computer/Internet skills to deliver a service. Successful TAs are catering to specific niche markets trying to deliver a personalised service with added value. These findings allowed the formulation of a “success mix” for TAs in New Zealand (Figure 4). The research has established that businesses which recognised the emergence of a new, more sophisticated consumer, embraced ICT as a strategic tool, and/or began to cater for niche markets are better off now than three years ago. At the same time there is another feature specific to the New Zealand TA market—all outbound travel is long haul, and much of this is complex with several stop-overs and costs a considerable amount of money. Interviews with consumers show that although they largely perceive TAs as simple transaction facilitators, they still hesitate to trust the Internet with their money and are still not quite confident to complete complex travel arrangements online in this situation. In simple terms this means that New Zealand consumers still need TAs, results replicated elsewhere (Anckar, 2003).

Nevertheless, the data reveal an intention by a growing number of consumers to abandon high street travel agencies when booking travel. Approximately half of the existing and prospective Internet bookers intend to use direct distribution approaches, whereas half intend to use the Internet merely as a communication channel to human travel agents, thereby primarily fostering reintermediation.

Although the Internet undoubtedly has the potential to revolutionize the travel distribution chain, it should be noted that many hindrances to the mass adoption of online services in travel still exist. The lack of travel agent expertise and advice is one of the greatest consumer disadvantages of electronic travel distribution. “Buy direct from the factory and save money” may be good advice for some types of products, but is generally not true for travel products. Anckar (2003) has pointed out that there are several categories of barriers for consumers booking and purchasing

online. These barriers are: lack of knowledge or experience with the Internet, technical problems, system limitations, and poor Web services, as well as difficulties in locating Web sites. Furthermore, making price comparisons is time-consuming.

Although the demand for online arrangements exists, the supply side has to be more mature and offer easy-to-use reliable ways of travel booking. It can be hypothesized that the next step in the evolution of distribution in the travel industry will be the development of special software that assists consumers in online bookings of their trips. TA will again be put in the position of adding value to their services, repeating once again the disintermediation-re-intermediation cycle.

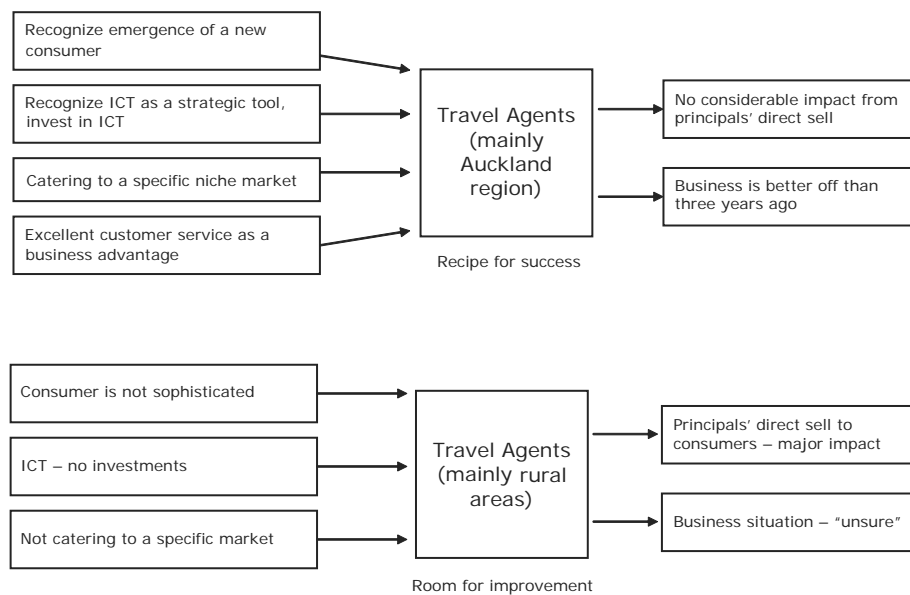
CONCLUSION

ICT has changed the competitive environment for travel agents in the New Zealand travel market. Tourism industry principals and technology providers in New Zealand are entering

the market—bypassing TAs and selling directly to consumers. This study on the New Zealand travel agent market revealed that commission cuts, suppliers selling direct to the consumer, the Internet, and the emergence of a new more informed consumer are the main pressure factors on travel agent businesses in New Zealand.

This research has also established that there is great variation in the extent to which travel agents use the advantages associated with new technology and how New Zealand travel agents perceive ICT. It seems that the major barrier in relation to new technologies is not the technological capacity of TAs, but the uncertainty surrounding the demand for online travel. The research also reveals great variability in attitudes towards ICT as a basis for sustained competitive advantage. The majority of the study participants have decided not to invest in ICT and do not perceive ICT as a strategic tool. So, while it appears that the level of ICT adoption among New Zealand travel agents is high, the use of ICT is limited to e-mailing and

Figure 4. “Success mix” for New Zealand TA businesses



information searching. The majority of NZ travel agents have Web sites, but the role of these Web sites is mainly for information and marketing rather than for e-business.

The Internet has provided several challenges for travel agents. Agents not only have to match the availability of information from off the Internet, but they also need to provide great value when servicing consumers who already have access to most of the available information.

It has been established in this chapter that the New Zealand consumer perceives travel agents mainly as “transaction facilitators” rather than a source of information or a person who intimately knows a destination or provides an unbiased deal for an airfare. At the same time, consumers pointed out that “flexibility” and “financial responsibility” are definite advantages in using travel agents. Consumers also pointed out the often chaotic nature of online information.

The New Zealand consumer is currently “hesitating” in their preference to use the Internet or a travel agent in purchasing travel products. Travel agents can use this critical time to promote their businesses more assertively, putting the emphasis on their personal financial responsibility and skills in the construction of complex itineraries as well as flexibility in changing travel arrangements to suit their clients.

REFERENCES

- Alamdari, F. (2002). Regional development in airlines and travel agents relationship. *Journal of Air Transport Management*, 8, 339-348.
- American Airlines. (2000). *American Airlines Web site*. Retrieved April 3, June 14, August 20, 2000 from the World Wide Web: <http://www.aa.com/>
- Anckar, B. (2003). Consumer intentions in terms of electronic travel distribution: implications for future market structures. *E-Service Journal*, 2(2), 68-86.
- Anckar, B., & Walden, P. (2000). Destination Maui? An exploratory assessment of the efficacy of self-booking in travel. *Electronic Markets*, 10(2), 110-119.
- Anckar, B., & Walden, P. (2002). Self-booking of high- and low-complexity travel products: exploratory findings. *Information Technology & Tourism*, 4, 151-165.
- Aronson, C. (2002a, June 12). *Travel agents boost pressure on Air NZ*. Retrieved July 5, 2002, from <http://www.nzherald.co.nz/storydisplay.cfm?thesection=news&thesubsection=&storyID=2046185>
- Aronson, C. (2002b, August 1). Price war as Qantas hits back. *The New Zealand Herald*, p. A1.
- Atkinson, R. D. (2001). *The revenge of the dis-intermediated: How the middleman is fighting e-commerce and hurting consumers*. Washington, DC: Progressive Policy Institute. Retrieved from <http://www.ppionline.org>
- Bloch, M., & Segev, A. (1996). *The impact of electronic commerce on the travel industry: An analysis methodology and case study*. The Fisher Centre for Information Technology and Management. CA: University of California.
- Bordat, P. (1999, January 20-23). Repositioning a GDS for future electronic markets. In D. Buhalis & W. Schertler (Eds.), *Information and Communication Technologies in Tourism 1999. Proceedings of the International Conference*, Innsbruck, Austria (pp. 318-327). Wein: Springer-Verlag.
- Buhalis, D. (1998). Strategic use of information technologies in the tourism industry. *Tourism Management*, 19(5), 409-421.
- Buhalis, D. (1999). The cost and benefits of information technology and the Internet for small and medium-sized tourism enterprises. In D. Buhalis & W. Schertler (Eds.), *Information and Communication Technologies in Tourism 1999. Proceedings of the International Conference*, Innsbruck, Austria (pp. 218-227). Wien: Springer-Verlag.

- Buhalis, D. (2000a). Conference report: Distribution channels in the changing travel industry. The Dorchester, London, 9-10 December 1998. *International Journal of Tourism Research*, 2(2), 137-139.
- Buhalis, D. (2000b). Tourism and information technologies: Past, present and future. *Tourism Recreation Research*, 25(1), 41-58.
- Buhalis, D., & Laws, E. (Eds.). (2001). *Tourism distribution channels: Practices, issues and transformations*. London: Continuum.
- Chircu, A. M., & Kauffman, R. J. (1999, January 5-8). Analyzing firm-level strategy for Internet-focused reintermediation. In *Proceedings of the 32nd Hawaii International Conference on System Sciences*, Maui, HI (pp. 5035-5045). Los Alamitos, CA: IEEE Computer Society Press.
- Deloitte Touche Tohmatsu. (2000, Summer). Understanding the impact of e-business. Deloitte Touche Tohmatsu Publications. *Insights: For Innovative Business Enterprises*, 10. Retrieved May 15, 2000, from <http://www.deloitte.co.nz>
- European Travel Commission—New Media Review. (2004). *Markets by country—New Zealand*. Retrieved June 9, 2004, from <http://www.etcnewmedia.com/review/default.asp?SectionID=11&CountryID=78>
- Fam, K. S., Foscht, T., & Collins, R. D. (2004). Trust and the online relationship: An exploratory study from New Zealand. *Tourism Management*, 25, 195-207.
- French, T. (1998). The future of global distribution systems. *Travel & Tourism Analyst*, 3, 1-17.
- Gamble, P., Chalder, M., & Stone, M. (2001). Customer knowledge management in the travel industry. *Journal of Vacation Marketing*, 7(1), 83-91.
- Garkavenko, V., Bremner, H., & Milne, S. (2003). Travel agents in the “information age”: New Zealand experiences of disintermediation. In A. J. Frew, M. Hitz & P. O’Connor (Eds.), *Information and Communication Technologies in Tourism. Proceedings of the International Conference, ENTER 2003*, Helsinki, Finland (pp. 467-476). Wien: Springer-Verlag.
- Garkavenko, V. & Milne, S. (2004, June 27-30). *Travel agents and disintermediation: Exploring the complex competitive environment*. Presented at the International Conference: Tourism—the State of the Art II, Glasgow.
- Giaglis, G. M., Klein, S., & O’Keefe, R. (1999, June 7-9). Disintermediation, reintermediation, or cybermediation? The future of intermediaries in electronic marketplaces. In *Proceedings of the 12th Bled International Electronic Commerce Conference*, Bled, Slovenia (pp. 389-407).
- Griffin, P. (2002). *Travel giant casts shadow*. Retrieved 10 September 2002, from <http://www.nzherald.co.nz/storydisplay.cfm?thesection=technology>
- Gursoy, D., & Chen, J. S. (2000). Competitive analysis of cross-cultural information search behavior. *Tourism Management*, 21(6), 583-590.
- Gursoy, D., & Umbreit, W. T. (2004). Tourist information search behavior: cross-cultural comparison of European union members states. *International Journal of Hospitality Management*, 23, 55-70.
- Harrington, D., & Power, J. (2001). Quality issues in tourism distribution: practices and prospects. In D. Buhalis & E. Laws (Eds.), *Tourism distribution channels: Practices, issues and transformations*. London: Continuum.
- Karcher, K. (1996). The four global distribution systems in the travel and tourism industry. *Electronic Markets*, 6(2), 20-24.
- Karcher, K. (1997). *Reinventing the package holiday business: new information and telecommunications technologies*. Gabler, Germany: Deutscher Universitats Verlag.
- Kennedy, G. (1997). Air NZ’s electronic tickets are winning the paper war. *National Business Review*, 27.

- Licata, M. C., Buhalis, D., & Richer, P. (2001, April 24-27). The future role of the travel e-mediary. In P. J. Sheldon, K. W. Wober & D. R. Fesenmaier (Eds.), *Information and Communication Technologies in Tourism. Proceedings of the ENTER 2001 Conference*, Montreal, Canada (pp. 139-149). Wien: Springer-Verlag.
- Malone, T. W., Yates, J., & Benjamin, R. I. (1987). Electronic markets and electronic hierarchies. *Communications of the ACM*, 30(6), 484-497.
- Mason, D., & Milne, S. (2002). E-Commerce and Community Tourism. In P. C. Palvia, S. C. Palvia & E. M. Roche (Eds.), *Global information technology and electronic commerce: Issues for the new millenium* (pp. 294-310). Marietta, Gerogia: Ivy League Publishing Ltd.
- Modahl, M. (2000). *Now or never: How companies must change today to win the battle for Internet consumer*. New York: HarperCollins.
- Newstalk ZB News. (2004). Net no threat say travel agents. Retrieved February 27, 2004, from <http://xtramsn.co.nz/business/0,,5112-3124930,00.html>
- New Zealand Herald, The. (2000, December 17). p. C9.
- New Zealand Herald, The. (2002, August 12). *Editorial: Beating the net threat*. Retrieved August 28, 2002, from <http://www.nzherald.co.nz/storydisplay.cfm?thesection=news&thesubsection=&storyID=2348908>
- New Zealand Herald, The. (2004, April 28). Security crackdown predicted on Internet flight bookings.
- O'Brien, P. F. (1999). Intelligent assistants for retail travel agents. *Information Technology & Tourism*, 2(3/4), 213-228.
- O'Connor, P. (1999). *Electronic information distribution in tourism and hospitality*. Wallingford: CABI Publishing.
- O'Conner, P., & Frew, J. (2002). The future of hotel electronic distribution: Expert and industry perspectives. *Cornell Hotel and Restaurant Administration Quarterly*, 43(3), 33-45.
- Oppenheim, A. N. (1992). *Questionnaire design, interviewing and attitude measurement* (2nd ed.). New York: Continuum.
- Oppermann, M. (1998). Service attributes of travel agencies: A comparative perspective of users and providers. *Journal of Vacation Marketing*, 4(3), 265-281.
- Palmer, A., & McCole, P. (1999). The virtual re-intermediation of travel services: A conceptual framework and empirical investigation. *Journal of Vacation Marketing*, 6(1), 33-47.
- Palvia, S., & Vemuri, V. K. (1999). Distribution channels in electronic markets: A functional analysis of the "disintermediation" hypothesis. *Electronic Markets*, 9(2), 118-125.
- PATA. (2004). *Online travel agents cast their web wide by Deloitte*, from <http://www.pata.org/mbrarea4.cfm?pageid=167speechid=69&datatable=currentissues>.
- Poon, A. (1993). *Tourism, technology and competitive strategies*. Oxford: CAB International.
- Porter, M. (1999, October 25). The net won't transform everything. *Inter@ctive Week*. Retrieved from www.zdnet.com
- Prideaux, B. (2001). Airline distribution systems: the challenge and opportunity of the Internet. In D. Buhalis & E. Laws (Eds.), *Tourism distribution channels: Practices, issues and transformations*. London: Continuum.
- Richards, G. (1995). Retailing travel products: bringing the information gap. *Progress in Tourism and Hospitality Research*, 1(1), 17-31.
- Sarkar, M. B., Butler, B., & Steinfield, C. (1995). Intermediaries and Cybermediaries: A continuing role for mediating players in the electronic

- marketplace. *Journal of Computer-Mediated Communication*, 1(3), 1-9.
- Sarkar, M. B., Butler, B., & Steinfield, C. (1998). Cybermediaries in electronic marketplace: Toward theory building. In J. Sheth, A. Eshghi & B. Krishnan (Eds.), *Internet marketing* (pp. 252-261). Orlando: Harcourt College Publishers.
- Scherer, K. (2001, December 20). Travel flies to the Net. *The New Zealand Herald*.
- Schmitz, S. W. (2000). The effects of electronic commerce on the structure of intermediation. *Journal of Computer-Mediated Communication*, 5(3).
- Silverman, D. (Ed.). (2004). *Qualitative research: Theory, method and practice* (2nd ed.). London: SAGE Publications.
- Smith, C., & Jenner, P. (1998). Tourism and the Internet. *Travel & Tourism Analyst*, 1, 62-81.
- Standing, C., Borberly, S., & Vasudavan, T. (1998). Re-engineering travel agencies with the World Wide Web. *Electronic Markets*, 8(4), 40-43.
- TAANZ. (2001b, July). TAANZ Actions. *Industry News*, 19.
- TAANZ. (2001a). Handbook 2001. In *Travel industry directory & information guide 2001*.
- Taylor, P. (1998, October 27). Middle men deleted as word spreads. *The Financial Times*.
- Tretheway, M. W., & Oum, T. H. (1992). *Airline economics: Foundations for strategy and policy*. Vancouver, BC: Centre for Transportation Studies, University of British Columbia.
- Tse, A. C.-b. (2003). Disintermediation of travel agents in the hotel industry. *International Journal of Hospitality Management*, 22, 453-460.
- UNCTAD. (2000, July 27). *Electronic commerce and tourism: New perspectives and challenges for developing countries* (United Nations Publication TD/B/COM.3/EM.9/2). Retrieved 15/10/2005, from <http://www.eyefortravel.com/papers/ecom-tour.pdf>
- Vassos, T. (1996). *Strategic Internet marketing*. Que Corporation.
- Vasudavan, T., & Standing, C. (1999, February 10-13). Web technology diffusion and service offerings by travel agencies. In *Tourism & Hospitality: Delighting the Senses 1999. Proceedings of the 9th Australian Tourism and Hospitality Research Conference*, Adelaide, South Australia. Canberra: Bureau of Tourism Research.
- Wardell, D. J. (1998). The impact of electronic distribution on travel agents. *Travel & Tourism Analyst*, 2, 41-55.
- Werthner, H., & Klein, S. (1999). *Information technology and tourism: a challenging relationship*. Wien: Springer-Verlag.
- WTO. (1995). *Global distribution systems in the tourism industry*. Madrid: World Tourism Organisation.
- WTOBC (World Tourism Organisation Business Council). (2001). *Internet poised to take a quarter of tourism sales*. Retrieved December 18, 2001, from http://www.world-tourism.org/newsroom/Releases/more_releases/October2001/011023.htm

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper, pp. 50-74, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Section 6

Managerial Impact of Information Communication Technologies

This section presents contemporary coverage of the more formal implications of ICT, more specifically related to the corporate and managerial utilization of information sharing technologies and applications, and how these technologies can be facilitated within organizations. Core ideas such as IT-related training and continuing education as well as the efficiency and effectiveness of ICT in modern organizations are discussed throughout these chapters. Contributions within this section seek to answer the fundamental question of ICT implementation in organizations—how can particular technologies best be integrated into businesses and at what cost? Particular chapters provide methods for integrating ICT into the workforce and offer feedback from employees and employers regarding the future of ICT in the modern organizations.

Chapter 6.1

Holistic Approach to Align ICT Capabilities with Business Integration

Marc Rabaey

Royal Military Academy and Vrije Universiteit, Belgium

Herman Tromp

Ghent University, Belgium

Koenraad Vandenborre

Hogeschool Gent and Ghent University, Belgium

ABSTRACT

In this ever faster changing world, organizations have to adapt quickly to changes in the market or its environment. Business integration, within one or between multiple organizations, is one of these changes imposed on organizations. In some cases, information and communication technology (ICT) is an enabler of an effective and efficient integration, but in other cases, ICT is one of the reasons of failure to this integration. In this chapter, a holistic approach to align ICT capabilities with business integration is proposed. In this proposal, a broader perspective is taken in which not only ICT, but also cultural and social aspects, are taken into account.

INTRODUCTION

Business integration is becoming more and more important in the current business landscape due to changing market dynamics, changing legislation, mergers and acquisitions. Business integration, however, does not stand on its own. The need for integration is a demand from the business, emerging from the business strategy of a company, itself derived from the grand strategy of that enterprise.

On the other hand, the need for business integration implies challenges on an enterprise's ICT department and the ICT **capabilities** it puts to the disposition of the business to assist in realizing the business strategy.

In this chapter, a holistic approach for the alignment of **business integration** with the necessary ICT capabilities is described. This holistic approach encompasses the set-up of an interdisciplinary forum (**IF**) whose task is to align the business strategy with the resource strategy and whose output consists of Service Level Agreements (SLAs) for human resources (HR), finance, ICT. The IF is the implementation of the holistic approach and, therefore, it cannot solely be a collection of technocrats. The IF takes into account the mission statement, the vision and the values of an enterprise. Values especially are a differentiating factor between organizations and define the organization's culture, a typical social phenomenon.

For every SLA, a steering plan and steering group is formed, guarding the negotiated SLA. In the holistic approach, the IF further delegates the SLA for ICT to the Enterprise Architecture, which serves as guardian of the ICT capabilities and ICT assets.

In the remainder of this chapter we will discuss the IF in general. Then, we discuss our view on Enterprise Architecture and how it relates to the IF. Following, it is time to tackle business integration's impact on Enterprise Architecture. The theoretical foundations as laid down in this chapter are evaluated against a case. Finally, we conclude with a summary.

THE INTERDISCIPLINARY FORUM

Context

Business integration, be it within the boundaries of one enterprise or between enterprises, is about the business value expected to be obtained through exchanging services and information between **business processes**. How to exchange the information is a technical challenge whose solution depends on the technology portfolio and the ICT capabilities of the ICT departments

responsible for implementation of the business integration. Why and what information should be exchanged are answered by analyzing the business needs. Hence, the information to be exchanged is dependent on the business strategy which, in turn, is an outcome of the grand strategy of the enterprise.

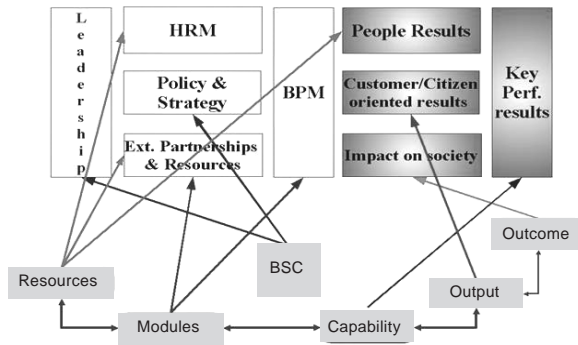
Rabaey, Hoffman, and Vandenborre (2004) argue, through a mapping of military strategy to civilian organizations, that for each resource a resource strategy has to be developed in function of the core business and, in doing so, it will maximize the achievement of the enterprise's main objectives. This resource strategy is, in contrast with the business strategy, not a direct derivative of the grand strategy, but it is aligned with this grand strategy.

Therefore, considering the differences in defining business and resource strategies, an alignment between these two has to be put in place. This is done through setting up an IF, which consists of experts in the field of the business strategy as well as experts from each resource field. The output of this IF is descriptions of services (through SLAs) and Resource Allocation Agreements (**RAA**) delivered by the different resource fields to the core business processes. For that reason, the supportive business units are made accountable for realizing the business strategy.

The discussion framework is based on a self-assessment technique of Malcolm Baldrige, European Foundation of Quality Management (EFQM) and Common Assessment Framework (CAF). These frameworks take topics as strategy, process management, leadership, partners and personnel into account. In the results, indicators are defined to check the critical issues.

The advantage of choosing a self-assessment technique as foundation for the working of the IF is that in doing so, the social and cultural characteristics of an enterprise or network of enterprises are taken into account. Considering **business integration**, the **IF** brings a consensus on (enterprise) cultural differences and establishes

Figure 1. Relationship CAF, BSC, and BPM



an appropriate culture (values) for the particular business processes.

Figure 1 shows the upper part the CAF model, in which Business Process Management (BPM) is a separate criterion. Much attention is given to BPM because **business processes** deliver the **capabilities** to attain the goals set by the business strategy. These capabilities in turn deliver the output to achieve the desired effects (outcome). To be able to compare the effects resulting from a business process with its desired effects, performance management should be integrated.

Regarding performance management, Kaplan and Norton (1996) have proposed the Balanced Scorecard (BSC). The four perspectives in their original work are “financial,” “clients,” “internal processes” and “learning and growth.” The main advantages of this model are its balancing of long-term with short-term objectives, its balancing of financial with non-financial objectives, but above all, the strategy map (cause-and-effect diagram).

Self-assessment techniques, however, overlap a lot with the BSC: ‘BPM’ with ‘internal processes,’ ‘customer’ with ‘clients’; and indicators and initiatives often tend to be the same. Therefore, the BSC should focus on the performance of an organization; however, still balanced: the generation of capabilities and the (operational) use of

these capabilities. This leads to an adaptation of the BSC as introduced on the Second European CAF Event (Rabaey, 2005) and here illustrated in the lower part of Figure 1. That the BSC and CAF complement each other is also illustrated in Figure 1.

The business unit wishes to have effects (*outcome*) in the society (CAF criterion (crit) 8) by giving a good service or product (*output*) to the citizens and organizations (Crit 6). Therefore, it needs *capabilities* (measured by Crit 9), which are generated by *modules* (processes, Crit 5), using resources (Crit 3, 6, 4). The mission statement, vision and values are defined by the managers of the operational strategy (Crit 1, 2). This leads to the following five perspectives in the adapted BSC: outcome—output—capabilities—module—resources. Regarding investments and evaluation of the business unit, this type of BSC is an extension of the CAF implemented in the **IF**, the IF serving as the global framework.

To avoid the sub-optimal deployment of all resources in the whole organization, a global IF session has to be held at corporate level. The same type of BSC for the business units may be used to guide the strategic leadership of the organization.

Business Architecture as Input for the IF

Business processes are dependent on changes in the internal or external environment. These changes may force the organization to adapt its business processes. A description of the adaptation of the business process, taking the former as well as the new situation into account, must include the process’ desired effect, the SLAs the process provides, the SLAs the process is dependent on and the current **RAA** for that process. This kind of description of a business process is part of the business architecture of that process and will be discussed in depth by Enterprise Architecture.

The description of the changes needed in the business process and the impact of these changes serves as input to the IF.

Decision Process

The IF evaluates the proposals it receives based on the pros and cons of the suggested **business process** adaptation, the cost involved, the **SLAs** the business process delivers, the SLAs the process is dependent on and the RAAs. The evaluation is based on a self-assessment technique; for instance, Malcolm Balridge. The last step in the evaluation of proposals for changes in business processes is prioritization, and from this prioritization choices are made. Once the choices are approved by the decision-maker, elaboration of the changes can be started.

For every resource involved in the change, the steering plan needs to be adapted, the SLAs are refined starting from the embryonic description of the SLAs in the proposal for the change to the business process and new RAAs must be negotiated. This decision process is illustrated in Figure 2.

Worthy to note is that SLAs can be provided by external partners.

Although it is clear that the IF is not an ICT-specific forum, it also deals with finance, HR ..., we limit ourselves in the remainder of this chapter to discussing the cooperation between the IF and ICT.

ENTERPRISE ARCHITECTURE

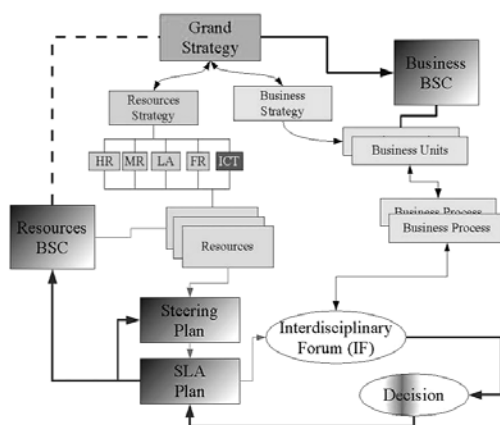
Enterprise Architecture's Role

Many different interpretations of the term **Enterprise Architecture** exist. These interpretations studied in the **IF** range from, at one end of the spectrum, the list of technological choices made in an organization concerning infrastructure and application design, to the other end of the spectrum, wherein Enterprise Architecture encompasses these technological decisions but also sets guidelines to information architecture and business architecture.

From observations and day-to-day practice in large-scale organizations, we learned that it is a necessity to consider Enterprise Architecture broader than merely infrastructure architecture and application architecture. This necessity stems from the fact that applications are built to support business processes and operate on information gathered through these business processes. Hence, architecture only concerned with infrastructure and application design is insufficient to support a business, because such an Enterprise Architecture has no view on the business and its dynamics and, hence, it cannot take precautions for changing business requirements or the reuse of certain artefacts in other business domains.

For these reasons, we always consider an Enterprise Architecture as consisting of distinguished levels. The naming of the distinguished levels may be different, but at least the general ideas as described hereunder should be part of the **Enterprise Architecture**:

Figure 2. IF: decision process



- Business Architecture
- Information Architecture
- Application Architecture
- Infrastructure Architecture

Business Architecture is about the description of the **business processes** as viewed from a business perspective and not, as is often misinterpreted, an ICT perspective. This description must certainly include how the business process is operated, which tasks or sub-processes are done by people, which tasks or sub-processes are automated, which **SLAs** the business process delivers to other processes, which SLAs from other business processes it is dependent on and what the RAAs involved are.

Information Architecture describes the information on which the business is dependent. This description must pay attention to where information enters the **business processes**, how this information enters the process (electronically or by other means), who is the owner of the information and by whom it is used. A very important artefact in Information Architecture is a matrix describing which information entities play a role in which business processes, which information entities are implemented in which applications and which applications serve which business processes. This matrix is often called the city map. State-of-the-art information architecture is an invaluable asset for Decision Support Systems (DSS) as described by Rabaey, Leclercq, Vandijck, Hoffman and Timmerman (2005b).

Application Architecture is about how to implement the applications or IT systems, the programming paradigms and languages, the development environment, software documentation guidelines, release to production procedures and so forth.

Infrastructure Architecture deals with guidelines concerning hardware platforms, network infrastructure, operating systems and so forth.

A definition for **Enterprise Architecture** taking into account the above requirements is given

by Ross (2003, p. 5): “An Enterprise Architecture is the organizing logic for applications, data and infrastructure technologies, as captured in a set of policies and technical choices, intended to enable the firm’s business strategy.”

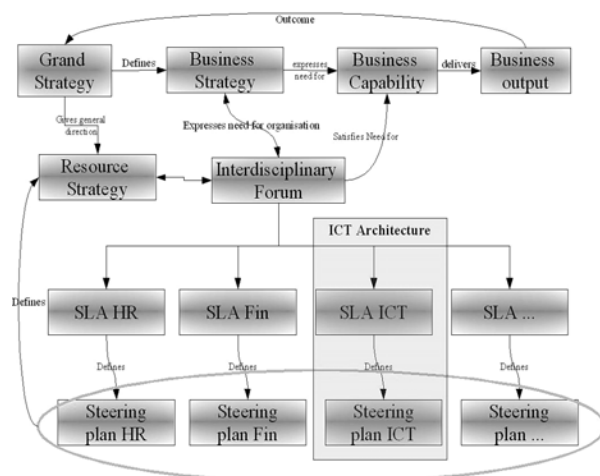
As a consequence of taking the above definition of Enterprise Architecture, the negotiation, implementation and maintenance of the ICT-related SLAs, following from the IF is the task of the Enterprise Architecture.

Schematically this can be depicted, as in Figure 3.

Prerequisites for a Successful Enterprise Architecture

Identifying the need for an **Enterprise Architecture** as a business-supportive entity and giving it the responsibilities to realize its specific **SLAs** as defined in the IF is a major step. But, by itself, that is not sufficient to have a successful Enterprise Architecture. Many other considerations play a role. For Enterprise Architecture to accomplish a successful realization of strategic business benefits, it must satisfy three major characteristics as described by Ross (2004): senior management involvement, project methodology and the level of architecture maturity.

Figure 3. IF and Enterprise Architecture’s role



Holistic Approach to Align ICT Capabilities with Business Integration

First, senior management involvement stretches in time further than the initial planning phase, with active involvement and having knowledge about ICT architectural principles and implementation.

Second, Enterprise Architecture must be built into the project methodology. Every business supporting project formulated through a business case can no longer, as was often the case in the past, be built as a silo application without taking into account past implementations and future directions. This, however, has a repercussion on the way people are used to working, and from change management, it is known that people are quite resistant to changes in the way they work. This again implies that long-time senior management involvement, combined with a change management track, is an inevitable stage to attain a successful Enterprise Architecture. Furthermore, the project methodology should be extended with stages in which enterprise architects validate a proposed solution to an implementation against the set of policies forming the Enterprise Architecture. Again, this is a change in the way of working and is often considered to be a delay for the project at hand.

Third is the level of Architecture maturity, as described by Ross (2003). An organization cannot decide from one day to another to install an Enterprise Architecture. This is a process that

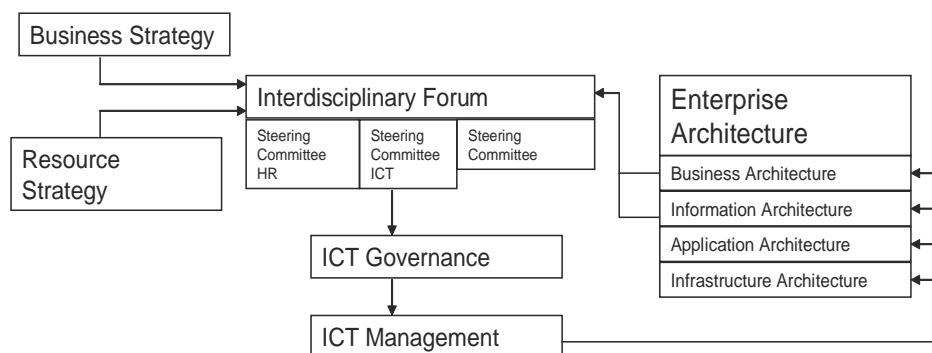
takes quite some time, depending on the size of the organization and the organization’s implicit ability to react agilely and flexibly to new conditions. The four stages identified by Ross (2003) are:

Application Silo Stage in which the Enterprise Architecture is just the collection of the architectures of isolated applications, often implemented in different technologies. Integration and information exchange efforts are characterized by being point to point and ad hoc. In this stage, resources are focused on delivering individual applications through own development or vendor package installation. A typical characteristic of this phase is that each application defines its own transactional data.

Technology Standardization Stage as the first step towards an enterprise wide Enterprise Architecture in which technology gets standardized and often centralization is put in place. The deployment of resources shifts from application development into the development of a shared infrastructure. This phase is further often characterized by the introduction of data warehouses and sporadic and not institutionalized business management participation.

Data Rationalization Stage characterized by an expansion of the enterprise architecture to include process and data standardization. The deployment of resources shifts from application development into data management and infra-

Figure 4. ICT Governance in relation to the Interdisciplinary Forum



structure development. The involvement of senior business managers becomes institutionalized and a dialog between business managers and IT becomes common practice. Very important in this phase is the shift of data ownership from IT towards the business. This phase is further often supported by tools like ERP, CRM...

A Modular Architecture characterized by enterprise wide global standards with loosely coupled applications and data and technology components to preserve the global standards while enabling local differences through modules extending the core processes.

How to set up an Enterprise Architecture in practice within an enterprise is described in great detail by Heinckens (2004), based on experiences gathered in the actual set up of an Enterprise Architecture department within a multinational organisation.

ICT Governance

Since the concept of ICT Governance is becoming more and more important in larger organizations concerned with ICT technology, it is relevant to map the suggestions made in this chapter to notions of ICT Governance in industry.

Broadbent et al. state that IT Governance is about who is entitled to make major decisions, who has input and who is accountable for implementing those decisions. IT Governance is therefore not synonymous with IT Management, but is about decision rights, whereas IT Management is about making and implementing specific IT decisions (Broadbent, 2003).

Therefore, the IT Governance processes put in place must be aligned with the Interdisciplinary Forum and will have repercussions on the ICT SLAs and the ICT Steering Plan. Broadbent and Weill (2003) argue that IT Governance combines three components:

IT Domains being the areas where decisions need to be made at the intersection of business and information technology. Five main IT domains

are distinguished: IT Principles, IT infrastructure strategies, IT Architecture, Business application needs and IT investment and prioritisation.

IT Governance styles specifying who delivers input for the decisions and who makes the decisions. Six different governance styles are distinguished, involving different combinations of business and IT executives at different organization levels.

ICT governance mechanisms, which are used to make and enact the decisions. Amongst the frequently used mechanisms Broadbent and Weill (2003) refer to the executive committee, IT councils, the IT leadership group, business/IT relationship managers and service-level agreements.

Combining the observations from Broadbent and Weill (2003) with the principles leading to the Interdisciplinary Forum leads to Figure 3.

The ICT Steering Committee is responsible for the definition of the SLAs and RAAs concerning ICT. In the adapted BSC, as introduced in paragraph "The interdisciplinary Forum: Context", this is the output level. Taking the steering plan as input, ICT Governance defines the tasks for the ICT Management which in turn is responsible for the implementation of the decisions made on ICT level. The day to day follow up of these activities in the four defined architectural areas is the responsibility of the ICT Management.

Service Level Agreements for ICT

Rabaey et al. (2004) define a matrix leading to as well plans for the different business processes in an organisation as for the SLA plans for the different business and business supportive domains. This matrix contains in one dimension the service providers and in the other dimension the service clients. Note that a business process or a supportive domain can act at the same time as service provider and as service client. The SLA plan for ICT is the union of the SLAs ICT has to deliver towards its clients. Figure 5 illustrates this graphically.

Figure 5. SLA Plan for ICT

| | | Service Providers | | | | | | | |
|-----------------|--------------------|--------------------|--------------------|-----|----|--------------|-----|--------------------|-------------------------|
| | | Business Process 1 | Business Process 2 | ... | HR | ICT | ... | External Processes | |
| Service Clients | Business Process 1 | | | | | SLA | | | Business Process 1 Plan |
| | Business Process 2 | | | | | SLA | | | |
| | ... | | | | | | | | |
| | HR | | | | | SLA | | | |
| | ICT | | | | | SLA | | | |
| | ... | | | | | | | | |
| | | | | | | ICT SLA Plan | | | |

As stated in the previous paragraph on ICT Governance the SLA plan is the outcome in the adapted BSC. How the investment or disinvestments in resources and modules should generate the capabilities to be able to come to this output is part of the steering plan for ICT.

Limitations on ICT

Despite the ubiquitous presence of information technology tools, ranging from Business Process management and modelling tools, workflows, programming languages, database management systems... organizations and business users are still confronted with lots of difficulties in automating their processes, just think about the number of projects failing to stay within time and/or budget.

Lots of effort has been put in trying to capture the richness of the business landscape into ICT artefacts, we mention for instance ERP packages, IBM's San Francisco project, EDI, XML... and still business users are confronted with very limited reuse of very expensive ICT artefacts. This leads us to the question why ICT is still not able to fulfil business needs.

Crucial to the correct working of the automated processes is the correctness, the availability and the quality of the information these processes operate on. This information is fetched and

stored in databases, which get accessed through programs developed aligned with the application architecture and which are stored on the hardware platforms as defined in the infrastructure architecture. From this point of view, it is the database that contains the information the processes rely on. Hence, the database, enriched with programming logic, dictates how information is stored and what the semantics of the information are.

Semantics of information are deduced from business requirements gathering and are for instance described through the use of "Use Cases". Afterwards these requirements are translated into programming language and database artefacts. This means that the full richness of the business problem at hand has to be written down in programming language and database constructs. The expressiveness of programming languages and databases however is much lower than the expressiveness of natural languages. Furthermore, the relations between software artefacts, be it objects in an object oriented language, tables in a database or the relations to map the objects to the database are not flexible. So it takes a lot of development and testing effort to change relations between software artefacts. This has as a consequence that if for instance a relation between software artefacts is misconceived in the gathering of the requirements, or the relation has to change due to a change in the business process or due to external circumstances (for instance a changing legislation) the database, the access logic to the database and possibly the presentation logic has (partially) to be redeveloped and retested.

As an example we describe what happened in a rather small but business wise significant project. The original project was estimated to be two hundred man-days and was to be delivered within 3 months. In the requirements gathering it was stated and confirmed by the business user that there was "one national representative organisation per country". In ICT terminology this means that there was a one to one relation between the national representative and a country.

The application was built according to this requirement. During development of the questionnaire, an essential part of the application, where the requirements stated that next to a general list of questions, each national representative organisation had to be able to add specific questions it was discovered that the relation between the national representative organisations and countries was many to many, meaning that one national representative organisation could be responsible for more than one country and that in one country there could be more than one national representative organisation.

The impact on the application was enormous; the total effort due to the misconception of this relation was approximately 20 man-days, being 10% of the initial estimated effort. Even more unfortunately, there was no time to do the necessary changes and an emergency solution was put in place. This emergency solution solved the problem technically but ruined the possible reuse of parts of the application due to the application specific interpretation that was given to certain data in the database.

BUSINESS INTEGRATION'S IMPACT ON ENTERPRISE ARCHITECTURE

Figure 6 gives an overview of the relationships between the different levels of strategy. The Grand Strategy determines the Business Strategy and defines the principles of the Resources Strategy. ICT is part of the Resources strategy. If the Grand Strategy states that synergy with other companies has to be sought, then a principle for ICT may be to conceive an architecture based on open standards or a Service Oriented Architecture.

Business people and Resources delegates meet each other in the Interdisciplinary Forum, where the Operational Strategy is defined. Business processes are designed to achieve the goals (effectiveness) with the most optimal use of resources (efficiency).

Figure 6. Relationship between different strategy levels

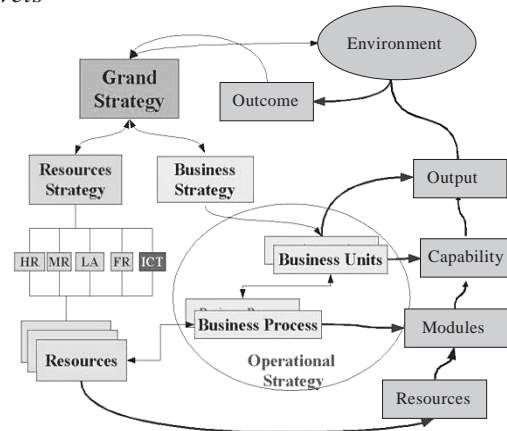
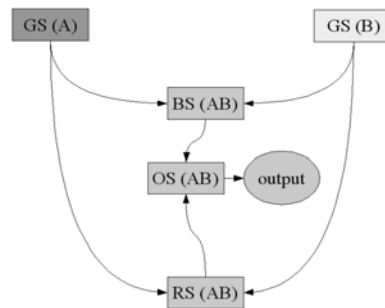


Figure 7. Strategy Integration

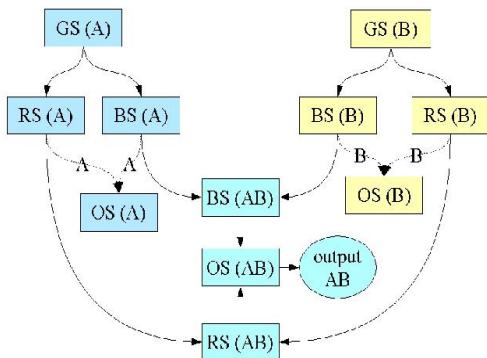


Business integration is about the cooperation of two or more entities acting as a single unit to obtain a certain goal. If for each involved entity the model, as described in the previous paragraph is used, decisions must be taken on the level of integration of business strategy, resource strategy and Enterprise Architecture. The possible levels of integration, looked upon from a strategy perspective, are described in the following paragraphs.

Strategy Integration

By the term “Strategy Integration” is meant the deduction of a common Business Strategy BS(AB) based on the Grand Strategy of two participants A

Figure 8. Strategic Integration



and B together with a common Resource Strategy RS(AB).

We do not further consider the case for Strategy Integration for it means that everything is integrated. The impact on the Enterprise Architecture in this case is that the respective individual Enterprise Architectures cease to exist and merge into a common Enterprise Architecture AB.

Strategic Integration

If the common interest of two or more parties is of such a strategic importance that one or more business processes are integrated and possibly business units are integrated, the term Strategic Integration is used. Its main characteristics are the set up of a common Business and Resource Strategy, next to the individual Business and Resource Strategies of the involved parties. The impact of this kind of integration on Enterprise Architecture is that for the integration purposes a common SLA and Steering Committee is formed which will exist for the duration of the integration effort. Parts of the Business Strategy and Resource Strategy of as well A as B are separated from A and B and put in the common Business and Resource Strategy of A and B. This has as implication that also part of the SLAs of A and B are split of in a common SLA for A and B.

Figure 9. Operational Integration

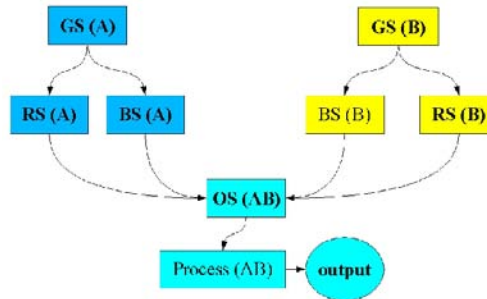
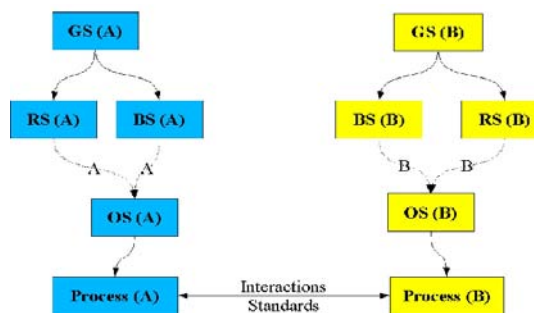


Figure 10. Operative Integration



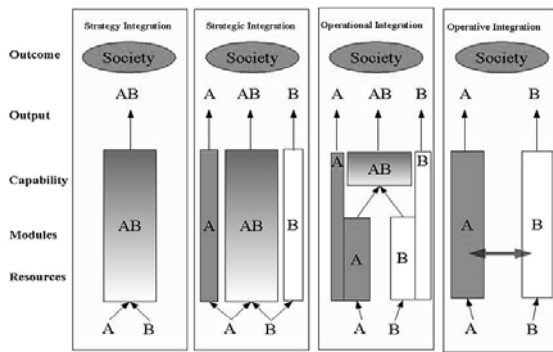
Operational Integration

Within Operational Integration, no common Business and Resource Strategy is set up. From the respective individual Business and Resource Strategies of A and B, a common Operational Strategy is deduced. For the Enterprise Architecture this means that again the respective individual Enterprise Architectures of the individual involved parties are conserved, however, in contrast to the case of Strategic Integration, no common SLAs are defined and no common Steering Committee is formed. This has as implication that part of the SLAs for as well A as B contains SLAs for A and B. The same goes for the Steering Plan.

OPERATIVE INTEGRATION

Operative Integration is, looked upon from a strategic point of view, the weakest of the possible

Figure 11. Balanced Scorecard Extension: Capability Generation



forms of integration. In this case, no common Business Strategy, no common Resource Strategy and even no common Operational Strategy are formed. The impact on Enterprise Architecture is that for the realisation of the integration merely interaction standards between business processes have to be defined. For these purposes, no SLA or Steering Plan has to be defined, a merely commercial contract between two or more parties is sufficient.

It is very useful to take another view (see Figure 11 on these different possible forms of integration, based on the adaptation of the Balanced Scorecard of Kaplan and Norton (1996) to non-commercial organisations as described by Rabaey (2005).

For what concerns the set up of the resource strategy for Enterprise Architecture, 5 key management mechanisms have been defined by Ross (2004):

- Clear Statement of ICT Architecture guiding principles
- The writing of business cases for architecture investments (see the case description for BIRB in the next paragraph)

- The forming of an IT Steering Committee
- A one page graphic depicting the high-level architecture
- A technology research and adoption process enabling project architects to align with the Enterprise Architecture

CASE: BIRB

The Company

Within the framework of the agriculture policy of the European Union, the Belgian Office of Intervention and Refunds (BIRB) is a federal agency, which is charged with Interventions, Refunds and Support Measures payments of financial subsidies to economic organisations that are not producers. The tasks of BIRB are:

- **Payment of Refunds:** A refund is a subsidy when agricultural products are exported outside the European Union (EU).
- **Issue of certificates:** A certificate is a document needed for import and export of agricultural products.
- **Management of intervention measures:** An intervention can be a direct purchase or direct support of storage of surpluses
- **Management of support measures:** Support for production, treatment and market promotion of agricultural products

BIRB's business partners are manifold and have very heterogeneous ICT-systems. Regarding business integration, at the strategic integration level, BIRB hosts common applications. Next to these strategic integrations, BIRB has a case for operational integration; however most of the cases are based on operative integration. It is BIRB's strategy to integrate its processes with its partners' processes in order to provide a better service.

Free Food Distribution

Free Food Distribution (FFD) is an instrument of social aid of the European Union. The surplus of agricultural raw produce is transformed into food, which is freely distributed to people in (social) distress.

The policy of BIRB is make every process as paperless as possible (Grand Strategy) and as a consequence to make every process web-based (Resources Strategy). The Free Food Distribution (FFD) has been chosen to be the pilot project to implement the e-Government policy of the BIRB, because it is quite independent from other processes but has the greatest amount of clients.

The first interdisciplinary forum session had as result that to change the manual FFD processes into an “e-government process” (as paperless and Web-based as possible), a Business Process Re-engineering (BPR) (Hammer et al. 1993) had to be performed. A list of possible solutions was presented to the Director-general, who decided on the scenario to be implemented.

Since the process should be almost paperless and web-based, a further business analysis is being performed together with the ICT department and using CAF, before the next interdisciplinary forum session. The chosen solution is based on Service-Oriented Architecture (SOA) and Business Process Execution Language for Web Services (BPEL or BPEL4WS). In what follows, the used evaluation technique is discussed.

Cross Border Business Collaboration

Cross Border Business Collaboration (XBC) is an extension of an Enterprise Application Integration (EAI) evaluation framework as is discussed in detail in Rabaey et al. (2005a).

The integration of processes may also affect other processes. All the processes are catalogued in the Process-Process Matrix (PP-matrix in Figure 12) where the relationships between the

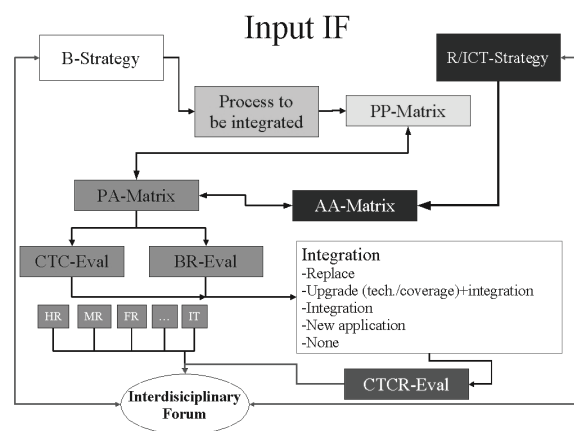
processes are described (supporting, collaborative, etc.). Most of the processes are supported by ICT-applications (noted in Process-Application Matrix (PA-Matrix). The interconnection of applications is mapped in the Application-Application

Matrix (AA-Matrix: file transfer, web services, API, and so on). The PP, PA and AA matrices are an implementation of the city map as discussed in the paragraph on Enterprise Architecture’s role.

When the consequences of the business integration or EAI are known, three evaluations take place. The first two evaluations are a CTC-Eval (Cost-Technical-Coverage Evaluation) and a BR-Eval (Business-Resources Evaluation: detection of Core Business Processes and/or Resources processes). The result of both evaluations indicates which actions should be undertaken. Possible actions are the replacement or upgrade of an application, the integration of one or more applications, the deployment of new applications or no action has to be undertaken. During the third evaluation (CTCR-Eval: Cost-Technical-Coverage-Risk Evaluation) all possible solutions are discussed. The Interdisciplinary Forum in turn evaluates these alternatives in a broader context.

In the case of the BIRB, the introduction of SOA to enable a BPEL implementation of the

Figure 12. Cross Border Business Collaboration



Free Food Distribution had a lot of impact on the existing architecture and on the culture at BIRB. Since the investment decision making process is characterised by uncertainty and incomplete knowledge, the real options approach was used.

The need for EAI rises from the technical side or from the business side of the organisation, which is also the case for Cross Border Business Collaboration. Until now we have discussed the business approach to EAI. The business needs find their origin in a change in the business or grand strategy, in business integration or in business process reengineering (BPR).

Resource-strategy driven EAI/XBC may be due to a change in the resources or grand strategy, efficiency issues (better use of resources), systems that may be technically obsolete or the introduction of new technology. In many cases, ICT is at the base of resource-strategy driven EAI/XBC.

In the latter approach, the evaluation will start with the Application-Application matrix. Via the Process-Application matrix the involved processes are detected. Then the influence on other processes is determined through the Process-Process matrix. It may occur that the business strategy has to be reviewed because of new, possible business op-

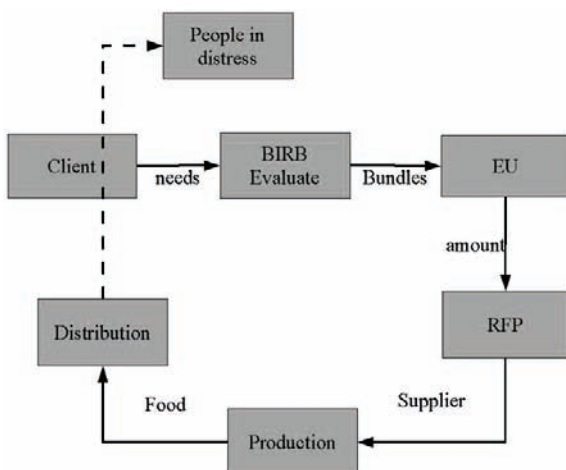
portunities due to the new technology or due to another use of technology.

Once approved by the people responsible for the business (or even grand) strategy, the evaluation of EAI/XBC will follow the same path as the business-driven EAI/XBC. With both approaches a Business/Resources evaluation is guaranteed. The case of FFD was a business-driven XBC. The kind of integration is mentioned between brackets. Figure 13 shows a summary of the phases in the FFD process.

The clients (social aid organisations) express their needs via the portal (operational). These needs are evaluated and bundled in a global demand of Belgium to the European Commission. The official amount of exchange is sent back to FFD. An external party handles (operative) the requests for proposal (RFP). As a result, the list of the suppliers with their respective orders is returned.

In the production phase, FFD collaborates with the suppliers, controllers (operative) and silo-managers (operational). The produced food is delivered to depots of Defence (Strategic), where the clients get the food (operational) and distribute it to the people in distress. So, all types of integration were present and were evaluated with the XBC-method.

Figure 13. Process Flow Free Food Distribution



Steering Plan ICT

In the proposal of Rabaey et al. (2004) the aggregation of all ICT-SLAs formed the steering plan. However by performing the IF with the Free Food Distribution, the impact of Service Oriented Architecture (SOA) on ICT-infrastructure could not be evaluated. Therefore two more plans were added: SLA-plan and RAA-plan. The optimization of the use of ICT-resources in the additional plans enabled the creation of business cases for ICT-infrastructure or global ICT-services.

Other Issues

Before the Business process re-engineering (BPR), only the activities inside BIRB were automated. Due to its interdisciplinary nature, the Interdisciplinary Forum proposed that all processes of FFD should be assessed and supported from the beginning the process (the expression of the needs) until the end (satisfaction of the needs) and not only the own BIRB-activities.

The result of this statement was that each actor in the process was consulted and that his or her environment (social and cultural) was taken into account. In this way, no hostile intrusion in the way of working (integration) of the external partners or actors was felt.

Originally three directors were concerned with FFD. After the BPR, one process-owner was dedicated to manage the processes of FFD (horizontally). The concerned directors give input from their domain (vertically) to the process-owner. Before the BPR, the introduction of a matrix-organisation was never accepted. Due to the Interdisciplinary Forum, every problem of FFD was discussed in a transparent way, which brought the “common sense” at the surface.

SUMMARY

In this chapter a holistic approach for business integration has been introduced with a strong emphasis on the alignment of ICT capabilities with the required business integration. The impact of business integration on Enterprise architecture was discussed along various integration scenarios. An extended and adapted version of the Balanced Scorecard for non-commercial organisations was introduced to define a general integration framework. The set up of the Interdisciplinary Forum, key to successful business integration, has been thoroughly tested in a real life case

within the Belgian Intervention and Restitution Bureau (BIRB) a case which has led to improvements in our original view of the working of the Interdisciplinary Forum.

SELECTED REFERENCES

Broadbent, M., & Weill, P. (2003). *Effective IT governance by design*. Gartner.

Hammer, M., & Champy, J. A. (1993). *Reengineering the corporation: A manifesto for business revolution*. New York: Harper Collins

Kaplan, R., & Norton, D. (1996). *The balanced scorecard: Translating strategy into action*. Harvard Business School Press

Rabaey, M. (2005). CAF and e-Cost. *Proceedings Second European CAF event*, Luxemburg.

Rabaey, M., Hoffman, G., & Vandendorre, K. (2004). Aligning Business- and Resource-Strategy: An Interdisciplinary Forum for Investments. In *Proceedings of 13th International Conference on Management of Technology, International Association for Management of Technology*.

Rabaey, M., Vandijck, E., & Hoffman, G. (2005a). An evaluation framework for enterprise application integration. In *Proceedings the 16th IRMA International Conference*, San Diego, USA. Information Resource Management Association. Hershey, PA: Idea Group Publishing.

Rabaey, M., Leclercq, J-M., Vandijck, E., Hoffman, G., & Timmerman, M. (2005b). *Intelligence Base: Strategic instrument of an Organisation*, NATO Research and Technology Agency. Information Systems Technology Panel Specialists' Meeting, The Hague, The Netherlands, November 2005 (NATO unclassified)

Ross, J. (2003). *Creating a strategic IT architecture competency: Learning in stages*. MIT Sloan School of Management

Ross, J. (2004). *Generating strategic benefits from enterprise architecture*. MIT Sloan School of Management Research Briefing.

This work was previously published in Adaptive Technologies and Business Integration: Social, Managerial and Organizational Dimensions, edited by M. Manuela, B. Conceição Cortes, G.D. Putnik, pp. 112-132, copyright 2006 by Information Science Publishing (an imprint of IGI Global).

Chapter 6.2

A Framework for Business Performance Management

Marco van der Kooij

Hyperion Solutions, The Netherlands

ABSTRACT

To manage their performance in a dynamic and complex environment, organizations need forward-looking intelligence. Forward-looking intelligence is the ability to make reliable predictions about where the business is going to and what is driving the business. To produce forward-looking intelligence, an organization should have an insight into its business drivers, an adequate management process, and skilled people able to collaborate and share knowledge. To support the production of forward-looking intelligence, the role of information technology is crucial. However, the existing decision-support infrastructures in companies often fail to support this production. In this chapter, a framework is presented that can be used to structure and organize the production of forward-looking intelligence. This framework also serves as a background for the evaluation and implementation of a supportive ICT infrastructure.

INTRODUCTION

What do airliners and companies in the food industry have in common? An abrupt crisis (9/11 and the BSE crisis) in their respective industries forced them to change their strategy dramatically. For instance, the beef sales of Dutch company Royal Wessanen suddenly decreased to zero in Germany due to the BSE crisis and the media attention about this crisis¹. Another recent crisis—the Enron and WorldCom affair - taught us that integrity, transparency in financial figures and accountability for these figures by top management is vital. As a result of this affair, the creditability of many companies was and still is at stake. Relevant questions are whether organizations could have foreseen such crises and how they should deal with them. The ability of organizations to anticipate events and developments in their business environment and to deal with these events is the main topic of this chapter.

When business volatility increases and market conditions become more aggressive and stakeholders more demanding, organizations should optimize their resources efficiently to meet changing goals and gain or maintain competitive advantage. To do this, relevant information about the business processes and the environment is imperative. Suppose a product manager of mobile phones is introducing a new range of mobile phones that should bring his/her company back into a market-leading role within six months. In order to provide a reliable estimate about the number of phones sold and their revenue, a lot of information is required. How much of the current range of phones has been sold and during which conditions, to whom and when? What is the estimated delivery time? What is in stock and what needs to be produced? Does this have an impact on the production and introduction of the new range? What is the impact of marketing activities for the current and new product range? What is the competition doing? What is the impact of the competitor's activities? What is the impact of introducing the new product range earlier or later? To make the right decisions, forward-looking intelligence is required. Forward-looking intelligence is the ability to make reliable predictions about where the business is going to and what is driving the business. Forward-looking intelligence entails having an insight into business drivers, a management process and skilled people able to collaborate and share knowledge with the systems and organization to support this.

The existing decision-support infrastructures in companies often inhibit, rather than enable, an organization from producing forward-looking intelligence. The underlying systems are departmental in scope, focus on single business functions, fail to integrate in any meaningful business sense, lack process support and are expensive to maintain and modify. In my daily practice I have noticed that the financial consolidation process is used to collect data from the last quarter for financial and management reporting about the

past, with a forecast that has a limited outlook to the future. The data from the consolidation process are of limited use in anticipating the future. These figures are meant for the statutory and financial reporting for some internal and external stakeholders. These figures explain too little about what is really going on in the business itself. Therefore, a forecast is needed, but the currently used forecasting method consists of a limited set of metrics which only grasp at the developments in sales and expenses for the remainder of the year or, if you are lucky, some quarters ahead in a rolling forecast. Just like the yearly exercise of putting a budget together, the value of this forecast is limited, as it is often completed only by the financial department and not by the people who are involved in the business on a day-to-day basis such as account, product and production managers.

Over the last couple of years many companies have invested a lot of money in enterprise resource planning (ERP), supply chain management (SCM) and customer relationship management (CRM) systems to improve operational processes. However, many systems did not meet expectations and some even failed. Next, data warehouses were built to collect data from all these operational systems in order to use the data for management information. Most data warehouses are either not able or not designed to deliver forward-looking intelligence to managers. Information technology (IT) is a core component to produce forward-looking intelligence and to support collaboration between people. The important role of IT is extensively described in this chapter.

To plan and control their organization, managers need timely, accurate and relevant intelligence. To obtain this intelligence, the following questions should be answered:

1. What are the "business drivers" and how well does the organization perform based on these drivers?

2. What are the most important uniform metrics to measure the performance of the company?
3. What does the management process look like for the entire organization?
4. How do people collaborate across all functional areas in the organization and/or outside the organization whenever necessary?
5. Which intelligence systems are used to support the management process and collaboration?
6. Who is responsible for and how is the support of the management process and systems arranged?

These questions enable organizations to manage their business performance. In this chapter each question is described in a separate paragraph. There is also a separate paragraph with guidelines for their practical implementation. This chapter can also be used as a checklist for business performance management and intelligence projects, as the most important aspects are described for initiating and implementing these types of projects.

BUSINESS DRIVERS

Southwest Airlines is the only airliner in the United States making a profit since 9/11. How is this possible? The reason for this is that Southwest Airlines knows exactly what the drivers in its industry are and knows what to do to remain profitable. For instance, the company knows exactly what the utilization is of each route by type of aircraft; which routes by type of aircraft are making or losing money; what the most important cost components are; what its customers' preferred service level is; what the level of customer satisfaction is, etc. The company also compares this information to the industry in general and its main competitors. Based on assumptions about

developments in flight behavior and the number of passengers, Southwest Airlines was able to create reliable scenarios and predictions. These scenarios prompted immediate action to terminate routes, to decide which type of aircraft should be used to control expenses for a certain route and to determine what the effect of these actions is to the profitability of the company. Another reason why Southwest Airlines outperforms its competitors is that it was able to test assumptions, identify bottlenecks and constraints and to solve these using different "what-if" scenarios better than the competition.

An example of a business driver for a company developing and selling software is license revenue. Based on this driver, the company can evaluate its performance compared to the market. License revenue also drives revenues from services to implement the software and maintenance fees for support to assure future investments in development. License revenue is also relevant for the evaluation conducted by shareholders, business partners and (potential) customers to judge whether it's worthwhile investing in this company. Together with the metric days sales outstanding, the business driver license revenue is revealing something about customer satisfaction and the quality of the software. Customers will not pay their bills when the software is not working as expected.

UNIFORM METRICS

Many organizations define and use indicators for monitoring their performance. However, several problems have been found with these indicators. For instance, a lot of companies use too many metrics. This results in an unclear and unrealistic view on what is going on in the business. In addition, when a set of indicators is used, some of them contradict others. An example of this is merged or acquired companies that combine different sets of metrics for performance measurement

without closer attention to the metrics actually required. This can also be the case in companies that changed their strategies (e.g., from operational excellence to customer intimacy) and the metrics associated with the new strategy are not aligned, company-wide, with the new strategy.

To identify the most important metrics, the information matrix can be used. The information matrix is a tool to outline goals, business drivers (BD), critical success factors (CSF), key performance indicators (KPI) and other common metrics. It explains, for each metric, where the data is coming from and which information it provides to whom, how often and by which means. The information matrix is also a tool for collaboration between the business and the IT department. The business users define the metrics and how they want to use them, while the people in the IT department can ensure that the right data is used to calculate the metrics and the appropriate tools are used to present the metrics to the business users in a format they prefer.

The column headings are explained below:

Metrics: In this column, the name of the metric is stated. The name must be unambiguous, common and understandable for every user. For example, the company’s goal is to increase license revenue growth by 10% each year. The business driver license revenue was described

in the paragraph Business Drivers. A critical success factor is what must be accomplished to achieve 10% growth each year. A key performance indicator is the metric to measure performance of an activity to achieve 10% growth each year (Oakland, 1993).

Definition: How is the metric calculated and accounted, e.g., with a formula, a number or a percentage? For example, license revenue is the net sales of all software products in U.S. dollars (thus without discounts). With this definition the metrics are guaranteed to be clear, concise and therefore, can be interpreted by everyone throughout the entire organization and also by other stakeholders when used for benchmarking. The data source(s) from which the metric is calculated must also be defined. This is the so-called mapping of the data.

Dimensions: For which dimensions does the metric have to be calculated? This also defines which slices of the data must be calculated by the metric. A slice is, for example, license revenue by product, by customer, by country or by month.

Level of Detail: At which levels must the metric be calculated? This is also the drill-down path for the metric. For example, license revenue by geographical area drills down from Europe to The

Table 1. The Information Matrix

| Metrics | Definition and Mapping | Dimensions | Level of Detail | Domain | Frequency | Means | Scenario |
|---------|------------------------|------------|--------------------|----------|-----------|-----------|----------|
| Goal | | Time | Year/Quarter/Month | Function | Hour | Paper | Actual |
| BD | | Customer | Customer Group | Person | Day | Report | Budget |
| CSF | | Country | Customer | | Week | Dashboard | Forecast |
| KPI | | Product | Product Group | | Month | Intranet | MTP |
| | | Supplier | SKU | | Quarter | | What-if |
| | | | | | Year | | |

Netherlands, to North Holland, to Amsterdam.

Domain: In which functional areas will the metric be used and for whom is it important? As an example, is it important for the entire organization and all managers or just for the directors and account managers in the sales department?

Frequency: How often is the metric measured? This is relevant to the requirements set for the systems, especially when the frequency is higher (e.g., data delivery and calculation by hour).

Means: How do the users want the information to be delivered and presented? Do they want a reporting tool with figures and graphs in one view, accessible over the Internet or hard copies of the reports? This is also relevant to the requirements of the systems used.

Scenario: For which data categories does the metric have to be calculated and used for variance analysis? For the current (actual) year, this is derived from the operational systems. For budget and forecast, the calculation may vary. For example, the budget is submitted bottom-up by a departmental manager based on top-down targets. Some of the costs such as the total IT costs are allocated to departments based on the number of computers in that department. The forecast is entered and modified over time by account, product or production managers based on their ongoing foresight in the business. Moreover, the budget data can be very specific for each product by customer, while the forecast is entered by customer group and product type. These differences set the requirements for the intelligence systems to use.

There are different methods to get the most important metrics, for example, with the help of a computerized brainstorm. With this method, different people can brainstorm anonymously using computers. Following this, the metrics are categorized into groups and duplicates are eliminated.

Next, they can complete the information matrix together. The selection of the uniform metrics used in the corporation may consist of a combination of different methods used; for example, value-based management, balanced scorecard or activity-based management (Geishecker, 2002). The use of these methods for the company's strategy is described in the paragraph Intelligence Systems.

To satisfy managers' constant need for intelligence, the information matrix can be used. It enables the definition of a set of uniform and common metrics and supports their utilization to measure the performance of the company over time. However, for this purpose, it is vital to keep the information matrix updated. The use of and the responsibility for the information matrix should be incorporated into the organization. This will be described in the paragraph Responsibility of this chapter.

THE MANAGEMENT PROCESS

At any level in the organization—top-management, departments or teams—management processes are essentially the same, no matter what aspect of the organization is being addressed. Management can be seen as a cycle consisting of six sub-processes (see Figure 1) (Hyperion, 2002). This cycle is not necessarily unidirectional, since interaction and collaboration are required at every step of the process to ensure success. Common, consistent information (the “shared information” hub in the middle) is required to ensure that all decision makers are working with the same information. The six fundamental processes are:

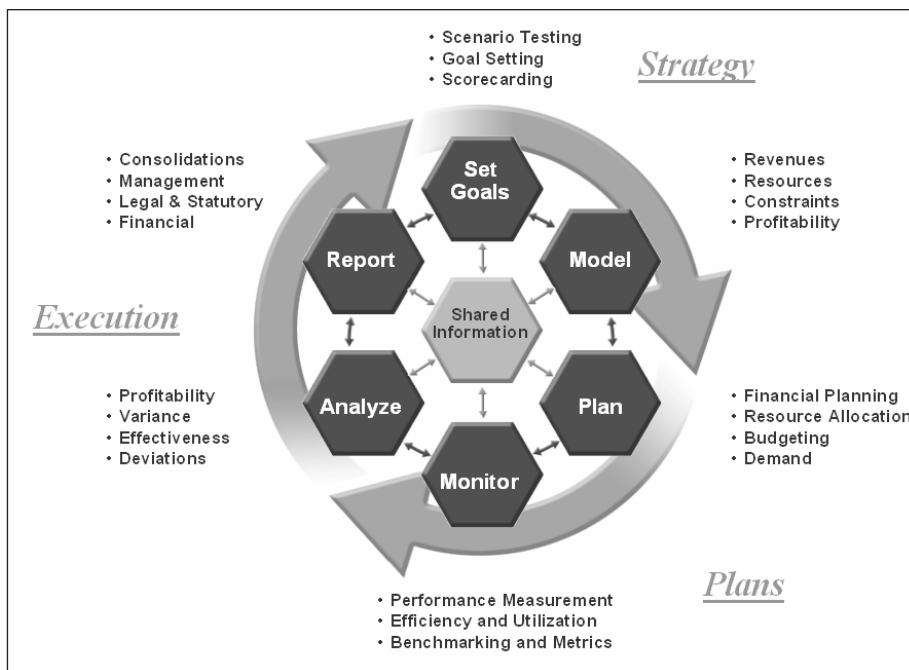
- **Goal-setting:** defining and confirming the criteria and measures for successful performance of the management process that bring together long-term business strategies and day-to-day business operations.
- **Modeling:** identifying the business drivers and determining the relationship between drivers and predicted results.

- **Planning:** establishing a set of actions or targets that are designed to meet the business goals.
- **Monitoring:** acquiring and normalizing internal results, key performance indicators and external influencing factors (e.g., market or economic events), triggering alerts and responding to exceptions at any given point in time.
- **Analysis:** gaining insight from results and variations in predicted outcomes and using this information to improve the process.
- **Reporting:** providing information in an expected, predefined format.

constantly monitor the progress and not just the outcomes. If there are variances in the metrics used to measure performance, plans need to be adjusted to ensure that goals are met. End results need to be analyzed and compared to the original goals to discover deviations and variances. All information can be used to explain the reported results and to adjust models for future success. By using this approach, continuous business improvements can be applied to an organization. For example, based on the strategic target of 10% growth in license revenue, the marketing department has a goal for the number of leads to provide to the sales department. Based on the assumptions and constraints (budget, employees, etc.) modeling is conducted to determine how many campaigns by which media can be executed and what the potential results will be. After that, the best and most likely scenario is transformed into an operational plan. The outcome of the plan is monitored against the actual results. If differences are detected, they are analyzed to find out their

It is critical that this approach of the business management process is fully supported by the intelligence systems, as described in that paragraph. It is important that realistic goals and objectives are set and that business models are used to test different scenarios and to validate plans. As plans are executed, it's necessary to

Figure 1. Management Process



causes and these are reported in order to make adjustments and improvements.

In the financial domain this process is known as the planning and control cycle (Mintzberg, 1994). Here it is called the management process, as this cycle applies to every manager in the entire organization. Managers secure the control aspect (monitor, analyze and report) through procedures and systems with internal checks from the financial domain and external checks from the auditor. The planning function is gaining importance, as previously mentioned, with the rolling forecast. Operational managers, who are close to the business, complete the rolling forecast. In this way, a more frequent and reliable picture of what is going on in the business and the company's own position in the marketplace can be provided. A change is expected from the annual budgeting process to a monthly or even more frequent rolling forecast process. Eventually, the creation and completion of the budget will be obsolete and completely replaced by the strategic planning process and the rolling forecast.

The need for an increase in speed within the management process is an additional issue. The entire management process needs to be performed faster, especially when certain events happen and thus render the current budget and forecast irrelevant. Corrective actions must be taken quickly to avoid the company from being outperformed by the competition. This means that the planning function should be closer to the business and outside the financial domain where it often is today. The financial domain facilitates the planning process with models and systems, at most.

COLLABORATION FOR ALIGNMENT

The definition, testing and translation of strategic goals into daily operations usually start with mid-term planning for several years. In today's business environment, looking forward several years is hardly possible, with the exception of scenario

analyses (Vijverberg, 1993), and has even been mentioned in press releases detailing the financial results of various companies. Moreover, increasing numbers of managers are becoming involved in the whole process at the same level and also in other levels of the organization (see Figure 2). In the planning process the output of the operational plan from one unit is the strategic plan for another unit. The same applies for control. The reporting from one unit is part of the monitoring of another. Information must be shared in the whole process and between processes to anticipate and take actions whenever events happen. This means that the process must be faster, more iterative and more interactive to ensure better collaboration between managers. The targets of the sales department mean that marketing has to supply them with enough leads. When this doesn't happen, the sales department needs to act in order to still realize its sales target. The sooner the sales department knows something is not going as planned, the faster it can act accordingly.

Shared information for collaboration is the reason why the use of uniform definitions for metrics is essential; for example, what is the definition of a lead and do sales and marketing use the same definition. Otherwise it is very difficult to share information and experiences. Subsequently, process management is also important. When hundreds or thousands of managers are involved in the rolling forecast and managers depend on the outcome of another unit, then the workflow of the process must be supported and managed. This sets requirements for the systems used.

Any business manager has five fundamental responsibilities which make up the management environment:

- Strategy setting and leadership (goals, targets, direction);
- Finances (budgets, expenses, capital requests);
- The people who make up a business (teams, business units);

- Products and services that are provided to customers;
- Customers.

The top management (leaders) of the company establishes the goals and objectives. Divisional and local management teams need to work together to make sure those goals and objectives are realistic and obtainable. Enterprise-wide collaboration is required to optimize all aspects of the business for success. This means that managers must work across domains and alignment is essential, both between domains and from top to bottom and vice versa (see Figure 3). For instance, the sales forecast from the commercial domain determines the demand planning for production in the production domain. Consequently, the production determines headcount planning and/or recruitment and the budget for hiring new employees or investments in equipment when the workload becomes too high. Obtaining insight into business issues across

domains sets requirements for the systems used and for the use of uniform definitions of common metrics (Oakland, 1993).

INTELLIGENCE SYSTEMS

Information technology plays a very important role in today's business and in managing the business. The first part of this section describes the developments in IT for supporting the management process. In the second part, the components of a framework for business performance management are described.

As shown in Figure 3, applications in the management environment use data coming from operational systems. These systems are used to store transactions such as sales orders, flight reservations, payments, etc. In many companies these transactions are also stored in a data warehouse to be used by managers to make informed decisions

Figure 2. Collaboration is Essential

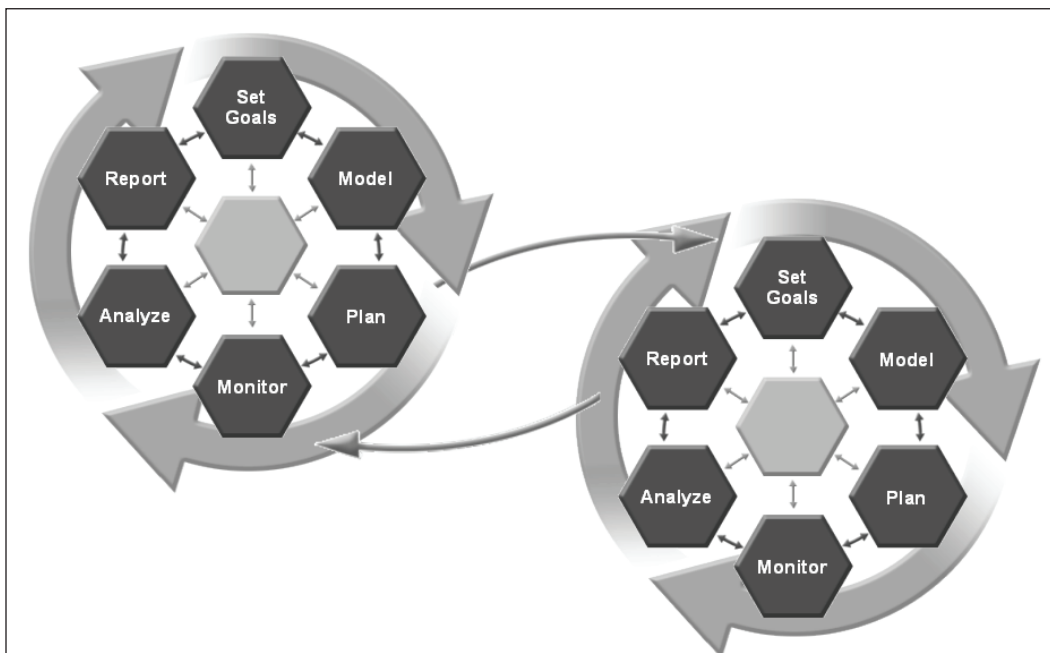
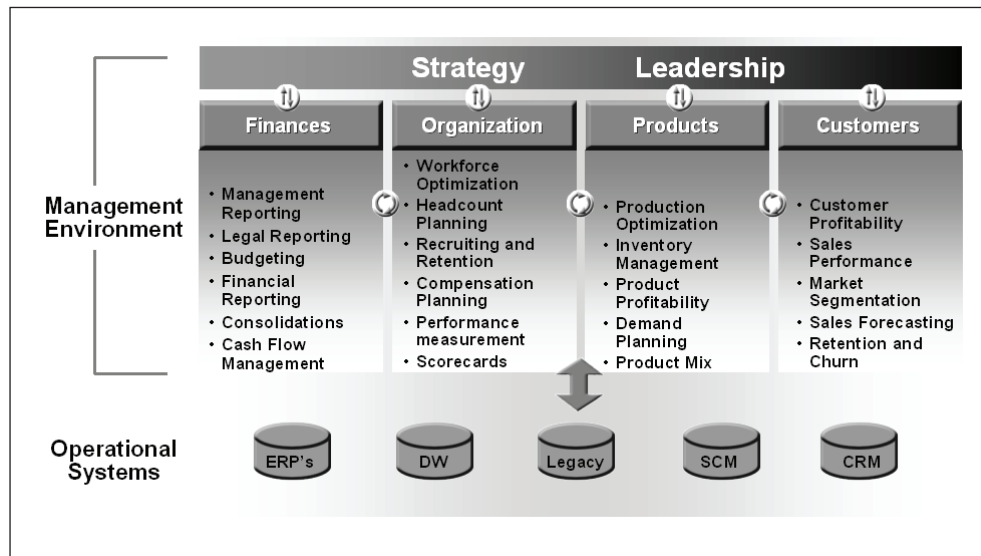


Figure 3. Collaboration Supports Management Responsibility and Alignment



and set actions. Often external data about market shares, competitors, the weather, etc., are added. Managers need this information to do a better job, achieve unprecedented, better results and to surpass the competition (Porter, 1985).

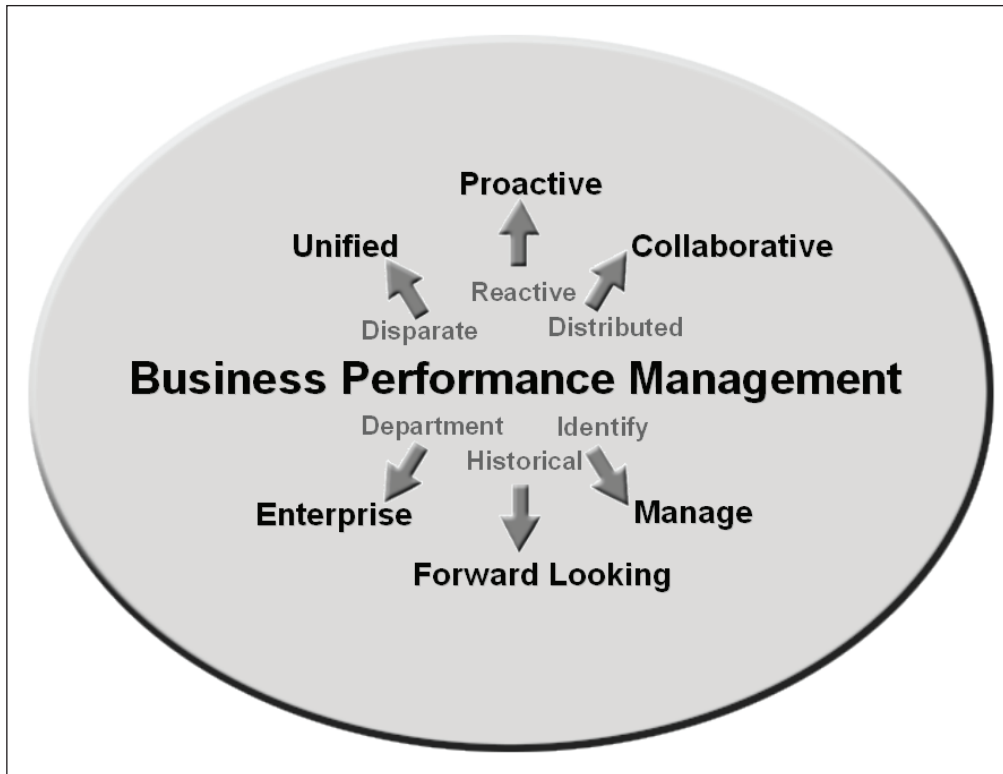
Business changes every day. Managers need information to anticipate changes no matter where this information comes from, as long as it is reliable. This information must support the management process and collaboration (Vijverberg, 1993). Today, in many companies, data are stored in separate systems for each domain or even in totally different and unintegrated applications in a specific domain. Spreadsheets and PowerPoint presentations are also widely used to store strategic information used in the management process. This software is not designed to assure uniformity in metrics (formulas can easily be changed) or to be used simultaneously with other users. When data warehouses and/or OLAP tools (OnLine Analytical Processing) are used, these systems are often only used in a specific domain or in a certain unit, consisting of historic data to report and analyze what happened.

Companies such as Southwest Airlines and Royal Wessanen are transforming from business intelligence to business performance management. Business performance management² describes the methods, metrics, processes and systems used in organizations to translate strategies into plans, monitor execution, and provide insight to improve financial and operational performance. It represents the strategic, integrated evolution of business intelligence (BI) to support the management process. To support management decisions there must be (see Figure 4):

- A proactive approach to decision-making;
- Collaboration between peers;
- The use of information to support management decisions;
- General use for all decisions;
- An enterprise-wide approach for managing a business;
- A unified approach to the business and its information.

Business performance management is beyond historical data delivery; it is about managing the

Figure 4. The Evolution to Business Performance Management



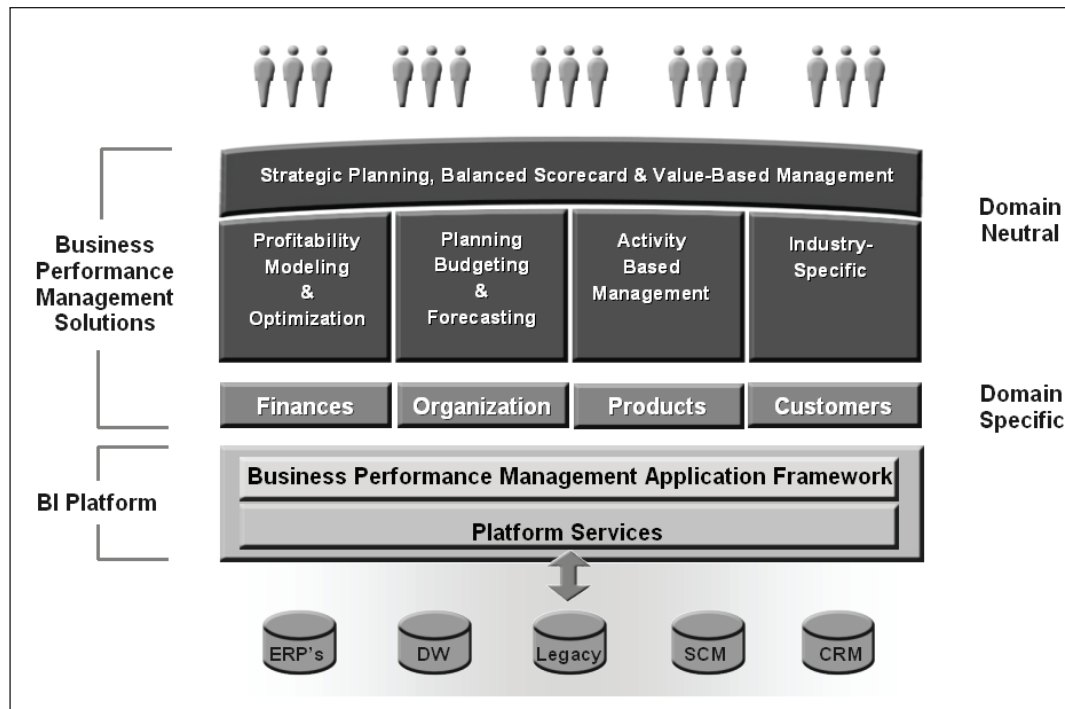
business with information. It automates and supports the workflow and decision-making involved in management. This is marrying intelligence and the management process in order to measure performance and drive profitability. The goal of business performance management is to drive business performance by supporting organizational goals to:

- Identify and exploit opportunities for investment, growth and profitability;
- Optimize deployment of organizational resources for maximum impact on the bottom line;
- Simplify the execution challenges of organizational strategy.

This means that a question such as: “How to increase profitability by 10% every year?” has huge consequences for almost every manager’s business. The impact of such a question is enormous. Answers to such questions do not come from operational systems or data warehouses. To fulfill managers’ ever-changing demand for information, requirements are set for the intelligence systems to be used.

As mentioned earlier, requirements are set for the intelligence systems to be used. These requirements are determined by the use of forward-looking intelligence based on uniform metrics in order to fulfill the ever-changing demand for management information, to have access to data and information no matter where it comes from, to provide all stakeholders such as customers,

Figure 5. Framework for Business Performance Management



suppliers and partners with access to required areas of the system, to support the management process with workflow and to support and manage the collaboration between people. The net result of this is to stay ahead of the competition in a very dynamic market. To achieve this, a business performance management framework must be in place to support strategic and operational decision-making (see Figure 5).

How can systems help to dominate the business instead of being dominated by others in the marketplace and to understand what really drives the business? Also, how can they help test scenarios based on trends and business drivers in order to be prepared and to adjust the company’s strategy when unexpected events happen? As previously stated, it all starts with the need for forward-looking intelligence. This intelligence is not available in operational systems and data warehouses. That

explains the need for an additional business intelligence platform (BI platform), in which values are calculated based on assumptions, bottlenecks, constraints and the collective experience available in present and historic data.

The business performance management framework consists of different layers and these are described below.

Platform Services

These consist of a number of components for the integration of data from operational systems, the administration of users, applications (dimensions and metrics), distribution of information and enterprise-wide collaboration of the company’s internal and external users. In brief, this is the technical fundament of the platform. The most important services are explained below.

Interoperability Services

Interoperability services are the most critical part of the framework in order to apply business performance management enterprise-wide. These services enable the collaboration between the different applications used for the sharing and mapping of uniform definitions (metadata). They offer version control: who changed what, when and why? Furthermore, these services enable the promotion of changes to applications from development to testing and production.

Applications do not have to be from the same supplier for collaboration to work between them. Open standards, such as XML (eXtended Markup Language), XMLA (for Analysis) and XBRL3 (eXtensible Business Reporting Language) are used to exchange metadata and data. Therefore, it is important that the applications can support these open standards to ensure the use of uniform definitions, metrics and information enterprise-wide.

Analytic Services

This component deals with the analytic power and the applied technique to offer an enterprise-wide scalable solution. Analytic power is required for calculations and business rules to calculate the derived values used as management information, which is not available in operational systems; for instance, derived values such as market shares for individual products or services by group of customers, profitability by customer and product or complex statistical calculations for scenario testing. Therefore, it is essential to enter assumptions into the BI platform to calculate results quickly. To have write-back capabilities to the BI platform is also important for the rolling forecast. The rolling forecast is often entered on a different level of detail than the data in the operational systems or for top-down targets, or other amounts are allocated based on predefined drivers. It is

even better to automatically process data from reports of industry analysts, news agencies or even competitors for a new forecast to see what the impact on the business will be, and in addition to that with proposed actions to take in different what-if scenarios with the impact of these proposed actions. In this case managers can decide very quickly about what to do and communicate with the people involved.

The applied technique is relevant for the storage of mass data. Is the data stored in the OLAP environment or can this be done in combination with relational database technology (Hybrid OLAP)? This is of great importance for analyzing millions of customers. The storage of data also has an impact on the platform to be used. Next to Windows, are Unix, Linux or a mainframe computer also viable options to store and calculate data and metadata? Is the use of multi-processors supported in order to achieve acceptable performance of complex calculations? Any failure resulting from the use of software and systems is often caused by the lack of using them. If users have to wait too long for answers to questions then they look for other ways to get answers.

Query and Reporting Services

End-users do not care where their information is coming from. They want acceptable performance and the software must be easy to use. Therefore, the use of Internet technology is crucial, as information must be disseminated worldwide in a reliable, secure way, internally in the company and also externally to stakeholders such as shareholders, customers, suppliers or business partners. In addition to all types of graphical features for presentation purposes, three things are critical to the end-user:

1. The information must be provided proactively based on triggers such as an alert on the screen or by e-mail. Users have access to Internet or e-mail everywhere, even with

their mobile phone. An example of a trigger is when net working capital increases due to the submitted forecasts and exceeds the acceptable bandwidth;

2. The information must, preferably, be presented in a single and central place for the end-user via a so-called “portal.” In this way, the developments in the manager’s area of responsibility are instantly clear. From there on, quick and easy drill-down should be performed to find the cause of the increase of net working capital. After that, actions must be taken to solve the issue before it actually occurs;
3. Both quantitative and qualitative information must be available. When the net working capital indicator increases due to the introduction of a competitive product and damages the sales of your products, then, for example, the press release information from the competitor is also available as an explanation. The beauty of Internet technology is that different types of information are easy to present together, regardless of where the information is stored.

The information matrix can be used to determine which users need which information delivered and presented and in what way. This should be taken into consideration when disseminating the information.

Integration Services

In the case of huge amounts of data, it is common, for integration purposes, to load this data from operational systems to data warehouses and between applications automatically. When a data warehouse and an ETL tool (Extraction, Transformation and Load) are used it is an advantage to incorporate this into the BI platform. Before data is loaded into a data warehouse it is cleansed, unduplicated and validated to improve and assure the quality of the data. For example, in

the case of a mobile telecommunications company all connections must be unique and all data must be associated correctly with each connection, such as personal, billing, payment and contract data. Part of this data will be used in the BI platform and domain-specific applications. This data has to be integrated easily and maintained from the source system or from a central repository. Additionally, if more detail is required in the BI platform this must be readily available to the end-user. For instance, when a number of customers withdraw and defect to the competition: what are their demographic characteristics and in what way are they the same? Action has to be taken before other customers with similar characteristics defect as well.

The openness and integration facilities of the BI platform are very important for setting up new applications. A lot of data is stored in all types of different systems, from “small” databases and spreadsheets to massive, inaccessible (proprietary) databases of ERP systems. As data from different source systems becomes easier to load automatically, the shorter the time for implementation will be and results will be shown quickly to the end-users.

Administrative Services

Maintenance of the BI platform and applications is another relevant component in order to run a complex system used worldwide. Here too, open standards are recommended, as these standards are already being used a lot in the company. The advantage of this is that knowledge is available and it is fairly easy to acquire new employees to assure continuity. Administrative services also include the workflow and control of the management process. This needs to be aligned with the current working method of the organization and not the other way around (i.e., business process redesign in the 80s and 90s in order to use certain ERP systems).

Application Framework

The application framework offers the option to develop applications based on building blocks so that rapid development is possible. These building blocks contain preprogrammed intelligence necessary for an analytic environment. In this way, developing applications from scratch is prevented and applications can be delivered on time and not when the original specifications have become obsolete. Critical business information must easily be available. Examples of applications are mentioned in Figure 4; however, some other examples are: inventory turnover analysis, route profitability, product sales analysis and employee compensation analysis. An application framework is useful for company or industry-specific applications which are not ready-made available or which require a very large investment.

On top of the application framework, different, ready-made applications are available. These can be divided into domain-specific and domain neutral applications.

Domain-Specific

There are, for every domain, applications available in the market such as the ones for financial consolidation or churn analysis. The major advantage of a domain-specific application is the ready-made availability of the accumulated knowledge and experience in it. This shortens the implementation of these applications considerably. Consequently, the danger of separate domain-specific applications is that each has its own definitions; for example, the marketing and sales departments use a different definition of net sales than the people in the finance domain. These applications must be aligned and integrated within the whole framework in order to make management decisions and to set actions. As mentioned earlier, the result of the sales forecast has an impact on the demand planning for the production process, etc.

Domain Neutral

The strategic management of the organization involves the methods used and the management process (Geishecker, 2002). Value-based management has an impact on the entire organization, as all activities must add value to the company. Companies are increasingly focused on profitability by customer and product or service. That is one of the reasons why activity-based management is also used in marketing and supply chain management. As stated earlier, the forecasting process has an impact on all managers with revenue and expenses responsibilities. The readily available, relevant information from people who are close to the business is crucial in order to act fast and stay ahead of the competition. These aspects and automating them are the responsibility of top management, so they increase transparency and their accountability for their activities to all stakeholders.

RESPONSIBILITY

Previous paragraphs have described the use of uniform metrics, a management process and the intelligence systems within a framework. To ensure that users are enabled to work with this framework a company requires organization and procedures to accommodate this. Furthermore, one person should be given ownership and responsibility for the framework. Where that role fits into the company is difficult to answer, as every company is different. From my experience at a number of multinational companies in The Netherlands I saw that the domain neutral applications were initiated and facilitated functionally by the finance domain. Employees from the IT department were available or even added for technical support. The advantage of the financial domain is its broad experience with automation of financial management information and that most

A Framework for Business Performance Management

applications in the management environment are financially driven. Also, a lot of the methods used, such as value-based management and balanced scorecard, originate from the financial area. The finance domain consists of an internal network within the organization, with local controllers and accountants who are accustomed to working together in the financial reporting process. However, this could not succeed without the support of the IT department. Firstly, this is because current standards (technical and procedural) applied in the organization must be used as much as possible to assure continuity. Secondly, the use of Internet technology and the related security issues is work for specialists. Thirdly, technical people are needed for the development of domain-specific applications, together with people from the domain concerned, based on the company's framework.

Ideally, a separate, organized group of people in a department should be available for the following activities:

- Control of the framework's content based on the information matrix (not to determine the content, as this is done in cooperation with the business users and senior management);
- And to translate this into improvements for current and new solutions;
- To monitor the alignment of the systems used with the management process;
- To accelerate and facilitate the use of applications;
- To take charge with new initiatives;
- To deploy and test scenarios and to conduct complex ad hoc analyses for strategic planning;
- To manage the technical realization and technical control of the BI platform and applications based on company standards;
- To monitor the quality of the metadata, data and performance of the systems used;
- To have a liaison role between business users

and the IT department for the management environment.

The following rule of thumb can be applied to this department's reporting within the organization and in the following order: in a business driven commercial company, to the Marketing and Sales Director. If another domain is very important for the business, like manufacturing, and there is a collaborative environment then place it there. In a financially managed company with also a focus on management reporting it is wise to report to the Chief Financial Officer. If IT is the only department with an overview in the whole organization then place it there with a reporting line to the Chief Information Officer (Buytendijk, 2001).

GUIDELINES

From experience and research, I have discovered some useful guidelines on how to start and implement a business performance management framework. These guidelines are as follows:

1. Bring together a limited number (eight to 12) of key users of management information in a workshop and use the described management process to make the following clear:
 - How well is the current process compared to the process described in the paragraph The Management Process?
 - Which reports and analyses are used in the different steps of the management process?
 - What is the content of these reports and analyses and how relevant are they? This is used to gain insight into business drivers and metrics.
 - Which methods are used enterprise-wide and per domain? Check these according to relevance for business drivers and the most critical metrics.

- Which forward-looking information and metrics are missing?
- How are reports and analyses made and with which systems?
- How is information shared and how do managers collaborate?
- How are the metadata, definitions and data integrated?
- Who is responsible for which systems and which activities are associated?
- What are the company's standards for business intelligence and which of them meet the requirements for the business performance management framework?

It is important to have people participating who are able to look further than their own domain and to realize that the impact of their daily business activities also has an impact on others within the company. If participants are only focused on their own needs then a company-wide view and the creation of alignment is hardly possible. It is advisable to facilitate this workshop with experts in order to prevent people from going into too much detail. By staying focused on the main topics the company's current position becomes clear very quickly. Document this carefully and use this document to find a sponsor from top management: someone who believes in forward-looking intelligence and wants to be able to respond faster in case of events (and feels that this is lacking). This step is also necessary for financing the program and supporting an enterprise-wide implementation.

2. Determine the ultimate goal of the program and then determine the gap with the current situation from Step 1. Construct, with the help of experienced people, the roadmap to execute the program. Divide the program into separately manageable projects and prioritize based on the biggest problems in the organization. For instance, by missing the

forecast due to myopia, insufficient insight into the company's own market position and market trends, a lot of companies are afraid to make announcements regarding future results. Therefore, companies themselves do not know how to proceed and are punished by the stock market. This causes problems for financing future growth to sustain or improve their competitive positioning.

3. Ensure the provision of quick and visible results. Start with the 10 to 15 most important metrics for the company. Make sure that the source data is available and use cleansed data so there is no doubt about the quality of the data. Present the metrics to a larger group of key users with a professional tool. Then broaden the scope by number of metrics, end-users and further into all domains. Make use of external experts wherever necessary to acquire knowledge and experience for future projects. I was the external expert for a company due to the people in the company having hardly any experience with a BI platform and business performance management applications. By using a framework and a roadmap it was clear for them (business users, IT department and the external software implementation partner) on how to proceed step-by-step with minimal risks.

4. Have guts and perseverance. The management process is more flexible than the primary process. It is a challenge to support the management process with systems. Operational systems are strict because of the unambiguous primary process, whereas intelligence systems must be very flexible. It is unknown, beforehand, to which questions answers must be given. Use this as a fact when exploring the management process, developing applications and implementing systems. The support of the IT department is key for the technical infrastructure of the framework. The more the framework fits into the current standards and procedures of the

A Framework for Business Performance Management

IT department the better it is. Nevertheless, flexibility from the IT department is also important because the needs of managers change every day. It is better to be equipped for that than to fight change every day. So make sure that the IT department is aligned as well.

5. Establish a separate department within the organization to secure the maintenance and the use of the framework, as stated in the previous paragraph Responsibility.

CONCLUSION

How bright is an organization in anticipating and specifically responding to events which have an immediate impact on profitability and competitive positioning? In this chapter, an approach to this issue is formulated: a business performance management framework. This framework contains methods to derive real insight into the business (drivers) and to get a grip on giant and complex organizations by means of a specific management process. In this process, it is imperative to use uniformly defined metrics and IT systems to supply forward-looking intelligence so people can collaborate for the success of the company. It is essential to root this firmly within the organization in terms of people and procedures to assure alignment and to gain and maintain the required knowledge. There are guidelines provided to start and implement a business performance management framework. With these guidelines, it is possible to start smart and provide results.

REFERENCES

Buytendijk, F. (2001). Research note: SPA-13-8990, Gartner Research.

Geishecker, L. (2002). Research note: COM-18-3797, Gartner Research.

Hyperion Solutions. (2002). *Business Performance Management – Master Deck*.

Mintzberg, H. (1994). *The Rise and Fall of Strategic Planning*. New York: Prentice Hall.

Oakland, J. S. (1993). *Total Quality Management: The Route to Improving Performance*. Oxford: Butterworth Heinemann.

Porter, M. (1985). *Competitive Advantage*. New York: The Free Press.

Vijverberg, A.M.M. et al. (1993). *Toekomstverkenning in organisaties*. Heerlen: Open Universiteit.

ENDNOTES

- ¹ Mr. K. Kramer (2002), CFO Royal Wessanen NV at the Dutch Hyperion user conference.
- ² Industry analysts are using similar definitions in the same context, e.g., Corporate performance management is the umbrella term that describes the methods, metrics, processes and systems used to monitor and manage business performance from Gartner.
- ³ XBRL is a XML extension and provides a common platform for critical business reporting processes and improves the reliability and ease of communicating financial data among users internal and external to the reporting enterprise (see www.xbrl.org).

This work was previously published in Information and Communication Technology for Competitive Intelligence, edited by D. Vriens, pp. 158-180, copyright 2004 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.3

Neural Data Mining System for Trust-Based Evaluation in Smart Organizations

T.T. Wong

The Hong Kong Polytechnic University, Hong Kong

ABSTRACT

Nowadays, many enterprises manufacture and distribute their products or services globally, and quite a number of smart organizations are formed on the Internet and are expected to evolve to a strategically important e-business model. Although information and communication technologies (ICT) and knowledge management plays an important role in linking the core and partner companies, it remains subservient to the humans that form the smart organizations. This chapter identifies two instances in which trust-based evaluations of partners in the smart organizations are applicable. A review of the literature indicates that neither researchers nor practitioners agree on a single model of interfirm trust that applies to all partner evaluation contexts. A decision-support system based on neural network and data mining technologies is proposed. A case example is given to illustrate a trust-based evaluation in real situation.

INTRODUCTION

Fostered by the rapid and ever-increasing pace of development of information and communications technologies (ICT), a new digital economy is emerging around the globe. In this new digital economy, small and medium enterprises will have more chances than ever before to play a role alongside the big players. Since the Internet is being adopted as the most important global communications infrastructure, and because global knowledge is becoming accessible by everyone with Internet access, the digital economy will be characterized by radically new forms of business relationships and will have a profound effect on the way we work and live.

The current business environment can be typified by continuous pressures to change and the shortening of product development times and product life cycles. Markets are fickle and strongly customer-led, with unrelenting pressures to bring down costs and to take advantage

of innovative technologies. Many organizations look to new organizational structures such as the smart organization to enable them to cope with these changed conditions. As computers rapidly shrink in size, ICT are becoming ubiquitous and invisible. Organizations preparing to go digital need to recognize the implications this transition will have on their business processes and organizations as a whole. Besides setting up the digital infrastructure, organizations need to be able to:

- enter into virtual global internetworked collaborations
- manage transition and adapt quickly
- leverage human capital to optimize performance

In other words, organizations need to get “smart.” The characteristics of a smart organization (Filos & Banahan, 2000) adopted in the present context are:

- internetworked
- dynamically adaptive to new organizational forms and practices
- knowledge and learning-driven
- hierarchically flattened where the individual’s skills, intellect, and knowledge, are recognized, valued, and leveraged

In the past, it was more cost-effective to own all aspects of the value chain—vertical integration was the business model of choice. In today’s global market, focus is critical. Owning the value chain may actually put an organization at a competitive disadvantage due to the lack of flexibility and financial commitment true vertical integration represents. Selecting the right partners and nurturing these relationships can help a company focus on what creates the most value for customers and concentrate on its core activities. Smart organizations also offer versatility. They create new, viable market options and allow companies to deal more effectively with the uncertainties

and complexities of today’s highly competitive global market.

Following Jarvenpaa and Leidner (1998), a global smart organization can be defined as a temporary, culturally diverse, geographically dispersed, electronically communicating work group. The notion of temporary in the definition describes teams on which members may have never worked together before and who may not expect to work together again as a group (Lipnack & Stamps, 1997). The characterization of smart organizations as global implies culturally diverse and globally spanning members that can think and act in concert with the diversity of the global environment (DeSanctis & Poole, 1997). Finally, it is a heavy reliance on the integration of information and communication technologies (ICT), knowledge and organizational networks that allows members separated by time and space to engage in collaborative work. The reasons that smart organizations are becoming so prevalent nowadays include low overhead, flexibility, minimum investment, and high productivity. By owning few resources and focusing on the organization’s expertise, the company can keep high levels of productivity while allowing its partners to do the same. Both the partners in a smart organization and the individuals who work for the partners are allotted greater flexibility. The partners can focus on core competencies, while individual workers may have the ability to telecommute from their homes. In a smart organization, companies are linked by the free flow of information. There is no hierarchy, no central office, and no vertical integration: just the skills and resources needed to do the job. Each participating company contributes what it is best at. It can be seen that since no single company will have all the skills necessary to compete in the global electronic market, these arrangements will become the norm. One of the keys to the success of the smart organization is the use of ICT to facilitate these alliances.

Creating a smart organization takes more than just the ICT. A recent study on issues of information technology and knowledge management concluded that there is no evidence that ICT provides options with long-term sustainable competitive advantage. The real benefits of ICT derive from the constructive combination of ICT with organization culture for learning and innovation, supporting the trend toward more flexible forms of organization. Information technology's power is not in how it changes the organization, but in the potential it provides for allowing people to change themselves. Creating these changes, however, presents a whole new set of human issues. Among the biggest of these challenges is the issue of trust in system security and trust among partners in the smart organization. It has been reported that the lack of trustworthy security services is a major obstacle to the use of information systems in private business (B2B) as well as in public services, and trust is closely linked to consumers' rights, such as security, identification, authentication, privacy, and confidentiality (Mezgar & Kincses, 2003).

In the following sections the importance of trust in the operation of a smart organization will be described, and suggestions on trust building and discussion of the trust problems associated with ICT system security and smart organization partnering will follow. A trust-based evaluation of smart organization partners using the neural network and data mining technologies will be given.

IMPORTANCE OF TRUST IN SMART ORGANIZATIONS

While technology seems to provide sufficient safeguards, such as digital signatures, encryption, web seal assurances, and standards that provide technology-based security and trust mechanisms at present, there seems to be a perception by businesses that transactions conducted specifi-

cally via the Internet are insecure and unreliable (Bhimani, 1996; Raman, 1996). The findings of a recent electronic commerce survey that examined the adoption of electronic commerce in Australia and New Zealand indicated that there is still an initial slow growth of Internet business to business electronic commerce within the Asia Pacific region as compared to United States. This is due to perceived risks in the security of business to business electronic commerce transactions and trust of the trading parties (KPMG, 1999). It seems as if despite the technical assurances, trading partners in business to business electronic commerce do not trust the "people side" of the transactions. Parkhe (1998) suggests that this is due to two types of uncertainties: uncertainty regarding unknown future events, and uncertainty regarding trading partners' responses to future events. It is in this environment of dual uncertainty that trust becomes an important element in the effective operation of smart organizations.

Trust has long been of interest to a variety of researchers. Mayer, Davis, and Schoorman (1995) define trust as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party." Trust among partners is critical for smart organizations. Without trust, commitment to the goals of the virtual organization can waver, as members perceive the alliance as weak or disintegrating, fractured by misunderstanding or mistrust (Handy, 1995). Trust is particularly important in networked organizations that require constant and close attention to shared commitments to safety and reliability, as well as a shared willingness to learn and adapt. It has been suggested that trust permits an organization to focus on its mission, unfettered by doubts about other members' roles, responsibilities, and resources, and that with trust, synergistic efforts in inter-organizational missions are possible (Gabrowski & Roberts, 1998). Developing trust in a smart

organization is a complex task. It requires fairly constant, small group activities among partners, because it is difficult to trust people you do not know well, whom you have not observed in action over time, and who are not committed to the same goals. Trust plays an important synthesis role because with trust, smart organization can leverage the ability and willingness to learn (Coyle & Schnarr, 1995), thereby enhancing performance and attention to reliability over time. Smart organizations with high levels of trust among their members can effectively utilize interactions and communication processes at their interfaces so partners can learn together, and can develop shared mental models of reliability and a shared culture of innovation. High levels of trust also contribute to strengthening linkages among member organizations. Trust among organizational members is an important prerequisite to changing these linkages to alliances, thus mitigating risks, as organizations are reluctant to adopt alliance-like organizational structures that make them vulnerable to the uncertainties of the global market, and to impacts from other organizations, without some assurances of shared vulnerability (Handy, 1995; McAllister, 1995). Aerospace conglomerates jointly developing mission- and safety-critical systems, comprised of defense contractors, universities, government departments, and other private organizations, are good examples of the need for trust in smart organizations. In these organizations, members have different backgrounds, experiences, goals, objectives, and understandings, but belong to the conglomerate to pursue shared development of mission- and safety-critical aerospace systems. For effective smart organization management to take place, however, members needed to trust in the other members' talents, capacities, willingness to work, and interests in the alliance (Augustine, 1997; SmartBridge, 1997). Without such trust, members could duplicate other members' efforts, subvert the mission and goals of the conglomerate by providing private information about conglom-

erate members to the members' competitors, and introduce inefficiencies and costs pathological to the smart organization goals.

Trust is one of the key drivers for innovation. Many researchers support the point that trust is likely to favor technological innovation and change (Humphrey & Schmitz, 1998; Lorenz, 1999; Moore, 1999; Maskell, 2000).

Trust Building

From the above it is seen that the building and maintenance of trust is a pre-requisite for successful smart organization operation. Given the diversity among the smart organization partners it may be unrealistic to seek universal solutions on a one-size-fits-all basis. From the literature the essential conditions for trust development in a smart organization may be summarized as follows:

A Common Business Understanding

Researchers such as Wigand et al. (1997) and Fuehrer and Ashkanasy (2001) noted that a crucial element in any business cooperation is the establishment of a common business understanding. An earlier work suggests that there are three specifications necessary for the establishment of a common business understanding in the networked context. The first is a clear product specification: the design, quality, and functionality of the product or service. The second is specification of the cooperation level, which requires agreement about deadlines, liability, prices, profit allocation, and staff and resource input. The third is formal specification of agreements between the partners. In a smart organization, these specifications need to be communicated clearly among all partners to achieve a common business understanding. There is always varying uncertainty between members, however. Therefore, there is a need to guard against opportunistic behavior varies between the partners (Wicks et al., 1999).

The three specifications (production, cooperation, and agreements between partners) can be achieved by negotiating relational contracts that guide the formation, operation, and dissolution of the smart organization, thereby facilitating an increase in the level of collaboration-enabling trust. Smart organizations, like other networked organizations, create fiscal and legal issues that must be clarified but they lack a formalized legal framework. Therefore, it is incumbent on the organization's members to develop their own guidelines for the operation of the enterprise. Such agreements may include clarification of members' tasks and responsibilities, agreement on contracts, allocation of funds, potential liability, and how members will contribute their expertise. In this sense, clear guidelines, spelled out in an early stage of the partnership, serve to reduce misperceptions and to foster the establishment of trust.

Other mechanisms to establish a common business understanding in a smart organization include development of an organization handbook, design of a mutual Internet site, chat room technology, or the use of team addresses for e-mail. A specific example is Livelink, a software selected by Siemens to enable creation of a common business understanding for virtual collaboration and knowledge-sharing across geographical and organizational boundaries.

High Ethical Standards

Three factors uniquely characterize the smart organization's position in regard to business ethics. Firstly, smart organizations are rarely guided by pre-existing codified laws, where values and standards are written into legal systems enforceable in court. Since the partners are not usually legally bound to the organization, any negative outcomes or perceptions attributed to poor business ethics could result in the organization's reputation suffering (Fichman, 1997). Second, because smart organizations are intrinsically temporary, corporate ethics are difficult to develop

because members will typically be finishing one Internet collaboration and entering into another. Thirdly, smart organizations are intrinsically boundary-spanning in nature, so that they must incorporate a diversity of culturally based values and morals.

Researchers focused on the notion of advances in ICT and the related effects on social behavior agree that unethical behavior in the ICT context is predominantly caused by technological changes and by the "inside keepers of the information systems" (Pearson et al., 1997, p. 94). They also agree that social behavior needs more than "new laws and modified edicts" (Johnson, 1997, p. 60), and that ethical issues will become increasingly important to enable business transactions to be carried out safely and securely. Although technology has been largely secured by advancing software and technology for virus detection, as well as en/decryption of information to ensure the security of business processes, Johnson (1997) noted that technology could never be sufficient to control all aspects of social behavior. Consequently, online behavior is predicated on an awareness and acceptance of ethical norms and behaviors. This can best be achieved through specification and clarification of the members' tasks, responsibilities, and agreed sanctions for proscribed behavior.

Pearson et al. (1997) reported on ethical standards for the IS profession proposed by three major professional associations in this field. These associations share an agreed set of behavioral obligations to society, to colleagues, and to professional organizations. The standards aim to promote the principle that individuals within the professions act in an ethical and responsible manner in order to influence the success of their organizations (Pearson et al., 1997). Clearly, similar standards can be developed for the operation of smart organizations specifying, for instance, the obligation to partners and clients.

Other possible mechanisms to promote ethical behavior in smart organizations include formal

codes of ethics, which comprise statements of prescribed and proscribed values or behaviors, and thus provide a strategic tool within organizations to inculcate and to demonstrate ethical standards.

Mutual Forbearance between Partners

Forbearance is refraining from cheating. Cheating may take a weak form—failing to perform a beneficial act for the other party, or a strong form—committing a damaging act. The incentives for forbearance arise from the possibility of reciprocity, leading to mutual forbearance. Parties that are observed to forbear may gain a reputation for this behavior, which makes them potentially attractive partners for others. The parties to a successful agreement may develop a commitment to mutual forbearance, which cements the partnership, and, in this way, mutual trust is created, which alters the preferences of the parties toward a mutually cooperative mode. Thus, short-term, self-interested behavior becomes converted to cooperative, trusting behavior.

Competence of Partners

In a smart organization partners will be more willing to share knowledge when they trust in others' competence. It is only natural that they would want to converse with others who have the knowledge and skills regarding the topic at hand, since smart organizations almost always center around a common theme.

Effective Communication and Interaction between Partners

Through communicating with people, we calibrate them, we get a better sense of them and we understand their priorities. Members of a smart organization can therefore increase the trust they are giving and the amount they will trust others,

by actively seeking opportunities to communicate with other members.

Trust Maintenance

Besides building trust, it is essential to maintain trust among partners within smart organizations. For instance, through the Smart Bridge project the temporal quality of trust was revealed (Grabowski & Roberts, 1998). Initially, when members in a networked organization were excited about the opportunities joint software development and integration posed, much proprietary product and planning information, as well as member-confidential development and integration strategies were exchanged. Over time, however, as the smart organization matured, and the strength of the linkages between some members faded, the initial trust between some members faded. Some members, although partners on paper, were excluded from planning and integration discussions late in the project, and less proprietary information overall was exchanged as the project matured. Thus, as this networked organization matured, trust among some members waned, suggesting that management of trust in smart organizations requires at least as much effort and interest as management of the smart organization and its linkages. Meyerson, Weick, and Kramer (1996) developed the concept of swift trust for temporary teams whose existence, like partners in a smart organization, is formed around a common task with a finite life span. Such teams consist of members with diverse skills, with a limited history of working together, and with little prospect of working together again in the future. The tight deadlines under which these teams work leave little time for trust building. Because the time pressure hinders the ability of team members to develop expectations of others based on first hand information, members import expectations of trust from other settings with which they are familiar. Analogous to the hyperpersonal model

(Walther, 1997), individuals in temporary groups make initial use of category-driven information processing to form stereotypical impressions of others. After the team has begun to interact, trust is maintained by a “highly active, proactive, enthusiastic, generative style of action” (Meyerson et al., 1996).

High levels of action have also been shown to be associated with high performing teams (Iacono & Weisband, 1997). Action strengthens trust in a self-fulfilling fashion: Action will maintain members’ confidence that the team is able to manage the uncertainty, risk, and points of vulnerability, yet the conveyance of action has as a requisite the communication of individual activities. In summary, whereas traditional conceptualizations of trust are based strongly on interpersonal relationships, swift trust deemphasizes the interpersonal dimensions and is based initially on broad categorical social structures and later on action. Since members initially import trust rather than develop trust, trust might attain its zenith at the project inception (Meyerson et al., 1996).

Another effective way of holding partners together in a smart organization is through execution of business projects. In a smart organization, projects will need to be renegotiated more quickly and individual partners need the ability to be creative about ways of completing projects based on the principles of trust. The individual partner in a smart organization now has to go beyond basic task cooperation and legal arrangements typical of traditional patterns of hierarchical work organization toward a search for greater trust and autonomy. Trust allows partners to take risks with themselves by being able to make mutual disclosures to others and to develop new task execution styles. Norms of behavior can only work if people know what to expect, but expectations also require some prior commitment, which is based on belief. When rapid change occurs, existing role structures can be destroyed, but without being replaced immediately with legitimate alternative structures. However, people will resist getting rid

of norms that have meaning for them, particularly where they think they are already well accepted and approved.

Changing from one situation to another will take time in order for individuals to learn at an emotional level how to come to terms with loss and growth. People who have already invested time and energy in learning how to manage a situation may find change unwelcome when having to learn new roles. The creation of roles can be seen in the life cycle of a networked organization and is believed to go through the stages of forming, storming, norming, performing, and adjourning (Handy, 1995). Trust is vital for commitment during the norming phase. The storming phase is anomic in the sense that people are challenging each other for authority over what is true, correct, and what they want. Order is reached when people accept norms as legitimate according to some criteria and then they can perform. There should be a consensus over norms, but there is a possibility of a minority coercing the others and then legitimacy is weak. Sufficient time must be allowed for people to work through the process using open communications, otherwise they cannot be committed, particularly if there is a requirement for a major change in norms, as one would expect when both planned and unplanned changes occur frequently.

One should also consider how cooperation can be affected by smart organization partnership. Cooperation is a special form of behavior which is concerned with reciprocal actions which are to each other’s mutual benefit. Selfish behavior can in a strategic sense lead to cooperation under certain conditions where both parties are mutually dependant on each other for an uncertain period ahead. At an individual level, in one off encounters, people can afford to be selfish (using game-like strategies) because they may not meet each other again. However, where they are likely to encounter the same people again on a repetitive basis the need for cooperation increases because the risk of future retaliation may rise. If

trust does exist between people there can still be dissent but this will not involve conflict, which is at each other's expense. In the case of selfish behavior, trust in the other person is not required and behavior may become competitive, as soon as people realize that they are no longer dependent on each other. Alternatively, role relationships may exist which are exploitative because of unequal power and low levels of trust.

Summing up, failure to manage trust properly in a smart organization can be a source of failure in business today. In the following sections the need for trust-based evaluations in smart organizations will be examined.

SECURITY PROBLEMS IN AD HOC NETWORKS

Nowadays, the great flexibility of TCP/IP has led to its worldwide acceptance as the basic Internet and intranet communications protocol. At the same time, the fact that TCP/IP allows information to pass through intermediate computers makes it possible for a third party to interfere with communications in any of the following ways:

- **Eavesdropping:** Information remains intact, but its privacy is compromised. For example, someone could learn your credit card number, record a sensitive conversation, or intercept classified information.
- **Tampering:** Information in transit is changed or replaced and then sent on to the recipient. For example, someone could alter an order for goods or change a person's resume.
- **Impersonation:** Information passes to a person who poses as the intended recipient. Impersonation can take two forms: spoofing or misrepresentation.

In the case of smart organizations, many sensitive personal and business communications over

the Internet require precautions that address the threats mentioned above. Two most common approaches used to deal with the security problems are encryption and steganography (Mezgar & Kincses, 2003):

- **Encryption:** Transforming the message to a ciphertext such that an enemy who monitors the ciphertext cannot determine the message sent. The legitimate receiver possesses a secret decryption key that allows him to reverse the encryption transformation and retrieve the message. The sender may have used the same key to encrypt the message (with symmetric encryption schemes) or used a different, but related key (with public key schemes).
- **Steganography:** The art of hiding a secret message within a larger one in such a way that the opponent cannot discern the presence or contents of the hidden message. For example, a message might be hidden within a picture by changing the low-order pixel bits to be the message bits.

The increasing use of wireless ad hoc networks such as the Smart Sensor Networks pose challenges to security (Zhou et al., 1999; Zhang, 2000; Deng et al., 2002). First of all, the use of wireless links renders an ad hoc network susceptible to link attacks ranging from passive eavesdropping to active interfering. Unlike fixed hardwired networks with physical defense at firewalls and gateways, attacks on an ad hoc network can come from all directions and target any node. Damage includes leaking secret information, interfering message, and impersonating nodes, thus violating the basic security requirements. All these mean that every node must be prepared for encounter with an adversary directly or indirectly.

Secondly, autonomous nodes in an ad hoc network have inadequate physical protection, and are therefore more easily captured, compromised, and hijacked. Malicious attacks could be launched

from both outside and inside the network. Because it is difficult to track down a particular mobile node in a large scale of ad hoc network, attacks from a compromised node are more dangerous and much harder to detect. All these indicate that any node must be prepared to operate in a mode that should not immediately trust any partner.

Thirdly, any security solution with static configuration would not be sufficient because of the dynamic topology of the networks. In order to achieve high availability, distributed architecture without central entities should be applied. This is because introducing any central entity into a security solution may cause a fatal attack on the entire network once the centralized entity is compromised. Generally, decision-making in the ad hoc networks is decentralized and many ad hoc network algorithms rely on the cooperation of all nodes or partial nodes. But new types of attacks can be designed to break the cooperative algorithm. Malicious nodes could simply block or modify the data traffic traversing them by refusing the cooperation or hacking the cooperation. As can be seen from the above, no matter what security measures are deployed, there is always some vulnerability that can be exploited to break in.

It seems difficult to provide a general security solution for the ad hoc networks. A traditional cryptographic solution is not adapted for the new paradigm of the networks. As can be seen from the above analysis, what is lacked in the ad hoc networks is trust, since each node must not trust any other node immediately. If the trust relationship among the network nodes is available for every node, it will be much easier to select a proper security measure to establish the required protection. It will be wiser to avoid the untrusted nodes as routers. Moreover, it will be more sensible to reject or ignore hostile service requests. Trust-based evaluation thus becomes a before-security issue in the ad hoc networks.

SELECTION OF PARTNERS IN SMART ORGANIZATIONS

In the new economy, knowledge is increasingly seen as central to the success of organizations and an asset that needs to be managed. The ability of an enterprise to manage knowledge as an asset (and provide a good return on investment) is seen as the key to survival in a global business environment in which the efficiencies of mass production of commodity goods have been successfully exported to emerging economies. The major issue of knowledge management is to place knowledge under management remit to get value from it—to realize intellectual capital. That intellectual capital can be regarded as a major determinant of the difference between a company's book price and the total value of its physical assets. For a successful company, this difference can be considerable, representing the difference between the way the company is seen by financial experts and by the market. For example, there is a great difference between the book price and share value of recently-launched biotechnology companies, whose market value is clearly based on their knowledge assets, rather than traditional capital. However, while the world of business is experienced in managing physical and financial capital, smart organizations have difficulty finding solutions to practical questions concerning partnership management, such as:

We are involved in an exciting project with four other companies. How can we tell whether all these partners would collaborate?

Market needs change often these days and we are always bringing new partners into projects. How can we select the right partners?

The main issue is that partners of the smart organizations are quite intractable from a knowl-

edge management point of view. By their very nature such partners create a great deal of new knowledge, which as such is of high value to the smart organization. However, the knowledge of how and why they created, and what they had created is not clear since it involves the interactions among a group of different people. Since smart organization partners do not have frequent face-to-face interaction, the core company has to have total faith that the partners will do the job they are assigned, and do it right. This leaves core companies with the daunting task of selecting partners who are not only able to work on their own, but can also function within a team structure—self-motivated partners. When it works, the organization processes flow nicely. However, when one partner starts slacking, the ramifications are dire in consequence. A frequent occurrence is when a partner joins the smart organization with certain expectations, but those expectations are modified by an unexpected technology breakthrough. Suppose a regional airline was brought into a certain route-alliance smart organization to harmonized express, general air cargo and heavy express air cargo products in the Asia Pacific Region, and it is just found that there is a growing need for the smart organization to focus on harmonizing dangerous good products. Assuming that due to national aviation legislations the partner airline cannot handle this kind of product, it makes sense for the core air cargo organization to switch partners. And suppose that the original airline has invested a considerable amount of capital in developing general and heavy cargo products handling equipment for the core organization, in addition to carrying out research on European air cargo markets. In the traditional business system, each partner suboptimizes for its own goals, which in this case would provide a less than optimal service, express general and heavy cargo handling only, leaving the dangerous goods handling to the competitors. A better business system will agilely adjust to the customers' need and at the same time reward the general cargo-handling

partner for essentially putting itself out of the smart organization. In such a case, that partner has to have trust that the smart organization will deal with it fairly whether it is fully in the smart organization or out. And the smart organization has to have trust in each partner that they will strive to optimize the enterprise even when it reduces or eliminates its own role.

While trust has long been a major issue in the organizational literature, there is little agreement on a single model of trust that applies to all partner evaluation contexts. One can only see from the literature that although trust is pivotal in reducing the high levels of uncertainty endemic to the global and technologically-based environment, interfirm trust was rarely considered in the evaluation of partners in a smart organization. For effective smart organization management, it is clear that electronic handshake would need to be based on trust between partner companies as well as the correct protocol. To facilitate the evaluation of interfirm trust a partner evaluation decision support system is suggested below (Lau & Wong, 2001; Wong & Lau, 2003).

NEURAL DATA MINING SYSTEM (NDMS)

In larger organizations, many different types of users with varied needs utilize the same massive data warehouse to retrieve the right information for the right purpose. Whilst data warehouse is referred to as a very large repository of historical data pertaining to an organization, data mining is more concerned with the collection, management, and distribution of organized data in an effective way. The nature of a data warehouse includes integrated data, detailed and summarized data, historical data, and metadata. Integrated data enable the data miner to easily and quickly look across vistas of data. Detailed data is important when the data miner wishes to examine data in its most detailed form, while historical data is

essential because important information nuggets are hidden in this type of data. Online analytical processing (OLAP), an example of architectural extension of the data warehouse, has become popular in the last couple of years. OLAP refers to the technique of performing complex analysis over the information stored in a data warehouse. For instance, by using the OLAP Hub (SPSS, 2004), a commercial Web-based online analytical processing software, the managers within a smart organization can access and analyze information about organizational performance, share their findings with others immediately via the Web, and take action as opportunities arise. Consequently, more informed decisions will result and this in turn will lead to enhanced productivity and increased profitability.

Once a data warehouse is set up, the attention is usually switched to the area of data mining, which aims to extract new and meaningful information. In other words, a pool of “useful information” that has been stored in a company data warehouse becomes “intelligent information,” thereby allowing decision-makers to learn as much as they can from their valuable data assets. In this respect, neural networks can be deployed to enhance the intelligence level of the OLAP application. Neural networks search for hidden relationships, patterns, correlations, and interdependencies in large databases that traditional information gathering methods (such as report creation and user querying) may have overlooked. The responsibility of the neural network is to provide the desired change of parameters based on what the network has been trained on. Intrinsically, a sufficient amount of data sample is a key factor in order to obtain accurate feedback from the trained network. As neural network is capable of learning relationships between data sets by simply having sample data represented to their input and output layers (Herrmann, 1995), the training of the network with input and output layers mapped to relevant realistic values with the purpose to develop the correlation between

these two groups of data will not, in principle, contradict the basic principle of neural network. With a trained network available, it is possible that recommended action can be obtained with the purpose to rectify some hidden problems, should that occur at a later stage. Therefore, in the training process of the neural network, the nodes of the input layer of the neural network represent the data from the OLAP and those of the output layer represent the predictions and extrapolations. It should be noted that the output information from the OLAP could be used to refine the OLAP data cube so as to continually update the database over time.

Characteristics of NDMS

The data interchange within the NDMS encompasses three modules, namely OLAP module, data conversion (DC) module, and neural network (NN) module (Figure 1). The data repository, which aims to support efficient data interchange among the three modules, is essential for the coordination and updating of information from various sources. As for the OLAP module, it consists of descriptive data (dimensions) and quantitative value (measures), both of which generate the OLAP data cube by building up two elements, namely, fact table and dimension (Erik, George, & Dick, 1999). In the fact table, the required data and user-defined methods for analysis are specified clearly. In the descriptive data of OLAP, the different dimension levels are defined for further computational use on different views of OLAP data cube. Typical dimension includes location, company, and time; whereas typical measure includes price, sales, and profit. With a multidimensional view of data, the OLAP module provides the foundation for analytical processing through flexible access to information. In particular, this distinct feature can be used to compute a complex query and analyze data on reports, thereby achieving the viewing of data in different dimensions in an easier and more

efficient way. To illustrate the benefits of OLAP as compared to the traditional approach of data management using structured query language (SQL), an example is shown here to benchmark their underlying methodologies of associated operations.

In the SQL approach, when a user needs to retrieve information across multitable, users must clearly define the necessary tables for finding the specific information. For instance, when a user needs to know how much sales is taken for a certain year and city and uses the Internet as promotion media, the tables and their relationships must be clearly defined. In normal practice, a query command line written in SQL as shown below can be used to retrieve information from the tables:

“Select sum(a.store_sales) from sales_fact_2004 a, promotion b, region c, store d, where a.store_id = d.store_id and c.region_id = d.region_id and b.promotion_id = a.promotion_id and c.sales_country= China and b.media_type = Internet”

When using the OLAP module, the table used for the query and the data used to perform the calculation are defined separately. Then, the user builds up a complex calculation on individual members to meet the specific requirements.

Because the calculation and analysis have been precomputed in the OLAP server previously, only a simple Multi-Dimension eXpression (MDX) is necessary to construct for retrieving identical result as shown in the following:

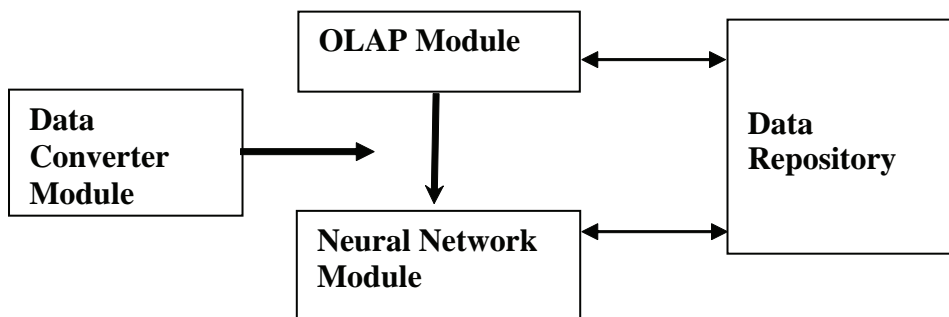
“Select [Measures].[Store Sales] on columns, [Store].[Sales_country] on rows from sales where ([Promotion].[Media_Type].[Internet], [Region].[Sales_country].[China])”

In the above expression, it can be shown that MDX is simpler and clearer than SQL statement. When the user requirement is changed, there is only a small part of the OLAP data cube needed for alteration in order to fulfill the user requirement. In this respect, some minimal change of the MDX is necessary. Comparing with the traditional approach, the SQL statement needs to be rewritten to meet the new requirement.

In general, MDX is suitable for creating decision support functionality, and a typical example has been provided as follows:

*“IF ([Measures].[Unit_Sales] > 1000, [Measures].[Store_Sales] * 0.8, [Measures].[Store_Sales])”*

Figure 1. Characteristics of NDMS



Before the implementation of OLAP, the calculated member is constructed by the measures. In this case, in an example that aims to find a suitable business partner for a particular task, the method has been depicted in Figure 2.

EVALUATION OF SO PARTNERS

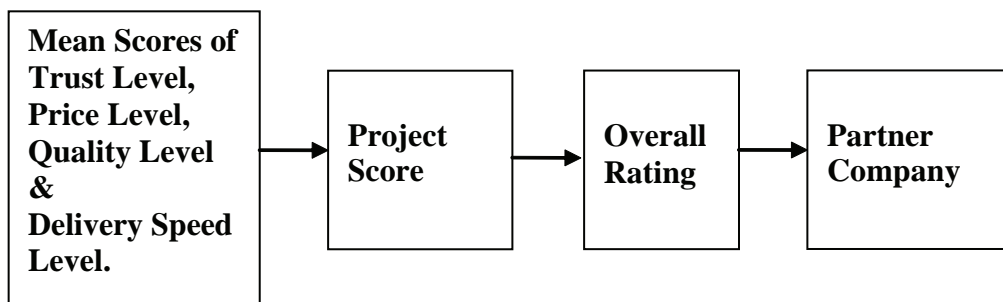
Industries in the 21st century find themselves in a world increasingly globalized and concerned with speed, quality, and cost. As a result, many enterprises now manufacture and distribute globally. The evaluation of SO partners generally involves distinct types of decisions. For instance, in the evaluation of product distributors, one focuses on a partner to handle a company’s product in the foreign or domestic market. Hence, access to markets and market intelligence are likely to be of key importance, together with reliability and control over conditions of distribution and sales. On the other hand, evaluation of supply partners involves the identification of a partner for meeting the company production requirements. In this case, supply chain variables such as material quality, price, supply lead time, and inventory control are generally considered to be of key importance. In both cases, trust between top management teams of the core and partner companies is of fundamental importance.

The selection of attributes or variables for consideration in the comparison of smart organi-

zation partners is quite important to the eventual outcome. For instance, considerations relating to financial objectives, expected quality level, safety standards, problem resolution mechanisms, and so forth. In addition, intangible benefits and risks are often present. The set of attributes should include all the criteria that are needed in order to describe the differences between partner competencies. It is desirable that the list is complete, but if there is a criterion on which all the partner competencies are equal, then that criterion can be discarded, since it will not have any differential impact on the final partner rankings.

In Figure 2, the scores of trust level, price level, quality level, and delivery speed level for each partner are used. The mean score of a project is calculated by taking the mean scores of the trust level, price level, quality level, and delivery speed level of the previous projects that have been carried out by the partner company concerned. Finally, the overall average of the partner company is determined by accumulating the prespecified weighting of the latest projects. The overall average can then be assessed by the top management of the core company. Since the OLAP technology is a user-friendly and software-independent tool, it can be embedded in most client server development tools and Web development tools. In the following case example, after the customer submits the requirement to the NDMS server, an MDX query can then be executed in order to retrieve available service providers based on the core competence specified.

Figure 2. Partner score method



With the OLAP module as a front-end component, the neural network (NN) module is employed as a back-end part of the NDMS, which concentrates on providing essential information such as alertness of abnormal scenarios based on the pattern of historical data. However, since the output data from the OLAP data cube may not be able to be used directly by the NN module due to possible data incompatibility, it is essential that a data translation mechanism (DTM) is to be incorporated to act as a “bridge” to link the two modules together to form an integrated unit.

The DTM module is meant to play this important role. In brief, the DTM module concentrates on achieving efficient data transfer between the OLAP module and the NN module, which requires specific data format for mapping the input nodes to guarantee proper operation. With the formatted data available via the DC module, the focus is now turned to the NN module, which aims to set up a suitable network topology in order to identify any correlation within the data pool. The NN module is meant to project possible outcomes—good or bad—based on the available pattern of data, thereby alerting users of detected abnormal behavior in terms of company performance and other hidden business issues. This provides important advice to support critical decision-making in the SO. In the following case example, parameters such as trust between management teams, product quality, and product cost are abstracted from recent company performance records. With the assistance of an expert team, many companies’ past behavior based on the selected parameters can be classified and ranked. In general, for the setup of a neural network, a number of inputs are required to enable such network to take into account the various multiple factors that may influence the performance assessment of a particular company. In this research, the neural network consists of four input nodes (five sets of the last five records including trust, quality, cost and speed) and five output nodes (various suggested actions to be taken), as shown in Table 1. To achieve the

objective of producing a reliable “trained” neural network, statistical data have to be mapped to the input and output nodes of the neural network. In this respect, it is recommended that at least 100 sets of data are required to train the network in order to develop a reliable module for the NDMS. With the availability of a fair amount of data sets, the next step is to train a neural network.

This means the parameters include network construction, and training data files are needed for definition. Then, users can apply analysis tools to provide insight into how the network is to be trained, as well as the appropriate topology of the network for the specific purpose. It is also likely that users will need to fine-tune the training parameters such as iteration number, learn rate, momentum, and so forth (Qnet, 2000), so that the specified values match the training characteristics for the model. After the completion of the training process, such neural networks can then be used as a knowledge repository to monitor companies’ performances, and provide decision support to users who then consider necessary actions to be taken.

After the training process, the trained neural network can then be recalled in order to process the new inputs through the network. In order to describe in more detail about the recall operation under the NN module, five latest track records of a company are required to be mapped to the input nodes for analysis. Output data from the NN module will predict the company’s performance based on the configuration of the trained network. A case example in the next section will elaborate how this works.

CASE ILLUSTRATION

To verify the applicability of the NDMS, a prototype system has been developed, based on the framework of the NDMS as proposed in this paper. Pursuing the NDMS infrastructure that has been defined in the previous section, the

OLAP module has generated a pool of useful data and accordingly, the NN module has created a reliably trained neural network. Next, five latest track records of a company have been gathered and listed as follows. In this case four factors—trust between top management, quality, cost and delivery speed—are being considered, and performance scores (PS) ranging from 1 (least point) to 7 (highest point) are used to assess the partner company, as shown in Table 1.

After such information has been input, the NN module gives an assessment report back to the user, thus supporting the user to take action if deemed necessary. In the following table, “0” output from the NN node indicates a negative suggestion to the associated statement, and “1” is the positive suggestion, whereas “0.5” indicates that there is not enough data to justify a firm suggestion.

Based on the NN output results as shown in the table, it can be seen that although Company A is trustworthy, it seems to have problem in meeting the agreed quality level, and it is suggested that additional assessment regarding the company’s performance is needed. Based on the suggestion of this assessment report, Company A was approached in order to find out the reasons behind the abrupt change in product quality. After an organized investigation of the issue, it was found that two of the key staff responsible for the quality assurance department left the company several months ago to join a newly established multinational corporation. Because of this unexpected change, the company suffered an unprecedented “brain-drain,” resulting in the sudden decline of quality level of certain mainstream products.

Because of the situation, Company A has been advised to implement some best practices related

Table 1. Five latest records of Company A

| Company A | Performance Score(PS) | | | |
|-------------------------------|------------------------------|-----------------|--------------|----------------|
| | Trust between top management | Product Quality | Product Cost | Delivery Speed |
| Latest record | 6 | 5.6 | 6.5 | 6.2 |
| 2 nd latest record | 6.4 | 4.8 | 5.9 | 6.4 |
| 3 rd latest record | 5.9 | 4.1 | 6.0 | 5.7 |
| 4 th latest record | 6.6 | 3.8 | 5.6 | 5.8 |
| 5 th latest record | 6.3 | 3.5 | 5.5 | 6.0 |

Table 2. Output from the NN module

| Company A | Output from NN module |
|---|-----------------------|
| Price quoted reflects current market situation | 1 |
| Product quality has been compromised to meet the quoted price | 1 |
| Dependability of company | 1 |
| Potentially competent | 0.5 |
| Additional assessment of company performance is required | 1 |

to quality assurance. In this case, the concept of total quality management (TQM) has been adopted and a TQM consultant team has also been requested to facilitate the implementation of such practice in the company. At this stage, it is still difficult to tell whether the company could significantly reverse the downturn performance in terms of product quality. However, because of the signal generated from the NDMS, the problem of a business partner has been revealed, and a prompt business decision could be made with supporting assessment report, thus avoiding the loss of a trusted business partner, which can in turn weaken the overall performance of the smart organization. This case example indicates that the introduction of the NN module to the OLAP module is able to significantly upgrade the decision support functionality of the smart organization. However, the results obtained, so far, are by no means perfect although they demonstrate that the suggested NDMS is viable.

LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

This study mainly focused on the practical need to consider trust between partner companies in a smart organization. Owing to the circumstances pertaining to the schedule of the study, the perception of a limited number of managers responsible for partner selection was used to verify the importance of interfirm trust. It would be desirable to extend the analysis to all the dimensions pertaining to trust, and explore the effect of trust on the performance of partner companies. Additionally, qualitative studies on mapping the cognitive processes of senior managers responsible for evaluation of partner companies in the smart organization would also be helpful. Here conjoint analysis might be applied. In the present context, conjoint analysis is concerned with understanding how senior managers make choices

among partner companies, so that a smart organization can choose new partners that better serve its needs. Although it has only been a mainstream research technique for the last decade or so, conjoint analysis has been found to be an extremely powerful way of capturing what really drives top managers to select one partner over another, and what the top managers of a particular smart organization really value. A key benefit of conjoint analysis is the ability to produce dynamic decision models that enable companies to test out what variables they would need to consider to improve the decision-making process. Coupled with the decision support tool proposed, such a methodology would help to understand how managers actually make such decisions and use experience in partner evaluation.

CONCLUSION

In order to achieve the target mission of a smart organization, the core company must be clear about its business aims and objectives. It must assemble a set of partner companies that can deliver to those objectives. It must support them in doing so and trust them to do so. In providing security solution to ad hoc networks or in the selection of partners, a company has to analyze the trustworthiness of the potential partners, their capabilities, track record, and future potential. However, there is no single model of trust that could be applied in practical situations. Hence, there is great pressure placed on the CEOs as the decision makers for selection of satisfactory partner companies. In this chapter, an intelligent decision support system for smart organization partner evaluation is introduced. It demonstrates the benefits of using a combination of technologies to form an integrated system which capitalizes on the merits and at the same time offsets the pitfalls of the involved technologies. A special feature is that the trust between management teams of companies could be incorporated as one

of the evaluation criteria. The NDMS has been found to be feasible in predicting the problems of companies as shown in a case example described in the paper. As suggested, further investigations on (i) key dimensions relating to trust between companies within a smart organization and (ii) the impact of trust on overall performance of partner companies would be needed.

ACKNOWLEDGMENT

The author wishes to thank the Department of Mechanical Engineering, The Hong Kong Polytechnic University for supporting this study.

REFERENCES

- Augustine, N. R. (1997). Reshaping an industry: Lockheed Martin's survival story. *Harvard Business Review*, 75, 83-94.
- Axelrod, R. (1990). *The evolution of co-operation*. Penguin Books.
- Bhimani, A. (1996) Securing the commercial Internet, *Communications of the ACM*, 39(6), 29-35
- Business Week (1993). The virtual corporation. February 8, 98-103.
- Coyle, J., & Schnarr, N. (1995). The soft-side challenge of the "virtual corporation." *Human Resource Planning*, 18, 41-42.
- Davidow, W. H., & Malone, W. S. (1992). *The virtual corporation*. New York: Harper Collins Publishers.
- DeSanctis, G., & Poole, M. S. (1997). Transitions in teamwork in new organizational forms. *Advances in Group Processes*, 14, 157-176.
- Erik, T., George, S., & Dick, C. (1999). *Microsoft OLAP solutions*. New York: John Wiley & Sons.
- Filos, E., & Banahan, E. (2000) Will the organization disappear? The challenges of the new economy and future perspectives. In L. M. Camarinha-Matos, H. Afsarmanesh, & R. J. Rabelo (Eds.), *E-business & virtual enterprises* (pp. 3-20). Dordrecht: Kluwer.
- Gamble, P. R. (1992). The virtual corporation: An IT challenge. *Logistics Information Management*, 5(4), 34-37.
- Giddens, A. (1993). The nature of modernity. In P. Cassell (Ed.), *The Giddens reader* (pp. 284-316). Stanford University Press.
- Handy, C. (1995). Trust and the virtual organization. *Harvard Business Review*, 73(3), 40-50.
- Herrmann, C. S. (1995). A hybrid fuzzy-neural expert system for diagnosis. *Proceedings of International Joint Conference on Artificial Intelligence* (pp. 494-500).
- Humphrey, J., & Schmitz, H. (1998). Trust and inter-firm relations in developing and transition economies. *The Journal of Development Studies*, 34(4), 32-61.
- Iacono, C. S., & Weisband, S. (1997). Developing trust in virtual teams. *Proceedings of the Hawaii International Conference on Systems Sciences*, Hawaii. (CD-ROM).
- Jarvenpaa, S. L., & Leidner, D. E. (1998) Communication and trust in global virtual teams. *Journal of Computer-Mediated Communication*, 3(4).
- KPMG. (1999). *Electronic commerce—The future is here*. Norton and Norton Institute.
- Kramer, R. M., & Tyler, T. R. (Eds.). *Trust in organizations: Frontiers of theory and research* (pp. 166-195). Thousand Oaks, CA: Sage.
- Lau, H., Chin, K. S., Pun, K. F., & Ning, A. (2000). Decision supporting functionality in a virtual enterprise network. *Expert Systems with Applications*, 19(4), 261-270.

- Lau, H., & Wong, T. T. (2001). Partner selection and information infrastructure of a virtual enterprise network. *Computer Integrated Manufacturing*, 14(2), 186-195.
- Lea, M., & Spears, R. (1992). Paralanguage and social perception in computer-mediated communication. *Journal of Organizational Computing*, 2(3/4), 321-341.
- Lipnack, J., & Stamps, J. (1997). *Virtual teams: Reaching across space, time, and organizations with technology*. New York: John Wiley & Sons.
- Lippitt, G., & Lippitt, R. (1978). *The consulting process in action*. University Associates Inc.
- Lorenz, E. (1999). Trust, contract and economic cooperation. *Cambridge Journal of Economics*, 23, 301-315.
- Marris, P. (1974). *Loss and change, institute for community studies*. Routledge and Kegan Paul.
- Maskell, P. (2000). Social capital, innovation, and competitiveness. In S. Baron, J. Field, & T. Schuller, (Eds.), *Social capital: Critical perspectives*. New York: Oxford University Press.
- Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of Management Review*, 20, 709-734.
- Mezgar, I., & Kincses, Z. (2003). The role of trust in information technology management. In A. Gunasekaran, O. Khalil, & S. M. Rahman (Eds.), *Knowledge and information technology management—Human and social perspectives* (pp. 283-304). Hershey, PA: Idea Group Publishing.
- Meyerson, D., Weick, K. E., & Kramer, R. M. (1996). Swift trust and temporary systems. In R. M. Kramer & T. R. Tyler (Eds.), *Trust in organizations* (pp. 166-195). Thousand Oaks, CA: Sage.
- Moore, M. (1999). Truth, trust and market transactions: What do we know? *The Journal of Development Studies*, 36(1), 74-88.
- Musthaler, L. (1995). Effective teamwork virtually guaranteed. *Network World*, October 16, SS10-SS11.
- Parkhe, A. (1998). Understanding trust in international alliances. *Journal of World Business*, 33(3), 219-240.
- Qnet v2000 (2000). Retrieved March 23, 2005, from <http://qnetv2k.com/>.
- Raman, D. (1996). Cyber assisted business - EDI as the backbone of electronic commerce, EDI-TIE.
- SmartBridge. (1997). Retrieved on March 23, 2005, from <http://www.hokie.bsl.prc.com/maritech/dsc94-44.htm>.
- Walther, J. B. (1997). Group and interpersonal effects in international computermediated collaboration. *Human Communication Research*, 23(3), 342-369.
- Wong, T. T., & Henry, C.W. Lau (2003), The impact of trust in virtual enterprises. In A. Gunasekaran, O. Khalil, & S. M. Rahman (Eds.), *Knowledge and information technology management—Human and social perspectives* (pp. 153-168). Hershey, PA: Idea Group Publishing.

This work was previously published in Integration of ICT in Smart Organizations, edited by I. Mezgar, pp. 159-186, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.4

E– Commerce and Small Tourism Firms

Patrice Braun

University of Ballarat, Australia

INTRODUCTION

Today's networked economy is a strategic combination of many factors, with electronic platforms and relationships underpinning competitive advantage. Enabled and driven by information and communication technologies (ICT) and connectivity, the networked economy is challenging the fundamental bases of established government frameworks, conventional business practices, and traditional marketing disciplines. To achieve business success in this techno-economic paradigm requires new ways of thinking for all.

This article examines regional development trends, such as the growing importance of connectivity, electronic-commerce (e-commerce), and industry networks for global competitive advantage. Within that context, it discusses issues facing small tourism firms in becoming part of the networked economy.

REGIONAL NETWORKS

A consistent pattern in today's economic business process is collaboration between firms, whereby

emphasis is placed on networking, knowledge sharing, and cooperation rather than competition (Asheim, 2001). The adoption and diffusion of ICT and the Internet are integral components in today's business processes, as connectivity has increased our ability to connect and communicate with others, regardless of whether they are located locally, regionally, nationally, or across the globe.

Research indicates that network building is not only a major new source of competitive advantage for any company, but also a crucial asset to business survival and an essential global and, indeed, regional development requirement (Porter, 1998). Because the processes of ICT-based information seeking, information distribution, and knowledge sharing are interactive, it is believed that a firm's information channels or interpersonal networks play an important role.

In recent times, regional development policy has undergone a paradigm shift from an exogenous or external focus to an endogenous or internal and relational network one (Storper, 1997). Networking, community building, and learning are portrayed as pivotal linkages for regional growth, whereby policy makers concerned with the perfor-

mance of regional economies are seeking to foster a networked community culture (Asheim, 2001). In geographic terms, networks can operate on international, national, regional, and local levels. Examples of this network-building trend may be found internationally on the European Commission and the APEC action agendas (APEC, 2001). The trend is also reflected in Australian regional development policy, which, in taking its cues from global trends in regional development, portrays connectivity, networking, industry clustering, regional specialization, and capacity building as pivotal for regional growth (ALGA, 2002).

As such, network formation is not a novel or emerging concept but rather a recycled notion caught up in a new policy wave. Theoretical discussions on interfirm organization can be found as far back as 1960 (Philips, 1960), although it would take several decades more until Miles and Snow (1992) identified a significant movement toward the so-called network form. Since then, myriad network structures and traits have been discussed in the literature, including firm interdependence, trust between network partners, pitfalls of network alliances, and issues surrounding change. The latter is of particular relevance in these rapidly changing times. Business networks are subject to external changes, such as a transformation in the economic and technological climate, and internal changes, such as competition and issues of power and trust (Håkansson, 1995).

Connectivity and the Internet have added new dimensions to the concept of networked firms. The advent of connectivity has boosted conventional reasons for interfirm networking, as the technology-enabled landscape provides the capacity for firms to collaborate with former competitors and potentially achieve “competitive co-evolution, enhanced by digital platform features” (Ordanini, 2001, p. 282). The concept of clustering, another form of network formation, has gained new prominence, as it can help create critical mass and facilitate the knowledge-based infrastructure needed for competitive advantage.

Porter (1998) discusses competitive advantage as being created and sustained through a highly localized process and ascribes enduring competitive advantage in a global economy to local knowledge, relationships, and motivation that cannot be duplicated by global partnering. Thus, as a result of the networked economy, it may be said that organizational change can be expected throughout regions and across a number of industries, and especially in information-based industries such as the tourism industry.

TOURISM AND TECHNOLOGY

Being among the two largest, most rapidly growing, and most dynamic industries, tourism and technology have become inextricably linked. Together, they are changing the way society operates (Werthner & Klein, 1999). The tourism industry has always relied heavily on information. In fact, until a tourist gets to his or her chosen destination, tourism *is* information rather than a physical product. While tourism services are produced and consumed in a physical world set in a regional or local context, purchase of a tourism product is generally based on information received through direct or intermediary market channels, prior knowledge, word of mouth, and perceptions of trust and service quality. As the nature of the tourism product is information-based, it is a search product that is evaluated by perusing product-related information. Being dependent on effective information flows makes the tourism product a complex one, as it is “...almost entirely dependent upon representations (such as pictures in brochures) and descriptions to help consumers make a purchase decision” (Laubenheimer, 1999, p. 279).

Tourism intermediaries typically fulfill functions such as presorting and structuring tourism product information, providing a place for the supply and demand sides to meet, and reducing uncertainty. Travel agents have traditionally been

high-profile intermediaries between travel suppliers and consumers, selling the tourism product, for which they derive a sales commission, to customers. Apart from their customer service role, a travel agent's product knowledge and expertise is the value added for the customer. Destination marketing organizations, such as regional and local tourist information centers, also perform an intermediary (booking) role, most often between consumers and tourism small to medium-size enterprises (SMEs) (Wynne, 2001).

Now information technology and the Internet enter the picture. The Internet has the ability to provide a highly suitable and major new market channel for tourist products, because it can display information and pictures. The travel and tourism sector to a large degree depends on business-to-consumer (B2C) e-commerce activity. The Internet can create a direct link between a worldwide supplier community and equally dispersed consumers. Speed is also crucial in the travel industry, and the Internet can provide an instant confirmation response to an inquiry such as flight or room availability. The influence of ICT on tourism product perusal and purchase is evident in the proliferation of travel/tourism sites on the Web (Bernstein, 1999). A search engine query on travel and tourism will return an incredible 15 million results, which includes information on anything from outback tours to deep sea adventures to bed-and-breakfast stays around the globe. To date, the sale of online airline tickets constitutes the largest part of e-commerce-related travel business. In North America alone, travel purchases before 2000 accounted for US\$4 billion in sales, with forecasts for 2003 ranging up to US\$29 billion (Pappas, 2001).

With increasing ICT literacy of prospective customers, consumer expectation of easy access to tourism product is rising. Such consumer expectations are likely to increase pressure on product providers to either offer instantaneous product information satisfaction or lose potential customers (Buhalis & Main, 1998). The emer-

gence of electronic markets and the increased ICT literacy of prospective customers, who now have the opportunity to bypass intermediaries in the travel value chain by booking directly on the Web, have kindled questions about the necessity and ability of small tourism firms to become part of the networked economy.

REGIONAL TOURISM SMEs

In many parts of the world, SMEs and micro tourism enterprises make a substantial contribution to regional economies. In this context, tourism SMEs are an important instrument for raising the profile of a region. At the same time, the requirements of the globalized economy raise the bar for tourism SMEs in all regions, with expectations toward a high capacity for ICT innovation, even on a relatively small scale (ALGA, 2002).

While connectivity has the potential to increase regionally-based tourism SMEs' visibility in the marketplace, small tourism enterprises have been facing difficulties embracing ICT and competing with their larger counterparts. Small tourism firms, much like other small firms, often lack the time, skills, and resources needed to implement ICT (Buhalis & Main, 1998). Micro and small tourism enterprises generally consider themselves outside the tourism industry, despite the fact that most of their customers are tourists (Evans, 2001). Their size being their main disadvantage, tourism SMEs tend to be overdependent on intermediaries for product marketing and distribution and, therefore, have limited bargaining power in the distribution channel (Werthner & Klein, 1999). Other barriers may include technology itself, where the lifestyle choice of owner-operators often entails a negative attitude toward ICT (Evans, 2001). Besides, many tourism SMEs are located in peripheral regions where the ICT infrastructure, especially broadband, can still be inadequate or prohibitively expensive due to limited demand (Anckar & Walden, 2001). In some cases, this

leads to a perceived lack of value of ICT and the Internet.

A New Zealand study of micro tourism firms identified the education and professional background of owner-operators to be significant barriers (Ateljevic, 1999), pointing to a widespread consensus that industry preparedness in terms of training falls well short of the requirements to operate within a now ICT-driven sector (Danielle, 1999). Presenting the results of a three-year study on the usage of and plans for ICT training in a fragmented and SME-dominated European tourism sector, Evans et al. (2001) note that small tourism firms may well remain lost in the electronic marketplace, unless they are assisted in the usage of ICT tools and acquire the skills needed to participate in the digital economy.

Being small businesses, tourism SMEs have rather limited marketing means and, despite the information-intense nature of the tourism product, are not necessarily up to the task of marketing themselves online. As individual enterprises with limited marketing budgets, most small firms fail to focus on marketing planning and market intelligence. Preoccupied with the operational running of their business, smaller operators have tended to approach their markets "...less formally and more intuitively from their detailed, close contact with their guests" (Main, 1999). To make matters worse, a micro tourism Web site is easily overshadowed by the plethora of mega tourism Web sites, such as Travelocity and Expedia, currently available on the Internet. To summarize, due to their nature and scale, small tourism firms lack the advantages of larger tourism enterprises, such as resources, know-how, and access to global distribution systems and other network support systems. At the same time, there is increasing pressure on small firms to offer Web-based product information.

REGIONAL TOURISM NETWORKS

Although ICT appears to threaten the existence of small tourism firms without resources, know-

how, and access to distribution channels, regional network formation may provide a solution for small tourism firms.

The interrelationship between tourism and technology is not a recent phenomenon; it dates back to the early days of computing and the impact of post-1960s mass travel. To date, however, travel industry networks that pursue Web-enabled capabilities have been largely driven by the airline industry seeking to extend its global reach through strategically aligned partnerships, global booking and distribution systems, and cost-saving synergies in services such as baggage handling, catering, engineering, and maintenance (Pappas, 2001). Thus, the Internet provides big players with far-reaching business-to-consumer (B2C) as well as business-to-business (B2B) opportunities to enhance and develop specialized relationships with their customer base. However, as a result of the networked economy, organizational changes are now expected to affect the entire tourism industry, which is predominantly made up of small enterprises.

Almost a decade ago, in addressing tourism and technology, Poon (1993) stressed that to avoid isolation, achieve economies of scale, and maximize destination benefits, there would be no place in the future for the stand-alone tourism SMEs; and that networking would allow small tourism firms to pool their resources, reduce operating costs, increase know-how, and formulate strategic marketing plans. Research further suggests that small tourism enterprises form a natural amalgam, because the fortunes of the destination and the firms are closely intertwined. Buhalis and Cooper (1998) believe that tourism SMEs tend to cooperate rather than compete by formulating value-added networks of product and service delivery (e.g., by referring customers to each other), thus enhancing tourist satisfaction. Anekar and Walden (2001) similarly advocate that a network or information technology infrastructure is not only useful but is, indeed, essential in bringing small tourism firms and cyber customers together, as well as increasing the willingness of cyber customers to

purchase tourism products from smaller regional suppliers. In addition, mapping and understanding the processes that take place in existing tourism networks has the potential to speed up technology adoption and create effective collaborative network outcomes (Braun, 2004).

Cooperative marketing research has long confirmed that networking in the form of cooperative marketing can add value to a destination (Palmer & McCole, 2000). Traditionally, such cooperation has been used in the production of joint marketing brochures and shared stands at trade shows. The advent of the Internet and related regional development trends offer expanded opportunities for cooperative marketing. Tourism operators on both the macro (destination) and micro (individual tourism SMEs) levels are starting to see the potential benefits of using Web technologies for cooperative marketing and transaction purposes (Main, 2002). In the wake of information technology and new regional network initiatives, cooperative marketing Web sites are proliferating (Tourism Victoria, 2002).

Interesting cooperative marketing and e-commerce opportunities notwithstanding, tourism SMEs' participation in networks is far from guaranteed. Joining a network constitutes a considerable leap for small tourism firms. Barriers to entering networks have been put down to cultural factors on the one hand and lack of resources (time, staff, opportunity) on the other. Evans (1999) particularly singles out aversion to joining groups and attending training sessions and meetings, which "may be antithetic to the stress that owner-managers place on autonomy and independence—the main reason they went into business on their own in the first place" (Evans, 1999, p. 380). Small firms tend to limit their external contacts to compulsory contacts, e.g., local government and tax agencies and direct support actors and agencies, e.g., customers, accountants, and banks.

A research project undertaken with small tourism firms in North London showed that the

greatest interest in networking came from those businesses that had the strongest links to the local economy (Evans, 1999). The development of a shared destination Web site proved to be attractive to local tourism operators in terms of joint marketing and securing new business. However, the project also highlighted the firms' relatively underdeveloped knowledge of ICT and a varying degree of reluctance within the sector in terms of joining a network. Although notable research into tourism-specific cooperative use of the Internet as a marketing tool and e-commerce remains in its infancy (Beckendorff, 2000), to date the greatest interest in using ICT networks in the tourism sector has been to develop joint online marketing initiatives, indicating that many tourism SMEs have yet to embrace Web-based e-commerce processes. Initial value for tourism SMEs lies in the debunking of ICT jargon, cutting connectivity cost, gaining online visibility, gaining trust in network structures, and obtaining e-commerce skills through linkages with local partners. Continued incentives and support will help tourism SMEs get comfortable and take mental, physical, and virtual possession of a shared ICT domain (Braun, 2002).

Tourism networks, like all networks, should be seen as complex and dynamic organisms with ever-changing actors and external economic and technological influences. ICT-based network formation involves an intensive learning process for every actor involved in the network. This requires strong social ties within the network, fluid communications flows, strong leadership, and commitment to the network. In certain instances, network formation and small business collaboration will need to be fostered through the offering of incentives and training. An appropriate balance also needs to be struck between autonomy and competition in evolving small tourism firms from an individualistic business to a network culture. By drawing on a broader skill base through the forging of new partnerships between regional e-commerce experts and marketing bodies, issues

such as product and market reach can be addressed. Similarly, inclusion of small firms in global marketing and distribution systems may help advance tourism regions and, thus, small tourism firms into the global marketplace and help forge new destination management partnerships.

CONCLUSION

Today, ICT and the Internet enable tourism SMEs and tourism networks such as regional destination marketing organizations (DMO) to better cope with increased information flows, getting the marketing message out to the public, and selling their product online through e-commerce.

The Internet has the ability to provide a highly suitable and major new market channel for tourist product, because it can create a direct link between regional tourism SMEs and worldwide consumers. By using the Internet as an online network and cooperative market channel, tourism destinations, marketing organizations, and individual tourism SMEs in regions all over the world have an opportunity to contribute to regional development and keep up with a now predominantly ICT-based industry.

For many small tourism firms, joining an ICT-based network and embracing e-commerce will entail radical new ways of business thinking, which will take time. As Gretzel et al. (2000) have pointed out, success in the new information economy is more about changes in approach than about the technology itself.

REFERENCES

APEC. (2001). Beijing Initiative on APEC Human Capacity Building. Retrieved July 10, 2001, from <http://www.apec.org>

Asheim, B. T. (2001). Learning regions as development coalitions. Partnership as governance

in European workforce states? *Concepts and Transformation*, 6(1), 73-101.

Ateljevic, J., Milne, S., Doorne, S., & Ateljevic, I. (1999). Information technology and service quality in small tourism firms. Paper presented at the *ATLAS Annual Conference*, Munich, Germany, July 27.

Australian Local Government Association (ALGA). (2002). State of the regions 2001. Available at http://www.alga.com.au/SOR-Overview_2002.htm

Beckendorff, P. J., & Black, N. L. (2000). A case study of Australian Regional Tourism Authorities. *The Journal of Tourism Studies*, 11(1), 11-21.

Bernstein, J., & Awe, S. C. (1999). "Wired Travelers": Travel and tourism Web sites. *Reference Services Review*, 27(4), 364-375.

Braun, P. (2002). Networking tourism SMEs: E-commerce and e-marketing issues in regional Australia. *Information Technology & Tourism*, 5(1), 13-24.

Braun, P. (2004). Regional innovation and tourism networks: The nexus between ICT diffusion and change in Australia. *Information Technology & Tourism*, 6(4), 35-47.

Buhalis, D. (1999). Information technology for small and medium-sized tourism enterprises: Adaptation and benefits. *Information Technology & Tourism*, 2(1-4), 79-95.

Buhalis, D., & Cooper, C. (1998). Competition or cooperation? Small and medium-sized tourism enterprises at the destination. In E. Laws et al. (Eds.), *Embracing and managing change in tourism*. London: Routledge.

Buhalis, D., & Main, H. (1998). Information technology in peripheral small and medium hospitality enterprises: Strategic analysis and critical factors. *International Journal of Contemporary Hospitality Management*, 10(5), 198-202.

- Danielle, R., & Mistilis, N. (1999). Information technology and tourism education in Australia: An industry view of skills and qualities required in graduates. In D. Buhalis & W. Schertler (Eds.), *International Conference on Information and Communication Technologies in Tourism 1999* (pp. 140-150). Innsbruck, Austria: Springer-Verlag.
- DETR. (2000). *Regional government in England: A preliminary review of literature and research findings*. Department of Environment, Transport and Regions, United Kingdom.
- Evans, G. (1999). Networking for growth and digital business: Local urban tourism SMTEs and ICT. In D. Buhalis & W. Schertler (Eds.), *International Conference on Information and Communication Technologies in Tourism 1999* (pp. 376-387). Innsbruck, Austria: Springer-Verlag.
- Evans, G., Bohrer, J., & Richards, G. (2001). Small is beautiful? ICT and tourism SMEs—A comparative European study. *Information Technology & Tourism*, 3(3/4), 139-153.
- Gretzel, U., Yuan, Y., & Fesenmaier, D. R. (2000). Preparing for the new economy: Advertising strategies and change in destination marketing organizations. *Journal of Travel Research*, 39(2), 146-155.
- Håkansson, H., & Snehota, I. (1995). *Developing relationships in business networks*. London: Routledge.
- Laubenheimer, M. C., Tecopolo, M., & Carlsson, T. (1999). From intra-regional competition towards intra-regional cooperation in tourism: The concept of telecooperation and virtual enterprises in the regional tourism business. In D. Buhalis & W. Schertler (Eds.), *Information and Communication Technologies in Tourism 1999. Proceedings of the International Conference in Innsbruck, Austria* (pp. 376-387). Vienna: Springer-Verlag.
- Main, H. C. (1999). Emerging technologies and their role in developing a marketing information system (MKIS) for tourism and hospitality products. In D. Buhalis & W. Schertler (Eds.), *International Conference on Information and Communication Technologies in Tourism 1999* (pp. 347-356). Innsbruck, Austria: Springer-Verlag.
- Main, H. C. (2002). The expansion of technology in small and medium hospitality enterprises with a focus on new technology. *Information Technology & Tourism*, 4(3/4), 167-174.
- Miles, R. E., & Snow, C. C. (1992). Causes of failure in network organisations. *California Management Review*, 34(4), 53-72.
- Ordanini, A., & Pol, A. (2001). Infomediation and competitive advantage in B2B digital marketplaces. *European Journal of Management*, 19(3), 276-285.
- Palmer, A., & McCole, P. (2000). The role of electronic commerce in creating virtual tourism destination marketing organisations. *International Journal of Contemporary Hospitality Management*, 12(3), 198-204.
- Pappas, G. (2001). The next chapter in business-to-consumer e-commerce: The impact of the internet on the airline industry. Retrieved October 18, 2001, from www.bcg.com
- Philips, A. (1960). A theory of interfirm organization. *Quarterly Journal of Economics*, 47, 602-613.
- Poon, A. (1993). *Tourism, technology and competitive strategies*. Oxford: CAB International.
- Porter, M. E. (1998). *On competition*. Boston: Harvard Business School.
- Storper, M. (1997). *The regional world*. London: Guilford Press.
- Tourism Victoria. (2002). Regional cooperative marketing program guidelines 2002-2003. Retrieved August 21, 2002, from http://www.tourismvictoria.com.au/pdf/rcmp_guidelines.pdf

Werthner, H., & Klein, S. (1999). *Information technology and tourism—A challenging relationship*. Vienna: Springer-Verlag.

Wynne, C., Berthon, P., Pitt, L., Ewing, M., & Napoli, J. (2001). The impact of the Internet on the distribution value chain. The case of the South African tourism industry. *International Marketing Review*, 18(4), 420-431.

KEY TERMS

APEC: Asia Pacific Economic Cooperation.

Connectivity: The ability to link to the Internet via a computer.

DMO: Destination marketing organization.

ICT: Information and communication technologies. The technology and tools used to transfer information and speed up communication processes.

Intermediary: Person or organization performing a (booking) role between consumers and business.

Market Channel: A publicly accessible means such as a newspaper, magazine, trade show, radio, billboards, television, or the Internet, used to advertise and market products.

SMEs: Small and medium-size enterprises. Refers to enterprises with a specific number of staff. A small-size enterprise generally refers to firms with less than 20 employees.

Web-Enabled: Business systems that are supported by Internet technologies.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, and X. Yu, pp. 233-238 copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 6.5

Towards Improved Business Planning Decision Support for Small-to-Medium Tourism Enterprise Operations

G. Michael McGrath
Victoria University, Australia

ABSTRACT

In a recent study conducted for the Australian Sustainable Tourism Cooperative Research Centre, improved business planning was identified as one of the most pressing needs of small-to-medium tourism enterprise operators. Further significant problems confronting these businesses were coping with rapid change, complexity and uncertainty. System dynamics (SD) is especially well-suited to the modelling and analysis of problem domains with these characteristics and, in this chapter, we report on the development and implementation of a “tourism enterprise planning simulator” (TEPS) based largely upon SD constructs and technologies. Scenarios in which TEPS might be used to good effect are outlined and the potential benefits of this deployment are detailed.

INTRODUCTION

A number of tourism researchers have noted that there is a demand among prospective (and current) small-to-medium tourism enterprise (SMTE) operators for improved business planning tools (see e.g., Baker, 2000; Bergin-Seers, Jago, Breen, & Carlsen, 2005; Mistilis, Presbury, & Agnes, 2004). Moreover, there would seem to be a place for online, automated tools: whether as an adjunct to traditional sources of advice or as stand-alone products. Low-cost, generic business planning software products are inadequate because they fail to take into account contextual factors important to the tourism industry. There are, however, some impressive, recently-developed destination planning support tools and these are tourism-specific—examples being the “Tourism Futures Simulator” of Walker, Greiner, McDonald, and

Lyne (1999) and the “Hotel Value Chain Profitability” model of Georgantzas (2003).

A feature of both these tourism planning and policy-making tools is that they are based upon system dynamics (SD) concepts, tools and techniques. SD has been around for over 40 years (see Forrester, 1961, for what is generally regarded as the seminal and most influential piece of work in the field), but has enjoyed something of a resurgence recently. To some extent, this is due to an increasing recognition (among researchers from many fields) that SD is especially suitable for capturing, modelling, and analysing: so-called “messy” problems; and key aspects of “change.”

Messy problems have been defined by Venix (1996, pp. 9-41) as being characterised by complexity, uncertainty, recursive dependencies, inter-related sub-problems, selective perception, self-interest, and, related to this, key stakeholders working from different views of the essential nature of the problem. A glance through any tourism/hospitality text should quickly convince the reader that these attributes all apply to the tourism domain: both at the destination level (see e.g., Ritchie & Crouch, 2003) and at the enterprise level (see Baker, 2000).

Change too is characteristic of the tourism industry. Indeed, in a recent study (McGrath, 2005), one of the most significant problems facing the Australian tourism industry was identified as rapid change: including technological change, major changes in the external business environment, and changes that are having substantial impacts at every point of the tourism supply chain (and at every level—from international to regional and local levels). The situation was summed up by one study participant as follows: “Not only are we shooting in the dark—we are shooting at a moving target” (McGrath & More, 2005, p. 4). Here, our interviewee was expressing a degree of dissatisfaction with: first, adequate data not being available to facilitate effective strategic planning; and, second, the fact that the tourism industry

is moving so quickly that, even where accurate data is accessible in a timely manner, it is often outdated and relatively useless in much too short a timeframe. However, the quote would seem to apply equally to many other problems currently confronted by the industry.

In recognition of the above, the Australian *Sustainable Tourism Cooperative Research Centre* (STCRC) recently provided funding and support for a research project aimed at producing a *tourism enterprise planning simulator* (TEPS). Distinguishing features of TEPS are:

- Extensive use is made of SD modelling technologies and tools (for capturing and simulating key aspects of change).
- The enterprise simulator sits inside a destination-level simulator. In this way, TEPS addresses a major problem associated with the multitude of generic, low-cost business planning tools available—namely, they fail to take into account tourism-specific, contextual factors.
- TEPS operates at different levels of granularity. At the very fine-grained level, actual data is used to establish relationships and to instantiate model variables. At the more coarse-grained levels, a restricted set of destination archetypes is induced and users assign values to variables through an “impressionistic” (or fuzzy) process.
- Artificial intelligence tools (such as rule-based deductive inference, case-based reasoning and fuzzy logic) are used to complement the base SD technology employed.

In this chapter, we report on the development, validation and potential use of the tourism enterprise business planning tool. The focus of our initial research is on tourism accommodation enterprises and the chapter is organized as follows: background to the research is presented in the following section and this is followed by an overview of the design and implementation of

TEPS. The following section deals with ways in which the simulator might be employed during tourism enterprise business planning and the benefits that flow from this. System validation, the current status of our project and future plans are then discussed and, finally, concluding remarks are presented.

BACKGROUND

SMTEs and Business Planning

The Australian tourism industry employs approximately 5.9% of the total workforce, accounts for 5.9% of GDP, and contributes 11.2% of total exports (Tourism Australia, 2004, p. 22). There is some argument concerning the accuracy of these figures but the recent establishment of a “Tourism Satellite Account” (Smith, 2004) by the Australian Bureau of Statistics (ABS) means that tourism’s contribution to the Australian economy is measured according to guidelines and methods established by the World Tourism Organization (WTO). This ensures that, at the very least, local tourism statistics are derived consistently with the closest thing to a generally-accepted set of standards the international tourism industry has and that international comparisons may be made with a fair degree of confidence.

In excess of 90% of Australian tourism businesses are SMTEs (Sharma, Carson, & DeLacy, 2000, p. 3) and it has long been recognized that SMTE operators have to deal with myriad problems. For example, in a recent paper dealing with the local tourism industry’s response to an Australian state government’s “come online” initiative, Morrison and King (2002, p. 111) divided SMTE firms into Techno-whizzos, Early adopters, Wait-and-sees and Wilderness operators. Members of the Wilderness group were described as generally aged 45+, with no computer or interest in them, they felt they were too old to learn more and they viewed the Internet as a waste of time. They also

had a dislike of officialdom/bureaucracy and were reluctant to participate in regional activities and networks. Somewhat depressingly, it was estimated that 60% of the SMTE sample were in the Wilderness category (with another 20% in the Wait-and-see group).

More generally, Gammack, Amaya Molinar, Chu, and Chanpayom (2004, pp. x –xi) analysed SMTEs in the Asia-Pacific region and nominated the following factors as significant inhibitors to enterprise development:

- A lack of a trained and professional workforce
- A lack of entrepreneurial skills among operators
- Low entry barriers—impacting on service quality, growth and business viability
- Lending arrangement and taxation regimes not conducive to SMTEs
- Conforming to (and supporting) sustainable regional infrastructure requirements
- Inconsistent and bureaucratic local authorities
- A lack of government recognition of the value of tourism
- A failure to recognize the potential benefits of industry clusters and collaboration
- Industry fragmentation and a proliferation of membership organizations
- A lack of technology (generally) and e-commerce (specifically) skills
- Relatively poor e-readiness and e-commerce uptake
- Scattered, poorly-integrated and difficult-to-locate business research information

A number of these factors might be classified under the broader heading of a “lack of strategic focus” and this has long been recognized as a problem among SMTE operators (see e.g., Sharma et al., 2000a; Mistilis et al., 2004; Morrison & King, 2002). This lack of attention to planning and strategy is evident in the Morrison and King

(op. cit) analysis presented above and, more recently, Mistilis et al. (2004) identified the lack of a strategic focus as the main impediment to the uptake of online technologies among Sydney hotel operators. Nevertheless, there are indications that things might be changing for the better and, during another Australian study conducted by the author (McGrath, 2005, p. 72), one State Tourism Authority (STA) representative asserted that:

Not a day goes by when we are not approached by at least a couple of prospective operators looking for help with their business planning. ... You can look at business planning as, maybe, a 14-16 step process. We talk to them [prospective operators] at Step 1, and the next time they hear from us is after they are established. Then, we are asking them for information! We need to do more for them.

Thus, at least some SMTE operators are looking to improve their business planning and, given the high rate of enterprise attrition in this sector (Baker, 2000; English, 1995), some attempts have been made to provide the necessary support. For example, the Decipher tourism data warehouse (Carson & Richards, 2004) provides business planning support through its Web site, Tourism Victoria is planning to implement an online business planning product and the STCRC has recently released a business planning “toolkit” for property owners considering “Farm and Country Tourism” ventures (Fausnaugh, Waight, Higginbottom, & Northrope, 2004). TEPS is intended to complement these products (the current intention being to eventually implement it within Decipher).

A quick search using Google (and the keywords, “business planning software”) returned just under 100 million matches. Even allowing for the fact that many of these are dead-ends, a brief perusal of a number of returned sites revealed a number of potentially useful business planning software aids. Thus, there is most definitely no shortage of generic business planning software. In

addition, adding the word “tourism” to the search string led to a few sites that (on the surface) do seem to have something to offer the prospective SMTE operator (see e.g., the “Tourism Business Development Toolbox” at <http://www.uwex.edu/ces/cced/tourism/>).

Nevertheless (while admitting that our analysis was less than comprehensive), few of these online, tourism-related, business planning Web sites appear to be well-grounded in the holistic (or systemic) view of the “sustainable tourism system.” This view is considered by some (e.g., Gammack et al., 2004, p. 1) to have its roots in the work of Brundtland (1987) and its many manifestations include the Mill and Morrison (2002) model (focusing on a “chicken-and-egg” like relationship between consumer travel decisions and destination marketing), the “triple bottom line” concept (Adams, Frost, & Webber, 2004; Elkington, 1999) (encompassing the natural, economic and cultural/social environments), and the “competitive destination” model of Ritchie and Crouch (2003). The WTO (1998) defines a sustainable tourism destination as a region where:

... tourism development meets the needs of present tourists and host regions while protecting and enhancing opportunities for the future. It is envisaged as leading to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems.

System Dynamics

The holistic view of a tourism destination seems to be now almost universally accepted among researchers and policy makers (if not industry practitioners) and, given this, it is perhaps a little surprising that greater advantage has not been taken of methods, tools and techniques commonly employed in SD (or “systems thinking”) research and implementation to assist in the development

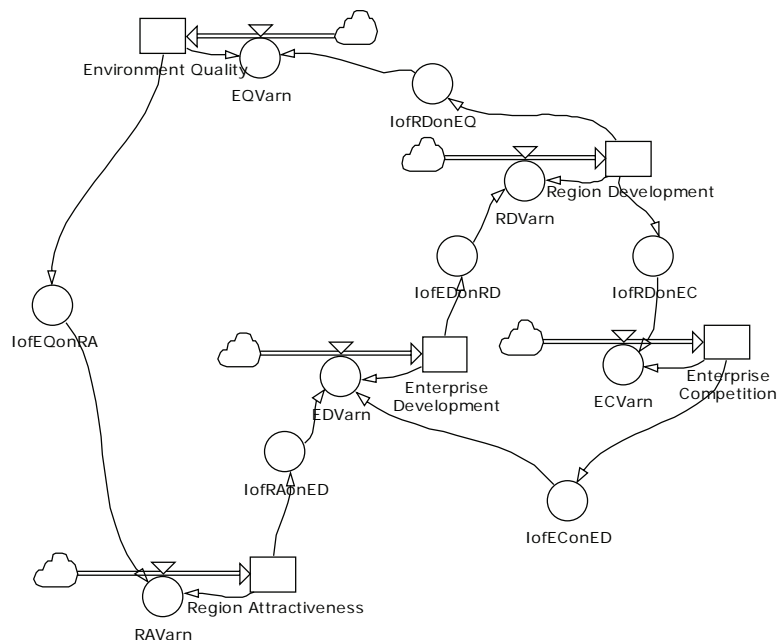
of better business practices amongst SMTEs. SD has its origins in the work of Forrester (1961) and, more recently, has enjoyed something of a resurgence—largely due to Peter Senge’s (1990) very influential work on “the learning organization,” and to the development and release of easy-to-use, powerful, SD-based software modelling and simulation tools (such as *iThink*, *Vensim*, and *Powersim*). Recent examples of where SD has been used to good effect in tourism include the “Tourism Futures Simulator” of Walker et al. (1999), the hotel value chain modelling work of Georgantzas (2003), the tourism multipliers model of Loutif, Moscardini, and Lawler (2000), and the information architecture modelling work of McGrath and More (2005).

The SD component of TEPS has been developed and implemented using *Powersim* (Powersim, 2003). Within *Powersim*, models are developed in what is referred to as stock-flow format and a simple model is presented in Figure 1 below.

The basic building blocks of SD models are stocks (represented as rectangles), flows (represented as arrows with circular flow regulators attached) and converters (represented as circles). In our model, examples of stocks are Region Attractiveness, Enterprise Development and Region Development. There is a level associated with each stock, which can be an actual value or a value bounded by some artificial scale. Region Attractiveness (and, indeed, all stocks in our example) are measured on a 0-200 scale and we have set the system up so that, when the value of every stock level is at 100, the system is in equilibrium. Stock levels vary with flows, which may be inflows, outflows or bidirectional. For example, RDVarn (Region Development Variation) is a bidirectional flow such that:

$$Region\ Development_t = f(Region\ Development_{t-1}, RDVarn_t)$$

Figure 1. Example of a SD model – stock-flow form



That is, in our model, the region development level at time, t , is a function of the region development level at time, $t-1$, and the region development variation at time, t . These equations are the foundation of *Powersim's* formidable simulation capabilities. The third of our basic constructs, converters, serve a utilitarian role: they hold values for constants, calculate mathematical relationships and serve as repositories for graphical functions. In general, they convert inputs into outputs (hence, the name, "converter").

Earlier (see the introductory section), we noted that many issues and problems associated with tourism fall into a class of organizational problems defined by Vennix (1996, pp. 13-41) as "messy" and that problems of this type are characterised by complexity, uncertainty, inter-related sub-problems, recursive dependencies, and multiple interpretations of the problem's essence. He then makes the claim that among the key factors that impede our ability to resolve messy problems are: (1) limitations on our cognitive powers; (2) a tendency to grossly oversimplify or circumscribe complex problems; and (3) an inability to comprehend multiple, related feedback loops. Finally, he argues that a SD approach has the potential to overcome many of these problems and, furthermore, that (collaborative) development of a model may foster consensus, perhaps leading to increased acceptance of whatever decision is eventually taken. A considerable body of research has focused on understanding, and improving, benefits that can accrue during group model building using system dynamic modelling tools (see e.g., Anderson, Richardson, & Vennix, 1997; de Geus, 1994; Morecroft, 1994; Richmond, 1997; Vennix, 1996). If used judiciously, group modelling with SD tools can assist in mastering the learning problems listed above, as well as addressing the different viewpoints and beliefs which participants from various functional areas bring with them to any learning or decision making exercise.

Although the model presented in Figure 1 is a substantially simplified version of the ver-

sion actually developed during our research, the complexity of the problem domain is clearly evident. This applies particularly to the feedback loops. For example: region attractiveness has an impact on enterprise development, enterprise development has an impact on region development, region development has an impact on the quality of the environment and the environment, in turn, has an impact on region attractiveness (thus leading us back to our starting point). Another feedback loop is: *Enterprise Development* → *Region Development* → *Enterprise Competition* → *Enterprise Development*. That is, an increase in enterprise development will (generally) result in an increase in region development which, in turn, might be expected to increase enterprise competition within the region. Finally, the increased enterprise competition may well lead to a decrease in enterprise development. This is an example of what the SD community refer to as a balancing loop: that is, enterprise competition acts as an inhibitor to unrestricted growth within the region. Another example of a growth inhibitor is environment quality.

Thus, our model contains a number of feedback loops. Vennix (op. cit), however, claims that many people are unable, at best, to understand the dynamics of a single feedback loop. Once multiple feedback loops are involved, even people who are experienced at interpreting feedback are unable to ascertain the behaviour of a system without resorting to a computer simulation (Anderson et al., 1997; Dangerfield & Roberts, 1995). During our research, we were able to adjust specific variables and observe the impact on other variables, over time, (through graphs automatically generated by *Powersim's* risk analysis software). This considerably assisted our end-users in improving their understanding of the complex, dynamic relationships present in the system. Vennix (op. cit) has argued that an advantage of involving decision makers from various areas in group modelling exercises is that they begin to understand that their actions not only affect their own

areas and interests but may have major impacts on other stakeholders as well. This, in turn, may result in improved collaboration within the model development exercise itself.

Stock-flow models, however, are not all that suitable for collaborative model development, where end-users have significant input. In their most basic form though, SD models are represented as causal loop diagrams (CLDs). A feature of CLDs is that they are both powerful and simple, relying as they do on just one fundamental construct: two variables, connected by an arrow, indicating a causal relationship. An example is presented in Figure 2, illustrating the “tragedy of the commons” archetype (Roberts, Andersen, Deal, Garet, & Shaffer, 1983), exemplified by the situation where, with cattle grazing on common land, incentives for individuals to increase herd size lead to overgrazing, eventual famine, and loss of livelihood (short-term benefits leading to long-term disaster).

The illustration presented in Figure 2 is taken from an actual case (WTO, 1998) concerning sub-Saharan African nomads who had survived sustainably in steady state for thousands of years. A well-meaning injection of aid in the 1950s

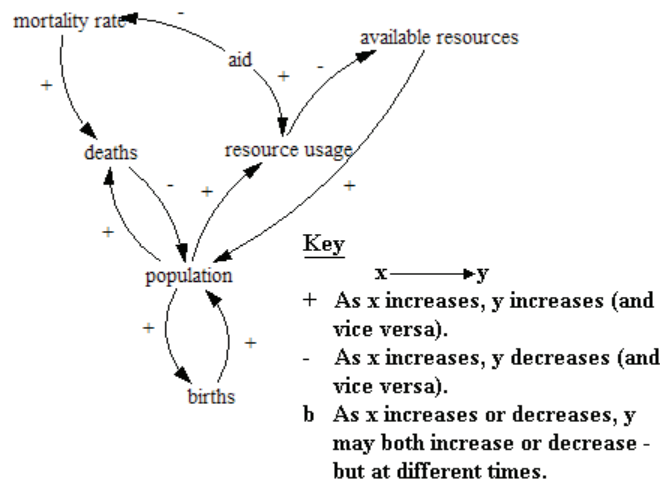
resulted in a short-term lifespan and standard-of-living increase (mainly through new medicines and greater resource usage brought about by digging deeper wells). This, however, threw the system out of balance, leading to a longer-term agricultural and cattle grazing resource decrease, desertification, stock losses, eventual famine and an increase in deaths.

We now turn our attention to our tourism enterprise planning simulator (TEPS). For the reasons outlined above, we have chosen to specify and implement the bulk of TEPS using SD concepts.

The Tourism Enterprise Planning Simulator: An Overview

The eventual plan is to implement TEPS within the STCRC’s online, business assistance Web site, *Decipher* (Carson & Richards, 2004). A high-level view of the TEPS architecture is illustrated in Figure 3. The bulk of the model is specified and implemented within an SD framework. A knowledge base, implemented primarily as rules, sits within TEPS and is called to perform specific functions (such as the calculation of certainty

Figure 2. CLD example – unintended consequences of well-meaning action



factors based on a fuzzy logic approach). Values returned from the knowledge base component are used to dynamically instantiate variables within the SD model. One such function is the calcula-

tion of a region attractiveness value. However, in this case, users may opt to bypass the knowledge base and interact directly with the SD component (i.e., TEPS may be run as a stand-alone SD ap-

Figure 3. TEPS – High-level architecture view

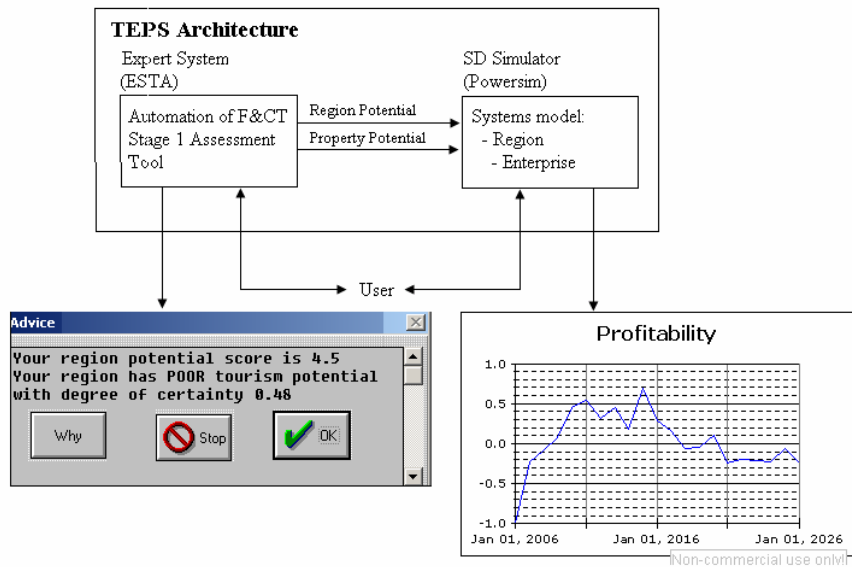
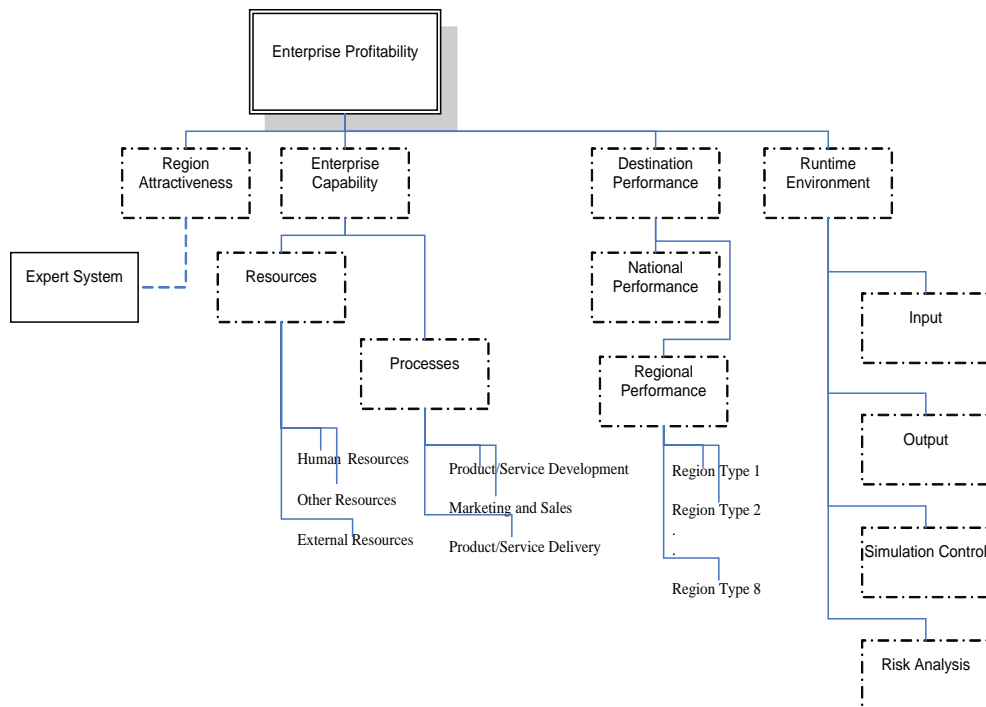


Figure 4. Functional decomposition of SD component



plication). Moreover, to date, the bulk of our effort in developing our prototype has been directed towards the SD simulator. Consequently, in the remainder of this chapter, we shall focus on this component.

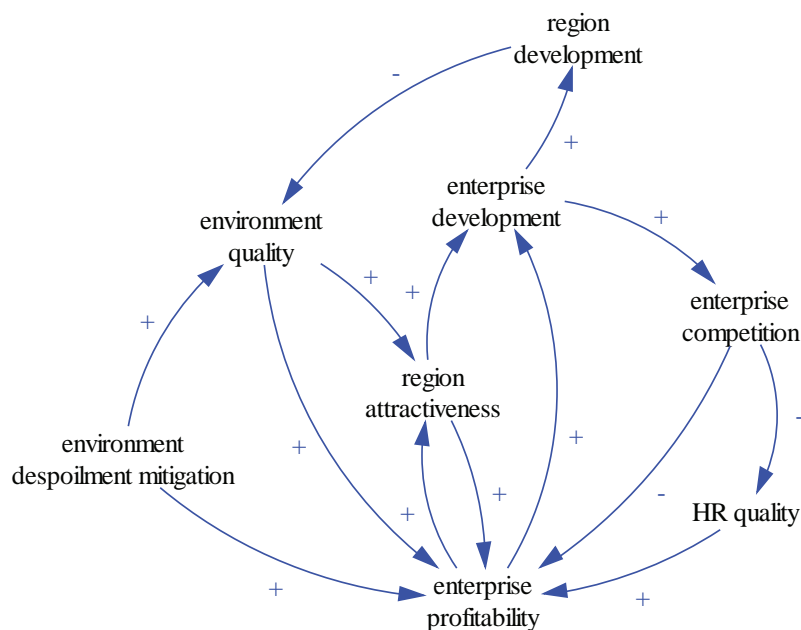
As noted above, during the previous ten years or so a number of excellent SD simulation software packages have been developed. As with almost any software tool, each of the leading tools have their “disciples” but, in our view, each of these tools have their strengths and weaknesses and tool selection often boils down to a matter of individual preference (and, oftentimes, familiarity with a previously used product). With this particular application, we opted to employ the *Powersim* development studio (*Powersim*, 2003)—mainly because it has excellent functional decomposition facilities (and, as time goes by, we believe our model will need to be broken down to more precise levels of detail).

A functional decomposition of the SD component of our prototype is presented in Figure 4.

The usual approach in developing an SD model is to: (1) specify the problem domain as a causal-loop diagram (CLD); and, then, (2) implement it in the slightly more complex stock-flow syntax employed by the software packages listed above (and illustrated in Figure 1). Here, because of space limitations, we restrict ourselves to CLD representations of our domain and a (slightly simplified) view of the Enterprise Capability component is illustrated in Figure 5.

Region attractiveness is at the core of the enterprise capability model. Attractive regions are natural targets for enterprise development and this leads to increased levels of enterprise development. More competition though, can have an adverse effect on enterprise profitability (e.g., through pressure to reduce tariffs) and this, in turn, may decrease motivation to invest further in enterprise development. Enterprise development also results in greater region development and, for the most part, this will lead to poorer environment quality. In turn, environmental despoilment (in the

Figure 5. Enterprise Capability component – top-level CLD



medium to long-term at least) will have negative consequences for both region attractiveness and enterprise profitability.

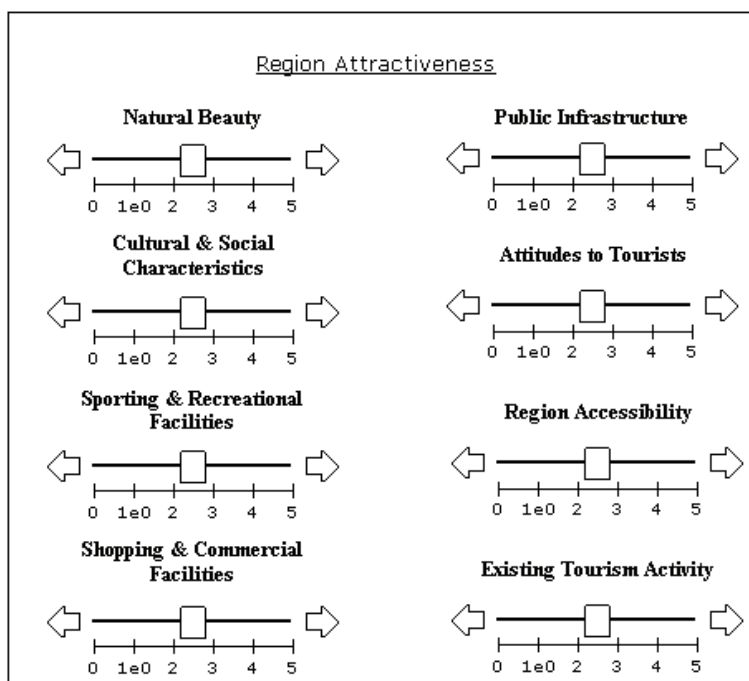
Thus, in these variables and causal links, we have a representation of (a variant of) the classic sustainable tourism model (discussed in the previous section). Essentially, if development is allowed to proceed unchecked, reinforcing loops will lead to increasingly greater levels of environment despoilment and lower enterprise profitability levels. Note, however, that environment despoilment mitigation has been included in the model as a mediating (or control) variable. That is, if a destination (collectively) is truly committed to protecting its natural resources this may keep the total system in balance and, also, work towards safeguarding enterprise profitability.

An additional variable included in our model is human resources (HR) quality. Effectively, increased enterprise competition will eventually lead to a reduction in overall HR quality

(e.g., because of poaching and better staff taking advantage of opportunities elsewhere) and, as a consequence, remaining poorer-quality staff will have a negative impact on profits (i.e., customers can tolerate only so much!).

HR Quality is implemented in our SD prototype as a 2nd-level sub-module below Enterprise Capability (see Figure 4). The structure employed here was drawn from the STCRC ‘Performance Measurement’ toolkit, designed to allow small motel operators to benchmark and improve their operations (Bergin-Seers et al., 2005). At the time this chapter was being written, “human resources” was the only domain component (of those shown in Figure 4) that had actually been implemented. However, the intention is to progressively implement functionality corresponding to the other resources and processes shown in Figure 4 (with the task scheduled to be completed by end-June 2006). Note though, that the prototype is still capable of producing useful outputs without

Figure 6. Region attractiveness – direct interaction through the SD control panel



lower-level modules being filled out with fine-grained detail (as shall be demonstrated in the following section).

Region attractiveness is calculated based on an approach presented in another STCRC toolkit; the “Farm and Country Assessment Tool (Stage 1)” (Fausnaugh et al., 2004). Using this toolkit, protective “Farm and Country” tourism operators are guided through a series of questions designed to assess the potential of their proposed tourism enterprise. One output from this process is a region attractiveness score and the functionality required to compute this value has been implemented within our expert system component. Alternatively, users may bypass the expert system and simply adjust a set of sliders within the SD component user interface (see Figure 6). Nevertheless, use of the expert system is recommended because: (1) users are alerted to many of the key factors that contribute to an attractive region; and (2) a “fuzzy logic” (Kosko, 1993) uncertainty handling routine assigns a “degree of confidence” level to the region attractiveness score calculated.

The Enterprise Capability module focuses on resources and processes specific to a particular (proposed) tourism accommodation enterprise. As noted earlier though, these are analysed within a destination context. More specifically, the National Performance component has been established so that simulation outputs accurately reflect the behaviour of key, national, accommodation sector indicators (e.g., total rooms, room nights occupied (RNO), seasonality, occupancy and revenue per RNO), on a quarterly basis over the period January 1998 to March 2005 (inclusive). Base data was taken from (ABS, 2005).

The SD simulator has been initialized to run for 29 quarters from the commencement of the current year. All variables are specified as indices. For example, RNO-national is an index of predicted RNO for total national visits (domestic and international), plotting percentage changes over time, on a quarterly basis against a base quarter. The March quarter of the current year is used as

the base quarter and is assigned a value of 100. Where later values exceed 100, it indicates growth in comparison to the base quarter while values less than 100 indicate decline compared to the base quarter. The method is the same as that employed in (TRA, 2005) and the assumption is made that accommodation trends will be similar to actual figures observed in the seven years from January 1998 to March 2005 (ABS, 2005).

The National Performance model has been “tweaked” to emulate the accommodation sector behaviour of eight different region types. Users are required to select the region type closest to the destination in which they hope to establish their enterprise and enterprise performance will then be derived with reference to the selected region type’s characteristics.

Tourism region types can be classified in a great many ways (e.g., by location, activities, climate, commerce/industry mix, population attributes, life-cycle stage, etc.) and Australian government tourism authorities (federal and state) have their own classification schemes. Following consultation with a number of government and tourism industry experts, however, we decided that the following region-type classification might suit our particular needs best: (1) Major Gateway; (2) Seaside (seasonal); (3) Seaside (year-round); (4) Coastal; (5) Provincial City (non-remote); (6) Rural; (7) Snowfields; and (8) Family Holiday. Whether this classification is effective will only be determined by actual experience with use of the simulator. We also should note that the system has been customized specifically for Australian conditions and would almost certainly require some modification before it could be used elsewhere (although it is unlikely this would involve changes to the model structure itself).

Finally, a detailed description of the runtime environment is beyond the scope of this chapter. We should note, however, that our user interface is similar to the “flight simulator” control panels commonly employed in SD applications (see e.g., Maani & Cavana, 2000, p. 116).

MODEL BENEFITS AND USAGE

Scenario 1: Basic Usage

Assume that we wish to examine the feasibility of setting up a motel in Anglesea—a small coastal town, about 70 minutes drive South-West of Melbourne. It has a superb surf beach and a fairly small population (chiefly retirees, commuters seeking a better lifestyle, and “weekenders”—mostly from Melbourne). The town has a large influx of tourists during the warmer months (particularly from December through to April) but experiences a significant drop-off in overnight visitors

at other times—despite the town being right in the middle of the gateway to (the Australian state of) Victoria’s major tourist attraction, the Great Ocean Road. In recent years, real estate prices have gone “through the roof”: mainly because of a massive increase in demand from prospective “lifestylers” and holiday-home buyers, and limited capacity to increase housing supply and supporting infrastructure (without eating into surrounding coastal, national park and farming areas). The town has little in the way of industry and commerce outside of tourism-related enterprises but the wider region supports substantial farming activity.

Figure 7. TEPS – sample output (Enterprise Profitability versus Year)

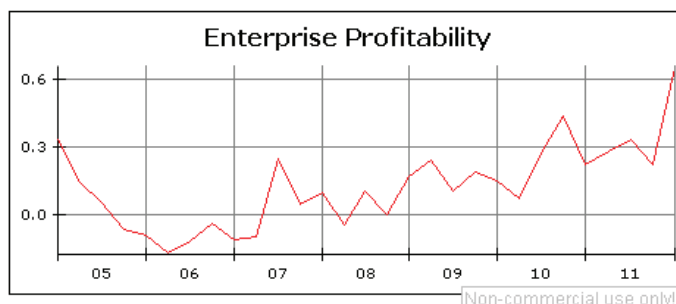
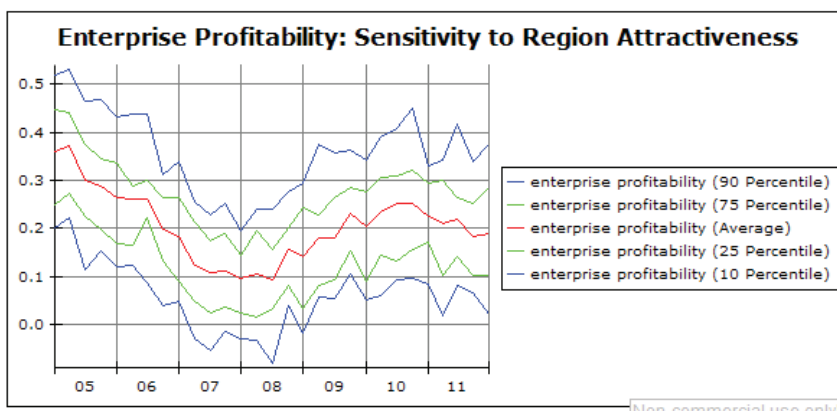


Figure 8. TEPS – example of a ‘risk analysis’ assessment



Firstly, region attractiveness determinants have to be initialized. We elect to do this via the SD control panel (see Figure 6) and this yields a score of 130 (on a 0-200 scale). This relatively good score is largely the result of the assignment of maximum (or close to maximum) values for natural beauty, sports & recreational facilities, existing tourism activity and public infrastructure. These, however, are partly balanced by the assignment of comparatively-weak values to cultural &

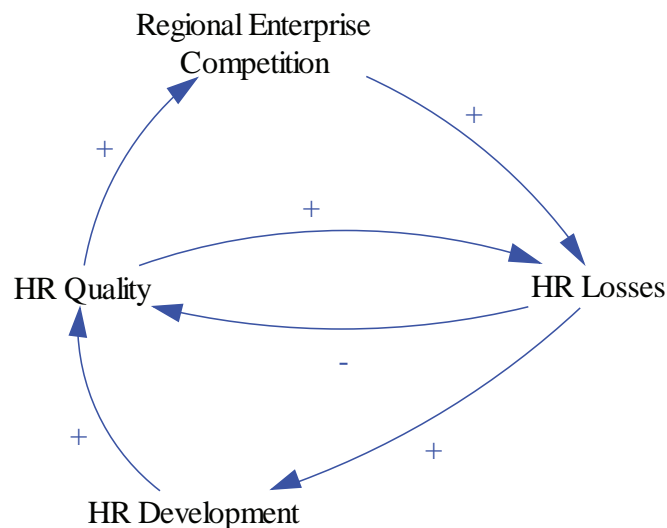
social characteristics, shopping & commercial facilities and attitudes to tourists.

We might then set the remaining input parameters on the control panel as follows: Region Type to Seaside (seasonal); Environmental Damage Mitigation to Major; and, finally, we elect to leave the two HR-related parameters (HR Quality and HR Training Commitment) at their default values of average (HR issues are examined in some detail in the following two scenarios). Parameter

Figure 9. TEPS – impact of HR development on quality



Figure 10. TEPS – unintended consequences of HR development activity



initialization is now complete and running the simulation yields the enterprise profitability graph presented in Figure 7.

At first glance, these results appear to be quite encouraging—Figure 7 indicating that, after a couple of years of pain, a gradual improvement in profitability might occur. In reflecting on the simulation though, we might (for example) be concerned about the accuracy of the values we have assigned to some variables and, in particular, have considerable doubts about the component variables of the region attractiveness parameter.

Fortunately, *Powersim* has a powerful risk analysis package and, using this, we may investigate our model’s sensitivity to changes in independent variables (or, more precisely, variables we decide to declare “independent” for some particular purpose). Basically, all that is required is to specify a mean and standard deviation for each of our independent (sub) variables, stipulate that Enterprise Profitability is the dependent (or effect) variable and, then, initiate a series of simulation runs (in our case, we use the recommended number of 40 runs) through the risk analysis software. The result is the “high-low” graph presented in Figure 8 and, here, it can be seen that around 80% of the variance (the area between the (90% and 10% lines) is within a 30% range (approximately). We conclude, therefore, that the model is not particularly sensitive to change in region

attractiveness. We could then conduct further risk analysis experiments to determine precisely which variables (or combination of variables) do influence model behaviour most. The importance of conducting this type of “sensitivity analysis” has long been known in SD circles—early guidelines having been formulated by Coyle (1977, p. 193) almost 30 years ago.

Scenario 2: HR Development

Assume we have some concerns related to the quality of local hospitality and tourism (H&T) staff we will be able to recruit for our start-up operation and, consequently, have decided that substantial staff training will be required. As such, through our TEPS control panel, we specify that our relative HR Quality is average and set the HR training commitment parameter to significant. The relevant simulation output resulting from these settings is presented in Figure 9.

A brief perusal of the above diagram readily reveals two important features: (1) improvement in HR Quality lags some way behind investment in HR Development; and (2) after a considerable initial increase, HR Quality plateaus and then drops off somewhat. The lag between development and quality improvement would probably be expected but the second of these features is

Figure 11. TEPS – failure to address fundamental problems in favour of quick fixes (smoothed to eliminate the impact of quarterly fluctuations)

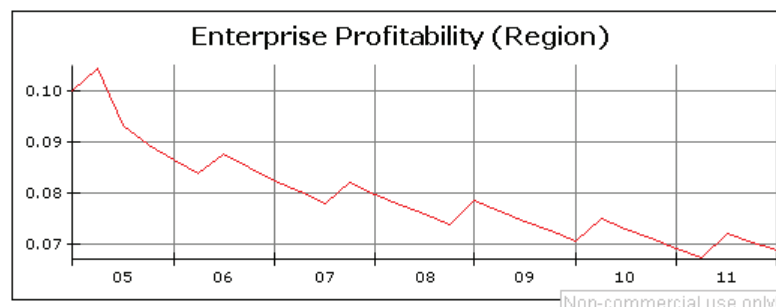
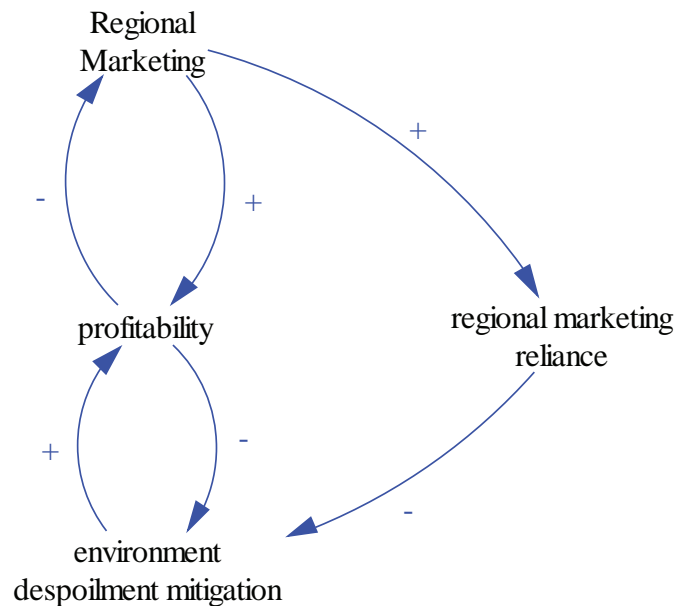


Figure 12. TEPS – over-reliance on quick fixes to fundamental problems



a little more complex and, while not an extreme case, it does represent an instance of the “fixes that fail” SD archetype (developed by the SD Group at MIT and detailed in Maani & Cavana, 2000, pp. 38-40). To understand what is happening here, we need to take a wider view of the system and, more specifically, the CLD representation presented in Figure 10.

With this “fixes that fail” example, we can see that investment in HR Development does, indeed, lead to a HR Quality improvement. However, this also results in two unintended consequences: (1) Regional Enterprise Competition intensifies (because we are now offering superior service to our competitors) and, consequently, some of our better staff may well be “poached” by our local opposition; and (2) we lose additional members of our newly-trained HR team to better-paying jobs outside our own region. Together, these contribute to substantial HR Losses and this, in turn, diminishes some of our recent, hard-won HR Quality gains. It also means that we have to invest even

more in HR Development if our HR standards are to be maintained at the desired level.

Scenario 3: Regional Marketing

In this example, we assume that regional commitment to environment despoilment mitigation is minimal and that, as a consequence, Region Attractiveness and (enterprise) profitability throughout the region will gradually decline over time. To arrest this deterioration, local authorities embark on a series of Regional Marketing campaigns. Simulation results are presented in Figure 11.

This is a classic instance of the “shifting the burden” SD archetype (Maani & Cavana, 2000, pp. 40-41), with our specific example being presented in CLD form in Figure 12. The essence of this archetype is that many (if not most) of us have a tendency to ignore long-term solutions to fundamental problems in favour of quick fixes. Thus, the Regional Marketing campaigns

produce good results in the short-term but the overall enterprise profitability trend is still clearly downwards: the reason being that short-term benefits have produced an unfortunate reliance on marketing campaigns and, as a consequence, key regional stakeholders perceive less need to address the fundamental problem of environment despoilment mitigation.

MODEL VALIDATION, IMPLEMENTATION, AND THE FUTURE

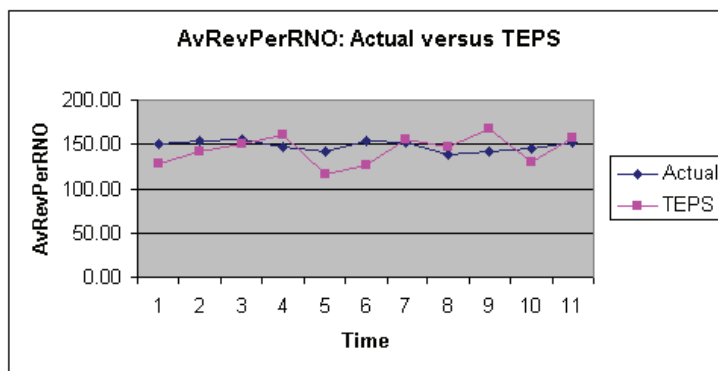
In the previous two sections, we have outlined the architecture of our TEPS system and demonstrated how it might be employed by our target users—primarily, prospective SMTE operators. The examples we have presented are specified at a fairly high level. Already though, a degree of complexity is apparent and this illustrates one of the benefits of SD modelling as claimed by its proponents: specifically, the approach can counter our tendency to over-simplify complex problems and issues into simple cause-effect relationships we can readily understand within the limits of our cognitive powers (Vennix, 1996). Of course, this is true of many conceptual modelling approaches and each of these have their own strengths and

weaknesses. SD, however, is particularly well-suited to domains where feedback loops and time are significant (Richardson & Pugh, 1981) and both of these feature prominently in tourism models (see e.g., Ritchie & Crouch, 2003, pp. 60-78).

A fundamental motive behind the development of TEPS was to attempt to encourage SMTE operators to think more strategically and to take a wider and longer, systemic view of the destination in which they intend to establish, maintain and develop their enterprise. Consequently, in interacting with TEPS, they receive feedback on the realities of inherent system features and constraints: such as the delicate development-environmental balance, limits to growth, unintended consequences and side-effects, and the folly of concentrating on quick fixes at the expense of more fundamental solutions. Much of this was illustrated in the previous section and if we are, indeed, able to reach a critical mass of our intended users, then our software tool may contribute towards tourism destinations evolving towards the type of “learning organization” described by Senge (1990).

Thus, as noted above, this educational aspect has probably been the primary inspiration for our work. Nevertheless, the fact that our simulator is capable of producing graphs of projected Enterprise Profitability, HR Quality, Regional

Figure 13. Model validation – actual versus TEPS results for AvRevPerRNO



Enterprise Competition, Region Attractiveness, Environment Quality and more is intended to act as the trigger that might prompt our targeted users to interact with the model in the first place. Thus, it seems essential that our principal outputs should be “sensible”—to the extent that we must be able to convince the average user that our projections are reasonable. Consequently, the model and its implementation as TEPS must be validated and this is being accomplished via a two-stage approach: desk checking and field-testing.

SD models are notoriously difficult to validate (Richardson & Pugh, 1981). As noted by Forrester and Senge (1980, pp. 209-210), there is no single test which might be employed to validate a SD model but, rather, confidence in the model accumulates gradually as it passes more tests and as new points of correspondence between the model and empirical reality are identified. Maani and Cavana (2000, pp. 69-70), drawing on the work of Coyle (1983, p. 362), describe this process as consisting of:

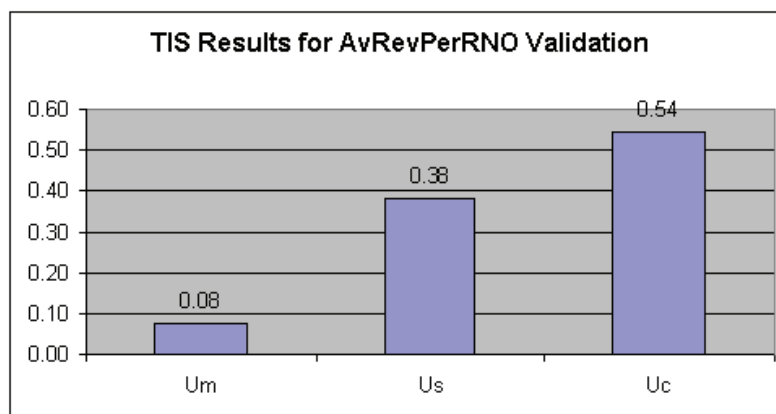
- **Verification tests**, which focus on the equivalence between the structure and parameters of the real system and the model
- **Validation tests**, which are concerned with demonstrating the correspondence between

the behaviour of the real system and the model

- **Legitimation tests**, which determine whether the model is in accord with any generally-accepted system rules

Essentially, the aim of validation is to “show that there is nothing in the model that is not in the real system and nothing significant in the real system that is not in the model” (Maani & Cavana, 2000, p. 69). An excellent example of how much of this can be accomplished through desk checking has been provided by Georgantzas (2003) where statistical measures, such as coefficient of determination and Theil’s Inequality Statistics (TIS) (Theil, 1966), were employed to compare the predictive results of a SD model focused on various key measures of the performance of Cyprus hotels against actual data (over a 40 year period). Similarly, we have subjected our own model to similar tests, concentrating on measures such as occupancy, room nights occupied (RNO) and average revenue per room night occupied (AvRevPerRNO). An example of one of our desk checking outputs is presented in Figure 13. This shows actual vs. predicted AvRevPerRNO for the region on which we based our Major Gateway generic region type.

Figure 14. TIS breakdown of the Figure 13 AvRevPerRNO trend lines



The basis of Theil's approach is that the mean square error (MSE) is divided into three components: (1) bias (U^m); (2) unequal variation (U^s); and (3) unequal co-variation (U^c). The sum of all three components equals one and, briefly, a large U^m indicates a potentially serious systemic error and, to a somewhat lesser extent, this applies to U^s as well. If U^c is large though, most of the error is unsystematic and, as noted by Sterman (2000, p. 877): "a model should not be faulted for failing to match the random component of the data." The TIS results for our example are presented in Figure 14 and, while they indicate that TEPS behaviour provides a reasonable approximation to reality (in this case anyway), there is significant room for improvement: specifically, the variance in our model is considerably greater than that of the actual data. In fact, this can be readily observed through a visual examination of the trend lines in Figure 13. The TIS results, however, are useful in that they quantify the extent of the various error types.

At the time this chapter was being prepared, much of the initial desk checking phase had been completed and, while some fine-tuning was still required, the model was judged as being sufficiently mature that the next stage of validation could commence: that is, field-testing. To this end, negotiations were underway with a New South Wales (Australia)—based tourism authority concerning field-testing TEPS within their region. Testing protocols and other arrangements were in the process of being finalized and it likely that some preliminary results will be available by end June 2006.

Medium to long-term development will focus upon the following activities:

1. Modifications and enhancements designed to address field-testing feedback and ongoing desk checking results
2. Further development of the lower levels of the model; again, this will be largely driven by field-testing feedback
3. TEPS is designed to operate at different levels of granularity. At the more "coarse-grained" levels users assign many of the system's parameters through an "impressionistic" process and this represents the current stage of development. At the very fine-grained level, actual data is used to establish key relationships and to instantiate model variables. Some of this currently takes place but one future development strand will focus on ensuring that, wherever convenient, variables will be assigned and relationships established automatically.
4. As noted earlier, the simulator will be embedded within the STCRC's Decipher (Carson and Richards, 2004) tourism business planning toolkit. This will facilitate the automatic assignment of values to parameters discussed in (3) above. In addition, it also may provide some indication of whether there is any real interest in TEPS among its intended user base—SMTE operators.
5. Further field-testing will be undertaken. At the very least, it is intended to test the simulator in an instance of each of the eight generic destination types for which the model has been customized.

Finally, as noted previously, although the current version of TEPS has been designed specifically for Australian conditions, we believe that the base model is sufficiently generic that it may well be suitable for any tourism destination and that the system has been designed such that it should be possible to conveniently customize it for different destination types (and instances of these types). Thus, while we have no specific plans at present, we aim to eventually test the model in an international setting and, thereby, go some way to establishing its external validity. Field-testing within the eight generic destination types we have identified as appropriate for the Australian context can be seen as a first step towards that objective.

CONCLUSION

We have detailed the development, implementation and use of a tourism enterprise planning simulator (TEPS) based largely upon SD constructs and tools. The motivation for our work and particular approach was: (1) the need for improved access to useful business planning tools among SMTE operators; and (2) the fact that SD copes well with domains that are rapidly-changing and, in addition, can be classified as “messy” (Vennix, 1996, pp. 9-41).

Few would argue that the tourism landscape is evolving at an express (indeed, some might say terrifying) pace and issues that need to be considered when developing tourism enterprises are certainly messy (according to the criteria listed earlier). For example, Buhalis (2000) nominates the number of different stakeholders, stakeholder relationships and goals, contradictions between these goals, and difficulties in maintaining an acceptable and sustainable balance between the interests of stakeholders, natural resources and development activity as major problems that must be confronted in destination marketing and management—and tourism enterprises cannot be established in isolation from destination-level considerations.

Validation of SD models has long been a controversial issue. In particular, the inclusion of “intangible” variables (such as friendliness) in models has received substantial criticism (Legasto and Marciariello, 1980). However, as Campbell (2000) has noted, omitting such variables from models implies that they have a value of zero (or no impact) and, generally, of the infinite number of values that intangible variables might take, the only the only instantiation that is almost certainly wrong is zero! Moreover, considerable advances in SD model validation techniques have been made in recent years and, in the previous section, we demonstrated how one statistical approach might be used to good effect. In addition, the SD approach

has been justified on its benefits and usefulness (Maani & Cavana, 2000, pp. 223-228).

For example, the model presented in Figure 5 contains four main feedback loops. As noted, Vennix (1996) claims that many people are unable to understand the dynamics of a single feedback loop. Once multiple feedback loops are involved, even people who are experienced at interpreting feedback are unable to ascertain the behaviour of a system without resorting to a computer simulation. Even though our example is substantially simplified (i.e., the total HR sub-domain is much more complex than the model illustrated in Figure 5), it clearly indicates the complexity of concept interrelationships and feedback loops within the tourism domain. Yet, it is already reasonably complex and, thus, our example illustrates another of the major benefits of the SD approach: namely that a graphical modelling approach can help to guard against over-simplification and promote shared understanding in both planning and research activity (Vennix, 1996).

Finally, ICT should work in a natural way to help grow the tourism industry. Yet, current research, including our own as discussed in this chapter, demonstrates that the reality is very different. SD offers a tangible solution to increasing our understanding of the field and leading us to more effective business planning and implementation. The use of such modelling approaches, however, must be grounded in improved ways of dealing with change as a norm—both for individual organizations and the industry as a whole. No longer can we afford the ostrich-like or reactive approach to change. Now we need change leadership that regards change as an opportunity and, as that classic management scholar Drucker (1999) suggests: focuses on policies for the future, encourages ways of looking for and anticipating change, finds appropriate ways to introduce change at micro and macro levels, and balances change and continuity appropriately. Only by so doing, by cleverly utilising technol-

ogy and change management interdependently, will the industry and its individual organisations reap the benefits they offer individually and win the challenges the global industry confronts in the 21st century.

ACKNOWLEDGMENT

This research was funded by the Sustainable Tourism Cooperative Research Centre (STCRC), an Australian Government initiative.

REFERENCES

ABS. (2005, March). *Tourist accommodation, Australia: Time series* (Rep. No. 8635.0). Canberra, ACT: Australian Bureau of Statistics.

Adams, C., Frost, G. & Webber, W. (2004). Triple bottom line: A review of the literature. In A. Henriques & J. Richardson (Eds.), *The triple bottom line: Does it all add up* (pp. 17-25). London: Earthscan.

Andersen, D. F., Richardson, G. P. & Vennix, J. A. C. (1997). Group model building: Adding more science to the craft. *System Dynamics Review*, 13(2), 187-201.

Baker, K. (2000). *Project evaluation and feasibility analysis for hospitality operations*. Melbourne, Australia: Hospitality Press.

Bergin-Seers, S., Jago, L., Breen, J. & Carlsen, J. (2005). *Performance measurement in small hotels* (Tech. Rep. Project No. 70061). Gold Coast, Australia: CRC for Sustainable Tourism Pty Ltd.

Buhalis, D. (2000). Marketing the competitive destination of the future. *Tourism Management*, 21(1), 97-116.

Brundtland, G. H. (1987). *Our common future*. Federal Office for Spatial Development, Berne. Retrieved December 1, 2005, from <http://www.are>.

admin.ch/are/en/nachhaltig/international_uno/unterseite02330/

Campbell, B. R. (2000). *Business process modelling: A system dynamics perspective*. Unpublished MSc(Hons) dissertation, Macquarie University, Sydney.

Carson, D. & Richards, F., (2004). Delivering technological innovation in tourism: Considerations in the implementation of decipher. In A. J. Frew, & P. O'Connor, (Eds.), *Information and Communication Technologies in Tourism 2004* (pp. 1-11). Vienna: Springer-Verlag.

Coyle, R. G. (1977). *Management system dynamics*. Chichester, UK: Wiley.

Coyle, R. G. (1983). The technical elements of the system dynamics approach. *European Journal of Operational Research*, 14, 359-370.

Dangerfield, B. & Roberts, C. (1995). Projecting dynamic behavior in the absence of a model: An experiment. *System Dynamics Review*, 11(2), 157-172.

de Geus, A. P. (1994). Modeling to predict or to learn? *Modeling for learning organizations*. OR: Productivity Press.

Drucker, P. (1999). *Management challenges for the 21st century*. New York: HarperBusiness.

Elkington, J. (1999). *Cannibals with forks: the triple bottom line of 21st century business*. Oxford: Capstone.

English, J. (1995). *Small business financial management in Australia*. London: Allen and Unwin.

Fausnaugh, C., Waight, P., Higginbottom, K. & Northrope, C. (2004). *Farm & country tourism—on your property: Stage 1 assessment tool*. Retrieved from the Australian STCRC Web site, <http://www.crctourism.com.au>

- Forrester, J. W. (1961). *Industrial dynamics*. Cambridge, MA: MIT Press.
- Forrester, J. W. & Senge, P. M. (1980). Tests for building confidence in system dynamics models. *TIMS Studies in the Management Sciences*, 14, 209-228.
- Gammack, J., Amaya Molinar, C., Chu, K. & Chanpayom, B. (2004). *Development needs of small to medium size tourism businesses*. Toowong, Qld, Australia: Asia Pacific Economic Cooperation Secretariat (APEC).
- Georgantzas, N.C. (2003). Tourism dynamics: Cyprus' hotel value chain and profitability. *System Dynamics Review*, 19(3), 175-212.
- Kosko, B. (1993). *Fuzzy thinking: The new science of fuzzy logic*. New York: Hyperion.
- Legasto, A. A. & Maciariello, J. (1980). System dynamics: A critical review. In A. A. Legasto, J. W. Forrester, & J. M. Lyneis, (Eds.), *System Dynamics*, *TIMS Studies in Management Sciences*, 14. New York: North-Holland.
- Loutif, M., Moscardini, A. O. & Lawler, K. (2000). Using system dynamics to analyse the economic impact of tourism multipliers. In P. I. Davidsen, D. N. Ford & A. N. Mashayekhi (Eds.), *Proceedings of the 18th International Conference of the System Dynamics Society* (pp. 132-232). Albany, NY: System Dynamics Society.
- McGrath, G. M. (2005, June 19-20). Information needs within the Australian tourism industry: A scoping study. In P. O'Connor & A. J. Frew (Eds.), *Proceedings of the Hospitality Information Technology Association Conference (HITA 05)*, Los Angeles (pp. 47-78).
- McGrath, G. M. & More, E. (2005). An extended tourism information architecture: Capturing and modelling change. In A. J. Frew (Ed.), *Proceedings of the 12th International Conference on Information Technology in Travel and Tourism* (pp. 1-12). Vienna: Springer-Verlag.
- Maani, K. E. & Cavana, R. Y. (2000). *Systems thinking and modelling: Understanding change and complexity*. Auckland, New Zealand: Prentice-Hall.
- Mill, R. C. & Morrison, A. M. (2002). *The tourism system* (4th ed). Dubuque, Iowa: Kendall/Hunt Publishing.
- Mistilis, N., Presbury, R. & Agnes, P. (2004). The strategic use of information technology in marketing and distribution—a preliminary investigation of Sydney hotels. *The Journal of Hospitality and Tourism Management*, 11(1), 42-55.
- Morecroft, J. D. W. (1994). Executive knowledge, models and learning. In *Modeling for learning organizations* (pp. 3-28). Oregon: Productivity Press.
- Morrison, A. J. & King, B. E. M. (2002). Small tourism businesses and e-commerce: Victorian tourism online. *Tourism and Hospitality Research*, 4(2), 104-115.
- Powersim (2003). *Powersim Studio 2003: Reference manual*. Bergen, Norway: Powersim Software AS.
- Richardson, G. P. & Pugh, A. L. (1981). *Introduction to system dynamics modeling*. OR: Productivity Press.
- Ritchie, J. R. B. & Crouch, G. I. (2003). *The competitive destination*. Cambridge, MA: CABI Publishing
- Richmond, B. (1997). The strategic forum: Aligning objectives, strategy and process. *System Dynamics Review*, 13(2), pp. 131-148.
- Roberts, N. H., Andersen, D. F., Deal, R. M., Garet, M. S. & Shaffer, W. A. (1983). *Introduction to computer simulation*. Reading, MA: Addison-Wesley.
- Senge, P.M. (1990). *The fifth discipline: The art and practice of the learning organization*. Milsons Point, NSW: Random House.

- Sharma, P., Carson, D. & DeLacy, T. (2000). National online tourism policy initiatives for Australia. *Journal of Travel Research*, 39(2), 157-162.
- Sharma, P., Carson, D. & DeLacy, T. (2000a). Developing a business information data warehouse for the Australian tourism industry—a strategic response. *Information and communication technologies in tourism 2000* (pp. 147-156). Vienna: Springer-Verlag.
- Smith, S. L. J. (2004). The measurement of global tourism: Old debates, new consensus, and continuing challenges. In A. A. Lew, C. M. Hall & A. M. Williams (Eds.), *A companion to tourism* (pp. 25-35). Malden, MA: Blackwell.
- Sterman, J. D. (2000). *Business dynamics: Systems thinking and modeling for a complex world*. Boston: Irwin McGraw-Hill.
- Theil, H. (1966). *Applied economic forecasting*. New York: North-Holland.
- Tourism Australia. (2004). *Australia's tourism facts and figures: At a glance*. Canberra, ACT: Australian Government, Department of Industry, Tourism and Resources.
- TRA. (2005). *Domestic overnight travel: Recent trends and challenges*. Canberra, ACT: Tourism Research Australia.
- Vennix, J. A. M. (1996). *Group model building: Facilitating team learning using system dynamics*. Chichester, UK: Wiley.
- Walker, P. A., Greiner, R., McDonald, D. & Lyne, V. (1999). The tourism futures simulator: A systems thinking approach. *Environmental Modelling and Software*, 14, 59-67.
- WTO. (1998). *Guide for local authorities in developing sustainable tourism*. Madrid: World Tourism Organization.

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, and M. Cooper, pp. 215-241, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.6

Investing in Online Privacy Policy for Small Business as Part of B2C Web Site Management: Issues and Challenges

Geoff Erwin

Cape Peninsula University of Technology, South Africa

Mike Moncrieff

Cape Peninsula University of Technology, South Africa

ABSTRACT

“You have zero privacy anyway. Get over it.” These words by Scott McNeally, CEO of Sun Microsystems, represent one pole of opinion on the privacy protection spectrum in the global world of the World Wide Web and Internet. At the other end, some authors identify privacy as “... perhaps the most contentious and serious issue facing information and communication technology (ICT) managers ...” Assessing these extreme opinions, how does a small business Web site operator determine a feasible and responsible course of action for handling personally identifiable information collected in the course of business? Theoretical and practical frameworks must reinforce privacy treatment. Mishandling of the privacy issue can

disrupt both the reputation and success of an e-commerce or other Web site, threatening the return on investment for the business. This chapter explores the current developments in privacy legislation in South Africa and examines the practical issues faced by a business-to-consumer (B2C) small business Web site owner implementing an online privacy policy.

INTRODUCTION

One of the risks associated with owning and operating a Web site is the contingent liability attendant on preserving confidentiality of personal information surrendered by an e-customer in the course of a transaction.

No matter how user-friendly and attractive a Web site is, the success of the Web site can be jeopardized by the casual or systematic mishandling of personal information by the Web site owner/operator as well as the Internet service provider (ISP). To protect the investment made by the Web site owner in developing and maintaining a Web site, management should ensure that the personal information volunteered by e-customers is securely and confidentially held. In the event that personal information is sold or passed on, accidentally or deliberately, without the direct consent of the e-customer, the Web site owner could face difficulties such as liability for damages, legal penalties, loss of existing customers, and reluctance by potential customers to use the Web site. The policies and methods of privacy protection can be a significant amount of Web site development and maintenance costs. In this chapter, the authors explore various issues associated with the management of personal information on a Web site associated with the protection of an e-customer's privacy.

BACKGROUND

Privacy

Gauzente (2004) finds that there is no single generally agreed upon definition of privacy. For the purposes of this chapter, the authors have chosen a definition quoted by Gauzente from the Electronic Privacy Information Centre (EPIC) as follows: "... the right of individuals to control the collection, use, and dissemination of their personal information that is held by others."

Personally Identifiable Information

Personally identifiable information (PII) is personal information that can be linked back to an individual. Such information can form enough

evidence to link it to a specifically named individual, hence the "personal" aspect. The Electronic Communications and Transactions Act (ECT Act, 2002) includes a comprehensive definition of PII. Romney and Romney (2004), among others, offer some examples of personal information: age, height, weight, medical records, and opinions. They state that publicly available information such as job title or address is not included in the definition of personal data (PII), although, in the opinion of the authors, data such as an address could help to narrow the possible individual involved.

Gauzente (2004) describes a "privacy concern continuum" of personal information ranging from gender, at the level of least concern, through credit card details at the highest level. Each B2C Web site owner must choose a level of privacy policy and implementation that affects concerns along this spectrum, usually in a phased approach. Goodburn and Ngoye (2004) assert that aggregate information compiled from PII does not enjoy the same protection under the law as PII, provided that the aggregate data is incapable of being related to specific individuals. Organizations that collate data from a collection of individuals into summary reports, such as opinion survey facilitators, would fall under this "aggregate information" category.

The issue of the availability of PII is increasingly contentious because of the ease with which an Internet connection can be used to disseminate such information, the multiple different opportunities each consumer has to provide PII to various Web sites, and the reports of so-called Spyware being used to gather PII without the user being aware of that activity.

The Issue of Privacy in B2C E-Commerce

E-customer concerns about privacy online are considered by many authors to be a key disincentive to shopping online (Hann, Hui, Lee, & Png,

2002; Schwaig, Kane, & Storey, 2005). PII can be used by a Web site owner/operator to customize the online shopping experience for a returning e-customer (e.g., by recommending products based on past purchases). The motivation for collecting PII need not be solely for in-house use, however, as it is highly valued by marketing organizations (Goodburn et al., 2004).

Privacy issues in business-to-consumer (B2C) e-commerce constitute a double-edged sword, which can inflict damage on both sides of the relationship. When privacy is compromised, the e-customer risks exposure of PII. This can have consequences ranging from the nuisance of receiving unsolicited marketing material through more insidious threats such as identity theft or discrimination. EPIC describes identity theft as "... the number one crime in the United States." EPIC attributes the rising incidence of identity theft to improper disclosure and use of PII (epic.org, 2005).

Ashley, Powers, and Schunter (2002) identify three reasons why organizations are concerned about PII viz. legislative penalty; brand and reputation erosion; lawsuits. Security breaches at online payroll service provider PayMaxx that exposed the PII of 25,000 people, forced closure of the site (news.com, 2005). Alexa, an Amazon.com subsidiary, was obliged to destroy some PII in its databases and pay up to USD 1.9 million to its customers in settlement of a class action lawsuit (news.com, 2001).

Relevance of Online Privacy Policies

Also referred to as a privacy notice, an online privacy policy (OPP) consists of statements informing an e-customer what information is collected during the course of a transaction and how it will be processed, stored, and used (Earp, Anton, & Jarvinen, 2002). Given the statement "Privacy concerns people, whereas confidentiality concerns data" (University of Kentucky, 2005), it could be

argued that a privacy policy ought more properly to be called a "confidentiality policy."

Schwaig et al. (2005) observe that relatively few e-customers bother to read OPPs and those that do find them hard to understand. In light of this, these authors question a company's motivation to spend money on something of little use to the customer. In their view, companies may be more concerned about being seen to have a policy, creating a favourable, trustworthy image, than about the policy's content or enforcement.

The results of a survey conducted by the authors for a previous paper confirmed that many South African e-customers also experience difficulty in understanding an OPP (Moncrieff & Erwin, 2004).

Impact of Small Business Management on Privacy Policy

In the South African context, small, medium and micro enterprises (SMMEs) are defined in the National Small Business Act (Small Business Act, 1996) as owner-managed, having no more than 200 employees, total turnover not exceeding ZAR 64 million and total gross assets (excluding fixed property) of no more than ZAR 23 million.

Peslak (2005) reports that privately held companies are less likely to have privacy policies than public companies. They are also less likely to show consistency in the adoption of e-customer driven policies. Since SMMEs are by definition owner-managed, it is reasonable to expect that adoption of information technology (IT) and e-commerce will be significantly influenced by the attitudes of the business owners. It can be inferred that this influence will extend to the SMME's compliance with privacy practices.

It takes an organization more interested in preserving and enhancing customer relationships than in collected data to implement a comprehensive privacy management system (Ashley et al., 2002). In the case of SMMEs, the motivation for this must come from the business owner.

The relatively small size of an SMME usually means that the owner/manager(s) have multiple roles, such as accountant, lawyer, network operator, clerk, manager, financier, and more. This reduces the attention that can be paid to issues such as privacy, *inter alia*, compared with large organisations. A large organisation often employs a chief information officer (CIO) to marshal resources and policies to address privacy and other overarching concerns. Outsourcing of privacy compliance to a specialist service provider may be essential for SMMEs.

Legislation

One of the consequences of the advances in Internet technology has been an exponential growth in data flows unmatched by corresponding privacy protection technology (Ashley et al., 2002). These authors suggest that associated violations of privacy have prompted many countries to enact protective legislation. Rising concerns about data protection are confirmed in a South African Law Reform Commission Report (2003), “the Report,” which states that over 30 countries have implemented data protection laws, and that the number of countries doing so is increasing steadily.

The expression of personal privacy legislation varies between countries. However, there are common underlying principles set out in the Report. The Report states that “personal” information must be:

1. Obtained fairly and lawfully
2. Used only for the specified purpose for which it was originally obtained
3. Adequate, relevant, and not excessive to the purpose
4. Accurate and up to date
5. Accessible to the subject
6. Kept secure
7. Destroyed after its purpose is completed

The Report discusses two seminal agreements issued in 1981, which have had far reaching influence on national laws around the globe. These are:

1. The Council of Europe’s 1981 Convention for the Protection of Individuals with Regard to the Automatic Processing of Personal Data
2. The Organisation for Economic Cooperation and Development’s (OECD) Guidelines Governing the Protection of Privacy and Transborder Data Flows of Personal Data

The durability of these documents may in part be ascribed to the fact they were expressed in terms of principles relating to gathering, holding, and usage of personal information rather than the technology of the era. In addition, the European Union enacted the Data Protection Directive in 1995 (European Union, 1995) with the aim of enabling the formulation of consistent privacy protection laws for citizens across member states of the Union. Articles 25 and 26 of the Directive are of particular significance to international trade in that they demand that there should be no cross border flow of personal data to a country “... which does not ensure an adequate level of protection ...”. The provisions of these articles have come to be known as the “safe harbour” principles.

In the United States, the Federal Trade Commission (FTC) is the arbiter of privacy regulation. Currently the FTC favours self-regulation by industry (Schwaig et al., 2005). Self-regulation is based on five principles—notice, choice, access, security, and enforcement detailed in the Fair Information Practices report (FTC, 2000).

The Report characterizes the European Union approach to data protection as based on legal protection of a political right. In the United States, the Report considers information privacy as being “... left to the marketplace ...” and based on economic rather than political power. The Report

characterizes the Australian and Canadian models as co-regulatory, where industry develops the rules, which are policed by an oversight agency. Canadian privacy legislation entitled Personal Information and Electronic Documents Act (PIPEDA) came into force in 2004. Fines for violation of PIPEDA can be up to CAD 100,000.

Privacy legislation in South Africa may be considered to be at a formative stage. Vecchiato (2005) quotes South African Cyber Law expert Reinhardt Buys as stating that privacy is "... only dealt with on a voluntary basis ..." in the ECT Act (2002). The South African Law Commission initiated a project entitled "Privacy and Data Protection" in 2002 which, when it comes to fruition, is expected to impact on the ECT Act (2002) and the Promotion of Access to Information Act (PROATIA, 2000) (South African Government Information, 2002).

The South African Law Reform Commission Report (2003) contains the following preliminary proposals:

- Privacy and data protection should be regulated by legislation.
- General principles of data protection should be developed and incorporated in the legislation.
- A statutory regulatory agency should be established.
- A flexible approach should be followed in which industries will develop their own codes of practice (in accordance with the principles set out in the legislation) which will be overseen by the regulatory agency.

The current fluid state of privacy legislation in South Africa in no way lessens the need for organizations to be aware of their obligation to preserve privacy.

Buys in Vecchiato (2005) points to the importance that EU countries attach to privacy and the key role that privacy plays in their trade relation-

ships. The South African Law Reform Commission Report (2003) expresses similar sentiments, warning that privacy concerns can constitute an impediment to international trade.

Privacy Education

Many people believe that cryptography presents a complete solution to the online privacy and security conundrum (Orgill, Romney, Bailey, & Orgill, 2004). Cryptography plays a role in making transfers of data (largely) unreadable to an outsider or unauthorised snoop. However, this may only delay the availability of the clear text from becoming known if the Web site operator has inadequate controls in place to control such windows of opportunity as discarded backup discs and access points which are not protected.

A common approach is to recognize that unauthorised access to data (PII) will occur and make the content of the accessed data unusable. This approach is also used with security and confidentiality issues, as well as with privacy. Privacy refers to PII. Confidentiality often refers to organisational material such as business plans, salaries of directors and the like. Even when cryptography is used, there is still the aspect of the receiver/storer of PII knowingly disseminating that PII, either for monetary gain or in ignorance of the sensitivity of the data.

Orgill et al. (2004) describe human nature as the weak link in any security strategy. These authors identify shortcomings in education as one of the reasons a person may compromise the security with which they are entrusted. A practical illustration of the importance one e-commerce participant attaches to reinforcing the privacy message among its employees can be found in the following extract from the OPP of share-it!, a German software vendor:

Every quarter, as well as anytime new policies are added, our employees are notified and/or re-

minded about the importance we place on privacy, and what they can do to ensure our customers' information is protected. (share-it!, 2005)

Romney et al. (2004) point to the need for ICT professionals to be familiar with developments in privacy law because of the inevitable impact on the design and operation of databases. These authors conclude that instruction in the basis of privacy legislation is essential to an ICT education. It is commonly held that ignorance of the law is no excuse. Ignorance of the ramifications of privacy law on the part of an ICT professional carries the risk of serious consequences, economic and legal, for both the ICT professional and his or her employer (Romney et al., 2004). This can endanger the viability of the organization, threatening the whole of the ICT investment.

OPERATIONS AND SYSTEMS LEVEL PRIVACY MANAGEMENT

A Holistic Strategy

A holistic privacy management strategy should address both the information systems and operational environments of the SMME. Information systems must be capable of supporting the requirements defined by the OPP. At the operational level, management need to demonstrate commitment to policy, and employees need guidelines to ensure

they are aware of the procedures to be followed in dealing with and protecting the privacy of PII.

A Systems Level Strategy

Ashley et al. (2002) state that there is no existing technological solution to the challenge of instituting enterprise-wide privacy management. In their view, the problem cannot be seen purely as one of data security. It is more a data management problem than one of security. Core to their thinking is that PII should be linked to the OPP in force at the time it was submitted by the e-customer. They advocate a “Sticky Policy Paradigm” (i.e., the policy should “stick” to the data and govern access to it). Table 1 below shows their framework for management of collected PII.

Ashley et al. (2002) call for creation of a privacy policy by a chief privacy officer (CPO), in consultation with people who can formulate it in terms of the legal requirements, the strategy of the business and the relevant legislation, if any. Elements that the policy must address are *Data Users* (data subject users), *Data Operations* (who can do what to the data), *Data Types* (e.g., “Contact Information” as opposed to types in a database schema), *Purposes* (how the data will be used), *Conditions* (qualification of rules e.g., disclosure to statutory authorities), and *Obligations* (e.g., requirement to log certain types of access). Deployment of the privacy policy requires correlation of the *Data Types* in the privacy policy

Table 1. Proposed framework for management of PII (Source: Ashley et al., 2002)

| | |
|---|---|
| 1 | Define an enterprise privacy policy. |
| 2 | Deploy the policy to the IT systems containing privacy sensitive information. |
| 3 | Record consent of end users to the advertised privacy policy when they submit privacy sensitive data. |
| 4 | Enforce the privacy policy and create an audit trail of access to privacy sensitive information. |
| 5 | Generate both enterprise wide and individualized reports showing access to privacy sensitive information and their conformance to the governing privacy policy. |

to PII in the organisation's databases; *Data Users* to roles in the organisation and *Purposes* to tasks and procedures performed in the course of business.

No PII should be collected without the explicit consent of the e-customer to the terms of the extant privacy policy including every stated use of the information. Stored information should be identifiable as belonging to the data subject, and linked to the currently effective policy and the data types within the policy. Enforcement of the policy can be implemented in real-time by means of a suitable application program interface (API) and through delayed monitoring of access log files.

Reporting facilities should be provided to permit an auditor to log and review breaches of policy. The data subject user should be able to request reports detailing the information held on file and indicating which private information has been compromised in terms of the agreement under which it was submitted. The data subject user must also be afforded means to correct the data.

Operational Aspects of Privacy Management

The search for practical methodologies for dealing with privacy concerns is not new. In a paper written before the advent of e-commerce, Smith (1993) prophetically describes information privacy as possibly "... the most important issue of the information age." The same organizational issues identified by Smith in the protection of PII remain relevant today.

Smith describes privacy policy development in the organizations studied as being intermittent, responding to outside threats such as adverse publicity or changes in legislation. A negative consequence of this approach was that in the periods between policy developments, employees had either to operate with policies inconsistent with actual practice, or without policy, at all when no

new policy had yet developed for a changed environment. Smith advocates a proactive approach as the "... backbone of the privacy approach of corporations that use personal information ...". The author urges that business executives take an aggressive stance to the creation of privacy policies. Once a policy is established, the author argues that employee commitment must be ensured through education. A continuous monitoring process is essential to ensuring that practice adheres to policy.

Smith warns against reliance on implicitly inferred policies because this places employees in a position where they cannot produce officially endorsed procedures to support their actions. To avoid a situation where employees experience "value conflicts" resulting from inconsistencies between policy and practice, the author recommends that an environment is engendered in which employees can freely raise concerns about information privacy.

DISCUSSION

E-commerce has matured and moved on from the heady days prior to the dot com meltdown in the early 2000s when the industry seemed to be driven more by catchphrases than sound business principles. Whether genuinely motivated by customer concerns or simply to look good in the marketplace, all B2C Web sites will need to establish privacy policies made public in an OPP. The evolution of privacy law in South Africa will to a large degree determine the content of these organizational policies.

To avoid penalties resulting from violation of privacy laws, the onus will be on the operator of a Web site to ensure that the promises in the policy are made good in day-to-day operations. Achieving this will firstly require commitment to the OPP from the owner of the SMME. Explicitly stated in-house policies congruent with the OPP will need to be established and regularly reinforced

with all employees. To avoid the “drift” described by Smith (1993), compliance with procedures must be audited regularly.

CONCLUSION

Few SMMEs are likely to have the infrastructure to support a full-time CIO. This does not mean that the privacy of data control function can be eliminated. Romney et al. (2004) quote Catherine MacInnes writing on compliance with PIPEDA in Computing Canada as follows:

... To comply with the legislation, some organizations will have to completely overhaul their process for collecting, using, and storing personal information...

South African B2C Web site operators are in a somewhat similar situation to their Canadian counterparts prior to the enactment of PIPEDA. Although the actual form of the final legislation is not known, it can be reasonably expected to be modeled on the proposals contained in the South African Law Reform Commission Report (2003). As such, it should be expected to have teeth in the form of significant legal penalties for violators. Web site systems will be subject to privacy laws, and management needs to factor that into their investment in the development, protection, and maintenance costs.

The requirement to manage PII responsibly cannot be ignored. Organizations involved in e-commerce have an obligation to cultivate awareness of emergent privacy legislation in their employees, to harness the appropriate skills (both technical and legal), to ensure that their procedures and systems are prepared for imminent changes. All these privacy considerations are now part of the normal management task of protecting the investment in the business.

REFERENCES

- Ashley, P., Powers, C., & Schunter, M. (2002, September 23-26). *From privacy promises to privacy management*. Presented at the New Security Paradigms Workshop '02, Virginia Beach, VA.
- Earp, J. B., Anton, A. I., & Jarvinen, O. (2002). *A social, legal and technical framework for privacy management and policies*. Presented at the 8th America Conference on Information Systems (AMCIS 2002), Dallas, TX.
- ECT Act. (2002). *Electronic Communications and Transactions Act 2002*. Retrieved March 29, 2005, from <http://www.polity.org.za/pdf/Electronic-Communications.pdf>
- epic.org. (2005). *Identity theft and data broker services*. Retrieved June 16, 2005, from http://www.epic.org/privacy/id_cards/testimony50905.pdf
- European Union. (1995). *Data protection directive*. Retrieved June 16, 2005, from http://www.cdt.org/privacy/eudirective/EU_Directive_.html
- FTC. (2000, May). *Privacy online: Fair information practices in the electronic marketplace: a federal trade commission report to congress*. Retrieved June 12, 2005, from <http://www.ftc.gov/reports/privacy2000/privacy2000text.pdf>
- Gauzente, C. (2004). Web merchants' privacy and security statements: How reassuring are they for consumers? A two sided approach. *Journal of Electronic Commerce Research*, 5(3), 181-198.
- Goodburn, D., & Ngoye, M. (2004). Privacy and the Internet. In *Cyberlaw @ SA II* (2nd ed.). Pretoria: Van Schaik.
- Hann, I., Hui, K., Lee, T. S., & Png, I. P. L. (2002, December 15-18). *Online information privacy: Measuring the cost-benefit trade-off*. Presented at the 23rd International Conference on Information Systems, Barcelona.

- Moncrieff, M. J., & Erwin, G. J. (2004, September 1-3). e-customer perceptions of an online privacy policy. In *Proceedings of the 6th Annual Conference on World Wide Web Applications*, Johannesburg.
- news.com. (2001). *Amazon unit settles privacy lawsuit*. Retrieved June 16, 2005, from http://news.com.com/2104-1017_3-256663.html
- news.com. (2005). *Payroll site closes on security worries*. Retrieved June 16, 2005, from http://news.com.com/Payroll+site+closes+on+security+worries/2100-1029_3-5587859.html
- Orgill, G. L., Romney, G. W., Bailey, G. B., & Orgill, P. M. (2004). The urgency for effective user privacy-education to counter social engineering attacks on secure computer systems. In *Proceedings of the 5th Conference on Information Technology Education*, Salt Lake City, UT (pp. 177-181).
- Peslak, A. R. (2005). Privacy policies of the largest privately held companies--a review and analysis of the Forbes private 50. In *Proceedings of the 2005 ACM SIGMIS CPR Conference on Computer Personnel Research*, Atlanta, GA (pp. 104-111).
- PROATIA. (2000). *Promotion of Access to Information Act 2 of 2000*. Retrieved June 12, 2005, from <http://www.polity.org.za/html/govdocs/legislation/2000/act2.pdf>
- Romney, V. W., & Romney, G. W. (2004). Neglect of information privacy instruction – a case of educational malpractice? In *Proceedings of the 5th Conference on Information Technology Education*, Salt Lake City, UT (pp. 79-82).
- Schwaig, K. S., Kane, G. C., & Storey, V. C. (2005). Privacy, fair information practices, and the Fortune 500: The virtual reality of compliance. *The Database for Advances in Information Systems*, 36(1), 49-63.
- share-it! (2005). *Privacy statement of share-it!*. Retrieved June 17, 2005, from http://www.shareit.com/privacy_statement.html?sessionid=232599852&random=b6c6c21f4ae32176a699f6044d45f168
- Small Business Act. (1996). *National Small Business Act, 1996*. Retrieved June 19, 2005, from <http://www.polity.org.za/html/govdocs/legislation/1996/act96-102.html>
- Smith, H. J. (1993). Privacy policies and practices: Inside the organisational maze. *Communications of the ACM*, 36(12), 104-122.
- South African Government Information. (2002, August). *Media statement by the South African Law Commission concerning its investigation into privacy and data protection*. Retrieved June 12, 2005, from <http://www.info.gov.za/speeches/2002/02082614461004.htm>
- South African Law Reform Commission. (2003). *Privacy and data protection, Issue Paper 24: Summary of proposals and questionnaire*. Retrieved June 16, 2005, from <http://wwwserver.law.wits.ac.za/salc/issue/ip24-sum-ques.pdf>
- University of Kentucky. (2005). *Privacy vs. confidentiality, what's the difference*. Retrieved June 19, 2005, from <http://www.research.uky.edu/ori/ORI-Forms/Privacy%20vs%20Confidentiality.pdf>
- Vecchiato, P. (2005). *SADC looking to harmonise cyber laws*. Retrieved June 12, 2005, from <http://www.itWeb.co.za/sections/business/2005/0504111215.asp>

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 169-181, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.7

The Use of IT in Small Business: Efficiency and Effectiveness in South Africa

Sam Lubbe

University of KwaZulu-Natal, South Africa

ABSTRACT

This chapter addresses the effective use of information technology (IT) in small businesses. Worldwide it is regarded as a problem as was illustrated in the literature review. Small business owners need to calculate and plan proper use of IT in their businesses by aligning their strategic IT planning to the business plan. A computing grid is proposed with a proper structure and guideline to help the owners.

It firstly defines what a small business is and looks at different approaches to formalise IT in the small businesses interviewed. The instrument that is used (questionnaire) is discussed as well. The results are represented and implications as well as guidelines for small business owners are explained and linked to the theory.

INTRODUCTION

Information technology's (IT) use in small business had been limited to occasional glimpses of "brilliance." Most of the small business owners have rarely had training to use IT effectively and did not worry about proper use of the Internet. This article therefore investigates the present state of IT in a representative sample in Kwa-Zulu Natal, South Africa.

LITERATURE REVIEW

Introduction and General Definitions

IT is impacting the roles and work of individuals and IT enabled change is also revolutionising business processes. It should also be noted that the real engine in association with IT, for economies in Africa, is small businesses. How a small business learns about its environment, how it selects and interprets information through its information system, and how it forms its information structure to get its information processing goals supported by appropriate resources is all fundamental aspects

of how small businesses can process information efficiently and effectively. They should keep in mind that sparks can fly between technology and small business. Chakravorti (2003) notes that the processes by which technology have an impact on smaller business is slow even though the intrinsic benefit is enormous.

DeLone (1988) notes that the majority of business organisations are classified as small and medium (SMME) enterprises. These small businesses differ from large enterprises in terms of strategy, structure, decision-making, and resource availability. He further argues that the allusion of small business research will have an impact on bigger businesses. In an earlier paper (1981), he states that few articles have studied the differences between smaller and bigger businesses (also noted by Duxbury, Decady, & Tse, 2002; Hunter, Diochon, Pugsley, & Wright, 2001; Tagliavini, Ravarini, & Buonanno, 2001). Doukidis, Smithson and Lybereas (1992) argue that IT has made an impact on large organisations but it is not as clear on smaller organisations and that little research had been done on it. Walczuch, den Braveen, and Lundgren (2000) note that small firms are not adopting the technology (e.g., Internet, etc.) with the same speed as the larger firms do. Bunker and MacGregor (2002) argue that it is also important to discover how IT is accepted and used with SMMEs.

Petkov, Fry, Petkova, and D'Onofrio (2003) note that small businesses need technology in order to succeed. Some of these technologies could be used to solve the problems of smaller businesses and accumulate knowledge for improvement of their services. Hunter (2002) argues that IT researchers have not differentiated businesses upon size. He notes that previous research has shown there is a difference in the management of small vs. large businesses in general, and specifically how IT is employed. Researchers, however, need to explore how small business may impact their use of IT. For this specific reason, the study had

been designed to study the impact of IT on smaller businesses in KwaZulu-Natal, South Africa.

Definitions of Small Business

Small business definitions range from those that encompass as few as 10 employees to up to 500 or 1000 employees (Burgess, 2003). Other definitions include turnover, assets, or variations across industry sectors. Managers, however, cannot expect that IT will be used in a similar fashion across businesses that have these ranges in size. Duxbury et al. (2002) argue that smaller business will have simple and highly centralised structures, lack trained staff resources, experience financial constraints, and take a short-range perspective imposed by a competitive environment. They further state that staff should not be more than 99 people. The possibility also exists that a small firm could behave like a big firm from an IS perspective. It is because of this range of definitions that it was decided to tie down the definition and use a standard definition for the region of KwaZulu-Natal: The owner should be involved in the control of the operation, there should not be more than 99 staff members and turnover should be less than R10 million per annum.

Architecture

DeLone (1981) states that smaller firms had been using computers for a shorter period of time than their larger brothers. He argues therefore that some smaller organisations have to make use of external services to ensure effectiveness. Smaller businesses also have smaller revenue and this can cause owners to restrict the IT they invest into. He also notes that smaller firms spend more on IT (especially hardware) in proportion to their total revenue. On the other hand, these smaller businesses take quicker decisions to invest in IT than larger businesses. He states that firms' size is directly related to the size of their IT and inversely

related to the percentage of EDP costs that are used to acquire computer equipment.

Winston (1998) notes that entrepreneurs need to have a positive attitude towards IT and the quality of its architecture. She states that positive attitudes by managers can ensure a higher quality IT architecture. Obviously, IT architecture with a low quality can impact badly on small businesses. The nature of the smaller business on the other hand would determine what type of IT architecture it would need (Rodriguez, 2003).

Purao and Campbell (1998) state that many smaller businesses get state of the art type architectures although they do not need all the computing power. Most of the issues about implementation of IS in small business also deals with the type of IT to be installed. Chakravorti (2003) argues that the players in this instance should all be connected with each other using a grid network and they should not act alone. Grid networking, however, can be an enemy of innovation and impact on the players but it should help them to work together. Barriers to prevent grid networking should be removed and connectedness would become a weapon in small businesses armoury to help diffuse the innovation and get to equilibrium faster.

Capabilities of IT

DeLone (1988) argues that the capabilities of IT should help smaller firms to react faster to market changes and their flexibility to acquire and assimilate new IT will be enhanced by this. Bharadwaj, Sambamurthy, and Zmud (1999), however, state that very little understanding as to what constitutes a firm's IT capability and how it could be measured exist. Drawing from theoretical perspectives, they conceptualize an enterprise-wide IT capability as a second order factor model. In doing this, they used structural equation modelling techniques and verified IT capability construct. They argue that recent research have paid attention to the role of IT capabilities in

enabling superior IT based innovation and business performance. These studies also identified broad capability classes such as IT infrastructure, human IT skills, and organisational resources that could apply to smaller businesses. Hunter, Diochon, Pugsley, and Wright (2001) note that dependency of IT is increased by the increased use of IT in smaller businesses. Small business owners should also ensure that IT is used as efficient as possible.

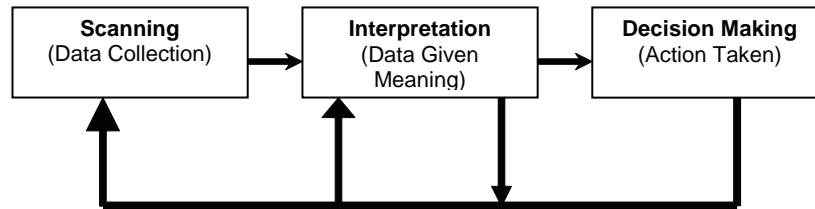
Although IT usage has been identified as a significant construct in small businesses, gaps remain in the understanding of how IT is used by different organisations and organisational members (Lee, Chandrasekaran, & Thomas, 2003). Their findings were that formalised firms facing competitive pressures have higher levels of IT usage among both management and non-management staff.

IT capabilities could also reduce the cost of business transactions and increased operational efficiency of businesses. Lee et al. note that IT capability simply refers to the use of IT by staff to improve their work processes. Their study has thrown light on business processes in smaller businesses (that is formalisation, a variable in determining IT usage) (also supported by Tagliavini et al., 2001). Organisations that want to increase IT capabilities should aim to set up work procedures, teams, and committees. Tagliavini et al. (2001) further argue that small companies seldom make use of internal IT staff. IS support is also a meaningful percentage of functional areas and should be regarded as satisfactory by the small business owner if they want to be competitive.

Zheng and Zmud (2003) note that organisational scanning and organisational information processing are two critical organisational information-processing activities. Their importance is intensified with globalisation, intense competition between small businesses and dynamic environments.

They argue that governance structures for scanning and interpretation are determined by the

Figure 1. Relationship among organisational scanning, interpretation, and decision-making (Source: Zheng et al., 2003)



need for environmental uncertainty reduction and problematic organisational equivocality resolution respectively. They note that interpretation is important, the more so for small businesses. Degrees of participation and hierarchy of authority is also important for small businesses and can provide a sound basis for future exploration of governance in complex organisational contexts such as small businesses. This will enhance capabilities of small business.

Critical Success Factors

Small business need to implement principles of CSF theory (Petkov et al., 2003). They also need to support learning in a distributed environment based on a distributed IT infrastructure and needs to be compatible with all technologies, enabling organisational learning at the same time. Bunker et al. (2002) argue that business types have an influence on the adoption of IT and some contextual differences, resultant skill, and process orientations make a difference. This could impact on CSFs and small businesses should keep this in mind.

Difference Between Large and Small Businesses

IT investment will make an impact on the competitiveness of small and medium organisations. SMEs are therefore starting to spend a higher

percentage of their turnover on IT. The sentiment is that smaller businesses should be a growth market for the IT sector in order to create this growth market. IT should be used by smaller businesses for instance to retain present customers and win new clients. Hunter et al. (2001) state that it is also useful to consider how small businesses differ from the larger sector to discover how this market could be sustained. Duxbury et al. (2002) argue that small businesses are not just little big businesses and that all small businesses are not the same—small is not always small.

The environment for management information systems might be different for small businesses and may well be missing the needs and problems of millions of small business users (DeLone, 1981). This older paper is being cited because it is an example of how this segment of business has been neglected for quite a while in the IS research field. The strategic orientation of managers of large businesses differs from managers of small businesses (Hunter, 2002). Bunker et al. (2002) note that many Western researchers based their opinion of what should happen in SMEs on what has happened in larger businesses. They argue that cross-cultural suitability should apply to small businesses as well. Their statement is based on the incorrect assumptions that research can be used to cross-pollinate other areas.

Small business managers tend to respond to opportunities with a minimum commitment of resources in a multi-staged approach. Resource

poverty must be used as an explanation of the difference between managers of large and small businesses. Resource poverty refers to the lack of both financial, technical and human resources. Managers of small businesses must therefore continually conduct their affairs with limited resources. This situation tends to increase the manager's focus on a minimum and multi-staged commitment process.

The momentum for the adoption of IT by small businesses comes from a number of sources. Small business may react to actions taken by their competition. Also, because of the prevalent use of IT, the cost to implement these systems has fallen within the reach of small business and is not exclusive to larger businesses. IT has also become more reliable and powerful and small businesses have started to recognise IT as a way to compete with larger companies. Walczuch et al. (2000) argue that a number of benefits that smaller firms are getting from using technology can be described as border crossing because these smaller businesses are always looking for potential business opportunities.

Lack of Resources

Peterson (2003) notes that the very small business suffers from lack of resources and of a sufficient customer base. Petkov et al. (2003) suggest that a lack of resources could affect the development of a CSF theory. Puro et al. (1998) argue that a deterrent for smaller business appears to be start up computerisation costs, unfamiliarity with the Internet and lack of guidance about how to start the process. The primary concern for these small business owners seems to be security hazards. All of these, according to Puro et al. could be due to a lack of resources.

Chakravorti (2003) notes that everyone was excited by the convergence of the changes happening all around and by investing resources expect this to make a profound and immediate difference. Smaller businesses had made huge

up-front commitments to reap early rewards and are then disappointed by the fact that things have not changed much.

Problems Encountered

DeLone (1981) notes that the age of the business is directly related to the experience they show while using computer services. Since many smaller businesses are not that long in business, they may lack this experience on what type of computer service they need. The bigger organisations with established computer services may experience other computing problems than those with younger services. It will therefore be difficult to evaluate the payoff of their "most important" applications. Hunter et al. (2001) state that problems occurred if criteria are not linked to the overall aims of the smaller businesses. The problem is that smaller businesses cannot keep track of technological changes taking place and cannot identify the unique challenges that lie ahead.

It is also a problem with conceptualisation because measures do not take into account the vast array of IT applications with different functionalities that exist in organisations today (Lee et al., 2003). Doukidis et al. (1992) argue that the problem have increased since the early 1980s. They note that advice received in terms of IT investment conceptualisation is still not good enough and that there is little staff involvement in IS development in smaller businesses. Some of the problems that smaller businesses experience in terms of IT are insufficient training, power failures, vendor incompetence, software and hardware. There are also some problems that are encountered with suggested solutions. Some reservations include:

- Lack of computer experience
- Software and hardware selection
- Lack of productivity—people finish their work sooner but does not do more work
- Potential implementation problems

- Financial impact
- Adequate service

The biggest mistake these smaller businesses make in implementing IT is that they do not know where they cannot do everything themselves. They also do not know how to get their customers to interact with them because they do not have the knowledge or experience to do so. Other mistakes they make include trying to do too much too fast and to be afraid of making mistakes because they might lose their business.

Size of Business, IT, and Performance

Few solid results have been found linking IT, organisational structures, and performance. This is because there is a problem of defining and measuring IT, performance, and the fit between technology and structure (Raymond, Paré, & Bergeron, 1993). In smaller organizations, it was discovered that there is a link between IT and structure. Mismatches, however, could exist and could be pointed out early. Small business can compete internationally if they utilize technology in full. IT can allow them to go from high to low-entry cost and will allow them the benefit of competitive advantage. The use of IT also ensures that smaller businesses appear distinctive and allow them access to venture capital.

RESEARCH QUESTIONS

The aim of the research is:

1. To study and evaluate the approach by SA small business owners specifically in the region of KwaZulu-Natal to IT investment and benefit identification
2. To develop a preliminary theory of good practice in the field
3. To test this theory by reference to other enterprises and practitioners

4. To develop the theory into managerial guidelines

The previous literature review and the critique thereof lead directly to the fundamental objective of this study, which is to investigate the application in practice, the impact, and the effectiveness of evaluation of IT investment in small businesses in South Africa (KwaZulu-Natal). Thus, the following research questions were identified: (1) How do South African small business owners identify IT investment and IT benefits? (2) What is involved in implementing sound IT investments in small businesses? (3) Would small business owners agree that this is good practice? and (4) Is it possible to develop the theory into managerial guidelines?

CRITICAL ASSESSMENT OF LITERATURE

This section refers to attempts by researchers (e.g., DeLone, 1981; Doukidis et al., 2003; Hunter et al., 2001) to investigate the use of IT by small businesses. All these authors note that no concrete evidence of the total impact of IT has been made in small businesses. However, these studies emphasize the impact of IT on small businesses in mind while investing scarce resources in IT. Authors like Duxbury et al. (2002) also explain the importance of business size when making an IT investment.

Over the last couple of years, authors (e.g., Hunter et al., 2001) have examined the possibility of quantifying IT expenditure in small business. Bunker et al. (2002) suggest that most surveys of small businesses underestimate the total investment in IT. Some authors (Lee et al., 2003; Raymond et al., 1993) note that the link between IT and performance varies. The problem is the measurement of the business value of IT and information in small business. They all agree, however, that the value of information for small

business should be closely linked to the decision supported by the information available. DeLone (1988) claim that all the components of IT should be considered if the right pricing method for the charge back of IT is to be selected for small business.

Some authors (e.g., Doukidis et al., 1992) established a link between IT investment and an increasing profitability margin for smaller businesses. They note that an increase in the profitability margin could be found in similar organisations in the same industry. All the studies researched agree that investing in IT for small businesses could make a contribution towards the benefits, which the organisation receives.

As can be seen from the previous, not much of the work has been carried out in the field of measuring the impact of IT investment on the profitability and risk of small organisations. Because of the fact that researchers have investigated different perspectives and these credited experts have expressed different views, the authors believe that a need exists for conducting a study in SA that will make a useful contribution for managers in their attempts to obtain results from the application of information systems in small businesses.

RESEARCH METHODOLOGY

The main objective of the study is to determine whether small business owners use guidelines when purchasing (investing) IT and how they apply and use IT in their business activities and whether using IT has obtained effective results.

LIMITATIONS

This study is only an overview of the aspects that should, according to the literature review, be included in the evaluation and selection process of suitable IT for smaller businesses.

DELINEATION OF THE STUDY

The researcher had decided to exclude legal procedures and focused on IT investments from a technical viewpoint. The research scope does not include the processes (e.g., contract negotiation) followed after the decision has been made, as the researcher feels that these steps might not have relevance to the selection of the best IT.

DEVELOPMENT OF QUESTIONNAIRE

The researcher compiled a questionnaire consisting of two sections (demographics and details of the small business and “grand tour” IT questions). The first section was divided into several sub-sections and covers the demographic details of the respondent and some aspects of the small business. The grand tour consists of a focus of the IT in use.

The questionnaire was completed (on behalf of the researcher) by a reliable data collector who interviewed small business managers or somebody they identified who allowed her to speak to the identified employees. The objective of the first section was to ensure they used IT as discussed in the theory. Section B was used to collect data about the IT in use. The objective of section B was to determine what procedure they use to invest into IT, whether they were satisfied with the present IT and does it deliver on demand.

All questions were derived from the literature survey as described earlier in this paper. Open ended questions were used in the questions. The reason for this is to evaluate areas where answers from the respondents indicate in depth approaches to the use of IT.

DATA DISCUSSION

The data was collated (EXCEL, 2000) and the statistics were calculated with the use of Excel.

Figure 2 details the demographics of the respondents.

As can be seen, more than 60% of the small business owners delegated the task to complete the interview to an employee. It is of no coincidence that there are 50% more men than women in this exercise (60% men vs. 40% women). However, it might be argued that managers allow men more freedom in the running of their business and this could be the reason why more men participated in this data collection exercise. Table 1 explains the market the respondents serve.

The market served by these small businesses range from local to international (1 only). The total adds up to more than 100% because the respondents ticked more than one option. It agrees with the literature that these small businesses can (by using computers) change, to a certain extent, the customers it serves. Many of the respondents supply only local communities and this agrees with the statement by Hunter et al. (2001) that smaller businesses are unique and community based. Most of these smaller businesses employ

less than 10 employees (96%) and only one employs more than 30 employees (stated in the literature review). Three of the businesses employ between 11-20 employees. This supports the statement that most smaller businesses in KwaZulu-Natal employ less than 30 people (99%) (see definitions in the literature review). About 80% of the smaller businesses are connected to the Internet and it eventually will help them with starting a computing grid.

More than half of the small business owners are younger than 30 years old (56%) while 6% of the owners are over 40 years. This auger well for the small business sector in South Africa and can assure continuity in the sector. The one problem is that most of them lack experience. DeLone (1988) argues that experience is directly related to the application of the computer services. This could be interpreted that if they are not experienced enough that they will not apply IT as frequently in their business operations. Nearly 75% of the people working in small businesses have less than 10 years experience and another 20% have 11-20

Figure 2. The type of position the respondent holds

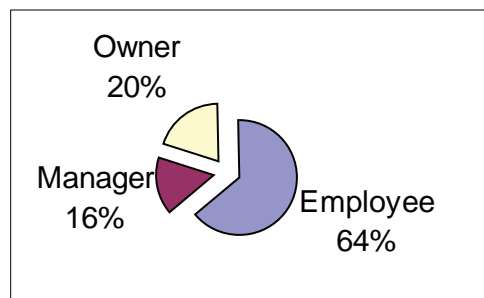


Table 1. Market served

| Market served | Number | % |
|---------------|--------|----|
| Local | 60 | 61 |
| Provincial | 23 | 23 |
| National | 23 | 23 |
| International | 1 | 1 |

The Use of IT in Small Business

years business experience. There is a high correlation between the years of overall experience and the years of work-related experience. Most of the small business owners have a Grade 12 or college qualification (66%). Thirty-one percent has a degree and the rest have a postgraduate qualification. This shows that you do not have to have a doctorate to be successful. Most of the people that completed the questionnaire help with normal business activities and the rest is either in an administrative position or management.

Details About the Small Businesses

Nearly 90% of the small businesses interviewed have retail (they were selling general goods (83%) and some services (17%)) as their main business activity while the rest of the respondents deliver services (e.g., medical, plumbing, etc.). Most of their revenue is stable (91%) while only 8% has regarded their income as expanding. One of the small businesses stated that they are insolvent and would probably close their doors. This could impact on the use of IT and how they investment into IT. Only one business exists longer than 10 years.

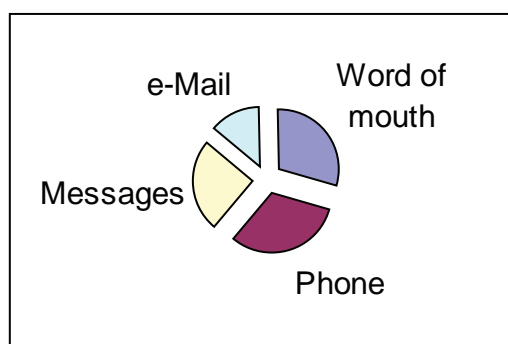
Means of Communication

Very little internal communication using digital communication takes place in the sample. Only

45% of the communication is done using e-mail. The rest of the communication takes place in the form of messages per paper (83%), using the telephone (100%), and personal messages (96%). It is clear that a new culture has to be created to ensure that total acceptance of IT takes place. External communication is by all means no different from internal communication. Ninety five percent of the respondents use oral communication as means to convey a message. Nearly all of them use the telephone to speak to people and snail mail usage is 80% while digital communication with outside people is only 30%. This needs attention and should be solved by some active research in this area in SA. This result is in agreement with the findings by Duxbury et al. (2002) who noted that smaller business do not trust digital media and has received little training in this aspect.

Advertising displays a similar trend where TV is used by only 3% to advertise their service and goods; word of mouth is used by 24%; and business cards by 3%. Newspapers are used by for advertising by 73% of the smaller businesses and the yellow pages by only 8%. Only one small business uses the Internet to market their goods. This is in agreement with Zheng et al. (2003) that small businesses do not rely too much on the Internet or electronic communication as means of advertising their business. Most of the times they use a fax or letter to order to items.

Figure 3. Internal communication



More than 60% noted that they have their own Web page, while only one small business does not know what it means. Most of the respondents know about the Internet but do not know how it will impact their business performance. About 50% of the small business owners had a clue what should be classified as IT. It is therefore clear that half of these small businesses do not have a suggestion what IS/IT entails and how it should be used. This is in accordance with Chakravorti (2003) who noted that the more things change the more (and less) they stay the same. DeLone (1981) argues that firm size and the use of computers have an impact on IT, and the previous figures support the statement he made.

The use of IT is spread over a spectrum and this agrees with the study by Bharadwaj et al. (1999) who argued that there is no defined use for IT in small businesses. The top use of IT/IS in small businesses in South Africa is the use for increased productivity and to handle their money on the Internet (e.g., payment of accounts, investment, etc.). This needs to be further investigated. This finding is also in agreement with Purao et al. who noted that there are some critical concerns and one is that there is no definitive application that stands out in smaller businesses. About 17% of the smaller businesses noted that IT/IS makes a difference but could not explain where the dif-

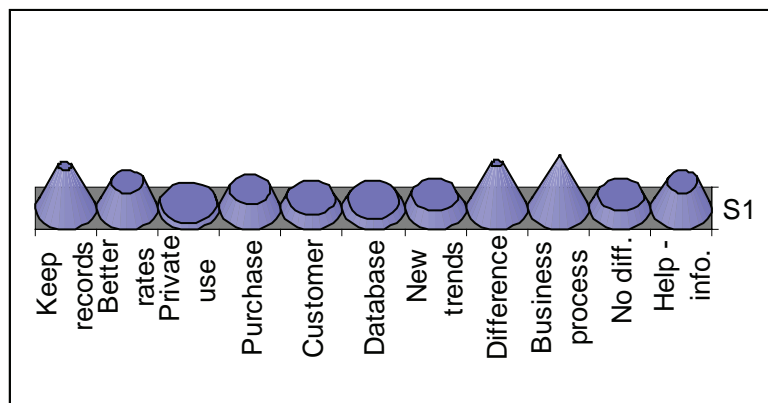
ference is that they noticed. Some of the uses of the computers amount to no more than number crunching and all resources that the computer offer them is not utilised at all. These include private use, some e-marketing, organising the business, maintaining databases on stock and customers, and researching and looking at new trends on the Internet. As it is evident that there is no consistent use of IT available although it seems that small business owners need to be trained on how to apply their IT.

The top uses of IT in the small business sample include the following:

- Software applications in business process (74%)
- Word-processing for typing letters (all of the small businesses use their IT for word-processing)
- Point of sales (86%)

It is clear that the smaller businesses that have computers use it for three types of exercises. There is little use in terms of WWW applications and they make employ it mainly for tasks that were done manually previously (e.g., cash register changed to point of sale application). Only 4% of the small businesses use their IT for searching on the Internet. The statement by Raymond et al. (1993) is

Figure 4. The use in small businesses (IT)



The Use of IT in Small Business

supported because they note that organisational business processes' structure is not changed even though their processes are computerised.

The investment process into IT is initiated by the owners (92%) and the managers of the small business. The investment process is based mainly on a "flashes-of-commercial-insight" (gut feeling) principle. No benefits are really considered by the investors because they do not have the experience or the knowledge how to do it, nor the time. Most of the times the small businesses are being "misled" while investing money into IT by the salesman who works on a commission base to earning a living. The IT investment done by the small business were mainly for private use (9%), business use (25%) and the main purpose why the IT was purchased was because their competitors have one and they got one but do not know how to use it. This shows there is a link between the use in the business of the IT and the actual reason for the purchase. This explains why most of them do not know what to use the IT for.

Most of the respondents stated that they have a strategic plan but this plan is not tied to their IT. They also do not tie the purchase of the IT to the strategic plan of the business. Most of them (88%) argue that their IT is delivering results but they could not explain what the results are and how this is being measured. This explains the reason why only 60% is satisfied with their investment in IS. Also, to further support this, nearly all the respondents stated that they are not too sure where it is failing them. This is supported by Raymond et al. (1993) who argued that people do not have the capacity to plan properly for the use of IT. They do not understand what the implications for performance in their business are. Nearly 60% of the small businesses agree that software developments can make the biggest impact but they stated that they do not know how to measure this impact. There is therefore a need to help the small business owner to understand and use IT properly. This agrees with the statement by Winston (1998) that attitude impacts on IT quality.

The biggest limitation to full implementation of IT into these small businesses comes down to the fact that 80% do not know how to use IT correctly. Other limitations include items such as:

- The correct use of software (7%)
- Too few clients (4%)
- Does not deliver service promised (3%)
- Not a good investment (3%)

More than 90% stated that they do not trust the information completely on the Internet (in agreement with a statement made by Lee et al., 2003). More than 80% noted that it did not help with any decision-making and is in agreement with the statement above that they do not trust information from the Internet. They all need help to apply IT correctly in the following fields:

- Marketing
- Financial
- Manufacturing
- HRM
- SCM

The research questions could thus be answered as follows:

- The data discussion demonstrated that small business owners do not have an idea of what is classified as IT investment. This is agreement with the theory discussion as well. They can therefore not identify the benefits that they should get.
- Because of the problem, they have of identifying and classifying it is difficult to nominate sound IT investments. Most of the organisations invest into IT as a token but not necessarily as part of their business procedures. This is also in agreement with the literature.

The guidelines as presented next were issued to some focus groups and they all agree that this

could be good practice but that the education of small business owners needs to be kept up to date to ensure proper application.

It was possible to develop some guidelines using the data discussion. The guidelines are presented below.

MANAGERIAL GUIDELINES AND CONCLUSION

As well as developing theory as to how IT investments are developed and evaluated in small businesses, the research also has an objective—to create a series of management guidelines, which will assist small businesses in applying formal procedures when making any IT investments.

These guidelines have been developed from the theory as well as from the results of all the different evidence gathering activities undertaken by the author during the research. The 10 principles so developed reflect elements of the theory developed into practical management guidelines for IT investment.

In order for IT investment to be formulated, implemented, and evaluated in an effective format, the small business owner should:

- **Clarify targets:** IT investments occur as the result of targets identified by small business owners. It means the organisation must look for one or more drivers that could be emphasised. IT investment is thus not just easy internal targets for IT investments. There is evidence from nearly all the case studies to support the principle and it is in line with the studies of DeLone (1988), Hunter et al. (2001), and Duxburry et al. (2002).
- Get to know the drivers for IT investment well and what is likely to change in the short to medium term. It involves monitoring the basic economics of the industry, the industry's technology, the competition, and developments in the IT industry. It would

probably require the setting up of a scanning group and incorporating these reports into the IT investment planning process. The outward process is supported by the work of Lee et al. (2003).

- Develop IT investment targets that are clear and understandable to all parties in the small business. Sub-ordinates that develop the action plans and test the IT should know what they need to do and what managers expect from them.

Outcome (benefit) objectives should be spelled out clearly because they would affect the action plans that would ensure the success of the IT investment. It applies to both tangible and intangible outcome (benefits). All these should be in a format to ensure that everything is running smoothly and that nobody will be able to state that they did not know what to do at any stage. Documentation should thus be available at all times.

Keep the small business's IT investment objectives and IT strategy in the consciousness of the staff as much as possible. Match all IT investment proposals to IT investment strategy and action plans. Make sure that all persons measuring and noting outcome (benefits) have a known and reliable performance index or measure with which to evaluate each outcome (benefit) type, both tangible and intangible. Raymond et al. (1993) support the principle in their study.

Determine the attitude of the owner. Is he or she sensitive to IT investment processes and its potential? It implies that owners are fully aware of the IT strategy and targets. Does the rest of the small business have the skills to make the IT investment process work? Furthermore, the work by Hunter (2002) and Doukidis et al. (1992) support the principle.

The small business must ensure that staff involvement receives the required attention. It may be achieved by ensuring that everybody is fully briefed. Specific thought must be given to

training schedules. Training should be part of the IT investment costs.

Develop adequate support facilities, which can handle a wide range of problems. The basis should be a partnership between all stakeholders in such a way that a two-way communication channel (a grid network exists) between groups of stakeholders who must ensure that the IT investment process is successfully completed. Petersen (2003) conducted work on the topic.

Look for IT investment targets across a wide range of issues, especially in areas that relate directly to the IT strategy and small business strategy. IT outcome (benefits) should be high on the lists of targets searched for. Regular evaluation needs to be conducted to ensure outcome (benefit) realisation. The work by Bharadwaj et al. (1999) also supports the principle.

Adequately staff the IT investment process and implementation with suitably trained and experienced personnel. Such staff must have both the skills of general workers as well as be fluent in IT. Hunter et al. (1999) support the principle.

It is clear that such a practical guideline requires considerable time and resources. Also owners need to be committed to ensure that all concerned promptly comply with these guidelines and that people do not get side-tracked by issues. In applying the guidelines suggested, many smaller businesses would have to face change of a cultural change exercise.

REFERENCES

- Bharadwaj, A. S., Sambamurthy, V., & Zmud, R. W. (1999, December 12-15). *IT capabilities: Theoretical perspectives and empirical operationalization*. Presented at ICIS 1999, Charlotte, NC.
- Bunker, D. J., & MacGregor, R. C. (2002, August 9-11). *The context of information technology and electronic commerce adoption in small/medium enterprises: A global perspective*. Presented at the 8th AMCIS, 2002, Dallas, TX.
- Burgess, S. (2003). *A definition of small business*. IRMA Special Research Cluster information. Retrieved September 2, 2005, from <http://www.businessandlaw.vu.edu.au/sbirit/>
- Chakravorti, B. (2003). *The more things change, the more (and less) they stay the same*. Ubiquity. Retrieved September 10, 2003, from http://www.acm.org/ubiquity/interviews/v4i28_chakravorti.html
- DeLone, W. H. (1981, December). Firm size and characteristics of computer use. *MISQ*, 5(4), 65-77.
- DeLone, W. H. (1990, December 16-19). *Lessons learned from information technology research on small organizations*. Paper presented at the Eleventh International Conference on Information Systems, Copenhagen, Denmark.
- Doukidis, G. I., Smithson, S., & Lybereas, T. (1992, December 13-16). *Approaches to computerization in small businesses in Greece*. Presented at ICIS 1992, at the Hyatt Regency in Dallas, TX.
- Duxbury, L., Decady, Y., & Tse, A. (2002). Adoption and use of computer technology in Canadian small business: A comparative study. In S. Burgess (Ed.), *Managing IT in small business: challenges and solutions* (pp. 19-47). Hershey, PA: Idea Group Publishing.
- Hunter, M. G., Diochon, M., Pugsley, D., & Wright, B. (2001, May 20-23). Small business adoption of IT: Unique challenges. In *Proceedings of the IRMA 2001 Conference*, Toronto, Canada.
- Hunter, M. G. (2002). *The use of information systems by small business: An international perspective*. IRMA Special Research Cluster. Retrieved September 2, 2005, from <http://www.businessandlaw.vu.edu.au/sbirit/>

- Lee, C. S., Chandrasekaran, R., & Thomas, D. (2003, August 4-6). *Examining IT usage across different hierarchical levels in organizations: A study of organizational, environmental, and IT factors*. Presented at the 9th AMCIS, 2003, Tampa, FL.
- Peterson, R. L. (2003, August 4-6). *The small IT business, the university, and community partners: A model for synergy*. Presented at the 9th AMCIS, Tampa, FL.
- Petkov, D., Fry, G. S., Petkova, O., & D'Onofrio, M. (2003, August 4-6). *Assisting small information technology companies identify critical success factors in Web development projects*. Presented at the 9th AMCIS, Tampa, FL.
- Purao, S., & Campbell, B. (1998, August). *Critical concerns for small business electronic commerce: Some reflections based on interviews of small business owners*. Presented at AMCIS 1998, Baltimore.
- Raymond, L., Paré, G., & Bergeron, F. (1993). Information technology and organizational structure revisited: Implications for performance. In *Proceedings of the ICIS*, Orlando, FL (pp. 5-8).
- Rodriguez, W. (2003, August 4-6). *Managing small-business/university IT partnerships*. Presented at the 9th AMCIS, Tampa, FL.
- Tagliavini, M., Ravarini, A., & Buonanno, G. (2001, May 20-23). Information systems management within SMEs: An Italian survey. In *Proceedings of the IRMA 2001 Conference*, Toronto, Canada.
- Winston, E. (1998, August). *How attitude impacts IT implementation quality: An exploratory investigation of the small business entrepreneur*. Presented at AMCIS 1998, Baltimore.
- Walczuch, R., den Braveen, G., & Lundgren, H. (2000, August 10-13). *Internet adoption barriers for small firms in The Netherlands*. Presented at AMCIS 2000, 2000, Long Beach, CA.
- Zheng, W., & Zmud, R. W. (2003, August). *Structuring environmental scanning and organizational information interpretation: An organization-level contingency model*. Presented at the 9th AMCIS, Tampa, FL.

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 107-125, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.8

Information Technology Investment Evaluation and Measurement Methodology: A Case Study and Action Research of the Dimensions and Measures of IT–Business–Value in Financial Institutions

Johan Nel

Brisbane Solution Centre, Australia

ABSTRACT

The chapter reviews the present methodology and comes to the conclusion that there is a solution for the predicament of the managers. The author is convinced that the ITIEM methodology is the solution.

INTRODUCTION

The study was motivated by the researcher's concern that a fundamental area of business, ITIEM, has been found to be extremely problematic for most organisations. The lack of an integrated methodical approach to the problem as well as the isolated non-integrated research done to date on

the effective measurement of IT-business-value enhanced the need for this study.

The Research Objective

The objective of this study was to identify from empirical evidence, using both case study, as well as action research techniques, a pragmatic ITIEM methodology that would enable organisations to identify their IT investments with the greatest IT-business-value; that will enable the greatest business benefits, while at the same time rigorously assessing all risks, being business risks, IT risks or people (human) risks.

Thus the research question:

What information technology investment evaluation and measurement methodology can organisations use to effectively evaluate and measure IT investments according to their IT-business-value?

In order to take advantage of the researcher's experience with the financial sector, the study focused on large, publicly held financial institutions. In addition, the financial sector is perhaps the most information intensive sector and has proportionally high investments in IT with proportionally high potential benefits.

The research question has not been made specific to financial institutions, as it was not anticipated that the study results nor ITIEM methodology will be specific to financial institutions. Nonetheless, the study has been conducted entirely within financial institutions, and for this reason, we have much less confidence extending the findings beyond this context.

THE INVESTIGATIVE QUESTIONS

The next level of specific investigative questions that needed to be answered in order to address the research question was:

- What are the major dimensions of IT-business-value?
- How is IT-business-value measured?
- What are the main risks to IT-business-value?
- What are the relative strengths and weaknesses of known ITIEM methodologies in a practical setting?

THE STUDY DESIGN

In order to gain better understanding of the practical issues surrounding effective ITIEM, it was decided to conduct a series of case studies of

organisational attempts to successfully implement and apply ITIEM methodologies. This was followed by action research to implement a proposed ITIEM methodology. The researcher played a pro-active role in the latter case. In both the case studies and the action research study, the unit of analysis is the ITIEM methodology.

The study design included:

1. A literature survey to identify the dimensions of IT-business-value, to identify the measures of IT-business-value, and to identify a candidate starting ITIEM methodology that is most comprehensive, addressing the most relevant measures of IT-business-value. This information was to be used to produce a draft case study protocol.
 2. A single, exploratory pilot case study of a South African bank yielding amongst other things, a revised case study protocol.
 3. A cross-case analysis of a multiple case study of five South African banks (including the pilot) yielding a draft ITIEM model.
 4. A cross-case analysis of three Australian banks, further enhancing the draft ITIEM model, and a cross-country analysis of the South African and Australian banks. The multiple case studies within South Africa and within Australia represent literal replications, while the cross-country comparison represents theoretical replication (Yin, 1994). It is predicted that there will be differences between the Australian and South African experience that are due to known differences in country contexts:
 - Inflation
 - Political stability
1. The ITIEM methodology identified in (1) was then revised to reflect the draft ITIEM model and a hybrid ITIEM methodology was proposed.
 2. The hybrid ITIEM methodology was implemented and revised with action research

resulting in the final ITIEM methodology and final ITIEM model.

- Financial value
- Contextual value

WHAT ARE THE MAJOR DIMENSIONS OF IT BUSINESS VALUE?

Cronk and Fitzgerald (1997, p. 410) suggest that the value resulting from investing in IT can be seen as IT-business-value. They provide a precise definition of IT-business-value:

The sustainable value added to the business by IT, either collectively or by individual systems, considered from an organisation perspective, relative to the resource expenditure required.

They also propose a model representing the relationships between the main dimensions of IT-business-value as depicted in Figure 1.

The literature review aided in the confirmation of the dimension of IT-business-value and following the literature review, the dimensions of IT-business-value suggested by Cronk and Fitzgerald (1997) were adapted to the following:

- Business strategy alignment
- “Soft” value

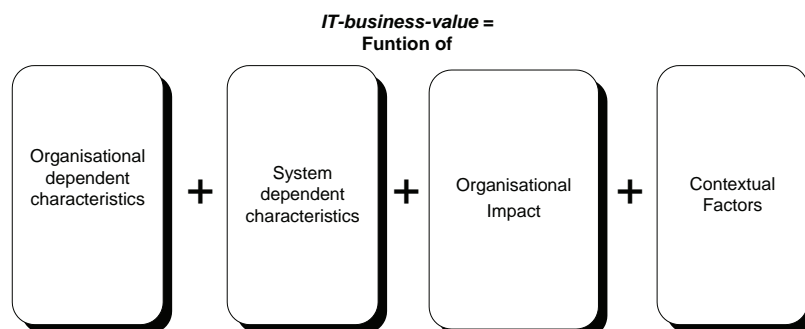
HOW IS IT-BUSINESS-VALUE MEASURED, AND WHAT ARE THE MAIN RISKS TO IT BUSINESS VALUE?

The Literature Review

The literature review aided in the identification of a comprehensive set of measures of IT-business-value, as well as the main risks to IT-business-value. By reviewing literature relevant to ITIEM, it also aided in the identification of an ITIEM method (information economics) that addresses most of the identified measures of IT-business-value.

A positive measure of IT-business-value refers to a positive value contribution to the business; where as a negative measure of IT-business-value refers to a possible negative impact to the business, a risk to the business. Table 1 summarises the measures of IT-business-value by IT-business-value dimension, as addressed by Parker, Benson, and Trainor (1988).

Figure 1. Groupings or dimensions of IT business value (Based on Cronk & Fitzgerald, 1997, p. 412)



The Case Studies

The IT-business-value dimensions and IT-business-value measures identified in the literature review were used to put forward a draft case study protocol, which was refined and finalised during the pilot case study and was then used for an exploratory, descriptive case study involving five banks in South Africa.

The South African case studies resulted in the addition of three more measures of IT-business value, namely:

- Organisational power and politics

Organisations are composed of internal constituencies that seek control over the decision process in order to enhance their position. Organisational power and politics refers to the manipulation of power in organisations using one or more power base available to the individuals. Power refers to the potential of an individual to control the behaviour of others. Hersey and

Blanchard (1980) identified five kinds of power use by people:

- **Legitimate power:** Refers to the position of the person in the organisation
- **Expert power:** Power because of knowledge, information, or expertise
- **Reward power:** Power to give or withhold rewards (praise, salary increases, promotions)
- **Coercive power:** Ability to ensure compliance by using physical, emotional, or psychological threats
- **Referent power:** Power due to loyalty to identify with a leader or evoked by the charisma of the leader

Better Sourcing of Inputs

Better sourcing of inputs refers to the organisations ability to obtain required inputs more effectively and efficiently with the use of the IT investment. In the case of banks, this refers to the ability to attract deposits.

Table 1. Measures of IT-business-value according to Parker et al. (1988)

| IT-business-value Dimension | Measures of IT-business-value Dimension | Positive/Negative |
|-----------------------------|---|-----------------------------------|
| Business strategy alignment | <input type="checkbox"/> Degree of integration | <input type="checkbox"/> Positive |
| | <input type="checkbox"/> Competitive advantage | <input type="checkbox"/> Positive |
| | <input type="checkbox"/> Project and organisational risk | <input type="checkbox"/> Negative |
| | <input type="checkbox"/> Strategic architecture | <input type="checkbox"/> Positive |
| | <input type="checkbox"/> Definitional uncertainty | <input type="checkbox"/> Negative |
| | <input type="checkbox"/> Systems infrastructure | <input type="checkbox"/> Positive |
| | <input type="checkbox"/> Technical uncertainty | <input type="checkbox"/> Negative |
| | <input type="checkbox"/> Competitive response | <input type="checkbox"/> Negative |
| “Soft” value | <input type="checkbox"/> None | |
| Financial value | <input type="checkbox"/> The quantified financial return of the IT investment | <input type="checkbox"/> Positive |
| Contextual value | <input type="checkbox"/> MIS | <input type="checkbox"/> Positive |

Better Product Design

Product design refers to a way to add product distinctiveness through design. In the case studies, the banks referred to computer-aided design (Web pages design, etc).

These measures of IT-business-value were added due to large banks as SAB1,¹ SAB3, and SAB4 having included these measures when evaluating IT investments. These banks were also of the opinion that these measures should be compulsory when a bank evaluates IT investments.

Although information economics (IE) addresses a single measure of “project and organisational risk,” the management of the banks were of the opinion that this single aggregated IT-business-value measure does not fully address their need to assess the human factors involved when investing in IT. Mitigating strategies were developed to lower the organisational power and political risk to an acceptable level when there was consensus that organisational power and politics may hamper the successful implementation of the IT investment.

The latter two measures of IT-business-value were added by the banks mainly due to their importance in the new financial services digital economy.

The Australian case studies contributed one additional measure of IT-business-value, namely:

- **Organisational culture:** An organisation’s culture refers to the core values that are shared by a majority of the organisation’s members (Robbins, 1987). A strong culture is characterised by the organisation’s core values being intensely held, clearly ordered and widely spread. The stronger an organisation’s culture, the less management need to concern themselves with developing formal rules and regulations to guide staff behaviour.

THE ACTION RESEARCH

The action research contributed two additional measure of IT-business-value, namely:

- **Organisational communication:** Effective organisational communication was seen to be a prerequisite to realise the foreseen IT-business-value of an IT investment. All employees, managers, executives, and board of directors must understand the IT-business-value of the IT investment as well as the required behaviour to achieve the proposed IT-business-value of the investment.
- **Staff and management skill sets:** The management team of AUS3 also wanted to include the business staff and management skills in the contextual value dimension. They were of the opinion that strategic skills, training levels and skill advantage needs to be assessed because all of these are needed to realise IT-business-value.

This measure of IT-business-value was added due to two Australian banks, which included these measures when evaluating IT investments. As an example, AUS2 consisted of several financial services with different sub cultures. These services were all lumped together and future IT investments were faced with a possible weak corporate culture, at the time.

The South African case studies concluded with a draft ITIEM model. The Australian case study was used to further validate the draft ITIEM model. This model was then used as input to a hybrid ITIEM methodology.

WHAT ARE THE RELATIVE WEAKNESSES OF KNOWN ITIEM METHODOLOGIES IN A PRACTICAL SETTING?

The case studies and literature review revealed the following:

Table 2. Summary of study

| IT-business-value dimension | Measures of IT-business-value | | Literature | | | | | | | | | | | | | | | | South African Case Studies | | | | | Australian Case Studies | | | IE | Draft Model | Hybrid Methodology | Action Research | Final Methodology | Final Model | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---------|------------|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|------|------|----------------------------|------|------|------|------|-------------------------|---|---|----|-------------|--------------------|-----------------|-------------------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|
| | Dimension | Measure | L1 | L2 | L3 | L4 | L5 | L6 | L7 | L8 | L9 | L10 | L11 | L12 | L13 | L14 | SAB1 | SAB2 | SAB3 | SAB4 | SAB5 | AUS1 | AUS2 | AUS3 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Business strategy alignment | Degree of integration | | | | | X | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | | | | |
| | Fulfillment of CSFs | | | | | X | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | | | |
| | Competitive advantage | | | | | | | | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | | |
| | Project & Organisational risk | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | | |
| | Strategic architecture | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| | Definitional uncertainty | | | | | | X | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| | Systems infrastructure | | | | | | X | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| | Technical uncertainty | | | | | | X | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| | Competitive response | | | | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| | Better sourcing of inputs | | | | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | |
| Better product design | | | | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | |
| Project size risk | | | | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| "Soft" value | User satisfaction | | | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | |
| | Organisational learning & growth | | | | | | | | | X | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | | |
| | Employee satisfaction | | | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | |
| Financial value | Quantifiable financial measures - ROI, ROA, NPV | | | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Contextual value | Organisational power & politics | | | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | |
| | MIS | | | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | |
| | Organisational culture | | | | | | | | | | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Organisational communication | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Staff and management skill sets | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

- ROI methods are less successful where IT-business-value cannot be precisely estimated in cash-flow terms and there is considerable uncertainty about the value of the estimates, or the intangible benefits are given a zero value because they cannot easily be expressed in cash flow terms (Kaplan & Norton, 1996).
- Decision analysis can be used in pre-implementation evaluation (as employed by Ozeroy, Smith, & Sicherman, 1992), to choose between geographic information systems), but it cannot perform post-implementation assessment. As a vehicle for interpretative debate, it is very reliant on the analyst and participants for inclusion of social and organisational issues.
- The most well known ITIEM methodologies are not comprehensive enough.
- IE is too complex with regards to value linking and value acceleration.
- More focus is needed on the human factors in ITIEM.

RESEARCH RESULTS

This chapter proposes a new ITIEM model that addresses the dimensions constituting IT-business-value, as well as how to measure IT-business-value. The ITIEM model of the dimensions and measures of IT-business-value was used to propose a more comprehensive, pragmatic ITIEM methodology than is available today and suggests how:

- IT investments can enable measurable IT-business-value.
- To determine which IT investments will yield the most IT-business-value for the organisation
- To ensure that IT investments and business initiatives complement each other

Table 1 lists all measures of IT-business-value identified from the literature and case studies. The measures are cross-referenced with their source ((literature and/or case study(ies)). In the sixth column, the measures are cross-referenced with IE. All measures are included in the ITIEM model.

The last five columns of the table shows which measures of IT-business-value are included in the:

- Draft ITIEM model
- Hybrid ITIEM methodology
- Action research
- The final ITIEM methodology
- Final ITIEM model

OTHER MAIN FINDINGS OF THE STUDY

The following are findings from the case studies and action research in addition to addressing the investigative and research questions.

The Case Studies

The case studies contributed the following key findings:

- Although IE addresses a single measure of “Project and organisational risk,” the management of the banks were of the opinion that this single aggregated IT-business-value measure does not fully address their need to assess the human factors involved when investing in IT. When there was consensus that organisational power and politics may hamper the successful implementation of the IT investment, mitigating strategies were developed to lower the organisational power and politics risk to an acceptable level
- During the case study, several important external factors influencing IT-business-value were identified:

- Political stability of the country
- The state of economy
- Community considerations
- Government

Although they were presented in the draft ITIEM model, the study did not attempt to address these influencing factors. These are factors beyond the control of the organisation and though of interest, beyond the scope of the study. However, this is a very important subject for further research.

The Action Research

The following are key findings from the action research:

- A strategic management process in an organisation is prerequisite to successful implementation of an ITIEM methodology in the organisation.
- Top management support for the implementation is also a prerequisite to successfully implement an ITIEM methodology in the organisation.
- The proposed ITIEM methodology by itself does not establish the IT investment priorities, but rather is an integral part of the business case presented to the IT steering to approve or reject the proposed IT investment.
- The Delphi technique used in the action research proved important for attaining consensus on the weights of the IT-business-value measures.
- An agreed ITIEM management process, taking into account the current decision-making process, is needed in the organisation to successfully implement ITIEM.
- All parties concerned with ITIEM need a clear understanding of the ITIEM methodology.
- Clear roles and responsibilities needs to be assigned to all concerned with ITIEM in

the organisation.

- The weights agreed on for the measures of IT-business-value may change when the local and/ or international economic climate changes.
- The action research confirmed that a complex set of measures will not work in practice.
- Although the researcher at first was initially of the opinion that the more thorough the evaluation criteria are, the better the initial investment evaluation would be, this now seems to be only partially true. The fact that all dimensions of IT-business-value were covered seems to be more important than the completeness of the individual IT-business-value measures. The discussion and consensus reached about the IT investment, facilitated by the ITIEM scorecard and business case details, is in the most cases more important than the actual IT-business-value “score.”
- The area of “human factors” was perceived to be highly valuable when evaluating and managing IT investments. It was confirmed that without focusing on the human aspect, the IT investment would not be appropriately used.

Assessment and Validation of IE

Although this study did not set out to test or validate the goodness of the dimensions, measures or methodology of IE, having selected IE in the literature review, it became central to the hybrid methodology we ultimately tested through action research.

From the literature survey, IE seems to be the most comprehensive method in its treatment of benefits and risks. From Table 17 it is evident that Parker et al.'s (1988) IE most comprehensively covers the identified IT-business-value measures identified in the literature, ten out of an identified fifteen measures of IT-business-value.

Although IE addresses a single measure of “Project and organisational risk,” the management of the case study banks was of the opinion that this

single aggregated IT-business-value measure does not fully address their need to assess the human factors involved when investing in IT.

In all instances, the case study banks used quantifiable IT-business-value measures, which ranged from simple pay-back-period to more sophisticated measures like NPV to take into account the time value of money.

In three instances, SAB1, SAB2, and SAB3, management confirmed that they had knowledge of Information Economics, but did not use the value acceleration or value linking concepts of Parker et al. (1988). The main concerns expressed by senior management were:

- It is complex to determine and costly to perform.
- It is sometimes impossible to “link back” the true benefit to just the IT investment

itself; many other factors also influence the accelerated outcome of “value.”

- Most of the banks had an IT investment benefit analysis process established through which the projected financial return of the IT investment could be established and evaluated in aggregate with all the other measures of IT-business-value already employed by the banks. These processes were well understood and applied by the banks.

THE ITIEM MODEL

The draft ITIEM model was further refined through the South African case study. The proposed ITIEM model was then further validated in three Australian Bank case studies and finalised during the action research. Figure 2 represents the final revised ITIEM model.

Figure 2. The final ITIEM model

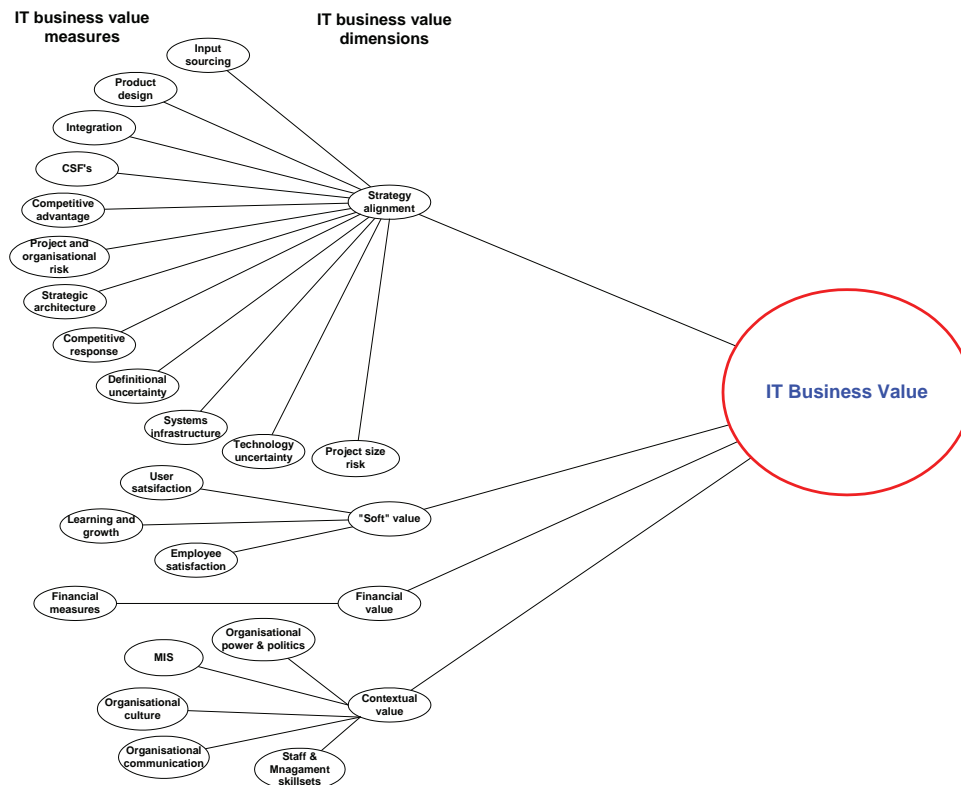


Table 2. Structure of the methodology

| IT-business-value dimension | Evaluation and measures of IT-business-value dimension |
|-----------------------------|--|
| Business strategy alignment | <ul style="list-style-type: none"> • Degree of integration • Fulfilment of CSFs • Competitive advantage • Strategic and organisational risk • Strategic architecture • Definitional uncertainty • Systems infrastructure • Technical uncertainty • Competitive response • Better sourcing of inputs • Better product design |
| “Soft” value | <ul style="list-style-type: none"> • User satisfaction • Organisational learning and growth • Employee satisfaction |
| Financial value | <ul style="list-style-type: none"> • Quantifiable financial measure: NPV |
| Contextual value | <ul style="list-style-type: none"> • Organisational power and politics • MIS • Organisational Culture • Organisational communication • Staff and management skill sets |

THE ITIEM METHODOLOGY

Drawing on the literature surveyed, the knowledge gained from the case studies, the ITIEM model was applied to propose a more comprehensive, practical ITIEM methodology. The final ITIEM methodology integrated all the dimensions of IT-

business-value and the measures of IT-business value from the ITIEM model. This methodology was successfully implemented and tested in AUS3 after four rounds of reflection, change, and re-implementation. The additional identified measures of IT-business-value were integrated to complete the ITIEM methodology. The structure of the methodology is depicted in Table 2.

The MD is still satisfied today that business is taking the lead in all IT investments and that “value for money” is being attained. The head of IT can focus on his contribution, namely to deliver quality IT assets to the business. The weights needed adjustment only once, after which all parties concerned were satisfied. It took four cycles before all parties concerned were satisfied and comfortable with the methodology. Today all IT investments above \$100,000 need to be prioritised using the methodology.

Limitations of the Study

The research was confined to large financial institutions and action research carried out in only one financial institution. Thus, we cannot generalise the findings to other lines of business. At most, we can conclude that the proposed methodology appears to be successful in financial institutions in Australia.

The proposed ITIEM model was minimally tested. The possible importance of the relationships between the dimensions of IT-business-value was not addressed in this study and should be seen as a limitation.

The management decision-making structure needed to implement the ITIEM methodology successfully was not fully discussed in this thesis. Though not a focus of the study, it was addressed during the action research.

As mentioned, the author is aware of the important mediating role of “appropriate use” and other variables, but as previously stated, it could be seen as a limitation that this study only focused on (1) how to evaluate IT investment proposals on the basis of IT-business-value as defined by Cronk and Fitzgerald (1997), and (2) measurement of the IT-business-value resulting from the use of IT.

IMPLICATIONS OF THE RESEARCH

The study suggests that all financial institutions need to evaluate and measure IT investments

to ensure appropriate use and positive IT-business-value. The proposed methodology can be adapted for a particular financial institution assist financial institutions to practically align their IT investments with business strategy, and measure the success of their IT investments.

The proposed ITIEM methodology can only be used for discretionary IT investments. It does not address IT investment categories like statutory requirements, ongoing maintenance, or any other non-discretionary categories.

Study results suggest several implications for further ITIEM research:

- The dimensions of IT-business-value and the measures of IT-business value should be further empirically researched to establish their relative importance to an effective ITIEM.
- The measures of IT-business-value identified by this study, exceeding the IE measures, need to be analysed in further research as to establish their completeness and relative importance. Al-Tameem and Wheeler (2000) also suggest that further research considering human and organisational aspects will be an important departure from the conventional ITIEM approaches. This is also supported by Jones and Hughes (2000) who argue that it is now time to challenge traditional ITIEM methodologies based on hard data. Because they have failed, a soft data approach may be more appropriate.
- Although the methodology was successfully implemented in a financial institution, it needs to be extended to other lines of business.
- Jones et al. (2000) also suggest that ITIEM encompasses a complex process. This process is worthy of articulation and analysis in further research.
- Khalifam, Irani, and Baldwin (2000) argue that there is evidence to support the view that ITIEM is affected by budgetary limitations

and that the way organisations justify their IT investments affects the strategy adopted. More in-depth studies are required to address this.

REFERENCES

- Al-Tameem, A. A., & Wheeler, F. P. (2000). *A process view of information system benefits management and evaluation*. Presented at the Americas Conference on Information Systems, Long Beach, CA.
- Bacon, C. J. (1992). The use of decision criteria in selecting information systems/information technology investments. *MIS Quarterly*, 16(3), 335-353.
- Bergeron, F., & Raymond, L. (1995). *The contribution of IT to the bottom line: A contingency perspective of strategic dimensions*. Presented at the International Conference on Information Systems, Amsterdam, The Netherlands.
- Brynjolfsson, E., & Hitt, L. (1993). *Is information systems spending productive? New evidence and new results*. Presented at the 14th International Conference on Information Systems, Orlando, FL.
- Buss, M. (1983). How to rank computer projects. *Harvard Business Review*, 61(1), 119-125.
- Butler-Cox (1990). *Getting value from IT* (pp. 1-55). London: Butler Cox Research Foundation.
- Chan, Y. E., & Huff, S. L. (1994). *Investigating information systems strategic alignment*. Presented at the 14th International Conference on Information Systems, Orlando, FL.
- Clemons, E. K. (1991). Evaluation of strategic investments in information technology. *Communications of the ACM*, 34(1), 22-36.
- Cronk, M. C., & Fitzgerald, E. P. (1997). *A conceptual framework for furthering understanding of IT-business-value and its dimensions*. Presented at the Pacific Asia Conference on Information Systems, Brisbane, Australia, Information Systems Management Research Concentration, Queensland University of Technology.
- Du Plooy, N. F. (1993). *The social aspects of information systems*. SACLA, Johannesburg, South Africa: University of Pretoria.
- Earl, M. J. (1989). *Management strategies for information technology*. Prentice Hall.
- Earl, M. J. (1994). The new and old of business process redesign. *Strategic Information Systems*, 1(3), 21-32.
- Farbey, B., Land, F., & Targett, D. (1993). *How to assess your IT investments*. Oxford, UK: Butterworth-Heinemann.
- Farbey, B., Land, F., & Targett, D. (1999). *IS evaluation: A process for bringing together benefits, costs and risks, rethinking management information systems*. In W. Currie & B. Galliers (Eds.), *Rethinking management information systems* (pp. 204-228). New York: Oxford University Press.
- Gable, G. G. (1994). Integrating case study and survey research methods: An example for information systems. *Journal of Information Systems*, 3(2), 112-126.
- Galliers, B. (1992). Information technology—management's boon or bane? *Journal of Strategic Information Systems*, 4(34), 1-4.
- Gibson, C., & Jackson, B. (1987). *The information imperative: Managing the impact of information technology on business and people*. Lexington, KY: Heath and Company.
- Gitomer, J. (1988). Simulation and modelling: Systems development tools. In R. E. Umbaugh (Ed.), *Handbook of MIS management* (2nd ed.). Boston: Auerbach Publishers.
- Grabowski, M., & Lee, S. (1993). *Linking information systems applications portfolio and*

- organisational strategy*. Hershey, PA: Idea Group Publishing.
- Hersey, P., & Blanchard, K. H. (1993). *Management of organizational behavior* (6th ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Hirschheim, R. A. (1992). *Information system epistemology: A historical perspective. Information systems research, issues, methods, and practical guidelines*. Oxford, UK: Blackwell Scientific Publications.
- Hochstrasser, B., & Griffiths, C. (1991). *Controlling IT investments, strategy and management*. Tokyo, Japan: Thomson Publishing.
- IBM. (1982). *Business systems planning*. New York.
- Jones, S., & Hughes, J. (2000). *Understanding IS evaluation as a complex social process*. Presented at the Americas Conference on Information Systems, Long Beach, CA.
- Kaplan, R., & Norton, D. (1996, January-February). Using the balanced scorecard as a strategic management system. *Harvard Business Review*, 75-85.
- Keen, P. G. W. (1993). *Decision support systems: Putting theory into practice* (3rd ed., pp. 57-73). Upper Saddle River, NJ: Prentice-Hall, Inc.
- Khalifa, G., Irani, Z., & Baldwin, L. P. (2000). *IT evaluation methods: Drivers and consequences*. Presented at the Americas Conference on Information Systems, Long Beach, CA.
- Land, F. (1992). *The information systems domain. Information systems research, issues, methods, and practical guidelines*. Oxford, UK: Blackwell Scientific Publications.
- Lee, A. (1989). A scientific methodology for MIS case studies. *MIS Quarterly*, 24(6).
- Lee, B., & Barua, A. (1999). An integrated assessment of productivity and efficiency impacts of information technology investment: Old data, new analysis, and evidence. *Journal of Productivity Analysis*, 27(2), 21-43.
- Lincoln, T. (1986). Do computer systems really pay-off? *Information and Management*, 11(1), 52-60.
- Loh, L., & Venkatraman, N. (1993). Corporate governance and strategic resource allocation. *Accounting, Management, & Information Technology*, 3(4).
- Lubbe, S., & Nel, J. F. (1993). *Organisational performance and IT investment intensity in RSA companies*. Presented at the National Conference for Masters and PhD Students in Computer Science, Johannesburg RSA, Department of Computer Science, UNISA.
- Lucas, H. C. (1993). *The business value of information technology: A historical perspective and thoughts for the future*. Hershey, PA: Idea Group Publishing.
- Mahmood, M. (1994). Evaluating organisational efficiency resulting from information technology investments. *Journal of Information Systems*, 4(1), 83-115.
- Mahmood, M., & Mann, G. J. (1993). Impact of information technology investment: An empirical assessment. *Accounting, Management, & Information Technology*, 1(4), 23-32.
- Markus, M. L., & Soh, C. (1993). *Banking on information technology. Converting it spending into firm performance. Strategic information technology management*. Hershey, PA: Idea Group Publishing.
- Matlin, G. (1979). What is the value of investment in information systems? *MIS Quarterly*, 3(3), 105-109.
- McFarlan, F. W., & McKenney, J. L. (1983). *Corporate information systems management*. Homewood, IL, Richard D Irwin.

- McGraw-Hill Open Learning Centre. (n.d.). Retrieved from http://highered.mcgraw-hill.com/sites/0072823755/student_view0/glossary.html
- Miller, J. (1989). *Information systems effectiveness: The fit between business needs and system capabilities*. Presented at the International Conference on Information Systems, Boston.
- Mooney, J. G., Gurbaxani, V., Tallon P. P., & Kraemer, K. L. (1995). *A process oriented framework for assessing the business value of information technology*. Presented at the 16th International Conference on Information Systems, Amsterdam, The Netherlands.
- Morris, I. (1992). *Strategic information systems planning*. London: White Head Morris.
- Nel, J. F. (1995). A theoretical perspective on information and information technology. In *Proceedings of the 10th National Conference for Masters and PhD Students in Computer Science*, UNISA, Pretoria, South Africa.
- Nel, J. F. (1997). IT investment management: A case study and survey on the effects of IT usage on organisational strategic performance in financial institutions. In *PACIS '97*, Brisbane, Queensland Australia, ISMRC/QUT.
- Neumann, S., & Sprauge, R. L. (1994). *Competitive advantage, strategic resources, and information technology: An empirical study*. Presented at the International Conference on Information Systems, Vancouver, British Columbia, Canada.
- OASIG. (1996). *The performance of information technology and the role of human and organisational factors*. London: Economic and Social Research Council of UK.
- Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organisations. *Organisation Science*, 3(3).
- Ozernoy, V., Smith, D., & Sicherman, A. (1992). Evaluating computerised geographic information systems using decision analysis. *Organisation Sciences*, 3(3).
- Parker, M., Benson, R. J., & Trainor, H. E. (1988). *Information economics: Linking business performance to information technology*. Englewood Cliffs, NJ: Prentice-Hall.
- Porter, M. E. (1996, November-December). What is strategy? *Harvard Business Review*, 61-78.
- Prince, C. J. (1997). IT's elusive ROI. *Chief Executive*, 122, 12-13.
- Remenyi, D., & Sherwood-Smith, M. (1996). *Active benefits realisation using a formative evaluation approach*. Johannesburg, South Africa: University of the Witwatersrand.
- Remenyi, D., Money, A., & Twite, A. (1995). *The effective measurement and management of IT costs and benefits*. Oxford: Butterworth-Heinemann.
- Robbins, S. P. (2002). *Organisational behaviour* (10th ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Sambamurthy, V., & Zmud, R. (1995). *Organisational competencies for managing investments in visionary applications of IT*. Presented at the 16th International Conference on Information Systems, Amsterdam, Netherlands.
- Semich, J. W. (1994). Here's how to quantify IT investment benefits. *Datamation*, 45-48.
- Soh, C., & Markus, L. M. (1995). *How IT creates business value: A process theory synthesis*. Presented at the 16th International Conference of Information Systems, Amsterdam, Netherlands.
- Strassmann, P. (1990). *The business value of computers*. New York: The Free Press.
- Strassmann, P. A. (1997). Will big spending on computers guarantee profitability? *Datamation*, 43(2), 75-85.

- Symons, V., & Walsham, G. (1988). The evaluation of information systems: a critique. *Journal of Applied Systems Analysis*, 15, 119-132.
- Thorp, J., & D. s. C. f. S. Leadership. (1998). *The information paradox: Realising the business benefits of information technology*. Toronto, Canada: McGraw-Hill Ryerson Limited.
- Tinsley, T., & Power, A. C. (1990). Why IS should matter to CEO's. *Datamation*, 85-88.
- Venkatraman, N. (1994). IT-enabled business transformation. *Sloan Management Review*, 73-87.
- Veryard, R. (1991). *The economics of information systems and software*. London: Butterworth-Heinemann.
- Walsh, P. (1999). *Building the balanced scorecard: A core process perspective* (pp. 1-27). Sydney, Australia: Graduate School of Business University of Sydney.
- Ward, J., Griffiths, P., & Whitmore, P. (1990). *Strategic planning for information systems*. John Wiley & Sons.
- Ward, J., Taylor, P., & Bruce, C. (1996). Evaluation and realisation of IS/IT benefits: An empirical study of current practices. *European Journal of Information Systems*, (4), 214-225.
- Weill, P., & Olsen, M. H. (1989). Managing investments in information technology: Mini case examples and implications. *MIS Quarterly*, 13(1), 3-15.
- Willcocks, L. (1992). IT evaluation: Managing the catch-22. *European Management Journal*, 10(2).
- Willcocks, L., & Griffiths, C. (1994). Predicting risk of failure in large scale information technology projects. *Technology Forecasting and Social Change*, 47, 205-228.
- Yin, R. K. (1994). *Case study research: Design and methods*. Beverly Hills, CA: Sage Publications.

ENDNOTE

- ¹ For confidentiality purposes, the organisations are referred to in code throughout the chapter.

This work was previously published in Managing Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 147-168, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.9

Examining the Approach Used for Information Technology Investment Decisions by Practitioners Responsible for IT Planning in Namibia

Karna Naidoo

University of KwaZulu-Natal, South Africa

ABSTRACT

Despite the technological progress made by organisations in Namibia, the impact of IT has not been studied. The existing definition of IT is not comprehensive enough to include all relevant IT expenditures. No return calculations are made, though managers are showing growing concern at the increasing IT costs. The purpose of this article is to determine what organisations in Namibia use as basis for investing in IT. In interviews with six organisations in Namibia, it was determined how they define and manage their investment in IT. Some conclusions can be drawn, the first being that organisations need to look at their definition of IT to include all aspects of IT like communication systems, maintenance,

etc. the second implication is that somebody must be appointed to take responsibility for managing the IT investment.

INTRODUCTION

Throughout history, progress in technological behaviour had profound social significance—regardless of whether it was based on mere intuition, trial-or-error, or scientific approach. Machiavelli as *cited* by Bass (1990) made the following comment about systems in general: “There is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new system. For the initiator has the enmity of all who would profit by the preservation of the

old system and merely lukewarm defenders in those who would gain by the new one.”

We now realise that information systems (IS) are the centre of a new business reality in the 1990s. The impact of the IT revolution is a phenomenon that is affecting every aspect of Third World societies. This revolution increasingly affects anything from the way organisations conduct business to the organisation of schools. The impact can even be stronger than the impact of gaining independence by drastically changing the course of economic development in a country. The major problem is that the use of IT is not fully understood nor studied in the Third World countries in order to yield meaningful insights.

PREVIOUS ATTEMPTS TO QUANTIFY IT EXPENDITURE

Although there has been some growth in the usage of IT over the last couple of years, no analysis of the impact of IT on sales, costs, and profits of organisations has been made in Third World countries. It is, however, important that organisations inform themselves of the impact of IT usage on operating results and profitability. Strategies can then be developed in order to gain a competitive advantage.

Weill and Olson (1989) use case studies of organisations to determine how IT is defined, how IT investments are measured, tracked, and what other factors control IT investment decisions. Some important issues emerged from their study, namely that managers must adopt a broad definition of IT and that IT expenditures can be measured and tracked against a convenient base (revenues, total expenses, or management control costs). Weill et al. believe that attention must be paid to certain factors concerning any important IT investment, namely: managers’ commitment to IT, previous organisational experience with IT, user satisfaction with systems, and the turbulence of the political environment of the organisation.

A literature study based on a graphical cost/benefit approach to computer systems selection was presented by Shoval and Lugasi (1988). They note that stages, like analysing the needs of the system and defining its requirements and attributes, need attention.

Ahituv and Neumann (1990) state that any attempt to assess the value of information should be closely linked to the decision supported by the information. They noted that the selection of criteria to use in comparative analysis is the easier part in cost/benefit analysis. The complicated part is to identify all the elements which form part of cost and benefits, and determining how to measure (or estimate) all those elements.

Kwong and Mohammed (1985) suggest the use of a computerised index (CI) that can quantitatively evaluate the impact of computerisation on profitability and, in the process, develop an indicator to the extent and sophistication of computerisation. The organisations used show that an increasing degree of computerisation is generally associated with an increasing profitability margin as indicated by the CI—even in the short term.

In his study involving experienced users, Davis (1989) suggests the use of determinants, the most important one being that if potential users believe that a given application is useful, they may simultaneously believe that the system is difficult to use and that the performance benefits of usage are outweighed by the efforts of using the application.

In conclusion, it can be said that IT investment uses resources of organisations. There are no consensus of the definition of IT and the measurement of its tangible and intangible benefits. This makes IT investment difficult to manage.

CASE STUDY RESULTS

Six mini case studies were conducted to help understand how organisations define and manage their IT investments in Namibia. The six

organisations compose of five large profit-making organisations, while the sixth organisation is a part of the educational system in Namibia. A lengthy, semi-structured interview was conducted with the senior representatives in information systems of each organisation. Every attempt was made to keep the identity of the organisation and sensitive information confidential.

Primary questions covered the following:

- What does the organisation regard as part of their IT?
- How do they manage and track IT investments?
- From where does the impetus for buying IT equipment start?
- What factors influence IT investment decisions?

Organisation 1—Education

Organisation 1 is in the field of tertiary education in Namibia. The interviewee is the director of the computer bureau. According to him IT is defined to include only hardware and software. During the past two years, the budget for purchasing IT equipment was drastically cut. All purchases of IT equipment were done from savings in department's budget. IT is tracked in a combined centralised and decentralised way, but no attempt is being made to include relatively small expenditures. IT equipment is not captured on the tracking of the investment if a department buys IT equipment from own savings. No ROI is calculated although departments are assessed on an output vs. input basis (output could be preparation for lectures while input could be space, equipment, number of persons in the department etc.).

The impetus to buy IT equipment originates from departments who identify a need, get top management's permission, and proceed to buy the equipment. Political considerations do play a significant part in decisions to invest in IT.

The management of the IT investment is done on a partly centralised and partly decentralised basis. There is no link between the buying of IT equipment and the strategy and the strategy of the organisation.

Organisation 2—Transport

Organisation 2 is a large organisation in the transport sector. The interviewee is the chief clerk who controls IT. The interviewee noted that the process of investing resources in IT is the responsibility of individual divisions. IT is defined as all hardware and software. The productive capacity of the IT is planned in order to allow maximum advantage of their investment. The interviewee believes that investment in IT could be maximized but stated that no real attempt is being made to do so. No return calculations are made on the investment and there are decentralised tracking of the investment. He noted that political issues do play part in decisions to invest in IT. The impetus to invest in IT comes from a central point. If the need for IT is recognised, he has to be notified. There is no link between investment in IT and the strategy for the organisation.

Organisation 3—Banking

Organisation 3 is a geographically dispersed commercial bank. The interviewee is a member of the management of the bank. The bank includes hardware and software in its general view of IT. No productive capacity planning for IT is being done in the bank. The bank keeps track on all levels of IT equipment in a combined centralised and decentralised basis. This is done as no simple measure is considered enduring enough in terms of accuracy. The bank's decision to invest in IT is done at corporate level the following inputs from base. Every department manages its own IT.

The interviewee stated that political considerations play a big part in the decision to invest

in IT. According to him, there definitely is a link between the buying of IT equipment and the strategy of the organisation.

Organisation 4—Insurance

Organisation 4 is a local firm who handles all sorts of insurance for a large clientele basis. The interviewee is the manager of the financial department. Their definition of IT includes hardware and software. No productive capacity or any tracking of their IT equipment was done. They do not conduct return calculations on their IT investment because they consider it too complicated. All IT equipment in their possession is managed from a central position.

Political considerations do play a part in their decision to invest in IT and that is why top management takes all decisions regarding IT investments. There is a link between the strategy the organisation employs and decisions to invest in IT or not.

Organisation 5—Consumer Products

Organisation 5 is a large manufacturing organisation in the consumer products industry. The interviewee is the manager of the information department. According to the interviewee, the definition includes all PC-hardware and software as well as all consumables. Productive capacity is planned in advanced as management wants to see IT equipment put to use. All IT equipment is managed in a centralised way. No return calculations are done on the investment in IT. The decision to invest in IT comes from management. He also said that political considerations play no part in decisions to invest in IT. There is a link the decision to buy IT equipment and the strategy for the organisation.

Organisation 6—Insurance

Organisation 6 is a large multi-national insurance organisation with three major businesses,

namely individual insurance, group insurance, and investment. The interviewee is the computer consultant to the organisation. The definition of IT does not include consumables but encompasses all hardware and software. Decentralisation of the organisation is the reason why managers of the organisation decided to decentralise the management of IT. No return calculation is made on IT investments. Political considerations play a part in the decision to buy IT equipment. The impetus to buy IT usually comes from managers and the lower-hierarchy based on what their opposition is doing and how they define their strategy.

ANALYSIS OF KEY FACTORS

The Definition and Tracking of IT

The majority of organisations viewed hardware and software as the only part of its investment in IT. There seems to be a trend to keep the definition of IT as narrow as possible.

IT Investment Management

Organisations track IT expenses with varying degrees of success. Tracking is done mainly on the basis of comparing it with budgeted amounts for the specific year and taking care not to exceed the budgeted amount. Another problem could be that IT investments by departments are not captured on the overall picture of the organisation. No return calculations on investments are done as people tend to think it is too difficult. The total hardware appeared as assets in the asset register though some organisations did not keep track of software expenses at all.

Political and Other Influences

Political considerations are important factors in most organisations and have significant impact on the acquisition of IT equipment. These considerations sometimes overshadow the technical and economic considerations and are becoming more important. In most cases the impetus for investment was taken by managers. This was not

necessarily connected to a decision to incorporate more IT into the organisation. In all (but two) organisations there was no link between IT and the strategy for the organisation.

IMPLICATIONS OF THE FINDINGS

The implications from the findings are: (1) Define and track IT as IT expenditures increase the need for a definition for IT becomes an important issue. This must be broadened to include all cost aspects of IT; and (2) the calculation of the return on investments in IT can be complex as no real cash flow is available.

RECOMMENDATIONS

Organisations in a Third World country like Namibia must realise that they have to manage their IT investment by:

1. **Defining and tracking IT investments:** Redefine the definition of IT so that it includes all expenditures, such as hardware, software, people, consumables, training, and maintenance. There must be accurate recording of this expenditure over time against a convenient base such as revenues or staff employed, etc.
2. **Looking at IT investment and return:** To justify IT investment poses a problem for many organisations. Return on investment (ROI) calculations sometimes does not apply to certain IT investments because it is difficult to determine a definite income stream. Managers must, however, recognise that ROI calculations are not always relevant for all IT investments. They must remember that some IT investments could be essential to the organisation's survival. Lastly, managers must keep in mind that the total IT investment needs to be calculated if they want to

see the effect of the IT investment on the organisation.

3. **Concentrating on organisational issues:** Issues that must be liked into are: Top management commitment to IT; previous experience with IT; user satisfaction with systems; and the political environment of the organisation.

CONCLUSION

It was found that IT definitions are not comprehensive enough. The problem could be that organisations do not sit down and constructively plan their investment in IT. I had the feeling that organisations in Namibia have no idea of the total amount of resources invested in IT. Another factor is that this investment is not managed satisfactorily and that nobody wanted to take responsibility for managing IT investment. My final conclusion is that workshops must be organised and people educated in the concepts of managing IT investment.

REFERENCES

- Ahituv, N., & Neumann, S. (1990). *Principles of information systems for management* (3rd ed.). Dubuque: WC Brown Publishers.
- Bass, B. M. (1990). *Handbook of leadership* (3rd ed.). New York: The Free Press.
- Davis, F. J. (1989, September). Perceived usefulness, perceived ease of use, and user acceptance of IT. *MIS Quarterly*.
- Kwong, H. C., & Mohammed, M. Z. (1985). Profit impact of computerisation. *Hong Kong Computer Journal*.
- Shoval, P., & Lugasi, Y. (1988). Computer systems selection. *Information and Management*, 15.

Examining the Approach Used for Information Technology Investment Decisions

Weill, P., & Olson, M. H. (1989, March). Managing investment in IT: Mini case examples and implications. *MIS Quarterly*.

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 182-189, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.10

A Case Study on the Selection and Evaluation of Software for an Internet Organisation

Pieter van Staaden
Media24 Ltd., South Africa

ABSTRACT

The author conducted research to determine whether IT managers, IT auditors, users, management, etc. (all decision-makers) use a certain evaluation and selection process to acquire software to meet business objectives and the requirement of users. An argument was used that the more thorough the software evaluation and selection process, the more likely it would be that the organisation will chose software that meets these targets. The main objective of the research was therefore to determine whether Media24 uses evaluation methods and obtains the desired results. The results confirmed that Media24 uses suggested protocol as noted in the theory for software acquisition correctly during most stages.

INTRODUCTION

There is a wide variety of methods that can be used for selection of software in various fields of business (e.g., manufacturing, service providers, insurance, wholesale, retail, etc.). This software is used for a variety of purposes in businesses. However, selecting the software that meets organisational requirements and business objectives could prove to be a challenge considering the number of vendors and software available.

Choosing the right software for your company can be bewildering. There are thousands of titles to choose from, and programs and their functionality differ frequently. (Buyerzone.com, 2002)

A hurried, uneducated choice could lead to various problems in the company. Some of these are failing to support an important business process, supporting a process inaccurately or inefficiently, unhappy customers, disgruntled employees, loss of sales, and poor financial performance.

Competition in the Western Cape requires good performance in all aspects of the electronic publication industry. Bad judgments or decisions in terms of software acquisition could cause a company some losses and complications in their daily operations. Choosing the right software is therefore important and can be achieved by using pre-determined evaluation and selection guidelines.

EVALUATION AND SELECTION OF A COMMERCIAL SOFTWARE SYSTEM

Decisions Made Prior to the Software Evaluation Process

As mentioned by Capterra's software selection methodology (2002), certain procedures should be completed before the actual evaluation is conducted. They suggest that the company should start off by interviewing some staff members, addressing corporate vision, analysing existing systems limitations and features, and looking at present policies and procedures. The company should also determine whether new software will help the business and if it will increase competitive advantage.

They argue that when the decision is made to purchase software, a project plan should be developed to evaluate and list the evaluation criteria that will be used during the process. A project team should also be selected to carry out the evaluation. This team must include representatives from all levels the organisation. If the proposed software incorporates financial aspects, the audit team should also be included.

Determine Requirements for the New Software Package

The purpose would be to create a comprehensive and prioritised list of requirements to help evaluate the software. Base Consulting Group (BCG) (2000) state that the requirements definition should consist of several processes (such as managerial requirements (budget/timing, reporting requirements), functional requirements (stated business needs, technical requirements), and IS standards (data flow diagrams, system interfaces, and hardware and network requirements with emphasis on capacity).

They also note that some companies do not develop detailed requirements and as a result may be dissatisfied with the final outcome. Romney and Steinbart (2000) support this statement and suggest that one or any combination of four strategies (listed below) should be used to determine requirements for the new software:

- Survey end-users to determine what their requirements for software is by using questionnaires, personal interviews, and focus group discussions.
- Analyse the existing system and eliminating requirements that have already been defined.
- Examine how the existing software is used, helping to determine the shortcomings of the system, and identifying any new requirements needed by users.
- Pilot demonstrations of applications/software systems could be utilised when there is a problem in identifying requirements.

Document the Requirements

The systems requirement document or software requirement specifications should be the starting point for measuring performance of the final system (Shelly, Cashman, & Rosenblatt, 1998). Users must understand the document to be able

to improve the final version. The content of this requirements document will depend on the type of company and the complexity of the new system. BCG (2000) states that the requirements document is the cornerstone to evaluate the software and should be used to identify requirements. Capterra (2002) argues that there is a methodological approach available to help with requirement analysis. This is listed in Table 1.

Selecting Vendors

Michell and Fitzgerald (1997) argue that the range of services offered by IT vendors is large and growing rapidly. They also note that while searching for the “best” vendor, it should be borne in mind that the process of selection and evaluation of a vendor is important. Base Consulting Group (2000) suggests that the project team’s first step should be to identify the vendors who offer software solutions that could be used. It could be a high-risk approach not to properly evaluate vendor companies. The sources used to compile the list of vendors should be recent and reliable. These sources include software user groups, databases, industry groups, research firms, consulting firms,

trade shows, seminars and conferences, current users, personal recommendations and contacts, competitors, IT, and business magazines, as well as Web sites.

PRELIMINARY EVALUATION OF VENDOR COMPANIES AND THEIR PRODUCT

Ward (2001) argues that selecting software from a vendor should be a simplified process. She suggests that vendors be invited to participate in a software demonstration because it reduces time spent on evaluations. Companies could work toward solving the business problems earlier resulting in faster return on investment. Base Consulting Group (2000) states that inviting too many vendors to participate increases the costs and timelines of the project. Team members may also lose focus after seeing too many product demonstrations. In order to shorten the time of the process send the request for proposal (RFP) to a shortlist of 5 vendors, and do a preliminary evaluation of the vendors.

The evaluation team should look at things like:

Table 1. Capterra’s methodology (2002)

| COLUMN NAME | DESCRIPTION |
|---|---|
| Functional department, business processes, and process. | This creates the requirements hierarchy and ensures that all processes are covered (e.g., would be creditors department, cheque printing, approving cheques for printing, etc.) |
| Requirement type | This identifies the requirement as functional, technical, vendor related, or contractual. |
| Requirement description | This details the requirement itself and should be as descriptive as possible. |
| Priority and ranking | <i>This could be used during the evaluation.</i> |
| Objective addressed | This could be used to match the requirement to a business objective. |
| Comments | This can be used for any additional comments or justifications. |

- The standard functionality and key features of the product
- Technology requirements (hardware, additional software, database, operating system, network, development tools)
- Product considerations such as viability, stability, and cost
- Products targeting different, smaller, or much larger companies or industries should be eliminated
- Eliminate products that are in development or a recent release.
- Licensing and support costs are examined and products that are over/under priced should be eliminated (licensing escalation must be considered).
- Develop a request for proposal (RFP).

According to Levinson (2001), an RFP guides buyers through a process of tying business needs to technical requirements (e.g., as the particular platform on which the software needs to run on or the systems with which the solution must interface). It clarifies why they are undertaking a particular project. Schwalbe (2000) suggests that the RFP should include: statement of the purpose, background information on the company issuing the RFP, basic requirements for the products and/or services being proposed, HW and SW environment, description of the RFP process, statement of work (SOW), and other information added (as appendices). The SOW should describe the work required for the procurement of the software and help vendors determine if they can deliver required goods and services.

EVALUATION PREPARATIONS

Gather and Organise Resources

Lars and Matthew (2002) note that a reason for not detecting errors early is because the inadequacy of

the test used by the team. The quality assurance of the evaluation project is jeopardised. To prevent this, the test team should ensure they have the resources to detect errors present. The adequacy of resources gathered should be determined at the same time potential vendors are identified. Resources could be added or updated to support the evaluation.

Determine the Evaluation Approach/ Technique

Restrictions on Evaluating Software

Dean and Vigder (2002) state that, while purchasing software, there are some unique constraints on the ability to conduct effective testing. In general, it should be assumed that there is no access to the source code. If the source code is available it could not be modifiable and it means that the executable part cannot be tested internally and this rules out white box testing. Documentation should consist of user manuals and advertising materials and is not directed at evaluating the software (e.g., it does not describe the behaviour of the software in response to abnormal input).

Evaluation Techniques and Methods

Romney et al. (2000) suggest benchmarking while processing times of software are measured. Software with the lowest time is normally judged the most efficient. Oberndorf, Brownsword, Morris, and Sledge (1997) engaged scenario-based testing methods to represent typical procedures for the software to be programmed and not the software undergoing tests. Test procedures are developed based on scenarios and each is evaluated against a set of criteria. In this case, the initial scenarios are established using preliminary operational definitions. The results of this will serve as confirmation that the software performed satisfactory against set parameters.

Romney et al. (2000) suggest a point scoring technique to evaluate the vendor. Each criterion

is assigned a weight based on its relevancy. The vendor is assigned a score based on how their proposal measures up to each criterion. The vendor with the highest score is then judged the “best.” They argue that “requirements” costing is an alternative where the total cost of the proposed software is calculated. This provides an equitable basis for comparison.

Another method suggested by Voas, Charron, and McGraw (1997) is the use of fault injection techniques. This is effective when buyers do not have access to the source code. The method consists of inserting erroneous values into the control stream and checking the results. This technique is an example of evaluating (for discovery) to determine unknown or unexpected reactions of the product under evaluation.

Beizer (1995) suggests *black box testing* to allow a tester to treat each module as a unit that can be defined by its inputs and outputs (the interfaces to the module) without considering the route by which an input is transformed into a particular output. Visibility into the internal workings of the code module is not necessary and source code not required. An example of black box testing is boundary value analysis where inputs are supplied to the software to be tested (these values represent valid, invalid and parameters). The outputs are measured and accepted if they fall within expected limitations. This type of testing is used during acceptance testing and is the basis of validation testing, confirming the software performed the required functions.

Other techniques (Hausen & Welzel, 1993) include analysing product documentation, presentations, using trial versions, scheduling demonstrations, or attending training of the software. They suggest that one or more of the previously mentioned techniques could be used to supplement the evaluation of software. The project team should use discretion when selecting evaluation techniques as a company’s approach and resources may vary.

Evaluation Considerations

Hausen and Welzel (1993) mention that some of the following principles should be taken into consideration:

- Repeat testing of the same product using the same product specifications with the same testing techniques must deliver similar results (Repeatability).
- Repeat evaluation of the same product to the same product specifications by different parties must deliver similar results (Reproducibility).
- The evaluation is free from bias while achieving any particular result (Impartiality).
- The result is obtained with minimum subjective judgment (Objectivity).

Product Evaluation

Hausen and Welzel (1993) state that the evaluation process should consider software features (compared to the requirements document), product information (acquired from the RFP, product demonstration, information gathered from investigating vendors, etc.), evaluation techniques, and process information (e.g., results obtained from the testing techniques).

Capterra’s methodology (2002) states that all software should be evaluated to determine if it meets requirements (functional and technical). Any additional (functional/technical) requirements should be listed and re-calculated. Missing requirements should be listed and cost incurred to add these features should be calculated. Price and maintenance levels of the product have to be evaluated by totalling cost and maintenance levels. Firms must consider initial product costs (also long-term costs (such as training, implementation costs, maintenance, and upgrading costs). Project teams should keep in mind that software is expensive and by picking the wrong one could have costly repercussions.

Final Evaluation of Vendor Companies Providing Possible Software Solution

Pollard (1999) suggested the evaluation of the support and maintenance staff of the vendor. He notes that it is necessary to know the number of people in customer support. The response time can be measured by calling the customer support department. The availability and quality of the implementation support also ought to be evaluated. The new software could have bugs and other problems (e.g., not meeting the required deadline). The vendor must provide training because users want to use the system properly.

He suggests following up on customer references, reviewing case studies and finding out how many companies are using the software. The financial stability of a vendor is an aspect to consider. Pollard (1999) supports this by suggesting the examination of the financial history and the long-term financial stability of the vendor.

Selecting the Software System

The total score of the software should be recorded on a scoring sheet when a point scoring technique is used. All the software must be listed from the highest to the lowest. The software with the highest score would represent the best fit for the organisation. Although the software with the highest score might represent the best solution for the company, there may be reasons unrelated to the requirements that could prevent an organisation from selecting software. Inconsistencies should be identified (also extremes in scoring that may influence it—or a competency or deficiency within a single business function). Criteria such as a business partnership, potential future business, or other intangibles, must also be included.

Notify the Vendor

Once the steering committee has approved the vendor, then the vendor should be notified and a contract drawn up. The diagram (on the next page) was derived from the theory to illustrate

steps used during the evaluation and selection process.

PROBLEM STATEMENT

Brown and Wallnau (1996) state that organizations should recognize the importance of technology “refreshment”:

- To improve the quality of their products and services
- To be competitive with organizations providing similar products and services
- To remain attractive to investors

Any organization should invest in appropriate software to stay in business. Careful decision-making on investment into software is therefore essential. Whether the release of an update, or the availability of new software, should force an organization to initiate an evaluation process that provides timely, balanced information on which decisions can be made.

The problem statement was thus stated as:

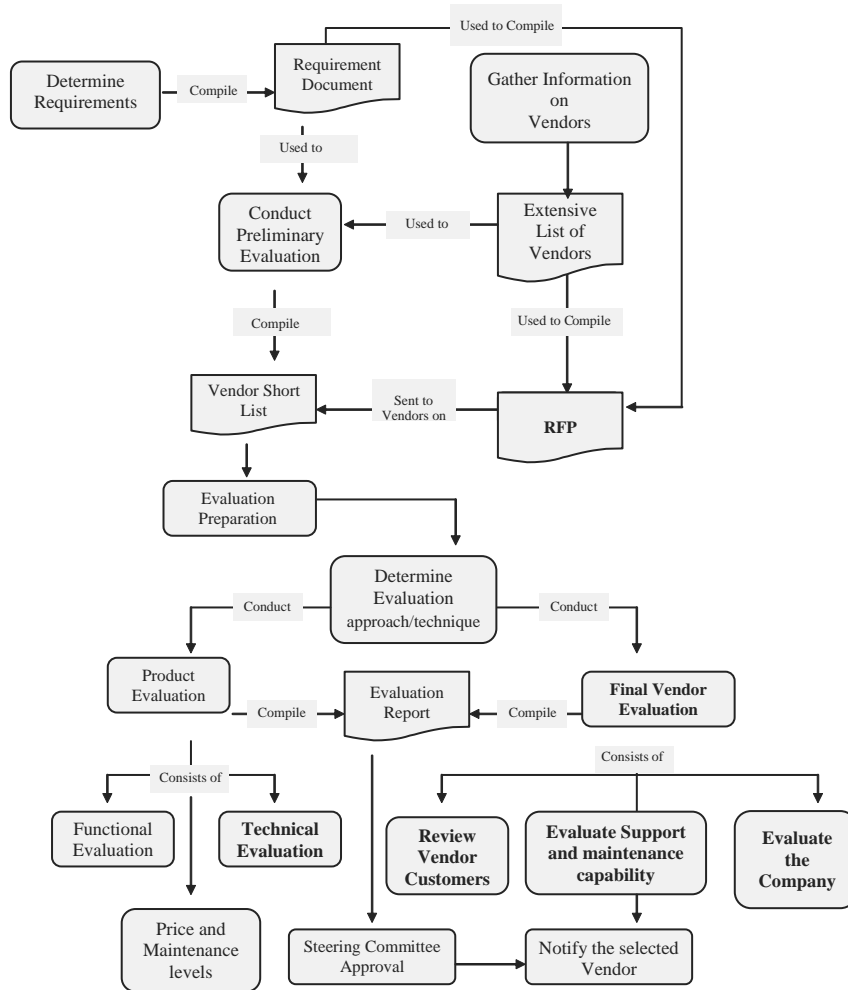
...the more thorough the evaluation of software, the greater the chances could be for the organization to select the software that will meet their business objective and the requirements of the users.

RESEARCH METHODOLOGY

Objective

The objective of the study is to determine whether Media24 uses the correct software evaluation and selection guidelines when purchasing software from a vendor as prescribed in the theory and whether these guidelines have obtained results. Based on the theory and the problem statement, the research questions were stated as follows:

Figure 1. Graphical summary of software selection



- Is the software evaluation process of Media24 thorough enough to select software that fulfils their end-user requirements?
- Does the organisation pick software that meets the business objectives easily?

Limitations of the Study

The researchers had decided to exclude legal procedures and only focussed on the project from a technical viewpoint. Also they were not allowed to use the name of any software used by Media24

as it might discredit the vendor or Media24. The research scope also does not include the processes (e.g., contract negotiation) followed after a decision has been made.

Development of Questionnaire

The researchers compiled a questionnaire consisting of two sections (Section A and B). Section A contained seven sub-sections, covering aspects of evaluation and selection processes. Section B contains the user satisfaction survey.

The questionnaire was handed to a Media24 IT manager who reviewed it. He also identified people responsible for evaluating and selecting software in Media24 to be respondents while he completed a questionnaire himself.

Section A was sent out to 15 decision-makers involved in acquiring software in Media24. The objective was to measure whether they used the evaluation techniques as prescribed in the theory. Section B was sent to 50 users of the software. The objective was to determine whether they were satisfied with present software. All questions were derived from the theory described earlier. A 5-point Likert scale was used in most of the questions (it included questions that required respondents to pick more than one answer). The reason is to evaluate areas where answers from the respondent indicates an in depth approach to the evaluation process. At the end of each section, a section was dedicated to find out in more detail what respondents think.

Analysis of Data

The results of both sections were compared using cross tabulation. The data was captured and analyzed on an excel spreadsheet. Twelve “section A” respondents returned the questionnaires and 74% of the respondents who received section B returned the questionnaire.

Section A: Evaluation Process

Nearly all the respondents agree that the steering committee correctly directs the evaluation process (11). This indicates that people realise that there is a structure in place that could oversee the evaluation of software and is in agreement with a similar comment by Capterra (2002).

All the respondents agree that there are sufficient resources available to ensure that the evaluation process runs smoothly. Nine of the respondents indicated that the project team has

Table 2. Project management structure

| | SA | A | NDA | D | SD |
|--|----|---|-----|---|----|
| There is a Steering Committee in place to oversee and direct the evaluation process | 11 | 7 | 1 | 0 | 0 |
| Sufficient resources are allocated to the evaluation process | 4 | 8 | 0 | 0 | 0 |
| A project team with the required expertise is assigned to conduct the evaluation and selection of the new software system. | 3 | 5 | 1 | 3 | 0 |
| AVERAGE | 4 | 6 | 1 | 1 | 0 |

Table 3. Requirements definition

| | SA | A | NDA | D | SD |
|---|----|---|-----|----|----|
| Technical requirements are determined (e.g., the system interface) | 5 | 7 | 0 | 0 | 0 |
| The Functional requirements are determined (e.g., business objectives system has to fulfil) | 5 | 5 | 2 | 0 | 0 |
| Managerial requirements are determined (e.g., reporting capabilities, budget, timing) | 4 | 8 | 0 | 0 | 0 |
| Requirements are properly documented and easy to understand | 2 | 7 | 1 | 2 | 0 |
| AVERAGE | 4 | 7 | .5 | .5 | 0 |

A Case Study on the Selection and Evaluation of Software for an Internet Organisation

enough expertise to conduct an evaluation. Three indicated that they disagree with this. There might be a problem that falls outside the scope of this study and needs to be addressed by management. The organisation therefore needs to assemble a

project team that is representative of the people working in the organisation (see also Dean & Vigder, 2002). Nine of the respondents indicated that Media24 used the interview method to determine requirements. The same respondents

Table 4. Vendor identification and evaluation

| | SA | A | NDA | D | SD |
|---|----|----|-----|----|----|
| Various sources (e.g., Web sites) are investigated in order to identify the software available. | 3 | 7 | 2 | 0 | 0 |
| A preliminary evaluation is conducted to limit software that are going to be extensively evaluated. | 3 | 7 | 0 | 1 | 1 |
| The support and maintenance staff provided by the vendor is evaluated based on... | | | | | |
| ...response time | 4 | 7 | 1 | 0 | 0 |
| ...quality of support | 1 | 9 | 2 | 0 | 0 |
| ...number of people | 0 | 1 | 1 | 8 | 2 |
| ...cost | 1 | 10 | 1 | 0 | 0 |
| The company providing the software system is evaluated based on... | | | | | |
| ...long term Financial stability | 5 | 5 | 0 | 2 | 0 |
| ...customer References | 4 | 7 | 1 | 0 | 0 |
| ...number of clients | 4 | 5 | 3 | 4 | 0 |
| ...long and short term strategic planning | 0 | 2 | 2 | 8 | 0 |
| AVERAGE | 2 | 7 | 1 | .7 | .3 |

Table 5. Request for proposal

| | SA | A | NDA | D | SD |
|---|----|---|-----|----|----|
| A Request for proposal is sent to Vendors. | 10 | 1 | 1 | 0 | 0 |
| The RFP includes... | | | | | |
| ...the purpose of the RFP | 1 | 9 | 2 | 0 | 0 |
| ...all necessary background information of the company issuing the RFP | 1 | 4 | 6 | 1 | 0 |
| ...the requirements for the new system | 4 | 7 | 1 | 0 | 0 |
| ...the hardware and software environment currently being used | 3 | 4 | 4 | 1 | 0 |
| ...instructions on how to reply and a description of how responses will be dealt with | 9 | 2 | 1 | 0 | 0 |
| ...a statement of work (SOW) that includes the required work needed for the procurement of the new software solution. | 1 | 9 | 2 | 0 | 0 |
| AVERAGE | 4 | 5 | 2.6 | .4 | 0 |

have also used the present system to ensure that they meet the correct requirements (see Figure 4). Six respondents have indicated that they use questionnaires to collect requirements. It seems that project teams in Media24 prefer to use three methods to determine software requirements.

All respondents have indicated that technical requirements are determined beforehand (systems interface). Ten of the respondents are happy that business objectives have been met while determining functional requirements. All agree that managerial requirements should be met when requirements are defined. Nine of the respondents noted that requirements are properly documented. Media24 needs to address this to ensure that people are in agreement otherwise it can become a problem.

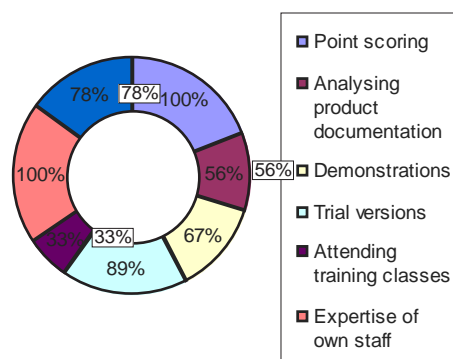
Ten of the respondents agree that many sources should be investigated to identify correct software. The same number agrees that Media24 should ensure that software that meets requirements are evaluated. This is done to limit the number of products to be considered. On the other hand, 11 of the respondents agree that the support/maintenance staff provided by the vendor is evaluated on response time while the quality of support is rated high by 10 of the respondents. It seems to the authors that 'old fashioned' values are still

important while looking at new IT investments. This is in agreement with the statement made by Capterra (2002) that end-users value help provided by the supplier.

The number of people working for the vendor is not regarded as important by the respondents; as long as their service is not affected by it (quality is rated higher). Eight stated that cost plays a role while maintenance is evaluated. Most of the respondents noted that the vendor should be evaluated on financial stability and customer references. The number of clients and long-term strategy of the vendors were not used when looking how reputable the vendor is. This is something that Media24 and similar organisations need to investigate.

Table 5 displays the data collected on the RFP. Most of the respondents agree that this is complied with by Media24. Many (10) stated that the evaluation processes are properly documented while thought is given to objectivity (11) and impartiality (9). Most (10) of them agree that repeatability is lacking while reproducibility (7) is important and needs careful attention. Impartiality is an aspect that needs to be addressed as a third of the people noted that it is lacking. The averages for the request for proposal can be improved but because there are individual items that manage-

Figure 2. Techniques used while evaluating software



ment of Media24 needs to pay attention to as stated. The common method used to evaluate the software is the point scoring technique (Figure 2). Trial versions of software have a better chance to be selected if it was analysed previously or used. The other method that Media24 uses to evaluate software is the expertise of their staff in a particular field.

Table 6 shows the evaluation process. The respondents were positive that the final score used to determine how well the software product meets the requirements is a good method. Nine respondents are in agreement that the documentation to do this evaluation is well laid out beforehand. Management needs to convince the three that does not agree to accept the documentation as presented. Objectivity is complied with

but repeatability of the evaluation is not highly thought off (and the same for reproducibility). Nine of the respondents noted that the tests were impartial. Again, it would be a task for management to convince the remaining three that this is the case before problems are experienced (also supported by Shelly et al., 1998).

Most of the people agree that the final decision to acquire software is based upon the evaluation results. Eleven of the respondents agree that they are happy with the results achieved by Media24. Agreeing meant that they use the methods as prescribed in theory but there are some methods that are not used presently (e.g., benchmarking and black box testing). These should be investigated and used to ensure that the methods presently being used is still considered the best (Beizer, 1995).

Table 6. Evaluation of the product

| | SA | A | NDA | D | SD |
|---|----|----|-----|-----|----|
| The evaluation score of the product is determined based on how well it meets the pre-determined requirements. | 1 | 11 | 0 | 0 | 0 |
| The evaluation process and results are properly documented. | 1 | 8 | 2 | 1 | 0 |
| When conducting the evaluation thought, is given to... | | | | | |
| ...Objectivity | 7 | 4 | 1 | 0 | 0 |
| ...Repeatability | 0 | 0 | 4 | 7 | 1 |
| ...Reproducibility | 0 | 6 | 4 | 2 | 0 |
| ...Impartiality | 7 | 2 | 2 | 1 | 0 |
| AVERAGE | 3 | 5 | 2 | 1.8 | .2 |

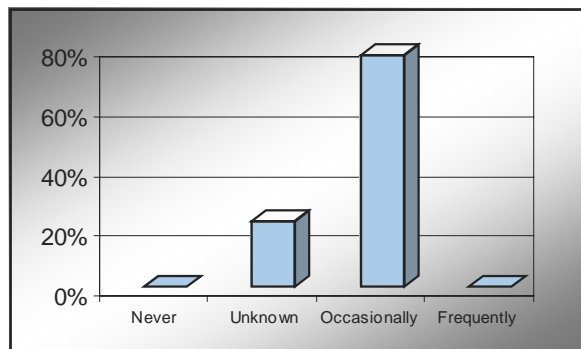
Table 7. Results obtained from decision makers

| | SA | A | NDA | D | SD | TOTAL |
|--|-----|---|-----|----|----|-------|
| The final decision is not made solely based on the evaluation result, but also includes other intangible aspects (e.g., potential future business) | 1 | 9 | 2 | 0 | 0 | 12 |
| I am satisfied with the evaluation results obtained by our company. | 4 | 7 | 0 | 1 | 0 | 12 |
| AVERAGE | 2.5 | 8 | 1 | .5 | 0 | 12 |

Table 8. User satisfaction

| | SA | A | NDA | D | SD |
|--|-----|---|------|---|-----|
| I am satisfied with the software I am using. | 2 | 9 | 0 | 1 | 0 |
| The commercial software system fulfills the business objective it was assigned to. | 1 | 7 | 3 | 1 | 0 |
| The commercial software system adheres to my requirements. | 2 | 8 | 0 | 1 | 0 |
| There is no room for improvement for the commercial software system I am using. | 0 | 4 | 2 | 5 | 1 |
| AVERAGE | 1.5 | 7 | 1.25 | 2 | .25 |

Figure 3. Number of complaints from users



User Satisfaction and Overall Effectiveness of Evaluation Process Used

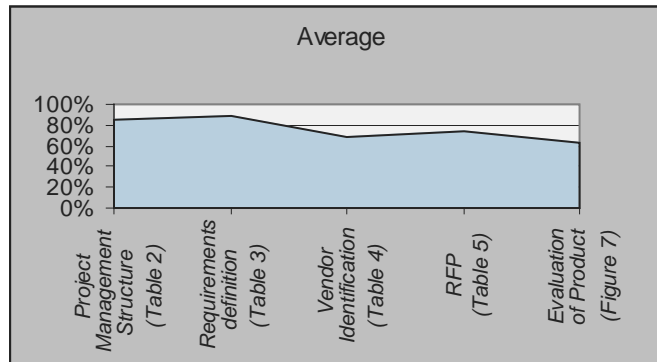
Nearly all the respondents (11) at Media24 are satisfied with the software that was purchased by Media24. Eight of the respondents have agreed that it falls within the parameters set by the organisation. The respondents that do not agree (4) may be users that were not part of the project team. They should be convinced that the software is of benefit to Media24. Eleven of the respondents agreed that the software meet their requirements. This is supported in their article by Michel and Fitzgerald (1997) who stated that

normally most of the users who were part of the process are happy with the software.

This could mean that the individual user requirements agree with Media24’s requirements. However, seven of the respondents agree that there is room for improvement This should be investigated in another study as this falls outside the scope of this study. This does not agree with previous statements made by the respondents. Maybe the present evaluation procedure should be extended to inquire about reasons why the respondents argue that there is room for improvement. This should be included as part of the evaluation.

The respondents (9) complain about the software occasionally to ensure that management pay

Figure 4. Key area's average



attention. Seven of the users argue that there is room for improvement. This would require another survey to find out why users complain about the software and if there is room for improvement.

Section B: Assessment

The main objective of section B was to assess whether the users were satisfied with the software acquired by Media24. There are some complaints lodged by the respondents (e.g., the systems response time and redundant processes and procedures included in the current system and that the software does not integrate with other software). The figure on the next page illustrates the percentage respondents who agreed that they use the correct evaluation techniques. The results are summarized according to key areas.

An area of concern should be the evaluation of the product for management (only 63% average with some areas that were identified that needs attention). Eighty-six percent of users agreed that they were satisfied with the software obtained. Sixty-five percent of users verified that the software systems meet the business objective and 84% noted that the software they are using meets their requirements (also supported by Voas et al., 1997).

DISCUSSION AND CONCLUSION

From the findings, the researchers conclude that Media24 has identified and used the better suited evaluation techniques as described in the theory. End-users were generally satisfied with the software and agreed that the software meet their requirements and business objectives. The above-mentioned statement answers the first research question. It is evident that software that help Media24 achieve its goal has a better chance of being selected (answer to the second research question).

The researchers note that there were some complaints mentioned by end-users. They feel that this “unhappiness” could be because not all employees were actively involved in determining the requirements or because the requirements were not communicated to all users. A manager during an interview noted that the software he was using does not integrate with one of the sub-systems. This eventually leads to more work, as manual reconciliation has to be done between the sub-system and the software. This could be because the requirements or the software weren’t described properly in the request for proposal. Most of the statements indicated that e-commerce organisations should be careful how they select software (Capterra, 2002; Hausen & Welzel, 1993; Lars &

Methven, 2002). This was also supported by the research findings of this study.

FUTURE RESEARCH

Further research might be needed to refine or redesign the evaluation approach used by Media24. The reason is that the current software will be outdated soon and with the rise of new technology, the evaluation and selection process might have to be adjusted. There were also some issues that were not picked up before the installation of the product (e.g., integration with sub systems). This indicates why the evaluation and selection process might have to be revised. Other studies could help place emphasis on the use of specific evaluation models. In order to speed up the process and to gather more data more respondents will have to be included in the sample before the next survey is conducted.

REFERENCES

Base Consulting Group: Strategic Technology White Paper Series. (2000). *Software selection: A business-based methodology*. Retrieved August 2002, from <http://www.baseconsulting.com/assets/PDFs/BusinessBasedMethodology.pdf>

Beizer, B. (1995). *Black box testing: Techniques for functional testing of software and systems*. New York: John Wiley & Sons Inc.

Buyerzone.com. (n.d.). Retrieved August 2002, from http://www.buyerzone.com/software,internet_software/printable_bg.html

Brown, A.W., & Wallnau, K. C. (1996). *A framework for systematic evaluation of software technologies*. Software Engineering Institute Carnegie Mellon University. Pittsburgh. Scientific Literature Digital Library. Retrieved August 2002, from

<http://citeseer.nj.nec.com/cache/papers/cs/23040/http:zSzzSzwebfuse.cqu.edu.auzSzInformationzSzResourceszSzReadingszSzpaperszSzsoftware.evaluation.pdf/brown96framework.pdf>

Capterra detail-level software selection methodology. (2002). Retrieved August 2002, from http://www.capterra.com/detailed_software_selection_methodology.pdf

Dean, J. C., & Vigder, M. R. (2002). *COTS software evaluation techniques*. National Research Council Canada: Software Engineering Group. Retrieved August 2002, from <http://seg.iit.nrc.ca/papers/NRC43625.pdf>

Hausen, H. L., & Welzel, D. (1993). *Guides to software evaluation scientific literature digital library*. Retrieved August 2002, from <http://citeseer.nj.nec.com/cache/papers/cs/12053/ftp:zSzzSzftp.gmd.dezSzGMDzSzSW-QualityzSzEval-Guide746.pdf/hausen93guides.pdf>

Lars, M., & Matthew, G. (2002). *Ten points for improving the testing process: White paper*. Retrieved August 2002, from http://www.tautester.com/download/ten_points.pdf

Levinson, M. (2001, July). Vendor management: Do diligence. *CIO Magazine*. Retrieved August 2002, from <http://www.cio.com/archive/070101/vet.html>

Michell, V., & Fitzgerald, G. (1997). The IT outsourcing market place: Vendors and their selection. *Journal of Information Technology*, 12(3), 223-237.

Oberndorf, P., Brownsword, L., Morris, E., & Sledge, C. (1997). *Workshop on COTS-based systems*. Retrieved August 2002, from www.sei.cmu.edu/pub/documents/97.reports/pdf/97sr019

Pollard, W. E. (1999, July). Confessions of a software salesman. *CIO Magazine*. Retrieved August 2002, from <http://www.cio.com/archive/070199/expert.html>

A Case Study on the Selection and Evaluation of Software for an Internet Organisation

Romney, B. R., & Steinbart, P. J. (2000). *Accounting information systems* (8th ed., pp. 638-641). NJ: Prentice Hall.

Schwalbe, K. (2000). *Information technology project management*. PA: Course Technology. 311, accessed August 2002.

Shelly, G. B., Cashman, T. J., & Rosenblatt, H. J. (1998). *Systems analysis and design* (3rd ed.). Cambridge: Course Technology.

Voas, J., Charron, F., & McGraw, G. (1997). *Predicting how badly "good" software can behave*.

Reliable Software Technologies Corporation. Scientific Literature Digital Library. Retrieved August 2002, from <http://citeseer.nj.nec.com/cache/papers/cs/743/ftp:zSzzSzrstcorp.comzSzpubzSzpaperszSzieee-gem.pdf/voas97predicting.pdf>

Ward, S. (2001, December). Keep it simple when buying enterprise apps. *CIO Magazine*. Retrieved August 2002, from http://www.cio.com/analyst/051101_hurwitz.html

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 190-208, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.11

Managing Socio–Technical Integration in Iterative Information System Development Projects

Bendik Bygstad

Norwegian School of Information Technology, Norway

ABSTRACT

The challenges of information systems (IS) development have changed significantly in the past 15 years. From a situation where the main problem was to build stable systems based on a requirements specification, the IS project manager now faces challenges of integration; for example: how to integrate a new information system into large existing information infrastructures and unstable business processes? Building on a socio-technical perspective, four types of integration were identified and analyzed: external and internal stakeholder integration, and internal and external technical integration. A longitudinal case study of an e-business development project in the airline industry identified and highlighted some managerial challenges of integration. Findings include: Internal technical and (to some extent) stakeholder integration is well supported by

traditional project management techniques and software engineering frameworks, such as the Rational Unified Process (RUP). However, the challenges of external stakeholder and technical integration is underrated in IS development research, and not well supported in RUP.

INTRODUCTION

Fifteen years ago, most IS projects were greenfield projects; on the basis of a requirements specification, a brand-new system was designed and programmed. When (eventually) finished, it was installed and run, and the users were trained in new interfaces and routines. The main challenges for the project manager were to get the requirements specification right and complete, and to develop the system to be technically stable.

Of course, this is still a demanding craft, requiring specialized skills, sound methodologies

and competent project management. However, the project manager today faces two more challenges:

- Most information systems are developed to support a business process, whether the scope is a dramatic process transformation or process improvement (Davenport, 1993; Laudon & Laudon, 2004). It is essential that the new system integrates with the business process, because a project that fails to do so will be a failure, even if the software product is well designed and programmed.
- A new system must also relate to an existing information infrastructure. The information infrastructure is seen as a heterogeneous network, comprising an installed base of technology, organization, culture and work practices (Hanseth & Lyytinen, 2004; Hanseth & Monteiro, 1996). Both opportunities and constraints are heavily influenced by the attributes of this base. In a successful organization, this heterogeneous network is an immensely valuable resource; it constitutes the backbone of the organization. But in a world of change, it also may be a barrier to business adaptation or innovation, because the information infrastructure is hard and expensive to change.

The successful IS project manager must address both these challenges. In a way, this redefines the role of the project manager, making him or her an integrator of both social and technical forces. The question is: How is the manager going to make people and technology work together in a complex and unstable setting?

Ideally, the process models of Business Process Reengineering (BPR) and IS development should answer this question. Unfortunately, the BPR community never really developed a full methodology for this integration (Giaglis, 1999). During the late 1990s, the software engineering community embraced *iterative and incremental*

process frameworks (Larman & Basili, 2003), such as RUP (Jacobson, Booch & Rumbaugh, 1999), Object-oriented Process, Environment and Notation (OPEN) (Henderson-Sellers & Unhelkar, 2000), Extreme Programming (Beck, 2000) and Dynamic Systems Development Method (DSDM) (Stapleton, 2003). The growing practice communities contend that these frameworks have the potential to integrate the business process and the new information system through step-wise stakeholder and technical integration (Blomberg, 2001; Kruchten, 2000; Stapleton, 2003). The basic mechanism is the short iteration that produces a small release that can be tested, integrated into the information infrastructure and assessed by the business organization.

This deserves attention not only in the realm of software engineering, but also in the broader context of information technology (IT)-based organizational change. While skeptics have pointed to lack of practical integration support for e-business architectures (Smolander, 2003), and poor project management support (Henderson-Sellers & Unhelkar, 2000), the large RUP community points to a number of success projects (Rational, 2006b). This paper explores, analytically and empirically, two important questions in this context:

- How can the IS project manager integrate the new information system with the business process and the information infrastructure?
- What integration support is there in software engineering frameworks, like RUP?

The rest of this paper is structured as follows. In the next section, the concept of integration is defined and discussed. Then, the integration support in RUP is briefly assessed. The research approach, longitudinal process research (LPR), is presented. Next, the integration challenge is investigated empirically through a longitudinal case study of an IS project in the airline industry.

The findings in the case study are discussed, and implications for practice and research are assessed. The last section concludes and points to further research.

DEFINING INTEGRATION

According to Webster, integration is “a combination and coordination of separate and diverse elements into a more complete or harmonious whole” (Webster’s, 1986, p. 1174).

Building on the socio-technical IS development tradition (Avison & Fitzgerald, 2003; Coakes & Elliman, 1999; Kling & Scacchi, 1982; Mumford, 1985) and actor-network theory-inspired IS research (Ciborra, 2000; Garrety, Robertson & Badham, 2004; Hanseth, 2002; Hanseth & Monteiro, 1996; Walsham, 1997), the two key element types to integrate are seen to be *stakeholders* and *technology*. Stakeholders are anyone (both humans and organizations) affected by the process, while technology may be networks, systems and components.

Stakeholder integration is defined here as a management activity that aims at facilitating cooperation between people and organizations, and helping them work together to create value. The mechanisms for achieving this may be structural (assigning formal roles and responsibilities) or process oriented, focusing on informal interaction (Heugens, van den Bosch & van Riel, 2002). In both cases, trust is important to keep the relationships alive.

Technical integration is, correspondingly, defined as a management activity to assemble components and systems in a way that make the resulting system work as intended. These components are often a mix of internally produced software, existing internal legacy systems, commercial software (COTS) and large networks, like Virtual Private Networks (VPNs) or the Internet. To make them work together is usually dependent on a combination of different actions: Designing correct interfaces, establishing stable operations and giving sufficient support from technical personnel. In the end, however, the most important element is probably correct use, thus connecting technical integration closely to stakeholder integration.

A basic idea in the socio-technical tradition is that the object of interest is not an *artifact*, a piece of technology, but rather the structuring and reproduction of a socio-technical network, consisting of both technical and social elements (Kling & Scacchi, 1982). Thus, the goal of an IS development project is not primarily seen as the construction of a software system, but to establish a working socio-technical network.

Both stakeholder and technical integration may be seen as management activities aimed at establishing *linkages* to different elements that have to work together. In large projects, the number of linkages will grow into complex networks, and this complexity leads to increased risk (Hanseth, 2002). The risk is enlarged by the fact that both the business process and the information infrastructure are unstable; they may change during

Table 1. Integration types

| Context | Stakeholder perspective | Technical perspective |
|--|--------------------------------------|------------------------------------|
| Integration within development process | (1) Internal stakeholder integration | (2) Internal technical integration |
| Integration with business process and infrastructure | (3) External stakeholder integration | (4) External technical integration |

the project time, due to external pressures or internal shifts of power.

Internal and external integration. Many integration activities are internal to the project, such as managing project teams, programming and testing components. But many integration activities are external to the project; aligning the project with business needs, modeling with future users, using external components and other systems. Thus, the integration process is multidimensional. It includes both stakeholders and technology, and the activities are both internal and external to the project. Thus, four types of integration are suggested in Table 1.

It is documented that integration is usually easier if done step-wise, because it reduces the technical risk and allows both the development project and the business process people to learn (Boehm, 1988; Davenport, 1993). Early user participation has long been established as an important success factor (Garrity & Sanders, 1998). On a more political level, it also enables enrollment of important allies into the project (Hanseth & Monteiro, 1996). Early technical integration secures the integrity of the system; testing is performed in each iteration, and performance issues may also be addressed early (Jacobson et al., 1999). This is recognized in the iterative software engineering frameworks: For each iteration, new stakeholders are drawn into

the project. And for each iteration, a small piece of solution is implemented, either in a test or pilot environment or in real production.

It may sound easy, but it is not. As Giaglis (1999) noted, the problem is not getting acceptance for the need of an iterative and integrative approach, but to actually manage it. The RUP framework was selected for this study as an example of a well-known framework. Therefore, the first step in this research was to assess to which degree RUP supports the IS project manager in his or her integration challenge.

ASSESSING INTEGRATION SUPPORT IN RUP

RUP is a large framework for software engineering developed by Rational Corp. in the late 1990s, building on Jacobson's work at Ericsson (Jacobson et al., 1999). As illustrated in Figure 1, RUP is structured in four phases: inception, elaboration, construction and transition. Within each phase are one or several iterations consisting of disciplines, starting with business modeling and ending with the physical deployment of software components. RUP is both a process framework and a commercial Web-based product. The Web product is RUP online (Rational, 2006a), with 3,700 Web pages describing the principles of RUP

Table 2. Distribution of RUP activities supporting the integration types through RUP phases

| Phase type Integration | Inception | Elaboration | Construction | Transition | Sum |
|--------------------------------------|-----------|-------------|--------------|------------|-----|
| (1) Internal stakeholder integration | 5 | 4 | 4 | 4 | 17 |
| (2) Internal technical integration | 11 | 23 | 23 | 14 | 67 |
| (3) External stakeholder integration | 14 | 5 | 3 | 7 | 29 |
| (4) External technical integration | 3 | 3 | 1 | 4 | 11 |

and providing a rich toolbox of guidelines, risk lists and document templates.

To assess the degree of integration support in RUP, a rather simple but systematic analysis was performed. The basic material was the templates of detailed activity lists provided in RUP online to help the IS project manager to plan the phases of the project. These lists are certainly not sufficient to plan a RUP project, but they give a reasonable picture of the profile of activities in each phase.

The assessment was done as follows: Each activity was classified within the four integration categories presented in Table 1. The resulting distribution of activities is shown in Table 2.

As the table shows, integration support is unevenly distributed. It is quite strong regarding internal technical integration throughout the phases, while it gives surprisingly little external

technical integration support. Internal stakeholder integration is weak throughout the project, confirming, perhaps, the critique against RUP for poor project management support (Henderson-Sellers & Unhelkar, 2000).

Support for external stakeholder integration is strong in the inception phase, but gets weaker in the later phases. A more detailed analysis of these activities shows that RUP gives strong high-level support to external stakeholder integration, but little practical support at the operational level. The same pattern is found regarding external technical integration. This may indicate another limitation in RUP: It endorses step-wise external integration, but little practical support.

**THE CASE STUDY:
DEVELOPING AN E-BUSINESS
SYSTEM FOR AN
INTERNATIONAL AIRLINE**

To investigate the challenges in more depth, a longitudinal case study was designed, studying an IS development project in the airline carrier industry. The research approach was LPR, which aims to study organizational change over time through intensive research in the actual context (Ngwenyama, 1998; Pettigrew, 1985, 1990). LPR focuses on building theories strongly embed-

Figure 1. Structure of RUP (Rational, 2006a)

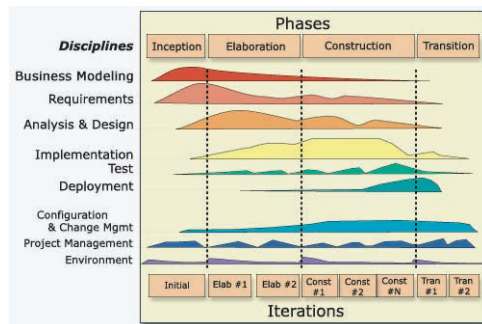


Table 3. Data collection

| Phase/dates | Activities | Stakeholders | Documents |
|------------------------------------|---|--|--|
| Phase 1 Sept. 2001 | Initial meeting with management to agree on objectives and procedures in the study. | Line manager Project managers | Project objectives and plans |
| Phase 2 Nov./Dec. 2001 | Workshop with project and business stakeholders to get the broad picture, followed by separate interviews | Project manager Project group Business users | Status reports Technical and architecture documents |
| Phase 3 Sept./Oct. 2002 | Separate interviews with stakeholders to construct full timeline in project | Project manager Project group Business users | Status reports Project evaluation report |
| Phase 4 Dec. 2002/ Feb. 2003 | Last round of interviews. Validation meeting to confirm and discuss findings. | Line manager Project manager Business users | Case description |

ded in the context of study. Reflecting Giddens' structuration theory (Giddens, 1987), context is seen by Pettigrew not only as an environment, but as "a nested arrangement of structures and processes where the subjective interpretations of actors perceiving, comprehending, learning and remembering help shape the process. The processes are both constrained by context and shape contexts" (Pettigrew, 1990, p. 270).

Important criteria for data collection are, according to Ngwenyama (1998):

- Ongoing engagement with the research site, to observe changes over time
- Participant observation, to contextualize and make sense of observations
- Multiple data sources, to record different interpretations of events and ensure validity of findings

The case, a RUP development project at Scandinavian Airline System (SAS), was researched for 16 months, using several techniques for data collection: Project managers, developers and users were interviewed at four intervals. Project meetings were observed, and a vast amount of project documentation was analyzed.

Data collection was done in four phases, as summarized in Table 3.

Ngwenyama (1998) suggests three modes for data analysis: (1) Comprehensive analysis, which helps to identify underlying structures and patterns of the organizational process; (2) temporal analysis, which helps contextualize findings by placing events and situations in a narrative structure; and (3) member verification, which ensures that the case description and interpretation researcher are considered correct and meaningful to the organizational actors.

The SAS case was analyzed in the following steps: Data was coded following the guidelines of Miles and Huberman (1994). After the videotaped interviews were summarized and registered into an Atlas database, texts were coded with in-vivo

codes, using only domain (project) terms. The large volume of project documentation was coded the same way.

First, a timeline with significant events was produced. Then, each iteration of the project was analyzed in detail, while in parallel looking for repeating patterns. Looking for integration related terms, a new layer of codes were applied: "Technical integration" was mapped to *component integration, testing, interface* and also to *legacy (and other) systems*. "Stakeholder integration" was mapped to *stakeholders, actors, users, customers, organizations* and *vendors*. The integration context was also coded; whether it was *internal* (to project) or *external* (to business process and information infrastructure) integration.

Validating the Case Description

Suggested mechanisms and patterns were validated using criteria suggested by Klein and Myers (1999).

The principle of dialogical reasoning addresses the validity problem of the relationship between the assumptions behind the research design and the actual findings. In the case study, this aspect was important in the coding process described in the previous section. Moving from codes to patterns, systematic attempts were made to construct the opposite pattern and ask whether it could make sense on the same data.

The principle of multiple interpretations calls for sensitivity in interpreting conflicting accounts of the same case. In the case description, special care was taken to analyze instances where data was contradictory; for example, when developers and user representatives had different accounts of what had happened.

The principle of member verification (Ngwenyama, 1998) was implemented as follows: After the initial workshop with important stakeholders, a timeline for the project was constructed. This was sent to participants for verification. After about a year of studying the project, a preliminary

case description was written and commented on by stakeholders. Last was a validation meeting, where project managers, developers and business users were invited to assess and comment on the final case description.

The SAS Content Management Interface (CMI) Project

The case is described from a socio-technical integration perspective, focusing on the stakeholder and technical integration challenges.

SAS is an international airline carrier based in Scandinavia. It is owned by the Swedish, Danish and Norwegian governments (50%) and private investors. In 2003, the SAS group had 34,000 employees, and turnover was 57 billion Swedish krona (SEK).

As a part of the marketing division, SAS established in 1999 the Electronic Direct Channel (EDC), directed at selling airline tickets and hotel reservations on the Internet. The EDC owns the SAS home page, including campaigns and online booking services. Simplified, the e-business process consists of these steps: Marketing air tickets in different national markets on the scandinavian.net Web site, and receiving electronic orders. Feedback mechanisms are Web hits on the home page and actual bookings.

The first generation of the SAS Web site was primarily available in Scandinavia, with content managed by editors using HyperText Markup Language (HTML) and FrontPage as publishing tools. In 2000, acknowledging the commercial potential of Web-based booking, SAS decided to establish a Web-based marketing channel in all important SAS markets, including Europe, Asia and the Americas. To support this new business process, a new content management and publishing solution was needed, and implementation was based on the Vignette platform. A project was initiated, with the following objectives:

- To establish a Web-based marketing channel in all important SAS markets, including Europe, Asia and the Americas.
- To enable the editors to publish materials and campaigns with an easy tool, a CMI.
- To integrate this new system with SAS' (legacy) booking system and the European Amadeus booking system.

In spring 2001, the IS development project was set up by SAS' daughter IT company, Scandinavian Information Group (SIG), with a project group of five: one project manager, one Web designer and three programmers. In parallel, an SAS project group, consisting mainly of marketing editors, was established to provide a strong business and user link with the development group.

Following a corporate decision from 1999, the project was planned within the RUP framework. Each iteration was set up to follow the disciplines in RUP, starting with a revision of requirements; proceeding with design, coding and testing; and ending with an increment, a temporary release, to be validated by users. Also, in accordance with RUP, a stakeholder and risk analysis was done.

The First Two Iterations: Unsuccessful Stakeholder Integration

The initial requirements specification, written by IT personnel at SIG, contained 14 use cases for the CMI application. In two workshops, the two project groups extended the number of use cases into 20 detailed ones. Then they started working on a graphical prototype to visualize the use cases.

The workshops were not very successful, and they were interpreted differently by the actors: The SAS project manager, who was now elaborating the requirements specification, was moderately satisfied:

The workshop in the first iteration was OK because it gave the users an impression of the system. The workshop in the second was useful, but we were not able to show the users how the system would work.

Some of the editors felt alien to the whole concept:

We spoke different languages, and they had no idea how we worked. We were polite, and there was no conflict, but that was how we felt. We thought we might get it straight later on in the process. The use cases were very – theoretical, and it was hard to participate. Also, I was so busy running the existing site that I had no time to spend on this, really. I felt guilty because of that, because I should have given much more input.

Another editor said:

Use cases focused on the new system, not on how things were solved today. Development was system oriented, not on the work process.

The developers later said:

Of course, the graphical prototype should have been a full architectural prototype – but this was not possible, because the presentation engine component was not ready. In addition, the editors did not really prioritize the workshops.

Not surprisingly, the results were unsatisfying. Nobody felt that the graphical prototype was useful. The presentation engine component, which was crucial for creating a page, was developed in another project in Copenhagen, and it was seriously delayed. Thus, by the end of the elaboration phase, the two main goals were not reached: The users and developers did not have a unified view of the system, and the architecture of the system was not stable. The situation was analyzed and the risks were assessed by the customer and the

project managers. Because of time pressures, they decided to proceed, and took care to prepare as much as possible to integrate the missing component later.

Iterations Three and Four: Successful Internal Technical Integration

No code had been produced in the first two iterations. In the third iteration, the project group got a better grip on the technology, and started to work more closely with the SAS project manager, who was now sitting in the same room. This iteration produced the basic CMI functionality, enabling the CMI users to upload content to the content database.

In the fourth iteration, the first release of the presentation component arrived, and the crucial functionality for creating pages was developed. In a few intense and informal work sessions, a design was developed as the application was prototyped. Commented one of the developers:

When the SAS project manager really joined the team, the whole atmosphere changed. We were able to experiment with screens and solutions at a practical level. Also, it was important that he really understood the technical difficulties involved. We were sitting long hours together, solving real problems. It was very productive and also great fun!

Test cases were also produced, and at this time the project group felt things were on the right track. While the user group was not involved, the SAS project manager communicated frequently with the editors, assuring them that the project was on track.

After the start of the fourth iteration, the September 11, 2001 terrorist attacks in the United States (U.S.) shook the whole airline industry, and as a result of this, combined with a tight project deadline, the project was scaled down. Only 10

of the initial 20 use cases would be developed. By the end of November, the user group started testing the system. Towards the end of the iteration, the SIG project manager went on maternity leave, and the SAS project manager was made in charge of the whole project.

Iteration 5: Improvised Integration

So far, the project had proceeded more or less as planned. But now a different phase started, which was not characterized by planned iterations but rather by problem solving and improvisations. The project manager commented:

At a certain point in a project the focus changes: Budget and plans are no longer the main consideration, and everything is focused on getting the product finished.

There were two reasons for this. First, the project experienced external technical integration problems. In the fourth iteration, the project waited for the completion of two important software components that were programmed by another SIG project in Copenhagen. Both were seriously delayed and not stable until spring 2002. There were also other technical problems. SIG had four different technical environments: Development, integration testing, production testing and production. In this case, the test environments did not fully support the CMI, and intermediary solutions had to be made. Complicating matters even more, a memory leak occurred, which took a long time to identify and fix. These problems made testing more difficult. Second, after beta testing had started, there were a rising number of change requests from the user group, and changes were introduced frequently during spring 2002. One of the editors said:

From the end of February, we started testing at our workplace. At that time I had no mental picture of the whole systems, only fragments. In March, when we started to load real data, I was able to

understand the workings of the system. Until then, it was like looking at the system through a pair of binoculars.

As the editors got more experience, the number of change requests increased. Said the Oslo editors:

The period around the start of the system we sat together with the developers and really understood the whole system. This was great, and the first time we really could give real input.

In March, there was a 2-day course in Stockholm for all the editors, at that time numbering around 30. Most of them were introduced to the system, and in spite of technical stability problems and long response time due to slow interfaces (APIs) in the Vignette platform, the course was perceived by the EDC and CMI project as rather successful for most of the editors. A few of them were less motivated, and lacked the basic IT user skills. After the course, the editors went home and started to load materials into a test database, which was later set into production. In this period, the CMI project worked hard with error corrections and use case change orders. The project manager said:

Many new features were wanted from editors, both Scandinavian and the others, especially navigation features tightly connected to their work processes, page search and design. We were surprised by the volume of change orders.

Results

Everything was set into production May 30, 2002, and has been in stable production since. The three goals of the project were achieved: a Web-based marketing channel in all SAS markets was established; the marketing editors in this organization had access to an easy-to-use tool to tailor the marketing and selling of SAS services

Table 4. The managerial challenges of integration

| Integration type | Managerial challenge | Support in RUP |
|----------------------------------|---|--|
| Internal technical integration | Step-wise internal integration of components needs careful planning and competent execution. | <i>This is well supported in RUP and in traditional project management techniques.</i> |
| Internal stakeholder integration | Step-wise integration of project team members calls for sensitivity, especially in relation to user representatives. | <i>This is partly supported in RUP.</i> |
| External technical integration | Integrating to the technical infrastructure is outside the direct control of the project manager. It calls for careful planning and risk management, but also for improvisations. | <i>RUP gives some high-level support, but not at the operational level.</i> |
| External stakeholder integration | Integrating to the business process is also outside the direct control of the project manager. It calls for planning and risk management, but also for political skills and improvisations. | <i>RUP gives some high-level support, but not at the operational level.</i> |

to their local markets; and the Web pages were integrated with the booking systems, enabling customers to buy tickets online. However, during the first 6 months of production, there were still a large number of change requests from the marketing editors.

The case study highlights a number of managerial challenges associated with integration. These will be discussed in the next section.

DISCUSSION

This section first discusses the findings of the case study, in terms of managerial challenges of integration. Then some implications for practice and research are proposed. Finally, some limitations of the findings are assessed.

Managerial Challenges of Integration

The findings of the case study are discussed within the framework of the four integration types (presented in Table 1). They will also be related to the analysis of integration support in RUP presented in an earlier section.

In the described case, integration is seen as a *process*. It was partly or fully achieved through different managerial interventions, supported by the iterative and incremental structure of RUP. The managerial challenges associated with the four integration types are discussed below and summarized in Table 4.

Internal Technical Integration

This aspect was, after some initial problems, solved very nicely in iterations three and four. The CMI system was built incrementally and controlled, utilizing the rich mechanisms in RUP for step-wise integration and testing.

Findings: For the technically competent project manager, a software engineering framework such as RUP provides sufficient support for step-wise and controlled technical integration.

Internal Stakeholder Integration

At the start of the CMI project, the most central users in the business process, the Scandinavian editors, were drawn into the project and given a central role in the workshops. The workshops in

iterations 1 and 2 were not successful, mainly because the project managers failed to convince the editors of the need for a new system. The project group responded to this with a certain degree of isolation, establishing a close team with the SAS project manager, who “changed sides”; that is, who identified more with the project than with the business process.

The progress of software development benefited very much from this cooperation. However, when the number of change requests increased in the later parts of the project, it was an indication that the iterative approach was not working optimally regarding user requirements.

Findings: Iterative IS development projects are not based on a frozen requirements specification, but rely on a step-wise interaction with business representatives through the iterations. Thus, it is critical to align project goals with business and user goals even after the initial top-down analysis. RUP does not give sufficient support for this task, as shown earlier.

External Technical Integration

The CMI project suffered from being dependent on components that were delayed. Thus, while skillfully planned, the step-wise technical integration was not working properly. Instead, the external integration problems appeared at a time when the editors tried to integrate the system into their organization, and it threatened the whole implementation.

The main technical problems arose from the fact that the development environment, and also the test environment, was configured differently from the production environment. In the test phase, this led to a series of small but important problems of instability. In the production phase, it led to the cache problem. As the project was designed, this kind of risk was hard to avoid, because a test environment mirroring a changing production environment would have been exceedingly expensive. In the end, the problem

was gradually solved by a competent data center, using problem-solving techniques, and not a structured development process.

Findings: Integrating with a large, existing information infrastructure calls for careful planning, but also for improvisations. Often, the infrastructure is subject to change during the project, and it is therefore impossible to integrate in a step-wise manner. Obviously, the project manager has to comply and adjust to these changes, whether or not they were planned. This aspect is underrated in RUP.

External Stakeholder Integration

The main target group for the CMI specification was the international editors, who needed a standardized and simple interface. Unfortunately, during the first four iterations they were not yet appointed, and could not participate. Thus, the continuous change of the business process made step-wise stakeholder integration unfeasible.

On the other hand, the international stakeholders were successfully enrolled in the project from March 2002, and during the busy, and partly improvised, period towards the production date, most of their requirements were satisfied. It should be noted, however, that during the first 6 months of production, there were still a large number of change requests, indicating that important business needs were not covered in the specification. It should also be noted that the late integration of stakeholders was done by improvisation.

Findings: Integrating with the business process calls for political skills and improvisations. Political skills are needed to build the alliances that make the solution work. Improvisations are necessary to integrate with an unstable process.

Of course, it is unreasonable to blame RUP for the late integration problems in the CMI project. But the “extended iteration” in the project, where the structured method gave little support and the project manager resorted to improvisation and problem solving, also indicates that this challenge is underrated.

Summing up: IS development in a complex and unstable technical and business environment, as illustrated in the SAS case, highlights the need for step-wise socio-technical integration.

Iterative IS development has an interesting potential to support this challenge, because the iterative structure allows for step-wise learning and incremental improvement. It also, to a certain degree, acknowledges the emergent nature of socio-technical interaction. However, in its present condition, RUP is too heavily influenced by its purely technical inheritance to give sufficient support to the full range of interaction challenges.

Implications for Practice

The CMI case highlights an important insight for practitioners: The integration challenge of iterative software development projects is larger and more complex than is described in the research and text book literature. Even the very competent CMI team experienced serious problems with external integration. For practitioners, this is an important factor in risk management: To succeed, the project manager must manage something that is basically outside his or her control.

The root of this risk is the fact that both the business process and information infrastructure are unstable in most enterprises. As illustrated in the CMI case, the focus in a development project may change considerably over time, making it hard to plan in detail. And changes in the business process and information infrastructure should be treated as a normal feature, not as an unexpected incident. For the project manager of iterative projects, this aspect also presents opportunities, but in a world of tight schedules and budgets, the external technical and stakeholder integration is a significant risk.

For the IS project manager, this implies that risk management focusing particularly on external integration—is as important as internal planning and control.

Implications for Research

At a general level, these risks are acknowledged in the IS development research (Avison & Fitzgerald, 2003) and in iterative software engineering frameworks (Jacobson et al., 1999; Stapleton, 2003).

However, as illustrated in the the SAS case, these risks are not appendices in handling a primarily technical task; on the contrary, they constitute a significant threat to the success of such projects. As the RUP analysis in the earlier section shows, the support in RUP is not sufficient to handle this challenge, in spite of some minor contributions (e.g., Kruchten, 2003).

Thus, on a practical level, RUP needs stronger support for external stakeholder and technical integration; in particular, in the construction and transition phases. In practice, this means emphasizing the external component/legacy system issues in the architecture description, and supplementing risk lists, iteration plans and task descriptions with activities that address business process stakeholder issues more explicitly. At the same time, it should be acknowledged in the RUP guidelines that the external integration cannot be planned in detail.

Planning and Improvising

External technical and stakeholder integration were seen to depend on both planning and improvisations to succeed. Finding that improvisations are important in change processes is congruent with the emergent view on organizations and with other related IS research (Ciborra, 1997, 2000; Ngwenyama, 1998; Orlikowski, 1996). However, it should not lead us to conclude that better planning is unnecessary or impossible. As the CMI case shows, improvisation puts a lot of pressure on a project manager, and introduces more risk into the project. The strength of an iterative software engineering framework is to reduce that risk, through step-wise integration. Thus, it is important to extend the capabilities

of RUP and other frameworks, to include better external integration.

Limitations

Limitations to the findings presented in this paper derive from the research approach. LPR is aimed at developing contextualized theory (Pettigrew, 1985). This suggests that the area of validity is the context of a large organization with an iterative IS development process in a setting of unstable business processes and a complex technical infrastructure.

CONCLUSION

The objective of this study was to understand the integration challenge in modern iterative IS development projects. Two questions were asked:

1. How can the IS project manager integrate the new information system with the business process and the information infrastructure?
2. What integration support is there in the software engineering frameworks, like RUP?

Integration was defined in a socio-technical perspective, and four types were suggested: external and internal stakeholder integration, and internal and external technical integration. A longitudinal case study of an IS development project in the airline industry identified and highlighted some managerial challenges of integration. Findings include:

- Internal technical and (to some extent) internal stakeholder integration is well supported by traditional project management techniques and software engineering frameworks such as RUP. The iterative approach enables a step-wise and controlled internal socio-technical integration.

- However, the challenges of *external* stakeholder and technical integration is underrated in IS development research. Integrating a new system with an unstable business process and a large, existing information infrastructure calls for careful planning, but also for improvisations, since it is outside the direct control of the IS project manager. This is not well supported in RUP.

These challenges are suggested to constitute a significant risk for the success of modern iterative IS development projects. For IS project managers, the implications are that risk management of external integration is an important part of iterative project management. For software engineering research—in particular for RUP—the findings indicate a strong need to provide stronger support for external stakeholder and technical integration; in particular, in the construction and transition phases.

Further research could study other iterative projects and look closer into which integration patterns emerge. One might also investigate new models for how IS project managers may contribute more actively to align the development projects and the business innovation, as recently done by Boehm by the introduction of *value-based software engineering* (Boehm, 2003). This is an area well suited for cooperation between researchers and practitioners.

ACKNOWLEDGMENTS

I am indebted to the different stakeholders of the SAS project, in particular Christian Mejlvang, Jorun Akerberg and Gunilla Johansson, for access to the project and for commenting on various versions of the case description. Further, the comments from the anonymous reviewers of the *International Journal of Technology and Human Interaction* were very helpful. Thanks also to the following scholars and practitioners for comments:

Peter Axel Nielsen, Bjørn Erik Munkvold, Henning Denstad and Cecilia Haskins.

NOTE

An earlier and shorter version of this paper was presented at the 37th Annual Hawaii International Conference on System Sciences, January 5-8, 2004, Big Island, Hawaii.

REFERENCES

- Avison, D., & Fitzgerald, G. (2003). *Information systems development: Methodologies, techniques and tools*. London: McGraw-Hill.
- Beck, K. (2000). *Extreme programming explained: Embrace change*. Boston: Addison-Wesley.
- Blomberg, J. (2001). Using the RUP for enterprise e-business transformation. *The Rational Edge*. Retrieved January, 2005, from www-106.ibm.com/developerworks/rational/library/content/RationalEdge/jan01/UsingtheRUPforEnterpriseBusinessTransformationJan01.pdf
- Boehm, B. W. (1988). A spiral model of software development and enhancement. *IEEE Computer*, 21(5), 61-72.
- Boehm, B. W. (2003). Value-based software engineering. *ACM SIGSOFT Software Engineering Notes*, 28(2), 1-12.
- Ciborra, C. (1997). De profundis? Deconstructing the concept of strategic alignment. *Scandinavian Journal of Information Systems*, 9(1), 67-82.
- Ciborra, C. (2000). *From control to drift*. Oxford: Oxford University Press.
- Coakes, E., & Elliman, T. (1999). Focus issue on legacy information systems and business process engineering: The role of stakeholders in managing change. *Communications of the AIS*, 2(4).
- Davenport, T. H. (1993). *Process innovation*. Boston: Ernst & Young.
- Garrety, K., Robertson, P. L. & Badham, R. (2004). Integrating communities of practice in technology development projects. *International Journal of Project Management*, 22(5), 351-358.
- Garrity, E. J. & Sanders, G. L. (1998). *Information systems success measurement*. Hershey, PA: Idea Group Publishing.
- Giaglis, G. (1999). On the integrated design and evaluation of business process and information systems. *Communications of the AIS*, 2(1), 1-33.
- Giddens, A. (1987). *The constitution of society*. Cambridge: Polity Press.
- Hanseth, O. (2002). *From systems and tools to networks and infrastructures. Toward a theory of ICT solutions and its design methodology implications*. Retrieved January, 2005, from http://heim.ifi.uio.no/~oleha/Publications/ib_ISR_3rd_re-subm2.html
- Hanseth, O., & Lyytinen, K. (2004). Theorizing about the design of information infrastructures: Design kernel theories and principles. *Sprouts: Working Papers on Information Environments, Systems and Organizations*, 4(Fall 2004), Article 1.
- Hanseth, O., & Monteiro, E. (1996). Inscribing behaviour in information infrastructure standards. *Accounting, Management and Information Systems*, 7(4), 183-211.
- Henderson-Sellers, B., & Unhelkar, B. (2000). *Open modelling with UML*. Harlow: Addison-Wesley Longman.
- Heugens, P., van den Bosch, F. & van Riel, C. B. M. (2002). Stakeholder integration: Building mutually enforcing relationships. *Business & Society*, 41(1), 36-60.

- Jacobson, I., Booch, G., & Rumbaugh, R. (1999). *The unified software development process* (1st ed.). Reading: Addison Wesley.
- Kling, R. & Scacchi. (1982). The Web of computing: Computer technology as social organization. *Advances in Computers*, 21, 1-90.
- Kruchten, P. (2000). *The rational unified process*. Reading: Addison Wesley Longman.
- Kruchten, P. (2003). *Using RUP to evolve a legacy system*. Retrieved January, 2005, from www-106.ibm.com/developerworks/rational/library/389.html
- Larman, C., & Basili, V. R. (2003). Iterative and incremental development: A brief history. *IEEE Computer*, 36(6), 47-56.
- Laudon, C. K. & Laudon, J. P. (2004). *Management information systems*. Upper Saddle River: Pearson Education.
- Miles, M. B. & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Mumford, E. (1985). *Sociotechnical systems design*. Manchester: Manchester Business School.
- Ngwenyama, O. (1998). Groupware, social action and emergent organizations: On the process dynamics of computer mediated distributed work. *Accounting, Management and Information Technologies*, 8(2-3), 127-146.
- Orlikowski, W. (1996). Improvising organizational transformation over time: A situated change perspective. *Information Systems Research*, 7(1), 63-92.
- Pettigrew, A. M. (1985). Contextual research and the study of organizational change processes. In E. Mumford, R. Hirschheim, G. Fitzgerald, & A.T. Wood-Harper (Eds.), *Research methods in information systems* (pp. 53-78). North-Holland, Amsterdam.
- Pettigrew, A. M. (1990). Longitudinal field research on change theory and practice. *Organization Science*, 3, 267-292.
- Rational. (2006a). *Rup online*. Retrieved June 30, 2006 from, www-306.ibm.com/software/awd-tools/rup/
- Rational. (2006b). *Case studies*. Retrieved June 30, 2006, from <http://programs.rational.com/success/>
- Smolander, K. (2003). *The birth of an e-business system architecture: Conflicts, compromises, and gaps in methods*. Paper presented at the 36th Hawaii International Conference on System Sciences, Big Island, HI.
- Stapleton, J. (2003). *D SDM: Business focused development*. Harlow: Addison-Wesley.
- Walsham, G. (1997). Actor-network theory and IS research: Current status and future prospects. In A.S. Leem J. Liegnenau, & J.I. DeGross (Eds.), *Information systems and qualitative research* (pp. 466-480). London: Chapman & Hall.
- Webster's. (1986). *Webster's third new international dictionary*. Chicago: Encyclopedia Britannica.

This work was previously published in International Journal of Technology and Human Interaction, Vol. 2, Issue 4, edited by B.C. Stahl, pp. 1-16, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.12

Several Simple Shared Stable Decision Premises for Technochange

Richard Diamond

University of East Anglia, UK

ABSTRACT

This study explores decision premises that were used to manage and stabilise a complex technochange programme in a financial institution. Decision premises were extracted from business maxims, principles and rules using linguistic techniques. In the paper, the premises are juxtaposed with their consequences. The evidence of documents, observable practices and software configurations supports the analysis. It is found that decision premises form a hierarchical, self-causal as well as self-contradictory system of reasoning that was applied over any individual situation, particularly a conflict. By virtue of being several but not many, decision premises reinforce the 80-20 rule of many consequences stemming a few causes. In the case firm, decision premises were used in order to make technochange efficient as well as institute cost-saving and business

ownership of software development. But there were drawbacks of intensified politics, software development delays, short-sighted capability decisions and work fragmentation for the front-line employees.

INTRODUCTION: DECISION PREMISES AND IT MANAGEMENT

In organisations, many decisions and processes are based upon premises that go without question. Everyone is familiar with decisions, which appear irrelevant or inefficient at the moment, but turn out to be wise. The wisdom, in part, is about the benefit of continuity. Good decisions are typically made within a system of premises, be it an explicit corporate strategy or not-so-obvious top managers' beliefs about how to run a business. A list of

beliefs can be short and simple, but they usually comprise a densely connected system with certain hierarchical relations between beliefs.

Having the benefit of hindsight, after the exploration of top managers' decision premises, I propose that their disregard of circumstances and workplace issues is an outcome of dynamics rather than intention. Critical management researchers observed that organisational growth does not provide opportunities to improve the contemporary workplace that is characterised as tense and fragmented (Marchington, Grimshaw, Rubery & Willmott, 2005). Organisation behaviour researchers observed the self-contradictory expression and double-bind of middle management's position, as managers needed to demonstrate sympathy and make necessary changes at the same time (Huy, 2002).

What makes it harder to make good decisions is a degree of lock-in that occurs in complex projects of technology implementation, because 'small' decisions mount up and make future changes expensive. Also, organisation-wide implementation of information systems or any other high technology is inseparable from change in business processes, culture, and strategy. In order to conceptualise this, Lynne Marcus (2004) introduced the idea of *technochange*. Central to technochange are the ideas of interdependence and diversity of initiatives and outcomes. In highly interdependent circumstances of technochange, it is difficult to either forecast the results of individual decisions or follow a logical and elaborate strategy. It is also difficult to forecast how much of resources will be spent, committed, or gained. Scientific and operational research methods provide only limited assistance in such forecasting. Therefore, a study of 'primitive' but practical ways of complexity managements of operations would be a contribution. This article makes an initial step towards the objective. It utilises understandings of applied linguistics and coaching practice in order to identify a system of decision premises

as 'a map of the world,' within which managers make decisions in technochange projects.

DEFINITION AND DYNAMICS

The term 'decision premises' was introduced by March and Simon (1958). Other names were 'business maxims,' interpretative schemes, and cognitive maps. I consider three dimensions to a definition of decision premises that shed light on how decision premises operate. The dimensions are presuppositions, frames, and beliefs.

Presupposition is an implication of a statement that remains logically true, whether or not the statement itself is true (Bandler & Grinder, 1975). For example, a business process might or might not have an owner, but it is presupposed that there is ownership. For another example, a decision might be made to fix a flaw in software because it will save future costs, or the same flaw can be left based on the same premise of the necessity of making the most economical decisions about costly IT.

An epistemologist would say that every activity or communication is made within a frame that defines its meaning (Bateson, 1972). Alternatively, meaning of a communication can derive from its context and surrounding communications. Frames are a construct of a higher logical order. For example, the frame of a strategy-away day is different from the frame of a board meeting. The term 'technochange' is a frame itself as it regulates broader consequences than the term 'software update' would.

Term 'decision premises' presupposes, literally, that decision premises do not exist in isolation. Typically, there are several, but not many, decision premises and they form a system with its own self-developing (sometimes self-referential) logic. Therefore, personal development literature talks about 'belief systems' and 'value systems.' In this study, beliefs are treated as something that

is either described by managers or observed in behaviour, documents, or decisions. Therefore, a clear boundary is set in order to prevent psychodynamic and psychoanalytical interpretations. With these brief definitions at hand, we only highlight the linkages between decision premises and the dynamics of human values.

Operation Out of Stable Decision Premises

Decision premises about 'how to manage' are generalised from rich experience and ongoing evidence. But when such a generalisation is formed, it is applied *over* any individual situation. Thus, decision premises are oriented towards process and structure, rather than content.

Decision making occurs within 'a model of the world' that is only a model. In order to raise awareness about this, Gregory Bateson (1972) points out that 'the map is not the territory.' Hence, the value of a belief system is not in being true but in providing guidance. It is *useful* to operate out of certain beliefs in order to get things done, even and especially if actual circumstances are not favourable. Under complexity and uncertainty, humans naturally and gainfully adhere to their familiar beliefs (Weick & Sutcliffe, 2001). This strategy also helps to economise on information processing and avoid information overload.

In the world of business, talented, highly paid and irreplaceable consultants and CEOs are those who internalised a good system of decision premises that, in turn, facilitates core competencies (Miles, 1982; Prahalad & Hamel, 1990). Such value systems are hard to imitate and replicate. The mental habits of holding a vision and treating decision premises as always-true presuppositions make their impact on reality strong, enduring, and observable. Thus, for talented managers 'territory is the map;' they utilise technology, people, and organisational resources in their attempts and achievements of change of reality.

RESEARCH METHODOLOGY

Search for Decision Premises

The article is based on a longitudinal empirical case study of a retail bank, referred to as *Alpha*. A breadth of data was collected about Alpha's IT and business operations. Generic data was collected about the company's strategy formation (e.g., balanced scorecard, structure of top management, and steering committees). Some decision premises are simply repeated with high frequency in such data. To check the actual consequences of decision premises, interviews with top managers were juxtaposed with documents and observations made at banking branches. Detailed data about computer systems was collected including printouts of screens, software specifications and instructions, and drawings of the corporate IT infrastructure. However, technical information told relatively little about decision premises of technology management, which characterises value-based dynamics of decision premises, rather than circumstance-based.

It was interesting to explore implementation and distortion of decision premises in practice, in other words, to compare 'what they say' to 'what it means' in terms of observable consequences. Gathering data about 'what they say' included interviews with top managers and application of linguistic and behavioural techniques. Gathering data about 'what it means' included documentary analysis and interviews with people at the lower organisational levels, specifically, professional contractors and workers at the front-line of customer services and software development.

Along with typical research methods of qualitative enquiry described above, three specific techniques were used in order to identify and confirm decision premises. (1) Linguistic search for presuppositions was based on reverse scenario questions (e.g., what if the situation is precisely the reverse) (Bandler & Grinder, 1975). (2) Literalism of the definition of 'several simple shared stable

Several Simple Shared Stable Decision Premises for Technochange

decision premises' directed the search towards simple language forms and phrases that were shared by the most people. (3) Behavioural signals of value activation and personal significance were observed (Andreas, 2002).

The interviews, especially ones with executive and top IT managers, provided the most input to the study of decision premises. 27 semistructured interviews were conducted; an average interview continued for one-and-a-half hour. Interview schedule is presented in Table 1. The people from all business functions were interviewed. Particularly interesting exchanges happened with the Alpha's Associate Director of Risk & Compliance and Associate Director of IT Support & Infrastructure. Overall, the selection of interview-

ees was defined by the *network traversal* of task and other interdependencies that were explored well beyond the formal authority hierarchy. The network traversal method involves exhaustive and sometime repetitive exploration of all task relations named by an interviewee. In order to keep track of interdependencies, Protégé software was used. The dataset allowed dynamic interaction; that is, the researcher interacted with the dataset on his laptop and asked questions about presence and details of interdependence in question. The visual representation plug-ins of the software allowed quick identification of the individuals who were in key positions in relation to a particular issue or business process, thus making network traversal intelligent.

Table 1. Alpha case: Interviews

| Role | Amount |
|---|---|
| Operations and IT Director, Technochange Project Co-Director | 3 |
| Business Change Director, Technochange Project Co-Director | 4 (1 in Jan, 1 in March, 2 in May) |
| Project Manager (long-term professional contractor) | 1 |
| Project Analyst (Project Office) | 1 |
| Associate Director for IT Infrastructure | 1 |
| Design Authority Team Leader (systems specification) | 1 |
| Assistant to Operations and IT Director | 1 |
| Business Operations Support Function Leader and liaison between branch (sales) and centralised customer services (operations) | 3 (1 in April and 2 in May along with time spent in branch visits) |
| Training and Communications Team Leader (consultant) | 3 (1 in April, 1 in May and 1 in June) |
| ACE Team Leader | 1 |
| Associate Director for IS Development | 1 |
| IT professional (SOS Division) | 1 |
| Delivery and Acceptance Team Leader | 1 |
| Associate Director for Compliance and Operational Risk | 1 |
| Financial Officer (liaising AlphaCoreIS project) | 1 |
| Various branch staff | 3 plus one-off questions, observation and hearing to situations at work (day) 2 (Branch Manager, Branch Associate) |
| Total: | 27 |

Several Simple Shared Stable Decision Premises for Technochange

Social encounters also provided a valuable opportunity for data interrogation (e.g., with unprepared replies). Under a condition of limited access to financial and operational plans, social encounters were particularly helpful in gaining information that was not recorded formally, but one would expect it to be so. Such information concerns long-lasting IT issues, prioritisation of IT tasks, and real options of the technochange.

Case Study Vignette

Alpha is a top U.K. building society. After three acquisitions in early 2000s, Alpha now operates

a network of more than three hundred branches. With its developed brand, Alpha pursues ‘a branch-led blended distribution strategy’ and focuses on mortgages and savings. In the summer of 2000, Alpha completed its IT strategy review and a five-year corporate strategic plan. The main result was a decision to purchase the new banking systems as an integrated package. The International Comprehensive Banking Systems (ICBS) software was purchased for £17 million. The strategic change concerned IT infrastructure, customer services, back office, risk management, and regulatory compliance. The project was publicised and given a clear priority against other projects.

Table 2. Several stable shared simple decision premises for technochange

| ‘What they say’: surface language structure | ‘What it means’: political uses and observable implications |
|--|---|
| Technochange Management (business processes and software development) | |
| (1) ‘Business change first’ | Considerable business change is necessary in order to succeed in technochange, but IT professionals exploit the idea in order to pursue technological solutions that are easier to maintain |
| (2) ‘It is easier to change business processes rather than software.’ ‘Adjust business processes to IT solutions’ | Organising and structuring <i>around</i> information systems. Decisions about IS made difficult and institutionalised (e.g., checked against ‘how is it done elsewhere?’) |
| (3) ‘It is OK for business process to have caveats.’ This was used in sign-off procedures | Commitment is necessary in order to make operations managers to sign up to work with new software and processes |
| (4) ‘Each business process should have an owner’ (5) ‘Business ownership of software development’ | A personalised owner is assigned to each business process and can resign only if another owner is found Business functions are responsible for their software development But the IT function retains control over releasing software in ‘the production mode’ |
| (6) ‘Brokerage of acceptable business solutions, and quality of the relationships with vendors’ are responsibilities of top managers | Practices of championship and sponsorship were expected from top management for mustering political support and securing necessary commitment. Assignment of certain tasks to top-managers directly creates ‘ambidexterity’ and benefits IT professionals |
| Technochange Economics | |
| (7) ‘Change in practices is cheaper than change in IT solutions.’ | Implications for work organisation were increased workload, disturbance, and stress for the front-line workers |
| (8) ‘IT department is committed to providing an efficient and cost effective service.’ | As economic beliefs begin to govern IS strategy and delivery, the politics of IT support thrives on economics |
| (9) Institutional criteria for software selection, for example, ‘Where else is the software installed?’ | Purposefully simple and institutionalised criteria for selection of software and complex IT solutions |
| Complexity Management (rules for interdependence and trade-offs) | |

continued on following page

Table 2. continued

| | |
|--|---|
| (10) 'Process orientation' (11) 'No key-man dependence' | Interdependence within the overall organisation increases |
| (12) 'Processing of operations that require expert knowledge should be centralised.' The sorting of knowledge-intensive and labour-intensive operations | Risk-averse decision of avoiding investment into the high-turnover branch workforce. Removal of capability (e.g., knowledge and know-how of software use) from end-users in banking branches. New professional groups and ambidextrous organisational forms (e.g., Business Operations Support and software rules team) |
| (13) 'Queue management' | Acceptable queue levels were defined as policy and constitute main efficiency criteria around which work was organised in retail branches and the call centre both |
| (14) 'Cultural change from service to sales' | Cultural management of complexity perceptions, which resulted in appraisal schemes, tension and 25% turnover |

ANALYSIS AND EXAMPLES OF DECISION PREMISES IN IT MANAGEMENT

The result of the analysis of the decision premises are presented in Table 2. They formed clusters or shared themes of technochange management, economising on IT-operations, and complexity management. The first two set priorities and the third set process rules. Technochange management resembled commonplace ideas about business process re-engineering. Complexity management was not articulated but regulated quite specific parameters (e.g., team size, difference between) using intuitive rules, such as 'no key-man dependence.'

Decision premises had a systemic organisation. There were at least three kinds of connection, specifically, *repetition-embeddedness*, *cause-effect*, and *contradiction*. Let us provide some illustrations. The premises (2) and (7) are repetitive about the core idea of adjustment of business processes and work practices to IT solutions. The premises (2) and (7) altogether causally support the premise (9); that is, application of simplistic institutional criteria. The premise (5) about the separation of work on software development and

IT infrastructure is a specific version of a general complexity management rule (12) about separation of knowledge-intense and labour-intense operations. In other words, the premise (5) is embedded in (12). The contradiction is also a necessary element of a system of values. For example, the premise (1) 'business change first' contracts the premises (2), (7), and (8) that advise of the most economic IT solutions and adjustment of business to those solutions.

Now, we will provide several quotes from documents and interviews that illustrate the actual implications of decision premises.

Cost-Saving

Cost-saving was constantly emphasised in IT policy documents and interviews of IT top managers. As a consequence of sharp categorisation, more than two thirds of IT task requests were rejected or put on hold with resolutions 'good, will wait' or 'we will return when resources are in place' (Associate Director IT Support).

'The IT department is committed to providing an efficient and cost effective service to its customers' (IT Service Level Objectives Agreement).

[Category of IT Task Request] B – Highly desirable (i.e., the work has a demonstrable short term payback). (Project Methodology: IT Task Request)

Business Ownership of Software Development

Decision premises prescribed that a manager of a suitable business function should take responsibility for adjustment of software functionality as necessary. This led to the separation of IT support and software development work as described in Table 3. ‘Business ownership’ shifted responsibility from IT professionals to business managers, but the need of an active involvement of IT specialists did not disappear. In the onion-like IT infrastructure, a ‘small’ change in software might require further changes on the various levels of database design, client-server middleware, operation systems, and network configuration that, in turn, might require changes in hardware and telecommunications. These technical changes were not facilitated by the fact that IT professionals prioritised technology and business-as-usual over software development and technochange.

Priorities are clear: telecommunications, banking branches, new software project. (Associate Director IT Support)

As a result, the second-order effect of cost-saving decision premises was not as cost-saving.

The practice of business ownership satisfied the decision premises of IT economising but caused considerable delays of the in-house software development—that is, delays of delivery of much needed business functionality.

Things take a lot longer...2-5 months delays in in-house software development became normal. (Team Leader of Systems Development).

How much does it take for IT people to deliver computer environments? Is it a tricky question? In practice to prepare some small database on customers, it took a week to communicate and prepare. Such work is supposed to be one-off. Communication back and forth on computer configuration [with SOS Division] is generally an issue for struggle. (Team Leader for developing marketing campaigns functionality).

Table 3. Practice of ‘business ownership for software development’

| Tasks charged to business functions | Tasks cannot be done without IT teams |
|---|--|
| Specification of business needs into software requirements, a job of business analyst. | Most operations with software development required assistance by the specialised teams of Systems Operation Support (SOS) Division. |
| In-house programming and adjustment of third-party software. Provision of management information and customised documentation (e.g., letters to customers). | The typical of such operations area bout helping with software development tools, dataset preparation in a corporate DB/2 database and computer environment preparation. |
| Configuration of International Comprehensive Banking Systems (e.g., branch information and product information). | SOS Division retained the right of release of software into ‘production mode’ in which the software is expected to run at the agreed level of stability. |
| Support of software-in-use, such as preparation of instructions and ongoing in-house training. | |

Logic of Systems

Even if business functioning was aligned by decision premises, every software had its own 'built-in' logic. Workarounds and the sheer complexity of such logic can override decision premises. The logic manifested itself in about 30,000 specialised and interlinked parameters of the International Comprehensive Banking Systems software that was used by Alpha.

There are experts in certain business areas, but even they tend to forget the meaning of parameters they use... effects could be unpredictable, difficult and timely to resolve and ramify. ... There are 29 products and large number of parameterised rules for each one. There is a clear issue to maintain rules, we do not understand all the rules' meaning and consequences. To discover the right setting of one parameter for product maturity took 7 days. (Business Change Director)

DISCUSSION. IMPACT OF DECISION PREMISES

Irregularities of IT Management

People do hide issues. (IT and Operations Director)

This was perhaps the major reason for having decision premises in the first place. The Directors of Alpha acknowledged 'managerial problems' of the large federalised IT-operations function. IT professionals arranged their work organisation with hidden, amorphous, and ambidextrous structures, all underlined by high interdependence. Prioritisation of tasks by IT professionals was far from clear. IT professionals were also exploiting 'the strategic use of information' (Pfeffer, 1992), such as interpretation from an advantageous viewpoint, selective presentation, and creating an appearance of rationality and success with regular presentations to end-users that were held

in executive suits. In their dealing with end-users, IT managers relied upon *frequent communication* and *enforcement of policy* in order to stabilise technology usages and secure operations within certain boundaries of reliability. The decision premises of economising guided the preference of enforcement of policy rather than configuration of complicated software—the first one is deemed as quicker and cheaper. Alpha's policies were framed in the language that *limited IT service delivery levels, provided rules to refuse or postpone task requests, formalised and limited definitions of faults, as well as outlined responsibilities of end-users.*

The decision premises overall and particularly (9) and (5) served the interest of IT professionals who limited their own responsibility but retained control. They also made IT support less accessible. Getting new functionality or new form of reporting delivered or getting an issue to the top management's agenda became burdensome and political activities.

The dynamics of decision premises also questions the productivity of *hybrid managers*, an approach that suggests a transfer of business managers to IT projects (Earl, 1989). The transferred managers in Alpha ended up being constrained by budgets, scarcity of qualified IT human resources, and project schedules even more than IT managers, because they were lacking background, professional affiliation, and support from the core IT staff who retained control over infrastructure and databases.

Change of Work

The following decision premises particularly affected the work organisation and day-to-day running of banking branches in Alpha.

- (2) *It is easier to change business processes rather than software. (7) Change in (workplace) practices is cheaper than change in IT solutions.*
- (12) *Removal of complex, knowledge-intensive operations from branches. (This was deemed*

good for branch personnel because it lessens their workload and helps to maintain low queues.)

- (13) *Delivering of only acceptable levels of service (e.g., as measured by queue size) whilst maintaining operational efficiency.*
- (14) *Service-to-sales cultural change.* (Every employee was expected to look for sale opportunity and refer customers to a specialised advisor.)

The consequences of these simple decision premises were far-reaching. The new software and ‘service to sales’ cultural change threatened the autonomy of the Alpha’s operational workforce. Such autonomy was built upon knowing and having a relationship with their local customers. Also, pressure was put on branch staffs in order to input customer relationship information into the system in a real-time mode. Branch staffs used to organise their work with a paper diary.

The [paper] diary is an advance warning of what is going to have to be done on the system, although you’re right that some pieces of work like following up on a lead or calling a customer—the procedure is that they should record that on the contact log on the system, but in a busy branch like that, I doubt they do both steps, I suspect that they rely on a paper version. (Branch Associate).

The removal of complex operations from branches did not relieve staffs’ responsibilities to customers but did leave them without knowledge of rather proprietary systems. It became harder for them to maintain a relationship with customers and explain all sorts of delays, loss of original paperwork, and other issues of centralised processing.

Sometimes [the centralised] branch support is really good, you can get things done. Financial Accounts—you have to e-mail, Taxation—you

have to e-mail... that’s fine and that’s usually done within 2-3 days. They don’t respond back and say ‘it has been done.’ We do have problems, when things get lost, especially if we’re sending up to head office, power of attorney, if it’s going on account, we take all documents and it goes to head office. I am sure you can work out how to do it [within the software locally], but I won’t do it. (Branch Associate)

We did a pilot in a different branch, when all of the calls for that branch went to the head office. But we found that 70-80% of those calls were still for the branch, so they ended up being put through, so they would then were double-handled. There were things that could only be answered at that branch. (Business Change Manager)

As we can observe, top management applied the decision premises *over* the existent context of work organisation in branches purposefully and consistently. Reduction of the staff’s knowledge about software led to a reduced need of IT support. Overall, the decision premises, the quick roll-out of new systems (6 months), and the pressure to sell, all led to a high staff turnover of 25% annually. Nonetheless, the dynamics of decision premises helped to achieve the standardised levels of customer service with relatively low-qualified staffs.

CONCLUSION

The usage of the decision premises was a prerogative of Alpha’s top management who were applying them in routine situations as well as critical decision making. The dynamics of decision premises can be summarised as follows:

- applied with limited attention to the context of circumstances and people; sometime, applied ‘ahead of the game.’

Several Simple Shared Stable Decision Premises for Technochange

- activated in order to manage ‘no win’ situations and trade-offs (e.g., sales vs. service); and
- upheld in conflict situations.

The system of decision premises was multilevel (e.g., specific premises were embedded into general ones), self-causal, as well as self-contradictory. It embraced both continuity and discontinuity. The system also produced *durable and multiple outcomes*. By virtue of being several but not many, the decision premises reinforced the dynamics of many outcomes stemming from a few causes, known as ‘the 80-20 rule.’

One interesting and specific outcome of the decision premises operating as a system was *irreversibility*. Software can be reconfigured, and locked-in computer platforms might be changed. However, decision premises define the usage and social order around any technology. Thought operations with technology have an immediate effect – they are easily reversible. On the other hand, policy choices might go unnoticed but, being enforced, they have enduring effects and ‘maximize the power of the guy at the top to influence action’ (Quinn 1998, p. 4).

The *system* of decision premises was also a tool of operational efficiency. It is well known that coordination is effectively (and most cheaply) facilitated by shared norms. The decision premises helped to limit the number of ways of usage of software, thereby, ensuing stable operations. In Alpha, the dynamics of decision premises led to the situation of *triple economising* on technology, coordination, and adoption.

The IT efficiency outcomes of the system of decision premises had two problems. First, the stable IT-operations should be juxtaposed with severe delays and overload of in-house software development. Second, decision premises stimulated fragmentation of work for the front-line workers in banking branches and processing centres (Frenkel, 1999). It was observed and confirmed with interviews that banking branch

workforce ended up with more demanding and fragmented work, yet the same pay and fewer incentives for learning.

In our case study, the decisions that defined the course of technochange were not made by IT professionals. Still, the dynamics led to the focusing on efficiency of technology and compromising on business processes, products, and quality of working life.

This is only an introductory study of decision premises. Further connections are possible to the body of knowledge about human values. For the purpose of being practical, relevant, and inductive, the article was limited from interpretations and elaborates frameworks of psychological theories and decision-making theories of economic sort.

ACKNOWLEDGMENT

I would like to thank my good colleagues Anita Greenhill and Bernd Stahl with who we convened a stream of work on post-modern elements in technology management and related organisational change, and an earlier special issue of this journal.

REFERENCES

- Andreas, S. (2002). *Transforming your self: Becoming who you want to be*. Moab, Utah: Real People Press.
- Bandler, R., & Grinder, J. (1975). *The structure of magic I. A book about language and therapy* (Vol. I). Palo Alto, CA: Science and Behavior Books, Inc.
- Bateson, G. (1972). *Steps to an ecology of mind*. New York: Ballantine Books.
- Earl, M. J. (1989). *Management strategies for information technology*. Cambridge University Press/Prentice Hall International.

- Frenkel, S., Korczynski, M., Shire, K., & Tam, M. (1999). *On the front line. Organisation of work in the information economy*. Ithaca: Cornell University Press.
- Huy, Q. N. (2002). Emotional balancing of organizational continuity and radical change: The contribution of middle managers. *Administrative Science Quarterly*, 47, 31-69.
- Lund, V. T., Raposo, J., & Watson, (2003). *From banks to banking: The on demand journey*. New York: IBM Institute for Business Value.
- March, J. G., & Simon, H. A. (1958). *Organizations*. New York: Wiley.
- Marchington, M., Grimshaw, D., Rubery, J., & Willmott, H. (Eds.). (2005). *Fragmenting work: Blurring organizational boundaries and disordering hierarchies*. Oxford University Press.
- Marcus, M. L. (2004). Technochange management: Using IT to drive organizational change. *Journal of Information Technology*, 19, 3-19.
- Miles, R. H. (1982). *Coffin nails and corporate strategies*. Englewood Cliffs, NJ: Prentice Hall.
- Pfeffer, J. (1992). *Managing with power: Politics and influence in organizations*. Boston: Harvard Business School Press.
- Prahalad, C. K., & Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review*, 68(3), 79-91.
- Quinn, J. B. (1998). Organizing around intellect [Interview]. *Harvard Management Update*.
- Weick, K. E., & Sutcliffe, K. M. (2001). *Managing the unexpected: Assuring high performance in an age of complexity*. San Francisco: Jossey-Bass.

This work was previously published in International Journal of Technology and Human Interaction, Vol. 3, Issue 4, edited by B.C. Stahl, pp. 1-28, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.13

Integrating Real Option and Dynamic Capability Theories of Firm Boundaries: The Logic of Early Acquisition in the ICT Industry

Alfred G. Warner
Penn State Erie, USA

James F. Fairbank
Penn State Erie, USA

ABSTRACT

Firms often acquire other firms to source technology but it is unclear why they might assume such risk by buying before a product standard is established in their industry. We draw upon real options and dynamic capability theories of firm organization to develop an integrated framework that explains why firms might acquire early and which firms are more likely to do so. We develop propositions regarding certain firm attributes as predictors of acquisition timing relative to passage of a technology standard. We argue that from a real options perspective, the primary reason firms acquire early is related to the firm's knowledge of the technology. However, attributes such as politi-

cal influence in the standardization process, prior experience making acquisitions, and how the firm resolves uncertainty about the technical expertise of potential acquisition targets are capabilities that also enter the acquisition timing decision. We provide a model based on those propositions and address how it can be empirically tested.

INTRODUCTION

Competition in industries where product standards define winning technologies has been compared to a particularly chancy casino game: Not only are outcomes and risks unknown, but the rules for competition emerge only in the process of

playing (Arthur, 1996), defining (or re-defining) which firm skills, abilities, and know-how are valuable. Entering early (i.e., before the successful or standardized technologies are defined) with particular skills or resources is risky because they could be the wrong resources and ultimately have no value. This problem is exacerbated when firms enter via acquisition of another firm, as acquirers notoriously fail to realize value after the purchase. Yet, in the information and communication technologies (ICT) industry, firms have increasingly chosen to enter this way and do so well before standards are established.

As an example, Table 1 shows acquisitions in the ICT industry in three key technologies over the period 1995-2000. Public records show that although almost all acquisitions of firms providing Fast Ethernet technologies occurred after the Institute of Electrical and Electronics Engineers (IEEE) generated the 802.3u standard, about half of the acquisitions in Gigabit Ethernet occurred before 802.3ab was accepted. At about the same time, firms like Cisco and Cabletron were acquiring asymmetric digital subscriber line (ADSL) startups well before the ITU G.Lite 992.2 standard was accepted in 1999. Acquisition has become an

Table 1. Acquisitions in three technologies in the ICT industry, 1995-2000 (acquisitions prior to standard in italics)

| Acquirer | Target | Date |
|---------------------|-----------------------------------|---------------|
| <i>FORE Systems</i> | <i>Applied Network Technology</i> | <i>Jun-95</i> |
| Cisco | Grand Junction | Sep-95 |
| Siemens | ORNET | Sep-95 |
| Cabletron | Enterprise Networks | Nov-95 |
| Compaq | Networth | Nov-95 |
| FORE Systems | ALANTEC Corp | Feb-96 |
| Bay Networks | NetICs | Dec-96 |
| Intel | Case Technology | Jan-97 |
| Intel | Dayna Communications | Sep-97 |
| Cabletron | NetVantage Inc | Jun-98 |
| Lucent Technologies | Lannet, div. of Madge Networks | Jul-98 |
| Lucent Technologies | Enable Semiconductor | Mar-99 |

Fast Ethernet acquisitions (IEEE 802.3u, effective July 1995)

| Acquirer | Target | Date |
|----------------------------|----------------------------------|-------------|
| <i>Cisco</i> | <i>Granite Systems</i> | Sep-96 |
| <i>FORE Systems</i> | <i>Scalable Networks</i> | Nov-96 |
| <i>Bay Networks</i> | <i>Rapid City Communications</i> | Jun-97 |
| <i>Cabletron</i> | <i>Yago Systems</i> | Jan-98 |
| <i>Lucent Technologies</i> | <i>Prominet Corporation</i> | Jan-98 |
| <i>ODS</i> | <i>Essential Communications</i> | May-98 |
| Level One | Acclaim Communications | Jun-98 |
| FORE Systems | Berkeley Networks | Aug-98 |
| Alcatel | Packet Engines | Oct-98 |
| Level One | Jato | Nov-98 |
| Intel | Level One Communications | Mar-99 |
| Intel | XLNT | Mar-99 |
| Vitesse Semiconductor | XaQti | May-99 |

Gigabit Ethernet acquisitions (IEEE 802.3ab, effective June 1998)

continued on following page

Table 1. continued

| Acquirer | Target | Date |
|----------------------|--------------------------|--------|
| Cisco | Telesend | Mar-97 |
| Cisco | Dagaz | Jul-97 |
| Cisco | NetSpeed Inc | Mar-98 |
| Cabletron | Ariel | Jun-98 |
| Cabletron | Flowpoint | Jun-98 |
| Marconi | Reltec | Mar-99 |
| Cisco | Fibex Systems | Apr-99 |
| Cisco | MaxComm Technologies | Aug-99 |
| Netopia | StarNet Technologies | Oct-99 |
| Terayon | Radwiz | Oct-99 |
| Efficient Networks | Flowpoint | Nov-99 |
| Westell Technologies | Teltrend Inc. | Dec-99 |
| Nortel Networks | Promatory Communications | Jan-00 |
| Intel | Ambient Technologies | Feb-00 |
| Intel | Basis Communications | Mar-00 |
| Terayon | Raychem Access | Mar-00 |
| Orckit | EDSL Networks | May-00 |
| Virata | Excess Bandwidth | Jun-00 |
| Virata | Agranat Systems | Jul-00 |
| Infineon | Savan Communications | Dec-00 |

ADSL acquisitions (ITU G.992.2, effective June 1999)

increasingly common mode of entry and a key element in how firms manage technology (Chaudhuri & Tabrizi, 1999; Karim & Mitchell, 2000) but it is not obvious why firms would choose to spend millions or billions of dollars to enter new technologies in standards-based industries before the standard is defined and uncertainty about outcomes is high. In this article, we integrate recent work in real options and dynamic capabilities theories as an explanation and framework for further empirical research.

Real options logic (ROL) is a theory of governance or firm boundaries with emphasis on how

firms manage uncertainty. It has historically been viewed as the purchase of the right to make staged investments where the value lies in the ability to defer further expenditures (Adner & Levinthal, 2004; Kogut & Kulatilaka, 1994). Currently, however, researchers have developed the idea that value can also derive from growth opportunities if firms can invest to secure technological positions or access to new capabilities (Folta & O'Brien, 2004; McGrath, 1997), particularly if managers can act strategically to influence the standardization outcome (McGrath, 1997). For example, when Cisco Systems acquired AuroraNetics for their resilient packet ring technology in 2001, other members of the IEEE 802.17 working group reportedly feared that Cisco could then dominate the standard-setting process (Matsumoto, 2001). Both internal development projects and acquisitions can be considered the purchase of a real option (Folta & O'Brien, 2004); accordingly, in this article we argue that early acquisition represents the purchase of a growth option.

However, if growth option ROL can explain *why* firms might acquire before a standard is adopted, it is ambiguous with respect to *which* firms might do so and is therefore incomplete as a theoretical explanation. Firms purchasing this sort of real option should be concerned with two issues: Will the technology acquired become part of the standard and, if so, will the acquirer be able to exploit that opportunity? A more complete understanding of the early acquisition decision requires the integration of another theory of firm boundaries where specific capabilities of the acquiring firm play a key role.

Dynamic capability (DC) theory is an extension of the resource-based view (RBV) of the firm. In the resource-based view, competitive advantage derives from the control of valuable, rare, and difficult to imitate resources (Barney, 1991; Peteraf, 1993; Wernerfelt, 1984). These include assets such as specialized equipment, human skills, technical knowledge, and organizational abilities (Eisenhardt & Martin, 2000). Dynamic

capabilities are regarded as higher-level resources in that they address how firms manage in turbulent environments through reconfiguration or transformation to achieve greater effectiveness (Teece, Pisano, & Shuen, 1997; Zollo & Winter, 2002). This is an alternative view of why firms make the governance choices they do, but it fails to specifically address what resources are best for future competitiveness. Success depends on the firm having superior knowledge about the future value of a resource or making a fortuitous buy (Barney, 1991; Eisenhardt & Martin, 2000). Some have argued that this lack of clarity on resource identification until after the fact makes the RBV/DC tautological (Priem & Butler, 2001). For these reasons, we believe that early acquisition can be better explained if growth oriented ROL and the RBV/DC are regarded as complementary rather than competing explanations. Firms might manage the rules of competition by entering early enough to influence the shape and structure of the standard (i.e., purchasing an option on growth opportunities to secure what could be extremely valuable resources), but this only makes sense when the decision to buy is supported by a set of key organizational capabilities. ROL and DC theories address different phases or aspects of the same resource acquisition process, and a synthesis of the theories might be useful in explaining acquisition timing.

Using the ICT industry as a frame, we develop a theory of how specific firm-level attributes can explain early acquisition. First, we argue that a significant gap in firm resources is the primary motivation for early acquisition as a real option, but that it is not a sufficient cause. We further describe how capabilities such as alliance experience and political power moderate and reinforce the real option by helping to manage the uncertainty problem. We also posit that other capabilities, such as acquisition experience, are important in managing integration of acquired firms. If the acquiring firm succeeds with the option play,

effective and efficient integration improves the likelihood of a win in the market.

Theories of governance or firm boundaries involve what activities the firm will conduct internally and what activities will be conducted outside through market or alliance. As Leiblein (2003) observes, such theories are often treated as independent explanations, whereas integration of relevant theories would enable the development of a more robust theory of governance. Our article represents a step toward that objective, as we argue that neither real options nor the resource based/dynamic capabilities view is sufficient to explain acquisition patterns in the ICT industry, but that as complements, they can. Though this article is not intended to be an empirical analysis, it does develop a basis for testing the extent to which these governance theories can be integrated.

BACKGROUND AND THEORY

Acquisition as a Real Option Investment

Real options are likened to financial options because the purchase of the option conveys the right, but not the obligation, to make further investment (Adner & Levinthal, 2004; Kogut & Kulatilaka, 1994). To illustrate, a financial option might be the purchase of a call on a stock at some time in the future. If the price of the stock rises high enough, the investor can strike the option by purchasing the shares at the option price and then re-selling them at the higher, actual price. If the price does not rise high enough, the investor can abandon the option. The key attributes of this model are the uncertainty about the future price, the contrast between limited downside risk and unlimited upside potential, and the property rights conveyed by ownership. Similarly, ROL argues that managers can undertake projects that more traditional valuation techniques, such as net pres-

ent value analysis, might undervalue if they have discretion in the timing of investments, can wait for the resolution of uncertainty (Leiblein, 2003), and then choose to take further action, defer, or even abandon the opportunity (Bowman & Hurry, 1993). Real options have generally been used to assess internal development decisions (such as R&D for new technologies), but have also been applied to investments between firms, such as joint ventures. An emerging line of real option theory recognizes that growth options emerge if particular capabilities (Folta & O'Brien, 2004) or technological positions (McGrath, 1997) can be generated by investment under high uncertainty. Growth options are particularly valuable in high technology environments because they create the opportunity for firms to participate in subsequent generations of products (Leiblein, 2003).

Real options logic has recently been applied to technology development in a standards environment in several important ways. Modularity or task splitting in overall system design (such as computers or local area networks) can lead to the components of the system comprising a "portfolio of options" (Baldwin & Clark, 2000), the value of which is greater than that of a unitary design. More specifically, Gaynor and Bradner (2001) have shown that the competition between modularized technical solutions in an open standardization process creates real options for participants. They also clearly demonstrate how uncertainty about which technologies will be used, and how, permeates the standardization process. For example, they observe that asynchronous transfer mode (ATM) technology was standardized as a potential competitor to other LANs, but became most successful in high-speed IP routers and DSL technologies, which exemplifies the unpredictability of standardization.

This uncertainty is key to the value of a real option. First, because managers cannot accurately foretell the future, the option permits them to secure a position with property rights when uncertainty is high and wait until the uncertainty is

resolved to take further action. An incremental approach limits downside risk (the price of the option) while endowing the owner with potential upside gains (Amram & Kulatilaka, 1999; Gaynor & Bradner, 2001). In technological opportunities, the uncertainty can be decomposed into several components. Initially, it is often unclear whether a particular technological approach will work. This has been termed "technical" uncertainty and can be resolved endogenously by investing in development (Dixit & Pindyck, 1994; McGrath, 1997), which is a function of the property right implicit in the option. Later, as technologies compete, the "market" uncertainty about which technology prevails is resolved in terms of a particular solution. In formal standardization, as Gaynor and Bradner's (2001) ATM example shows, resolution may come first as a win in the standards process and subsequently as a win (or loss) in the actual market competition between standardized technologies.

Second, the uncertainty around which technology wins is usually considered exogenous and outside the control of the firm (Amram & Kulatilaka, 1999), but scholars have recently developed the idea of a third form of uncertainty external to the firm but, unlike market uncertainty, subject to strategic intervention (McGrath, 1997; McGrath, Ferrier, & Mendelow, 2004; Miller & Folta, 2002). In these circumstances, managers can invest and act strategically to shape how the uncertainty is resolved.

Firms can secure growth options in several ways. The most often used example is entry into a new technology through internal development, which may clearly be construed as the exercise of the right generated by an investment in R&D as described above. How real options logic applies to inter-firm arrangements is less clear, but a property-rights perspective can be seen as parallel to internal development. Internal projects are the property of the firm that undertakes them, so it is clear they have a right to invest further or abandon the project. In the sense of securing an

equivalent position, acquisition of another firm conveys equally strong property rights to the buyer and, if undertaken when the relevant uncertainty is still high, is strategically equivalent to the same stage opportunity created by internal investment. For this reason, Folta and O'Brien (2004) consider entry through internal development and entry through acquisition as theoretically parallel in their analysis of "dueling options." Thus, either internal development or acquisition into a standards-based technology before the uncertainty over which technology will prevail is resolved can reflect a positioning response to innovation or a growth option (Folta & O'Brien, 2004).¹

The decision to secure a growth option through acquisition should be a function of the firm's relevant knowledge about the emerging technologies. Technological change ranges from incremental to radical (Anderson & Tushman, 1990), but this is relative; heterogeneity in firm investments, history, and resources suggest that within a particular industry, firms will regard the significance of technological innovations differently. Firms with relevant knowledge resources might view imitation of a new technology as relatively straightforward because it is near their existing capabilities and their prior investments have generated absorptive capacity (Cohen & Levinthal, 1990) or the ability to integrate and apply new knowledge. Firms that have made long-term and irreversible commitments to competence in other domains will find they lack the proper resources for imitating new technologies because they lack relevant absorptive capacity. These organizations might try to develop the skills internally but find that the time required to learn cannot be condensed easily or inexpensively. While this can be partially overcome through accelerated investment (Kim, 1997), there are time compression diseconomies involved that restrict the return to investment in learning (Dierickx & Cool, 1989). Even hiring talent away from competitors can be difficult because the resources might

not be easily tradable or accessible in the market (Barney, 1991; Teece, et al., 1997).

The effect of timing further complicates the choice of how to develop a response to new technologies. Late entry can adversely affect profitability (Ali, Krapfel, & LaBahn, 1995), market share (Lawless & Anderson, 1996), and even survival (Christensen, Suarez, & Utterback, 1998; Mitchell, 1989). In standards-based industries, entry timing can have another role. Since formal standards are often established in anticipation of market competition, solutions that eliminate particular approaches can put firms at a competitive disadvantage relative to those whose technologies are supported by the standard. This suggests that the critical time for entry and intervention is before the standard has been established, and firms lacking relevant knowledge resources must find a way to acquire them so they can compete or else be compelled to enter late and face the challenges of playing "catch-up." Therefore, firms increasingly turn toward acquisition to acquire the requisite high-technology skills (Chaudhuri & Tabrizi, 1999).

We therefore argue that initial differences in knowledge endowments for firms facing innovation will dictate the sort of real option purchased. We would expect firms that have relevant resources to attempt internal development first and if they acquire, they would be more likely to do so after the standard is complete. If firms that lack the relevant resources cannot learn about the technology quickly enough to attempt internal development, we argue that the real option perspective should lead them to acquire before the standard has passed. For example, Cisco CEO John Chambers once characterized the firm's most likely competition as IBM and Nortel (O'Reilly, 1998). If, as we discuss below, technical knowledge can be proxied by patent portfolios, IBM's wealth of patents in relevant fields and Cisco's lack in the same should imply that Cisco would be more likely to acquire early and IBM acquire

late, if at all. This closely reflects the acquisition patterns that actually occurred. Clifford Meltzer, another Cisco executive, explained the strategy: “We don’t believe we are smart enough to know all the important technologies over the next few years. You pick some, and then watch the industry” (Rogoski, 1997). We thus propose:

Proposition 1a: *Early acquirers (i.e., firms acquiring before the standard is accepted) will be more likely to lack relevant technical knowledge than will late acquirers.*

We also argue that the extent of overall invention in the industry moderates the value of resident knowledge stocks. If there is relatively little inventive work occurring, then the chances of a firm’s stock of knowledge being made obsolete are less likely. If, however, the rate of invention is high, firms might be compelled to look outside for knowledge resources, particularly if there are multiple approaches to solving a technological problem (Steensma & Fairbank, 1999). That is, the intensity of the “trigger” for the investment decision can vary (Zahra & George, 2002). In optical networking, for example, Nortel had established a very strong position in SONET/SDH technologies research and development (Arellano, 1999). However, the emergence of dense wave division multiplexing (DWDM) technologies, evidenced by a surge in US patents, apparently outstripped Nortel’s capacity to leverage earlier optical expertise. DWDM systems are complex and includes component such as laser modules, modulators, pump lasers, receivers, multiplexers, among many elements (McEuen, 2000). Although the firm was able to internally develop some components such as tunable lasers, Nortel eventually turned to acquisition to meet the demands of market pace (LaBarba, 1999), buying firms such as Cambrian Systems for metro DWDM capabilities, Qtera for long-range optical signaling, Xros for optical routing, and Core Networks for their tunable lasers. Accordingly, we propose:

Proposition 1b: *When the rate of invention in a technology family is high, firms will be more likely to perceive themselves as lacking relevant technical knowledge and will be more likely to acquire early (i.e., before the standard is accepted).*

How Dynamic Capabilities Moderate the Acquisition Decision

If the uncertainty around the standard is exogenously resolved, this gap in knowledge assets should be sufficient motivation for firms to make the real option acquisition and we should expect no other regularities among earlier acquirers. However, if managers can act strategically to affect outcomes (McGrath, 1997), then characteristics internal to the firm should emerge as commonalities among early acquirers. We argue that firms undertaking early acquisition will seek both the right technology and the right target, that is, a technology that shows promise and a target that can be successfully integrated and exploited by the acquiring organization. Meeting either objective will depend on specific firm attributes that directly support the option investment and/or the process of acquisition, and therefore moderate the acquisition decision. Such attributes are best characterized in a dynamic capabilities framework, since they become routine, learned processes, refined through experience. According to Eisenhardt and Martin (2000), these capabilities are “the antecedent organizational and strategic routines by which managers alter their resource base—acquire and shed resources, integrate them together, and recombine them—to generate new value-creating strategies” (p. 1107), and advantage goes to firms that use these capabilities sooner or more effectively than the competition.

Recent work illustrates three such routines or capabilities which can directly support the option aspect of the acquisition: political, alliance, and integration skills (Eisenhardt & Martin, 2000; Zollo & Singh, 2004). We expect that acquirers will exhibit differences in political or process

power and that more powerful firms will find it beneficial to enter when their power can be deployed. As Wernerfelt and Karnani (1987) note, the ability to influence outcomes is itself a sufficient motivation to enter when uncertainty is still high. We also argue that acquirers with alliance experience should be able to asymmetrically resolve some of the technical uncertainty around the option, which also influences timing. Capabilities can also affect how well the acquisition process is managed. Alliance experience serves a second role here in that firms can more effectively determine if partners would be good acquisition targets and integrate well. Finally, firms that are experienced in integrating acquisitions should better understand the time, organizational, and cultural requirements of such purchases. We examine each capability below.

Political Capabilities

The standardization process in the ICT includes the work of several types of bodies ranging from the formal international structure (such as the International Telecommunication Union (ITU) and the International Electrotechnical Commission (IEC)) to the formal regional organizations, such as the European Telecommunications Standards Institute (ETSI). Further, many of the standards in the ICT industry are developed by “gray standards bodies,” a classification that includes self-organizing regional entities such as the Institute of Electrical and Electronics Engineers (IEEE) and the European Computer Manufacturers Association (ECMA), as well as industry groups such as the ATM Forum. These groups are open in process and multi-vendor oriented (Egyedi, 2000) and vendor firms can sponsor technologies and participate in the process that accepts or rejects those technologies.

The influence of firms is such that they are increasingly regarded as a dominant force in standard-setting worldwide (Heywood, Jander, Roberts, & Saunders, 1997), but we argue that

firms will differ in their power in this context and those with greater perceived influence will be able to move markets or the processes that lead to markets. We anticipate that the specific standardization process will moderate this ability.

Standardization has been described as a social exercise in the construction of technology in that actors collectively establish processes and routines for the definition and solution of problems (Tushman & Rosenkopf, 1992). To the extent that the social construction also reflects the competitive orientation of the vendor firms involved, differences among the firms should enter the analysis. For instance, standardization processes are increasingly complemented by the work of block alliances that expedite technical testing and coordination. Examples include the Fast Ethernet, Gigabit Ethernet, and 10Gigabit Ethernet Alliances that coexisted with and complemented the work of the relevant IEEE 802.3 committees as well as the Universal ADSL Working Group and its recommendation to the ITU. These block alliances are explicitly vendor based and, in gray standardization work, usually comprise firms that are concurrently involved in the standards process (Warner, 2003). Even if firms are not directly involved in the formal standardization process, the effect of power can persist if the work of the block alliance is included in the standard. The power of firms to influence how that work is developed at the alliance level is then reflected in the ultimate formal document.

Thus, firms that have more market or financial power (Munir, 2003; Wernerfelt & Karnani, 1987) or are central firms in long-term networks (Soh & Roberts, 2003) might be able to influence outcomes based simply on their choice of technologies. Soh & Roberts (2003) have mapped the networks in the US data communications industry and show that network central firms were early entrants and leaders of coalitions. Central firms may also form cliques that can dominate the technological decision process (Rosenkopf & Tushman, 1998). For example, in the work between the ADSL Forum

and the Universal ADSL Working Group, Forum vice-chairman Bill Rodey argued that contention over technologies within the groups was minimized because the major firms had banded together (Oakes, 1998).

In addition, success in leading market entry strengthens or maintains the dominance of central firms for the next technological opportunity (Soh & Roberts, 2003) or for advances within the technology (Chiesa, Manzini, & Toletti, 2002). Finally, firms may seek to employ individuals they feel are influential in the standardization process or influence who staffs key administrative positions in standards committees (van Wegberg, 2004) or simply swamp the process with voting representatives (Heywood, et al., 1997). Therefore, firms with more power or clout should be more likely to enter early (particularly in gray standardizations processes) because they would be better positioned to shape outcomes.² While this capability supports the real option for either internal development or acquisition, with respect to acquisition in particular, we propose:

Proposition 2: *Early acquirers will be more likely to have greater influence in the relevant standardization community than will late acquirers.*

Alliance Capabilities

Alliances present opportunities to not only learn what partners know, they also allow firms to learn *about* partners more deeply and thus moderate the option investment decision in two ways. First, alliances allow partners to judge the content and applicability of the knowledge and skills the other brings to the collaboration (Grant & Baden-Fuller, 2004), which can reduce uncertainty about technical merit. Second, the process of establishing and maintaining an alliance provides information about each partner's culture, capabilities, and systems beyond the expressed motive for the venture (Zollo, Reuer, & Singh, 2002) which affects the ease and likelihood of successful integration.

Those with alliance expertise should have better information about (and be better able to judge) partners/targets than firms that do not have such experience. This expertise can vary along dimensions of investment level and scope.

How alliances are structured in terms of ownership can affect the level of information generated. Firms that have equity investments in candidate targets privately reduce information asymmetry relative to other potential acquirers and are in a better position to assess the relevance of the target's technology. Equity alliances are frequently used in R&D ventures because of the problems associated with knowledge expropriation (Gulati, 1995; Oxley, 1999). In order to gain financial backing, managers of private, capital-seeking firms must reduce information asymmetry by disclosing important information about their firm to potential backers including financial records, plans, and assets (Janney & Folta, 2003). This privileged access gives firms the ability to assess candidate technologies and reduce technical uncertainty. Provided the technologies meet the acquirer's relevance test, these firms should be more desirable acquisition targets than firms about which the investor does not have equivalent information.

Furthermore, firms vary in the extent to which they have developed alliance portfolios or strategies. In the late 1990s, some firms in the ICT industry began to operate not only as technology producers but also as managers or coordinators of venture capital funds, taking equity stakes in a wide array of firms with emerging technologies. Intel is a good example in that they have three equity funds (the Digital Home Fund, Communications Fund, and the China Technology Fund) and investments for each fund are publicly available (Intel, 2005). Other ICT firms that have implemented similar approaches in the past include Nokia (Nokia Venture Partners, now known as BlueRun Ventures), Lucent's New Venture Group, Nortel's Business Venture Group, and Cisco's Business Development Group. At the

same time, non-equity based consortia or block alliances became popular ways to generate rapid standard development and interoperability testing and to coordinate the contributions of firms to standardization (Warner, 2003). Firms in these blocks should therefore have information not available to those outside. Overall, these alliance structures should allow participating firms to develop a richer acquisition environment and are capabilities that directly support both the real option and the subsequent integration process. We propose:

Proposition 3a: *Early acquirers will be more likely to have had an equity alliance with the target than will late acquirers.*

Proposition 3b: *Early acquirers will have larger alliance portfolios than will late acquirers.*

Integration Capabilities

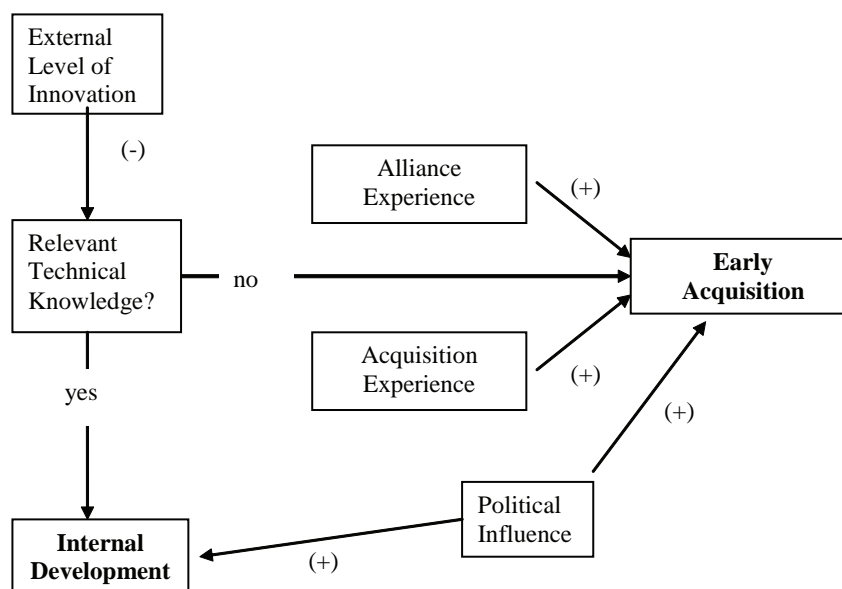
Extracting value from acquisitions, particularly in the sense of integrating new knowledge, is difficult and firms often fail to achieve desired objectives (Chaudhuri & Tabrizi, 1999). First, learning takes time even under good conditions. Transferring skills within the organization can be difficult and time consuming (Teece, et al., 1997; Zander & Kogut, 1995) and the problem is exacerbated when acquirers and targets have different prior knowledge sets. The two organizations must establish a common ground for discussion and exchange before the new knowledge can be exploited.

Second, even when the new knowledge is “understood” by technicians and managers on an individual level, it must be transformed into routines and processes that the firm can use, which involves changes at many levels in the organization. This process can be blocked if the implementation too strongly challenges existing technical and managerial systems (Leonard-Barton, 1992). Recent research focusing on innova-

tion output after acquisition has concluded that firms commonly underestimate the difficulty of integrating new information into the organization (Ahuja & Katila, 2001). Finally, integration is more difficult when there are significant size, structural, cultural, or other differences between the acquirer and target firm (Inkpen, Sundarum, & Rockwood, 2000).

Given these difficulties, prior acquisition experience has been shown to positively affect subsequent performance (Haleblian & Finkelstein, 1999; Hayward, 2002). This is due to several learning related causes. First, experience can lead firms to develop more efficient screening of acquisition candidates (Vermeulen & Barkema, 2001). Second, experience creates a more informed understanding of the time and skills required to integrate an acquisition and extract the value from the knowledge resources. Zollo and Singh (2004) argue that the process of codifying experience for application to subsequent purchases is key to managing the acquisition and assisting in the integration of targets. These assessment and integration routines are learned and practiced and constitute a dynamic capability (Eisenhardt & Martin, 2000). Experienced acquirers should be more conscious of the time investment to make a purchase successful. As a general illustration of these ideas, we note that Cisco is well known as a remarkably successful acquirer. Some of the reasons advanced for this include the due diligence process by which the firm qualifies targets with a strong focus on the social and cultural characteristics of the proposed target, identifying the prospects for a good fit with Cisco (Mayer & Kenney, 2004). For this reason, the firm prefers to target relatively young, small firms it can more easily integrate, particularly with respect to retention of key personnel. This conservative approach, according to CEO John Chambers, means that Cisco “has killed nearly as many acquisitions as we’ve made” (O’Reilly, 1998, p6). Another reason for Cisco’s success is in the integration process itself. Once the deal is

Figure 1. Factors affecting entry timing



closed, Cisco’s ten-step systematized integration process took over. Those steps include merging information systems such as conversion to Cisco’s MRP, vendor evaluation and rationalization, and implementation of statistical process controls (Wheelwright, Holloway, Kasper, & Tempest, 1999), and were played out in 90- and 180-day programs (Mayer & Kenney, 2004). Because of the importance of experience in forming acquisition integration practices, we propose:

Proposition 4: *Early acquirers will be more likely to have prior acquisition experience than will late acquirers.*

To summarize our propositions, we argue that in the ICT industry, the timing of acquisitions reflects both the need and ability of some firms to invest in real options. Early acquisitions will more likely be undertaken by firms that lack appropriate knowledge resources which still seek to enter the market in a timely fashion and manage

the outcome of the standards process *vis-à-vis* that technology purchase. This will be moderated by the rate of invention in the industry: When the level of invention is high, we anticipate that firm knowledge stocks will tend to be less relevant and increase the likelihood of early entry through acquisition. Certain capabilities will support the likelihood of option purchase. Early acquirers will more likely possess political influence or clout because firms lacking this power would regard the resolution of the uncertainty as exogenous and out of their control, and are thus disincented to enter before the standard is passed. We also argue that acquisition timing reflects asymmetries in knowledge about potential candidates. Alliances eliminate some uncertainty for acquirers in this strategy and partners from prior alliances, especially partners in which the acquirer has had an equity stake, will more likely be acquired early. Finally, acquisition timing will be a function of preference and experience in the process. Firms might historically prefer acquisition as a sourcing

mode and thus have developed skills and knowledge stocks regarding acquisition integration. Under these conditions, acquisition is likely to be early. Figure 1 provides a simple illustrative model of the relationship between our propositions and early acquisition.

DISCUSSION

As it stands, our model describes how we expect firms to behave with respect to acquisition and entry timing in the ICT industry. However, there are normative implications to an integrated approach. Earlier work in real options theory was prescriptive in the suggestion that the firm be viewed as a bundle of options (Bowman & Hurry, 1993). That is, when conditions are uncertain, firms should invest in a series of options to preserve flexibility and position. A key assumption is that the uncertainty will be resolved exogenously, which means that all firms are on an equal footing. In other words, the only issue for firms is if they have the wherewithal to purchase the option. Even so, a recent critique of the theory observes that real options promoted as a general means of creating firm-wide flexibility are “oversold” (Barnett, 2003) and that they are better as a project-specific tool. Barnett (2003) also notes that developing effective options is resource intensive, much like creating key organizational capabilities. We believe this is an important argument on several grounds.

First, as we have discussed here, acquisition can be construed as a real option but one that requires investment beyond merely purchasing the target. In order to make the acquisition successful, firms will need to leverage a number of other capabilities in the wake of the purchase. Thus, these growth options are not simply a “buy and wait” proposition, but require active management. Second, particularly in this context, we would argue that these real options are not merely “like” developing capabilities, but are expressly developing them.

This occurs on several levels. If the acquisition is successful, the firm has acquired new technical skills that are not only useful in current applications but as a springboard for future development within the same technology. Moreover, the acquiring firm has reinforced the political and integration capabilities that supported the acquisition, improving their position for subsequent option investments. Thus, from a normative position *contra* earlier options reasoning, we argue that not all firms are capable of taking these options and that undertaking acquisitions as an option can be a highly risky process for firms lacking the supporting capabilities.

Our integrated model is testable. If early acquirers fail to show some, if not all, of the regularities we predict, then the theoretical integration is superfluous. We consider several issues in empirically testing these propositions since operationalizing the variables we propose will require some judgment. The dependent variable—acquisition timing—is a good example. Because agreement on standards evolves, and at some point prior to actual adoption the debate has ended and there is no longer opportunity to influence the outcome, acquisition is “early” only if conveys at least the opportunity to affect the shape of the standard. One way to define this is to track the actual course of discussion within the standard process and to assert that acquisitions made when disagreement was still high should be considered early. However, not all such processes can be easily monitored because they might involve off-line actions (such as vendor groups), they are difficult for researchers to access, or because they are concluded and acquiring the relevant primary information is not possible. We suggest that a first cut approach might simply establish a cutoff time prior to standard passage that distinguishes acquisitions made under greater or lesser uncertainty. For example, the set of acquisitions made at least six or twelve months prior to the first passage of a standard should have been made under conditions of much greater uncertainty than the set of later

acquisitions. This time frame reflects how the pace of standardization has increased over the past decade and what once took years might now only require months (Rada & Berg, 1995).

Another issue will be operationalizing technical knowledge. We suggest the use of patent portfolios as a general metric. Patents have served as proxies for the stock of codifiable knowledge—that which firms draw upon to learn (DeCarolis & Deeds, 1999; Dierickx & Cool, 1989) and in the ICT industry, patents have been used to model technological competence (Madden, Rao, & Galvin, 2002; Rao, Vemuri, & Galvin, 2004). Further, patents will be useful in such a study because they are classified by technology, which provides information on both the rate and direction of inventive change (Archibugi & Pianta, 1996). Though recent work has argued that firms with significant knowledge assets, such as patents, may resist joining standardization movements to avoid knowledge spillovers (Blind, 2006), we note that this analysis addressed ten industries (and did not include the ICT industry) where firms with sufficient market power could take effective unilateral action outside the standards process. However, the modularity of system design in the ICT industry (Baldwin & Clark, 2000) constrains the ability of firms to opt out of standardization and introduce proprietary products. While this suggests that standards may vary across industries in their perceived downstream importance, and opens up research possibilities into the interaction between importance and standardization participation, it does not obviate the use of patents in this industry as one measure of technical knowledge.

Measuring prior acquisition experience should be straightforward because if the acquirer or target is a publicly held firm (and virtually all acquirers in the ICT industry are publicly held), acquisition is a matter of public record. The issue for research is the extent to which the marginal returns to learning through acquisition persist. That is, are more acquisitions always better or do the marginal benefits of learning how to integrate purchases

disappear after some (presumably small) number of acquisitions?

Alliance portfolios will be more difficult to measure than acquisition experience as firms do not face the same reporting requirements. There are several potential approaches to this problem using available information. First, non-equity alliances, particularly memberships in industry groups and consortia, are generally announced either by firms party to the alliance or, in the case of industry groups, by the group itself and are a matter of record. Information about equity alliances is sometimes retained because it can convey strategically important information to competitors, but investments are increasingly announced by investors or the recipients. For example, if firms have corporate venturing portfolios, the information about firms in the portfolio is publicly available. Finally, if a publicly held firm has a stake in an acquisition target, this is always disclosed in the announcement of purchase.

The ability to influence processes is a complex variable that poses a number of measurement challenges. Based on the work cited above, we expect that operationalizing influence will include firm characteristics such as size, and the extent to which the firm is or has been a leader or founder of successful industry consortia. Alternatively, researchers may turn to network analysis tools to assess how central firms are in the industry, particularly over time. The work of Soh and Roberts (2003) may provide a direct measure of centrality as would a cumulative measure of membership in consortia, particularly founding membership.

CONCLUSION

This article has developed a descriptive model showing how early entry through acquisition can be explained by integrating the principles of real options and dynamic capabilities theories of firm boundaries. Real options theory explains why

firms may generally invest in a new technology through acquisition but does not specifically inform us as to which firms might be so inclined. The dynamic capability perspective shows us which firms could best incorporate new resources but not how to select those assets, suggesting that acquiring resources that convey competitive advantage is sometimes just a matter of fortune. That is, dynamic capability theory provides a more useful explanation after the resources have been acquired. In combination, however, real options and dynamic capabilities show how firms can identify opportunities and, if they possess the requisite capabilities such as political, integration, and alliance skills, purposefully move to acquire resources and take the actions that make those resources valuable. This integration should help explain why and which firms acquire early in the ICT industry.

REFERENCES

- Adner, R., & Levinthal, D. A. (2004). What is not a real option: Considering boundaries for the application of real options to business strategy. *Academy of Management. The Academy of Management Review*, 29(1), 74.
- Ahuja, G., & Katila, R. (2001). Technological acquisitions and the innovation performance of acquiring firms: A longitudinal study. *Strategic Management Journal*, 22, 197-220.
- Ali, A., Krapfel, R., Jr., & LaBahn, D. (1995). Product innovativeness and entry strategy: Impact on cycle time and break-even time. *Journal of Product Innovation Management*, 1995(12), 54-69.
- Amram, M., & Kulatilaka, N. (1999). *Real options*. Boston: Harvard Business Press.
- Anderson, P., & Tushman, M. L. (1990). Technological discontinuities and dominant designs: A cyclical model of technological change. *Administrative Science Quarterly*, 35(4 Dec), 604-633.
- Archibugi, D., & Pianta, M. (1996). Measuring technological change through patents and innovation surveys. *Technovation*, 16(9), 451-468.
- Arellano, M. (1999). Fast company: Nortel's long involvement with OC-192 research is helping it dominate the market. *Tele.com*, 4(17), 42.
- Arthur, W. B. (1996). Increasing returns and the new world of business. *Harvard Business Review*(July-August), 100-109.
- Baldwin, C. Y., & Clark, K. B. (2000). *Design rules*. Cambridge, MA: The MIT Press.
- Barnett, M. L. (2003). Falling off the fence? A realistic appraisal of a real options approach to corporate strategy. *Journal of Management Inquiry*, 12(2), 185.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.
- Blind, K. (2006). Explanatory factors for participation in formal standardisation processes: Empirical evidence at firm level. *Economics of Innovation and New Technology*, 15(2), 157-170.
- Bowman, E. H., & Hurry, D. (1993). Strategy through the options lens: An integrated view of resource investments and the incremental-choice process. *Academy of Management Review*, 18(4), 760-782.
- Chaudhuri, S., & Tabrizi, B. (1999). Capturing the real value in high-tech acquisitions. *Harvard Business Review*, 77(5), 123-130.
- Chiesa, V., Manzini, R., & Toletti, G. (2002). Standard-setting processes: Evidence from two case studies. *R & D Management*, 32(5), 431.
- Christensen, C. M., Suarez, F. F., & Utterback, J. M. (1998). Strategies for survival in fast-changing industries. *Management Science*, 44(12), S207-S220.

- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35, 128-152.
- DeCarolis, D. M., & Deeds, D. L. (1999). The impact of stocks and flows of organizational knowledge on firm performance: An empirical investigation of the biotechnology industry. *Strategic Management Journal*, 20(10), 953-968.
- Dierickx, I., & Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science*, 35(11), 1504-1513.
- Dixit, A. K., & Pindyck, R. S. (1994). *Investment under uncertainty*. Princeton, NJ: Princeton University Press.
- Egyedi, T. M. (2000). Institutional dilemma in ICT standardization: Coordinating the diffusion of technology? In K. Jacobs (Ed.), *Information technology standards and standardization: A global perspective*, 48-62. Hershey, London: Idea Group Publishing.
- Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: What are they? *Strategic Management Journal*, 21, 1105-1121.
- Folta, T. B., & O'Brien, J. P. (2004). Entry in the presence of dueling options. *Strategic Management Journal*, 25, 121-138.
- Gaynor, M., & Bradner, S. (2001). *The real options approach to standardization*. Paper presented at the Hawaii International Conference on Systems Sciences, Honolulu, HI.
- Grant, R. M., & Baden-Fuller, C. (2004). A knowledge accessing theory of strategic alliances. *Journal of Management Studies*, 4, 61-84.
- Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal*, 38, 85-112.
- Haleblian, J., & Finkelstein, S. (1999). The influence of organizational acquisition experience on acquisition performance: A behavioral learning perspective. *Administrative Science Quarterly*, 44(1), 29-56.
- Hayward, M. L. A. (2002). When do firms learn from their acquisition experience? Evidence from 1990-1995. *Strategic Management Journal*, 23(Jan), 21-39.
- Heywood, P., Jander, M., Roberts, E., & Saunders, S. (1997). Standards: The inside story. *Data Communications*(March), 59-72.
- Inkpen, A. C., Sundarum, A. K., & Rockwood, K. (2000). Cross-border acquisitions of US technology assets. *California Management Review*, 42(3), 50-71.
- Intel. (2005). *Intel Capital Portfolio*, Vol. 2005.
- Janney, J. J., & Folta, T. B. (2003). Signaling through private equity placements and its impact on the valuation of biotechnology firms. *Journal of Business Venturing*, 18(3), 361-380.
- Karim, S., & Mitchell, W. (2000). Path-dependent and path-breaking change: Reconfiguring business resources following acquisitions in the U.S. medical sector, 1978-95. *Strategic Management Journal*, 21, 1061-1081.
- Kim, L. (1997). The dynamics of Samsung's technological learning in semiconductors. *California Management Review*, 39(3), 86-100.
- Kogut, B., & Kulatilaka, N. (1994). Operating flexibility, global manufacturing, and the option value of a multinational network. *Management Science*, 40(1), 123.
- LaBarba, L. (1999). Nortel tunes into lasers: New units push envelope toward sparing concept. *Telephony*, 236(9), 22.
- Lawless, M. W., & Anderson, P. C. (1996). Generational technological change: Effects of innovation

- and local rivalry on performance. *Academy of Management Journal*, 39(5), 1185-1217.
- Leiblein, M. J. (2003). The choice of organizational governance form and performance: Predictions from transaction cost, resource-based and real options theories. *Journal of Management*, 29(6), 937-961.
- Leonard-Barton, D. (1992). Core capabilities and core rigidities: A paradox in managing new product development. *Strategic Management Journal*, 13, 111-125.
- Madden, G., Rao, P. M., & Galvin, P. (2002). *Technological competency of leading ICT firms: US patent data evidence*. Paper presented at the International Telecommunications Society, Seoul, South Korea.
- Matsumoto, C. (2001). Rivals vie to reshape net topology. *Electronic Engineering Times*(1183), 1,16.
- Mayer, D., & Kenney, M. (2004). Economic action does not take place in a vacuum: Understanding Cisco's acquisition and development strategy. *Industry and Innovation*, 11(4), 299.
- McEuen, D. (2000). DWDM: Increasing the capacity of optical networks. *ElectronicNews*, 46(27), 16.
- McGrath, R. G. (1997). A real options logic for initiating technology positioning investments. *Academy of Management: The Academy of Management Review*, 22(4), 974-996.
- McGrath, R. G., Ferrier, W. J., & Mendelow, A. L. (2004). Real options as engines of choice and heterogeneity. *Academy of Management: The Academy of Management Review*, 29(1), 86-101.
- Miller, K. D., & Folta, T. B. (2002). Option value and entry timing. *Strategic Management Journal*, 23, 655-665.
- Mitchell, W. (1989). Whether or when? Probability and timing of incumbent's entrance into emerging industrial subfields. *Administrative Science Quarterly*, 34(2), 208-230.
- Munir, K. A. (2003). Competitive dynamics in face of technological discontinuity: A framework for action. *Journal of High Technology Management Research*, 14(1), 93.
- O'Reilly, C. (1998). Cisco Systems: The acquisition of technology is the acquisition of people. In S. G. S. o. Business (Ed.). Palo Alto, CA: Stanford University.
- Oakes, C. (1998). ADSL Standard: Divided Tech, United Companies: Wired News.
- Oxley, J. E. (1999). Institutional environment and the mechanisms of governance: The impact of intellectual property protection on the structure of inter-firm alliances. *Journal of Economic Behavior & Organization*, 38(3), 283-309.
- Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14, 179-191.
- Priem, R. L., & Butler, J. E. (2001). Tautology in the resource-based view and the implications of externally determined resource value: Further comments. *Academy of Management Review*, 26(1), 57-66.
- Rada, R., & Berg, J. (1995). Standards: Free or sold? *Communications of the ACM*, 38(2), 23-27.
- Rao, P. M., Vemuri, V. K., & Galvin, P. (2004). The changing technological profile of the leading ICT firms: Evidence from U.S. patent data, 1981-2000. *Industry and Innovation*, 11(4), 353-372.
- Rogoski, R. (1997). *In the past, the future: Cisco System's RTP chief says partnering key to firm's success*. Bizjournals.com (Feb 10).

- Rosenkopf, L., & Tushman, M. L. (1998). The co-evolution of technology and organization. *Industrial and Corporate Change*, 7, 311-346.
- Soh, P.-H., & Roberts, E. B. (2003). Networks of innovators: A longitudinal perspective. *Research Policy*, 32(9), 1569.
- Steensma, H. K., & Fairbank, J. F. (1999). Internalizing external technology: A model of governance mode choice and an empirical assessment. *The Journal of High Technology Management Research*, 10(1), 1-35.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.
- Tushman, M. L., & Rosenkopf, L. (1992). Organizational determinants of technological change: Towards a sociology of technological evolution. *Research in Organizational Behavior*, 14, 311-347.
- van Wegberg, M. (2004). Standardization and competing consortia: The trade-off between speed and compatibility. *International Journal of IT Standards & Standardization Research*, 2(2), 18.
- Vermeulen, F., & Barkema, H. (2001). Learning through acquisitions. *Academy of Management Journal*, 44(3), 457-476.
- Warner, A. (2003). Block alliances in formal standard setting environments. *International Journal of IT Standards and Standardization Research*, 1(1), 1-18.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5, 171-180.
- Wernerfelt, B., & Karnani, A. 1987. Competitive strategy under uncertainty. *Strategic Management Journal*, 8, 187-194.
- Wheelwright, S. C., Holloway, C. A., Kasper, C. G., & Tempest, N. (1999). *Cisco Systems, Inc. Acquisition integration for manufacturing*. Cambridge, MA: Harvard Business School.
- Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27(2), 185-203.
- Zander, U., & Kogut, B. (1995). Knowledge and the speed of the transfer and imitation of organizational capabilities: An empirical test. *Organization Science*, 6(1), 76-92.
- Zollo, M., Reuer, J. J., & Singh, H. (2002). Interorganizational routines and performance in strategic alliances. *Organization Science*, 13, 701-713.
- Zollo, M., & Singh, H. (2004). Deliberate learning in corporate acquisitions: Post-acquisition strategies and integration capability in U.S. bank mergers. *Strategic Management Journal*, 25, 1233-1256.
- Zollo, M., & Winter, S. G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, 13(3), 339.

ENDNOTES

¹ Internal development and acquisition are clearly not the only ways of entering new markets. Firms can use alliances or product licensing as alternative entry modes. However, these governance modes typically do not convey property rights, such as the ability to modify or customize supplied products. This inability was one reason cited in Cabletron's acquisition of FlowPoint in 1998 (Sweat, 1998). The real option right to decide to abandon or invest further is a specific outcome of how the option purchase conveys property rights.

² We are indebted to an anonymous reviewer who points out that the effect of such power may not be linear. In some processes, the

efforts of very large firms are stymied by a coalition of other firms or entities, suggesting a liability to perceived power. Therefore,

we agree that the effect may be curvilinear and that there may be decreasing returns to these measures of political strength.

This work was previously published in International Journal of IT Standards and Standardization Research, Vol. 6 Issue 1, edited by Kai Jakobs, pp. 39-54, copyright 2008 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.14

IT Training as a Strategy for Business Productivity in Developing Countries

Shirish C. Srivastava

National University of Singapore, Singapore

Thompson S.H. Teo

National University of Singapore, Singapore

ABSTRACT

Most existing studies on technology training address the operational issues of training process (e.g., training needs assessment, learning, delivery methods, etc.). The strategic concerns of IT training for enhancing business productivity largely are not addressed by the current literature. In this article, we explore the strategic concerns of IT training in hierarchical organizations, which are typically prevalent in developing countries. We synthesize various ideas in the literature on change management, training needs analysis, and IT adoption in order to evolve a strategic IT training framework for hierarchical organizations. The proposed framework recognizes the differences in IT training requirements for different levels of employees and suggests a differentiated train-

ing content for different segments of employees. The training framework provides an actionable and comprehensive tool that can be used for systematically planning IT training for enhancing productivity of organizations.

INTRODUCTION

Most existing studies on technology training address the operational issues of training process in the context of the western world; for example, training needs assessment (Nelson, Whitener, & Philcox, 1995), learning styles (Bostrom, Olfman, & Sein, 1990), and delivery methods (Compeau & Higgins, 1995; Sein & Bostrom, 1989). The strategic issues related to IT training in developing countries (e.g., what kind of training is required

for employees; should the training given to all employees be similar in content and delivery) remain relatively unexplored in past research. In this article, we explore these strategic concerns of IT training for hierarchical organizations, which are more prevalent in developing countries. We reiterate the strategic objectives of IT training that usually are lost sight of in the mundane and routine training activities in organizations.

Need for Systematic Training

IT training in many organizations is a matter of chance rather than a planned initiative. Training, in contrast, refers to a planned effort by a company to facilitate the learning of specific knowledge, skills, or behaviors that employees need in order to be successful in their current job (Goldstein, 1992). The pressure for better training is expanding due to the increasingly popular view that people, rather than technology, represent the primary source of enduring competitive advantage (Ford, 1997). Although the need for training is being realized by many organizations, in many cases in developing countries, the training for new technology is not in tandem with organizational requirements. Some employees do receive IT training, but it is mostly a result of the personal initiative of that particular employee in the field of his or her interest. This field may or may not be of direct consequence to his or her job. In some cases, it is the mere persuasion of the training provider that initiates the training nominations from these firms. Consequently, the content and context of IT training often is decided by the training provider and not by the firm. This results in incongruence between training outcomes and organizational requirements. Effective training has to be in consonance with existing organizational structures and practices. There is a need to consider the interface between the organizational system and training (Goldstein, 1992; London, 1989) in order for the outcome to be fruitful and effective.

In many cases, IT training is thought of as a necessary evil and not as a strategic tool for enhancing productivity. For example, Indian Railways, one of the biggest employers in the world with more than 1.6 million employees, does not have a systematic IT training program for its employees, though it is one of the biggest users of IT resources. Employees are imparted IT training on the basis of their emergent skill needs rather than as a part of a well-thought strategic plan. Some firms are proactive in realizing the importance of IT training but till are not able to plan their training modules systematically for want of critical knowledge about the who and what of IT training (i.e., which employees should be trained in what aspects for better leveraging of IT resources). An example in which the firm's success can be attributed to its well-thought-out and planned IT training is the Housing Development Board (HDB) in Singapore. HDB realized the importance of systematic IT training for its employees and was able to leverage training for its success. One of the major contributing factors was top management's proactive attitude toward IT adoption and training (Teo, 1999; Teo & Ranganathan, 2003).

There is no doubt about the fact that everyone in an enterprise does not require the same kind of training in IT for effective adoption and performance (Srivastava & Teo, 2004). In the context of developing countries, where most of the organizations are hierarchical in nature, these organizations have a well-defined chain of command, and the position of employees in the organizational hierarchy determines their responsibilities. The proposed framework seeks to identify the training requirements for different segments of employees so that customized IT training programs can be designed to facilitate speedy and fruitful IT adoption by these enterprises. Effective training requires a systematic approach to training needs assessment, which determines not only who to train but also what to train (McGhee & Thayer 1961). McGhee & Thayer (1961) also cite a lack of

theoretical models for providing systematic training. Surprisingly, this gap in IT training literature still has not been addressed in a systematic and convincing way. This study seeks to present a comprehensive, conceptual, actionable strategic IT training framework for business enterprises, which will help in efficient and effective IT proliferation and usage.

Strategic IT Training Framework

Noe and Ford (1992) have stated the need for training practice to be used as a part of the strategic planning process of the firm. In contrast to this, most firms view IT training as an operational or functional necessity rather than as a strategic tool to gain competitive advantage. In line with the changing market conditions, the training systems in organizations also have to evolve continuously. Using training as a strategic tool is equally valid, not only for IT but for all other functions as well. IT training presents yet a more challenging endeavor, because it calls for a complete transformation of most of their existing systems. For example, the proliferation of ERP and CRM techniques often are based on the concept of business process re-engineering, which requires a major revamping of the existing systems. The rate of evolution for all new technology tools and methods, including IT, definitely has to be at a much faster pace. Tannenbaum and Yukl (1992) have stressed the need for training to be viewed as a system embedded in the organizational context. Training should be conceptualized as integral to the strategic goals of the organization (Schuler & Walker, 1990) and a component of the human resource planning process (Jackson & Schuler, 1990). The orientation of training typically has been micro in its orientation with a focus on individual learning development and change. This is true despite the fact that at the conceptual level, training needs assessment (McGhee & Thayer, 1961), evaluation (Kirkpatrick, 1967), and instructional design models (Goldstein, 1992) state that training

should be aligned with the organizational goals. A key question to be addressed is “what is to be learned?” (Campbell, 1988), and equally important is to know “by whom.”

McGhee and Thayer (1961) and Goldstein (1992) argue that a thorough need analysis will include (a) organizational analysis, (b) task analysis, and (c) person analysis. At the organizational level, we are concentrating on typical organizations, which are hierarchical in structure. At the task analysis level, we are considering the job requirements of various levels of management, and at the person analysis level, we are generalizing the personnel at different levels. Ostroff and Ford (1989) applied a multilevel perspective to needs analysis and noted that the previous three facets may reside at different or even multiple levels of analysis. The training program of the organization needs to be linked to the organizational business strategy (Brown & Read, 1984), the changes in the strategic plan should be reflected in the revised training objectives (Hussey, 1985), and the needs assessment must incorporate a future orientation (Scheinder & Konz, 1989).

Levels in an Organization

All personnel in an organization can be classified in three distinct levels based on the kind of work that level performs. Anthony (1965) made the distinction between the three levels of management based on their decision-making functions (strategic, tactical, and operational). The three levels into which all the employees of an organization can be classified are top, middle, and frontline. The top level includes the CEO and various unit heads. They are the people who are responsible for spelling out the road map of the company. Their decisions have long-term implications not only for the company but also all for its employees. The role of this level in smaller organizations like SMEs is even more important, because not only are they aware of the key strategic problems of the company, but the

smaller size of the company brings them closer to the actual workplace; hence, they also are able to monitor the effects of their decisions. The middle level includes the functional managers. They are largely responsible for the smooth functioning of the areas under them within the broad framework of policies and guidelines spelled out by top management. They are required to plan and source the various resources for production and marketing. This group of personnel requires having a thorough knowledge of working procedures of the industry. The frontline personnel include all the employees excluded from the upper two categories. They include supervisors, inspectors, and workers. They are the employees who actually are involved in the day-to-day business operations and are required to have well-developed skills in handling the various devices and systems that they operate.

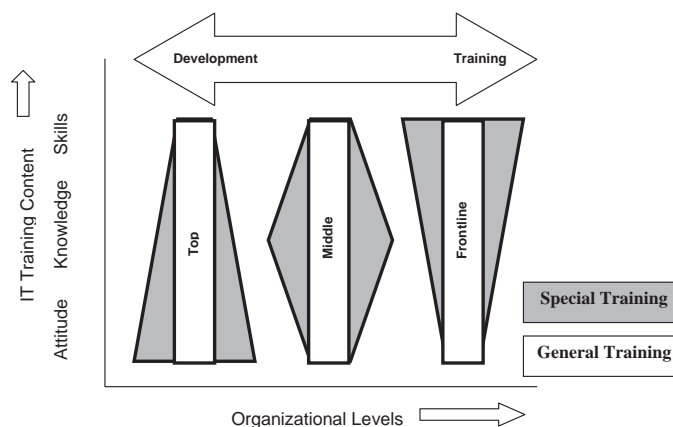
Since different levels of employees have different kinds of functions to perform, it implies that these three levels have different informational needs in relation to their function. Hence, their training needs also are quite different from each other (Daft, Lengel, & Trevino, 1987; Srivastava & Teo, 2004). Further, the different levels require

different kinds of knowledge, skills, and attitudes (KSAs). The different types of knowledge acquisition require different types of training methodologies. Anderson (1982) made a distinction between declarative knowledge, which is fact knowledge (knowing what), and procedural knowledge, which is knowledge of procedures (knowing how). The frontline level may require more of the procedural knowledge, whereas as we go higher, the personnel may require more declarative knowledge related to IT.

Figure 1 presents a strategic IT training framework for organizations, which takes into consideration the hierarchical nature of most organizations in developing countries. The framework recognizes that the IT training needs for the different levels of employees in organizations are quite divergent in terms of content. The three broad contents of IT training are attitude toward IT, knowledge of IT, and on-the-job IT operational skills. The change in the breadth of the triangle and quadrilateral in Figure 1 indicates the change in requirement of the training content for different levels of hierarchy.

The proposed framework seeks to offer answers to questions regarding training component

Figure 1. Strategic IT training framework



for different levels of the organization and serves as a practical tool for hierarchical organizations in planning their IT training initiatives. The profound problem with IT training has been that, in most of the cases, the training is not directed to the informational needs of that level, and often there is a mismatch. This mismatch of the IT training content with the informational needs of the employee results in a twofold wastage. First, the money spent on training that employee is wasted, since it will not help the employee in his or her job. Second, the time spent on training is also a wasted resource. The proposed framework (Figure 1) explores IT training for different levels of organizational personnel with regard to training content. Training content expounds the broad parameters (in terms of knowledge, skills, and attitudes) on which the planners should organize the training for the different levels of employees. A summary of the training content is illustrated

with illustrative examples in Table 1 in the context of ERP implementation.

This differential hierarchical IT training of employees has been implemented successfully by the Housing and Development Board (HDB) in Singapore, which encompasses formal and structured IT training programs for different levels of staff from junior officers to the CEO (Teo, 1999). The IT training programs are designed according to the job and informational requirements of the level of personnel.

Top Level

Top-level managers are usually the perpetrators of underlying currents and culture in an organization. In most traditional organizations, the top managers often are viewed as trendsetters whom all employees in the organization try to emulate. Hence, it is very important for top management to

Table 1. Summary of training content

| Training Content | Fundamental Question | Explanation With Example |
|------------------|---|---|
| Attitudes | <i>Why?</i> The answers to such questions determine the strategic direction of the firm and are usually provided by top management | It seeks to explain the importance of IT and why it should be adopted by the organization, the kind of benefits (long-term as well as short-term) that can be derived from the use of IT. The emphasis is more on molding the views toward leveraging IT in order to improve business productivity and competitiveness. In the case of ERP, such training will inform the participants about the significant benefits that IT is capable of giving to the firms. It seeks to develop the enthusiasm and remove inhibitions by informing about the real business value of IT. The trainees are taught about the various technologies available as well as their potential impact so that they can better decide on the choice of technology for the company. |
| Knowledge | <i>What?</i> These decisions determine the tactical course of action of the firm and are mostly in the domain of middle management of the firm | This seeks to inform about the details for a particular technology. It aims at empowering trainees with the requisite background in order to distinguish and decide which among the options available for a particular technology may be beneficial and suited for their business. Going further with the ERP example, the knowledge component of the training provides the ability to decide among various choices of ERP systems that are available to suit their needs. |
| Skills | <i>How?</i> The frontline workers require this expertise to operate the various systems in an enterprise | This aspect of training provides the necessary ground tools to the workers to actually work on the chosen systems. It provides workers with the necessary expertise to operate the specific software and hardware chosen by the company. An example of skills may include the techniques for operating the different modules in SAP ERP system. This skills training logically comes after the two vital preceding decisions have been taken (1) to use ERP system in the company and (2) among available ERP systems to use SAP |

have positive and favorable attitudes toward IT and new technology adoption. This has implications on the training content for these top-level managers. This group of people requires more attitudinal training toward IT (Table 2). They should be able to realize the importance of IT and the impact that it can have in transforming their enterprise. They require relatively little IT-specific knowledge or skills. These leaders should be trained in a way so that they understand the potential benefits of IT adoption as well as the potential costs of not adopting IT. Such understanding by top management would enable them to be better able to enthuse and motivate their employees for IT adoption. The tapering pyramid in the proposed framework expounds training mostly in understanding “whys” (i.e., attitudes). The requirement of training about

“what” (i.e., knowledge) and “how” (i.e., skills) is comparatively less.

Their preparation should be aimed more toward the developmental dimension than toward the training dimension. They require having a broad understanding of the various ways in which IT can help their business. They should be aware of the various kinds of IT available in the market and the latest trends in the industry worldwide. They should have enough knowledge in order to decide about the kind of systems relevant for the business.

The objectives of employee development are not tied necessarily to a specific job or task. London (1989) defined development as courses, workshops, seminars, and assignments that influence personal and professional growth. Development is

Table 2. Training requirements for different levels of employees

| Level/ Requirement | Attitudes | Knowledge | Skills |
|-------------------------------|--|--|---|
| Top | <ul style="list-style-type: none"> · Positive belief toward IT relevance · Enthusiasm for IT proliferation · Creative, innovative, and risk-taking attitude · Ability to enthuse and motivate others for IT adoption | <ul style="list-style-type: none"> · The latest developments and trends in IT · In-depth business knowledge and emerging IT standards for their industry | <ul style="list-style-type: none"> · General office and communication software (e.g., e-mail, word processing, spreadsheet, etc.) |
| Middle | <ul style="list-style-type: none"> · Positive, proactive, and enthusiastic toward IT adoption · Attitude to learn and teach new things for better efficiency and productivity | <ul style="list-style-type: none"> · In-depth knowledge about the capabilities of the available hardware and software systems · Knowledge about the implementation impediments for various IT systems · Latest developments and trends about IT usage in similar industries | <ul style="list-style-type: none"> · General office and communication software (e.g., e-mail, word processing, spreadsheet, etc.) · Understanding of the operational requirements for the software and hardware systems being used by their department · Specific skills for the critical IT systems in their department |
| Frontline | <ul style="list-style-type: none"> · Positive and enthusiastic toward new learning and IT adoption | <ul style="list-style-type: none"> · Generic knowledge about the capabilities of IT for their industry and specific knowledge about the IT systems on which they have to work | <ul style="list-style-type: none"> · General office and communication software (e.g., e-mail, word processing, spreadsheet, etc.) · Understanding of the software and hardware systems being used by their department · Specific specialist operational skills for the software and hardware systems being used by them · General skills and ability to handle related IT systems in their organization |

focused less on specific skills; instead, it focuses on the comprehensive knowledge and attitudes required for improving the long-term personal effectiveness of the employee, which results in an overall benefit to the firm. Top management in a firm is responsible for deciding the course of action for the enterprise; hence, their overall development in IT will result in empowering them with the right attitudes for executing this function effectively and efficiently.

Middle Level

The middle level is concerned mostly with the tactical decisions in an enterprise. Middle-level managers are required to make decisions on how to best utilize the existing systems in an enterprise per the directions of top management. Suppose top management has been imparted an attitudinal training in IT, and they decide that ERP system is suitable for their enterprise. They give necessary directions to middle-level management to implement ERP in their organization. Now, middle-level management should have the critical knowledge to appreciate the functionality of the ERP system. They should be able to spell out the relative benefits of using the ERP system and, consequently, help top-level management choose the required system, consultants, and so forth. Thus, their training sequence is next in importance to the top level, and their training content is focused more on the knowledge aspect of training. They require a thorough knowledge and understanding of the various systems of the firm and the IT capabilities and, more importantly, how they can be integrated.

The training program planning procedures need to identify and consider the technical as well as the managerial skills needed for advanced technologies well in advance of its implementation (Kozlowski, 1987; Majchrzak, 1988). This requires knowledge of planning techniques that are not well-represented by the conventional needs

assessment models (Kraut, Pedigo, McKenna, & Dunnette, 1989). The hexagon shown in the framework emphasizes the need to have a greater emphasis on knowledge-related aspects of IT in training rather than attitudes or skills. Once they are able to spell out what is to be adopted by the enterprise, then the frontline workers can be imparted the specialized training of skills set. Thus, the training programs for middle-level managers should be more knowledge-related so that they are able to comprehend the IT options available in the industry and are able to make informed decisions (Srivastava, 2001). Many German mid-size firms are adopting Linux as their cost-effective platform (Blau, 2003). Such a decision can come only from a well-informed middle management that has a thorough knowledge of the various options and has the capability to make a comparison.

Frontline Level

The frontline workers are the actual executors of the various tasks in an organization. Top-level management brings the idea (concept) into the enterprise, middle-level management gives form (methodology for operationalizing the concept) to that idea, and frontline workers actually execute (operationalize) this idea. Frontline workers should have rigorous training in the actual systems and IT modules related to their jobs. If we consider the ERP implementation example again, then frontline workers require requisite skills for operating the selected modules of the IT systems chosen. Their training may be very specialized, depending on the skills set required for operating the particular systems. As shown in the proposed framework, they require maximum training in specialized skills and comparatively less in knowledge and attitude-related training. There is no doubt about the fact that they do require a positive attitude toward IT, and this attitude can be instilled in them through socialization and proliferation from top management. Their training need not be directed toward IT-related attitudes and knowledge but

should be focused on the specific skills required by them for execution of the particular job. Their skill-acquiring activity can begin only after top management is prepared to embark upon the IT odyssey and middle management has chosen the ship for this journey; hence, logically, the sequence of their IT training in an enterprise is after top and middle management.

General and Special Training

IT training requirements of personnel in any organization also can be classified as general and special. General training (composed of attitudes, knowledge, and skills) is the common training component that has to be imparted to all employees for efficient functioning in the organization; whereas, special training is given according to the specific job requirements of the employee. Specialist training can be person-, group-, or level-specific. The strategic training framework in Figure 1 captures this in terms of general and special training for all levels of employees. From the framework, it is clear that all categories of employees require some basic grounding in IT-related attitudes, knowledge, and skills for efficient functioning. The only difference in the content in the specialist and general training is that top management may require negligible specialist training in IT skills, whereas frontline management may require much less specialist training in attitudes. At this point, we also would like to emphasize that it is not possible to achieve IT success in an organization without imparting some general IT training in all three aspects (attitudes, knowledge, and skills) for all categories of employees. For example, in an organization, top management may require general IT skills such as checking e-mails and working on a word processor and a spreadsheet, but may require specialist training in attitudes (e.g., being more creative and proactive toward new technologies, risk-taking ability, perseverance, persistence, etc.). On the other end of the spectrum, the frontline

staff may require specialist knowledge about the various IT-related systems that it is using for different operational requirements (e.g., specialized software packages) and functional knowledge of ERP modules. Their requirement of operational knowledge does not discount their basic attitudinal requirements of their enthusiasm for learning and using new technologies. The point about general and special training for different levels of organizational personnel also is highlighted in Table 2, which charts the requirements for different levels of employees.

Huang (2002) also has highlighted the importance of training employees in certain fundamentals of information technology, which will remain nearly constant even in a dynamic technological environment. The general training in the proposed framework (Figure 1) is similar to general technology education, and the special training has been captured in the business application training and just-in-time training (Huang, 2002)

Again considering the case of IT training in HDB, Singapore, the training categories are divided into four levels (basic, advanced, extended, and continuing), depending on the job requirement and computer literacy of the individual staff member (Teo, 1999). This is done with a view to provide a better fit between the actual training imparted and the job requirements (Brown & Read 1984; Kirkpatrick 1967). The attitudinal training in HDB also is brought about through seminars, conferences, and discussions as well as through the promotion of professionalism among IT users through formal certification (accredited by the Singapore Computer Society) of its staff (Teo, 1999; Teo & Ranganathan, 2003).

CONTRIBUTIONS AND CONCLUSION

The motivation for this article is to provide a theoretical basis for providing an IT training framework applicable to hierarchical business

organizations, which is more common in developing countries. Through this study, we provide a comprehensive, actionable, conceptual strategic IT training framework, which is the first contribution of this study. As systematic training is an important input for IT adoption in enterprises, we hypothesize that the presented IT training framework will help to transform technological shyness to technological savviness, leading to enhanced business productivity and competitiveness. We have highlighted the applicability of the proposed framework by drawing some examples from HDB, Singapore, an organization recognized for its efficient and effective IT training programs (Teo, 1999; Teo & Ranganathan, 2003).

Second, we reiterate that training should be viewed not only as a means for serving operational needs but also as a strategic tool (Noe & Ford 1992; Schuler & Walker 1990). The proposed training framework segments organizations in the traditional hierarchical structure and identifies the broad content of IT training in the context of these levels of employees to facilitate IT adoption in a systematic way. Top management personnel of an enterprise who are supposed to provide a strategic direction to the enterprise are the ones who should have a positive attitude toward IT adoption and should understand the tangible and intangible benefits that IT offers them in the short as well as the long term. They not only should be the first ones in an enterprise to be trained in IT, but their training also should focus on empowering them with the attributes that result in fruitful IT adoption by these enterprises. Once top management sets the ball rolling with their right attitudes, then middle management should be in a position to execute the IT plans in an enterprise. Hence, they must have the right knowledge in order to make the right decisions about the choice of platforms, software, and so forth. Their training, therefore, should infuse in them the knowledge to understand and to make decisions best suited for the firm. The role of the frontline workers is at the delivery stage of the

IT plan, conceptualized by top management and operationalized by middle management. These frontline workers should be skilled in operating the chosen software and hardware systems so that right results are delivered to the firm by IT adoption. Hence, their training requirement is more on the skills aspect and actual performance at the delivery stage.

Third, enterprises are faced with the problem of dwindling resources and increasing competition. The proposed framework provides guidelines to practitioners and managers to efficiently deploy their resources on fruitful IT training. It gives a direction to managers for planning IT training of its personnel so that there are no wastages and so that the various levels of personnel get the IT knowledge that is functionally and strategically relevant for them.

Fourth, the proposed framework reiterates that not all employees in hierarchical organizations require similar kinds of IT training, which is especially applicable in the context of developing countries. The informational needs of top, middle, and frontline personnel are very different. Hence, IT training programs for these levels must be designed according to their roles and requirements in order to avoid wastage of scarce resources. Systematic IT training per the proposed framework will make these enterprises competitive in the global economy. Overall, the framework provides researchers and practitioners with a useful tool in order to better understand the different training requirements for different levels of the organization. Such understanding would pave the way for more effective usage of scarce resources to ensure that personnel at various levels are adequately trained to leverage IT effectively in order to improve business productivity and enhance competitiveness.

There are three main limitations of this framework. First, in the present-day world, organizational structure is undergoing a major transformation. We are gradually moving toward flatter organizations in which the classification

per the traditional structure may not hold good for many organizations. However, organizations (especially those in developing countries) tend to be slow in adopting newer organizational structure and tend to continue to have a hierarchical structure. Second, some organizations are relatively small, and top management at times also may be performing the operational and tactical role in addition to the strategic role. Hence, the framework has to be modified suitably for such enterprises. Third, we have assumed that IT adoption should be driven from the top. Sometimes, middle-level and frontline personnel are the ones who bring to management's attention what the competitors are doing with regard to the deployment of IT. Nevertheless, top management support for IT is an essential element for successful IT deployment. Such support will be difficult if top management does not have favorable attitudes toward IT adoption.

Future research can identify the detailed elements of KSAs required for the various levels of personnel for particular IT system implementation (e.g., ERP and CRM). Extensions of this article also can be done by studying some of the successful organizations and by analyzing their IT training strategy for its employees compared to the proposed strategic IT training framework.

REFERENCES

- Anderson, J.R. (1982). Acquisition of cognitive skill. *Psychological Review*, 89, 369–406.
- Anthony, R.N. (1965). *Planning and control systems: A framework for analysis*. Boston: Harvard University.
- Blau, J. (2003). German midsize firms go for Linux. *IDG News Service*. Retrieved from http://www.infoworld.com/article/03/10/29/HNgerman-goforlinux_1.html
- Bostrom, R.P., Olfman, L., & Sein, M.K. (1990). The importance of learning style(s)? In end-user training. *MIS Quarterly*, 14(1), 101–119.
- Brown, G.F., & Read, A.R. (1984). Personnel and training policies—Some lessons from western companies. *Long Range Planning*, 17(2), 48–57.
- Campbell, J.P. (1988). Training design for performance improvement. In J.P. Campbell, R.J. Campbell, & Associates (Eds.), *Productivity in organizations* (pp. 177–216). San Francisco: Jossey-Bass.
- Compeau, D.R., & Higgins, D.A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, 19(2), 189–211.
- Daft, R.L., Lengel, R.H., & Trevino, L.K. (1987). Message equivocality, media selection, and manager performance: Implications for information systems. *MIS Quarterly*, 11(3), 355–366.
- Ford, J.K. (1997). Advances in training research and practice: An historical perspective. In J.K. Ford, & Associates (Eds.), *Improving training effectiveness in work organizations* (pp. 1–16). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Goldstein, I.L. (1992). *Training in organizations: Needs assessment, development, and evaluation* (3rd ed.). Pacific Grove, CA: Brooks/Cole.
- Huang, A.H. (2002). A three-tier technology training strategy in a dynamic business environment. *Journal of End User Computing*, 14(2), 30–38.
- Hussey, D.E. (1985). Implementing corporate strategy: Using management education and training. *Long Range Planning*, 18(5), 28–37.
- Jackson, S.E., & Schuler, R.S. (1990). Human resource planning: Challenges for industrial/organizational psychologists. *American Psychologist*, 45, 223–239.
- Kirkpatrick, D.L. (1967). Evaluation of training. In R.L. Craig, & L.R. Bittel (Eds.), *Training and development handbook* pp. 87–112). New York: McGraw-Hill.

- Kozlowski, S.W.J. (1987). Technological innovation and strategic HRM: Facing the challenge of change. *Human Resource Planning*, 10, 69–79.
- Kraut, A.I., Pedigo, P.R., McKenna, D.D., & Dunnette, M.D. (1989). The role of manager: What's really important in different managerial jobs. *Academy of Management Executive*, 3, 286–293.
- London, M. (1989). *Managing the training enterprise*. San Francisco: Jossey-Bass.
- Majchrzak, A. (1988). *The human side of factory automation*. San Francisco: Jossey-Bass.
- McGhee, W., & Thayer, P.W. (1961). *Training in business and industry*. New York: Wiley.
- Nelson, R.R., Whitener, E.M., & Philcox, H.H. (1995). The assessment of end-user training needs. *Communications of the ACM*, 38(7), 27–39.
- Noe, R.A., & Ford, J.K. (1992). Emerging issues and new directions for training research. *Research in Personnel and Human Resource Management*, 10, 345–384.
- Ostroff, C., & Ford, J.K. (1989). Assessing training needs: Critical levels of analysis. In I.L. Goldstein (Ed.), *Training and development in organizations* (pp. 25–62). San Francisco: Jossey-Bass.
- Scheinder, B., & Konz, A. (1989). Strategic job analysis. *Human Resource Management*, 28, 51–63.
- Schuler, R.S., & Walker, J.W. (1990). Human resources strategy: Focusing on issues and actions. *Organizational Dynamics*, 19(1), 5–19.
- Sein, M.K., & Bostrom, R.P. (1989). Individual differences and conceptual models in training novice users. *Human Computer Interaction*, 4, 197–229.
- Srivastava, S.C. (2001). IT training needs for mechanical department over Indian railways. In *Proceedings of the Seminar on Training Needs for Indian Railway Officials, Indian Railways Institute of Mechanical & Electrical Engineering (IRIMEE)*, Jamalpur (pp. 8–16).
- Srivastava, S.C., & Teo, T.S.H. (2004). IT training as a strategy for business productivity: A framework for small and medium-sized enterprises in Asia. In *Proceedings of the Eighth Pacific Asia Conference on Information Systems, (PACIS 2004)*, Shanghai, China.
- Tannenbaum, S., & Yukl, G. (1992). Training and development in work organizations. *Annual Review of Psychology*, 43(1), 399–441.
- Teo, T.S.H. (1999). Managing information technology at the housing and development board in Singapore: A holistic approach for the public sector. *Journal of Information Technology Cases and Applications (JITCA)*, 1(3), 26–44.
- Teo, T.S.H., & Ranganathan, C. (2003). Leveraging IT resources and capabilities at the housing and development board. *Journal of Strategic Information Systems*, 12, 229–249.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 2, Issue 4, edited by L. Tomei pp. 1-28, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.15

Action Research Methods

Patrice Braun

University of Ballarat, Australia

INTRODUCTION

To date, most research into the implications of the Internet for SMEs has focused on individual business barriers to ICT and e-commerce adoption. Such research has shown that SMEs tend to be time- and resource-poor, with their size being their main disadvantage vis-à-vis ICT adoption (OECD, 2000; Van Beveren & Thompson, 2002). Perhaps the question is not whether small firms have adopted ICT, but rather where are small firms in terms of their ICT adoption. ICT encompasses a series of separate yet interrelated components; for example, electronic mail (e-mail), the Internet, the Web, and e-commerce, which can be adopted in a variety of social and business settings. Hence, it is suggested that ICT cannot be considered as a single technological innovation but rather as a series of (process) innovations, potentially resulting in variable ICT adoption patterns (Walczuch, Van Braven, & Lundgren, 2000).

Keeping up with rapidly changing ICT trends and moving ahead with the adoption of the various ICT components is a challenge for all firms but may be particularly confronting for resource- and time-poor SMEs (Earl, 2000). To counter this

phenomenon, a SME aggregation or cluster argument may be made for the use of ICT to develop joint e-marketing and e-commerce economies of scale (Braun, 2002). In the context of emerging technologies and related knowledge-economy business models, linking stakeholders in dynamic clusters is believed to enhance competition and regional innovation (OECD, 2000). Indeed, the literature is saturated with views on geographic proximity, or clustering of industries and companies, to create innovation and competitive advantage (Asheim, 2001; Porter, 1990).

The geographic scope of a cluster can vary from a single city, state, or region to a network of companies across state borders or even country borders. They can be formal or informal, in the public or private sector, horizontal or vertical, or physical as well as virtual (in an online environment). In a horizontal network, companies within the same industry sector might share an industrial or technological base, operate within a common market, and use a common purchasing or distribution channel. Vertical networks include horizontal cluster participants, as well as suppliers, users, and related services. Porter discusses competitive advantage as being “created and sustained through

a highly localized process” (Porter, 1990, p. 19) and ascribes enduring competitive advantage in a global economy to local knowledge, relationships, and motivation that cannot be duplicated by global partnering (Porter, 1998).

Connectivity has boosted conventional reasons for interfirm networking and virtual clustering—for example, by creating critical mass online—as it facilitates the knowledge-based infrastructure network imperative for today’s competitive advantage. While a number of recent studies have shown benefits in physical SME clustering (Enright & Roberts, 2001; Lowe & Berrisford, 2002), notable research on ICT adoption in a virtual clustering context and studies on network use of the Internet as a cooperative e-commerce tool remain in their infancy.

Building on the concept that global positioning and competitive advantage for SMEs may be achieved through connectivity and clustering, this article first explores the conditions for small business network formation underpinned by technology, then presents the results of an action research study with a regional Australian SME tourism network seeking to establish a virtual e-marketing and e-commerce portal environment.

SMALL BUSINESS NETWORKS

Implementing new business models to achieve competitive advantage in the techno-economic innovation paradigm bring to the fore ICT adoption, strategic planning, and network issues.

Research into the adoption of networked technologies by SMEs indicates that the adoption of network structures and networked technologies by SMEs is generally related to the size and nature of SMEs and largely depends on their perception of affordability and business growth opportunities for their business (OECD, 2000). SMEs generally approach clustering and networked infrastructures such as the Internet with caution and hesitate to invest their time and

money in a rapidly changing economy. SMEs do not necessarily view the Internet as a vehicle to transform their individual business capability from a parochial to a networked or global level, which may be achieved through the setup of electronic commerce (e-commerce) portals or other Web-enabled cluster structures (Murray & Trefts, 2000). The latter study cites lack of technology skills, lack of a strategic sense of how to move forward, and fear of competitor use of the Internet as significant barriers for uptake of networked technologies by SMEs. Therefore, creating network infrastructures and collaboration between small firms is contingent not only on adoption of ICT technology, but also on economic and social contexts.

European studies on SME positioning in the networked economy point to SME’s networking as being contingent on favorable economic conditions, for example, by providing government-sponsored external networks (Cooke & Wills, 1999).

An Asian study similarly provides empirical evidence that successful SME collaboration needs to be underpinned by resources that provide SMEs with the tools to become global players (Konstadakopoulos, 2000). The European studies on SME positioning in the networked economy also associate social relationships with enhanced business, knowledge, and innovation performance (Cooke & Wills, 1999). While connectivity through public or private initiatives may facilitate the electronic linking of SMEs to one another for potential business-to-business (B2B) resource and transaction sharing, and help to reduce isolation of individual SMEs, there is another critical factor to consider in terms of network building between SMEs, namely trust.

Trust is an attribute not only of organizations but also of communities, industry networks, or even entire geographic regions, which can help expedite economic development and facilitate large-scale economic activities (Fukuyama, 1995). Trust between network partners is said to

reduce fear of opportunistic behavior and improve collective learning and knowledge sharing. The trust may be historical and already exist between different firms, as illustrated above, or it can be built during the relational exchange (Gulati, 1995). Some scholars argue that relationships do not necessarily have to be based on trust, as long as systemic mechanisms are in place that allow stakeholders to have confidence that network partners will exhibit cooperative rather than opportunistic behavior and not take competitive advantage of knowledge-based exchanges (Das & Teng, 1997). In the aforementioned Asian example, SME collaboration was in fact taking place based on prior existence of trust and in an atmosphere of continued trust building between stakeholders (Konstadakopoulos, 2000).

In summary, SME (virtual) clustering seems contingent on favorable network conditions such as connectivity (infrastructure), network relationships, and trust. ICT and related capabilities, such as virtual business network environments, can potentially have a significant impact on how interorganizational relationships are developed. Conversely, the structure and culture of an existing network of firms can have considerable influence on the way in which the telecommunications network is developed, implemented, and used.

CASE STUDY

An action research study with a regional Australian SME tourism network seeking to adopt ICT and e-commerce provides some practical insights into network-based ICT and e-commerce adoption. Action research (AR) is a methodology and intervention process that is collaborative in nature, as it aims to work with stakeholders rather than on them (Reason & Bradbury, 2001). All action-oriented interventions value some form of participation, although there are varying degrees of collaboration depending on the method of invention. The participatory and action-oriented

nature of action research is particularly suited to technological innovation, such as the adoption of ICT and portal technology, as it is flexible enough to meet the emerging issues of technology-related change.

In the pursuit of introducing ICT-related change in the tourism network, AR was found to be particularly suited to ICT-related organizational change, as it enables inquiry into and integration of the technical, economic, organizational, human, and cultural aspects of the intervention. AR-type consultations typically include a cyclical and action-oriented design that includes a diagnostic phase, a planning phase, a taking-action phase, and an evaluation phase. Apart from its cyclical approach and practicality, AR is generally appropriate when a project relates to “an unfolding series of actions over time in a given group, community or organisation” (Coughlan & Coughlan, 2002, p. 227).

The AR intervention ensued from a portal development consultancy with a geographically dispersed regional tourism network in the state of Victoria, Australia. Tourism network formation in the form of cooperative destination marketing has been in place in Victoria since 1993 as part of the state’s strategic direction to develop integrated marketing campaigns for its product regions and to attain competitive advantage through collaboration (Tourism Victoria, 1993). Each product region has a so-called campaign committee, a voluntary organization made up of representatives from local industry and local government. Campaign committees are responsible for the marketing of the product region and the maintaining of communications with industry stakeholders in their region.

The AR project was undertaken with one such campaign committee, the Grampians Campaign Committee (“the Committee”), seeking to extend its traditional marketing media range and upgrade its basic ICT network to include an online marketing and transaction presence. The Grampians are considered one of Australia’s renowned tourism

attractions, drawing in excess of 1.2 million visitors annually. The region encompasses some 900 tourism SMEs, seven major townships, numerous villages, and seven local government shires.

The brief was to design a portal model that would support business-to-consumer (B2C) marketing and e-commerce transaction efficiencies and serve as an interfirm B2B interaction and knowledge-creation platform for tourism SMEs in the product region. The AR intent was to ensure that an appropriate portal model would be implemented that reflected stakeholder interests and portal needs. Although AR is an emergent process, and designing such a process is often considered incongruous with the nature of the intervention (Van Beinum, 1999), an overarching portal development approach was nonetheless adopted to provide starting conditions for the process, whereby the intention was to involve as many portal stakeholders as possible in the portal design process. The AR actions proposed to regional stakeholders were to:

- Take part of a data-gathering phase and collect stakeholder e-commerce inquiries and portal needs prior to the design phase of the portal
- Participate in a one-day forum to collectively formulate an initial e-commerce model for the product region
- Take part in follow-up communication to finalize the portal model

Interaction occurred between mid-2001 and early 2002 with a group of 20 stakeholders, who were either part of the Committee, representing tourism industry SMEs, or had a direct industry interest in the portal. After the completion of the AR intervention, all electronically available data—such as e-mail messages, audiotaped conversations, field and journal notes, ICT and tourism policy documents, speeches, and other pertinent documentation—collected during the course of

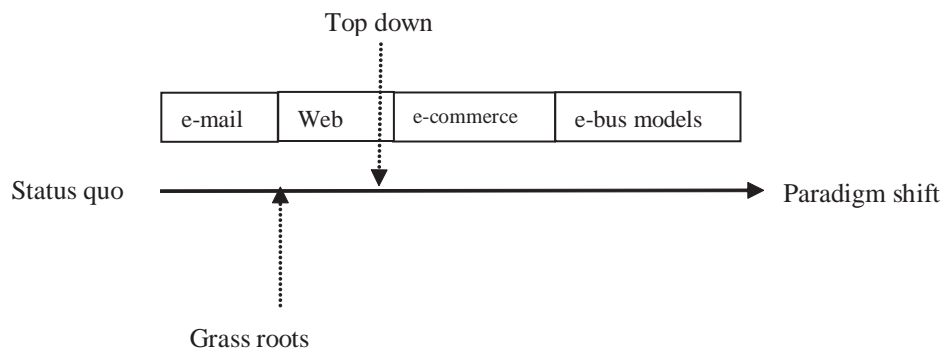
the intervention were aggregated into a qualitative software program for data analysis.

STUDY RESULTS

In conducting and tracking the AR process of developing a product region portal, study results indicate that embracing portal technology is a complex and phase-based process. While e-mail had become the standard communication method for internal Committee business, it had not yet ubiquitously been adopted as the external mode of communication with SME stakeholders across the product region. The AR study indicated that both the hard technology (the telecommunications infrastructure that underpins the uptake of ICT) and the soft technology (the formal and informal skills and knowledge required for the uptake of ICT) remained inadequate. Contextual factors, many in existence prior to ICT adoption, such as stakeholders possessing (access to) ICT knowledge, infrastructure, skills, and time, played a significant role in portal adoption patterns across the product region.

Overall, stakeholders lacked both time and strategic vision, which resulted in a low level of participation in the AR process and lack of “ownership” of the portal. In examining connectivity through conversation and e-mail traffic analysis, it became apparent that institutional stakeholders (e.g., those with work-related access to network infrastructure) were markedly more “connected” than industry (SME) stakeholders. While many product region stakeholders were aware of the Web, the study indicates that most SMEs had not yet progressed to the e-commerce phase, confirming that adopting e-business technologies is indeed an evolutionary process that requires the negotiation of a journey that involves continuous learning and change. Adoption of the entire cluster of ICT technologies could, hence, be viewed as a linear process along an adoption continuum

Figure 1. ICT adoption continuum



(Figure 1). After adopting e-mail, the Web is the second step for adoption consideration; e-commerce is the third step. This is then potentially followed by adoption of a complete e-business model, at which point we might speak of complete ICT adoption or an ICT paradigm shift.

In further considering the SME approach to portal adoption within the network, the study suggests a strong relationship between portal development and network makeup, both in terms of place, e.g., stakeholder position in the network, and space, e.g., the geographic makeup of the network. The Grampians history and the vast boundaries of the Grampians product proved to be pivotal factors negatively influencing ICT network cohesion and SME interest in, and engagement with, the portal. The latter, in turn, influenced the scope of portal adoption within the product region and the SME approach to virtual clustering to achieve economies of scale.

On the whole, clustering was regarded as an interesting but far-fetched idea. Despite the Committee's interest in aggregating domain stakeholders, communication strategies or incentives to create industry awareness of clustering were not

part of the product region's vision or strategic plan. Grampians SMEs were generally still too new to the virtual world to understand the relevance of clustering for their own small business, let alone as a crucial economic strategy for their product region. Because e-commerce was still beyond most Grampians SMEs' level of ICT adoption, the aggregation of SMEs in a virtual cluster or any other potential value added that might have been established along the regional value chain remained unrecognized and, hence, untapped. The specially designed industry clustering tier in the portal was not conducive to augmenting ICT adoption or to fostering an SME cluster culture.

The Grampians' reluctance to cluster may be attributable to various causes. First, the Grampians product region may have been too vast, with SME firms being too geographically dispersed to maintain relationships with and build trust between firms. Second, ICT alone could not permeate subregional barriers or initiate an inclusive virtual cluster culture. As other SME network research has indicated, network conditions need to be conducive to clustering.

CONCLUSION

ICT and related capabilities such as virtual business network environments can have a significant impact on competitive advantage in the networked economy. However, as this article has demonstrated, embracing the cluster of ICT technologies, including portal technology, is a complex and phase-based process. Many SMEs are not yet aware of the potential and value of collaborative e-commerce structures. Merely adding ICT and e-commerce capability to a network structure does not necessarily change or increase SME interest in virtual clustering. For SMEs to take mental, physical, and virtual possession of a shared ICT domain, they will need to get comfortable with ICT and better understand the value of virtual clustering in terms of competitive advantage and economies of scale.

Becoming a network stakeholder may entail an enormous conceptual leap into the future for many SMEs. Network novices will need substantial encouragement and support to make them willing to take the network plunge (Braun, 2002). Creating awareness of networked opportunities, developing skills in using networked technologies, and increasing SME understanding of the potential of (virtual) cluster environments may be helpful. When favorable network conditions are present, participation in an SME virtual cluster is likely to produce economically beneficial outcomes.

REFERENCES

- Asheim, B. T. (2001). Learning regions as development coalitions. Partnership as governance in European workforce states? *Concepts and Transformation*, 6(1), 73-101.
- Braun, P. (2002). Networking tourism SME: E-commerce and e-marketing issues in regional Australia. *Information Technology & Tourism*, 5(1), 13-24.
- Cooke, P., & Wills, D. (1999). Small firms, social capital and enhancement of business performance through innovation programmes. *Small Business Economics*, 13, 219-234.
- Coughlan, P., & Coughlan, D. (2002). Action research. Action research for operations management. *International Journal of Operations and Production Management*, 22(2), 220-240.
- Das, T. K., & Teng, B. (1997). Sustaining strategic alliances: Options and guidelines. *Journal of General Management*, 22, (4), 49-64.
- Earl, J. M. (2000). Evolving the e-business. *Business Strategy Review*, 11(2), 33-38.
- Enright, M., & Roberts, B. H. (2001). Regional clustering in Australia. *Australian Journal of Management*, 26(Special Issue), 66-84.
- Fukuyama, F. (1995). *Trust*. New York: Free Press.
- Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal*, 38, 85-112.
- Konstadakopoulos, D. (2000). Learning behaviour and cooperation of small high technology firms in the ASEAN region. *ASEAN Economic Bulletin*, 17(1), 48-62.
- Lowe, J., & Berrisford, N. (2002). *Capturing value in the grains value chain*. Ballarat: Centre for Regional Innovation and Competitiveness, University of Ballarat.
- Murray, R., & Trefts, D. (2000). *The IT imperative in business transformation*. Retrieved July 25, 2000, from <http://www.brint.com/online/>
- OECD. (2000). *A global marketplace for SME*, Progress report by the Industry Committee Working Party on SME. Retrieved June 20, 2000, from <http://www.oecd.org/EN>

Porter, M. E. (1998). *On competition*. Boston: Harvard Business School.

Porter, M. E. (1990). *The competitive advantage of nations*. London: Macmillan.

Reason, P., & Bradbury, H. (2001). Introduction: Inquiry & participation in search of a world worthy of human aspiration. In P. Reason & H. Bradbury (Eds.), *Handbook of action research* (pp. 1-14). London: Sage.

Storper, M. (1993). *Tourism Victoria strategic business plan*. Tourism Victoria.

Storper, M. (1997). *The regional world*. London: Guilford Press, Tourism Victoria.

Van Beinum, H. (1999). On the design of the ACRES program. In D. Greenwood (Ed.), *Action research. From practice to writing in an international action research development program* (Vol. 8, pp. 3-24). Amsterdam: John Benjamins.

Van Beveren, J., & Thompson, H. (2002). The use of electronic commerce by SME in Victoria, Australia. *Journal of Small Business Management*, 40(3), 250-253.

Walczuch, R., Van Braven, G., & Lundgren, H. (2000). Internet adoption barriers for small firms in The Netherlands. *European Management Journal*, 18(5), 561-572.

KEY TERMS

AR: Action research. Action research is an action-oriented methodology or intervention process that is collaborative in nature. It aims to work with stakeholders.

B2B: Business-to-business trading; involves the sale of goods or services by a business to another business.

B2C: Business-to-consumer trading; involves the sale of goods or services by a business directly to individual customers.

Cluster: A group of linked enterprises that share a common purpose of gaining competitive advantage and economies of scale.

Competitive Advantage: A condition that enables companies to operate in a more efficient or higher-quality manner than the companies it competes with, and that results in financial benefits.

Connectivity: The ability to link to the Internet via a computer.

E-Commerce: Connection, electronic data exchange and transaction capability via the Internet.

Economies of Scale: This refers to the notion of increased efficiency for the production and/or marketing of goods/products by pooling or sharing resources.

ICT: Information and communication technologies; includes phone, fax, e-mail, the World Wide Web, and the Internet.

Portal: A Web site or service that provides access to a wide range of services.

SMEs: Small and medium size enterprises; refers to enterprises with a specific number of staff. A small size enterprise generally refers to firms with less than 20 employees.

Value Chain: A value chain is a string of diverse companies working together to create or satisfy market demand for a particular product or a bundle of products.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, & X. Yu, pp. 1-5, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 6.16

The Impact of IT Investment in South African E-Commerce SME Organizations

Sam Lubbe

University of KwaZulu-Natal, South Africa

ABSTRACT

This chapter considers the possibility of a link between organisational performance and information technology (IT) investment intensity in SME organisations practising e-commerce for the period 2001/2002. The answers to the research questions note that in top performing organisations; (1) IT costs as proportions of operating costs were higher; (2) IT costs as a proportion of turnover was lower, than in weak performing organisations; and (3) that a positive correlation exists between the computerisation index (CI) and the operating costs ratio. The investigation also reveals that chief executive officers (CEO)'s expect additional output while planning e-commerce operations and keeping IT budgets constant. Evidence is presented that company performance is linked to the level of IT investment intensity in the sample of organisations investigated, even though more output was expected from the IT department.

INTRODUCTION

Achieving business value from information technology (IT) and e-commerce investment at the same time is probably one of the more common organisational concerns of (CEOs) today (Lubbe & Pather, 2002). IT and e-commerce are the growing areas of investment in most organisations; in fact many organisations will not be able to function without IT or digital commerce. The role of IT has also been redefined by some organisations to include attempts to embark on e-commerce operations. The role of IT in organisations is not merely a tool for processing communication, but a strategic weapon that can thus affect an organisation's competitive position (Lubbe et al., 2002; Weill & Olson, 1989).

Some of the variables that will be discussed include IT, e-commerce, investment, and achieving value from IT investment. The contribution of this article is significant, as it will contribute to the understanding of managers that the impact

of e-commerce may change the way organisations handle their total IT investment. The article will, however, review only South African organisations and aims to improve on the topic's understanding off IT and digital investment by managers and academics.

REVIEW OF PAST RESEARCH

Mason, McKenney, and Copeland (1997) argue that information systems (IS)¹ as a discipline has not yet developed a tradition of historical research. This historical analysis by them broadens the understanding of the processes and designs during which IT is introduced into organisations and the forces the shape IT investment uses. They argue that a dominant design for this shape could be manifested in several ways; a new organisational infrastructure, new functionality, new products, new services, new production functions or new cost structures. The problem with historical analysis is to discover why some organisations lead their respective industries in the use, design and application of IT, and why other organisations, having spent millions of dollars achieved modest success rates.

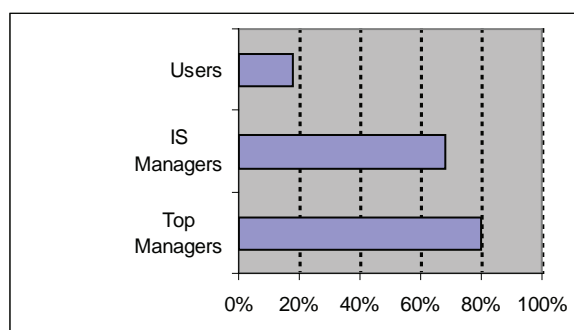
Hu and Plant (2001) argue that the promise of increased advantage was the driving force behind large-scale investment in IT since the 1970s.

Current debate continues amongst managers and academics with reference to the measurable benefits of IT investment. Return on investment (ROI) and other performance measures in academic literature, indicates conflicting empirical findings. They also submit that it would be convincing to infer causality if IT investment in the preceding years is significantly correlated to the performance of the organisation in the subsequent year. Hu et al. (2001) used the Granger causality model with three samples of organisations and discovered that there was no increase in the level of financial performance. Rather, it is the other way round—increased financial performance lead to increased IT investment.

Li and Johnstone (2002) argue that a manager can use the framework within which the appropriateness of using real options theory in strategic IT investment by systematically justifies the use of it. They classify IT costs and provide some insight about the relationship between technology standardisation and IT investment decisions. Research by Lubbe et al. (2002) also reflects that managers of organisations are concerned whether their organisation is achieving IT and e-commerce value from their organisation's IT investment (Figure 1).

Bui, Sankaran, and Sebastian (2003) argue that technology and societal changes are moving the global market rapidly towards a new economic

Figure 1. Top managers and IS managers are most concerned about achieving value from IT and e-commerce



order rooted in e-commerce. They investigate some factors including macro economy, ability to invest, access to skilled workforce, cost of living, and pricing. The authors also state that many organisations face a chronic shortage of resources (including funding). Management should be aware that e-business is part of the complex and general economic structure and the success of organisations depend on that structure as well as the optimum allocation of resources.

Dykman (2003) notes that information systems (IS) represent a significant investment for many organisations. Managers need to know that the decision made to spend money on IS should be analysed like any other major purchase. She argues that general management often gives in to the expert power of the technologists, both internal and external to the organisation to invest in IS. The ROI on an IS acquisition may not be quite as simple or straightforward as other capital expenditure. She, however, states that it is still possible to do the financial analysis for the investment.

Dykman (2003) argues that it would be of great benefit if there were a general recipe that could assist to ensure success. Ideally all the strategies (e-commerce, IT, and organisation), including the framing of all investments, could be aligned around business requirements, rather than on technology requirements. She states that it needs a workhouse of a system to facilitate the operations of the organisation as it works to realise its strategic vision. She further argues that managers should be measured against the accuracy of their tangible financial projections for IS investment. Every investment should be justified with concrete revenue (benefit) and expense commitments. Dykman (2003) notes that managers should aim to do a better job assessing the benefits associated in a proposed IS investment in tangible and financial terms. Executives demand this when evaluating the approval, or denial, of any other capital expenditure. IS investment decisions are business decisions and therefore not technology decisions.

Moodley (2003) argues that e-commerce technologies are becoming increasingly important to South African apparel producers as they are integrated into global value chains. Moodley (2003) suggests that the empirical evidence emanating appears that e-commerce is still in its infancy but there is potential for growth. The problem is to ensure that there is sufficient financial support to sustain success. Moodley (2003) argues that South African organisations should increase their investment in e-commerce.

Quayle (2003) notes that the awareness and level of implementation of e-business in European small and medium enterprises (SME) differ in some aspects from larger organisations. He argues that the issues of highest importance are leadership, time to market, marketing and financial management, and a narrow vision of business survival. He further states that small firm's perceptions of quality, price, production reliability, service reliability, and capability to provide support are normal buyer's demands. Nowhere is the aspect of value from IT investments reflected. The idea is that the cost to execute transactions be reduced. He states that developing e-business expertise is essential to sustain the competitive advantage. SMEs must be aware that some aspects such as financial management could impact on their future plans.

It is also argued by Santhanam and Hartono (2003) that the resource-based view can be used to investigate the impact of IT investment on organisational performance. A strong IT capability can support improved organisational performance. Furthermore, their results indicate that organisations with superior IT capability, exhibit current and sustained organisational performance. They note however, that previous performance must be taken into account while doing these calculations.

Kearns (2004) states that while IT investment has the potential of providing competitive advantage, actual returns on such investment vary widely and a majority of CEO's rank past

IT investment disappointing. There are many methods for investment evaluation, but traditional methods do not adequately account for the intangible benefits that characterises strategic investments. They also lack other features of portfolio selection. He describes a model based on the analytic hierarchy process that could possibly overcome the deficiencies associated with traditional approaches to economic evaluation of IT investment. This approach reflects both on tangible and intangible methods and links IT investment to business strategies.

THE RESEARCH QUESTIONS AND RESEARCH METHODOLOGY

Research Questions

The Relationship Between Profitability and IT Investment

Lubbe et al. (2002) noted that a relationship exists between profitability and IT expenditures in South African e-commerce organisations. Quayle (2003) notes that no relationship exists between organisational performance and the relative portion of resources allocated to IT. He argues that the measure of performance will not capture all factors that contribute to the organisation. Using case studies, Weill et al. (1989) reveal the importance of converting IT investment into productive inputs with different levels of effectiveness, depending on the organisation. There is also empirical evidence that the use of IT results in lower cost (Santhanam et al., 2003). The first research question can thus be formulated as:

Is there a negative correlation between IT investment with profitability in e-commerce intense organisations?

The Relationship Between Profitability and Computerisation Index 2

Weill et al. (1989) argue that two key factors are emerging determining the return on investments (ROI) on IT is difficult; and investment in IT alone is not sufficient. Dykman (2003) suggests that IT investment reduces the cost of revenue generation. Santhanam et al. (2003) suggest that evidence indicates that organisational performance is linked to the level of IT investment intensity. This research question specifically compares the overall performance of the organisation with the CI index (another measure of computerisation) and not the IT expense (ITEX) ratio as used previously.

The second research question can thus be stated as (based on the study of Santhanam et al. 2003):

Is there a positive correlation between IT investment intensity and organisational performance?

The Relationship Between Profitability and IT/E-Commerce Strategic Management Integration with Organisational Strategic Management

The third research question is formulated as:

Is there a positive correlation between IT investment and strategic management of IT and e-commerce operations?

RESEARCH METHODOLOGY

The author had decided to use qualitative research because it is designed to help him understand the people and the social and cultural contexts within which the organisation operates. To establish the best design it was decided to collect the data needed

to answer the research questions discussed above using a structured questionnaire. The population consisted of all IT intensive organisations that have just started an e-commerce operation during the period 2001/2002. From this list, a number of companies were selected who indicated their willingness to cooperate with the investigation. They were mailed a copy of the questionnaire with a request to include financial statements for the period covered (2001/2002).

The completed questionnaires were analysed to extract the data. The CI was calculated from data collected using the questionnaires. Financial ratios were calculated using data from the statements and the questionnaires. Data showing the relationships between the CI and measure of financial performance were plotted on graphs using Microsoft Excel.

Limitations of the Study

It is acknowledged that there are other factors that could affect the research but the author has decided to limit the study to the papers that were available to him. It was assumed that the organisational financial and other figures, as rendered, were accurate and complete where they could be verified with audit/working papers. Additionally it was assumed that the respondents completing the questionnaire did so accurately. However, a possible source of error lies in the respondents' interpretation of the terminology used in the questionnaire, although it was pre-tested.

Furthermore, some data given by the respondents could not be verified fully, owing to its sensitivity. Also, it was not possible to check the method of accounting and it is acknowledged that this could have influenced some financial ratios. However, given these limitations, it was still possible to use the models to answer the research questions since these sources of error did not differ from those evident in other studies (e.g., Lubbe et al., 2002; Weill et al., 1989). It was also possible to interpret the results based on the

data obtained as no statistical technique could show them to be unreliable.

The Results

Information Systems in South Africa in Context

South Africa is a medium sized country, 471,000 square miles at the southern tip of the African continent with a population of some 45 million people. Relative to the rest of Africa, South Africa is substantially industrialised. South Africa is a wealthy country from an industrial and agricultural point of view and computers have been actively in use in South African business, education, and industry since the early 1960s when both IBM and ICL opened offices in Johannesburg. Today South Africa employs computers in every aspect of industry, business and government as well as having a relatively high percentage of home computers among the middle class. All the major vendors are present and there is considerable interest in hi-tech.

The business and industrial sectors in South Africa are as sophisticated as anywhere in the world in the use of information systems. South Africa leads the world in deep level mining and supports this activity extensively with computer systems. The country also has a substantial financial services sector that has won international recognition for its excellence in information technology. For example, the First National Bank (FNB) of South Africa was named one of the world's top 100 computer users by ComputerWorld Magazine in May 1995 and in July 1996, the same bank also won the prestigious Smithsonian Institute prize for the innovative application of biometrics in their information technology.

Discussion of the Results

In order to test the validity of aspects of the questionnaire respondents may have had difficulty

understanding when answering, a pilot study was conducted using some of the companies in the sample. This was done to ensure that it was possible to collect all data required for the ratios. Ambiguities were removed in order to reflect a concise research instrument.

**Research Question 1:
The Relationship Between Profitability and IT Investment**

The data needed for this section was gathered from financial returns provided by the organisations. Figure 2 illustrates a profile of both, the turnover and operating expenses for the organisations in the sample (2001/2002). Turnover exceeds the operating expenses in 2001 as can be seen from Figure 2. However, in 2002, the effects of a low growth rate in South Africa manifests in the turnover slumping to a low. One organisation spent additional resources to expand their operations affecting the overall picture.

Operating Expense Ratio (OPEX)³ and information technology expense ratio (ITEX)⁴ were the two ratios used in this instance. These were calculated and presented in Table 1.

These ratios were calculated and averaged over the period under investigation to negate the effects of seasonal and abnormal influences as indicated. Finally, the organisations were sorted in ascending order using the OPEX ratio as a primary key in

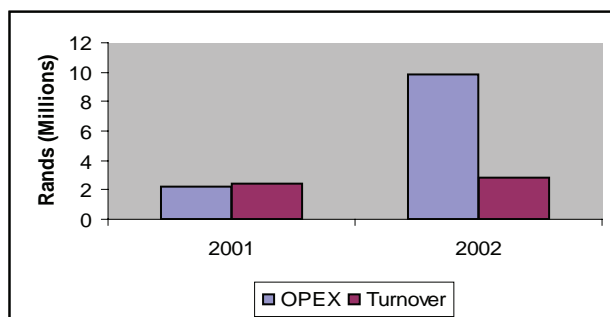
and grouped in quartiles (Table 2). This was done partly to disguise the data and to neutralise the effect of seasonal and other influences.

As stated before, Table 2 is the result of sorting the organisations (OPEX as the primary key) in ascending order and grouped together in quartiles; the first three companies were used for quartile I, the second three for quartile II, etc. Although all the previously mentioned operations were used to negate the effects of seasonal and economic fluctuations, the results of a loss by one organisation could be seen in the second quartile. There is a negative correlation of 0.5425 between the Operating expense ratio and the IT ratio. This provides evidence that there is a link between the two ratios and supports statements by authors such as Weill et al. (1989) and Lubbe et al. (2002).

**Research Question 2:
The Relationship Between Profitability and Computerisation Index**

Table 3 compares the operating expense ratio, IT expense ratio, and CI⁵. The CI indicates and supports the second research question noting that there is a link between computerisation and organisational performance. The better an organisation performs, the higher the CI. From a statistical point of view, the Spearman ranking indicates a high negative correlation of 0.8842

Figure 2. Turnover vs. operating expense



The Impact of IT Investment in South African E-Commerce SME Organizations

Table 1. Operating expense ratios (OPEX) and IT expense ratios (ITEX)

| Co | 2001 | | 2002 | |
|----|-------|-------|-------|-------|
| | OPEX | ITEX | OPEX | ITEX |
| 1 | 0.152 | 0.119 | 0.157 | 0.128 |
| 2 | 0.128 | 0.037 | 0.148 | 0.053 |
| 3 | 0.162 | 0.117 | 0.180 | 0.145 |
| 4 | 0.257 | 0.160 | 0.427 | 0.180 |
| 5 | 0.172 | 0.483 | 0.252 | 0.820 |
| 6 | 0.422 | 0.139 | 0.374 | 0.232 |
| 7 | 0.783 | 0.118 | 0.718 | 0.099 |
| 8 | 0.916 | 0.002 | 0.933 | 0.003 |
| 9 | 0.991 | 0.002 | 0.963 | 0.001 |
| 10 | 0.987 | 0.003 | 0.980 | 0.003 |
| 11 | 1.009 | 0.062 | 0.860 | 0.082 |
| 12 | 0.093 | 0.001 | 0.963 | 0.000 |

Table 2. Quartile groupings for organisations (2001/2002)

| Quartile | OPEX | ITEX |
|----------|-------|-------|
| I | 0.155 | 0.100 |
| II | 0.317 | 0.336 |
| III | 0.734 | 0.037 |
| IV | 0.965 | 0.076 |

between the CI and the OPEX, while only a positive correlation of 0.4126 was measured between the OPEX and ITEX ratios. CI is therefore a better measure for the intensity of computerisation in an organisation. Lubbe et al. (1992) indicated that the CI applies to other industries as well and this further supports this finding.

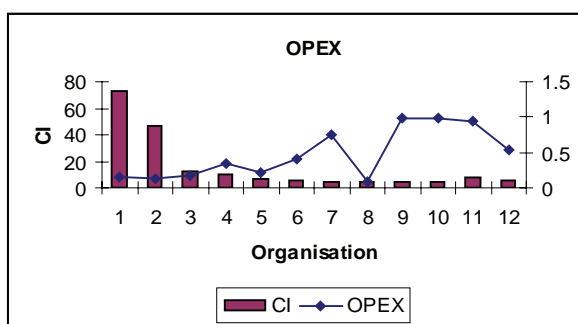
Further statistical analysis indicates an F-Ratio of 3.89 and squared mean deviation of 0.384485 between the CI, OPEX, and ITEX ratios. The correlation matrix used to estimate

the coefficients produced a correlation-coefficient of -0.8778 between the CI and OPEX ratio and a correlation-coefficient of -0.675 between the CI and ITEX ratio. The correlation was in both instances negative and high. There was also a weak correlation between the CI (the constant, level of computerisation) and the ITEX and OPEX ratios (the variables). It thus helps to answer the second question by delivering proof that there is a relationship between profitability and computerisation. Figure 3 illustrates the link between CI and OPEX clearly.

Table 3. Relationship between CI and operating and IT ratios

| C | CI | OPEX | ITEX |
|----|----|--------|-------|
| 1 | 73 | 0.155 | 0.124 |
| 2 | 47 | 0.138 | 0.045 |
| 3 | 13 | 0.171 | 0.131 |
| 4 | 10 | 0.342 | 0.170 |
| 5 | 7 | 0.212 | 0.652 |
| 6 | 6 | 0.398 | 0.186 |
| 7 | 5 | 0.751 | 0.109 |
| 8 | 5 | 0.0925 | 0.003 |
| 9 | 5 | 0.977 | 0.002 |
| 10 | 5 | 0.983 | 0.003 |
| 11 | 8 | 0.934 | 0.072 |
| 12 | 6 | 0.528 | 0.000 |

Figure 3. CI vs. OPEX ratio



**Research Question 3:
The Relationship Between Profitability and IT/E-Commerce Strategic Management Integration with Organisational Strategic Management**

A positive correlation of 0.54 was calculated, which led the researcher to accept the fact that there is a relationship between profitability and IT/e-commerce strategic management integration at the 95% level. A problem that all the respondents mentioned is that they still get the same amount

of funding but that top management expects more from them. In real terms, this means that top management expects e-Commerce to stem naturally from the IT department. All the responding organisations placed e-Commerce as part of the IT department.

DISCUSSION AND CONCLUSION

The relative high correlation that is evident from Figure 3 may be attributed to the strategy employed

with IT investment decisions and is supported by Dykman (2003). The strategic importance of IT investment should be emphasized and the importance of IT investment decisions needs to be considered by business managers. The reason being stated is that it may affect their e-commerce and other commercial operations. Organisations also need to ensure that e-commerce is not part of the IT department but a department on its own with an own strategy.

It is important to note that the more integrated IT and e-commerce investment decisions become the better chance for full alignment with the overall organisational strategy. This will help businesses in the long run. Although the study does not conclusively deliver proof of a positive or negative correlation in one instance, it shows that in the sample used, a strong tendency exists that:

- Organisational performance is correlated with IT investment intensity.
- IT investments will be correlated to IT and e-commerce intensive organisations with their profitability.

It should be noted that to find organisations just embarking on e-commerce is extremely difficult and explains the reason for the small sample size.

REFERENCES

Bui, T. X., Sankaran, S., & Sebastian, I. M. (2003). A framework for measuring national e-readiness. *International Journal of Electronic Business*, 1(1), 3-22.

Dykman, C. A. (2003). Financial evaluation of information systems investments. In C. K. Davis (Ed.), *Technologies & methodologies for evaluating IT in business* (pp. 175-189). Hershey, PA: IRM Press.

Hu, Q., & Plant, R. (2001). An empirical study of the casual relationship between IT investment and firm performance. *Information Resources Management Journal*, 14(3), 15-25.

Kearns, G. S. (2004, January-March). A multi-objective, multi-criteria approach for evaluating IT investments: Results from two case studies. *Information Resources Management Journal*, 17(1), 37-62.

Li, X., & Johnstone, J. D. (2002). Evaluate IT investment opportunities using real options theory. *Information Resources Management Journal*, 15(3), 32-47.

Lubbe, S., Hoard, A., & Parker, G. (1992). The profit impact of IT. *Journal of IT*, 1(10), 44-51.

Lubbe, S., & Pather, S. (2002, July 15-16). A study into theoretical success factors for successful Internet commercial enterprises. Presented at ECITE 2002, held at Université Dauphine, Paris.

Mason, R. O., McKenney, J. L., & Copeland, D. G. (1997, September). Developing a historical tradition in MIS research. *MISQ*, 21(3), 257-277.

Moodley, S. (2003). The potential of Internet-based business to business electronic commerce for a technology follower: The case of the South African apparel sector. *Journal of Internet and Enterprise Management*, 1(1), 75-95.

Quayle, M. (2003). E-business in a turbulent world: Usage in European small and medium enterprise. *International Journal of Electronic Business*, 1, 41-52.

Santhanam, R., & Hartono, E. (2003). Issues in linking information technology capability to firm performance. *MISQ*, 27(1), 125-153.

Weill, P., & Olson, M. H. (1989). Managing investment in information technology: Mini case examples and implications. *MISQ*, 13(1), 3-17

ENDNOTES

¹ Information technology (IT) and information systems (IS) will be used alternatively and for the purpose of this article will be interpreted as meaning the same whilst discussing the investment of IT.

² Computerisation index was discussed in detail in a previous paper of Lubbe, Hoard, and Parker (1995): The profit impact of IT investment. *Journal of Information Technology (JIT)*, 1(10), 44-51.

³ OPEX = non-interest operating expenses to income.

⁴ ITEX = IT expenses to non-interest operating expenses.

⁵ CI means the extent and sophistication of computerization. Ten variables (for example years using computers, management activity level, etc.) were selected to collectively represent the computerization process.

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 94-106, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.17

Organizational Performance and IT Investment Intensity of South African Companies

Johan Nel

Brisbane Solution Centre, Australia

ABSTRACT

This chapter considers if a link exists between company performance and information technology (IT) investment intensity in selected South African companies. The study, which covered the period 1989–1991, was based on the hypotheses viz: that in top performing companies (1) IT costs as proportions of operating costs were higher; (2) IT costs as a proportion of turnover was lower, than in weak performing companies; and (3) that a positive correlation exists between the computerization index and operating cost efficiency ratio. Evidence is presented that company performance was linked to the level of IT investment intensity in a sample of organizations in the RSA. Findings of later case study research supporting this are also presented.

INTRODUCTION

Getting business value from information technology (IT) investments is probably one of the most common business concerns of the chief executives in organisations today. IT is one of the growing areas of investments for most organizations; many organizations would not be able to function without IT. The role of IT has changed from being a tool for processing transactions to a “strategic weapon” that can affect a company’s competitive position (Benjamin, 1984; Cash & Konynski, 1985; Weill & Oson, 1989). More recently however, there have been reports of real business and human benefits delivered by IT falling short of expectations (Beck, 2000; Du Plooy, 1993; Earl, 1994; Lee & Barua, 1999; Mahmood, 1994; Thorp & Leadership, 1998).

From its research findings, Butler Cox Foundation (1990) observed that managers of organizations are concerned about whether their organization is getting value from IT investments. Weill et al. (1989) noted that the product portfolio and profit impact of marketing strategy (PIMS) established average IT expenditure in 1983 as 2% of revenues. The Diebold Group survey in 1984 revealed that centralized management information systems expenditures on average accounted for 1.4% of revenues. Shoval and Lugasi (1988) postulated that the selection of alternative computer systems must consider the relative importance of the benefit and cost factors. Kwong and Mohamed (1985), in a case study of petroleum-producing companies in Malaysia, adduced that the computerization index (CI) measures the extent and sophistication of computerization.

In an empirical study among insurance companies in the USA, Harris and Katz (1988) established a relationship between an organization's profitability and their IT capital intensity. They concluded that the most profitable firms, or top performers, are more likely to spend a significantly higher proportion of their non-interest operating expense on IT. They observed further that the least profitable firms are more likely to spend a significantly smaller proportion of their non-interest operating expense on IT. Sippel (1989) stated that life insurance, like most of the financial services sector, is an "information intensive" industry. Lubbe et al. (1992) conjectured that the ratios used by Harris and Katz, and the CI model of Kwong et al. (1985) are applicable in the South African long term insurance industry.

Ward (1987) observed that a trend towards decreasing IT costs and increasing IT capabilities will make the use of IT both economically and technically feasible in the next decade. Bender (1986) examined the relationship between the ratio of information processing expense to operating expense and the ratio of operating expense to premium income in life insurance companies. The correlation between the two

ratios was negative, indicating that higher values of the ratio of information processing expense to operating expense were associated with better performance.

Allen (1987), in a literature study on methods to make information systems (IS) pay its way, postulated that companies gain a competitive advantage if IT is run as a profit centre. Surveys done (Choudhury, 1986; Drury, 1980) in both charge-back and non-charge-back environments showed that MIS managers are in favour of using charge-back to control the use of scarce information resources.

Nel (1991) in an empirical study conjectured that the amount of IT expenditure is larger in some industry sectors than others. In addition, that rates of increase in expenditure are also significant. Industry sectors for which information is a key asset, (often referred to as "information intensive" or "strategically dependent on IT" industries), rely heavily on IT to support their organizations and their expenditure is relatively high. In the South African financial sector, IT budgets can easily account for 40% of operating expenditure.

Strassmann (1991) found little or no correlation between the proportion of corporate revenue spent on IT, return on assets or shareholder's investments.

THE HYPOTHESES AND RESEARCH METHODOLOGY

The Hypotheses

Relationship Between Profitability and IT Investment

Harris and Katz (1988, 1991) studied the relationship between profitability and information technology expenditures in American insurance companies. Turner (1985) noted no relationship between an organization's performance and the

relative portion of resources allocated to IS. He observed that the measure of performance will not capture all factors that contribute to high performance. Using case studies, Weill et al. (1989) noted the importance of converting IT investment into productive inputs with different levels of effectiveness, depending on the organization. There is empirical evidence that the use of IT can result in lower labour costs (Harris & Katz, 1997).

Thus, the first hypothesis, based on the hypotheses of Harris et al. (1991), can be formulated as:

- **H1:** IT investments will be negatively correlated, in IT intense companies, with their operating expense ratio.

Relationship Between Profitability and Computerization Index

Weill et al. (1989) identified two key factors, which are: (1) that determining the return on investments in IT is difficult and (2) that investment in IT alone is not sufficient. Kwong et al. (1985), in a case study of the profit impact of computerization, suggested that IT investment reduces the cost of revenue generation. Harris et al. (1991) observed that evidence indicates that firm performance was linked to the level of information technology investment intensity.

The second hypothesis can thus be conjectured, based on the hypothesis of Kwong et al. (1985):

- **H2:** Organizational performance is positively correlated with information technology investment intensity.

Relationship Between Profitability and IT Strategic Management Integration with Corporate Strategic Management

The third hypothesis was formulated as:

- **H3:** IT investments will be positively correlated, in IT intense companies, with their strategic management of IT.

Research Methodology

In order to gather the data needed to calculate all statistical and other indicators, a structured questionnaire was used. The population consisted of listed companies on the JSE and other companies in South Africa. All the identified companies were sent a questionnaire with a request to include financial statements for the period covered.

The completed questionnaires were analyzed to extract the data. The CI was calculated from data collected by the questionnaire. The financial ratios were calculated using data from the statements and the questionnaire. Data showing the relationships between the CI and the measures of financial performance were plotted on graphs using Quattro Pro Version 4.0. Additionally to the graphs, it was decided to perform statistical analysis. Stat graphics was used for regression analysis and the Spearman Rank Correlation Test.

PILOT STUDY

In order to test for aspects of the questionnaire, which respondents may have had difficulty in understanding, a pilot study was completed using some companies in the sample. This was to ensure that it was possible to collect all data required for the ratios. Ambiguities were removed in order to reflect a concise research instrument.

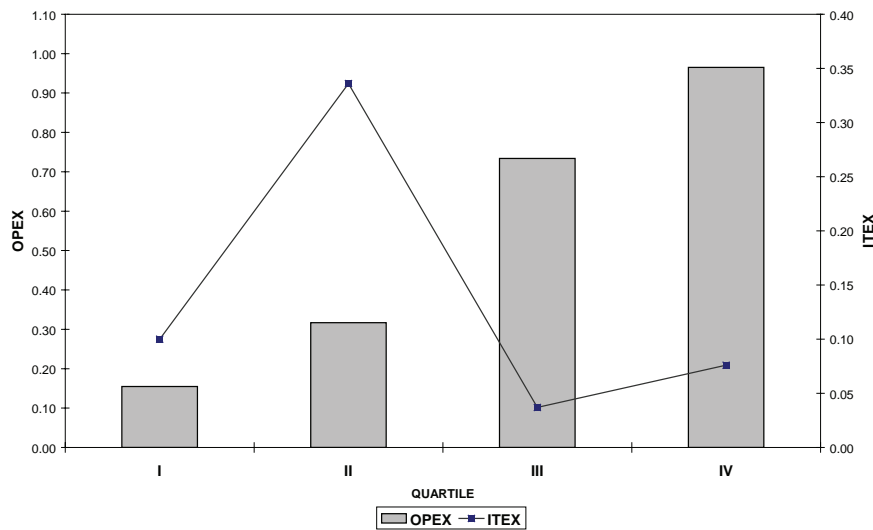
DATA COLLECTION INSTRUMENT RELIABILITY

It was assumed that the company's figures were accurate and complete. In addition, it was assumed that the respondent completing the ques-

Table 1. Operating expense ratios and IT expense ratios

| C | 1990 | | 1991 | |
|----|-------|-------|-------|-------|
| | OPEX | ITEX | OPEX | ITEX |
| 1 | 0.152 | 0.119 | 0.157 | 0.128 |
| 2 | 0.128 | 0.037 | 0.148 | 0.053 |
| 3 | 0.162 | 0.117 | 0.180 | 0.145 |
| 4 | 0.257 | 0.160 | 0.427 | 0.180 |
| 5 | 0.172 | 0.483 | 0.252 | 0.820 |
| 6 | 0.422 | 0.139 | 0.374 | 0.323 |
| 7 | 0.783 | 0.118 | 0.718 | 0.099 |
| 8 | 0.916 | 0.002 | 0.933 | 0.003 |
| 9 | 0.991 | 0.002 | 0.963 | 0.001 |
| 10 | 0.987 | 0.003 | 0.980 | 0.003 |
| 11 | 1.009 | 0.062 | 0.860 | 0.082 |
| 12 | 0.093 | 0.001 | 0.963 | 0.000 |

Figure 1. Operating expense ratio vs. IT expense ratio (1990-1991)



tionnaire did so accurately. Some data given by the respondent in the questionnaire could not be verified. The study also did not check the method of accounting and it is therefore acknowledged that it could influence results obtained.

RESULTS

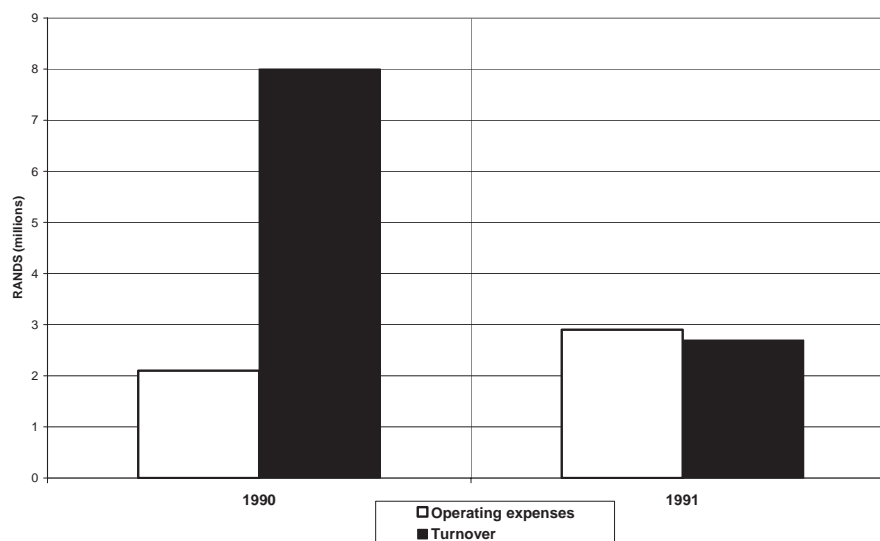
Hypothesis 1

The data needed for this section was gathered from financial returns provided by the companies. Figure 3 illustrates a profile of both the turnover and operating expense for the companies in the

Table 2. Quartile groupings for companies (1990-1991)

| QUARTILE | OPEX | ITEX |
|----------|-------|-------|
| I | 0.155 | 0.100 |
| II | 0.317 | 0.336 |
| III | 0.734 | 0.037 |
| IV | 0.965 | 0.076 |

Figure 2. Turnover vs. operating expense (1990-1991)



sample from 1990 to 1991. As it can be observed from the figure, turnover normally exceeds the operating expenses. However, in 1991, the effects of the economy could be seen as turnover slumped to a low. One of the companies did spend more money on expansion of their operations and this does affect the picture as painted.

Table 1 shows the calculated operating expense (OPEX) ratio and information technology expense (ITEX) ratio, the ratios were averaged over the period under investigation to negate the effects of seasonal and abnormal influences as seen in Figure 1. Finally, the companies were sorted in

ascending order of the OPEX ratio and grouped in quartiles as shown in Table 2. This was done partly to disguise the data and to neutralize the effect of seasonal and other influences.

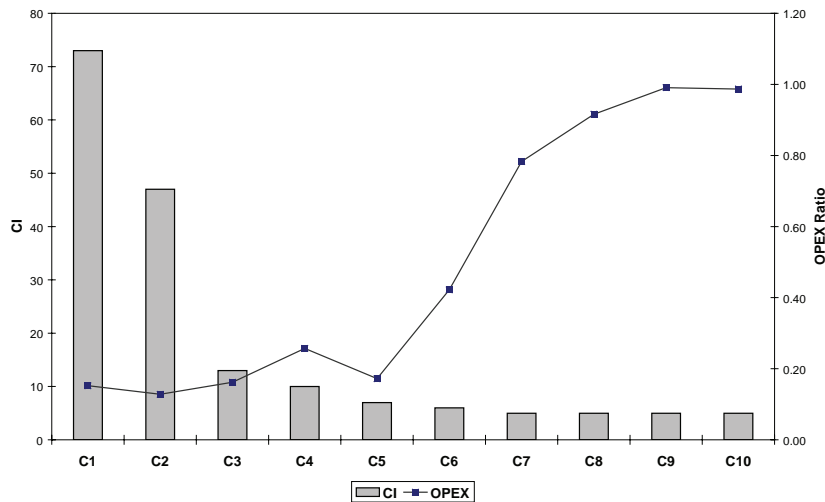
In Table 2, the first three companies being used as quartile I, the second three as quartile II, and so forth. Figure 2 shows the average OPEX ratio vs. the average ITEX ratio.

Although all the previously mentioned operations were used to negate the effects of seasonal and economical fluctuations, the result of a loss could still be seen in the second quartile. The overall effect, however, supports the first hypothesis.

Table 3. Relationship between CI and operating and IT ratios

| C | CI | OPEX | ITEX |
|-----|----|-------|-------|
| C1 | 73 | 0.152 | 0.119 |
| C2 | 47 | 0.128 | 0.037 |
| C3 | 13 | 0.162 | 0.117 |
| C4 | 10 | 0.257 | 0.160 |
| C5 | 7 | 0.172 | 0.483 |
| C6 | 6 | 0.422 | 0.139 |
| C7 | 5 | 0.783 | 0.118 |
| C8 | 5 | 0.916 | 0.002 |
| C9 | 5 | 0.991 | 0.002 |
| C10 | 5 | 0.987 | 0.003 |
| C11 | 8 | 1.009 | 0.062 |
| C12 | 6 | 0.093 | 0.001 |

Figure 3. CI vs. operating expense ratio



Using Statgraphics, there seems to be a negative correlation of 52.45% between the operating expense ratio and the information technology ratio. This further supports the first hypothesis.

Hypothesis 2

Table 3 compares the OPEX ratio, ITEX ratio, and the CI. The figures in this table support the second hypothesis that the better a company performs, the higher the computerization index. Statistically, the Spearman correlation indicates

a high negative correlation of 88.42% between the CI and the OPEX while a positive correlation of 41.26 was discovered between the OPEX and ITEX ratios. This indicates that the CI is a good measure of the intensity of computerization in any company. It also supports the assertion made in a previous study by Lubbe et al. (1992) that the CI applies to other industries and thus.

Further, statistical analysis indicates an F-ratio of 3.89 and a squared mean deviation of 0.34485 between the CI and the OPEX and ITEX ratios. The correlation matrix used to estimate

the coefficients produced a correlation coefficient of $-.8778$ between the CI and OPEX ratio and a correlation coefficient of $-.675$ between the CI and the ITEX ratio. A positive correlation coefficient of 0.4894 was calculated between the OPEX and ITEX ratios. These results produced a high degree of correlation between the CI (the constant) and the ratios of ITEX and OPEX (the variables). Thus, it further supports the second hypothesis and leads to the acceptance of this hypothesis. Figure 3 supports these findings.

Hypothesis 3

A positive correlation of $.54$ was discovered which led to the acceptance of Hypothesis 3. This was at the 95% level.

Following a pilot case study, case analysis of five South African Banks done by Nel (2004) using the following sources of information, as well as a case study protocol with personal interviews:

- Annual reports
- Monthly reports
- All classified minutes of all management committees (the author was an assistant to the inter-company secretary to all the South African banks studied)
- Strategy documents (author facilitated the strategic management process in ABSA BANK)
- Personal interviews with most general managers, at least twice a year
- Brief interviews with the managing directors
- User satisfaction surveys (author conducted these)
- Competitor analysis reports
- Independent expert's reports

It can be concluded that the top two financial performing banks had a high degree of alignment and integration between the business- and IT strategic management of the organisation.

CONCLUSION

The relative high correlation that is evident from Figure 5 may be attributed to the strategy employed with IT investment decisions and is supported by the studies of Nel (1991) and Nel (2004). The strategic importance of IT investment's needs to be emphasized and the importance of IT investment decision's needs to be considered by business managers, as it may affect their company's profitability in the long run.

Although the study does not conclusively prove a positive correlation for all organizations in the Republic of South Africa, it shows that in the sample a strong tendency exists that:

- Organizational performance is positively correlated with information technology investment intensity.
- IT investments (strategic management of IT) will be positively correlated, in IT intense companies, with their profitability.

REFERENCES

- Ahituv, N., & Igbaria, M. (1988). A model to facilitate costing, prices, and budgeting of computer services. *Information and Management, 14*.
- Ahituv, N., Neumann, S., & Zviran, M. (1989, December). Factors affecting the policy for distributing computer resources. *MIS Quarterly*.
- Allen, B. (1987, January-February). Make information services pay its way. *Harvard Business Review*.
- Bender, D. H. (1986). Financial impact of information processing. *Journal of Management Information Systems*.
- Butler Cox Foundation. (1990). *Value from IT investments*. Working Paper Series.

- Davis, F. D. (1989, September). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*.
- Harris, S. E., & Katz, J. L. (1988, July). Profitability and information technology capital intensity in the insurance industry. *IEEE*.
- Harris, S. E., & Katz, J. L. (1991). Organization performance and information technology investment intensity in the insurance industry. *Organization Science*.
- Hufnagel, E. M., & Birnberg, J. G. (1989, December). Perceived chargeback system fairness in decentralised organisations: An examination of the issues. *MIS Quarterly*.
- Kwong, H. C., & Mohamed, M. Z. (1985). Profit impact of computerisation. *Hong Kong Computer Journal*.
- McFarlan, F., Pyburn, P., & McKenney, J. (1983). The information archipelago—plotting the course. *Harvard Business Review*.
- Mullany, M.J., Miller, R., & Dos Santos Gomes, A. (1991). An enquiry into property-goal type definitions of the term ‘information system’. Unpublished.
- Nel, J. F. (1991). Die effektiwiteit-en produktiwiteit van ‘n Stelselontwikkelingsfunksie. Unpublished.
- Shoval, P., & Lugasi, Y. (1988). Computer systems selection: The graphical cost benefit approach. *Information and Management*.
- Strassmann, P. (1991). *The business value of computers*. New York: The Free Press.
- Ward, J. M. (1987). Integrating information systems into business strategies. *Long Range Planning*, 20(3).

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe, pp. 137-146 copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.18

Government Procurement ICT's Impact on the Sustainability of SMEs and Regional Communities

Peter Demediuk
Victoria University, Australia

INTRODUCTION

SMEs (small and medium sized enterprises) are a dynamic force for sustainable economic growth and job creation within developed and developing communities (MFT, 2001; NOIE, 2003; BRTF, 2003). SMEs stimulate private ownership and entrepreneurial skills; they are flexible and can adapt quickly to changing market demand and supply conditions; they generate employment, help diversify economic activities and make significant contributions to export and trade. An economy's overall economic health and well-being can be measured by the growth of SMEs-so it is vital to enhance the capacity of SMEs to compete domestically, nationally, and internationally (APPC, 1999).

The sustainability of SMEs is compromised by their struggle to gain a significant share of the government procurement pie, and this impacts

on the economic, social and cultural capital of countries and communities and the distribution of wealth. So governments need to foster an appropriate business and policy environment to improve the growth prospects of SMEs (Loudon, 2003). In particular, the implementation of Information and Communication Technologies (ICT) can provide an enabling environment for SME access to government procurement markets (Calarco, 2003).

BACKGROUND: SMES AND GOVERNMENT PROCUREMENT MARKETS

Definitions of SMEs differ from economy to economy, and are based on specific criteria such as the number of employees, level of assets or turnover. However the economic, social and cultural

contributions of SMEs that are common across economies are their ability to (MFT, 2001):

- create jobs with low capital costs;
- create conditions for development and introduction of new technologies;
- function as subcontractors for large corporations;
- adapt faster to the demands and fluctuations of the market place;
- fill marginal areas of the market, which are not targeted by large corporations;
- decentralise business activity and help foster faster development of regions, small towns and rural communities; and
- alleviate the negative impact of structural changes.

By opening up the public sector procurement market to SMEs, governments in Australia, the USA, the UK, New Zealand, and the developing economies are attempting to use their buying power to build the business capabilities of SMEs, foster economic growth, and get “value for money” in public spending (Breen & Demediuk, 2003; BRTF, 2003). Whilst the opportunity space for SMEs in the government procurement market is currently limited in developing countries (Wittig, 1999) and in developed nations (BRTF, 2003; DCITA, 2002), globalisation, the acceleration of technological change and innovation create expanded opportunities for SMEs (OECD, 2000). In particular, the use of ICT is a major driver for improving SME access to local and international government procurement (Calarco, 2003).

IMPACT OF ICTS ON GOVERNMENT PROCUREMENT SYSTEMS

ICTs facilitate the development of purchaser-supplier systems that have been termed e-procure-

ment or e-tendering. In practice, systems can be as simple as providing orders via an e-mail message or as complex as integrated supply chain ordering, delivery and payment systems (Calarco, 2003). E-procurement functionality is about the business not just the technology. The major functions of such electronic systems can range across registration of suppliers; notification of tenders; issuing and downloading of tender documents; receiving and responding to enquiries; submission of tender offers; notification of contract award; and ongoing supply management (Calarco, 2003). The use of ICT in E-procurement can involve (Wittig, 2002, p. 7):

- procurement planning & budget control;
- tracking supply needs (including demand forecasting, inventory management, etc.);
- preparing catalogues of approved items (e.g., for common use items, framework contracts) and providing information on the buyer's procurement catalogue;
- communicating the buyer's procurement program (e.g., yearly, quarterly) and advertising previous contract awards;
- tracking the solicitation approval process, advertising the buyer's solicitation notices, providing suppliers' access to the buyer's solicitation documents, and buyer/supplier communications on technical and other clarifications regarding solicitation;
- sharing of information in networks of public procurement agencies on topics like: membership, news, public procurement events, common texts on public procurement laws and regulations, regulation guidelines, standard procurement documents and contracts, and standard management and record-keeping forms;
- managing supplier data, like expressions of interest, suppliers' registration and pre-qualification, suppliers' submission of bids, quotations and proposals;

- buyer processing and evaluation of bids, quotations, proposals and buyer communication of award to supplier;
- communications as needed between buyer & supplier prior to closing the contract;
- communications between buyer & supplier on supply management (delivery and progress of awarded contracts, including tracking supplier delivery schedules), and invoicing & payment; and
- data archiving for purposes of audit trail and security.

ICT may improve the functionality of government procurement marketplaces through e-procurement systems that facilitate transparency, accountability and access through an open system; reduce the transaction costs to all parties of doing business by minimising non-valued added activities (telephoning, printing, postage, re-keying, etc.); reduce process cycle times; and provide a platform for competitiveness and growth (Calarco, 2003). While such ICT-based reforms benefit all firms, it should have a more significant impact on SMEs since "... SMEs have fewer resources, (and) anything that makes the process easier and lowers the cost of involvement will have a greater relative result for them" (Holden & Dade, 1998, p. 2).

Governments can provide a more level playing field in information access that not only assists SMEs to find and respond to market opportunities, but also acts as an incubator for the uptake of new technologies that can improve businesses generally. In one region the state-of-the-art technology may be the general introduction of e-mail capacity, whereas in another more developed community it may be the ability to make a binding contract over the Internet (Wittig, 2002).

The goal of relative improvement in SME access to government procurement markets requires technology solutions such as aggregated, simplified or standardised access portals, along

with good help-desk options and technology and training support (BRTF, 2003). What is also required is a revision of the processes to which the technology is to be applied. If ICT innovations simply embed into an electronic form some existing procurement policies and procedures that inhibit SME access, the problems for SMEs may become relatively worse. For example, the use of larger contracts in government procurement is often driven by the need for greater efficiency. These larger contracts require less staff to manage them and there is a single point of contact for dealing with problems. However the contracts generally result in a reduced number of larger suppliers, effectively ruling out smaller firms and the advantages they potentially bring in agility and focused solutions. Where tender evaluation criteria are geared towards lowest tender price, the perceived innovation, flexibility and quality advantages of SMEs are discarded, as the potential for wider societal and economic community development is lost. SMEs are also disadvantaged where small-scale tenders are left off generally advertised lists, or SME tenderers are required to provide unlimited liability or reach unrealistic experiential or financial pre-qualification hurdles (Breen & Demediuk, 2003).

FUTURE TRENDS

Given the limited success of many ICT-based government procurement initiatives (Breen & Demediuk, 2003; OGC, 2002), in the future full account must be taken of SME perspectives when government agencies are designing new ICT-based policies, processes or initiatives. There also needs to be greater awareness among SMEs of the benefits of the ICT and the "Information Society" and of integrating Internet use and electronic commerce in their business strategies. Awareness, interest and capability of SMEs in relation to ICT-based procurement systems can be fostered by resource

and demonstration centres, training initiatives, pilot projects and encouraging the development of effective and user-friendly frameworks for certification, authentication, transaction security, and preservation of intellectual property rights (IPRs). These imperatives provide a rich source for future research studies into the operationalisation of ICT in an SME context.

CONCLUSION

Where ICT drives improved SME access to government procurement markets through greater transparency and access, they can have a positive impact on the development of economic, social and cultural capital. However SMEs can be further disadvantaged and the sustainability of regional communities compromised where ICT merely embed existing inhibitors of SME access to government business into more efficient electronic forms.

REFERENCES

APPC. (1999). *Delivering opportunities for small and medium enterprise in government procurement and contracting*. Canberra: Australian Procurement and Construction Council.

Breen, J., & Demediuk, P. (2003). *Developing strategies to overcome challenges faced by SMEs in accessing government procurement markets in the Asia-Pacific region*. Singapore: APEC.

BRTF. (2003). *Government: Supporter or customer?* London: Better Regulation Task Force.

Calarco, C. (2003). *Identifying e-procurement implementation strategies for developing economies*. Singapore: APEC.

DCITA. (2002). *Inhibitors to small-to-medium sized enterprise participation in Commonwealth*

Government IT outsourcing contracts – Action plan. Canberra: Department of Communications, Information Technology and the Arts.

Holden, P., & Dade, C. (1998). *SMEs and public procurement: Lowering transaction costs to increase participation*. Geneva: International Trade Centre.

Loudon, M. (2003). *The procurement policy framework: What you need to know*. Canberra: Selling to Government Seminar.

MFT. (2001). *Introduction*. Newsletter Issue 1. Cairo: SME Section: Egyptian Ministry of Foreign Trade.

NOIE. (2003). *NOIE News*. Canberra: National Office for the Information Economy.

OECD. (2000). *The Bologna Charter 2000 on SME Policies*. Paris: OECD.

OGC. (2002). *Smaller supplier...better value?* London: Office of Government and Commerce (HM Treasury) and Small Business Service.

Wittig, W. (1999). *Building value through public procurement: a focus on Africa*. Durban: 9th International Anti-Corruption Conference.

Wittig, W. (2002). *Public Procurement and the Development Agenda*. International Trade Centre, Geneva. WTO (World Trade Organization).

KEY TERMS

E-Procurement: E-procurement is the business-to-business (B2B) or government-to-business (G2B) purchase and sale of supplies and services that is facilitated by the Internet and is sometimes referred to by other terms such as e-tendering or supplier exchange.

E-Tendering: Another term for e-procurement.

Help Desk: A section that can respond to technical queries by users.

Information and Communication Technologies (ICTS) In E-Procurement: Portals and electronic systems that facilitate registration of suppliers; notification of tenders; issue and downloading of tender documents; receiving and responding to enquiries; submission of tender offers; notification of contract award; and supply administration.

Information Society: A context in which people interact with technology as an important part of life and social organization to exchange information.

Intellectual Property Rights (IPRS): Treats certain intangible products of the human mind as

belonging to the creator or holder in legal form such as patents, trademarks or copyright.

Portals (Web Portals): Web sites that give access to a broad array of resources and services such as: e-mail; discussion forums; search engines; and business information.

Small and Medium-Sized Enterprise (SMEs): Small and medium-sized enterprises are socially and economically important, since they represent 99% of all enterprises worldwide and contribute to entrepreneurship, innovation and economic, social and cultural development. Precise definitions that separate SMEs from large enterprises differ between countries and rely on variables such as headcount, turnover and balance sheet size.

This work was previously published in Encyclopedia of Developing Regional Communities with Information and Communication Technology, edited by S. Marshall, W. Taylor, & X. Yu, pp. 321-324, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 6.19

Women Entrepreneurs in Finnish ICT Industry

Tarja Pietiläinen

Life Works Consulting Ltd., Finland

Hanna Lehtimäki

Life Works Consulting Ltd. & University of Tampere, Finland

Heidi Keso

Life Works Consulting Ltd. & University of Tampere, Finland

INTRODUCTION

The Nordic countries—Finland, Denmark, Norway, and Sweden—offer interesting material to investigate gendering processes. In these societies, gender equality policy has long traditions and many propagated goals have been researched: women and men participate in paid work almost to the same extent; women make a significant contribution to family income, because it rests on a dual income model; public, low cost day-care is available to all children over one year of age; women's level of education is exceeding that of men's. Yet, the labour market is notoriously segregated both horizontally, meaning that men and women work in different occupations, and vertically meaning that men hold high ranking positions in public and private organisations. The

focal phenomenon of this article, entrepreneurship shows even more profound segregation with women and men enterprising in different lines of business and within the same lines of business in different branches (Kovalainen, 1995; Spilling & Berg, 2000).

Nordic experience shows that gaining access to men-only spaces does not bring the same prestige, make women equally influential, and powerful as men. Thus, the question remains what are the processes which hinder women entrepreneurs from achieving a significant position? The article offers one possible answer by reporting a study by Pietiläinen (2002) who set out to investigate what kinds of spaces for entrepreneurial action women business owners are offered in the Finnish information and communication technology (ICT) industry.

BACKGROUND

Since the early 1980s, academic interest in women entrepreneurs has increased steadily due to the increasing impact businesses owned by women have on society and the economy. Presently female entrepreneurship research is a subfield of entrepreneurship studies (Carter, Anderson, & Shaw 2001). In this field, scholars are united in their view that women's unequal access to economic power needs to be changed.

Within the field, researchers differ in their views about the sources of gender inequality and the means to analyse and battle it. This, of course, is based on the presumption that inequality is undesirable. In Pietiläinen's study the different views were categorised into three broad empowerment agendas in female entrepreneurship literature. Table 1 displays the three feminist lines of inquiry. The first two lines of inquiry provided the study with analytical concepts which aided the interpretation of gendering processes in the empirical material. The third approach "doing gender," was followed throughout the research process.

Gender Equality

The overwhelming majority of research is inspired by "gender equality." Researchers following this line of inquiry believe that overt discrimination prevents women from realising their full entrepreneurial potential (Fischer, Reuber, & Dyke, 1993). Over the years they have devoted much research into identifying what kinds of barriers women have to overcome before, during, and after a business start up. Results point to gender differences and cultural prejudices. The latter have been identified as the biggest obstacle for entrepreneurial women. Repeatedly, they encounter gender-based stereotyping and suffer from lack of credibility and support (e.g., Carter & Kolvereid, 1998; Fabowale & Orser, 1995; Kolvereid, Shane, & Westhead, 1993).

Voice to Women

Researchers who are interested in investigating women entrepreneurs' "own voice" and experiences start from the assumption that the source of inequality is women's lifetime experiences of subjugation. These studies represent the second empowerment agenda. Socialization into a woman's position results in uniquely female worldview, and consequently, in different entrepreneurial behaviours than men's (Ahl, 2002). This research has excelled in revealing that women's entrepreneurial choices are greatly shaped by the overall pattern of women's labour market behaviour, life style, and stage of life (e.g., Brush, 1992; Goffee & Scase, 1985; Green & Cohen, 1995; Sundin & Holmquist, 1989).

Doing Gender

Recently, a growing number of European researchers claim that inequality in entrepreneurship is a result of gendering processes which privilege male-typical behaviours and values. Their proposition is to make use of the concept "doing gender" (West & Zimmerman, 1991). These scholars suggest that researchers of female entrepreneurship need to take a critical look at their own empowerment agendas to move forward. Critical assessment of research inspired by "gender equality" thinking shows that gender equality, in fact, diverts attention away from deeply masculine connotations of entrepreneurship. "Voice to women," in turn, suffers from searching for unique female behaviours, which does more to mystify female experience than to give space for real life women entrepreneurs with their differing aspirations, possibilities, and life strategies. The proponents of "doing gender" approach suggest that effort should be put into exposing the gendered power relations at work in entrepreneurship (Kovalainen, 1995), and move toward change in gendered social and symbolic arrangements governing entrepreneurial activity (Ahl, 2002).

Table 1. Three lines of feminist inquiry in female entrepreneurship literature

| LINE OF INQUIRY | SOURCE OF INEQUALITY | ANALYTICAL CONCEPTS | EMPOWERMENT AGENDA | EXAMPLES OF RESEARCH |
|-----------------|---|--|--|---------------------------------------|
| Gender equality | Overt discrimination of women | Gender stereotyping; gender differences | Removal of obstacles; incentives to women; change of attitudes | Kolvereid, Shane, & Westhead, 1993 |
| Voice to women | Women's experiences of subjugation | Female typical qualities and characteristics; Female typical experiences | Creating women only opportunities and spaces; raising consciousness; change of attitudes | Sundin & Holmquist, 1989; Brush, 1992 |
| Doing gender | Gendering processes which give power to men and male typical behaviours | Gendered social and symbolic arrangements; gendered power relations; hidden masculine connotations | Exposing gendered power relations; change in social + symbolic arrangements; change of attitudes | Ahl, 2002; Kovalainen, 1995 |

METHODS AND MATERIALS

Pietiläinen's study (ibid.) applied qualitative methodology to identify what kinds of spaces for entrepreneurial action women business owners are offered in ICT industry. Textual analysis was used on a city's strategy documents, media articles about one female-owned new media company Nicefactory Ltd, and transcribed interviews with the company's female owner-entrepreneurs. Empirical material covered the years 1997-2002. As to the theoretical background gender was examined as doing. "Doing gender" approach was chosen because it allowed for studying gender as a process, not as individual characteristics. In the study, "doing gender" was used both as a theoretical concept and methodological means. Theoretically, "doing gender" allowed focusing away from understanding just the individual entrepreneur to understanding how gendered social

and symbolic arrangements of entrepreneurship in ICT industry are shaped. Methodologically, "doing gender" focused qualitative analysis on that continuous meaning making of gender which is embedded in the every-day activities of people and organisations involved.

THE CASE-COMPANY AND CONTEXT OF THE STUDY

The focal company of the study, Tampere based Nicefactory Ltd, was conceived when its owners observed the lack of well-produced Web contents. Specifically they wanted to provide a Web service to female Internet users. The two founding partners of Nicefactory Ltd. worked in radio, TV and print media for an extended period of time before establishing their own company. One of the partners has a university degree in

naval engineering and the other holds a master's degree in social psychology. In autumn 1998, they launched their first Web site, www.Nicehouse.fi with content featuring information and discussions about various family-related topics. Their next Web site, www.49er.net, providing real time sailing race information, was launched shortly thereafter. In 2000, a technical university commissioned Nicefactory Ltd. to create a customized learning environment, an opportunity for the company to develop yet another type of Internet content service. The same year, Nicefactory Ltd. launched two new Web sites: www.Addiktio.net, which focuses on "all kinds of addictions," and www.Sooda.com, a Web service designed primarily for teenage girls, but expanded to attract teenage boys, too. Since its launch, Sooda.com has become one of the most popular Finnish Web communities.

At the turn of the century, Finland was well known for its excellence in information and communication technology (ICT) and a highly developed, widespread Internet culture. Nokia had led the Finnish ICT-sector's growth and rapid internationalization. There was and still is extensive technological knowledge at all levels of society, and Finns are eager to use the latest technological innovations. What was still lacking from this success story, however, was an innovative and user-friendly media culture and business-oriented content production with international potential (e.g., Castells & Himanen, 2001; Tarkka & Mäkelä, 2002). While the ICT-sector had largely developed through technological innovations the content innovations and production had lagged behind.

ICTs—A World without Women

The masculine image of the ICT industry is so strong that it seems paradoxical to link women and entrepreneurship in that industry. Most explicitly, ICT-industry is a world without women: male engineers run the businesses, develop, and

market the services/products while women tend to be responsible for office work (Vehviläinen, 1997) and human resources function. Women business leaders are bound to stand out and draw attention as a rarity. A well-known example is Carly Fiorino's position at Hewlett Packard.

When it comes to the definitions that are widely used to describe ICT business, a more, subtle, yet distinctively masculine image emerges (Lie, 1995). It is unanimously recognised that the core competencies of the industry build upon high-tech know how (e.g., Lovio, 1993). From this acknowledgment, it is a small step to define technical accomplishments as groundbreaking innovations and maintain that more is to be expected due to heavy investments in product development (e.g., Schienstock, 2004). Expectations are also supported by the qualities of the people working in the industry. Men who found ICT companies tend to have (technical) degrees. This fact is believed to indicate that the companies are more strategically oriented, more prepared to growth, and more prone to risk taking than the case is in an average start-up.

THREE CONSTRUCTS OF SPACE FOR WOMEN'S ENTREPRENEURSHIP

Based on the empirical analysis, Pietiläinen's (2002) study resulted in three constructs for understanding processes which hinder women entrepreneurs from achieving a more significant position in the Finnish ICT business. The three constructs are "gender neutral entrepreneurship," "female entrepreneurship," and "powerful women's entrepreneurship."

The first construct, "gender neutral entrepreneurship," gives support to the notion that entrepreneurship, although a human activity is not linked to gender in any fundamental way. The construct is most explicit in strategic management discourse, which becomes important

when business opportunities, future growth, and internationalisation or globalisation are visioned. These topics point to the issues which need entrepreneurs' attention in emerging businesses.

The construct provides interpretations to fade out femininities that female entrepreneurs inevitably bring with them to entrepreneurship. The gender neutrality is achieved by meaning making, which first, excludes femininities from the meaning horizon of the category of "entrepreneur" (see also Ahl, 2002) and then, equates selected masculinities of competitiveness, rationality, instrumentality, and control with the ideal entrepreneurial figure.

As such, "gender neutral entrepreneurship" provides a highly appealing space of action to a woman. The idea of that female sex presents an exception can be overcome. This space could secure the position of the "real entrepreneur" for women as well, not only for male business owners. There is, of course, a price attached. It is not easy to find acceptable ways to display femininities as they threaten to expose the otherwise hidden masculinities of the "entrepreneur."

As embodied physical women, female entrepreneurs remind constantly that gender cannot be excluded from entrepreneurship for good. The second construct is labelled "female entrepreneurship." It deals with the femininities and maintains that there is a distinction between "entrepreneurship" and "female entrepreneurship." The distinction rests on gender hierarchy, which makes it rational to relegate gender to women business owners and consider their business actions as gendered exceptions. The construct offers space for action, which many women entrepreneurs are not comfortable with. Experiences of gender stereotyping and (dis)credibility problems give no explanation as to why marginalise women's entrepreneurship by yet another separation. The construct opens up also space for positive action, because it allows for appreciative understanding that living the life of a woman creates a valuable source of business information. Often, women's

preferences and ways of doing things are easily bypassed in service and product development as well as marketing, because gender hierarchy prevents from seeing the value of women's activities.

The third construct, "powerful women's entrepreneurship", couples female entrepreneurship with the success stories of start-up businesses in the new economy. It represents selected women entrepreneurs as outstanding representatives of female sex in the male world. The construct dominates media's way of representing female entrepreneurs in the new media business. The positive side of space for action is that media has the power to increase general public's awareness of women's business start-ups. Young men's ICT-business endeavors dominate media publicity and therefore coverage of women's efforts makes a difference. Although women entrepreneurs are treated as a special category, the construct gives meaning making resources to modify particularities of female entrepreneurship into prime means of entrepreneurial advancement.

Ambiguous Spaces for Women's Entrepreneurship

The three constructs offer conflicting and ambiguous spaces for female entrepreneurship in ICT-industry. "Gender neutral entrepreneurship" is a construct which is deeply rooted in strategic management discourse. It is one of the most powerful streams of thinking and acting in the present business world. This connection means that strategic management offers no easy support for entrepreneurial initiative by women, especially if it is innovative in the business field.

"Female entrepreneurship" is more open to women's entrepreneurial behaviour. However, it creates a boundary between entrepreneurship and women's entrepreneurship. The boundary is based on hierarchy, where women's business represents "lesser" form of economic activity. The culturally embedded hierarchy is hard to overcome by individual women.

Yet another type of marginalisation takes place by the construct “powerful women’s entrepreneurship.” Here, media creates an ideal image of a female entrepreneur and presents it to the public. When a real-life woman compares herself to the ideal, she will most likely find herself lacking the qualities, skills and time to perform within the standards set by the ideal image. Research shows that many business women experience feelings of being inadequate when they think that they are not able to meet the expectations created by the ideal.

Typically, people build their entrepreneurial identities on professional identity which is supported by education and work experience (Hytti, 2003). Ambiguity and conflict stemming from the three constructs refer to the puzzling experience that sex as an anatomical fact presents a more decisive factor to evaluate an entrepreneur’s business competence than professional and business experience. In these moments of evaluation, gender is at the same time highly visible and virtually invisible. This is due to fact that entrepreneurship is invisibly male gendered, but thought of as gender neutral and, at the same time, visibly gendered when the actors are women. For individual women entrepreneurs, the dynamic interplay between the visible gendering and the invisible, seemingly gender neutral gendering presents a “rough” field to practise entrepreneurship.

FUTURE TRENDS

The study by Pietiläinen (2002) points out that more research is needed to investigate gender as an ongoing process of meaning making. There is abundant evidence, that to an individual woman entrepreneur, the key question is how to successfully share time between entrepreneurial and personal responsibilities. However, the means by which balancing is achieved by women entrepreneurs, has been overlooked by researcher. The pressure of balancing tends to increase in

knowledge intensive business (e.g., ICT-business) where long working hours, project based work, and travel are prevalent practices. What has attracted less attention is that typically, entrepreneurship is associated with for-profit activities in the public sphere and entrepreneurs’ needs of nurture and emotional support are seen as private matters, not belonging to for-profit world. The division between work performed in public and work performed in the private reveals that entrepreneurship is considered gender neutral, public activity. Individual entrepreneurs, instead, are gendered and therefore gender “intervenes” to female and male typical ways of coping with the division. Consequently, we need new, critical conceptualisations of entrepreneurship, to overcome deeply held divisions and hierarchies.

CONCLUSION

Female entrepreneurship research shows that economic factors explain only partially women’s entrepreneurship. A fairly recent newcomer in this line of inquiry, doing gender studies contribute to understanding that interpretations of entrepreneurship create spaces which men and women are able to occupy differently. These studies alter the theoretical emphasis of entrepreneurship research from examining gender differences per se to analysing how such differences are produced. The theoretical usefulness of examining individual women is questioned. The challenge is to relinquish the stable notions of gender differences and similarities between women’s and men’s entrepreneurship, popular in the extant literature. Even if there are no clear references to gender, there are seemingly neutral articulations that produce different material outcomes for women. In this sense, meaning making of entrepreneurship rearticulates the power imbalance informing relations of gender.

REFERENCES

- Ahl, H. J. (2002). *The making of the female entrepreneur. A discourse analysis of research texts on women's entrepreneurship*. JIBS Dissertation Series No. 015. Jönköping University: Jönköping International Business School.
- Brush, C. (1992). Research on women business owners: Past trends, a new perspective and future directions. *Entrepreneurship, Theory, and Practice*, 16(4), 5-30.
- Carter, N. M., & Kolvereid, L. (1998). Women starting business: The experience in Norway and the United States. In *Proceedings of Women Entrepreneurs in Small and Medium Enterprises* (pp. 185- 202). Paris: OECD.
- Carter, S., & Rosa, P. (1998). The financing of male- and female-owned businesses. *Entrepreneurship and Regional Development*, 10(3), 225-241.
- Castells, M., & Himanen, P. (2001). *The Finnish model of the information society*. Helsinki, Finland: Sitra and WSOY.
- Fabowale, L., & Orser, B. (1995). Gender, structural factors, and credit terms between Canadian small businesses and financial institutions. *Entrepreneurship: Theory and Practice*, 19(4), 41-65.
- Goffee, R., & Scase, R. (1985). *Women in charge: The experiences of female entrepreneurs*. London: George Allen & Unwin.
- Green, E., & Cohen, L. (1995). Women's business: Are women entrepreneurs breaking new ground or simply balancing the demands of "women's work" in a new way? *Journal of Gender Studies*, 4(3), 297-314.
- Hytti, U. (2003). *Stories of entrepreneurs—Narrative construction of identities*. Turun kauppakorkeakoulun julkaisuja, Sarja A-1:2003. Turku: Turku School of Economics.
- Kolvereid, L., Shane, S., & Westhead, P. (1993). Is it equally difficult for female entrepreneurs to start businesses in all countries? *Journal of Small Business Management*, 31(4), 43-51.
- Kovalainen, A. (1995). *At the margins of economy. Women's self-employment in Finland, 1960-1990*. Avebury: Adlershot.
- Lie, M. (1995). Technology and masculinity. The case of the computer. *The European Journal of Women's Studies*, 2, 379-394.
- Lovio, R. (1993). *Evolution of firm communities in new industries. The case of the Finnish electronics industry*. Helsinki School of Economics and Business Administration, A:92. Helsinki, Finland: Helsingin kauppakorkeakoulu.
- Pietiläinen, T. (2002). *Moninainen yrittäminen. Sukupuoli ja yrittäjänäisten toimintatila tietoteollisuudessa*. Acta Universitatis Oeconomicae Helsinginensis, A-207. Helsinki, Finland: Helsinki School of Economics.
- Schienstock, G. (2004). *Embracing the knowledge economy. The dynamic transformation of the Finnish innovation system*. Cheltenham: Edward Elgar.
- Spilling, O. R., & Berg, N. G. (2000). Gender and small business management: The case of Norway in the 1990s. *International Small Business Journal*, 18(2), 38-59.
- Sundin, E., & Holmquist, C. (1989). *Kvinnor som företagare—osynlighet, mångfald och anpassning—en studie*. Malmö: Liber.
- Tarkka, M., & Mäkelä, T. (2002). *Uusi mediakulttuuri innovaatioympäristönä. Kotimainen ja kansainvälinen tutkimus*. Mediakulttuuriyhdistys m-cultury. Sisältötuotanto-työryhmän väliraportti 7.
- Vehviläinen, M. (1997). *Gender, expertise, and information technology*. Department of Com-

puter Science, A.1997-1. Tampere: University of Tampere,

West, C., & Zimmerman, D. H. (1991). Doing gender. In J. Lorber & S. A. Farrell (Eds.), *The social construction of gender* (pp. 13-37). Newbury Park: Sage.

KEY TERMS

Doing Gender: A gender theoretical line of reasoning that gender is a process of power which first, creates and maintains differences between the sexes and second, constructs a hierarchy to the benefit of men and masculinities.

Empowerment Agenda: A proposal of actions which are needed to enable discriminated people to act upon their own interests.

Gender-Based Stereotyping: Using common sense criteria to categorise people into males and females. The criteria include assumptions about gender appropriate characteristics, behaviours, and physical qualities.

Gender Equality: A gender theoretical line of reasoning that overt discrimination prevents women from realising their full potential.

Women's Own Voice: A gender theoretical line of reasoning that meanings and interpretations a woman or a group of women invent and use to make sense of their experiences remain silenced due to prevailing gender order.

This work was previously published in Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 1267-1272, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 6.20

Directing Equal Pay in the UK ICT Labour Market

Claire Keogh

University of Salford, UK

Angela Tattersall

University of Salford, UK

Helen Richardson

University of Salford, UK

INTRODUCTION

The UK labour market is dramatically changing, with rapid technological innovations alongside globalisation where organisations are required to place a premium on human and intellectual capital. The demand for labour is outstripping supply, and businesses are increasingly dependent on their ability to attract, invest in and develop their workforce (Kingsmill, 2003). However, a recent comparative report of the information technology (IT) workforce in Holland, Germany and the UK indicates that women are haemorrhaging out of the IT sector (Platman & Taylor, 2004). Given that presently there is an IT specialist's skills shortage of 18.4% (IER/IFF, 2003), and female IT managers represent a mere 15% of ICT managers, 30% of IT operations technicians and 11% of IT

strategy planning professionals (EOC, 2004a), this suggests that the ICT industry is not equipped for equality and diversity at work.

Despite many years of egalitarian rhetoric and 3 decades after the UK Equal Pay Act (1970) was introduced, women still receive on average 18% less than that of their male counterparts working full-time and 41% less than men when working part-time hours. The ESF-funded DEPICT project seeks to identify pay discrimination experienced by women in ICT at a national level throughout England. An important aim is to highlight the impact of pay and reward discrimination has on the underrepresentation of women in the ICT labour market. From this study, we hope to more clearly understand the reasons for the gender pay gap, particularly in the ICT sector; and the impact this has on women's entry and retention to occupa-

tions where they are already severely underrepresented. Equal pay is an issue for all; it's unjust, unlawful and impacts on social justice, equality and economic performance (EOC, 2001b). Pay is a major factor affecting relationships at work; distribution and levels of pay and benefits affect efficiency of organisations, workforce morale and productivity. It is vital for organisations to develop pay systems that reward workers fairly for the work they perform (ACAS, 2005).

WHAT IS THE GENDER PAY GAP?

The Equal Pay Act was enacted in 1970 and came into force in 1975 in the UK. At that time, the gender pay gap stood at 36%—today, 35 years later, the pay gap remains obstinately at 18%. For women who work part-time, the pay gap is even larger, at 40%, similar to 30 years ago. The gender pay gap compares the earnings of female and male employees, while the gender income gap compares the individual incomes of all women and men. The gender gap between women and men's mean individual incomes in 2002-2003 was 46%, and the gender gap between women and men's median income was 47%. (EOC, 2005c)

Thus, the gender pay gap is the difference in average earnings between men and women and is usually measured by hourly rate or weekly wage. Previous to the Equal Pay Act (1970), evidently the main cause of the gender pay gap was direct sex discrimination, and historically, women received up to half the pay of men even when performing the same job. After the introduction of the equal pay legislation, which prohibits employers from paying women less than men purely on the basis of their sex, the continuing gap was attributed to occupational segregation, indirect discrimination and human capital factors (for example, attainment of qualifications and experience).

ROOTS OF THE GENDER PAY GAP

The Equal Opportunities Commission (EOC) set up an Equal Pay Task Force in 1999 to explore the gender pay gap issue (EOC, 2001a). They reported three main contributors to the pay gap: occupational segregation, discrimination in pay systems and caring responsibilities.

- **Occupational Segregation:** The UK labour market is highly segregated, both horizontally and vertically. Horizontal segregation has led to 60% of the female workforce working in only 10 broad occupation types. Vertical segregation has evolved through a cluster of women working in lower-level jobs, often low skilled and low paid. Occupational segregation remains one of the strongest influences on young people's choice of career. Girls are still moving into industry sectors such as nursing, teaching and childcare. Boys continue to enter engineering, building services or ICT. Individuals' "life choices" are seriously compromised by occupational segregation; there has been no significant increase of women entering the construction, engineering, plumbing or ICT industries during the past 10 years (EOC, 2004a).
- **Caring Responsibilities:** In the UK women are still shouldering the main responsibility for childcare and increasingly taking the responsibility for the care of their elderly relatives. In these cases, women often have to work part-time, it is impossible for them to work long hours or they take time out of work. These factors contribute to the impact on women's earning power and promotion potential.
- **Discrimination in Pay Systems:** Organisations assume that because they have the same rate of pay for men and women then they have equal pay systems; however, pay

systems are extremely complex (Neathey, Dench, & Thomson, 2003). Individualised pay is determined on value judgements and includes bonus schemes and performance-related pay. Women experience pay discrimination due to lower starting salaries, exclusion from bonus schemes, inability to qualify for long service awards and being awarded lower marks in performance assessments.

THE GENDER PAY GAP AND THE UK ICT LABOUR MARKET

On first inspection, ICT gender pay gap data gathered from the Office of National Statistics

suggest a relatively small pay gap when comparing women’s and men’s hourly and weekly income (EOC, 2004a). For example, male ICT professionals earn on average £684.80 a week compared to the female ICT professional weekly wage of £619.80.

The figures shown in Table 1 portray the gender pay gap in the UK in a comparatively positive light. IT industry in a comparatively positive light; nevertheless, as most women are positioned at the lower end of the market, we assert that the gender pay gap is, in fact, greater than these statistics suggest and that pay discrimination is inherent in the ICT sector. There are limitations to statistical data on the “IT labour market”— research suggests that “working in IT” is an extremely difficult and complex sector to define (WINWIT, 2004).

Table 1. Gender pay gap data from the Office of National Statistics (2003)

| | FEMALE | | MALE | | Gender Pay Gaps | |
|--|--------|--------|--------|--------|-----------------|--------|
| | Hourly | Weekly | Hourly | Weekly | Hourly | Weekly |
| ICT Managers | 21.16 | 784.9 | 23.69 | 892.8 | 10.7 | 12.1 |
| ICT Professionals | 16.35 | 619.8 | 17.87 | 684.8 | 7.5 | 9.5 |
| -IT strategy and planning | N/a | N/a | 22.19 | 848.6 | N/a | N/a |
| -Software Professionals | 15.20 | 517.5 | 16.83 | 644.5 | 9.7 | 11.3 |
| IT Service delivery occupations | 12.46 | 463.8 | 14.65 | 562.2 | 14.9 | 17.5 |
| -IT operations technicians | 13.14 | 468.2 | 15.20 | 582.8 | 13.6 | 16.6 |
| -IT user support technicians | 10.97 | 415.0 | 13.19 | 507.2 | 16.8 | 18.2 |
| Telecommunications engineers | N/a | N/a | 11.89 | 477.6 | N/a | N/a |
| Computer engineers, installation and maintenance | N/a | N/a | 12.16 | 483.3 | N/a | N/a |
| All Occupations | 10.56 | 396.0 | 12.88 | 525.0 | 18.0 | 24.6 |

Source: Office of National Statistics (2003), New Earning Survey

There are highly skilled women working in IT departments in many organisations and also in other industry sectors, such as the creative sector with design technologies and in new media industries. Taking this into consideration, we acknowledge that the IT sector is diverse and that much of women's engagement with IT may lay outside the traditional IT sector.

The ESF-funded DEPICT project seeks to investigate issues surrounding equal pay in the ICT sector as a result of the following factors:

- Individualised pay packages are common in the ICT industry, which involves requiring strong individual negotiation skills and a high level of confidence. Women have reported being uncomfortable with this method of pay-and-reward negotiation, and find that masculine and aggressive organisational culture mitigates against success in such negotiation (WINWIT, 2004). Moreover, the ICT skills that women possess are often undervalued, marginalised or unrecognised regardless of achievement (WINWIT, 2004; Woodfield, 2000).
- There is a culture of "salary secrets" in the IT industry, and women have reported that they only find out about pay inequalities once they reach management level and have access to financial or personnel information. In research analysing gender equality in organisational pay structures and pay practices, including an initial evaluation of Equal Pay Reviews (Neathey et al., 2003), data revealed that more than 1 in 5 employers (22%) did not allow their employees to share information about pay with colleagues. Employers often expect confidentiality about pay and disclosing this information to colleagues can lead to disciplinary action.
- The Women in North West IT (WINWIT, 2004) reported gaps in annual salaries between male and female ICT professionals as much as £17,000. Women were also

reported to have experienced discrimination in pay and promotion after returning from maternity leave and choosing to work family-friendly hours.

- Many women with caring responsibilities need to work part-time and this is often incompatible with working in the ICT industry, as part-time working is rarely an option.
- The current pension system operating in the UK is based on full-time, lifetime employment and is excluding workers who work part-time and people whose employment is disrupted by periods of unpaid domestic responsibility, which disproportionately impacts negatively on women (Prosser, 2005).

THEORETICAL FRAMEWORK FOR THE PROJECT

The economic, social and political root of women's inequality in the labour market is a contested theoretical area. This section discusses neo-classical, dual labour market theory and critical approaches to explaining women's inequality at work and the theoretical framework that is shaping this research.

Neo-classical economic theory explains women's pay discrimination in two main ways. First, there is an "individual" explanation suggesting that the wage paid to an individual relates to the value of the output that the individual produces. If women are paid less than men, this must be because the value of what they produce is less; that is, they are less productive (Richardson, 1984). Human capital theorists, on the other hand, try to link women's supposedly lower human capital to their role in the family. This view suggests that women have a "free choice" and indeed choose to obtain less education and training, choosing instead the role of child rearing. If women enter the labour market, this choice, therefore, has an impact on pay rewards.

Of course, these views can be criticised for suggesting an innate and rational economic view of the labour market and family relations divorced from actual experience. The state is involved in much of the organisation of the labour market and society through education and welfare policy, for example. Not all women share the same experience and choice of education and training, and such theories are attributing experiences to all women regardless of whether they work or have children.

Such approaches are now finding resonance in theories of the “information society” or “knowledge economy” (in particular, see Castells, 1996). Giddens (1984), concurring with Beck’s individual and risk society thesis (Beck 1992), suggests that the changing situation of men and women in the family and at work must be seen in terms of individual choice: “We live in a world in which social order of the nation state, class, ethnicity and traditional family is in decline. The ethics of individual self-fulfilment and achievement is the most powerful in modern society” (Beck, 2002).

Taking a more practical view of the labour market, some theorists view a dual structure at work arising out of the need to cope with consumer and market fluctuations (see, e.g., Barron & Norris, 1976). In this approach, women dominate the secondary sector of employment, involving occupations with greater opportunities for dispensability and gender segregation, which more easily enables discrimination; a more acquiescent workforce because the wage is not always the sole income; and finally, a lack of solidarity because of the scattered nature of these secondary workplaces and preponderance of part-time work. This dual-market structure, therefore, affects women’s overall position, and ideological factors both cause and effect women’s inferior position within the labour market and the family.

Again, stereotypic assumptions form the basis of dual labour market theory (Beechey, 1980). It is implied that domestically women are reliant

on men’s wages and are only incidentally part of the workforce. This is not the reality for most women or the experience in most households (German, 2003).

Our research is shaped by critical and feminist approaches to understanding women’s inequality in the labour market. Critical approaches to women’s inequality largely are rooted in Marxist or Feminist theory. Feminist theories often locate women’s inequality in patriarchal gender relations within capitalist relations. Women are thus divided along class lines but share the oppression of male domination. Capitalism and patriarchy in this way continually interacts, affecting women’s position in the economy and family. This leads to the “economics of male advantage” (Cockburn, 1983, p. 8). In Marxist analysis, women’s position in the labour market depends not on market principles, but arises from the organisation of production with roots in class exploitation. Inequality in the labour market is linked to women’s oppression in the family. German (2003) explains that the family is both broken down by the effects of capitalism but also maintained and reinforced by capital as the cheapest, most convenient and most socially stable way of caring for the existing generation of workers and reproducing the next generation. The family fulfils too precious a role to be left to “free market” individualism. In reality, three-quarters of households are still headed by two-parent families, and men and women are moving closer together in terms of work and domestic life, but not in circumstances of their choosing. They do so “against a backdrop of continuing women’s oppression and intensified exploitation for both men and women” (German, 2003, p. 31). Fitting into these roles is hard work—for women, it means working for less than equal wages and, for men, increased unpaid childcare in the home.

Yet the family is a gendered institution and is often taken for granted. Wharton (2005) describes how the family is viewed as “somehow functional for society rather than a social construction and changing in relation to history and culture” and

she continues to observe that though family diversity is a social fact, this is “obscured by a set of taken-for-granted beliefs about the family as a social institution” (Wharton, 2005, p. 105). These include myths of the nuclear family, the heterosexual family, women as mothers and caretakers and men as fathers and breadwinners. However, it is these myths that inform the choices made, including government and employment policies. As Huws (2003) suggests:

... more than this, women’s role in the domestic sphere is used to confirm and legitimate their marginal status in the labour market. The gendering of jobs cannot be reduced to a discussion of women in the domestic sphere, but must be seen as arising from the interplay between their socially ascribed, and therefore shifting, roles in both the public and private domains. (2003, p. 28)

RESEARCH METHODOLOGY

The ESF-funded research project DEPICT began in January 2005, with a detailed look at the causes of pay inequality between women and men. Researchers will draw upon expertise from steering committee members made up of representatives from the ICT industry, trade unions, academics, other agencies and upon background material by the Equal Opportunities Commission and other related literature.

The research will conduct qualitative research to gather primary data and will conduct in-depth semi-structured interviews with women entering, returning, working in or who have left the sector to ascertain their views and experiences on pay issues. Additionally, the study aims to produce supporting evidence via Web-based quantitative questionnaire that will be publicised on women’s ICT forums, the aim of which is to gather data about pay from as many women working in the sector as possible to enhance the understanding of the complexities of the issue.

The project will end in December 2006, when a report will be prepared for the ESF and research results will be disseminated via workshops for organisations, women, local government representatives and other interested parties throughout England.

CONCLUSION

This article provides an overview of current research being undertaken by the ESF-funded DEPICT project at the University of Salford’s Information Systems Institute that aims to investigate equal pay issues in the UK ICT sector. Despite 30 years of equal pay legislation in the UK, the gender pay gap still stands at 18%, the main contributing factors being occupational segregation, caring responsibilities and discrimination in pay systems. The DEPICT project intends to highlight problems of overt and hidden pay discrimination and explore the implications these issues have on women’s progression and retention in the ICT industry, where women are already severely underrepresented. We present the argument that current data is limited, as the ICT sector is difficult and complex to define. We have presented a contextual theoretical framework for conducting the research by describing human capital theory and the dual labour market theory alongside critical approaches to explain women’s inequality at work. The final section indicates a brief overview of the research methods that will be utilised during the research process.

REFERENCES

Advisory, Conciliation and Arbitration Service (ACAS). (2005). *Pay systems*. Retrieved June 2005, from www.acas.org.uk/publications/B02.html

- Barron, R. D., & Norris, G. M. (1976). Sexual division and the dual labour market. In D. Leonard Barker & S. Allen (Eds.), *Dependence and exploitation in work and marriage* (pp. 47-69). London: Longmans.
- Beck, U. (1992). *Risk society: Towards a new modernity*. London: Sage.
- Beechey, V. (1980). Women and production: A critical analysis of some sociological theories. In A. Kuhn & A. Wolpe, A. (Eds.), *1978 Feminism and materialism. Women and modes of production* (Chap. 7, pp. 155-197). London: Routledge and Kegan Paul.
- Castells, M. (1996). *The rise of the network society*. Oxford, UK: Blackwell.
- Cockburn, C. (1983). *Brothers. Male domination and technological change*. UK: Pluto Press.
- Engels, F. (1972). *The origin of the family, private property and the state in the light of the researches of Lewis H. Morgan*. London: Lawrence and Wishart.
- Equal Opportunities Commission (EOC). (2001b). *Just pay: Report of the Equal Pay Task Force*. Retrieved June, 2005, from www.eoc.org.uk
- Equal Opportunities Commission (EOC). (2004a). *Occupational segregation, gender gaps and skills gaps* (Occupational Segregation Working Paper Series No. 15).
- Equal Opportunities Commission (EOC). (2005c). *Facts about women and men in Great Britain 2005*. Retrieved June, 2005, from www.eoc.org.uk
- German, L. (2003, December). Women's liberation today. *International Socialism* 2(101), 3-34.
- Giddens, A. (1984). *The constitution of society*. Cambridge, UK: Polity Press.
- Huws, U. (2003). *The making of a cybertariat. Virtual work in a real world*. London: The Merlin Press.
- Institute for Employment Research (IER) and IFF Research Ltd. (2004). *National Employers Skill Survey (2003)*. Sheffield: DfES.
- Kingsmill, D. (2003). *The Kingsmill review of women's pay and employment*. Retrieved June, 2005, from www.kingsmillreview.gov.uk/docs/kingsmillreviewreport.pdf
- Neathey, F., Dench, S., & Thomson, L. (2003). *Monitoring progress towards pay equality. Research Discussion Series*. UK: Equal Opportunities Commission.
- Office for National Statistics (ONS). (2003). *New earnings survey 2003*. London: The Stationery Office.
- Platman, K., & Taylor, P. (2004). *Workforce ageing in the new economy— A comparative study of information technology employment*. UK: University of Cambridge.
- Prosser, M. (2005). *Results of Women's National Commission's consultation on women and pensions*. Retrieved June, 2005, from www.thewnc.org/wnc_work/oensions.html
- Richardson, H. J. (1984, April). *Job evaluation and equal pay for women workers in the British labour market* (unpublished masters thesis). Canterbury: University of Kent.
- Wharton, A. S. (2005). *The sociology of gender: An introduction to theory and research*. London: Blackwell.
- Women in North West Information Technology (WINWIT). (2004). Retrieved from www.isi.salford.ac.uk/gris/winwit
- Woodfield, R. (2000). *Women, work and computing*. Cambridge: Cambridge University Press.

KEY TERMS

Equal Opportunities Commission (EOC):

The EOC is an independent, non-departmental public body, funded primarily by the government. Although independent from the government, they are responsible to the cabinet minister with responsibility for women and equality and to the deputy minister for women and equality in the Department for Trade and Industry.

Equal Pay Act: The Equal Pay Act covers discriminatory contractual terms related to pay and benefits (such as holidays, cars, etc.). The Act was amended by the Equal Pay (Amendment) Act 1983, which stated that men and women should be paid equally for work of equal value to their employers. This intended to tackle the fact that women tend to be occupationally segregated and so often cannot compare “like job with like.” The Equal Pay Act only has jurisdiction for jobs done at an establishment within Britain. (The Sex Discrimination Act applies to any non- contractual payments of money or benefits; e.g., a one-off Christmas bonus payment.)

Gender Pay Gap: The gender pay gap is determined by calculating women’s overall average pay as a percentage of men’s. So, for example, the pay gap is said to be 18% where women’s pay is 82% of men’s. The gender pay gap is said to “narrow” as women’s average pay moves closer to men’s. To arrive at a figure for the gender pay gap, most official statistics compare the average hourly earnings of men and women working full-time as the best way to compare “like with like.” This accounts for differences in hours worked.

Human Capital: Human capital theory suggests that women are rewarded for their previous investment in their own education and training;

women do not receive the same rewards in terms of entry to employment, promotion and levels of pay received as men as a result of “choosing” to invest human capital in labour, such as childrearing.

Occupational Segregation: Occupational segregation is a major cause of the gender pay gap, which currently stands at 18% 30 years after the Equal Pay Act. In the UK, women are concentrated in a limited range of occupation types, predominantly in the lower-paid sectors of employment, such as catering, cleaning and caring.

Pay Discrimination: Since 1975, women and men have had the right to equal pay, but pay discrimination still takes place in many workplaces. Sometimes, women are paid less than men for doing the same job. In other cases, women are paid less than men for doing work of equivalent value for their employer. Both these forms of discrimination may be unlawful. Men paid less than their female colleagues also have a right to equal pay.

Salary Secrets: The “hidden truth” regarding pay inequality between men and women often go unnoticed until women reach senior management levels. Employers often require individual salary levels to be kept confidential.

ENDNOTE

- ¹ Mean individual income is the average, by calculating the sum of all earnings and dividing the total by the number of employees. However this total can be influenced by very high earnings of a few individuals and can present a distorted view of the “average.”

Chapter 6.21

MNE Knowledge Management Across Borders and ICT

Jürgen Kai-Uwe Brock
University of Strathclyde, UK

Yu Josephine Zhou
International University of Applied Science, Bad Honnef-Bonn., Germany

INTRODUCTION

Firms are consumers, producers, managers, and distributors of information (Egelhoff, 1991; Casson, 1996) and as such a repository of productive knowledge (Winter, 1988). Consequently the ability to generate, access, and utilize relevant knowledge is an essential organizational activity in order both to reduce uncertainty about the firm's external environment and improve the efficiency of its internal operations.

Particularly for multinational enterprises (MNEs), efficient implementation of knowledge management processes is of competitive importance. In contrast to their set of indigenous competitors, MNEs face liabilities of foreignness (Zaheer, 1995) and a more complex organizational structure that transcends cultures and countries.

Advances in location insensitive information and communication technology (ICT), in

particular the Internet's marketplace (Rayport & Sviokla, 1994), could significantly facilitate MNEs' knowledge management efforts. Ease of information gathering, communication, and knowledge management is no longer a strict function of geographical proximity. As a result of the Internet, the location specificity of knowledge (von Hayek, 1945) is becoming less location dependent, and thus less costly. Despite this, the role of the Internet in knowledge management has its limits due to its inherent media characteristics and the aforementioned liabilities particular to the operations of MNEs.

This article explores the possibilities and limitations of the Internet in supporting knowledge management in the specific context of MNEs. It is structured as follows. First we will provide a background to the article by discussing and defining the specifics of MNEs, MNEs' knowledge management challenges, and the specifics of the Internet. Subsequently the article will analyze

and explore the potential impact of the Internet on MNEs' knowledge management processes. A discussion of future trends and an overall conclusion close the article.

BACKGROUND

Global trade has grown 16-fold since the 1950s, by far outstripping the growth in GDP (Economist, 1998). A key driving force behind this trend is foreign direct investment (FDI), whereas FDI is defined as an acquisition of an asset in a foreign country (host country) made by an investor in another country (home country) with the intention to manage this asset (WTO, 1996). MNEs are the main driver behind FDI. Although definitions vary, an MNE can be defined as a firm that is engaged in FDI in several countries outside its home country (for a more detailed discussion the reader might refer to, e.g., Vahlne & Nordström, 1993; Rugman & Verbeke, 2004).

Before discussing the specific knowledge management challenges of MNEs and the role of the Internet therein, it is vital to understand why MNEs exist at all. International business theory has addressed this. The core idea of international trade theory—the idea of market imperfections—was utilized by international business researchers to explain international activities at the firm level by projecting these imperfections into the firm. This helped to explain the emergence and existence of MNEs, as opposed to firms only trading with each other by means of importing and exporting. In 1960 (published in 1976), Hymer's market imperfections theory in essence postulated that firm specific advantages like technology and management skills are the core source enabling firms to successfully operate abroad, offsetting cost and information advantages enjoyed by indigenous firms. Hymer's idea was then further refined and developed by Buckley and Casson (1976) to become internalization theory. Buckley and Casson conceptualized the MNE as a firm

that responds to pre-product or intermediate-product market imperfections by internalizing these markets (like components, semi processed goods, knowledge, skills, and technology) across national boundaries (via FDI). Internalization means that a firm makes use of its organizational hierarchy and in-house resources to manage a specific business transaction as opposed to buying it on the market. By internalizing the transfer of a firm's assets and capabilities, firms mitigate transfer problems and at the same time exploit their internal advantage(s) internationally.

At the heart of internalization is the management of knowledge-related imperfections (Kogut & Zander, 1993), which makes effective knowledge management a central task for MNEs. Knowledge management within MNEs is about two interrelated tasks:

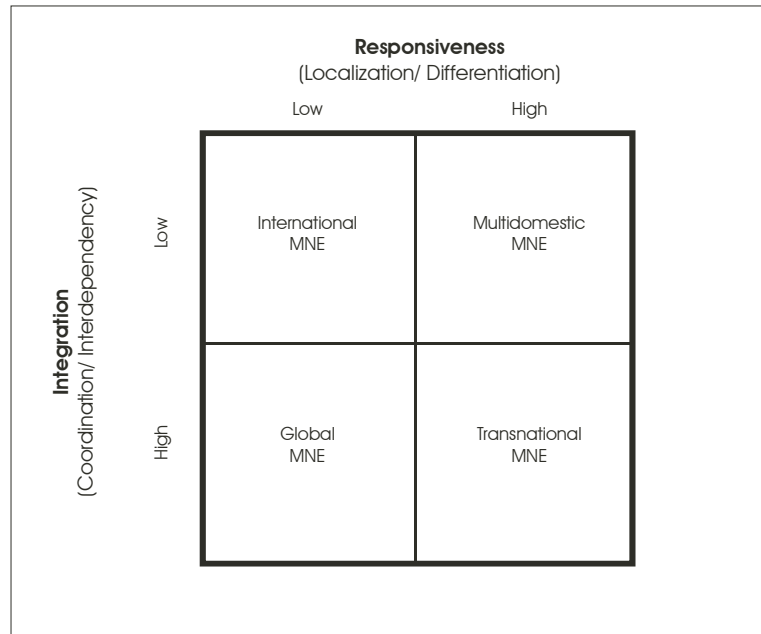
1. Knowledge management within the MNE (intra-MNE) which focuses on continuous knowledge creation, transmission, use, and retention between and within headquarters and subsidiaries.
2. Interface knowledge management (extra-MNE) which is about the continuous identification of the MNEs' external knowledge environment, its scanning, the collection of relevant external knowledge, and synthesis with existing intra-MNE knowledge.

This categorization can be related to types of MNEs (see Figure 1). Intra-MNE knowledge management mainly relates to the integration dimension, and extra-MNE knowledge management mainly relates to the responsiveness dimension. Obviously, as an MNE moves from low to high on both dimensions, knowledge management (intra- and extra-MNE) requirements increase.

This article will focus on the first knowledge management task (intra-MNE knowledge; integration), because it is unique to MNEs.

The key challenge for intra-MNE knowledge management is knowledge transmission (Kogut

Figure 1. Types of MNEs



Source: Derived from Harzing's MNE typology synthesis (Harzing, 1997)

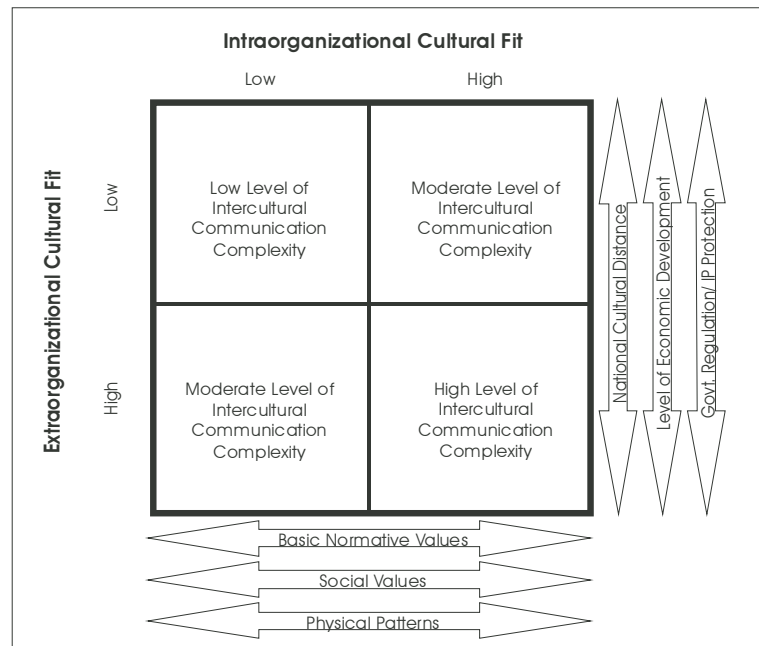
& Zander, 1993). Transmitting knowledge is costly (Teece, 1977). The more tacit—or personal (Polanyi, 1958)—and complex the information, the more difficult and expensive it will be to transmit it. This is so because the codification and teaching costs in the transmission process increase as tacitness and complexity increases. Transmitting knowledge across different cultures and countries further increases the costs due to different norms, habits, languages, and interpersonal processes that can inhibit communication flows (Johanson & Vahlne, 1977). These differences operate at two levels, the intra-organizational level and the extra-organizational level, both defining the communication complexity in the knowledge transmission process (see Figure 2). While the former refers to differences between the different organizational cultures within MNEs (mainly headquarters to subsidiary/-ies), the latter

refers to differences at the national level (home country to host country/-ies). However, the intra-MNE transfer of knowledge can be eased by the development of a common understanding and of capabilities—combinative capabilities according to Kogut and Zander (1993)—how to manage this transmission. Such development emerges—via repeated interactions—over time in the form of organizational routines.

Before analyzing how the Internet's marketplace could impact the intra-MNE knowledge management process, an evaluation of the marketplace is required.

Whereas the marketplace represents the physical world of resources, the marketpace represents the virtual world of digitized information (Rayport & Sviokla, 1994). The most evident and widely known manifestation of the marketpace is the Internet. Following key elements of December's

Figure 2. Intercultural MNE communication matrix



Source: Derived from Harvey and Griffith (2002)

(1996) definition, the Internet can be defined as:

- Computer-mediated communication, including
- information dissemination and
- information retrieval that
- involves data (bits) exchanges taking place on the
- global collection of computer networks using
- the TCP/IP protocol suite for data transfer.

The information content can involve a broad range of data types (text, graphics, images, sound, video), and various forms of open and closed (in the case of intranets and extranets) information processes (one-to-one, one to many;

asynchronous, synchronous) are possible. The Internet can thus be used by organizations such as MNEs to process, distribute, and retrieve codified knowledge, and it can be used to interact (communicate) with others. To express this, the terms “information pull,” “information push,” and “interaction” are introduced. Information pull refers to organizational activities related to synchronously or asynchronously pulling information from the Internet (or intranet, extranet). Information pull can be active or passive, with, for example, searching the Web referring to the former and subscribing to mailing lists referring to the latter. Subscribing to corporate mailing lists is a passive, non-specific information pull activity, because the subscriber does not know exactly what specific kind of information he or she receives prior to subscribing.

On the other hand, information push refers to organizational activities related to pushing information onto the Internet (or intranet, extranet). Active information push refers to organizations actively marketing their information push activities. In contrast, passive information push refers to organizations setting up Web sites without any internal or external promotions.

Interaction is the Internet's third potential use for organizations. The main difference between information push/pull and interaction is that interaction involves non anonymous, asynchronous or synchronous personal exchange of information between known communication parties. Both information pull and information push is at least partially anonymous. Interaction as understood here means mediated personal interaction between known users or parties. When an organization pushes corporate information onto the Internet, it does not know *ex ante* who might actually retrieve and read its content. The same applies for posting non personalized messages to newsgroups or mailing lists, because the sender does not know in advance who will read his message and who will not. In addition, the sender does not know the identity of all the receivers, unless he is the initiator and owner of the mailing list requiring subscribers to reveal their identity during the subscription process. The same applies in the case of information pull. Although users accessing a Web page or Internet-based databases leave "digital fingerprints" (Drèze & Zufryden, 1997) and Web sites can send so-called "cookies" to users accessing a Web page, users pulling information from the Internet can remain anonymous if they wish to by refusing cookies or by using anonymizer software. In contrast, interaction as defined here involves the one-to-one or one to many exchange of information between pre-specified and known parties. The defining element of interaction is value exchange between known parties.

All of the aforementioned three use categories are interrelated, with information pull activities potentially being influenced by and leading to

information push activities and interaction activities, and vice versa. Also, the three uses relate to similarly interrelated activities taking place in the non mediated marketplace.

MAIN FOCUS OF THE ARTICLE

Although the role of ICT in organizations in general has been the focus of studies since the 1970s (e.g., Pfeffer & Leblebici, 1977), little is known about the specific role of ICT in cross-cultural contexts (e.g., St. Amant, 2002; Weisinger & Trauth, 2002) and MNE operations (e.g., Petersen & Welch, 2003). With the background provided in the previous section, it is possible to explore possible effects of the Internet's marketspace on intra-MNE knowledge management.

Knowledge management scholars have identified four dynamically interacting processes how organizational knowledge is created and transmitted (Nonaka, 1991). The first process—termed "socialization"—is about tacit-to-tacit knowledge transfers. The traditional German apprenticeship system is an example of such a transfer. An apprentice learns via observation, imitation, and practice. In this process he or she "imports" the tacit knowledge base of the master which becomes his or her own tacit knowledge. The second knowledge transfer process is "articulation," whereby explicit or codified knowledge is directly transferred to become explicit knowledge elsewhere. An example of such a process would be an individual recombining a set of coded knowledge such as a financial report into a different document. The third and fourth processes are about transformative transfers, whereby explicit knowledge is turned into tacit knowledge or vice versa. The tacit-to-explicit transfer is called "combination." Combination takes place when an individual articulates his or her tacit knowledge base, thereby converting it into explicit knowledge that can be shared with others. Finally, "internalization"—a technical term in

the knowledge management literature that has a different meaning to the one in the international business context—is the explicit-to-tacit process of knowledge transfer. This process takes place when employees use the explicit organizational knowledge available, for example in the form of a database, to extend their own tacit knowledge.

How could the Internet support or enhance these four processes in the case of intra-MNE knowledge management?

On the one hand, the answer lies in an understanding of the differences between mediated and unmediated communication. On the other, an appreciation of cultural differences in communication is required. With regards to the former, rational media choice theories, such as social presence theory (Short, Williams, & Christie, 1976) and media richness theory (Daft & Lengel, 1986) postulate that an individual determines his or her choice of media by rationally assessing the requirements of a communication task and selecting an appropriate medium matching these requirements. Media is categorized along a continuum based on the channel's information richness, which depends on the medium's ability for immediate feedback, the number of carried cues, the number of channels utilized, its language variety, and its level of personalization capable of reducing equivocality. This set of theories postulates that the higher the perceived need for social cues and equivocality reduction in a communication situation, the higher the likelihood of face-to-face communication, the richest mode of information exchange with the highest degree of social presence. This would, for example, be the case in tacit-to-tacit knowledge transfers ("socialization"). In contrast, the Internet is considered less information rich. It follows that the reduction in channel capacity on the Internet compared to face to face communications makes knowledge transfers more difficult despite its cost-reducing properties in general.

Mixed empirical findings regarding the predictive validity of the rational media choice theories

(e.g., Markus, 1994; Walther, 1996; Ngwenyama & Lee, 1997) have led to the development of social influence models of communication technology use (e.g., Ngwenyama & Lee, 1997). The social influence models of communication technology use all regard information richness or leanness in communications not as attributable to the properties of the communication medium alone, but as emerging from the interaction between people and contexts. According to this school of thought, media choice is influenced by the attitudes and behaviors of others, as well as norms that have developed within a group, within organizations, or across organizations. Hence, media perception is not fixed, but it varies across people, organizations, situations, tasks, time, and user experience with the medium. Because these models make no a priori assumption about any direct relationships between communication richness and the quantity of social cues (Ngwenyama & Lee, 1997), they in essence detach the message from the medium. Any message can be rich (or lean) relatively independent of the medium, more dependent upon the users' experience with the medium, their experience with the communication topic, and their experience with the communication partner or the communication context (Carlson & Zmud, 1999). Communication richness is therefore an outcome of social behavior, not solely an outcome of the nominal, rationally determined media richness of the communication channel. All this implies that although the amount of social information per communication act via the Internet is lower compared to face to face communication, it is more the rate of social information exchange than the amount of social cues exchanged that constitutes the key difference between the two forms of communication (Walther, 1996). Compared to non mediated communication, the exchange of social cues is "just" temporally retarded. Hence, informal, interpersonal communication can take place over computer-mediated communication channels, as user experience with the medium, the topic, the communication partner, and the

communication context accumulates and increases. This phenomenon has been termed the “channel expansion effect” (Carlson & Zmud, 1999). But when first exposed to new media such as the Internet, it is likely that people’s need for unmediated, face-to-face interactions increases (Nohria & Eccles, 1992).

A similar, albeit media-independent expansion effect can be observed within the organizational context of the MNE. As described by Kogut and Zander (1993), the personnel of the MNE must share a similar background and organizational culture in order to be able to encode and decode messages—in any of the four processes described above—correctly, otherwise misunderstandings will arise. Such capability, constituting the MNEs’ transactional ownership-advantage (Dunning & Rugman, 1985), is MNE specific and only emerges over time through repeated interactions.

Considering communication differences across cultures is the second aspect that requires attention to understand how the Internet could support or enhance the four processes of intra-MNE knowledge management (see Figure 2). Hall’s work on intercultural communication (Hall, 1976, 1983) provides a suitable framework that has been applied widely in similar research contexts, especially its contextual dimension (e.g., St. Aman, 2002; Zakaria, Stanton, & Sarker-Barney, 2003; Matveev & Nelson, 2004). The contextual dimension in Hall’s framework represents the ways in which information is perceived, exchanged, and used by people from different cultures. Hall categorized cultures on a high- to low-context continuum. Low-context cultures such as those in the United States, Germany, and Scandinavian countries tend to present and exchange information in an explicit and direct manner. The implicit assumption is that little or no contextual overlap with the receiver is required, because all necessary information is vested in the explicit code (i.e., words) used. In contrast, high-context cultures such as those in Japan, China, Russia, and Latin America tend to rely less on coded, explicit com-

munication. In such cultures most of the actual information content resides within the physical and situational context, as well as inside the communication parties. Less explicit information exchange is the natural consequence. Research has shown that such cultural differences also impact the way people go about their information pull, push, and interaction tasks, whether ICT mediated or unmediated (e.g., Straub, Keil, & Brenner, 1997; Pook & Füstös, 1999; Kersten et al., 2003; Pauleen, 2003; Zakaria et al., 2003).

Considering these different aspects, it becomes evident that it is likely that the relative role of Internet versus face-to-face-based knowledge management processes depends on the type of knowledge transfer process; the MNEs employees’ experience with the Internet and its three generic uses; the employees’ experience in transferring, absorbing, and using intra-MNE knowledge; and the intercultural communication complexity. Table 1 provides an overview.

For tacit-to-tacit transfers, the role of the Internet is the most limited, and only one of the three generic uses apply. Unmediated face-to-face interactions will play the dominant role with the highest base level, particularly in complex communication situations that require very personal communication strategies (Harvey & Griffith, 2002). Only over time, as the previously mentioned expansion effects occur and the emergence of an organizational communication culture reduces communication complexity, will the interaction use of the Internet increase and the role of unmediated interactions decrease. An exception to this trajectory is a surmised initial increase in face-to-face interaction (Nohria & Eccles, 1992). The overall shift over time will be of a complementary rather than fully substitutive nature (Kraut, Steinfield, Chan, Butler, & Hoag, 1998), especially in high-context cultures (Zakaria et al., 2003). A video conference over the Internet with an instructor practically demonstrating procedural knowledge is an example of a tacit-to-tacit knowledge transfer.

Table 1. Knowledge management aspects, culture, ICT, and MNEs*

| Process | Culture | Role of the Internet# | | | | Face-to-Face# | Relevance for MNE I type | | | | Hypothesized, Stylized Relationship |
|---------------------------------------|--|-----------------------|---------------|---------------|---------------|---------------|--------------------------|--------------|---------------|------|-------------------------------------|
| | | Pull# | Push# | Interaction # | International | | Multidomestic | Global | Transnational | | |
| Tactit-to-Tact ("socialization") | Intercultural Communication Complexity | High | - | Low | High | High | Low | Low - Medium | Medium - High | High | |
| | Intercultural Communication Complexity | Low | - | Low → Medium | High → Medium | High → Medium | Low | Low - Medium | Medium - High | High | |
| Explicit-to-Explicit ("articulation") | Intercultural Communication Complexity | High | Medium | Medium | Medium | Medium | Low | Low - Medium | Medium - High | High | |
| | Intercultural Communication Complexity | Low | Medium → High | Medium → High | Low → Low | Low → Low | Low | Low - Medium | Medium - High | High | |
| Tactit-to-Explicit ("combination") | Intercultural Communication Complexity | High | - | Low | High | High | Low | Low - Medium | Medium - High | High | |
| | Intercultural Communication Complexity | Low | - | Low → Medium | High → Medium | High → Medium | Low | Low - Medium | Medium - High | High | |
| Explicit-to-Tact ("internalization") | Intercultural Communication Complexity | High | Low | Low | Low | Low | Low | Low - Medium | Medium - High | High | |
| | Intercultural Communication Complexity | Low | Low → Medium | Low → Medium | Low → Low | Low → Low | Low | Low - Medium | Medium - High | High | |

* Focus Intra-MNE; # Over time (t1 → t1+n)

Explicit-to-explicit transfers are the stronghold of the Internet. All three generic uses apply, the frequency of use is the highest, and the face-to-face base level is the lowest. Codified organizational knowledge such as a blueprint stored in an Internet-enabled database is an example. Here, the need for unmediated communication is rather low, with the exception of complex intercultural communication situations. In addition, the need for unmediated communication might increase initially to achieve source credibility and trust.

For tacit-to-explicit transfers, only the push and interaction use of the Internet applies and its relative role lies somewhere between the two processes previously discussed. Turning uncoded, personal knowledge into codified knowledge requires richer, unmediated communication, particularly initially and in culturally dissimilar contexts. However, similar to tacit-to-tacit transfers, expansion effects might reduce the relative importance of unmediated interactions over time. As previously mentioned, an initial increase in face-to-face interactions (Nohria & Eccles, 1992) might be an exception to this. An example of such a transfer over the Internet would be an employee who publishes (pushes) an installation guide that incorporates his experience in installing the described piece of machinery on an MNE's best practice intranet site.

In the case of explicit-to-tacit transfers, both media play a limited role, with the influence of the Internet's pull and interaction use likely to increase over time as users gain expertise in pulling the right set of information from the medium and in interacting with colleagues from different countries. Here the relative role of the Internet for the MNE is similar to its role in the tacit-to-explicit transfer. The two differences are that the pull use of the Internet applies while the push use does not and that the overall use frequency of both media is lower. Internalization is more of a media-independent internal human learning process where mainly the source—face-to-face or mediated—matters. An example would be an

employee in a subsidiary who downloads a new manual containing work rules that he or she will subsequently use in the daily work. Over time the explicit, codified knowledge is absorbed and becomes part of the employee's personal, tacit knowledge base.

As indicated in Table 1, the importance of these effects depends on the MNE type and the associated importance of intra-MNE knowledge management (see Figure 1 and Table 1). If integration is low, the relevance and role of the Internet is limited. If integration is high, the Internet can facilitate intra-MNE knowledge management as described above. In addition, the MNE's overall strategic intent regarding knowledge management matters. If a personalization strategy rather than a codification strategy is followed (Hansen, Nohria, & Tierney, 1999), the role of the Internet will be more limited.

FUTURE TRENDS

The importance of knowledge management in MNEs will increase in the future. As economies' value add shifts to services and knowledge becomes the key asset for firms, productive use of organizational knowledge becomes the main challenge (Drucker, 1999). Moreover, as the international integration of economies increases, cross-cultural communication competence becomes an increasingly important aspect in knowledge management. Research has demonstrated its positive impact on performance (Matveev & Nelson, 2004). What is less clear is how the role of the Internet will change in the future and how this relates to knowledge management within MNEs. Even its present role in knowledge management processes is not well understood. The Internet is a very dynamic and innovative medium, and its capabilities have significantly improved over time, including faster network connections. Therefore one could speculate that the role of the Internet will expand further. As mobile access to the In-

ternet improves, individuals' and organization's skills in using it improve, and its bandwidth further expands richer information can be transmitted. This will reduce—albeit not completely substituting—the need for unmediated communication in the knowledge transmission process. Real time, virtual reality conferencing between headquarters and subsidiaries is but one example. Additionally, as global Internet diffusion further increases, cultural differences might matter less and lead to the emergence of a meta-culture that transcends location-bound aspects of culture in communication.

Yet it is important to understand that the Internet is “only” an infrastructure technology available to every MNE. In other words, it is a competitive necessity, not a source of competitive advantage per se. Only if the MNE integrates the Internet seamlessly into its culturally sensitive knowledge management processes, leveraging its resource-related and transaction-related advantages, will the Internet enable MNEs to sustain their competitive advantage. An understanding of the Internet's limitations and strengths as discussed above will help.

CONCLUSION

This article explored the possibilities and limitations of the Internet in supporting intra-MNE knowledge management. As was shown theoretically, the Internet can support such management tasks, assuming that personal relationships among employees and a joint understanding of the organizational context and culture have developed. Over time, as experience with the medium, the exchange partner, and the exchange context increases, this role becomes more prominent. Despite this, unmediated communication remains of importance. Especially in complex intercultural communication situations, in the early phases of knowledge transmission processes, and in cases where tacit knowledge is dominant, the Internet's

current role is more limited. In addition, the nature of the MNE matters. Especially for MNEs that manage a highly interdependent network of subsidiaries with a high level of integration, efficient use of the Internet is imperative to stay competitive. With this in mind, a more differentiated role of the Internet in intra-MNE knowledge management processes emerges. Neither will it completely obsolete distance and the location-dependency of knowledge, nor will it play no role in knowledge management (for the latter argument see, for example, McDermott, 1999).

Although this middle-of-the-road position might be logically appealing, future research should test these conclusions. Thus far, empirical evidence in this area is scant and mainly anecdotal. Can the hypothesized relationship be found in MNEs? What are the antecedents and consequences of face-to-face versus Internet-mediated knowledge management processes? Does intercultural complexity moderate or mediate antecedents and consequences of media use in knowledge management processes? What overall organizational impact could be expected? Will it lead to—or be the result of—smaller MNEs and/or more decentralized MNEs and/or more integrated MNEs (for such findings in general, see Brynjolfsson, Malone, Gurbaxani, & Kambil, 1994; Dewan, Michael, & Min, 1998)? So far, these questions have not been answered.

REFERENCES

- Brynjolfsson, E., Malone, T.W., Gurbaxani, V., & Kambil, A. (1994). Does information technology lead to smaller firms? *Management Science*, 40(12), 1628-1644.
- Buckley, P.J., & Casson, M.C. (1976). *The future of the multinational enterprise*. New York: Holmes & Meier.
- Carlson, J.R., & Zmud, R.W. (1994). *Channel expansion theory: A dynamic view of media and*

- information richness perceptions*. Academy of Management, Best Papers (pp. 280-284).
- Casson, M.C. (1996). The nature of the firm reconsidered: Information synthesis and entrepreneurial organization. *Management International Review*, 36(Special Issue I), 55-94.
- Daft, R.L., & Lengel, R.H. (1986). Organizational information requirement, media richness and structural design. *Management Science*, 32(5), 554-571.
- December, J. (1996). Units of analysis for Internet communication. *Journal of Communication*, 46(1), 14-38.
- Dewan, S., Michael, S.C., & Min, C.-K. (1998). Firm characteristics and investments in information technology: Scale and scope effects. *Information Systems Research*, 9(3), 219-232.
- Drèze, X., & Zufryden, F. (1997). Testing Web site design and promotional content. *Journal of Advertising Research*, 37(2), 77-91.
- Drucker, P.F. (1999). Knowledge-worker productivity: The biggest challenge. *California Management Review*, 41(2), 79-94.
- Dunning, J.H., & Rugman, A.M. (1985). The influence of Hymer's dissertation on the theory of foreign direct investment. *American Economic Review*, 75(2), 228-236.
- Economist. (1998). Survey world trade—time for another round. *The Economist*, (October 3).
- Egelhoff, W.G. (1991). Information processing theory and the multinational enterprise. *Journal of International Business Studies*, 22(3), 341-368.
- Hall, E.T. (1976). *Beyond culture*. Garden City, NY: Anchor.
- Hall, E.T. (1983). *The dance of life: The other dimension of time*. Garden City, NY: Anchor.
- Hansen, M.T., Nohria, N., & Tierney, T. (1999). What's your strategy for managing knowledge? *Harvard Business Review*, (March-April), 106-116.
- Harvey, M.G., & Griffith, D.A. (2002). Developing effective intercultural relationships: The importance of communication strategies. *Thunderbird International Business Review*, 44(4), 455-476.
- Harzing, A.-W. (1997). An empirical analysis and extension of the Bartlett and Ghoshal typology of multinational companies. *Journal of International Business Studies*, 31(1), 101-120.
- Hymer, S.H. (1960). *The international operations of national firms: A study of direct investment*. PhD thesis, Massachusetts Institute of Technology, USA.
- Johanson, J., & Vahlne, J.-E. (1977). The internationalization process of the firm—a model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies*, 8(1), 23-32.
- Kersten, G.E., Koeszegi, S.T., Vetschera, R. (2003). The effects of culture in computer-mediated negotiations. *Journal of Information Technology Theory and Applications*, 5(2), 1-28.
- Kogut, B., & Zander, U. (1993). Knowledge of the firm and the evolutionary theory of the multinational corporation. *Journal of International Business Studies*, 24(4), 625-645.
- Kraut, R., Steinfield, C., Chan, A., Butler, B., & Hoag, A. (1998). Coordination and virtualization: The role of electronic networks and personal relationships. *Journal of Computer-Mediated Communication*, 3(4). Retrieved August 5, 2000, from <http://jcmc.huji.ac.il/vol3/issue4/kraut.html>
- Markus, M.L. (1994). Electronic mail as the medium of managerial choice. *Organization Science*, 5(4), 502-527.
- Matveev, A.V., & Nelson, P.E. (2004). Cross cultural communication competence and multicultural

- team performance—perceptions of American and Russian managers. *International Journal of Cross Cultural Management*, 4(2), 253-270.
- McDermott, R. (1999). Why information technology inspired but cannot deliver knowledge management. *California Management Review*, 41(4), 103-118.
- Ngwenyama, O.K., & Lee, A.S. (1997). Communication richness in electronic mail: Critical social theory and the contextuality of meaning. *MIS Quarterly*, 21(2), 145-167.
- Nohria, N., & Eccles, R.G. (1992). Face-to-face: Making network organizations work. In N. Nohria & R.G. Eccles (Eds.), *Networks and organizations: Structure, form, and action* (pp. 288-308). Boston: Harvard Business School Press.
- Nonaka, I. (1991). The knowledge creating company. *Harvard Business Review*, (November-December), 96-104.
- Pauleen, D.J. (2003). Lessons learned crossing boundaries in an ICT-supported distributed team. *Journal of Global Information Management*, 11(4), 1-19.
- Pook, L., & Füstös, J. (1999). Information sharing by management: Some cross-cultural results. *Human Systems Management*, 18, 9-22.
- Petersen, B., & Welch, L.S. (2003). International business development and the Internet, post-hype. *Management International Review*, 43(Special Issue I), 7-29.
- Pfeffer, J., & Leblebici, H. (1977). Information technology and organizational structure. *Pacific Sociological Review*, 20(2), 241-261.
- Polanyi, M. (1958). *Personal knowledge: Towards a post critical philosophy*. Chicago: Chicago University Press.
- Rayport, J.F., & Sviokla, J.J. (1994). Managing in the marketplace. *Harvard Business Review*, (November-December), 141-150.
- Rugman, A.M., & Verbeke, A. (2004). A perspective on regional and global strategies of multinational enterprises. *Journal of International Business Studies*, 35(1), 3-18.
- Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunication*. London: John Wiley & Sons.
- St.Amant, K. (2002). When cultures and computers collide—rethinking computer-mediated communication according to international and intercultural communication expectations. *Journal of Business & Technical Communication*, 16(2), 196-214.
- Straub, D., Keil, M., & Brenner, W. (1997). Testing the technology acceptance model across cultures: A three country study. *Information and Management*, 33, 1-11.
- Teece, D.J. (1977). Technology transfer by multinational firms: The resource cost of transferring technological know-how. *Economic Journal*, 87, 242-261.
- Vahlne, J.-E., & Nordström, K.A. (1993). The internationalization process: Impact of competition and experience. *The International Trade Journal*, 7(5), 529-548.
- Walther, J.B. (1996). Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research*, 23(1), 3-43.
- Weisinger, J.Y., & Trauth, E.M. (2002). Situating culture in the global information sector. *Information Technology & People*, 15(4), 306-320.
- Winter, S.G. (1988). On Coase, competence, and the corporation. *Journal of Law, Economics and Organization*, 4(1), 163-180.
- WTO. (1996, October 16). *Trade and foreign direct investment*. Report by the WTO Secretariat.

von Hayek, F.A. (1945). The use of knowledge in society. *American Economic Review*, 35(4), 519-530.

Zaheer, S. (1995). Overcoming the liabilities of foreignness. *Academy of Management Journal*, 38(2), 341-363.

Zakaria, N., Stanton, J.M., & Sarker-Barney, S.T.M. (2003). Designing and implementing culturally sensitive IT applications: The interaction of culture values and privacy issues in the Middle East. *Information Technology & People*, 16(1), 306-320.

KEY TERMS

Articulation: One of four knowledge transmission mechanisms according to Nonaka. Articulation is about explicit or codified knowledge being transferred to become explicit knowledge elsewhere by recombining two or more sets of coded knowledge.

Channel Expansion Effect: Communication over computer-mediated communication channels such as the Internet can increase in richness and social presence over time while keeping its nominal channel capacity. This effect occurs as user experience with the medium, the topic, the communication partner, and the communication context accumulates.

Combination: One of four knowledge transmission mechanisms according to Nonaka. It is a tacit-to-explicit knowledge transfer taking place when individuals articulate their tacit knowledge base, converting it into explicit knowledge that can be shared with others.

Foreign Direct Investment (FDI): An acquisition of an asset in a foreign country (host country) made by an investor in another country (home country) with the intention to manage this asset.

Internalization: In international business and organization science literature, internalization means that an organization makes use of its organizational hierarchy to manage a specific business transaction, as opposed to buying it on the market. In knowledge management literature, internalization is one of four knowledge transmission mechanisms according to Nonaka. It refers to the explicit-to-tacit process of knowledge transfer. This process takes place when individuals use explicit knowledge to extend their own tacit knowledge base.

Multinational Enterprise (MNE): A firm that is engaged in FDI in several countries outside its home country.

Socialization: One of four knowledge transmission mechanisms according to Nonaka. Socialization is about tacit-to-tacit knowledge transfers via observation, imitation, and practice.

Tacit Knowledge: Polanyi's statement "We know more than new can say" probably best explains what tacit knowledge is. In contrast to explicit knowledge, which is expressed in formal language systems (e.g., data, formulae, or any written document), tacit knowledge is personal and difficult to formalize. Personal insights, intuition, and sensing are examples of such knowledge. It is embodied in procedures, routines, activities, values, culture, and feelings.

This work was previously published in Encyclopedia of Knowledge Management, edited by D. Schwartz, pp. 635-644, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 6.22

Is Organizational e–Democracy Inevitable?

The Impact of Information Technologies on Communication Effectiveness*

Bernadette M. Watson

University of Queensland, Australia

Gavin M. Schwarz

University of New South Wales, Australia

Elizabeth Jones

Griffith University, Australia

ABSTRACT

In this chapter, we consider the relationships between social identity and e-democracy in organizations that exist in the constantly changing global business and technological environment. We also consider the inevitability of organizational e-democracy in organizations undertaking information technology (IT) changes, the technology at the base of e-democracy. Through an examination of employees' experiences of change, we investigate their perceptions of changes in effective communication during major organizational change implementation in a hospital context. While the changes were far reaching, we mainly focus on the

introduction of information and communication technology (ICT). We use an empirical examination of an Australian public hospital's IT change experience as the backdrop to assess the accuracy of the statement that there is an improvement in the autonomy within organizations as a result of IT changes. We discuss our findings in light of the implications that arise for HR practitioners.

INTRODUCTION

In this chapter, we consider the relationships between effective communication, social identity, and e-democracy in organizations that exist

in the constantly changing global business and technological environment. We also consider the inevitability of organizational e-democracy in organizations undertaking information technology (IT) changes, the technology at the base of e-democracy. Through an examination of employees' experiences of change, we investigate their perceptions of changes in effective communication during major organizational change implementation in a hospital context. While the changes were far reaching, we mainly focus on the introduction of information and communication technology (ICT).

We define e-democracy as the technological advances in communication media that provide employees with more information and more direct access to other employees (supervisory and subordinate levels) than previously existed. These changes to communication channels provide organizational connections and lead to e-democracy practices that seek to improve the autonomy of organizational members. Thus there is a freeing of information to help erase or ease organizational boundaries, which changes the relationship between executive and middle management parties.

The chapter uses an empirical examination of an Australian public hospital's IT change experience as the backdrop to assess the accuracy of the statement that there is an improvement in the autonomy within organizations as a result of IT changes. We assert that while hospitals are a very specific type of organization, they represent a typical hierarchical organization that uses the same human resource (HR) practices and principles that underlie all successful ICT implementations. We adopt the theoretical framework of social identity theory (SIT) (Tajfel, 1978) to understand how communication effectiveness and e-democracy evolve during IT change. SIT proposes that individuals understand their self-concept through their identification with salient social groups (1978, p. 63). Such groups include gender, profession, nationality, and religion — to

name just a few. Individuals derive their sense of self-worth and positive self-esteem by viewing their group memberships (in-groups) as better than other groups to which they do not belong (out-groups). Employees will often tend to make favorable in-group comparisons to ensure that their workgroup is perceived as more successful and prestigious than comparable out-groups. Such comparisons lead to positive evaluations of one's own self-worth. This theory, which is discussed in more detail below, has important implications for the ways in which individuals will react to and manage ICT change.

ICT often changes the environment in which individuals work. As the work environment changes, so to do work-related tasks and roles. Changes to role and work functions alter the composition of workgroups and so impact on an employee's identification with his or her workgroup and intergroup relations between groups. From an SIT perspective, we view organizations as cultures. Thus the hospital environment has its own culture; within this, subcultures or groups (e.g., work units, departments) co-exist. We argue that SIT is a theoretical framework that provides insights into how employees absorb and manage ICT-enabled changes.

Thus our chapter highlights the social side of organizational change that is often ignored by the planners and implementers of change. We emphasize the need for HR managers to recognize these social issues. In this way HR practitioners will maintain the good employee environment that they have developed, as well as improve the outcomes of organizational change for members of that organization. Using a longitudinal study, we examine how employees' work identities impact on their understanding and adoption of ICTs. Bearing in mind the chapter's focus on e-democracy, we examine employees' perceptions of communication effectiveness and discuss these findings in the context of the HR focus that frames this book.

Is Organizational e-Democracy Inevitable?

The chapter highlights two important issues within the area of organizational change and new technology introduction:

1. the changes in employees' perceptions of their role and the groups within the organization that they identify with that are brought about by ICT-enabled change, and
2. the implications of these changes for HR practitioners.

Focusing on the ways that individuals in traditionally hierarchical organizations understand and adapt to the changes in their work, we examine the process of change from the viewpoint of both the implementers of change and the employees who must adapt to change. In so doing, we investigate how communication processes and their level of effectiveness change with IT implementation. Our intention is to provide e-human resources management with key recommendations that need to be in place to successfully implement an organization's planned ICT change.

This research is framed by the arrival of the knowledge economy that allows e-democracy practices to exist. As the knowledge economy has evolved, as part of more widespread changes to organizations including ICT, some researchers have examined how employees' identification with organizations explains change outcomes (Terry, 2001).

We recognize that there is a gap in our understanding between the emergence of organizational e-democracy and the potential changes to the organizational structure and communication that can result from ICT implementations. We bridge this gap by highlighting the fact that, because individuals identify with their workgroups, when the current status or existence of these groups is threatened, resistance to the change may result. HR practitioners need to understand the composition and function of employee workgroups — both formal and informal. They will then develop an

understanding of how and why members of these groups resist the changes within the organization and can seek to remedy the issues.

Organizations that typify the knowledge economy are viewed as dynamic and organic (Alvesson, 1995). As a consequence, the nature of organizational change in such organizations can be unpredictable. Understanding that change will bring about unexpected alterations to the way that employees respond to change is, therefore, key to being able to manage these people. In line with this view, Carlopio (1998) notes that the implementation stage of organizational change, while crucial to successful change, has been wrongly considered to be a rational and linear process.

In the subsequent pages we discuss the implementation of ICT change to stimulate discussion on the nature and place of organizational e-democracy. We seek to promote debate on the ways that social identification adapts and modifies itself within an organization undergoing ICT change. We focus on the implications for HR practice as we examine the uptake of ICT changes, the emergence of e-democracy, issues of identification, and the role of effective communication.

In this chapter, we first briefly describe the theoretical background to our research, focusing on the overlap between organizational democracy, change, and social identity. Using the experiences of a large public hospital undergoing change, we then provide evidence to demonstrate the value of connecting ICT innovation with social identity processes and e-democracy outcomes. We discuss the role that social identification with an organization or workgroup plays in an organization during ICT change. Finally, we examine the outcomes of such change as it affects the core business of an organization and make recommendations for HR practitioners. These recommendations will equip HR practitioners with a more appropriate and relevant knowledge base from which to plan and operationalize technology change.

RESEARCH BACKGROUND

The Paradox of Democracy in Organizational Research

Over 100 years after de Tocqueville's (1835) discussion on the triumphs, hazards, and powers of democracy, Slater and Bennis (1964) argued that "democracy is inevitable." They offered democracy as the most efficient and practical form of social organization, mimicking Weber's (1924/1968) philosophy on bureaucracy. At the time of their argument, the Cold War was the center of world attention, making the issue of democracy both topical and compelling. In the context of the global and technological changes occurring over the past five years, our research borrows from Slater and Bennis' thesis, but considers the same issue from an organizational perspective.

Today we live in a knowledge economy whose core assets are the intelligence, understanding, skills, and experience of employees, not the machinery, buildings, or real estate of yesteryear (Drucker, 2001; Manville & Ober, 2002). This environment has focused attention on the role of ICTs and their ability to disseminate information. The emergence of a knowledge economy, where effective information transfer and the decentralization of organizational power structures is paramount, however, raises questions about the nature of organizational democracy.

Despite its prominence in change research (e.g., Beer & Nohria, 2000), organizational democracy within the knowledge economy is confusing. In the contemporary workplace, knowledge is regularly portrayed as the primary resource for individuals (Drucker, 1992). The simultaneous sharing of information through sophisticated technology is viewed as a primary tool of organization (Orlikowski & Iacono, 2001). This process assumes that the militaristic conditions of the industrial organization are antiquated and perhaps even unnecessary. Consequently, changes to traditional bases of power and influence are

believed to occur through decentralization and information access (e.g., Applegate, 1994; Halal, 1996). Change initiated in the knowledge economy is regularly presented as a constant feature of the modern organization, despite the dissatisfaction that exists with the nature of change research (see Tsoukas & Chia, 2002). This perspective that change is constant in the knowledge economy adds a paradoxical tangent to organizational e-democracy.

These changes do not necessarily foster democracy (Mantovani, 1994), even though there are implied benefits of the evolving, boundary-less, and pluralistic nature of organizations in the current global economy. Many organizations are still organized autocratically (Kraemer & Dedrick, 1997; Schwarz, 2002). Corporate ownership structures, governance systems, and incentive programs are still firmly entrenched in the industrial age. Organizations are still primarily organized through small management groups typical of hierarchies (Markus, 1983; Robey & Boudreau, 1999). Any features of employee empowerment are limited.

It would, of course, be negligent not to recognize the advances made in the use of more democratic governance methods, such as participatory management practices (e.g., Drehmer, Belohlav, & Coye, 2000), organizational citizenship (e.g., Lambert, 2000), and communities of practice (e.g., Wenger, 1999). Nonetheless, change research is often too concerned with two aspects of change. First, the research concerns itself with re-evaluating the authority, power, and control features that normally exist in institutions (Scott, 2001). Second, it concerns itself with the promotion of alternative organizational designs and practices (Schilling & Steensma, 2001).

Organizational change in a knowledge economy context is regularly hypothesized to bring about a more democratic organizational shape than previously existed. For example, we expect more information connectivity and freer communication than before. We expect more autonomy, but

less centralization and less hierarchy than before. Yet there is enough research, and a growing line of argument, to undermine this assumption. Is organizational democracy in the knowledge economy (i.e., e-democracy) inevitable? If organizations change, then logically, so too must employee perceptions of their role in the organization. In a consideration of the objectives of this chapter, we therefore invoke social identity theory (SIT) as a guiding framework that may help understand the outcomes from change and whether or not e-democracy emerges as a result of ICTs.

Social Identity Theory and its Organizational Context

In the section that follows, we provide a preliminary overview of the theory, referring readers to Hogg and Terry (2001, 2000) for a comprehensive review of the theory and its links to organizational contexts. Social identification “is the perception of oneness with or belongingness to some human aggregate” (Ashforth & Mael, 1989, p. 21), encompassing salient group classifications. Social identity theory, therefore, is based on the premise that most often it is our group-based identities that are important in our interactions with others.

The central tenet of this approach is that belonging to a group is largely a psychological state. This grouping confers social identity, or a shared representation of who one is and how one should behave (Hogg & Abrams, 1988). In this way, group belongingness reduces our uncertainty about where we fit in society (Hogg & Mullin, 1999). More recently, SIT has been applied to the organizational context. Implicit in this understanding of organizational identity function is the recognition that organizations are composed of the people in that organization. In essence then, “Organizations are internally structured groups, which are located in complex networks of intergroup relations that are characterized by power, status, and prestige differentials” (Hogg & Terry, 2001, p.1). As a result, organizations are

implicitly dynamic, continually changing entities. Changes that affect the organization can therefore have serious effects on employees in terms of their identification with workgroups and the relationships between workgroups.

While there has been a longstanding research tradition examining organizational identification, more recently SIT researchers have viewed organizations as being composed of individuals possessing multiple group identities. These identities range from the employees’ overall identification as members of an organization, to their identification with specific work units and professions. At any one time different group membership may be salient for an employee. Accordingly, when a manager interacts with a subordinate, he or she is likely to identify with their respective roles of manager and subordinate as most salient in the work situation (Gardner & Jones, 1999). Yet in another context the person’s professional identity may be most salient.

SIT has been used by organizational scholars to better understand how the individual relates to these collectives, and the intergroup relations that accompany the process of identification (see Pratt, 2001, for a comprehensive review of this trend). Such a perspective does not deny the importance of an individual’s personal identification, but sees it as often less relevant than group identification in the workplace.

Social identity theory proposes that individuals will tend to make favorable evaluations about their in-group (‘us’), but make unfavorable evaluations concerning the out-group (‘them’). If we identify at the organizational level, we perceive all employees of our organization as in-group members and employees of competing organizations as members of an out-group. More often though, it is at the sub-organizational level that we make the most relevant comparisons. The result is that employees will then tend to favor their workgroup or department and evaluate it more positively than other workgroups or departments. Organizational change, including

the development of the knowledge economy, may not only lead to the formation of new identities, but may challenge/threaten existing identities and intergroup relations. Thus mergers, acquisitions, and downsizing have increasingly become the subject of research examining organizational change and SIT (Terry, 2001; van Knippenberg & van Leeuwen, 2001).

Such research has been crucial in understanding change from an SIT perspective, but as Hogg and Terry (2000) note, they do not address important developments of SIT in the last decade that are particularly relevant as to whether e-democracy may emerge in response to ICTs. Recent developments include research on identification problems dealing with (1) loyalty, and (2) nested and cross-cutting identities. Looking first at the issue of loyalty, as information intensity becomes more relevant to organizational functioning, many of the traditional roles of identity are undercut (Neef, 1998). Group identification is a process whereby individuals become connected with others and where joint interests may overtake those of the individual. When there are changes in perceived membership or competing identities emerge which make the lines of group belongingness unclear, questions concerning group loyalty may arise. Specifically, employees ask whether their loyalty should be conferred to the group, the organization, the professional association, the occupation, or to workmates?

Thus, before individuals can act in a given organizational context, they need to situate themselves, allowing certain identities to be nested or embedded within others (Ashforth & Johnson, 2001). Nested identities exist at the higher order level, such as an employee's identification with his or her division, which is nested under the organizational identification. Lower order identities are those of identification with an individual's job. Job identification would be nested under an individual's workgroup. Conversely, cross-cutting identities refer to an employee's committee or task force identification that runs across the

hierarchical structure. Cross-cutting identities and lower order level nested identities are more likely, more salient, and more proximal than are higher order level identities (see Ashforth & Johnson, 2001, for a full discussion on this topic). Internal conflicts may arise when an individual perceives competing demands across two of his or her work identities. The cognitions and identity changes that occur during change therefore need to be thoroughly investigated in order to better understand the change outcomes.

The longitudinal study that we present in this chapter acknowledges these aforementioned complexities and seeks to raise awareness levels of HR managers to these issues. Specifically, we contend that an examination of any change implementation without due consideration to the psychological processes that underlie an employee's perception of the change will not provide an accurate picture of the evolution process during change. Nor will such an examination provide an understanding of the potential subsequent changes in e-democracy.

The empirical review that follows describes how employee workgroup identification interacts with technology change and communication effectiveness, and the outcomes in terms of e-democracy. Employee responses include perceptions about changes to their levels of job satisfaction and commitment, as well as changes to the status and prestige of their workgroup and other groups within the organization. For HR practitioners, these are important considerations that, if managed well, allow for smooth transitions during change. Researchers have typically neglected the intergroup nature of change, despite the fact that corporate change involves major reallocations of status, power, and resources across divisions of an organization (Gardner, Paulsen, Gallois, Callan, & Monaghan, 2000).

We present change as a process that impacts on an organization in at least two ways. First, there is the individual impact upon employees in terms of their levels of job satisfaction and

Is Organizational e-Democracy Inevitable?

organizational commitment. Second, researchers — and by implication, HR practitioners — need to consider the significant impacts upon employees' levels of identification with their workgroups or the social categories with which they identify. This second impact is demonstrated by employees' perceptions of changes in the groups they identify with, perceived status, and the levels of in- and out-group bias.

Our approach adds to previous research by considering whether e-democracy is an inevitable consequence of ICT changes, and how a social identity perspective helps us understand the effects of ICT changes. We argue that social identity theory provides an alternative (socially) evaluative insight into the nature of change and the process of how organizations evolve and adapt to the knowledge environment economy. In this chapter, we concentrate on how group memberships within organizations are influenced by change. Our approach differs from other researchers who have applied democracy at the organizational level in debating what the organization and organizational change will look like (e.g., Lammers & Szell, 1989; Mason, 1982).

Social identity argues that organizations are internally structured groups that are located in complex networks of intergroup relations characterized by power and status (Hogg & Terry, 2000). In referring to the processes that underlie the development and maintenance of individual and group identities, social identity allows us to better deconstruct the process of organizational democracy using this prestige differential.

As part of this examination, we discuss change and organizational democracy by focusing on how the social identity of health professionals in a large metropolitan hospital affects their understanding of and adaptation to new ICTs. Our analysis was guided by two research questions:

RQ1: What is the relationship between employees' perceptions of their workplace identification and e-democracy change?

RQ2: How do the features of ICT change and organizational e-democracy relate to employees' perceptions of communication effectiveness during change?

METHOD

Context

Information and communication technologies are regularly promoted as drivers that take costs out of the supply chain, improve the management of customers, and enhance the capability of the organization to quickly respond to a changing marketplace (Glover, Prawitt, & Romney, 1999). ICT developments are perceived as key organizational tools that can alter reporting structures, cultures, job roles, and the identities of employees and their groups. These technologies have been an excellent means of expanding access to information across an organization, empowering employees through added flexibility and enhanced functional integration. These new capabilities have occurred despite the increasing recognition that in reality many very expensive IT systems are abandoned or never realize their full potential (Fahy, 2001). To date, we know that while organizations often have high expectations for change when new systems are commissioned, technology implementations regularly result in the reduced or failed adoption of complex, integrated technology architectures (Koch & Buhl, 2001).

Nonetheless, as with most industries, ICTs are an increasingly essential part of contemporary healthcare. The healthcare industry has recently experienced substantive changes brought about by this new technology, with consequences for health providers, professionals, and patients. These include changes to the way healthcare is delivered through the emergence of new medical professions (e.g., genetic specialists), the devolution of minor medical treatments as nursing staff become more highly trained in new technology,

and less invasive treatments. Future medical ICT-related developments include the use of robotics and telemedicine, enhanced drug design through the use of computerization, and the trend towards electronic services (e.g., e-procurement) as a way to deliver healthcare services. Ongoing developments related to ICTs that will change the nature of healthcare in the next 20 years include emerging medical communication technologies and increasing application of evidence-based healthcare globalization. It is within a hospital context that we sought to examine examples of such industry changes.

The Studies

As previously noted, we focus on change in a large Australian metropolitan public hospital that was undergoing significant organizational re-engineering change both in its infrastructure as well as in the introduction of new technology. We used a sample from a series of 85 in-depth, unstructured interviews with a cross-section of healthcare employees. We examine how these employees described and identified with the change process. This change included staff restructuring; the introduction of innovative wards to trial changes that were planned to occur in the new hospital building; the devolution of finance from management to department level, with the introduction of new financial technologies (i.e., enterprise resource planning system: ERP); and the phasing in of new medical technologies (e.g., the picture archive communication system: PACS). These changes had implications for increasing the knowledge and authority levels of staff. Management of department finances by charge nurses rather than by higher management levels meant that senior nurses were now responsible for the budget of specific wards and units. Thus they would have access to information databases that were previously not available. In theory such changes should empower these nurses. Similarly, the PACS would provide easy access to patient x-rays across the

hospital, and lead to more efficient and effective communication between hospital departments. In fact improved and more fluid communication was a vision for the new hospital with more communication between units and wards than had previously existed. The participants in our study represented a cross-section of different levels and roles in the hospital, including executives (often with medical backgrounds), doctors, nurses, and allied health professionals (e.g., physiotherapists, psychologists, occupational therapists).

In our interviews, we were particularly interested in the ways in which employees' work units or professional identities influenced their understanding of the changes being implemented. To this end we focused on the health professional employees within the hospital as identified above. We investigated the relationship between changed organizational structure and employee perceptions about their role and identification in the organization. In particular, we examined the ways that new IT implementation altered the dynamics of the organization in terms of lines of communication (including communication effectiveness) and democratic structure.

Our research for this chapter was conducted at two stages between 1998 and 2000. At Time 1 (1998), we conducted 67 in-depth, unstructured interviews. From this data collection period, we selected 19 interviews for in-depth analysis. The sample included five executives, four doctors, six nurses, and four allied health professionals. During this time period, the hospital was at the beginning of undertaking many changes (e.g., downsizing and changes to work practices — including ICT implementations such as ERP and PACS). For Time 2 (2000), we conducted 28 in-depth unstructured interviews from which we have drawn a sample of 18 interviewees. During this time period, the implementation of changes initiated at Time 1 were quite advanced (e.g., hospital rebuilding, changes to work practices, and the ICT changes).

For this chapter, we analyzed the interviews of nine executives, one doctor, five nurses, and three allied health professionals. It is unfortunate that at Time 2 we were only able to interview one doctor. For each period of data collection, interview transcripts were analyzed with the use of the QSR qualitative software package called NVIVO. Trained coders identified common themes throughout the data. The interviews conducted at Times 1 and 2 were open and unstructured. The aim at Time 1 was for the interviewees to describe what they felt was good and bad about the changes that were to occur. At Time 2, the interviewees again described what they felt was good and bad about the changes that were occurring. They also described their perceptions concerning the implementation process.

EMPIRICAL EXAMINATION OF THE RELATIONSHIP BETWEEN E-DEMOCRACY, COMMUNICATION EFFECTIVENESS, AND SOCIAL IDENTITY IN A HOSPITAL

In the following results we examine the findings in relation to our two research questions. To this end, using hospital employees' descriptions of change, we summarize our results as they relate to the nature and place of e-democracy, HR practice, and more generally to employees' workplace identification during a period of change. We will include specific examples of hospital staff descriptions as they relate to both our research questions in order to illustrate their perceptions of the change process. We examine our findings across the two times to investigate whether there are distinct differences between the two phases as they relate to identification, e-democracy, and communication effectiveness.

Overview of Findings

With respect to RQ1, we examined the emergence of e-democracy by looking for perceived changes in health professionals' levels of reporting, their increased access to knowledge, and increased levels of authority. Results suggested that over the period of change, while there were modifications to nomenclature and associated rhetoric to describe the change process, control over employee behavior and management authority remained as it was prior to the changes in infrastructure and ICT implementations (e.g., PACS and ERP technology). Thus, despite the potential of the new systems to provide a greater availability of information, serving as a means of empowerment, no changes to the democratic structure occurred. Such systems, while offering employees the opportunity to manage their departmental accounting themselves or to rapidly access patient information in digital format, did not increase employee input or strengthen the knowledge economy. Rather, as shown at Times 1 and 2 respectively, failure to sufficiently train and support the staff led to frustration and reduced efficiency. Nurses and doctors tended to highlight their professional memberships in terms of patient care and did not embrace the ICT changes that would change their management of patients. Regardless of the implied benefits of change, substantive role, function, or empowerment adjustments did not occur.

Hospital executives never perceived their roles or positions to be threatened, and therefore perceived or represented most of the changes (technology and others) as a positive step for the hospital. Doctors were negative about the proposed changes and focused their attention on challenges or problems associated with the hospital's functioning and staff feelings towards the change process. Nurses also spoke negatively of the change in the belief that they were not involved in decisions

made by executives, and that the changes implemented would not enable promised efficiencies. Interestingly, many allied health workers were the most positive about overall change. However, it is interesting to note that one group of allied health workers who worked permanently in one unit rather than moving throughout the hospital (as do physiotherapists, dieticians, and speech therapists) was more affected by ICT changes and was not positive about the outcomes.

With respect to RQ2 — communication effectiveness — health professionals noted that maintaining their perceived levels of communication effectiveness prior to the change was problematic. Their concern stemmed from the fear that because of some ICT innovations (e.g., PACS), there was a reduction in face-to-face communication with other health professionals — a key aspect of communication for health careers. Thus in this organization maintaining effective communication did not align well with aspects of the proposed ICT change.

Clearly, employees who control aspects of their work and working conditions are going to be happier than employees who do not. With relation to our findings, hospital executives who possessed the macro picture of the change and monitored the changes were more positive than those staff members who were confronted with change implementation and new ICTs. Just as clearly, however, despite the potential of an organizational community through ICTs, participatory management and empowerment is not an inevitable component of technology change. Results relating to RQ1 and RQ2 suggested that despite goals of enhanced performance, there was no redistribution of authority. Thus, while the hospital executive perceived that there would be staff empowerment through better ICT systems, this expectation was not realized.

Specific Findings

Workgroup Identity

Social identity theory posits that when change occurs, some employees will react with perceptions of threat to their in-groups. As a consequence, they will act to protect their social group status. Thus in-group bias may increase, but the group may also seek to create a new group identity. If the group does strive to create a new group identity, then social identity theory would predict a new energized in-group identity, as was seen in the creation of the “black is beautiful” new identity in the 1960s for black Americans. When doctors and allied health professionals spoke about the technology change, they identified with two in-groups, the hospital (distal in-group) and their profession (proximal in-group). When discussing the change implementation in more general terms (e.g., patient care), however, both their proximal in-group and out-group salience were more evident, that is, they spoke more about work units and professional identity. Interestingly, nurses did not make their professional identity salient when talking about ICT changes — rather they identified with the more distal in-group of hospital. The reasons underlying this finding are unclear. In contrast, when nurses talked about other general change issues, their identity as a nurse and in particular their unit was salient. This point is taken up below,

Overall, executives identified as being part of the hospital first and foremost. Doctors talked about how medical professionals (the in-group) felt threatened by the change process that was being managed by the executive board (the out-group). For example, at Time 1, a senior doctor commented on a computerized patient file system that he thought would be phased in at a later stage of the change:

Is Organizational e-Democracy Inevitable?

“I’m not so sure it [the new patient file system] will be a success. I suspect they’re trying to save on clerical staff and turn us, all the clinicians, into mini-clerks.” (Participant A, Senior Doctor, Time 1)

This doctor was reporting his perceptions that executives were imposing new work roles on clinicians. The hospital’s non-executive medical employees understood that their roles had changed because of the new system’s information-sharing or task-related initiatives. They were compelled to adapt to these role changes as prescribed by the executive level. In the quote, the doctor stated that his in-group felt threatened as a group by the out-group of executives. The episode demonstrated the broader principle that rather than create a new identity, built on ICT-based participatory practice, the strength of traditionally instituted group affiliation and group status remained in place. A Level 3 nurse at Time 1 also spoke about the executive as the out-group and his perception of threat.

“They [the executives] all say we’re cutting back on jobs, but nobody knows what numbers and to who[m] they’re looking at or who[m] they’re keeping on. It’s that big question mark that everybody’s a little bit scared.” (Participant B, Registered Nurse, Time 1)

At Time 2 a different senior doctor commented on the role of the executive and their power in relation to the government control of the executive.

“Well they [the executives] neither have the given authority nor management skills. They might acquire the management skills if they were delegated the authority, but [health state government] is very much rule and structure, and authority comes from the top down. And any attempts to give individuals management authority are very rapidly squashed by reversal of their decisions

when they are not liked.” (Participant C, Senior Doctor, Time 2)

These comments still focused on the executive as the out-group, but this participant was also viewing the bigger picture of where the executive sat in terms of their power. The comments again validated the lack of change in respect to overall structure and democratic process during ICT change.

Effective Communication

Health professionals expressed concern about the effects of new technology on communication. For example, an allied health professional was of the opinion that the new PACS technology led to reduced communication between health professionals, leading to a loss of relationship with other clinicians and trainee staff. She commented that the medical staff [people] would lose the network connections that currently existed.

“...new residents may not be super-familiar with the techniques...but by seeing them face to face, you can say well, look, you know, how you can determine priorities...the personal [contact] will be lost. People won’t know who to contact when they really need something in a hurry. It’s just punching into a screen [ordering using a computer screen]...rather than coming down and seeing someone and say, ‘Look, what can you do about it?’” (Participant D, Allied Health Professional, Time 1)

A member of the executive level focused on this reduced level of communication at Time 2. However, she looked to the level of efficiency that would be achieved.

“We have images available throughout the organization at the same time, but [do] not have to run around with only one person having access at the

one time.” (Participant E, Member of Executive (and doctor), Time 2)

The sentiments regarding the PACS technology expressed by the allied health professional at Time 1 demonstrated the view of non-executive health professionals that communication still needed to take place at the physical rather than the electronic level. Face-to-face communication was viewed as an important feature of the intra-hospital networking system. A perceived lack of such communication brought about by the ICT change was therefore viewed as a threat to communication efficiencies. For example, PACS technology meant that x-ray requests could now be requested electronically. The old system had meant that forms were filled out and taken down to the x-ray division. As a result of the archaic manual system, however, interns got a better understanding of x-ray procedures and could ask for advice from the radiographers and radiologists because they interacted with them. As exemplified by the allied health professional quote at Time 1, ICT change thereby paradoxically allowed both a reduction in information connectivity alongside an increase in autonomy. But rather than enable the ease of information sharing, as e-democracy practices forecast, our results revealed an atrophy of inter-disciplinary contact and subsequently lower effective communication than previously existed.

In presenting much the same belief in the need for face-to-face communication, doctors suggested that PACS changes did not allow important information relayed by people to be received effectively. A doctor related the medical professional perspective of the PACS change:

“I think that probably medical staff prefer to communicate in person and by voice. That’s the way we spend our day talking to people...and we [doctors] don’t like communicating so much by paper, and yet administrative staff communicate

with us via paper which is seen as impersonal.” (Participant F, Doctor, Time 1)

This doctor implied that owing to the culture of medical staff (i.e., his in-group), important information was continuously lost, ignored, or overlooked as the systems changes started to take effect.

At Time 2 a nurse commented that the structure of the hospital would improve the communication. His comments supported the notion that health professionals recognize the need to communicate on a face-to-face basis. Interestingly, he also addressed the issue of work identities. While this comment does not directly address ICT, it highlighted the face-to-face culture that exists in the hospital context.

“Because of the way the building is laid out, it flows on, there is no defined point of one ward ending and the next ward starting. A lot of units overlap each other as well, so it’s going to force communication between them. That has, I mean, it’s positive in one aspect, but negative in that they don’t have their own identities as such.” (Participant G, Nurse, Time 2)

Change and Adjustment as an Outcome of Social Identity and Communication

Workgroup identity and communication work against each other or together to influence both intergroup and individual adjustment to change. In the hospital setting described in this chapter, the outcomes were such that the hospital remained a highly stratified institution. Both executive and non-executive groupings were able to develop justifications and explanations for the lack of participatory change and for existent structural arrangements. Specifically, although some executives expressed concern for lower level staff as they were experiencing a high workload and

Is Organizational e-Democracy Inevitable?

stress associated with the changes, they were simultaneously convinced that there were more positive issues brought about by the change than there were negative. The system and the processes it set in place did not bring about an amalgamation of different groups, nor did it equalize the way authority was transferred. Non-executive groups adopted a far more reactive outlook to the change, as one doctor states:

“There are some clinicians [who are] very computer literate and very keen on computers — both in work and recreation. Others like me are not the slightest bit interested, and that technology’s going to be forced on us, and I think it’s foolish. I mean we’re not trained and we shouldn’t be paid to put information into computers and operate computers. We are trained and should be paid to be skilled clinicians, not computers jockeys.” (Participant A, Senior Doctor, Time 1)

Such a reaction to changes suggested a difficulty in adapting to some kinds of changes. The view held by this doctor was that medical practitioners should not have to be involved in technology unless they wish it. This reaction also reflected a belief that a lot of time was being spent on change-related activities, without adequate compensation or proper attention being paid to those being forced to use the new system. In particular, doctors believed that executives were making decisions based on budgetary constraints rather than patient care. This opinion clearly emphasized the different group identity outlook (i.e., healthcare professionals versus healthcare managers). Doctors were resistant to technological changes, and perceived that their job was to treat patients and everything else was secondary. Nurses presented a resistance with ICT-enabled changes, based on similar reasoning, and focused on role changes and possible staff reduction.

The difference in individual and therefore intergroup adjustment was further typified by the executive group’s perception of how adjustment

to change should be managed. A senior executive commenting on the voluntary retrenchment of 40 workers as their jobs became obsolete observed that working with the staff who would be laid off made for a smooth transition.

“Most people were quite happy with the outcome. Instead of building it up into something that had to go to an Industrial Relations Commission type thing, we actually managed it at the shop floor level, with the local managers and us giving them some guidance instead of bringing all the heavies all the time.” (Participant H, Senior Member of Executive, Time 1)

The inference made by this very senior executive who was brought in to manage the change was that adaptation to changes is easily made if the correct internal procedures are followed. In his mind, this procedure included talking to staff at the shop floor level and discussing the need for redundancies for the hospital’s own good. This reaction emphasized the view that the hospital’s cumulative needs over-rode those of the group. For this executive, in his mind, he was reaffirming that communication about change is effective if it is well managed through staff involvement. There was, of course, some level of involvement at the non-executive level, with some employees happy to be part of an internal arrangement rather than take industrial action, generally. Nonetheless, the individual risk associated with ICT change overwhelmed the change rationalization offered by executives. In particular, as the change implementation progressed, nurses became increasingly agitated by the potential job losses expected to occur. This concern was linked to frustration about the level of care that would occur as an outcome of the resultant devolution of responsibility. Other nurse concerns related to training and patient care outcomes as a result of role changes.

“...like computers in the wards. They’re everybody’s headache at the present moment, because

the system is not set up to deal with everybody's needs and there are loop holes [problems] getting computers up and running, [and] getting staff [to] use it." (Participant I, Nurse, Time 1)

This observation reflected a common perception that while new technology resources were welcome, they were introduced for spurious budgetary reasons, rather than to improve patient care. Consequently, they initiated a series of problems at the ward level. A belief among some nurses was that the hospital was not prepared for ICT change outcomes. In short, they argued that the hospital's infrastructure was not equipped for the planned IT changes.

The executives were viewed by some medical staff as interested in the benefits to the hospital that arose from the introduction of new technology rather than health benefits. The most visible outcome of this divide was that the good change outcomes brought about by the new system were obscured, as a nurse observes:

"For me personally, it feels like [executives] are only interested in money, more so than patients. Now I don't know whether that's a nursing perspective or the way I've been taught or anything like that, but I feel that they seem to make decisions, but it's not in the interests of the patients. It's always in the interest of the dollar." (Participant J, Nurse, Time 1)

The disparity between identities across employee groups brought about by the different technology change focus led to the new technology being undermined. Whereas the new system offered healthcare professionals a plethora of sophisticated new functions, the widespread belief that the executive grouping was more interested in financial gains than patient care created a serious breach in faith. As a doctor and nurse noted, far from embracing new roles and participatory regimes, caregivers concentrated on the legitimacy of the new system:

"The computerized x-ray facility [is] foolish because I think we're putting in unproved systems. We're going to be the first [using PACS] almost and it's always a very silly thing to do." (Participant A, Senior Doctor, Time 1)

"It's annoying in a way because lots of...the things that seem to get the most money or the most attention are things that aren't for patient care. So even while using the technology for paperwork and things like that, the things that could make nurses' jobs easier, we're not really spending any money on that technology." (Participant K, Nurse, Time 1)

These comments highlighted the inference that patient safety was not improving with the innovations because the hospital is first and foremost interested in institutional outcomes. Thus, while technology advances can aid the patient, they were perceived to also put the patient at risk if the new technology is not supported at all levels of the hospital. Hospital executives may have cultivated a belief that some technology was installed for the sake of the hospital being seen as a state-of-the-art organization, without prioritizing the needs of the patients. Clearly patient outcomes in this context were not as focal as they might be. In this context, ICT change implied patient risk when executives imposed changes on the roles of health professional roles. Health professionals may resist the changes and so resist the ICT.

DEMOCRACY IS INEVITABLE ... BUT MAYBE NOT JUST YET

In this chapter, using the hospital case study, we advance the view that how employees perceive group memberships and their relations with other groups during the introduction of ICT change reinforces the regulatory, evaluative, and obligatory dimensions of organizational life over e-democracy practices. These findings should generalize

Is Organizational e-Democracy Inevitable?

to other hierarchically structured organizations, particularly those employing a range of professional groups.

Using a social identity framework, we reiterate that organizations suffer from problems of intergroup relations. Unlike other research and commentary, however, we assert that group identity and status differences simultaneously impede and enable e-democracy. For instance, whereas Semler (1989) suggests that the participatory features of organizational e-democracy are “just hot air” (1989, p. 3) that needs to be minimized, our results reveal that the features of democracy are embedded in the organization under review, but may not be able to penetrate traditional bases of power and influence. In other words, the organization chooses to appropriate parts of the democracy features of a new technology that seem to best fit its preexisting structure or institutional arrangement. IT-enabled changes therefore paradoxically reinforce normative institutional practices (after Scott, 2001). In response to our focal research question that examines the inevitability of e-democracy, Slater and Bennis (1964) were correct in asserting the place of and importance of democracy. Our results suggest, however, that while aspects of e-democracy are inevitable (i.e., symbolically more information is available to staff), social identity provides a barrier that reduces the extent to which e-democracy will occur.

Our findings have important implications for HR practitioners. Our results show that ICT brings changes to the ways in which employees focus on their roles and identities. In particular, we argue that group identification is a key part of the successful adoption of e-democracy change. At the two phases of changes described here, when ICT changes were highlighted, findings suggest that compared to doctors and allied health professionals, higher order identities (e.g., hospital) are more salient for nurses. This result may reflect that fact that the nurses were less involved with the technology changes than the doctors

and allied professionals at these two phases of change. For example, PACS was highly relevant for some allied health professionals and doctors. Thus, groups who find themselves immersed in the new system, and affected by it, do present their proximal roles as salient. By contrast, when change implementation and patient care was the focal topic, all health professionals identified with their professional in-group.

Individual empowerment through PACS was not translated upward into group changes in the organizational hierarchy. As noted above, our findings focus on a healthcare industry, but their relevance to other organizations with hierarchical structures is self-evident. This finding, concerning employee identities, also raises a second implication that HR practitioners need to bear in mind during ICT change. That is, they need to be aware of the salient identities within organizations and not simply focus on the formal roles and functions that are outlined in the organizational charter. Our findings reveal that, at least for some groups, higher order identities during IT implementation seem to be more salient. We would have predicted that lower order level identities would be more salient in the ICT context, but this is not so. Thus the management of ICT changes is a complex phenomenon that may differ from the implementation of other types of changes. Specifically, rhetoric of empowerment and authority voiced by senior management do not equate to high levels of e-democracy with staff who historically did not have such responsibilities — nor is it sought by these staff. This observation highlights that, at least in our context, the overall good of the organization (the hospital) and professional roles are paramount. This finding goes some way to explaining why role relations remain intact during ICT implementation, regardless of the collaborative practices organizations adopt during new information technology implementations.

A third implication that HR practitioners need to focus on is that employee identity can act as a barrier to the uptake of change. Resistance to

change is not a new phenomenon, but in this chapter we have begun unpicking the elements of that resistance. If ICT brings with it significant changes to a professional's job description and duties, HR must acknowledge this change and address the changes directly with the professionals involved. This last point relates closely to the following two HR implications that arise from our findings.

HR practitioners must recognize the importance of ensuring the participation of key groups in the planning and implementation of changes. They must also recognize the importance of effective and relevant training procedures in the newly acquired technology. The former implication suggests that HR practitioners should put in place an appropriate program of focus groups and workshops for employees which will serve to encourage key personnel to engage in and champion the changes. From such programs, these employees will gain an in-depth understanding of the rationale for each aspect of ICT change. With their increased knowledge and understanding of the change, they will then be able to impart their knowledge to other employees affected by the change. Specifically, the rationale that underlies each ICT introduction needs to be openly explained to the staff. In turn, staff should be allowed to provide input as to their perceptions of the value of the implementation. HR practitioners need to be aware of the critical importance of this level of dialogue throughout all phases of change.

The latter implication, regarding training, relates to our results that reveal that despite the potential sophistication of the new systems, such technology requires effective training procedures to be put in place. Staff training programs need to be timed so that they integrate smoothly with the introduction of new technology. Training must be viewed by the change agents as another important aspect of the change and implemented at the appropriate time in the change program, with back-up and training assistance available as needed. Clearly then, HR managers need to

address resource and training issues and, in the case of some professions, create an environment where the professional will want to engage in the technology. While there are some professionals who will seek to resist new technology, it is important that education and training be aligned with technology preparation and a clear outline of the benefits to the organization. Again, active dialogue at all stages of change is critical.

A final implication for HR is the need to recognize the communication culture of the organization. If the organization is one that relies on face-to-face and one-on-one communication, HR practitioners must not only address the impact of the new technology, but must monitor how employees manage the change in their traditional channels of communication. Not to recognize the huge culture change that new communication media bring to traditional organizations is to jeopardize the efficient functioning of the organization and risk increases in miscommunication and disharmony.

We have highlighted the unintended consequences of new technology implementation. By illustrating the problems with assuming the inevitability of e-democracy, we indicate that integrating HR practices with the task of designing information systems is much more than simply specifying particular equipment parameters. Rather the process is about designing, inscribing, and configuring the system both for users and recipients alike — in this case, health professionals and their patients. This process needs to include ongoing negotiation as the system evolves. We would suggest that patients or other clients may not benefit from new ICTs, at least in the short term and in the current climate of HR-managed change. This disadvantage to patients/clients needs to be addressed by HR practitioners through the suggestions above. Our SIT framework highlights the need for attention on human resource issues during the implementation of new information technology. The impact of information technology improvements on the workforce needs careful

Is Organizational e-Democracy Inevitable?

evaluation beyond a simple assessment of technology outcomes or organizational benefits.

CONCLUSIONS

In this chapter, we illustrate how social identity processes drive organizational e-democracy change outcomes. We emphasize how an organization's communication processes and its levels of effectiveness may change with ICT implementation. Our findings suggest that IT implementations are sometimes installed at the expense of other systems, which may be more directly beneficial to the patient. To generalize to other organizations, we ask: Are organizations installing IT for IT's sake without due consideration of the needs? Paradoxically this approach to IT and, in particular, ICT change may disadvantage the original aims of the organization.

ICT changes do not necessarily equate to improved communication between employees or workgroups. Our findings highlight that as new ICT systems are put in place, communication channels and dynamics alter. This alteration may not align with staff empowerment or increased communication effectiveness. HR practitioners need to examine current communication procedures and involve employees in the potential changes to communication that the new ICT brings. With the introduction of new technology, communication networks within organizations such as hospitals are often likely to break down. If the organizational culture has a tradition of face-to-face communication (as do hospitals), HR practitioners need to be aware that ICT implementation will have a huge impact on practice and on culture. Open discussion of disadvantages in a new system can only be acknowledged and constructively dealt with if there is genuine staff input and dialogue. Our findings suggest that HR managers need to be cognizant of the fact that effective communication may be compromised. Further they need to ensure that the change pro-

gram is communicated and managed effectively. In this way, further miscommunication issues may be reduced or even avoided.

Our current findings suggest that e-democracy is not enhanced through IT change. Rather, we have found that the contrary is true. HR must respond to the frustration expressed by professionals concerning the actual changes and the implementation process. To address these concerns effectively, HR must understand both the formal and informal organizational charter. Without due consideration to the opinions of professionals throughout the change process, our findings suggest resistance.

REFERENCES

- Alvesson, M. (2000). Social identity and the problem of loyalty in knowledge-intensive companies. *Journal of Management Studies*, 37, 1101-1123.
- Applegate, L.M. (1994). Managing in an information age: Transforming the organization for the 1990s. In R. Baskerville, S. Smithson, O. Ngwenyama, & J.I. DeGross (Eds.), *Transforming organizations with information technology* (pp. 15-94). Amsterdam: North-Holland.
- Ashforth, B.E., & Johnson, S.A. (2001). Which hat to wear? The relative salience of multiple identities in organizational contexts. In M.A. Hogg & D.J. Terry (Eds.), *Social identity processes in organizational contexts* (pp. 31-48). Philadelphia, PA: Psychology Press.
- Ashforth, B.E., & Mael, F. (1989). Social identity theory and the organization. *Academy of Management Review*, 14, 20-39.
- Beer, M., & Nohria, N. (2000). Resolving the tension between theories E and O of change. In M. Beer & N. Nohria (Eds.), *Breaking the code of change* (pp. 1-34). Boston: Harvard Business School Press.

- Carlopio, J. (1998). *Implementation: Making work-place innovation and technical change happen*. Roseville, NSW: McGraw-Hill.
- de Tocqueville, A. (1835/1966). *Democracy in America*. New York: Harper & Row.
- Drehmer, D.E., Belohlav, J.A., & Coye, R.W. (2000). An exploration of employee participation using a scaling approach. *Group and Organization Management*, 25, 397-419.
- Drucker, P.F. (1992). The new society of organizations. *Harvard Business Review*, 70(5), 95-104.
- Drucker, P.F. (2001). *The essential Drucker*. Oxford: Butterworth Heinemann.
- Fahy, M. (2001). *Enterprise resource planning systems*. London: Chartered Institute of Management Accountants.
- Gardner, J., & Jones, E. (1999). Problematic communication in the workplace: Beliefs of superiors and subordinates. *International Journal of Applied Linguistics*, 9, 198-205.
- Gardner, J., Paulsen, N., Gallois, C., Callan, V., & Monaghan, P. (2000). An intergroup perspective on communication in organizations. In H. Giles & W.P. Robinson (Eds.), *Handbook of language and social psychology* (2nd ed.). London: John Wiley & Sons.
- Glover, S.M., Prawitt, D.F., & Romney, M.B. (1999). Implementing ERP. *Internal Auditor*, (February), 40.
- Halal, W.E. (1994). From hierarchy to enterprise: Internal markets are the new foundation of management. *Academy of Management Executive*, 8(4), 69-83.
- Hogg, M.A. (2001). A social identity theory of leadership. *Personality and Social Psychology Review*, 5, 184-200.
- Hogg, M.A., & Abrams, D. (1988). *Social identification*. London: Routledge
- Hogg, M.A., & Mullin, B.A. (1999). Joining groups to reduce uncertainty: Subjective uncertainty reduction and group identification. In D. Abrams & M.A. Hogg (Eds.), *Social identity and social cognition* (pp. 249-279). Oxford, UK: Blackwell.
- Hogg, M.A., & Terry, D. (2000). Social identity and self-categorization processes in organizational contexts. *Academy of Management Review*, 25, 121-140.
- Hogg, M.A., & Terry, D. (2001). Social identity theory and organizational processes. In M.A. Hogg & D.J. Terry (Eds.), *Social identity processes in organizational contexts* (pp 1-12). Philadelphia, PA: Psychology Press
- Koch, C., & Buhl, H. (2001). ERP supported team working in Danish manufacturing. *New Technology, Work and Employment*, 16, 164-177.
- Kraemer, K.L. & Dedrick, J. (1997) Computing and public organizations. *Journal of Public Administration Research and Theory*, 7, 89-113.
- Lambert, S.J. (2000). Added benefits: The link between work-life benefits and organizational citizenship behavior. *Academy of Management Journal*, 43, 801-816.
- Lammers, C.J., & Szell, G. (Eds.). (1989). *International handbook of participation in organizations*. Oxford: Oxford University Press.
- Mantovani, G. (1994). Is computer-mediated communication intrinsically apt to enhance democracy in organizations? *Human Relations*, 47, 45-63.
- Manville, B., & Ober, J. (2003). Beyond empowerment: Building a company of citizens. *Harvard Business Review*, 81(1), 48-53
- Markus, M.L. (1983). Power, politics and MIS implementation. *Communications of the ACM*, 26, 430-444.

Is Organizational e-Democracy Inevitable?

- Mason, R.M. (1982). *Participatory and workplace democracy*. Carbondale, IL: Southern Illinois University Press.
- Neef, D. (Ed.). (1998). *The knowledge economy*. Boston: Butterworth-Heinemann.
- Orlikowski, W.J., & Iacono, C.S. (2001). Research commentary: Desperately seeking the "IT" in IT research – a call to theorizing the IT artifact. *Information Systems Research*, 12, 121-134.
- Pratt, M.G. (2001). Social identity dynamics in modern organizations: An organizational psychology/organizational behavior perspective. In M.A. Hogg & D.J. Terry (Eds.), *Social identity processes in organizational contexts* (pp. 13-30). Philadelphia, PA: Psychology Press.
- Robey, D., & Boudreau, M.C. (1999). Accounting for the contradictory organizational consequences of information technology: Theoretical directions and methodological implications. *Information Systems Research*, 10(2), 167-185.
- Rothschild, J., & Whitt, J.A. (1986). *The cooperative workplace: Potentials and dilemmas of organizational democracy and participation*. Cambridge: Cambridge University Press.
- Schilling, M.A., & Steensma, H.K. (2001). The use of modular organizational forms: An industry-level analysis. *Academy of Management Journal*, 44, 1149-1168.
- Schwarz, G.M. (2002). Organizational hierarchy adaptation and information technology. *Information and Organization*, 12(3), 153-182.
- Scott, W.R. (2001). *Institutions and organizations* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Semler, R. (1989). Managing without managers. *Harvard Business Review*, 89(5), 76-84.
- Slater, P., & Bennis, W.G. (1964). Democracy is inevitable. *Harvard Business Review*, 2, 51-59.
- Tajfel, H. (1978). Differentiation between social groups: Studies in the social psychology of intergroup relations. *European Monographs in Social Psychology*, 14. London: Academic Press.
- Terry, D. J. (2001). Intergroup relations and organizational mergers. In M.A. Hogg & D.J. Terry (Eds.), *Social identity processes in organizational contexts* (pp. 229-248). Philadelphia, PA: Psychology Press.
- Tsoukas, H., & Chia, R. (2002). On organizational becoming: Rethinking organizational change. *Organization Science*, 13, 567-582.
- van Knippenberg, D., & van Leeuwen, E. (2001). Organizational identity after a merger: Sense of continuity as the key to post-merger identification. In M.A. Hogg & D.J. Terry (Eds.), *Social identity processes in organizational contexts* (pp. 249-264). Philadelphia, PA: Psychology Press.
- Weber, M. (1968). *Economy and society: An outline of interpretive sociology*. Edited and with an introduction by G. Roth & C. Wittich. New York: Bedminster Press.
- Wenger, E. (1999). *Communities of practice: Learning, meaning and identity*. Cambridge: Cambridge University Press.

ENDNOTE

- * The authors wish to acknowledge that the data from this publication formed part of a large 3 year project funded by the Australian Strategic Partnership with Industry – Research and Training (SPIRT), Ref C0010720 entitled Employee Adjustment to Continued Organisational Change.

This work was previously published in E-Human Resources Management: Managing Knowledge People, edited by T. Torres-Coronas & M. Arias-Oliva, pp. 206-235, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.23

The Role of Information and Communication Technology in Managing Cultural Diversity in the Modern Workforce: Challenges and Issues

Indrawati Nataatmadja

University of Technology, Australia

Laurel Evelyn Dyson

University of Technology, Australia

ABSTRACT

This chapter demonstrates how managers can use information and communication technology (ICT) more effectively in culturally diverse workforces. Basing our analysis on the cultural dimensions of Hofstede and Hall, we compare a range of ICTs and provide a chart summarizing their strengths and weaknesses. In addition, a framework for developing ICT is proposed, and an example of its application to a global organization is presented. The study shows that none of the existing ICT tools is perfect in all situations and all cultural contexts. Therefore, managers need to provide a variety of ICTs to their employees, and developers should build flexibility into their ICT designs.

INTRODUCTION

With cultural diversity in the modern workforce a reality today, there is a challenge for managers to capitalize effectively on this diversity in order to harness the benefits while avoiding potential problems. To optimize the positive outcomes, information and communication technology (ICT) is an essential tool. Using appropriate technologies is shown to break down cultural barriers and to promote understanding and knowledge sharing among employees of different language backgrounds and, hence, lead to successful collaboration.

First, we will discuss culture and its dimensions according to some of the principal cultural

theorists of today: Hofstede, the GLOBE group, Trompenaars, and Hall. We also will highlight the importance of language in modern-day management practices. The second section will analyze the relationship among management, cultural diversity, and ICT, and how managers can improve employee effectiveness, employee empowerment, and decision making, and also facilitate knowledge management within the organization. Third, a range of information and communication technologies will be compared and contrasted, including e-mail, discussion forums, chat rooms, intranet, groupware, teleconferencing, videoconferencing, and mobile technologies. These technologies will be evaluated in the context of the cultural dimensions outlined in the first section to provide a guideline for managers to choose the best-fit ICT for their needs. Finally, we will provide a framework to develop new ICT systems for a multicultural workplace.

In summary, this chapter's objective is to raise the awareness of managers, administrators, information systems developers, and other knowledge workers about the role of ICT in managing cultural diversity in the workforce. Valuing diversity by welcoming, recognizing, and cultivating differences among people so that they can develop their unique talents ultimately will assist in the creation of effective and competitive organizations.

BACKGROUND: CULTURAL DIMENSIONS

Culture is the set of key values, norms, and beliefs that members of a society or an organization share (Daft, 2000). Hofstede and Hofstede (2005) state that these values can be described in terms of dimensions, a dimension being defined as "an aspect of culture which can be measured relative to other cultures" (p. 23).

Geert Hofstede is one of the most respected cultural theorists. His famous cultural dimensions theory was based on a six-year survey and analysis

of hundreds of IBM employees from 53 countries (Marcus & Gould, 2000). These dimensions have been adopted widely and have been applied to many research studies (Hofstede, 2001):

1. **Power distance:** The degree to which a society accepts inequality in power distribution. High-power distance societies accept that there is an unequal distribution of power. In a low-power distance society, equality and opportunities for all are expected. It has flatter hierarchies, and it is easier for people to move upward in society.
2. **Uncertainty avoidance:** The degree to which the society accepts uncertainty and ambiguity. High uncertainty avoidance societies create many rules, regulations, and procedures to avoid uncertainty and ambiguity. Low uncertainty avoidance societies are less concerned about uncertainty and ambiguity. They are more flexible and more tolerant to different opinions and changes.
3. **Individualism vs. collectivism:** The degree to which the society accepts the individual's rights to look after his or her needs first, in contrast to collectivism in which individuals have to adhere to group needs first. High individualism societies will place individual needs and rights above collective needs and rights.
4. **Masculinity vs. femininity:** The degree to which the society believes in masculine ideals of competition and achievement, in contrast to feminism, which emphasizes relationships, compromise, and quality of life.
5. **Long-term vs. short-term orientation:** The degree to which society prefers working in sequence and its tolerance of interruption. Long-term orientation societies value perseverance, hard work, long-term tradition, and commitment. Short-term orientation societies are more willing to embrace changes and desire immediate results.

More recent research on cultural dimensions conducted by the GLOBE (Global Leadership and Organizational Behaviour Effectiveness) project team identified nine dimensions, six of which originated in Hofstede's work (House, Hanges, Javidian, Dorfman, & Gupta, 2004). The approach only appeared in 2004, and hence, very few studies have been carried out to verify the validity of the model or to apply it to evaluating ICT from a cultural perspective.

Another well-known, cross-cultural theorist is Fons Trompenaars (Deresky, 2006; Trompenaars & Hampden-Turner, 1998). His research was spread over 10 years, representing 47 national cultures. Only a limited number of researchers has adopted Trompenaars' framework when evaluating ICT, and often in conjunction with Hofstede (Gould, Zakaria, & Yusof, 2000).

Edward T. Hall is another respected anthropologist and cross-cultural researcher. One of his important contributions is the concept of communication context. Hall (1976) stated that in low-context societies, communication is direct and explicit. In high-context societies, people have to be aware of verbal and nonverbal cues that carry implicit meaning. In addition, they usually prefer to know the history of relationships and the backgrounds of the communicators. For example, more significance is attached to information coming from a person who has high status or who is respected for his or her knowledge or expertise in the field. Hall's theory has received increasing attention in recent years as more people focus on communication issues with ICT.

Beyond Hall's concept of communication context, there are also other aspects of language that need to be considered in multicultural work environments. Languages have many different parameters, including vocabulary, grammar, word order, intonation, and idiom. For example, in English, intonation applies to whole sentences; however, in Chinese, intonation applies to single words (Manning, 2004). Hence, the same Chinese word with a different intonation can lead to different meanings and different interpretations. These

differences can be a major source of misunderstandings and a source of poor communication or collaboration.

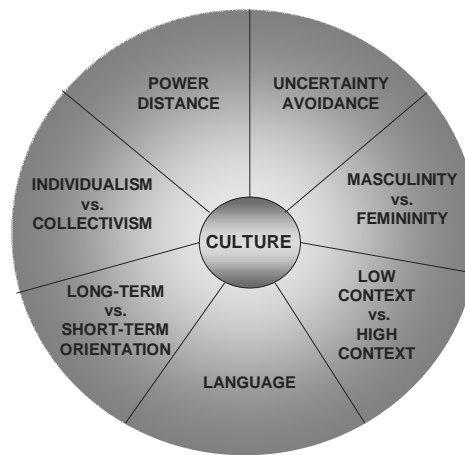
Some researchers would question these theories of national culture as stereotyping and forcing people into fixed cultural patterns (Myers & Tan, 2002). Nevertheless, Hofstede notes that one can identify statistical trends and tendencies despite the fact that not every individual complies with the overall cultural patterns of his or her country (Marcus & Gould, 2000). Furthermore, Trompenaars argues that even though within each culture there is a spread of values and assumptions, this spread forms a pattern around the average for that cultural group (Trompenaars & Hampden-Turner, 1998). Some researchers also have questioned the relevancy of cultural dimensions in the era of the global use of ICT. However, Geert and Gert Hofstede argued that "the software of the machine may be globalised, but the software of the minds that use them is not" (Hofstede & Hofstede, 2005, p. 330).

In this chapter, in order to simplify our discussion in what is obviously a very complex area, we will focus on only some of the cultural dimensions previously outlined. Since most researchers in culture and ICT have utilized Hofstede's dimensions, these will form the main basis of our analysis rather than the theories of Trompenaars or the GLOBE Project. However, because of the fundamental importance of communication in ICT and in managing cultural diversity in the workplace, we also will rely on Hall's theory of communication context in addition to other language issues. These dimensions of culture are summarized in Figure 1.

MANAGEMENT, CULTURAL DIVERSITY, AND ICT

The challenge for management is how to capitalize on cultural diversity. Daft (2000) stated that ICT can provide a better relationship among

Figure 1. Dimensions of culture



managers, employees, and their environments. By being aware of the various cultural dimensions and taking into account language differences when implementing and using ICT, managers can achieve the following:

1. Improved employee effectiveness
2. Empowered employees
3. Organizational learning or knowledge management

Improved Employee Effectiveness

Employees can access information they need and also can share information or insights with each other more easily by using ICT. It can provide information about customers, markets, and competitors through databases, news bulletins, and the Internet. Since they have access to more information, managers are able to delegate more challenging work to employees. Consequently, this will lead to better employee effectiveness. For example, salespeople can research pricing over the network and then use this to close deals by offering more competitive prices to customers (Daft, 2000).

Empowered Employees and Decision Making

ICT can contribute to power sharing and break down power distance by providing information to lower-level employees who otherwise will not get access to it. ICT has resulted in the restructuring of many organizations since the introduction of personal computers in the 1980s; there has been a trend toward a flattening of the organization with the elimination of many middle management positions (Oz, 2002). Employees have been given responsibility to make decisions that previously were made by their supervisors. They have been provided with decision-making tools, such as spreadsheets, decision support systems, and business intelligence tools. ICT communications tools such as e-mail also allow every employee to communicate with every other employee, including top managers. This has broadened the decision-making base of the organization and resulted in people from many different cultural backgrounds contributing and having their say. Without the participation of all members, the goals of capturing the best that diversity brings will not be achieved (Joplin & Daus, 1997).

Knowledge Management

Two components have emerged as of prime importance in knowledge management: people as central to the processes of knowledge creation, sharing, and application; and ICT as a vehicle by which the knowledge processes can work (Daft, 2000). Cross-cultural differences will affect how knowledge flows through the organization. A country that is high in power distance tends to have top-down knowledge flows, whereas a country with lower power distance will accept knowledge flows from bottom-up, top-down, and laterally. Furthermore, knowledge flows *between* cross-cultural groups is more likely to happen along formal, business-related issues. However in informal interactions, most knowledge flow exists *within* cultural groups (Ford & Chan, 2003). To encourage better knowledge flows, management should encourage staff to use the intranet and e-mail for formal and informal news by establishing an open communication strategy, either through incentives or policy. For example, in low power distance cultures like the U.S. and the UK, staff was found to be ready to share knowledge when senior management encouraged them to do so (Forstenlechner, 2005).

Further research by Ford and Chan (2003) revealed that knowledge sharing is affected primarily by language barriers. While they found that some knowledge was transferred between the two groups under study, either directly from knowledge holder to recipient or through a translator, a lot of knowledge was lost due to the inability to express the knowledge in the second language or due to translation. ICT can improve this situation by providing asynchronous technologies like discussion forums that allow employees more time to study information before replying by deploying intranets, groupware tools, and collaborative systems that disseminate information efficiently to staff, and by providing translation software.

CULTURAL DIVERSITY AND WORKPLACE COMMUNICATION USING ICT

Management of cultural diversity involves communication first and foremost. Culture will affect how individuals communicate with others, because culturally learned norms, rules, and beliefs affect the way people communicate as well as predict the effect of their communication behavior on others. Dube and Pare (2001) found that the communication barrier between participants from different cultural and language backgrounds becomes more severe if they communicate using ICT, leading to misunderstandings and loss of information. This occurs because of the lack of contextual clues available in most technologically mediated communication. In addition, the communication style of the dominant culture usually will take over and, consequently, deter people from different cultures participating (Zorn, 2005). However, Massey, Hung, Montoya-Weiss, and Ramesh (2001) proposed that certain ICTs may enhance the ability of some individuals to communicate, depending on the particular communication style inherent in their culture.

Several attributes of ICTs must be considered when assessing their suitability for fostering communication in culturally diverse workplaces. Synchronicity vs. asynchronicity is a simple way of classifying computer-mediated communication. Synchronous ICT tools are those that allow people to talk to each other and to receive quick replies in the same session, similar to a face-to-face conversation. Asynchronous tools usually involve a delay in response, since participants are not necessarily using the tool at the same time and normally do not have any way of knowing when others will be online. Massey et al. (2001) provide a more refined framework of characteristics with which to describe and evaluate ICT tools:

The Role of Information and Communication Technology

- **Richness:** The capacity to convey nonverbal as well as verbal cues and, thus, to facilitate shared meaning.
- **Social presence:** The degree to which individuals feel close. The richer the ICT, the more social presence it provides.
- **Interactivity:** The rapidity of feedback provided by the medium, thus enhancing interactivity among participants.
- **Rehearsability:** The extent to which messages can be fine tuned before sending or posting.

Table 1. ICTs and their strengths and weaknesses in communication

| ICT | Strengths | Weaknesses | Cultural Dimensions Fit |
|--------------------------|--|--|--|
| <i>Email</i> | <ul style="list-style-type: none"> • Reprocessability provided by record of communication | <ul style="list-style-type: none"> • Lack of richness and social presence since no non-verbal cues | <p><i>Good for:</i></p> <ul style="list-style-type: none"> • Uncertainty avoidance • Individualism <p><i>Poor for:</i></p> <ul style="list-style-type: none"> • High context cultures |
| <i>Discussion Forums</i> | <ul style="list-style-type: none"> • Rehearsability as postings can be edited • Reprocessability provided by record of discussion and sometimes by search facilities | <ul style="list-style-type: none"> • Low interactivity because of asynchronicity • Lack of richness and social presence since no non-verbal cues | <p><i>Good for:</i></p> <ul style="list-style-type: none"> • People with poor oral language skills • Uncertainty avoidance • Long-term orientation • Individualism <p><i>Poor for:</i></p> <ul style="list-style-type: none"> • High context cultures |
| <i>Chat Rooms</i> | <ul style="list-style-type: none"> • High interactivity provided by synchronicity | <ul style="list-style-type: none"> • Speed of interaction challenging and no rehearsability | <p><i>Good for:</i></p> <ul style="list-style-type: none"> • Short-term orientation • Collectivist cultures <p><i>Poor for:</i></p> <ul style="list-style-type: none"> • People with poor written language skills |
| <i>Intranet</i> | <ul style="list-style-type: none"> • Quick dissemination of information across cultures | | <p><i>Good for:</i></p> <ul style="list-style-type: none"> • People with poor oral language skills • Collectivist cultures |
| <i>Group-ware</i> | <ul style="list-style-type: none"> • Flexibility provided by range of tools • Relationship building across cultures | | <p><i>Good for:</i></p> <ul style="list-style-type: none"> • Collectivist cultures |
| <i>Tele-conf.</i> | <ul style="list-style-type: none"> • Some added richness provided by more verbal cues • High interactivity and feedback | <ul style="list-style-type: none"> • Lack of rehearsability and reprocessability | <p><i>Good for:</i></p> <ul style="list-style-type: none"> • Collectivist cultures <p><i>Poor for:</i></p> <ul style="list-style-type: none"> • People with poor oral language skills |
| <i>Video-conf.</i> | <ul style="list-style-type: none"> • High level of richness and social presence • High interactivity and feedback | <ul style="list-style-type: none"> • Lack of rehearsability and reprocessability | <p><i>Good for:</i></p> <ul style="list-style-type: none"> • High context cultures • Collectivist cultures |
| <i>Mobile Tech.</i> | <ul style="list-style-type: none"> • High interactivity • Flexibility provided by range of functions | <ul style="list-style-type: none"> • Lack of rehearsability and reprocessability | <p><i>Good for:</i></p> <ul style="list-style-type: none"> • Short-term orientation <p><i>Poor for:</i></p> <ul style="list-style-type: none"> • High power distance cultures |

- **Reprocessability:** The degree to which individuals can re-examine messages sent to them.
- **Flexibility** (what Massey et al. call “symbolic variety”): The number of different modes of communication or choices provided by any communication tool.

Using this framework, Massey et al. (2001) found that three cultural dimensions could assist in understanding cross-cultural communication differences:

- **Individualism-collectivism:** People from a collectivist culture may prefer synchronous technology (chat rooms, teleconferencing, and videoconferencing), because it allows real-time interaction and makes them feel close to each other, leading to a collective feeling and social presence. In an individualist culture, people may be more comfortable doing the work individually, in parallel to others, and can adjust better to asynchronous technology (e-mail, discussion forums, etc.).
- **Uncertainty avoidance:** Massey et al. (2001) believed that synchronous technology is generally a better fit for reducing task ambiguity because of the greater possibilities of interactivity and immediate feedback and, therefore, may be preferred by people from high uncertainty avoidance cultures.
- **High and low context:** The richer the technology, the better it will be for high-context people because it allows for a feeling of social presence and provides nonverbal as well as verbal cues.

Different communication tools thus have different benefits and may not have universal acceptance with all employees. As a result, the organization should be flexible, provide a range of tools, and allow employees to choose whatever mode of communication with which they feel

most comfortable. In the following discussion, we examine modern ICTs and outline their potential benefits in the context of a culturally diverse workforce. Table 1 provides a summary of the main tools and their advantages and disadvantages.

E-Mail

Some studies have shown that e-mail as a primary mode of communication can help to avoid culture clashes and can overcome more subtle language barriers because many people from a non-English speaking background can write and read English better than speak it, particularly if they have learned English in a formal classroom setting. Another advantage of using e-mail is that both sides will have a record of the communication, which will help to reduce misunderstandings (Jana, 2000); that is, there is a high degree of reprocessability provided by e-mail message banks.

On the other hand, Pauleen and Yoong (2001) say that in high-context cultures, people will rely heavily on nonverbal gestures and on an understanding of the surrounding context, which may include the backgrounds of the people involved, previous decisions, and the history of the relationship. A degree of personal relationship is important. The nonverbal cues used to judge people’s true feelings are not available when communicating through a solely text-based channel such as e-mail. It is not a rich medium. However, people from low-context cultures prefer more objective and fact-based information and so have no problem with e-mail. Therefore, when working across cultures, because of conflicting communication styles, e-mail could be an added barrier.

Discussion Forums

Discussion forums provide another means of written communication that may favor people who have studied English formally and, therefore, are more confident about writing than speaking

the language. In one notable respect, forums are superior to e-mail in that people generally have more time to think before posting something, and most forums allow one to edit the posting if mistakes have been made (unlike e-mail in which there is no getting the message back once it has been sent). In other words, discussion forums have a high degree of rehearsability.

In forums, a reply has to be connected to someone else's posting according to a topic (thread), and so, discussions are usually ordered and more formal than many e-mails. Postings can be seen much longer, sometimes even for years, and sometimes can be searched via a search engine, thus providing a useful bank of information (Zorn, 2005). Thus, they have a high degree of reprocessability, allowing individuals to view and consider messages carefully. People from non-English speaking backgrounds may find it easier to follow the more structured discussion, appreciate the extra time that they can spend reading discussion threads, and even feel comfortable with the passive role of reading others' postings without being obliged to post themselves.

The main disadvantages of discussion forums are that there is limited interactivity, because the person must wait for an unspecified period before receiving a reply due to its asynchronous nature, and, as with e-mail, there is limited richness and social presence, which may affect people from high-context cultures.

Chat Rooms

The informal structure of chat, its synchronicity, and ease of use make it a good tool for building relationships among the workforce. Like other synchronous communication tools, it has a high level of interactivity. MSN messenger is one of the free chat software programs that is used widely to share information and to attach documents. However, Zorn (2005) states that in order to participate actively in electronic chat, one has to be able to type quickly and write short, quick

sentences. In fact, there is a special chat language (<http://abbreviations.virtualsplat.com/category/chat-abbreviation.asp>). In chat rooms, people have to post quickly, because they do not want other chatters posting before they have time to respond. It will make them feel like interrupting, and they might lose the thread of the conversation because it has already moved on to another topic. This puts people who don't know the terms used or who are from other language backgrounds at a distinct disadvantage.

Intranet

Many organizations nowadays have found that a company intranet allows for quick dissemination of information among all employees, such as the posting of minutes, action lists, and news. Jana (2000) reports a successful example of a company, Quadstone, that uses an intranet to link its employees from many nationalities across two continents, which has eliminated the problem of different accents and poor understanding of spoken English. With increasing globalization and more and more companies pursuing a geographically distributed organizational model, intranets are an ideal communication tool.

Groupware

For sharing information to a mass audience, messaging and groupware tools such as Lotus Notes may be an appropriate choice (Topi, 2004). Groupware tools such as Notes enable staff to share documents within the organization and externally via the Web; engage in threaded discussions via discussion forums; send messages over e-mail, receive notification and reminders and, in short, communicate and share resources with fellow workers via its intranet capabilities (Hawryszkiewicz, 2003). They can promote opportunities for informal, spontaneous exchanges, which, in turn, can foster more productive work collaborations than are possible without this per-

sonal foundation (Pauleen & Yoong, 2001). This relationship building is particularly important in culturally diverse workplaces. Groupware has the advantage that it is very flexible and provides a range of communication tools from which employees from different cultural backgrounds and with different preferences can select the communication channel that is appropriate for them.

Teleconferencing

Unlike most of the written communication tools already described, teleconferencing provides a high degree of interactivity and allows people to convey emotion relatively easily. However, it is very difficult for participants to actively participate if they are not fluent in the language used in the teleconference. They also will have trouble entering the conversation without seeing the other people and being able to pick up visual cues, and often misinterpretations will occur (Dube & Pare, 2001). It also has the problems of low rehearsability and low reprocessability, both of which give people from other language backgrounds a further disadvantage.

Videoconferencing

Videoconferencing is a good tool for culturally diverse workplaces, because it enables team members to see facial expressions, gestures, and many other visual cues, and so establish a social presence. Pauleen and Yoong (2001) found that “eyeing” people was important in relationship building and that videoconferencing generally enhanced social relationships by allowing people to “put a face to the name” (p. 210). It is better than teleconferencing, which is difficult for people from other language backgrounds. However, Dustdar and Hofstede (1999) found that there were fewer contextual clues in videoconferencing than in face-to-face meetings and proposed that the design of videoconferencing needs to support social protocols and be culturally aware. Further-

more, while teleconferencing and, particularly, videoconferencing are richer communication media than other ICTs, they require a high level of commitment, flexibility, and discipline from the participants (Dube & Pare, 2001); for example, working outside normal business hours to accommodate time zone differences, care in watching for turn-taking cues, and a commitment to including all participants in the conversation.

Mobile Technologies

Mobile technologies, such as cell phones, laptop computers, personal digital assistants (PDAs), two-way pagers, and the blackberry (an e-mail device), have been adopted widely in many organizations in which employees commonly work off-site, roam from one location to another, or need to be on call. They have been responsible for extending a social presence into areas where, before wireless networks, it could not exist before. Generally, they provide a high level of interactivity (either through phone calls or text messages) and an increasing flexibility, as the range of available functions increases every year. Rehearsability and reprocessability, though, are low.

A number of studies have shown that cultural differences affect how at least some of these technologies are used. For example, in the U.S., the number of mobile phone users is high, and there is a preference for graphic mobile technologies such as Palm.Net and Pocket Internet Explorer to send e-mail messages, in preference to text messaging (Urbaczewski, Wells, Sarker, & Koivisto, 2002).

Text messaging has been shown to vary greatly depending on power distance. Sarker and Wells (2003) found that in high-power distance cultures such as Korea, text messaging to supervisors was viewed as highly offensive, whereas in low-power distance cultures such as Norway, text messaging was not offensive, although sometimes it was considered inappropriate in more formal communications due to its reliance on abbreviations and slang.

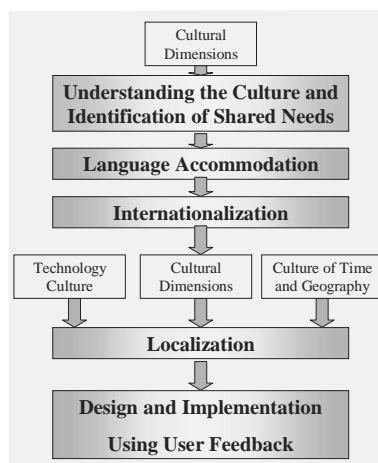
Cultural variables have a large influence on preferred mobile device interface features. One international study (Choi, Lee, Kim, & Jeon, 2005) showed that Korean and Japanese participants displayed a high degree of uncertainty avoidance in their preference for clear, concrete menu labeling and a large amount of secondary information about the contents available to advise their choice of options. The Koreans also were found to be more collectivist, preferring popularity rankings so that they could choose content that many other people had used. The Finnish participants, on the other hand, were characterized as risk takers who disliked secondary information on menu items, instead being happy to click on options and see for themselves what was available. They liked a low-context, simple design with fewer icons and colors. In order for mobile technology to be effective in fostering communication in the workplace, it needs to be designed to take cultural preferences such as these into account.

CHALLENGES IN DEVELOPING ICT FOR THE CULTURALLY DIVERSE WORKFORCE

The design of ICT with a focus on cultural diversity is important if organizations are to optimize the use of ICT in management, knowledge management, and communication. Most system development in the past has been aimed at culturally homogenous groups, but with increasing globalization, this is no longer acceptable. There has been much research into the challenge of developing ICT for culturally diverse user groups, and this work is ongoing. A framework for cross-cultural ICT development is given in Figure 2.

1. **Understanding the culture:** The first step in ICT development is to understand the target cultures (Nakakoji, 1996). The cultural dimensions of Hofstede and Hall provide a systematic basis to begin the description and segmentation of the user group's cultures.

Figure 2. Framework for developing culturally diverse ICT



If different cultural groups are to use the same system, then this stage also should include the identification of any shared needs, interests, and goals in addition to communication strategies among groups (Bourges-Waldegg, Lafreniere, Tscheligi, Boy, & Prates, 2001).

2. **Language accommodation:** Since language is the most obvious difference between cultural groups, language translation, or at least language accommodation, is the next step. Where there is one dominant language, system designers might decide that the cost of providing systems in multiple languages is not feasible. However, providing features to translate and edit the language and allowing users to check their grammar and spelling are necessary (Dube & Pare, 2001). In addition, ICT designers should try to develop cues such as context-adding smiley faces or emoticons in e-mail and chat rooms in order to avoid misunderstandings and provide social presence (Churchill & Bly, 2000; Zorn, 2005).

The most important issue for ICT communication tools is in determining the structures of communication; for example, communication procedures, turn taking, methods of interrupting, and other social protocols. Different cultures have different social etiquette and different levels of power distance; transgressions against these can affect the outcome of communication severely (Churchill & Bly, 2000). The developer, therefore, must consider different cultural communication styles and strive to keep the environment tailorable in order to allow people to develop their own social environments. Design should focus on communications and conversations, not on technology (Churchill & Bly, 2000; Zorn, 2005).

3. **Internationalization:** This step ensures that the design is culture-independent, which is

particularly important when organizations are doing business globally on the Web and when it is impossible to predict exactly who the users will be. This is also a useful preliminary step in tailoring systems to different known cultural groups. Having identified culturally specific elements of the system, as many of these are eliminated as possible. A good example given by Nakakoji (1996) is the method of dealing efficiently with different languages on screen; rather than embed text into figures, it is stored separately. Figures then can be displayed and the text added in at the time of display in the language appropriate to the user. This avoids the necessity of redrawing figures in each language and results in economies of storage, since the number of figures is reduced to a minimum.

A variant on internationalization is universal usability. Some designers believe that universal access to ICT is only possible if systems are designed with all possible users in mind (Shneiderman, 2000). They have developed the Universal Design Principles, which include equity, flexibility, simple and intuitive design, legibility of information, error tolerance, low physical effort, and appropriateness to human physical and environmental limitations (Burgstahler, n.d.)

4. **Localization:** Normally, following internationalization, the system is localized for each user group's culture by including elements of local content and style. The design should accommodate different languages, date and number formats, color and graphic representations, appropriate icons, and an appropriate direction of flow (left to right, or right to left), according to the culture (Nakakoji, 1996). Perhaps more important than superficial appearance is the organization and representation of information structures to represent the users' knowledge framework; explicit representation of the information architecture of the system

The Role of Information and Communication Technology

is also a good idea in order to enhance user understanding (Walton, Marsden, & Vukovic', 2002).

Localization also should accommodate cultural dimensions, since these are also critical for user acceptance. For example, one comparison of Malaysian and U.S. Web sites showed that the Malaysian Web sites reflected the high power distance requirements of their users and a strong emphasis

on collective and social goals, whereas the American Web sites for similar products displayed a much lower power distance, a greater stress on individualism, and a more task-oriented approach (Gould et al., 2000). Research into ICT design for Arabic users has proposed that collectivism and high context communication is important in addition to privacy and security issues (Zakaria & Stanton, 2003).

Table 2. Example of applying the development framework

| Development Phase | | USA | UK | Indonesia |
|----------------------------------|---|---|---|--|
| <i>Understanding the Culture</i> | Identify Cultural Dimensions (ITIM, 2003; Hall, 1976) | <ul style="list-style-type: none"> • Low power distance • High individualism • Short-term orientation • Medium to high masculinity • Low context communication | <ul style="list-style-type: none"> • Low uncertainty avoidance | <ul style="list-style-type: none"> • High power distance • Collectivist • Medium-low masculinity • Medium uncertainty avoidance • Long-term orientation • High context |
| | Identify Shared Needs | Company goals and organizational "culture" | | |
| <i>Language</i> | Language | English | | English + Indonesian |
| | Etiquette | Provide options for turn-taking and other local communication protocols | | |
| <i>Int.</i> | Internalization | Common graphics, layout, tools, functions | | |
| <i>Localization</i> | Local Content and Style | e.g., US spelling; mm/dd/yy date format | e.g., UK spelling; dd/mm/yy date format | e.g., US spelling of English; dd/mm/yy date format; no graphic sexual depiction |
| | Apply Cultural Dimensions | For example: <ul style="list-style-type: none"> • Low power distance: focus on customers and their needs • Individualistic: focus on recognition of employee achievements via email or electronic noticeboard | | For example: <ul style="list-style-type: none"> • High power distance: focus on company profile to impress customers • Collectivist: allow anonymous postings on discussion board; emphasize group achievement |
| | Technology Culture | e.g., Greater complexity in customer interface since higher computer literacy rates | | e.g., Less sophisticated, easy-to-use customer interface |
| | Time/Geog. Culture | e.g., Information and alerts regarding public holidays in USA, UK and Indonesia | | |
| <i>D&I</i> | Design & Implementation | Local user testing and reiterative design approach | | |

In addition to cultural dimensions, the designer also has to consider issues of technology culture, such as:

- The way of charging for technology access, including Internet and phone, which sometimes prohibits people from being online. In some countries, access is charged per minute, and so charges might be high.
- The technological expertise available. The system should be easy to use, provide a gentle learning curve, and allow for different technological capabilities, particularly where expertise is known to be low.
- The understanding of the use and place of technologies. For example there is no need for passwords in certain societies for individually owned computers (Churchill & Bly, 2000).

Churchill and Bly (2000) also list the culture of time and geography as important considerations:

- Different holidays and working hours.
 - Different notions of private and public time. Systems should enable a set of shared expectations about where to leave messages and available times for interaction in order to create a sense of co-presence among participants. They should be capable of providing asynchronous as well as synchronous messages.
5. **Design and implementation:** Refining of the system's design based on user feedback is especially important in multicultural design environments (Nakakoji, 1996). This normally involves reiterations of testing with the user group and sometimes active participation of users on the design team.

Example of Applying the Development Framework

Here we will give a practical scenario to demonstrate how this model might be implemented (Table 2). Let us take the example of a U.S. firm that has subsidiaries in the United Kingdom and Indonesia. It wishes to create a Web site that will provide customers with product and service information and also act as a portal to its intranet and groupware tools for employees in all three countries.

FUTURE TRENDS

There are many emerging technologies that will impact how cultural diversity is managed in the future. To some extent, ICT will evolve to answer existing challenges and issues in a more effective way. However, new challenges will arise as new technologies come on the market and also as the world changes under the increasing impact of globalization.

The use of mobile devices is rapidly increasing, owing to improved wireless technology, cost reduction, and advances in service provision. In addition, people's ways of carrying out their work is changing, with the number of mobile workers rising around the world (Chen & Corritore, 2005). These people rely more and more on mobile devices to keep them connected to the office and connected to clients. For example, laptop PCs are gaining market share. In 1995, there were 31 million, accounting for 13.7% of all PCs in-use, while in 2005, the number was expected to double to 25% of market share (Computer Industry Almanac Inc., 2005 June). However, the design of many mobile devices presents additional and unique challenges that primarily arise from the small size of the interface, limited input and in-

teraction capabilities, slower bandwidth, security risks, and the need to adapt content to the context of where the device is being used (Murugesan & Venkatakrishnan, 2005). The challenge of establishing how one can use these mobile tools effectively in a culturally diverse workplace is magnified by these issues.

New technological developments in other fields also could change the way that modern workforces do business and their preferred ICT. Voice-over IP (VoIP) is already saving costs on international telephone calls for many businesses (Erlanger, 2005-2006). An extension of this technology is video-over IP, which promises to reduce the usage costs by allowing videoconferencing for the price of a local call to the ISP. This is now being employed effectively in some geographically dispersed organizations in which face-to-face meetings are difficult to arrange (Olde, quoted by Housely, 2005). With fewer financial disincentives to using videoconferencing, it well may become the preferred interoffice or interorganizational communication tool, providing a richer medium and a greater social presence than any other ICT. For people from many cultures and, in particular, high-context cultures, this might become the best option after face-to-face communication and meetings. These benefits are likely to be realized as soon as the security challenges of VoIP and video-over-IP are resolved.

Currently, ICT is dominated by the English language. In 2001, the top three languages on the Internet were English (43%), Japanese (8.9%), and Chinese (8.8%) (Gromov, 2002). However, in the future, China may well become the dominant force. By 2005, English showed a marked decline to 31.9%, while China had grown to 12.8% (Miniwatts International, Ltd., 2005). China, which is now in second place in broadband subscriptions, is projected to surpass the U.S. (Computer Industry Almanac Inc., 2005 November), and in mobile telephony, China is already the leader (Computer Industry Almanac Inc., 2005 September). This has enormous implications on the design of Web

pages and ICT generally. More than ever, it will be necessary for the developer to be aware of cultural considerations and to follow a rigorous development framework that focuses on cultural issues.

Ultimately, more research is needed into cultural aspects of ICT development and particularly into comparing and contrasting multiple groups from different cultures. Currently, most research is limited to comparisons of ICT between only two national cultures, such as the U.S. and Germany (Junglas & Watson, 2004) or the U.S. and Malaysia (Gould et al., 2000). There are very few case studies involving multiple cultures in international businesses.

CONCLUSION

With the transformation of the modern workforce into an increasingly culturally diverse one, there is a challenge for managers and administrators in managing this diversity effectively. ICT offers many different tools to assist, each with its own advantages and its own weaknesses. For the manager, there is the challenge of choosing appropriate tools for the workplace to better take into account different communication styles and cultural backgrounds. There is also the challenge for the systems developer in designing new applications that reflect the reality of cultural diversity in the workplace today.

In this chapter, we have discussed the management of cultural diversity using ICT in the context of language and the dimensions proposed by the principal comparative cultural theorists of our day, Hofstede and Hall. Studies have shown that at least some of these dimensions form a valid framework for interpreting and understanding the differences between ICTs and how they can be used most effectively in promoting better work practices, knowledge sharing, and communication in multicultural organizations. These are power distance, uncertainty avoidance, individualism vs.

collectivism, short-term vs. long-term orientation, and high-context vs. low-context communication. Only one study discussed Hofstede's dimension of masculinity vs. femininity (Marcus & Gould, 2000) but was not considered by the authors as providing sufficient evidence.

One of the obvious challenges to the manager is the fact that none of the existing ICT tools is perfect in all situations or in all cultural contexts. For example, whereas one tool, such as e-mail, might provide fast, direct, fact-based communication suited to people from low-context cultures, studies show that it is a problem for people from high-context cultures, because it is not a rich medium and gives few nonverbal cues. As a result, the manager should provide a range of communication and other ICT tools and give employees from different cultural backgrounds the opportunity to choose whatever ICT with which they feel comfortable. Likewise, developers will need to build flexibility into their design of new systems, if they are to be culturally appropriate and gain acceptance.

REFERENCES

- Bourges-Waldegg, P., Lafreniere, D., Tscheligi, M., Boy, G., & Prates, R. O. (2001 March-April). Identifying "target cultures"; To what extent is that possible? *CHI '01 Extended Abstracts on Human Factors in Computing Systems*, 223-224.
- Burgstahler, S. (n.d.). *Universal design of instruction*. Retrieved October 14, 2005, from <http://www.washington.edu/doit/Brochures/Academics/instruction.html>
- Chen, L., & Corritore, C. (2005). Nomadic culture and its impact on organizational support for nomadic behaviors and employee job satisfaction. In W. Brookes, E. Lawrence, R. Steele, & E. Chang (Eds.), *Proceedings of the International Conference on Mobile Business* (pp. 9-15). Los Alamitos, CA: IEEE Computer Society.
- Choi, B., Lee, I., Kim, J., & Jeon, Y. (2005). A qualitative cross-national study of cultural influences on mobile data service design. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 661-670). Portland, OR: ACM Press.
- Churchill, E. F., & Bly, S. (2000). Culture vultures: Considering culture and communication in virtual environment. *ACM SIGGROUP Bulletin*, 21(1), 6-11.
- Computer Industry Almanac Inc. (2005, September 26). *China tops cellular subscriber top 15 ranking*. Retrieved January 17, 2006 from <http://www.c-i-a.com/pr0905.htm>
- Computer Industry Almanac Inc. (2005, June 20). *Mobile PCs in-use surpass 200m*. Retrieved January 11, 2006, from <http://www.c-i-a.com/pr0605.htm>
- Computer Industry Almanac Inc. (2005, November 14). *USA leads broadband subscriber top 15 ranking*. Retrieved January 11, 2006, from <http://www.c-i-a.com/pr1105.htm>
- Daft, R. (2000). *Management* (5th ed.). Orlando, FL: Dryden Press.
- Deresky, H (2006). *International management: Managing across borders and cultures* (5th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Dube, L., & Pare, G. (2001). Global virtual team. *Communication of the ACM*, 44(12), 71-73.
- Dustdar, S., & Hofstede, G.J. (1999). Videoconferencing across cultures—A conceptual framework for floor control issues. *Journal of Information Technology*, 14, 161-169.
- Erlanger, L. (2005-2006, December-January). VoIP may be vulnerable to threats. *Information Age*, 34-37.
- Ford, D. P., & Chan, Y. E. (2003). Knowledge sharing in a multi-cultural setting: A case study.

- Knowledge Management Research & Practice*, 1(1), 11-27.
- Forstenlechner, I. (2005). The impact of national culture on KM metrics. *KM Review*, 8(3), 10.
- Gould, E. W., Zakaria, N., & Yusof, S. A. M. (2000, September). Applying culture to Website design: A comparison of Malaysian and US Websites. *Proceedings of the 2000 Joint IEEE International and 18th Annual Conference on Computer Documentation* (pp. 161-171). Los Alamitos, CA: IEEE Computer Society.
- Gromov, G. R. (2002). *History of Internet and WWW: The roads and crossroads of Internet history*. Retrieved January 11, 2006, from <http://www.netvalley.com/intvalstat.htm>
- Hall, R. T. (1976). *Beyond culture*. New York: Anchor Press.
- Hawryszkiewicz, I. T. (2003). *Developing e-business systems*. Sydney: University of Technology, Sydney.
- Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations*. London: Sage Publications.
- Hofstede, G., & Hofstede, G. J. (2005). *Cultures and organizations: Software of the mind*. New York: McGraw-Hill.
- House, R. J., Hanges, P. J., Javidan, M., Dorfman, P. W., & Gupta, V. (Eds.). (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies*. London: Sage Publications.
- Housely, T. (2005). IP telephony (presentation to the ACS April Branch Forum). Sydney: Australian Computer Society.
- ITIM. (2003). *Geert Hofstede: Cultural dimensions*. Retrieved January 23, 2006, from http://www.geert-hofstede.com/hofstede_dimensions.php
- Jana, R. (2000). Preventing culture clashes. *InfoWorld*, 22(17), 95-96.
- Joplin, J. R. W., & Daus, C. S. (1997). Challenges of leading a diverse workforce. *Academy of Management Executive*, 11(3), 32-47.
- Junglas, I. A., & Watson, R. T. (2004). National culture and electronic commerce: A comparative study of U.S. and German Web sites. *E-Service Journal*, 3(2), 3-34.
- Manning, A. D. (2004). Universals and variables in cross-cultural communication. *Proceedings of the International Professional Communication Conference* (pp. 36-41). Los Alamitos, CA: IEEE Computer Society.
- Marcus, A., & Gould, E. W. (2000). Crosscurrents: Cultural dimensions and global Web user-interface design. *Interaction*, 7(4), 32-46.
- Massey, A. P., Hung, Y. T. C., Montoya-Weiss, M., & Ramesh, V. (2001). When culture and style aren't about clothes: Perceptions of task-technology "fit" in global virtual teams. *Proceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work* (pp. 207-213). New York: ACM Press.
- Miniwatts International, Ltd. (2005). *Internet world stats: Usage population statistics*. Retrieved January 11, 2006, from <http://www.internetworldstats.com/stats7.htm>
- Murugesan, S., & Venkatakrishnan, B. A. (2005). Addressing the challenges of Web applications on mobile handheld devices. In W. Brookes, E. Lawrence, R. Steele, E. Chang (Eds.), *Proceedings of the International Conference on Mobile Business* (pp. 199-205). Los Alamitos, CA: IEEE Computer Society.
- Myers, M. D., & Tan, F. B. (2002, January-March). Beyond models of national culture in information systems research. *Journal of Global Information Management*, 24-32.

- Nakakoji, K. (1996). Beyond language translation: Crossing the cultural divide. *Software, IEEE*, 13(6), 42-46.
- Oz, E. (2002). *Management information systems* (3rd ed.). Boston: Thomson Learning.
- Pauleen, D. J., & Yoong, P. (2001). Relationship building and the use of ICT in boundary-crossing virtual teams: A facilitator's perspective. *Journal of Information Technology*, 16(4), 205-220.
- Sarker, S., & Wells, J. D. (2003). Understanding mobile handheld device use and adoption. *Communications of the ACM*, 46(12), 35-40.
- Shneiderman, B. (2000). Universal usability: Pushing human-computer interaction research to empower every citizen. *Communications of the ACM*, 43(5), 85-91.
- Topi, H. (2004). Supporting telework: Obstacles and solutions. *Information Systems Management*, 21(3), 79-85.
- Trompenaars, F., & Hampden-Turner, C. (1998). *Riding the waves of culture: Understanding cultural diversity in global business* (2nd ed.). New York: McGraw-Hill.
- Urbaczewski, A., Wells, J., Sarker, S., & Koivisto, M. (2002). Exploring cultural differences as a means for understanding the global mobile Internet: A theoretical basis and program of research. *Proceedings of the 35th Annual Hawaii International Conference on System Science* (pp. 654-663).
- Walton, M., Marsden, G., & Vukovic, V. (2002). "Visual literacy" as challenge to the internationalization of interfaces: A study of South African student Web users. *Proceedings of the CHI'2002*. New York: ACM Press.
- Zakaria, N., & Stanton, J. M. (2003). Designing and implementing culturally-sensitive IT applications: The interaction of cultural values and privacy issues in the Middle East. *Information Technology & People*, 16(1), 49-75.
- Zorn, I. (2005). Do culture and technology interact? Overcoming technological barriers to intercultural communication in virtual communities. *ACM SIG-GROUP Bulletin*, 25(2), 8-12.

This work was previously published in Information Resources Management: Global Challenges, edited by W. Law, pp. 283-304, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 6.24

Creating an Entrepreneurial Mindset: Getting the Process Right for Information and Communication Technology Students

Briga Hynes

University of Limerick, Ireland

Ita Richardson

University of Limerick, Ireland

ABSTRACT

Change in the structure and profile of the industrial base in Ireland emphasises the importance of the small firm sector in certain growth sectors. One such sector is the information and communication technology (ICT) sector, which now demands a more enterprising graduate. This chapter emphasises the importance of third-level¹ education in preparing students for their career, either as employee or entrepreneur. We discuss how entrepreneurship education, through its broad and integrative philosophy accommodates the changing workplace demands. It links together the synergy of enterprising activity and the small firm ICT sector through education courses, specifically entrepreneurship education. This is achieved through the adoption of the process framework for ICT entrepreneurship education. Describing how

they can be modified to facilitate and encourage the more creative and enterprising mindset in the ICT student, we present two courses that have been successfully implemented at the University of Limerick.

INTRODUCTION

A challenge facing policy makers in Ireland is how to encourage more individuals to consider self-employment as a career option and as an alternative to the more traditional career patterns of paid employment in the ICT sector. Since career choices are informed and influenced during the educational experience of the individual, we suggest that the education context of the individual should be examined to determine how it could be developed to encourage ICT

individuals to consider self-employment. To do this we argue that there is a need to modify and devise current programme offerings to include increased exposure in a realistic and practical sense as to what self-employment is about and how it can be a career option to consider. To add value to the competency base of the ICT student, entrepreneurship education can facilitate a more informed choice and exposure to the possibility of self-employment.

The question posed is how can the education context and experience of the ICT student contribute to creating this entrepreneurial mindset? To achieve this, it is necessary to examine the broader philosophy of the purpose of education.

Our answer to this question is the linking of entrepreneurship education to the ICT curriculum through the adoption of a more integrated and interdisciplinary approach. This will create a more entrepreneurial mindset in ICT students in third-level educational institutions. This adds value to the educational experience of the ICT student, providing them with the knowledge, skills, and competencies required for self-employment.

Entrepreneurship education is a process, involving a series of stages and a number of stakeholders who need to be an active part of the process. The central stakeholders are the students, teachers (trainers), the educational institution, and employers within the business community. Entrepreneurship education courses should provide students with a very real-life experience and enhance not just knowledge acquisition but also skills development in areas of idea generation; market research; product and process development; communication; negotiation; conflict management; project management; and people management.

Essentially this chapter addresses a number of related topics such as entrepreneurial activity, entrepreneurship education, and the changing knowledge required by ICT graduates. In doing this, we integrate these topics which are frequently researched independently.

Initially the chapter provides a background to ICT and entrepreneurship within Ireland, thus strengthening the rationale for the chapter. We then propose that an effective means of bridging the entrepreneurship knowledge and skills gap for the ICT student is the development of entrepreneurship education initiatives. To achieve this a process framework of ICT entrepreneurship education is presented and described. Following this, two interdisciplinary entrepreneurship courses at undergraduate level are profiled to describe how this need can be addressed. In the discussion of such courses important issues such as programme design, the role of the lecturer to facilitator, resource implications, and delivery and assessment issues are examined. The chapter concludes with a discussion on the benefits of adopting such initiatives and the implications for policy makers and educators.

THE SMALL FIRM SECTOR: THEIR IMPORTANCE TO THE IRISH ECONOMY

In 2003 it was estimated that the number of small firms in Ireland was approximately 186,114, an increase of 16,114 over a 3-year period since 2000, (The Revenue Commissioners Statistical Unit, 2003). The same report states that the majority of these firms employed less than 50 people (182,916 firms). Overall, these firms accounted for more than 99% of all enterprises in the state and contributed to 68.4% of private sector employment. Furthermore approximately 16,000 new businesses are created each year in Ireland (Small Firms Association [SFA], 2003).

Forfás (2004) indicated that certain sectors were also critical to the continued success of the economy. One such sector is the ICT sector. Current government policy is examining how a greater level of enterprising activity can be developed in the small firms' ICT sector.

This snapshot of the contribution of small firms in Ireland may appear positive and indicate a growing entrepreneurial culture. However, a more in-depth profiling would suggest otherwise. Research completed by O’Gorman and Jones (2000) suggested that as the proportion of employment contribution of Irish small firms was lower than their European counterparts (11% compared with EU average of 15%) there was a need to revitalise the small firm sector as a source of future importance for the Irish economy. This need was more recently reinforced in the Global Enterprise Monitor (GEM) (2003) survey, which found that 6% of already established firms (0-4 years) employed 20 or more people, which would translate into only 16,000 entrepreneurs having significant growth aspirations for their firms.

Regarding the stock of new firms established, GEM (2004) indicated that 45% of respondents perceived good opportunities to start a business, which was a 19% increase in optimism on the 2002 rates. However, while 45% believed that good opportunities existed to start a new business only one in nine Irish adults (10.99%) indicated that they would expect to start a business in the next 3 years. This is the same rate as was reported in 2003 and slightly lower than the rate in 2002 (13%). It should be noted that this indication of intention to get involved in entrepreneurial activity is only half the rate it is in Poland (21.87%) and is also behind other European countries such as France (14.38%), Greece (13.45%), Italy (11.62%), and Sweden (11.73%).

The trends for the period 2001-2004 (time period for which data is available) are summarised in Table 1.

It is important to ensure that this decline is arrested, as it will have implications for both the number of new firms established and for the number of surviving small firms in Ireland in the next few years. Central to the composition of this indigenous sector is the ICT sector.

GROWTH OF THE ICT SECTOR IN IRELAND

The success of the growth of the ICT sector in Ireland is attributed to a number of factors, which include upgrading of Ireland’s telecommunications infrastructure, low corporation tax, English speaking workforce, availability of highly qualified and educated workforce, a strong indigenous firm base, and deployment of European Union (EU) structural and cohesion funds to Ireland (Enterprise Ireland Strategy Group, 2004; Forfás, 2004; Trauth, 2000). According to reports over the past number of years this sector employed an estimated 92,000 people within 1,300 companies, with a combined estimated turnover of €52 billion for the year 2003 (Central Statistics Office, 2004; ICT Ireland, 2005).

One of the “exploitations,” which should occur, is to ensure that the small firms’ ICT sector benefits from the presence of multinational companies in Ireland. In fact one indigenous company in Ireland, Iona Technologies, which was established following a research project at Trinity College (Dublin), is responsible for more than 25 spin-off firms (ICT Ireland, 2003). The same report suggests that partnerships between early stage ICT companies and multinational

Table 1. Entrepreneurial activity in Ireland 2001-2004 (Source: Global Entrepreneurship Monitor, 2004)

| Measure of Entrepreneurial Activity²² | 2001 | 2002 | 2003 | 2004 |
|---|-------------|-------------|-------------|-------------|
| Total entrepreneurial activity (TEA) | 12.20% | 9.14% | 8.10% | 7.70% |
| Nascent entrepreneurs | 7.34% | 5.66% | 5.10% | 4.39% |
| New firm entrepreneurs | 4.88% | 4.20% | 3.76% | 3.59% |

companies would provide the early-stage firms with competitive advantage.

Furthermore, a consequence of Ireland's rapid economic progress over the past decade has been an increase in Ireland's cost base to a point where Ireland is no longer a competitive location for many of the traditional manufacturing companies. Simultaneously, Ireland is facing increasing competition for inward foreign direct investment (FDI) for low, added-value, manufacturing-oriented activities from Eastern Europe and Asia. This reinforces the need to compensate for the demise for FDI in traditional sectors by increasing the number of indigenous firms in growth sectors such as ICT.

This need is reinforced in research findings of GEM (2003) and Forfás (2004), who suggested a need to increase resources to build a more self-sufficient, indigenous industrial base to reduce the reliance on FDI. In Ireland, government industrial policy emphasises the development of these sectors, which have growth potential in added-value service and product areas in a global market. This will provide the country with a small firm sector that is capable of responding to the changing needs of growth in a national and global context. We suggest that the continued creation and increase in the number of new firms established on its own is not an indicator of a positive small firm sector. A sustainable enterprise and small firm sector should consist of a combination of new firms and established growth firms, which compliment each other.

Therefore, to accommodate these trends, policy should encourage more individuals to consider self-employment in these growth sectors as a career option and as an alternative to the more traditional career patterns of paid employment. Since career choices are greatly influenced by the educational experience of the individual, we consider that the role and influence of the educational system should be part of this policy agenda.

As educationalists we have a role to play in this. The education context of the individual should be examined to determine how it could be developed to encourage individuals to consider self-employment. From our experience we have found that this enterprising activity can be linked easily with certain disciplines to add value to the competency base of the student resulting in greater participation in self-employment in that discipline. Given its importance to the Irish economy the discipline that we are interested in is ICT.

EDUCATION: PREPARING THE GRADUATE OF THE FUTURE

According to Rand (2004), education is about developing a student's mind and potential to equip them to deal with the challenges posed in the real world. A broader definition from Baig (2004) states that the primary purpose of education is to provide individuals who can contribute to the economic prosperity of a country. The educational experience should develop students to the best of their abilities, to prepare them for the needs of the workplace and encourage them to generate new ideas and to improve the standards of living of that country. However, as the needs of the workplace are constantly changing, it is important that education providers are aware of the current needs to ensure course offerings are relevant.

Research by Expert Group on Future Skills Need (EGFSN) (2004) indicated the need for a variety of skills to ensure that firms are equipped to meet and be proactive for the changing needs of the international and global environment. These skills can be grouped as follows:

- Practical experience, flexibility/innovation skills
- Management skills for the 21st century
- IT skills
- Generic skills

Practical Experience, Project-Based, and Flexibility/Innovation Skills

Industry is increasingly looking to recruit graduates with practical work experience and commercial understanding. As a result, students with strong technical abilities but little practical experience are losing out on potential jobs. Education courses need to foster adaptability, flexibility, and innovation skills, which must become integral to the education system at all levels if the needs of a changing workforce are to be met. For example, the introduction and expansion of project-based learning will help to provide these skills. By moving in this direction, there is significant scope to improve both the quality of learning and the development of soft skills relevant to the workplace without compromising the intellectual content of courses.

Management Skills for the 21st Century

Management skills to include decision making, risk taking, managing change, and people management have become increasingly important to national economic development. Therefore we need to ensure that students are well equipped in these necessary management skills. In particular, when we focus on innovation and entrepreneurship, the need to ensure technology transfer from the research lab into the commercial arena requires specialised management expertise such as the management of technology transfer and intellectual property.

Information Technology Skills

Given the rapid diffusion of computing technologies into the business and domestic markets, there has been a huge increase in the number of jobs involving the use of information technology (IT). This has resulted in IT skills³ and the use

of desktop packages such as word processing, spreadsheet, and database packages becoming increasingly important. Workforce IT skills are becoming one of the most important factors affecting business competitiveness. Such skills, which are used across all levels in organisations including management levels, are increasingly viewed by employers as a basic requirement. Again, it is imperative that such skills are presented in educating the worker of the future.

Generic Skills

The greater prominence of high-tech manufacturing, internationally traded services, and R&D activities in Ireland's economy require high standards of generic skills to complement academic or vocational ones. Generic skills include basic skills such as literacy and numeracy, and also key skills such as communication, team working, planning, problem solving, and customer-service handling. Furthermore, research indicates that an increased number of people are working in professional and managerial occupations and that the importance of skills such as communication and planning is growing. (EGFSN, 2004)

From the previous findings it is clear that industry requires a graduate who is not just trained as a subject matter expert from a theoretical perspective. There is a definite need for graduates to have skills, which are based on the ability to approach work from a flexible, creative, and innovative approach. It is necessary that graduates are able to perform as a member of a team and have important people management skills.

A Responsive Education Environment

As a consequence of these changes influenced by economic, social, and technological environmental factors there is a clear need for the education system to be responsive to the changing requirements of the enterprise sector and general business community. The industrial sector has to cope with

flexibility and responsiveness and it is incumbent on the educational system to demonstrate the same traits. The educational experience should provide individuals with an attitude, ability, and competency to excel and participate in the highly dynamic business and technological environment of the future (EGFSN, 2004). A better balance between the courses studied, the length for which they are studied, and the requirements of industry should be taken into account. This suggests the need for more interdisciplinary courses. Increasingly, there is a need for graduates to have skills beyond their core disciplines.

Developing These Skills: The Role of Education

So how and where can graduates be equipped with these skills? We suggest that the third-level educational system is a key catalyst to impart these very necessary skills to the ICT student.

The role of the educational system in achieving this is acknowledged by Galloway, Anderson, Brown, and Whittam (2005), who suggested that educators, including universities, “have an obligation to meet students’ expectations with regard to preparation for the economy in which they will operate.” Krueger, Reilly, and Carsrud (2000) argued that career-related decisions reflect a cognitive process that is influenced by the attitudes, beliefs, and intentions which are in turn influenced by the knowledge and experience base of the student. The educational system influences the knowledge base, the acquisition of skills, competences, and attitudes on which future career choices are based. Since these decisions are fundamental to the future of the individual we argue that it is incumbent on the educational system to inform and expose students to a broad range of career options including entrepreneurship.

EXPOSING THE ICT STUDENT TO ENTREPRENEURSHIP

There is a need for all third-level institutions to adopt a much greater and more strategic enterprise focus, both in terms of satisfying the skill requirements of business and industry as well as fostering new business start-ups. From a policy level the importance of enterprise education is acknowledged by the European Commission (Europa, 2003), who advocated that entrepreneurship education is important to create the “correct mindset” to foster greater enterprising behaviour. This need is reinforced by many researchers as summarised by Galloway, Anderson, Brown, and Whittam (2005). This summary suggested the need for universities to develop as entrepreneurial institutions, becoming more proactive in addressing the needs of the employers and the business community when devising programs. They should help to encourage the growth of new businesses thus exploiting the creative potential and depth of knowledge within higher education. Other benefits promoted by De Faoite, Henry, Johnson, and Van der Sijde (2003) found that entrepreneurship education provided for the integration of a variety of business subjects, the promotion of improved decision-making skills, and an increase in technology transfer between universities and the market place. Thus they create improved synergy and added value between both entities and the potential to add value to nonbusiness and technical programmes. The need to broaden enterprise education outwards from business schools has also been endorsed by the European Commission (Europa, 2003) and Galloway and Brown (2002). Galloway and Brown (2002) also suggested that a “cross disciplinary approach” to enterprise education could influence a range of industry sectors including the arts, science and technology disciplines. Hytti and O’Gorman

Creating an Entrepreneurial Mindset

(2004) found that the better or more successful programmes were those who had the ability to integrate learning across the general educational experience of the student and those introducing enterprise education into other courses. The innate abilities of an individual, coupled with the overall socioeconomic environment (ease of establishing a new business, access to finance, and advice as well as the prevailing cultural attitudes to entrepreneurship) are extremely important factors in determining whether they pursue an entrepreneurial path. These innate abilities can be greatly enhanced by education and training.

We are in agreement with a number of researchers (such as Audretsch, 2002; Department for Education and Skills [DFES], 2002, 2003; Martin, 2004; National Committee of Inquiry into Higher Education [NCIHE], 1997) that the focus and objectives of entrepreneurship education programmes should involve the acquisition of a broader set of life long skills and not simply training for business start-up. Entrepreneurship

education should contribute to the development of a range of skills, including the ability to innovate and to provide leadership, which pays dividends for the individual and the economy in any employment context. Furthermore, Martin (2005) suggests that through enterprise education, both students and staff may be more likely to start up new firms and to develop business opportunities and in doing so create a more enterprising culture in the institution.

Essentially, there is considerable scope for the educational system to foster a culture that is conducive to innovation and entrepreneurship. The role it can play ranges from instilling a positive attitude to entrepreneurship among young people, via the promotion of positive role models and presenting failure as a prerequisite for success, to providing the enabling or prerequisite skills needed for success. These enabling skills range from an understanding of business, financial marketing, and legal issues to generic or soft skills such as team-working, communication, and interpersonal skills.

Figure 1. Process framework for information and communications technology entrepreneurship education (Adapted from Hynes, 2006)

| Inputs | | Process | | Outputs |
|---|--|--|---|---------|
| Students | Content Focus | Teaching Focus | Professional / Technological | |
| Prior knowledge base Motivation Personality Needs/interests Independence Attitudes Parent influence Self-esteem Values Work experience | ICT (science, mathematics, programming, ICT design, development process) Entrepreneurship (entrepreneurship, intrapreneurship, innovation, new product development, innovation, idea generation, research and development) Business (marketing, accounting and finance, human resources) Legal aspects (Intellectual property rights, employment legislation, insurance) Soft skills (Communication, presentation, writing) | Didactic (reading/lectures) Skill building (case studies, group discussions, presentations, problem solving, simulations, teamwork, projects) Discovery (brainstorming, personal goalsetting, career planning, consultancy) | Personal (confidence communication) Knowledge (enterprise, initiative, self-employment, business, management and market skills, analytical, problem solving, decision making, communication, presentation, risk taking) Career (improved knowledge, broader career options, broader less-structured career perspectives). | |

How can the enterprise education context and experience of the individual contribute to creating the correct entrepreneurial mindset? To answer this, it is necessary to examine the broader philosophy of the purpose of enterprise education, how current courses may be modified, and how new courses can be developed to address these needs.

PROCESS FRAMEWORK FOR ENTREPRENEURSHIP EDUCATION

In an evaluation of entrepreneurship courses Hynes (1996) suggested that entrepreneurship education is process driven. This process consists of a number of stakeholders who have a range of needs, which may differ in nature and scope. Starting a new business involves more than the development of a final product or service. Rather it encompasses a series of stages which link together and are managed in a subjective way by the entrepreneur. These are influenced by a number of factors both personal and situational. In the specific context of the ICT student the focus is on how it can create an awareness of self-employment as a viable alternative career path upon graduation or in a few years after gaining some practical experience.

Based on Hynes' (1996) work we have modified the process framework for the ICT student (see Figure 1). One of the benefits of the framework is that it is flexible and encourages adaptation to suit both the participant needs and the demands of the workplace.

Overview of the Process Framework of ICT Entrepreneurship Education

The model used has three primary elements: (1) inputs, (2) process, and (3) outputs. The role of entrepreneurship education (and thus the role of the educator) is to put a process in place which will include consideration of broader less-struct-

ured career perspectives. These will ensure that the student at least considers entrepreneurship as part of their professional career path.

How this is achieved is dependant on the content, subject areas, and the accommodation of multiple teaching methods. The emphasis on getting the process right is also raised by authors such as Chell and Allman (2003) and Gibb (1996). They raised issues about the provision of entrepreneurship education and the pedagogical and delivery developments required to appropriately meet the needs of the various stakeholders.

Course Objectives

As with the design and development of any educational intervention, there must be a set of clear realistic and achievable objectives guiding the development of entrepreneurship education courses. There is a need to include multiple objectives incorporating both discrete quantifiable ones and less specific and more behavioural related objectives. This later category may be more difficult to measure as their impact may not be immediate and become more relevant after the student has graduated and is involved in a career choice or change.

Building on the process framework, entrepreneurship education objectives should include creating awareness and knowledge of self employment as a viable career option. It should also facilitate students to more confidently identify business opportunities. It should also equip students with the attitudes, skills, and competences collectively referred to as "entrepreneurial mindset" where the graduate adopts an entrepreneurial and creative approach to the "world of work" either in an employee or employer role. While the student is the immediate and direct stakeholder, it is necessary that the needs of the other indirect stakeholders such as employers and lecturers are considered in course design.

We need to ascertain the various approaches adopted in courses with a view to examine how

they can be modified or incorporated into entrepreneurship courses for ICT students who are, in this case, the primary input to course development.

Inputs: The Student

When students come into courses, regardless of the subject area, they bring with them their own personality, life experiences, and prior learning. These include such factors as motivation, self-esteem, values, personal interests, and work experience. The job of entrepreneurship education is to give students the ability, skills, and tools with which they can mould these inputs to provide the expected outputs.

In some cases, for example, students may enter the course with low self-esteem. Through the educational process, these students may discover some ability that they have, which has not been visible to them prior to this. This in turn can boost the esteem in which they hold themselves. While some Irish students will have experienced entrepreneurship through second-level entrepreneurship schemes, the education system is structured in such a way that many students will not come to third level with any entrepreneurial background. Therefore, it is incumbent on the entrepreneurship educators to ensure that the innovative ability of the student, often hidden until this stage in their education, is brought out during the education process.

The personal profile and personality characteristics of the students (“inputs”) are important to define before the content or teaching focus is finally decided upon. It is at this stage that many of the needs of the workplace can be accounted for and accommodated in the content, teaching, and delivery process. A useful method of ensuring this detail is collected is through the completion of an *entry questionnaire* or *entrepreneurial self-assessment questionnaire*. This assists the students to determine their own levels of self-awareness and interest in both disciplines, which they are studying.

Process

As with any process, it is important to convert inputs to outputs. The education process for entrepreneurship courses should include both content and teaching focus. While these can be dealt with separately, it is important that they are also integrated to ensure that the objective(s) is achieved. Decisions on one of the stages will impact and influence the other.

Content Focus

The process framework includes IT content (Figure 1). The content focus presented provides students with an understanding of ICT topics and of the stages of the entrepreneurial process in a holistic manner to highlight the synergies that exist between both areas. When educating the ICT graduate (regardless of whether they are working towards entrepreneurship), we need to consider the skills that they require. They should be provided with topics such as programming and design; they need to understand the hardware and software underlying computer processing; they need to understand the algorithms and logic involved in computing; and they need to have specialist skills such as graphics design and genetic algorithms. Furthermore, they need to be kept up to date with progressions within science, engineering, and technology, for example, bioinformatics and nanotechnology (EGFSN, 2004). Depending on the focus within ICT courses, different skills will be taught by the educators. What is important is that the content of such a course is given due consideration, and the graduate is provided with the correct mix of skills which can introduce them, in this case, to the entrepreneurship labour market.

Entrepreneurship Subject Focus

The students should be educated in entrepreneurship and innovation for new start-up businesses

in the ICT sector, and entrepreneurial behaviour within larger organisations should be presented in tandem with the aforementioned ICT content. The key topics here introduce students to the theory and practice of entrepreneurial creativity and innovation, providing an understanding of the nature of entrepreneurship and the characteristics of the entrepreneur. They should also examine the role of the sociocultural and economic environment in fashioning innovative entrepreneurship. In addition, the topic should examine technical entrepreneurship and the process of managing innovation. As there is a very practical and applied emphasis on the topic students must be encouraged to generate a number of business ideas. The ideas should be as practical as possible and related to market and business opportunities. After initial research and evaluation, an idea can be selected for the development of the business plan—topics to be covered include the importance of marketing and market research. Issues such as secondary and primary research, industry analysis, competitive advantage, identifying target markets, product/service development, manufacturing/operations, forecasting demand, intellectual property, market/sales strategy, legal forms of organisation, and sources of finance can be presented as to how they apply to the start-up firm.

Other “content focus” topics such as marketing; accounting and finance; and human resources are often not associated with the study of ICT. The provision of these within entrepreneurship modules will add value to the knowledge of necessary business subject areas and also develop the skills base to encourage more enterprising behaviour.

Soft Skills: Content Focus

Furthermore, to survive in their careers, graduates from ICT entrepreneurship education need to have soft skills such as communication, presentation, and writing skills. They need to be able to communicate effectively with their peers, management,

and subordinates. Additionally, as entrepreneurs, they need to be able to present themselves effectively with the business community around them, while also being capable of marketing their potential product/service to customers. They will have to face challenges such as presenting business plans to potential investors and making internal changes which affect employees. The challenge for us as educators is to provide graduates with these skills, while making sure that the breadth of the subject does not cause the depth to be eroded. This is ensured by adopting multiple flexible delivery and teaching methods.

Teaching Focus

Traditional lecture-driven teaching methodologies are not relevant to entrepreneurship courses. Kirby (2002) argues that these traditional approaches may inhibit the development of entrepreneurial skills and characteristics. Therefore, the role of the trainer moves from the traditional “sage on the stage” to becoming a “guide on the side” (Hannon, 2005). The trainer needs to adopt the role of coach, mentor, and challenger and have the ability to provide feedback in a constructive and relevant manner.

The teaching process should focus on “active learning” and “problem based learning” (Postigo & Tamborini, 2002). Active learning places less emphasis on transmitting information to the student. Instead, greater emphasis is placed on the student exploring their own skill, competencies, and general self-awareness. The use of problem-based learning can result in the development of other important skills. In a problem-based learning environment, either on their own or in teams, students assume responsibility for solving problems, which are practical and relevant to the various subject areas. It encourages creativity, resourcefulness and tests the student’s ability to make decisions, take risks, and analyse a situation. Essentially, the combination of both approaches provides students with personal and career de-

velopment. Galloway, Anderson, Brown, and Whittam (2005) suggested that role models, guest speakers, and case studies can inspire urgency in entrepreneurial intent. They can contribute to knowledge about and encourage skills development such as self-efficacy, confidence, initiative, and problem-solving skills. These methods can be used as part of active learning and problem-based learning approaches.

Delivery of entrepreneurship courses is often primarily dependent on a few key faculty members. These faculty members need to be equipped to deliver courses, which are often less lecture driven, less theoretical, and require a level of entrepreneurial behaviour. This is a key issue for consideration and is indeed an area worthy of further research. Research by Hytti and O’Gorman (2004) in a comparative study of entrepreneurship programmes across a number of countries (Ireland being one), found that the trainers lacked the skills and information required about entrepreneurship to provide students with the necessary skills and knowledge for entrepreneurship education. They recommended the need for in-career training to support and address the needs of the trainers to ensure they are better equipped.

As concluded by Hannon (2005), how can growth in graduate entrepreneurship be achieved without competent and capable trainers? There is a need to examine the quality and experience of entrepreneurship educators, their level of experience or exposure to entrepreneurship, and the training and development opportunities that are available and accessible. Other key attributes required are the willingness to give time and commitment to the delivery of such courses. As was previously discussed, entrepreneurship should be delivered across disciplines, therefore there is a need to encourage team teaching where faculty from the business disciplines cooperate with faculty members from nonbusiness disciplines to cover the range of technical and nonbusiness subject topics.

Focusing then on ICT entrepreneurship, teaching should be performed in three ways: (1) didactic, (2) skill building, and (3) discovery. Didactic teaching is important in presenting information to students. This is useful where we need to impart information to students, for example, lectures, reading, and video clips are often used. In the case of ICT entrepreneurship education, topics such as intellectual property rights may be covered solely through didactic teaching. However, most of the subjects presented in the content focus for ICT entrepreneurship will require some element of didactic teaching combined with other forms of teaching.

Skill building allows the students to interactively become involved with the topics being studied. Methods such as group discussions, projects, and problem solving are often used during skill building. In ICT entrepreneurship education, much of what is required is that students build their skills through such interactivity. By doing this, not only do they become more familiar with the skills that are required to become good entrepreneurs, but they also are presented with the situation where they are trying out these skills. In ICT entrepreneurship education, it would be unusual to teach subjects through skill building only—it is normally taught starting with didactic teaching and followed by skill building. Subjects such as design, new product development, and marketing would be part of this process.

Furthermore, discovery can also be used as a teaching method. Discovery allows students to develop their self-awareness and the inputs which they brought with them to a course through reflective practice either in an individual or group situation. In ICT entrepreneurship education, discovery is important as the drive and intuition for entrepreneurship often comes through the “inner-self” combined with prior knowledge. Methods of discovery in teaching include brainstorming, personal goal setting, and consultancy and combined with didactic and/or skill building, can be

used successfully in teaching subjects such as idea generation, innovation, and research.

The teaching process aspect is critical to ensure that identified skills and knowledge objectives are achieved. The teaching focus should also take into consideration the obstacles that militate against participation in ICT entrepreneurship education. The focus should combine both formal and informal teaching methods and also encourage topics such as problem solving and career planning. The teaching focus should provide students with the knowledge of not just “what” to do but “how” to do it.

Teaching Focus and Content Focus: Creating the Links

One of the difficulties experienced by ICT educators is the changing pace of technology. Therefore, we need to ensure that students are not only equipped with the “current” ICT knowledge base at time of graduation, but furthermore, are equipped with the skills to update their knowledge as required. To tell them about current trends and knowledge can be done through didactic teaching. However, to allow them to apply this knowledge, skill building methods emphasising action and problem-based learning should be incorporated. It is not enough, for example, for the student to be shown how to write a program—they must experience writing a program for themselves before they can really understand how to do this correctly. Furthermore, discovery teaching provides students with a learning process which will equip them with the ability to continue educating themselves throughout their career.

The combination of content and teaching focus can provide students with an understanding of the stages of the entrepreneurial process. The completion of a business plan in an interdisciplinary team provides the student with a practical and realistic insight into how self-employment in the ICT field can at some stage be a career option for them. The process focus should combine both formal and

informal teaching methods, encouraging topics such as problem solving and career planning.

Outputs/Assessment

Robertson, Collins, Wilson, and Lyewlyn (2003) stated that assessment and examination form the basis of how well the student has utilised time and resources available to them to accomplish the objectives of the course studied. Conventionally, at third level, a final examination—which is generally theory based—forms the primary component of assessment. Gibb (1996) and Henry, Hill, and Leitch (2003) suggest that entrepreneurship education does not fit neatly into these models of assessment of the traditional examination.

Assessment methods need to mirror the objectives of the ICT entrepreneurship courses and also accommodate the different nontraditional teaching and delivery methods discussed previously.

Institutional Environment for Entrepreneurship Education

In the broader context, an influence on the acceptance and encouragement of entrepreneurship education programmes is the culture, systems, and structures of the actual educational institution. The institutional environment includes the resources, facilities, and general support that entrepreneurship programs are provided, within the educational institution itself. The “entrepreneurial nature” of the institution is tested and exhibited in their recognition and support or otherwise of entrepreneurship programmes.

As is seen from the explanation of the framework, entrepreneurship education is process driven, which requires a level of integration and synergy between a number of elements. It is essential that integration exists between the content and delivery elements and indeed integration can occur within these elements. This level of integration is imperative to ensure the specific needs of the “inputs” are addressed in a relevant

Creating an Entrepreneurial Mindset

manner and the desired outputs of this group are materialised.

In summary, the process framework of entrepreneurship education provides for a flexible and adaptable approach for the delivery of entrepreneurship education to diverse groups of students. The framework can be customised to meet the specific needs of a targeted group. This level of customisation is allowed for by the consideration of and starting the process from the review of the inputs. This customisation is now examined by presenting how current courses offered within the University of Limerick can be adopted to suit the needs of the ICT student.

To date, participating students have come from disciplines such as equine studies, wood science, and public administration programmes. Based on the framework presented, we integrate the content and process of these courses. Given its success with these nonentrepreneurship students, we expect that the use of the framework can indeed support the integration of ICT and entrepreneurship, ultimately creating an ICT entrepreneurship mindset. These programs adopt a multidisciplinary and intercollegial approach.

ENTREPRENEURSHIP AT THE UNIVERSITY OF LIMERICK

The first entrepreneurship initiative was introduced at the University of Limerick in 1983. Courses introduced since then have been designed to develop and transfer knowledge about the enterprise process. They are expected to encourage students to examine entrepreneurship as a viable career option. Courses operate at both undergraduate and graduate levels. They range from structured courses consisting of lectures, assignments, case studies, and readings to innovative integrated courses where students actively participate in the small business sector, develop business plans, and are exposed to prominent entrepreneurs, both national and international.

The two courses that we present are described in terms of their objectives, input (student group) the process (content and teaching), and outputs (assessment) taking ICT entrepreneurship into account. The first course is currently a broad course aimed at students in the third year of their undergraduate business studies degree programs. The second course is aimed at final year students and is thus a “capstone” module within their undergraduate degree programs in business studies, equine science, wood science, and public administration.

Course 1: Enterprise Development

This course exposes students to the process of entrepreneurship and the stages of developing a new business from idea generation to final preparation and presentation of the business plan. It provides hands-on experience in the creation and development of a new business venture. Students, in teams, take a multidisciplinary approach to the preparation of a professional business plan. For the ICT student, this business plan should focus on the changing trends in the industry, thus identifying potential business opportunities that can be developed into viable business ideas. For example, they could focus on the medical device industry, where software is a growth sector in Ireland.

Objectives

A number of objectives, tangible and intangible are incorporated into the development of the course. Primary objectives are:

- To develop sophistication in creating a new venture, including skills in evaluating, preparing, and presenting a business plan (combination of tangible and intangible objectives).
- To create in the student an entrepreneurial mindset and a sense of entrepreneurial behaviour, which can be effectively used in

a number of different work environments (intangible objective).

- To provide the students with the insight and knowledge to understand the changing requirements of the ICT industry and how it might affect future business plans (tangible and intangible objective).
- To facilitate students in the development and application of the analytical and decision-making skills necessary in formulating, implementing, and controlling a business plan and in the development of a prototype of their proposed idea (tangible and intangible objective).
- To establish project creditability and improve students' presentation and communication skills (tangible and intangible objective).
- To encourage students to enter the "Enterprise Ireland Student Awards 2006," a national competition run by Enterprise Ireland (tangible objective).

Inputs: Student Group

The content of the course should assume no prior knowledge of entrepreneurship by the students. However, in this course, students are expected to have prior knowledge of information systems, the ICT industry, and a general understanding of business. Given this requirement, participating students should have a diversity of relevant backgrounds and not be limited to ICT knowledge, which could happen if a number of disciplines are not involved. Team members should also demonstrate this diversity. Other inputs mentioned in Figure 1 will vary depending on the individual students (for example, gender, motivation, and confidence).

Process

The aforementioned objectives are achieved by the integration of the content and teaching process.

Content Focus

The content focus should provide fundamental knowledge and insight into entrepreneurship and starting a small firm. Students need to be given detail on the importance of entrepreneurship activity for the development and future of the ICT sector. They also need to understand how a changing ICT sector will affect the ICT business of the future and be capable of integrating this into their business plan. Other topics to be covered include: evaluation of business opportunities; market research; industry analysis; marketing and sales strategies; management structure; product and service development; manufacturing and operations; start-up finance and return on investment; and financial projections. It is clear from this list that significant business content is required in this module. Through the provision of an understanding of the components of the business plan, students learn to integrate both their prior knowledge brought into the course and the new knowledge that they learn within the course. Students are introduced to the alternative ownership structures (sole trader, partnership, limited company), where the advantages and disadvantages and the legal implications of the options are debated.

From the soft-skills perspective, the course is expected to guide the student on assembling and writing a business plan in a professional manner.

Teaching Focus

To ensure the objectives presented are met, our experience is that we must include a combination of delivery methods in this course.

Formal lectures (didactic methods) are required to present some of the content of this course. This includes the theoretical aspects of establishing a business, how to assess viable business ideas, investigating the market, assessing customer demand, formulating a business plan, and identifying sources of finance. It should also include relevant

Creating an Entrepreneurial Mindset

ICT-related topics such as future expectations of the ICT industry and how developments within the ICT industry will change the nature of their proposed business. Content of lectures would be guided by a recommended text, supplemented by journal/paper articles, reviews, and cases.

In our entrepreneurship courses, we consider the inclusion of guest speakers from government development agencies, financial institutions, professional organisations representing the ICT sector (for example, Irish Software Association, ShannonSoft), and owner/managers from industry as an important aspect to any entrepreneurship course. Through presentation of past experience, they can convey a level of knowledge and context to students. Furthermore, they can encourage discussion and self-analysis by the student as to their interest and ability to pursue self-employment. These methods place emphasis on identifying where the theory and practice link together in a real-world situation.

Workshop sessions (discovery learning) are used to support students in developing their business plans. Students, in their project groups, would be expected to attend one workshop session per week. In these sessions students should provide an update on their progress while the faculty member provides feedback. The workshop will ensure that problems or issues in the progression of the development of the business idea for the group are identified as soon as they arise. Through the use of scenarios, role-playing, and peer review students can enhance their communication, decision making, and presentation skills.

Outputs: Assessment

While we expect this to be a 100% project-based course, the assessment should include a breakdown of milestones, transparent to the student, indicating what is required from them. This is indicated in the course description given to students on the commencement of the course. These include:

Project management

15% - Individual grade

New product/service proposal

10% - Group grade

Progress report

20% - Group grade

Final business plan

55% - Group grade

Project management should examine the student's ability to work in a team and how they contribute in a constructive manner to a team scenario to complete their final project. Criteria for assessment should include time management, people management, conflict management, the ability to adhere to deadlines, the ability to make decisions and their resourcefulness in solving problems. This improves the student's ability to manage their time and resources in a more effective and productive manner.

How the student's creative and opportunity-sensing skills are developed should be examined through the new product/service proposal. This can assess the submitted business idea in areas such as the source of idea; rationale for submission of idea; potential market; knowledge and understanding of ICT industry; and competitive opportunities.

A complete business plan must be drawn up with a design of the product/service to be produced. This should be a significant submission and the guideline length is 25 pages, excluding appendices. Projects should show some degree of *innovation*, must be *feasible* and *marketable*. The business idea should be as practical as possible and relate to direct opportunities observed in the Irish ICT economy.

The progress report and the final business plan will test the ability of the student to link and integrate all the elements and stages of developing a new business idea. It also examines

written communication and presentation skills in report writing.

This course highlights how, with the understanding of the characteristics of the students, suitable and relevant targeted content and delivery methods are devised to create a more enlightened knowledge about the process of identifying a business opportunity and transforming it into a potentially viable business and career option. Through active engagement in this action-based learning process, the student also develops and enhances a range of important life-long skills such as greater self-awareness and increased confidence, team-working skills, communication, and decision-making skills.

Course 2: Small Business Consultancy

The second course we present here also uses the components of the process framework as a guide to its development. However, this course is aimed at fourth year students who are expected to embark on the workplace within the following 12 months. Also the emphasis in the teaching and content area is focused on discovery and problem-based experiential learning. This course is unique in that there is an added component—the small firm. As the course involves small firms they form another input element that needs to be considered in the course development.

To be successful, this course should be promoted by both the institution presenting the course and local development agencies and small firms. It should offer small ICT businesses a consultancy service to identify and solve a business problem. Currently, in the case of the University of Limerick, where this course is run with non-ICT-related courses, interested small firms are matched with a team of students who act as consultants to assist the owner/manager to solve a business problem or develop their business further. Thus, in the future, students can provide confidential managerial assistance to local ICT firms. Typical assignments

would include: feasibility studies, business plans, marketing plans, and market research reports. Students can benefit enormously from this experience as they have the opportunity to apply experiential knowledge and concepts learned in the classroom to real-life business situations. The nature of the business consultancy course will involve close working relationships over a semester, which at the University of Limerick constitutes 14-week period, with owner/managers of the various companies assisted. The students are not placed in the client firm. The students are facilitated and guided through the consultancy process with a faculty member. The emphasis is on problem-based learning.

Objectives

Tangible and intangible objectives need to be incorporated into the development of the course. The focus here is the provision of a capstone course for students who are about to graduate. Consequently, the main emphasis is on intangible objectives. The objectives include the following:

- To introduce students to the principles and processes of management consultancy within the ICT industry (intangible objective).
- To provide practical hands-on experience of engaging with the client organisation in a professional consulting capacity (intangible objective).
- To give the student an opportunity to bring up-to-date ICT knowledge into the industry (tangible objective).
- To provide students with an opportunity to conduct desk research and primary research (tangible and intangible objectives).
- To develop students' report writing skills (tangible objective).
- To improve students analytical, communication, and presentation skills (tangible and intangible objective).

Creating an Entrepreneurial Mindset

- To improve the student's understanding of the practicalities of the roles and tasks assumed by the owner/manager in the operational and strategic management of a small firm. (intangible objective).
- To provide students with the capability of advising ICT owner/managers in a professional manner (intangible objective).

Overall, the course in fulfilling personal and career objectives for the student, in tandem fulfills objective of problem solving and learning for the small firm client.

Inputs

Input 1: Student Group

For this course, students should bring prior knowledge of general entrepreneurship and of general business functions to the course. They would also be expected to have an understanding of basic business terms, an understanding of the ICT theory, and an understanding of the trends in the industry. This understanding should include product life cycles, for example, if they are software students they should understand software process and software development life cycles. Students at this stage are more focused on career decisions.

Input 2: Small Firm (the Client)

The added input dimension, as referred to previously, is the client firm. The characteristics of the firm such as their stage of firm development, the nature of the business problem, the willingness of the client to adhere to the requirements of the course, and the understanding of the client of the limits of student resources and expertise are factors that need to be considered for suitable matching of client and student teams.

The characteristics of both sets of inputs require consideration in the design of the content

and, in particular, the design of the teaching and delivery methods to ensure they successfully facilitate and support the student in the completion of their assigned tasks.

Process: Content and Teaching Focus

A very high level of integration between the content and teaching focus is required to achieve the stated objectives. In order to highlight this, we describe this integration and discuss how the course should be delivered from teaching and content perspectives.

During the first week teams of four to five students should be created in the class. Each team should be interdisciplinary, ensuring a well-balanced focus on entrepreneurship and ICT expertise within the group. The team requires a brief indicating the client needs and expectations. A meeting must be held between the client, student team, and faculty member. The purpose of this meeting is to familiarise the client and student team with each other and to discuss the requirements of the project in detail. Subsequent to this meeting the consultant team should devise a research proposal. The research proposal should indicate clearly what the agreed objectives of the research are, the proposed methodology that will be used to address the objectives, and a project log, which indicates the milestones and the time management of the project. This should be sent to the client, with a follow up telephone call by students to discuss any queries. Any modifications to the research proposal should be made at this stage. This modified document will guide the completion of the research. From a teaching perspective, there will be a minor component of formal lectures. However, teaching should be primarily driven by workshops, thus providing discovery learning. This should be completed by week three of the semester.

During the remainder of the 9 weeks, through some formal lectures, the students should be familiarised with the theory of consultancy. They

should also be integrating this knowledge with the ICT knowledge that they are bringing to the group so that they are familiar with the particular company in which they will be involved. Furthermore, it is useful if guest speakers are invited to talk to the class. This would include at least one guest speaker who is a consultant and who can explain their consulting experience and the methods he/she uses to consult. Members of a development or funding agency who are involved in assessing completed consultancy projects on behalf of the clients can also provide relevant insights to the students.

During these weeks the students should provide a progress report to both the client and faculty member on a weekly basis. They need to meet with their faculty member for a 1-hour workshop to review progress and address issues emerging in the research.

In the 10th week, students should deliver a draft report to the faculty member they work with, who can make suggestions about additions or modifications that will be required to meet the client's needs. In the 12th week, the consulting group should resubmit the draft report with the recommended changes. This can then be presented to the client as the final output of the consulting relationship. In the final week the student team undertakes a formal oral presentation of the findings of the research to the client and faculty member.

This process engages the student in skill building and discovery learning. The use of case studies, interactive workshops, questioning, group discussion, and client briefings will all facilitate the student to take responsibility for their learning and will ensure it facilitates them in the achievement of their objectives within a certain time frame.

Assessment: (Outputs)

As with course 1 that we described, this course assessment will also be based on the project,

but again should be broken into transparent milestones.

Project management and project log
30% - Individual grade

Draft report
30% - Group grade

Final project report
25% - Group grade

Project presentation
15% - Individual grade

The combination of assessments ensures that ongoing learning is assessed on both an individual and group basis. Having individual and group assessment will test the student's ability to work and contribute to a team set up while also demonstrating the ability to perform on their own.

In this course there are two elements that can be assessed individually. Project management is similar to the previous course. An added dimension in this course is the requirement for the individual student to maintain a schedule of their activities and contribution to the project. This examines how the individual contributes to the team in areas such as attendance at all meetings, adherence to deadlines, constrictive feedback to other team members, new ideas/innovations brought to the team, what strengths they brought to the team, and in what areas they could have performed better.

We envisage that less weighting will be given to the final report (25%) than in course 1. This reflects the need for the student team to have ongoing outputs, which feed into the final report. Thus, we include a grade for the draft report. These interim assessments examine the process and not the outcomes or the final physical report.

The final assessment can critique how professionally and articulately the student, as both a team member and an individual, can communicate the

findings of the research and make a set of realistic and practical recommendations to the client. The assessment also includes feedback from the client firms to ascertain their level of satisfaction with the consultancy process. Interestingly they can also learn from the experience and participation.

This course, through problem-based learning, can, in a practical sense, engage the student with the world of work in an ICT small firm. They can be given the responsibility to make decisions that will be implemented in a real life scenario. It can create a sense of confidence of dealing with owner/managers, improve their ability to hold meetings, write proposals, and make decisions. They can demonstrate their ability to justify the rationale for these decisions which are supported by practical suggestions for their implementation.

Educating for ICT Entrepreneurship

For the disciplines where the programs are currently run, the University of Limerick has evaluated the impact of these programs from an employer and student perspective. Feedback received has demonstrated that we are providing enterprising graduates for the existing workplace. This has been particularly evident in the development of skills and competencies in innovation, team work, and decision making. Furthermore, graduates from this program have started their own businesses and an increasing number of graduates consider business start-up as a career option at some stage.

Through the presentation of these two courses we have demonstrated that the process framework for entrepreneurship education is an effective mechanism and guiding tool to devise skills and competency-based courses to create and encourage more enterprising activity in the ICT student. As is seen from the profiling of two courses, entrepreneurship courses need to be flexible and adaptable to meet the needs of the students in different disciplines and can also simultaneously benefit the broader small firm ICT community in that region.

The process framework for ICT entrepreneurship education can be used to achieve the required combination of professional, personal, and competency skills development. However, we argue that if ICT entrepreneurship education is to become more mainstream in educational institutions, then there is a need for more specific targeting of government policy at a number of levels, which are discussed in the next section.

CONCLUDING COMMENTS

Education has the responsibility to prepare graduates to embrace and be equipped to contribute positively to the workplace either as an employer or employee. The third-level educational system needs to address these changing needs through the development of more ICT entrepreneurship courses. This should be supported by effective policies. We have shown how the process framework for ICT entrepreneurship education is an effective mechanism to guide the design and development of such courses. This process framework emphasises the importance of understanding the needs of the student. An informed context (situational and personal) of the student will then allow for relevant and targeted design of the content, teaching, and assessment of proposed courses. The characteristics of the broader educational institution environment also needs to be considered. The courses presented acknowledge these factors and result in effective and integrative courses, which foster the creation of entrepreneurial mindset in the ICT graduate. It is important that such programs are integrated in a more mainstream manner into ICT curricula. In order to do this policy issues need to be considered.

Collaboration and Cooperation

As was discussed, there are a number of stakeholders involved in the design and implementation of effective entrepreneurship programmes. From a strategic policy level there is a need for

greater communication and coordination in the development of policies devised by departments of education and science and enterprise and employment. This coordination will ensure that policies devised for educational courses are relevant to the needs of the changing workplace. It will also ensure implementation and support at the government level.

At an operational level, greater exchanges and discussion should exist between departments of education and science, third-level institutions, and teachers associations. This is important to ensure change is encouraged and implemented without resistance.

During the development of ICT entrepreneurship education, we as educators need to ensure that the needs and changes in the ICT sector are addressed in course design and development. Demonstration of the importance of these programs must be highlighted through formal evaluation of these initiatives. This requires cooperation and strong working relationships between the third-level institutions and ICT representative organisations such as the Irish Software Association, Enterprise Ireland, and Forfás. Furthermore, these linkages would encourage a positive disposition towards sponsorship.

Resource Allocation

As discussed, ICT entrepreneurship education design and implementation requires extra resources in terms of time, faculty, and physical resources. To ensure the development and promotion of such courses, specific funding should be allocated, and resource allocation models should acknowledge their resource-intensive nature. Creating courses that integrate entrepreneurship with ICT will make for a better educational experience for the student, the institution, and the economy. There will be no return on investment without investment in the first place.

Institutional Commitment to the Trainers

We also noted that to implement successful ICT entrepreneurship courses requires that the teaching process is different from traditional lecture-driven approaches. This teaching process must include the different forms of teaching: didactic, skill building, and discovery. Given that this teaching requires involvement from different sources (such as local industry) and use of methods not prevalent in teaching, there is a requirement for the commitment and buy-in of the educational institution and the individual faculty. Also, as skill building and discovery teaching take more time and effort than didactic teaching, those who are involved in this should be rewarded for their involvement. It is imperative that if such courses are to be sustained and become more mainstreamed in universities then there is a need for management and institutional procedures to acknowledge, accommodate, and encourage such courses. There needs to be a general culture conducive to enterprising behaviour in the institution. This may take the form of a reduced teaching load or the recognition for the development of such initiatives in faculty promotions models.

CONCLUSION

The demands of the workplace in Ireland are changing in terms of the type and profile of growth-industry sectors. The development of the small-firm sector continues to be important for the Irish economy, in particular sectors such as the ICT sector. ICT and entrepreneurship must be combined to ensure that we have a strong indigenous ICT sector to continue this economic growth.

REFERENCES

- Audretsch, D. B. (2002, July). *Entrepreneurship: A survey of the literature*. Prepared for the European Commission. London: Enterprise Directorate General, Research (CEPR).
- Baig, K. (2004). *The real purpose of education*. Retrieved from www.youngmuslims.ca/articles/display.asp?ID=44
- Central Statistics Office. (2004). *Information Society statistics—Ireland 2004*. Dublin, Ireland: Government of Ireland.
- Chell, E., & Allman, K. (2003). Mapping the motivations and intentions of technology oriented entrepreneurs. *R&D Management*, 33(22).
- De Faoite, D., Henry, C., Johnson, K., & Van der Sijde, P. (2003). Education and training for entrepreneurs: A consideration of initiatives in Ireland and the Netherlands. *Education and Training*, 45(8/9).
- Department for Education and Skills (DFES). (2002). *Howard Review of enterprise and the economy in education*.
- Department for Education and Skills (DFES). (2003, January). *The future of higher education*. Paper presented to Parliament by the Secretary of State for Education and Skills.
- Enterprise Ireland Strategy Group. (2004). *Ahead of the curve: Ireland's place in the global economy*. Dublin: Irish Government Publications.
- Europa. (2003). *Webs' definitions of micro, small and medium sized Enterprises*. Retrieved from www.europa.eu.int/scadplus/leg/enlvb/n2606.htm
- Expert Group on Future Skills Needs (EGFSN). (2004). *Submission to the forum on the workplace of the future*. Retrieved from www.skillsireland.ie
- Forfás. (2004). *Employment survey*. Retrieved from www.forfas.ie
- Galloway, L., Anderson, M., Brown, W., & Whitlam, G. (2005, May). *The impact of entrepreneurship education in HE*. Report for Business Education Support Team.
- Galloway, L., & Brown, W. (2002). Entrepreneurship education at university: A driver in the creation of high growth firms. *Education and Training*, 44(8/9).
- Gibb, A. (1996). Entrepreneurship and small business management: Can we afford to neglect them in the twenty-first century business school? *British Journal of Management*, 7, 309-321.
- Global Entrepreneurship Monitor. (2003). *How entrepreneurial is Ireland?* Department of Business Administration, University College Dublin. Retrieved from www.gemconsortium.org/download.asp?fid=327
- Global Entrepreneurship Monitor. (2004) *Global Entrepreneurship Monitor 2004—National and regional summaries*. Retrieved from <http://www.gemconsortium.org/>
- Hannon, P. (2005, November). *Graduate entrepreneurship in the UK: Defining a research and education policy framework*. Twenty-eighth National Institute for Small Business & Entrepreneurship Conference.
- Henry, C., Hill, F., & Leitch, C. (2003). *Entrepreneurship education and training*. Ashgate, Aldershot, UK.
- Hynes, B. (1996). Entrepreneurship education and training—Introducing entrepreneurship into nonbusiness disciplines. *Journal of European Industrial Training*, 20(8).
- Hytti, U., & O’Gorman, C. (2004). What is enterprise education? An analysis of the objectives and methods of enterprise education programmes in

four European countries. *Education and Training*, 46(1).

ICT Ireland. (2003). Creating a world class environment for ICT entrepreneurs.

ICT Ireland. (2005). *Key industry statistics*. Retrieved from http://www.ictireland.ie/Sectors/ict/ictDoelib4.nsf/vlookupHTML/key_industry_statistics?OpenDocument

Kirby, D. (2002, November). Entrepreneurship education: Can business schools meet the challenge? *RENT Conference*, Barcelona, Spain.

Krueger, N., Reilly, M. D., & Carsrud, A. L. (2000). Competing models of entrepreneurial intentions. *Journal of Business Venturing*, 15.

Martin, L. M. (2004, June 11). Developing an international entrepreneurship programme; A work in progress. *IEEE Conference*, University of Wolverhampton, UK.

Martin, L. M. (2005, November). Technology and graduate enterprise education; Innovation management exercise IMIE. *Twenty-eighth National Institute for Small Business & Entrepreneurship Conference*.

National Committee of Inquiry into Higher Education (NCIHE). (1997, July). *Higher education in the learning society (The Dearing Report)*.

Postigo, S., & Tamborini, M. F. (2002, July). Entrepreneurship education in Argentina. *International Entrepreneurship Education and Training Conference, IntEnt*.

Rand, A. (2004). Retrieved from www.teachersmind.com

Revenue Commissioners Statistical Unit. (2003). *Annual Report 2003*. Dublin, Ireland.

Robertson, M., Collins, A., Wilson, K., & Lyewlllyn, D. (2003). Embedding entrepreneurial studies across the curriculum paper. *Twenty-sixth National Institute for Small Business & Entrepreneurship Conference: SME's in the Knowledge Economy*.

Small Firms Association (SFA). (2003). *Small Firms Association Annual Conference*.

Trauth, E. M. (2000). *The culture of an information economy: Influences and impacts in the Republic of Ireland*. Boston: Kluwer Academic.

ENDNOTES

- ¹ In Ireland, students attend second-level education from age 12-18 (approx). They then attend third-level institutions (universities, technical colleges) to complete undergraduate courses, which range from 1 to 4 years (Undergraduate Certificate, Undergraduate Diploma, Pass Bachelor Degree, Honours Bachelor Degree). The discussion in this chapter relates to Honours Bachelor Degree programs.
- ² Entrepreneurial activity as classified in the GEM (2004) study incorporates two indicators, namely, the level of activity of individuals thinking of starting a business (nascent entrepreneurs) and secondly the established firm (up to 42 months in operation).
- ³ We want to clearly distinguish between IT skills and ICT education. IT skills include desktop packages as mentioned in this section. ICT education is the education of graduates in subjects such as software engineering, computer science, and computer engineering.

This work was previously published in Information Systems and Technology Education: From the University to the Workplace, edited by G. Lowry and R.L. Turner, pp. 105-127, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 6.25

Working at Home: Negotiating Space and Place

Tracy L. M. Kennedy
University of Toronto, Canada

ABSTRACT

This chapter explores the work-family interface by investigating home as a potential work space that must still accommodate the social and leisure needs of household members. By examining spatial patterns of household Internet location, this chapter investigates the prevalence of paid work in Canadian homes, illustrates how household spaces are reorganized to accommodate the computer/Internet, and examines how the location of Internet access is situated within sociocultural contexts of the household and how this might affect potential work-from-home scenarios. Data collected from a triangulation of methods—surveys, interviews and in-home observation—also illustrate the relevance of household Internet location from an organizational perspective. The relationship between individuals and business organizations is interactive and integrative, and the home workplace is complex and blurred with other daily social realities, which influence effective work-at-home strategies and potentially shapes productivity and efficiency.

INTRODUCTION

The nature of work is changing in today's information society, especially with the prevalence of information and communication technologies (ICTs) in the home. In many instances paid work is relocating to the home, which offers people more flexibility, yet often less clear boundaries between work and household (Sullivan & Lewis, 2001). There has been considerable literature concerning how paid work at home—or telework¹—is detailed, outlining numerous positive and negative features of working from home, and the impact of paid work at home on the household and organizations (Armstrong, 1997; Dimitrova, 2003; Frissen, 1992; Gurstein, 2001; Haddon & Brynin, 2005; Hardill & Green, 2003; Salaff, 2002; Stanworth, 1997). Despite conflicting analyses and debates about the impact of telework on individuals and organizations, little attention has been paid to the spatial semantics of organizing the location of household ICTs to compliment (or hinder) not only leisure and social use, but also work related tasks and work-at-home scenarios. If indeed busi-

nesses and organizations wish to encourage their employees to work at home, then it is important to think about how individuals spatially organize household ICTs and what impact this has not only on work performance and productivity, but also household members.

Most recent statistics in Canada indicate that Canadian Internet use is highest from home, with 62% of households using the Internet at least once a day, on average, from home (Statistics Canada, 2002). Canadian statistics (Statistics Canada, 2001a) also reveal that from 1996-2001, more people chose to work from home than ever before (1,175,760 billion, or 8% of the working population), and that most people who work at home live in urban areas. Having the Internet in the home has changed the way people think about work, how they do their work, and ultimately where they do their work.

This chapter explores the work-family interface by investigating the construction of the home as a potential work space that must still accommodate the social and leisure needs of household members. By examining spatial patterns of household Internet location, this chapter will:

- investigate the prevalence of paid work in Canadian homes,
- provide an overview of household Internet locations,
- illustrate how household spaces are reorganized to accommodate the computer/Internet, and
- examine how the location of Internet access is situated within sociocultural contexts of the household and how this might affect potential work-from-home scenarios.

We also need to consider the relevance of household Internet location from an organizational perspective. While there may be numerous benefits of paid work at home (or telework) to both the individual worker and the organization, there is a need to think about a construction of

telework that incorporates individual and business needs and expectations. Examining the practices involved in deciding household Internet location provides sociocultural context to decision-making processes regarding paid work and ICTs in the home: “new organizational, social and personal relationships may accompany these new spatial arrangements, highlighting the entangled interrelations between space, work and organization” (Halford, 2005, p. 20).

The Connected Lives Project

The Connected Lives Project is a Canadian study led by Professor Barry Wellman who heads NetLab at the University of Toronto. The project, funded by the Social Science and Humanities Research Council, consists of six graduate students and numerous research assistants in the greater Toronto area. The goal of the research project is to learn about how Canadians communicate with their friends and family, providing an in-depth investigation of how the Internet is affecting the “everyday life” of Canadians and how the Internet is embedded in daily routines and practices. Where most studies until now have focused on who uses the Internet, the Connected Lives Project focuses on how different kinds of users (and nonusers) of new communications technologies engage in social relationships and community. The research design employs a methodological triangulation including surveys, interviews, and observations.

Survey: The 32 page survey for the Connected Lives Project was developed between November 2003 and June 2004 by the NetLab research team. English-speaking adult participants over the age of 18 in East York were randomly sampled in June of 2004 and 621 households were sent an information letter regarding the research project and later contacted in person and by telephone to set up interview dates. With a response rate of 56%, 350 surveys were completed between July 2004 and March 2005. Each survey took 1-2 hours to

Working at Home

complete. Surveys included questions regarding the use of new communication technologies and the nature of their contact, on and off-line, with friends and relatives that are both near and far.

Interviews: The interview schedule was also developed by the Connected Lives team between September 2004 and January 2005. Participants who completed the initial survey were asked if they were interested in a follow-up interview. The response rate was 85% of those survey respondents who wrote “yes” or “unsure” when asked at the end of the survey if they would be willing to be interviewed. In-home, semi-structured interviews were conducted between February and April 2005 with one fourth of the survey participants (n=87).

The interviews were conducted by Connected Lives doctoral students and took 2-4 hours and provided detailed information about household relations, Internet use, travel behavior, social networks, and information seeking, which provided a better and more comprehensive understanding of initial survey questions. In households with a computer, we asked permission to take a digital picture of where the computer with Internet access was located. This provided NetLab researchers a visual depiction of not only computer and Internet technologies, but also a visual representation of where Canadians are using the Internet in their homes and what is going on around them.

Observations: Once the interview was completed and if the interview participant had a household Internet connection, we asked the participant to demonstrate how they actually use the Internet in their homes. Interviewers observed how participants search for information, particularly information concerning health and culture. Of the 87 interview participants, 43% (n=37) were observed using the Internet. The interviews and observations provide a rich understanding of how Canadians use new communication technologies for interpersonal relations and to obtain information.

Overview of Participants

Race and ethnicity: The Connected Lives Project takes place in East York, a distinct part of the current city of Toronto with a population of 114,240 in 2001 (Statistics Canada, 2001b). Its populace represents a wide range of ethnicities, socioeconomic statuses, and household arrangements, which is reflective of Canadian diversity. For example, 40,620 of the East York population are from visible minorities (Statistics Canada, 2001b). Visible minorities (i.e., nonwhite-Canadians) comprise 27% of the survey sample: primarily East Asians and South Asians, with Chinese-Canadians and Indian-Canadians being the largest groups. This is lower than the 2001 Canadian census report that indicates visible minorities comprise 36% of the East York population. Unfortunately these ethnic groups are somewhat underrepresented in our methodological process because of language and cultural barriers. In most other respects, the data reflect census demographics, including gender, age, income, education, and family composition.

Age, gender and marital status: Fifty-eight percent of the survey respondents are women, with a median age of 45. Fifty-nine percent of the somewhat less representative interview sample are women; with a median age of 49. Nearly two thirds (62%) of the survey respondents are married or stably partnered, as are 68% of the interview participants. Three fifths (61%) of the survey respondents have children; as do a somewhat higher 66% of the interview participants.

Education and income: Forty-three percent of the survey respondents have university degrees, while 27% have a high school education or less. Fifty-one percent of interview participants have a university degree, while only 20% of the interview participants have a high school education or less. The bulk of the population is working class and middle class; median personal income is between \$30,000 and \$40,000. Sixty-two percent of the survey respondents are doing paid work, thus

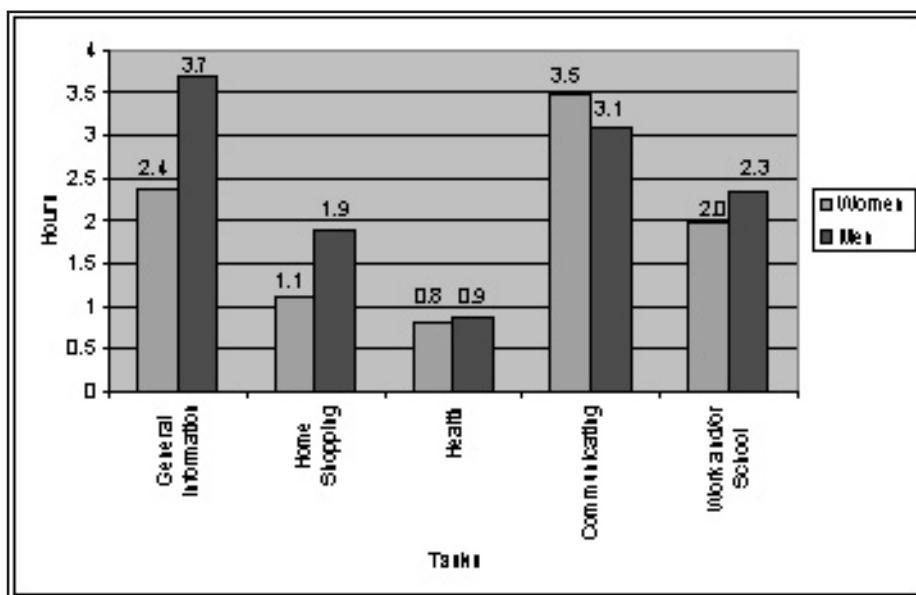
with a substantially higher median of between \$50,000 and \$75,000. Thirty-seven percent of all participants are retired, 16% are students, and 13% are full-time homemakers. Others report that they are between jobs, on leave, or have other reasons for not working.

Paid work at home: Twenty-six percent (n=56 and 16% of all participants) of participants reported conducting paid work at home. Of these participants, 91% conduct work related to their main job. Fifty-seven percent of participants who work at home are female. The reasons given for working at home are catching up with work (42%), saves time (37%), saves money (33%), better working conditions (33%). Twenty-six percent note other reasons such as convenience and ease. Participants who work at home report spending an average of 16.5 hours a week on paid work at home.

DISCUSSION

Internet users: The amount of people using the Internet continues to grow. Computer Industry Almanac² projects that the worldwide Internet population in 2006 will be 1.21 billion users. On a Canadian scale, most recent statistics (Statistics Canada, 2002) indicate that 62% of Canadians are now online either from home, work, school, or public facilities, with 51% using the Internet from the household. Individuals with higher levels of education, working people with higher income, and those with children still at home are the leading users of the Internet in Canada (Statistics Canada, 2002; U.S. Census Bureau, 2001 states similar findings in the USA). This is also the case for other technology such as telephone, television, and so forth (Dutton, 1999; Dutton, Rogers, & Jun, 1987; also the computer Murdock, Hartmann, & Gray, 1995).

Table 1. Mean number of hours per week spent on Internet activities at home by gender, for those with the Internet (N=235)



Working at Home

Most of the survey respondents (79%) have at least one computer at home, and 94% of these computerized households are connected to the Internet. Similar to Canadian and American Internet use (Ekos Research Associates, 2004; Rideout & Reddick, 2005), 75% of Connected Lives are connected to the Internet. Comparable to the Canadian mean usage of 12.7 hours per week (Ipsos-Reid, 2005), Connected Lives respondents reported being online a median of 10 hours per week and sending e-mails a median of 21 times per week.

Internet usage patterns: Considerable research has addressed how people use the Internet in general (see Pew Internet and American Life;³ Howard, Rainie, & Jones, 2001). Overall, there are four general ways of using the Internet—communication, information, recreation, and commerce. Using the Internet for communication—e-mail and instant messaging—to keep in touch with family, friends, coworkers and peers is a popular use for the Internet (Katz & Rice, 2002). Similarly searching for information and Web surfing for

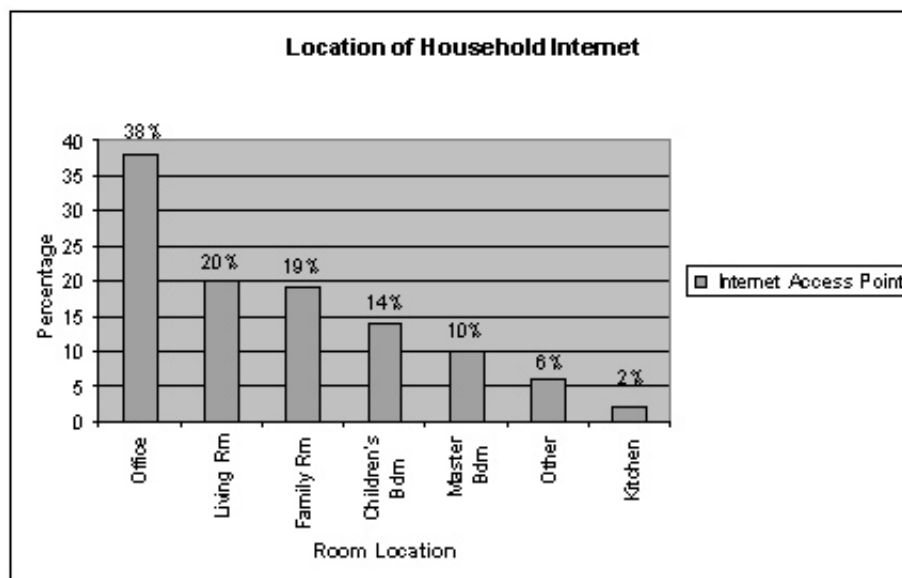
leisure interests is also popular, and people are increasingly purchasing products and conducting their banking online.

The use of the Internet by Connected Lives participants reflects similar documented usage patterns. Communicating with others and seeking general information are still the most common uses of the Internet from home, with women spending more hours a week (3.5) communicating with people than men do (3.1 hours). Men spend 3.7 hours per week searching for general information, whereas, women spend 2.4 hours per week (see Table 1). This reflects gendered usage patterns explained in detail in other research (Kennedy, Wellman, & Klement, 2003).

Location of Internet Access

Concerns have been raised about the effects of Internet use on families and households. For example, in 2000 Robert Putnam suggested that computers are partly responsible for the decline of social interaction between family members.

Table 2. Location of household Internet (N=328)



However, other researchers indicate this is not the case (see Anderson & Tracey, 2002; Frohlich & Kraut, 2002), as more and more households are spending time on the Internet together in the family hub (if that is where the Internet is located) (Frohlich & Kraut, 2002; Lally, 2002) and incorporating it into their everyday lives. Moreover, it is apparent that family, leisure, school, and work activities are becoming blurred and fuzzy, meshing collectively as schedules and tasks blend together and often overlap.

The presence of the Internet in the household has called for spatial considerations on its placement. New homes being constructed are beginning to reflect the prevalence of computers and the Internet, indicating that the Internet is indeed becoming domesticated (Dutton, 1999), with changes in the design of houses reflecting cultural changes (Frohlich & Kraut, 2002). The experiences and contexts outside the household will also ultimately affect the structure of the home itself (Haddon, 1999).

As well as the choices of technology use—such as telephones, personal computers and televisions—in the home and where they are located is determined by beliefs and attitudes about household organization, which is greatly determined by one's culture, socioeconomic status, and ethnicity (Dutton, 1999). Even the choice of the type of Internet connection—dial-up, high-speed phone or cable, wireless, and so forth—is also dependent on this. The place where household members decide to put the computer/Internet signifies its importance in their lives, from communication hub (Rommes, 2002), to information center (Aro & Peteri, 2003) and from entertainment place to work space.

Deciding Internet Location in the Household

Where to place the computer with Internet access, either in a private office in the home, or in a communal space, greatly affects who uses it, and

when they use it (Aro & Peteri, 2003; Frohlich & Kraut, 2002; Haddon & Skinner, 1991). For example, when the computer is placed in a person's private office space, it can deter his/her spouse and children from using it (Haddon & Skinner, 1991). Similarly, if the computer (with Internet access) is placed in a parent or child's bedroom, it can be difficult for other household members to have access to it, for example, when they are sleeping. Household members must make the decision on where to situate the Internet access point. This decision is often contingent on how the computer is perceived; whether the Internet is for work, play, or school will influence where the Internet access point is located. However, there are other factors worthy of consideration as well.

Household Mechanics

East York is located in the greater Toronto area (GTA) with an integration of small wartime bungalows to large-scale homes, and apartment buildings ranging from less than five levels to levels over 25. Fifty-four percent of participants live in houses and 45% in apartments with less than 1% residing in other locations.⁴ Internet space is constructed in ways that suit the household; however, external factors are also influential. The size of the home, presence of children, whether a household member is working or running a business from home, and a household member's perception of the appropriateness of the Internet in various rooms will affect where the Internet is located (Frohlich & Kraut, 2002).

One important factor when considering the location of the household Internet is the mechanics of the house itself. Many Canadians are constricted by electrical wiring, telephone jacks, or cable ports in order to connect to the Internet. Few homes currently utilize wireless connections, and Internet Service Providers are generally only offering dial-up, high-speed phone (DSL), or cable Internet access (though this will likely change in the near future). For households using

Working at Home

Table 3. Number of household computers (N=327)

| Number of Home Computers | % |
|--------------------------|----|
| 0 | 21 |
| 1 | 50 |
| 2 | 20 |
| 3 | 7 |
| 4 | 2 |
| 5 | <1 |
| 7 | <1 |

dial-up services, where to put the Internet access point is influenced by the number and location of telephone jacks. The same can be said for DSL, which requires a telephone jack, and cable access which requires a cable port:

Interviewer: ...Your computer is kind of near the front there. Is there any reason you put it over there as opposed to say over here or something?

Participant #306: Why over there? Well, because I think—we think—it is the best place, because there is a connection with the telephone. There is connection there, we don't have a connection here. In (another) room we have a connection but we don't have a place to put a computer in there.

Similarly, this participant notes the age of the home and its constraints:

Interviewer: Your access point is in the basement, how did you decide to put the computer down there?

Participant #455: Well you know, that's interesting because these houses are wired from 1952 so that gives me serious limitations to where I put the computer.

Granted in houses with multiple computers, this can be remedied by installing a hub or router so that other computers can access the Internet through a single connection. However, the number of households with more than one computer is still low (see Table 3) and purchasing additional computers certainly would be problematic for lower income households. Modems, routers, and wireless cards for personal computers all cost money and may be considered unnecessary luxury items for some people.

As well, people may not feel they can set up a network connection in their households if they are lacking computer skills and they may not feel comfortable asking someone for help. Importantly, some people are satisfied with using dial-up and do not feel the need for faster access, while others are utilizing DSL or cable access without the need or desire for a wireless network. Regardless, the initial Internet access point is still influenced by where the telephone jacks or cable ports are located.

Another consideration that concerns household mechanics is the layout of the house itself and the number and size of rooms. For example, apartments do not have basements that can be converted into offices or recreation rooms. Often the growth of a household—or having children—converts the initial office space of the childless couple into a child's bedroom, and the computer moves to another spot. In apartments with no children, or single person households that have one bedroom, choices become limited in terms of where to put the computer. For example, one participant notes the restrictions of the layout of the household:

Interviewer: How did you decide to put the computer in the living room...?

Participant #561: That was pretty much decided by the layout of the place. The bedroom would not have had enough space, and there's just not that many locations. It's the layout.

Interviewer: Would you rather have it in a different space...?

Participant #561: If I had a choice? Yeah.

Interviewer: Where would you rather have it?

Participant #561: If I had another room, you know?

Room sizes in apartments also influence decision making, as spaces can become cluttered with the presence of the computer and computer desk in small rooms. One participant reveals how the apartment constrains Internet use from home:

Participant #773: ...The problem is psychological in that being here in this apartment, I feel enclosed like a rat. Sometimes being here one hour, I say I have to go out and do some moving, go downtown...just to breathe some fresh air. Here, being too long and the whole day long, gives a feeling that you are enclosed like a rat in a cage.

Houses can be a similar challenge in terms of space—the size and number of rooms and the existence of a finished basement will all influence the choice of Internet location. This participant has thought about buying another computer, but is constrained by the number of rooms in the house:

Participant #879: And if we buy a home with two or three bedrooms, I think we buy another computer.

Some people are already conscious of office and computer space and potential Internet access points when purchasing new houses, as indicated by this participant (see Figure 1):

Interviewer: Have you always had (the computers) down there? Have you had (the computers) in other places?

Participant #439: Since we've been in this house, no. We've been here about 15 years, and that was

Figure 1. Home office in basement



© 2005 Wellman Associates (Used with permission)

Working at Home

one of the reasons why we bought this particular place because of the basement. We thought it was an ideal space for an office. The place we were in before was a smaller semi-detached with an unfinished basement. It was only my husband who was self-employed at that point, but we had his office set up in one of the bedrooms and it was a nightmare. I mean there just wasn't enough room for anything.

Aesthetics

When East York participants were asked why they placed the Internet access point where they did, aesthetics were important to several respondents. Given the amount of time Canadians are spending accessing the Internet, it seems obvious that the atmosphere or ambience of the computer area should be important:

Interviewer: What made you decide to put the computer out here? You get the plants and the trees...

Participant #239: I sit here, I look out. I see the trees, I see my plants. Ideal. If I had it in the bedroom, which I did some years ago, I'm just looking at the wall, which is terrible. This is ideal.

Whether for work, play, or education, participants note that the “view” from their computer is important (see Figure 2). Placing the computer near a window to see the garden, the neighborhood, the birds, the greenery, and so forth is motivating, calming, and visually pleasing to Internet users, especially if they are at the desk for many hours. Similarly, placing the computer in an open concept space (such as a living room or family room) provides the user with a less closed-in and isolated feeling than when in a separate room. One participant notes discontent over the initial place of the computer and the changes that were made:

Participant #015: Sitting in the basement with the old computer, I found it too dark and dingy, so we made the office upstairs...what we would consider our computer room upstairs.

Figure 2. Computer use with a view



© 2005 Wellman Associates (Used with permission)

Private Spaces

As Table 2 indicates, the majority of participants indicate that their Internet access point is located in a “private” space; 38% utilize an office space or study, 14% have the Internet in a child’s bedroom, and 10% have the Internet in the master bedroom. This gives a total of 62% of participants with Internet access in what might be considered a “private” space. Almost two thirds (59%) of participants who do paid work at home have their computer in an office or master bedroom.

There are some important things to note about these “private” locations. First, we have to remember that often the choice on where to place the Internet access point might be constricted by household mechanics (as discussed previously), therefore, there might not be a choice of location, but instead a default location of Internet access. In these situations, people make do with what they have and work around notions of public and private spaces within the household.

Second, some of these spaces—office/study or bedrooms—might not be considered “private” spaces for everyone. For example, the office or study may be available and accessible to all household members at any given time, instead of belonging to one particular household member. Privacy becomes something that is negotiated or understood by household members, and may change in different circumstances or contexts. In instances where there is only one Internet access point and more than one user, participants are aware that others in the household need to use the computer. When asked what time of day participants accessed the Internet the most from home, the survey data show that the Internet is used most frequently at home between 5PM and 11PM, when many people have returned home from paid work or school. However, during the interviews, participants report that they access the Internet at times when other household members are not home, or when others are not using it. This indicates that what may generally be considered

as a private space in the household—a space that belongs to another household member—may not be so private because everyone in the household feels they can enter at any time.

Privacy means different things to different people. For people doing paid work from home, having the Internet in the household can often be difficult; interruptions by household members can be commonplace, where other household members may not understand the boundaries between work and home when the work is being done at home (Haythornewaite & Kazmer, 2002). Finding a quiet place to work and negotiating household responsibilities becomes tricky for those household members doing paid work or school work and research from home. Participants were also wary of how their working from home might affect others in the household, stating that they do not want to bother others in the household while they are working on the computer.

As well, participants who work from home noted that it was important for them to separate their work life from their home life, and therefore made conscious decisions to have the computer and Internet access in a space where they can go to for work and then leave the room when finished.

Participant #137: I knew I wanted it (the computer) in my office and not visible, and that I could put it out of the way.

One participant notes the division of tasks that is separated by the location of the computer:

Interviewer: Why did you decide to put the computer in that place?

Participant #848: ...I didn't want it in here. This room is big and I just didn't want it in this room that's all. This is a different kind of room. Right here is where I work mostly, and in that room I read, and you get into a habit, at least I do, of doing things in different places.

Working at Home

Separating work and home is situated around the designated private work space. An interesting observation that surfaced while researchers were taking pictures of the Internet access point was the comments participants made about the “mess” of the office area. They were very aware that their computer area was laden with papers, folders, and other indicators of use. “Don’t mind the mess” comments during the interviews revealed that participants were conscious of this disarray. Participants felt that by having the Internet in a private space that is removed from regular household traffic, they were able to contain the mess and visual disorganization. In these situations, the invisibility of the computer and work space area becomes important:

Participant #421: I have things all over the desk but I know that nobody’s going to touch them. You know what I mean? If I had things sprawled out on the kitchen counter or whatever, I can guarantee that they wouldn’t be there when I went back the next night so and we actually had this conversation cause my husband went down there and he was like “when are you gonna put the stuff away? Like haven’t you finished this project already?” and in my mind I’m saying “Yeah, but there’s just that one thing you know I want to put it all together before I put it away” and it’s okay if it takes me a couple of weeks to get it because that’s out of the way and nobody’s going to touch it.

Communal Places

Some household spaces are more conducive to social interaction. Communal areas such as the dining room; living room or family room; spare room; or basement/recreation room allow household members easy access to the computer and the ability to communicate with others at the same time. Fifty-one percent of respondents indicated the location of the computer with Internet access was in the living room, family room, or kitchen area.

The decision to put the Internet access point in a more communal area that is open to all household members occurs for different reasons in different households. Establishing a multimedia portal is a conscious decision for some participants. Having television, Internet, music, video, or DVD all in one place encourages household members to all be in one place, but perhaps doing different things. This notion of togetherness even though household members might be doing different things is important to many participants. Aside from individual usage of media in the hub of living spaces, participants noted that these more accessible or “public” locations in the home encourage household members to “show and share” what they are doing online. Searching for information online is a common practice in many Canadian households. The kind of information that is being shared is often related to real estate; travel and vacation; home repairs or renovations; or product information. Importantly, participants are not only showing and/or sharing, but they sometimes use the Internet together when planning activities such as movies, concerts, vacations, and so forth. Having the Internet in communal household spaces encourages members to share their online experiences with others. Multi-tasking is also easier when working in communal places, and sharing work time with family time is more permissible, indicating the blurring of work and leisure activities.

Also, while communicating on the Internet is often considered a more personal and private activity, the interviews reveal how households spend communal time communicating together—using Instant Messaging, Audio Chats, and Webcams—with family members outside the household, both locally and globally:

Participant #343: ... when I chat with my family, my wife—she sits with me. She also chats with them. I chat with her family too. So she sits with me, and she chats with her family.

This is particularly important for immigrants or people with family and friends in other parts of the world, who rely on Internet communication to maintain their ties when people can be very far away. This is not to say that this does not occur in households where the Internet access point is in an office, study, or bedroom. Despite the location of Internet access in the more private spaces of bedrooms and offices, household members are still inclined to use the Internet together or show and share their online experiences. However what is important here is the ease with which this can occur when the Internet access point is located in a communal space and the easy integration of online and off-line that can occur in these collective spaces. Having the Internet in communal spaces can be beneficial for household members because they are spending time together using the Internet. While computers have been blamed for the decline of social interaction between family members (Putnam, 2000), this might not be the case if the Internet is located in living, family, or recreation rooms.

The decision to put the computer and Internet access point in a visible location is opposite to decisions made for the invisibility of the computer. Besides notions of togetherness and communal activities, participants with children stated that they were concerned with being able to see what their children were doing online and being able to track their activities:

Participant #442: ...and then upstairs, we have a master bedroom, two bathrooms, two bedrooms. It's funny, we talked about putting a computer up there, but I don't want the computer out of my sight yet. My husband would like it out of here, just because he aesthetically doesn't like it here. But I told him I don't want it out of our sight. I want it where, when the kids are on it, someone's aware of them being on it, and we can be in tune with it... It's like, if you want to use the computer, you use the computer here, because we're always

either in the kitchen or the family room. That's kind of where we live in the house, so it's a great way to monitor the use...

The sheer presence of an adult in the room may deter children from using the Internet in ways that parents may deem inappropriate. The visibility of the computer also allows parents to monitor how long children stay online, and if they are on too long parents can easily turn off the computer, or end their session:

Interviewer: Why is your computer out here?

Participant #810: We think about the future to buy my son a computer. But not now because I don't want him to stay in his room on the computer. I permit him one hour on computer to play... I don't want him to play [too long], that's why it's here [in the living room]. I can see my son.

While communal spaces allow for easy monitoring of children's activities, these spaces also allow everyone else in the household to easily view what parents and/or spouses may be doing. Under the watchful gaze of others, searching for information or communicating with others may be limited or constrained. For household members working from home or doing school work, loud communal spaces may not be as useful or practical as a more private space. Location of the household Internet in spaces that are available to others, or in areas where other household technologies may be (such as the television) affects privacy and concentration (Frohlich & Kraut, 2002).

Contesting Spaces and Places

People are aware of the impact that location has on household Internet access and use. While participants are generally satisfied with where they have their computers, some share discontent with the interviewers. Remodeling rooms, finish-

Working at Home

ing basements, and rearranging layouts reflect the active thought process of where to put the household Internet (see Figure 3).

Interviewer: So how does that spot work for you? I mean is that somewhere where you think it's going to stay or is there a place that's better?

Participant #132: Oh no, hopefully not. Our plan is that—eventually turn—we have a spare bedroom back here that were hoping to turn into a den, so we're gonna hopefully (put the) TV, couch, computer in there...

Participant's Spouse: ...we just bought a computer hutch with everything centrally there, the laptop and (the) computer as well—everything will be there, fax, scanner...

Participant #132: God I hate all that...

Another participant talks about how an open area was created for computer use:

Participant #232: ...we have an open area on the second floor that we designed on the second story. So, it could have been a 4-bedroom, but I wanted it to be open. So it's like a big landing where the computer is. So when I'm working at home, or doing something at home, I'm available to everybody still. I don't want to be off in a room somewhere.

What this also reveals is that people have a sense of not only how household members might use the space, but also how it might (or might not) be integrated into the routines and daily tasks of household members.

When remodeling or renovating is not an option, participants who can afford multiple computers use this as a way to challenge constraining household spaces. While purchasing additional computers is often a way to remedy conflicts between household members that occur over Internet use and access, it is also a way to challenge the private and public spaces of the household. In households with more than one computer, often

Figure 3. Renovating household spaces for the computer



© 2005 Wellman Associates (Used with permission)

participants will have computers with Internet access in different rooms—locations that are both communal and private so that there is a choice. If one is doing paid work at home, the use of the Internet in the office is a rational choice. If one is online and does not require solitude, Internet access in the living room with others present is an option.

Many participants are aware of the structural limitations that their household presents, whether it is small rooms, lack of phone jacks, or whether the computer is in the office or living room. What is particularly interesting is how some participants are aware of these potential constraints and actively problem solve and negotiate these restrictions. For example, numerous participants have laptops with a wireless connection that allows them to be online whenever they want and in any room they choose. This can take them from the kitchen to search for recipes, to the office for paid work, to the living room for recreation, or leisure pursuits online. Notions of space and place become more fluid if you are able to take the Internet with you wherever you go:

Participant #373: I'm getting old and stubborn, so now that it's wireless...I want to be where the sun is. I want to be where if it's a cold night, I'll take it down here from upstairs if Chris is not using it and turn on one of the gas fireplaces and be comfortable. So, now that it's wireless, I'm anywhere.

Other participants are aware of the constraints of desktop computers and stated that rather than buy another desktop computer; they are more interested in transportable Internet usage. This notion of portability indicates not only the diversity of daily Internet usage, but that surroundings matter—and that at different times throughout the day there are different needs and expectations of household Internet use. The context of household Internet use is important here as much as the room arrangements. There is a need to think about how

households perceive the Internet in terms of appliance, tool, toy, or perhaps all of these.

CONCLUSION

The Internet is changing the way household members carry out their daily tasks, whether work, school, or leisure related; it is becoming increasingly integrated into people's everyday lives, and households are utilizing the Internet in different ways from paid work, to communication with family and friends; and general information to more context-specific tasks such as seeking health information for children, looking for recipes for dinner, and planning family vacations.

In this chapter, I have addressed the decision-making process of where to position the household computer and the factors involved in how this decision is made. Household mechanics, aesthetics, private spaces, communal places, and how people contest and challenge existing spatial dynamics in the household are important issues to consider as more people conduct paid work from their homes, more businesses hire teleworkers, and organizations move towards creating new virtual work environments. Space and location of household computers and Internet matters, and these spaces must be perceived and understood in lieu of the household dynamics and processes they are embedded in.

Household Internet location is relevant to an organizational perspective. If we conceptualize the relationship between individuals and business organizations as one that is interactive and integrative, and one that includes not only worker and employee but other household members, then we can say that the home workplace is complex and blurred with other daily social realities—housework, school, children, entertainment, and so forth. ICTs are not used solely for work or employment, and the presence of work-related tasks in the home may complicate this further. Ultimately, these are factors that will influence

effective work-at-home strategies and potentially shape productivity and efficiency.

It is difficult to predict whether telework will continue to increase, or whether businesses and organizations will expand further into virtual organizations. However, with the prevalence of the household Internet and the number of people conducting paid work in the home, we might speculate how the construction of households might change. What might the future “smart home” look like? As new housing—apartments, condominiums, and houses—are being built with Internet connections already available⁵ (see Hampton, 2001), people may not be faced with issues concerning household mechanics or where to put the computer with Internet access, these decisions might be already made.

In a future where virtual organizations and telework are widespread, we might expect to see new housing complexes with wireless Internet access, larger open concept living rooms, multimedia centers built into living areas, or perhaps even computers with Internet access already present in homes, much like dishwashers, stoves, and refrigerators. Conversely, we might see floor plans for houses reflecting separate “work” environments already loaded with ICTs. It is hard to envision a digital/virtual/smart household that integrates paid employment, education, and family life. I have illustrated in this chapter that individuals and organizations need to unite to ascertain needs, expectations, and outcomes in order to benefit both employer and employee.

As Baines and Gelder (2003) argue, when home is a site of paid work, household members and daily tasks are often incorporated into the telework routine in ways not found in most forms of employment; there are contentions, there is conflict and negotiation—there is everyday life. As a guideline to organizations and business for effective future planning, Shin, Higa, and Sheng (1997) suggest that the implementation of telework can be viewed as a strategic organizational change to improve organizational effectiveness. However,

we need to think about the intertwining of “business and pleasure” and “spaces and places” in the context of paid work in the household to overcome barriers and constraints of past teleworker experiences; “spatial hybridity changes the nature of work, organization and management in domestic space, in cyberspace and in organizational space” (Halford, 2005, p. 20).

REFERENCES

Anderson, B., & Tracey, K. (2002). The impact (or otherwise) of the Internet on everyday British life. In B. Wellman & C. Haythornthwaite (Eds.), *The Internet in everyday life* (pp. 139-163). Oxford: Blackwell Publishers.

Armstrong, N.J. de F. (1997). Negotiating the boundaries between ‘home’ and ‘work’: A case study of teleworking in New Zealand. In E. Gunnarsson (Ed.), *Virtually free? Gender, work and spatial choice* (pp. 175-200). Stockholm: NUTEK.

Aro, J., & Peteri, V. (2003). *Constructing computers at home*. Paper presented at the Conference for the Association for Internet Researchers, Toronto, Ontario.

Baines, S., & Gelder, U. (2003). What is family friendly about the workplace in the home? The case of self-employed parents and their children. *New Technology, Work and Employment*, 18(3), 223-234.

Dimitrova, D. (2003). Controlling teleworkers: Supervisions and flexibility revisited. *New Technology, Work and Employment*, 18(3), 181-195.

Dutton, W. (1999). *Society on the line: Information politics in the digital age*. Oxford University Press.

Dutton, W., Rogers, E. M., & Jun, S. (1987, April). Diffusion and social impacts of personal computers. *Communication Research*, 14(2), 219-50.

- Ekos Research Associates. (2004). *The dual digital divide IV*. Ottawa, Canada: Ekos Research Associates.
- Frissen, V. (1992). Trapped in electronic cages? Gender and new Information technologies in the public and private domain: An overview of research. *Media, Culture and Society*, 14, 31-49.
- Frohlich, D., & Kraut, R. (2002). *The social context of home computing*. Retrieved May 23, 2006, from <http://www.hpl.hp.com/techreports/2003/HPL-2003-70.pdf>
- Gurstein, P. (2001). *Wired to the world, chained to the home: Telework in daily life*. Vancouver: University of British Columbia Press.
- Haddon, L. (1999). Gender and the domestication of the home computer: A look back. In W. H. Dutton (Ed.), *Society on the line: Information politics in the digital age* (pp. 353-354). New York: Oxford University Press.
- Haddon, L., & Brynin, M. (2005). The character of telework and the characteristics of teleworkers. *New Technology, Work and Employment*, 20(1), 34-46.
- Haddon, L., & Skinner, D. (1991). The enigma of the micro: Lessons from the British home computer boom. *Social Science Computer Review*, 9(3), 435-449.
- Halford, S. (2005). Hybrid workspace: Re-spatialisations of work, organization and management. *New Technology, work and Employment*, 20(1), 19-33.
- Hampton, K. N. (2001). *Living the wired life in the wired suburb: Netville, glocalization and civic society*. Unpublished doctoral dissertation, University of Toronto, Canada.
- Hardill, I., & Green, A. (2003). Remote working—Altering the spatial contours of work and home in the new economy. *New Technology, Work and Employment*, 18(3), 212-222.
- Haythornewaite, C., & Kazmer, M. M. (2002). Bringing the Internet home: Adult distance learners and their Internet, home and work worlds. In B. Wellman & C. Haythornthwaite (Eds.), *The Internet in everyday life* (pp. 431-463). Oxford: Blackwell.
- Howard, L., Rainie, L., & Jones, S. (2001). Days and nights on the Internet: The impact of a diffusing technology. *American Behavioral Scientist*, 45(3), 383-404.
- Ipsos-Reid. (2005, August 9). *Online news and information seeking: What the future holds*. Report. Retrieved August 12, 2005, from <http://www.ipsos-na.com>
- Katz, J., & Rice, R. (2002). *Social consequences of Internet use: Access, involvement and interaction*. Cambridge, MA: MIT Press
- Kennedy, T., Wellman, B., & Klement, K. (2003, Summer). Gendering the digital divide. *IT & Society*, 1(5), 149-172.
- Lally, E. (2002). *At home with computers*. Oxford, UK: Berg.
- Murdock, G., Hartmann, P., & Gray, P. (1995). Contextualizing home computing: Resources and practices. In N. Heap, R. Thomas, G. Einon, R. Mason, & H. Mackay (Eds.), *Information technology and society* (pp. 269-283). London: Sage Publications.
- Putnam, R. (2000). *Bowling alone*. New York: Simon & Schuster.
- Rideout, V., & Reddick, A. (2005). Sustaining community access to technology: Who should pay and why. *Journal of Community Informatics*, 1(2). Retrieved May 23, 2006, from <http://www.ci-journal.net/viewarticle.php?id=39>
- Rommès, E. (2002). *Gender scripts and the Internet*. Enshede, The Netherlands: Twente University Press.

Working at Home

Salaff, J. (2002). Where home is the office: The new form of flexible work. In B. Wellman & C. Haythornthwaite (Eds.), *The Internet in everyday life* (pp. 464-495). Oxford, UK: Blackwell

Shin, B., Higa, K., & Liu Sheng, O. (1997). *An adoption model of telework for organizations*. Paper presented at the Hawaii International Conference on System Sciences.

Stanworth, C. (1997). Telework and the information age. *New Technology, Work and Employment*, 13(1), 51-62.

Statistics Canada. (2001a). *Work at home stable while working outside the country increases*. Retrieved May 23, 2006, from <http://www12.statcan.ca/english/census01/Products/Analytic/companion/pow/home.cfm>

Statistics Canada. (2001b). *East York community profile*. Retrieved May 23, 2006, from <http://www12.statcan.ca/english/profil01/Details/details1pop.cfm?SEARCH=BEGINS&PSGC=35&SGC=963520006&A=&LANG=E&Province=35&PlaceName=east%20york&CSDNAME=East%20York&CMA=&SEARCH=BEGINS&DataType=1&TypeNameE=Borough%20%5BDissolved%5D&ID=15196>

Statistics Canada. (2002). Retrieved May 23, 2006, from <http://www40.statcan.ca/101/cst01/comm10a.htm?sdi=internet>

Sullivan, C. (2003). What's in a name? Definitions and conceptualizations of teleworking and home-working. *New Technology, Work & Employment*, 18(3), 158-165.

Sullivan, C., & Lewis, S. (2001). Home-based telework, gender, and the synchronization of work and family: Perspectives of teleworkers and their coresidents. *Gender, Work and Organization*, 8(2), 123-145.

U.S. Census Bureau. (2001, September). *Home computers and Internet use in the United States*. Retrieved May 23, 2006, from <http://www.census.gov/prod/2001pubs/p23-207.pdf>

ENDNOTES

- ¹ The meaning of telework itself is often contested within the literature. It can mean working at home or working from home, and often does not include people who are self-employed with their home as the office; or if telework conceptualized better as "homework" (Sullivan, 2003). For the purposes of this chapter, I will refer to telework as any form of paid work in the household that utilizes ICTs.
- ² <http://www.c-i-a.com/pr032102.htm> see also http://www.clickz.com/stats/sectors/geographics/article.php/5911_151151
- ³ <http://www.pewinternet.org/>
- ⁴ Participants noted basements or condominiums.
- ⁵ Traveling into Toronto along the Gardiner Expressway, new condominiums now block view of the SkyDome/Roger's Center. All the advertisements for these new homes tout Internet access already available in the units.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 257-279, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 6.26

Writing–Across–the–IT/MIS Curriculum

Stephanie J. Etter

Mount Aloysius College, USA

Jeffrey W. Merhout

Miami University, USA

ABSTRACT

Popular literature not only claims that college graduates are entering the workforce lacking sufficient writing skills but that companies must spend billions of dollars annually to train employees how to communicate effectively through writing (Canavor & Meirowitz, 2005; College Board, 2004). While writing across the curriculum is not a new concept, it seems that only certain areas of the curriculum have adopted it. The integration of writing into the management information systems (MIS)/information technology (IT) curriculum is an important and achievable goal necessary for the overall development of students in IT or MIS degree programs. While traditional IT/MIS programs rely heavily on technology-based courses, we argue that these technology courses must also promote effective writing habits needed for

career growth in the IT/MIS fields. As business proposals, newsletters and reports are frequently being written by those in the information systems department of a corporation, rather than by those in the communication department, it is increasingly important that we prepare IT/MIS students with the appropriate writing skills needed for their careers. For example, in many cases we prepare students to create Web pages, a highly public information source, without providing any instruction on writing within the IT/MIS curriculum. This chapter illustrates how writing assignments can be used in many MIS/IT classes.

INTRODUCTION

The National Committee on Writing surveyed 120 major American corporations and found that

the ability to write clearly significantly impacts the hiring and promotion process among salaried (i.e., professional) employees (College Board, 2004). While business majors may find writing integrated in the classroom at various academic levels, students majoring in IT and MIS are frequently focusing on technical material (e.g., hardware, software, communication technologies, programming languages, database management) rather than refining much needed communication skills like writing. While these students may find themselves employed at the same corporations as the business majors, they may not be granted the same opportunities for advancement.

A report in *Business Wire* (Technology Industry Suffers, 2005) states that writing activities account for an average of 37% of the typical professional's workday in the technology industry. The IT/MIS graduates entering today's workforce will be expected to write various communications, from business proposals and reports to online newsletters and Web sites. Even a simple e-mail requires clear and easily understood writing. In many cases, we prepare students to create Web pages, a highly public information source, without preparing them to fill the pages with appropriate text. IT/MIS students may be required to defend or explain a component of their technical work, either in a formal business proposal or as an answer to an online technical question.

In either instance, a written explanation that is hard to understand could hurt the bottom line. Canavor and Meirowitz (2005) argue that clear and easily understood writing provides a competitive advantage in this time of globalization. They state, "whatever the language, there's a critical need for clear, jargon-free writing that can easily be understood by non-native readers" (p. 31). According to *Business Wire* (Technology Industry Suffers, 2005), "Technology is new and complex by nature; therefore, technology companies depend on strong writing to clearly reveal the value of their products." This same report argues that unclear writing can dramatically affect the success

of technology sales, customer service and overall customer satisfaction, as technology sales tend to be broad and frequently impact hundreds of thousands of users at a time. Effective writing and technical documentation is expected of today's IT workers. Without it, companies will find initial sales difficult and can expect an increase in the types and amount of support services it must provide after the sale.

Many writing deficient students may not get the chance to do any writing on-the-job as some companies now test writing skills as part of the hiring screening process. A 2004 survey concludes that "80% or more of the companies in the service and finance, insurance and real estate (FIRE) sectors, the corporations with the greatest employment growth potential, assess writing during hiring" (College Board, 2004, p. 3). It is important to note that these industries employ a significant number of people in the IT and MIS fields. This same study reports that a "similar dynamic is at work during promotions. Half of all companies take writing into account when making promotion decisions" (College Board, 2004, p. 3). These decisions may be made on formal proposals or reports, but everyday communications such as e-mail may be considered, as well. E-mail has become the predominant writing activity for most business professionals, accounting for more than 2 hours per day on average for each employee (Business Professionals Unprepared, 2005).

The IT/MIS curriculum is often focused so intently on technology that students may fulfill degree requirements without fully learning other skills essential to successful career development. In an era of globalization, extremely competitive job markets and pockets of high unemployment rates, IT/MIS students need to graduate with skills that provide for employability and advancement. Communication skills, especially writing, should play an integral role in the IT/MIS curriculum. In order to accomplish this task, educators should strive to help develop IT/MIS students from a liberal education standpoint (e.g., development

of critical thinking, illustrating critical thinking through writing, consideration of contexts, and engaging with other learners).

The purpose of this chapter is to argue that integrating writing at numerous stages throughout the IT/MIS curriculum is an important and achievable goal for the further development of our students and, more specifically, to illustrate how writing can be incorporated into IT/MIS courses at both the undergraduate and graduate levels. While much of the following discussion may be culturally specific to Western societies and principally to the United States (U.S.) (as discussed by Fox, 1994), educators in any country who are interested in developing well-rounded graduates may benefit from this chapter.

IMPORTANCE OF WRITING

The decline in communication skills of college students is perhaps the best argument for including writing requirements in courses that traditionally do not have a writing component, such as those found in IT/MIS curriculums. Countless educators lament that many (or most) students cannot express themselves well (e.g., Bean, 2001; Epstein, 1999; Plutsky & Wilson, 2001), and this phenomenon threatens a nation's ability to develop citizens who can fully participate in political and economic processes. Moreover, when one cannot write well, it is often a symptom of a failure to think critically, which can be more damaging than just a lack of communication skills, especially for IT workers. In a 2003 survey, employers in the U.S. reported that many college students graduate without the communication and writing skills necessary to succeed in the workplace (Malveaux, 2003). The recent survey published by the College Board (2004) supports the earlier research by reporting that U.S. "corporations express a fair degree of dissatisfaction with the writing of recent college graduates" (p. 14). This problem is not specific to the U.S., however, as

employers in the United Kingdom (UK) are also reporting a shortage of fundamental skills in job seekers who are recent graduates, specifically in the areas of communication and problem-solving abilities (Parrish, 1998).

Since many U.S. degree programs require only one or two composition courses, it is our working assumption that the skills learned in these courses are not sufficient to provide students with appropriate speaking and writing skills. Some institutions still count solely on language (e.g., English) or communications courses as the only sources for developing effective writing and speaking skills, part of a discipline-by-discipline approach in which courses rarely cover concepts outside of a specific discipline. Many institutions, however, have incorporated "writing across the curriculum" programs or, as they are known in Canada and Great Britain, "language across the curriculum programs." Writing across the curriculum calls for the inclusion of writing requirements in courses throughout a student's college curriculum (Bean, 2001). Carnes, Jennings, Vice and Wiedmaier (2001) further explain that a writing across the curriculum program "enables faculty of non-communication disciplines to build on the writing skills taught in communication courses, provides students with the opportunity to strengthen and reinforce communication skills and encourages consistency in communication training and assessment" (p.1). Moreover, this movement argues (and we concur) that the development of writing competence should be a shared responsibility between the various disciplines and the language departments within a college or university (Tynjala, Mason, & Lonka, 2001; Weimer, 2001).

While the push for writing across the curriculum has been around for several decades, a new push, this time for information literacy, is being brought into focus. Thompson (2005) argues that the teaching of writing should be a natural extension of our responsibility to teach information literacy. The teaching of writing and of informa-

tion literacy both involve “ideas generated from information; both stress abundant and accurate information” (p. 48). By teaching information literacy, we are providing students with the skills needed to “recognize the need for information” and determine its “accuracy, relevance and comprehensiveness” (ALA, 1998). Obviously, these skills are also needed for writing.

We believe those responsible for educating tomorrow’s information resources managers should share in the development of these future leaders’ writing and critical thinking abilities by incorporating writing requirements throughout MIS/IT curriculums. This argument is supported by Nelson (1992), who contends that the development of key learning skills, including critical thinking and problem-solving abilities, is imperative for technical workers to keep up with rapid technological innovations. This is not the same as supporting the concept of writing in the disciplines (WID), as WID programs prepare students for the discourse of a specific discipline by showing students discipline-specific models of writing (Ochsner & Flower, 2004). Since the IT/MIS fields are so intertwined in the day-to-day operations of business, students must learn to write for audiences outside of their discipline.

Bean (2001) convincingly argues that writing is a key way to develop critical thinking abilities and problem-solving skills, and notes that “integrating writing and other critical thinking activities into a course increases students’ learning while teaching them thinking skills for posing questions, proposing hypotheses, gathering and analyzing data, and making arguments” (p. 1).

Similarly, Tynjala et al. (2001, p. 17) argue that “writing is a tool for thinking and a tool for learning.” Bonwell and Eison (1991) add that informal in-class writing exercises, which can even be used in large class sections, can assist in student acquisition of course content. Hence, a compelling case can be made that improving MIS students’ writing abilities by requiring and guiding written assignments can enhance their

communication skills and critical thinking abilities while simultaneously assisting in the acquisition of the key concepts of a given course.

CHALLENGES OF IMPLEMENTING WRITING IN THE IT/MIS CURRICULUM

Implementing writing into any curriculum not traditionally considered to be writing intensive can be difficult on several levels. A 2001 study by Plutsky and Wilson found that faculties were especially concerned with their ability to provide appropriate feedback for writing and grammar. According to Bean (2001), in addition to feeling that their own writing skills are inadequate to provide appropriate feedback, faculty may hold other misconceptions about incorporating writing assignments, including the idea that time is taken away from coverage of content, that writing assignments are not appropriate for certain types of courses and that writing assignments will bury the instructor in paper grading. The challenges of incorporating writing into IT/MIS curriculums may also include, as Bean discusses, designing effective problem-oriented assignments, coaching students to be better writers and critical thinkers, commenting on and grading assignments, and dealing with grammar and sentence correctness.

To maximize the effectiveness of writing assignments, instructors must carefully design problem-based assignments that generate in-depth analysis of the course content and develop critical thinking skills while creating a finished product that can be fairly graded in a manageable fashion. Carnes et al. (2001) present a checklist for creating writing assignments: carefully planning the assignment and grading criteria; enumerating the assignment details in writing; explaining the grading criteria, preferably with a checklist; stating the details of when the assignment is due and in what format; providing opportunities for

interim feedback; and using a detailed evaluation sheet that is very similar to the assignment grading criteria checklist. Gelinias, Rama and Skelton (1997) reiterate the importance of careful planning by identifying three critical planning decisions for integrating writing across the curriculum programs: defining measurements of quality for student writing, selecting forms of communication appropriate for the discipline, and selecting the appropriate mix of communication skills to teach in class.

Bean (2001) discusses the significance of coaching the writing process, of writing appropriate (and effective) comments on papers (e.g., positive feedback whenever possible) and of explicating and adhering to detailed grading criteria. The goal in coaching the writing process is to efficiently assist in the development of students' writing abilities by guiding the process without becoming overly burdened by grading requirements. Bean (p. 237) notes the traditional means of coaching writing by making "copious, red-penciled comments on finished student products [is] almost universally regarded among composition specialists as an inefficient use of teacher energy." Rather, the instructor should identify potential problems as early in the process

as possible by having students submit early drafts to peers and/or to the instructor for feedback. Another idea in guiding the process is to refer students to a university writing center, assuming one exists. Once the writing process is near completion, the instructor can make high-level comments that require revision before the final draft is resubmitted. After receiving the final draft, the instructor should make minimal comments as it is unlikely students will benefit from this unless they are required to make revisions. Instead of making detailed notes on the paper to justify a grade, an instructor should use a grading or scoring scale, often called a scoring or assessment rubric, preferably based on the same scale presented to the students at the beginning of the assignment as criteria for evaluating their work. A rubric is an assessment tool that uses detailed criteria to evaluate content knowledge and process skills (Coray, 2000). An example of a rubric used to score a research paper for an MIS course is provided in Table 1.

Faculties often dislike the use of rubrics because they can be time consuming to create. With the help of Web sites that create modifiable rubrics for you, such as *teach-nology.com*, rubric creation should no longer be seen as a barrier for their use in assessment.

Table 1. Grading rubric

| Requirement | YES | NO | Maybe |
|--|-----|----|-------|
| The problem statement is well-developed, and the problem is significant. | | | |
| The thesis statement is clear and succinct. | | | |
| Evidence to support the thesis statement is relevant (e.g., current) and strong. | | | |
| The paper makes a contribution. | | | |
| Arguments are logical. | | | |
| Ideas are well-developed and logically arranged. | | | |
| There are smooth transitions between sections, between paragraphs and between sentences. | | | |
| The voice, tone and style are appropriate for the assignment. | | | |
| Sentences are grammatically correct with zero misspelled words. | | | |
| The use and explanation of acronyms and abbreviations is appropriate. | | | |
| Peer review comments are attended to and/or responded to in a separate paper. | | | |
| Copies of sources are included (either hard copy or electronically). | | | |
| The paper is not plagiarized. | | | |
| Grade: | | | |
| Comments: | | | |

EXAMPLES OF IT/MIS WRITING ASSIGNMENTS

Bean (2001) classifies writing assignments as formal, or as informal, exploratory assignments. The use of informal assignments, such as in-class writing, journals, reading logs, creativity exercises, practice essay exams, early drafts of essays and memos to oneself (e.g., to explain a process), can serve as a writing component in any course without burdening the instructor with a heavy grading requirement. The goal of these assignments is to get the student thinking about the key concepts of the course. Bean (p. 118) argues that “exploratory writing, focusing on the process rather than the product of thinking, deepens most students’ engagement with course materials while enhancing learning and developing critical thinking.”

Informal writing assignments also have a place in the IT/MIS curriculum, such as 5-minute essays at the end of class that ask students to sum up the key points of the class in relation to another topic, such as a current event or their future career plans. Brief writing assignments during class time are one way to engage students in an active manner and seem to be appropriate for all types of courses, including IT education. For example, when teaching data modeling, we require our students to think about and summarize their thoughts on the process of creating a well-designed data model rather than just grading their finished product (such as their entity relationship model). The purpose of such an assignment is to help the student realize that data modeling is a creative process that often requires iteration and that the finished product should constantly be challenged as to its robustness. Even if an individual student did not actually make these exact points, an ensuing class discussion, perhaps in lieu of grading their writing, could help the student to understand that data modeling is just as much a process as it is an end product.

Formal writing assignments include short write-to-learn assignments (also called microthemes), thesis-based term papers, formal exploratory essays, reflection papers, essay questions on exams and a variety of other assignments that can be tailored to specific disciplines, such as poetry in psychology or creating word problems for mathematics class (Bean, 2001). Microthemes can be an effective way to assess how well the class as a whole is learning (or not learning) the key conceptual material in a course. Bean provides an example of a psychology professor presenting a scenario of cats reacting to being fed and then asking students to write an essay where the student applies several behavioral theories from psychology to explain the scene. Similarly, in a database course, we could ask our students to critique a database design that has several faults, such as not being properly normalized and/or omitting relationships between entities that would be needed to facilitate certain key queries.

Thesis-based term papers are very appropriate for MIS courses that survey the various information technologies and discuss the implications of these technologies from different perspectives, such as from a strategic, managerial and organizational impact standpoint. In thesis-driven papers, the thesis is usually presented near the beginning of the paper, where the purpose of the remainder of the essay is to present appropriate evidence and make persuasive (i.e., logical) arguments in support of the thesis. Assignments requiring a thesis are usually superior to simply asking students to write about a general topic appropriate for the class. Such a general course-related assignment likely would not require the student to develop the deep analysis and synthesis that is normally the product of effectively developing and defending a specific thesis about a topic. An example of a thesis-governed assignment used in a graduate course will be presented in the next section of this chapter.

Adding writing to the IT/MIS curriculum may also include using writing during exams. The ad-

dition of essay or short-answer questions to exams in the IT/MIS curriculum serves several purposes. First, it breaks up the cycle of rote memorization often required for successful completion of a multiple-choice exam, a very common exam method used in IT-related courses. Second, it allows the instructor to see if students really have an understanding of the material or if they have simply memorized the notes for the exam. Bloom, Englehart, Furst, Hill and Krathwohl's (1956) well-known taxonomy of learning (knowledge, comprehension, application, analysis, synthesis and evaluation) proposes that different levels of understanding can be achieved across subject areas. Short-answer or essay exam questions require higher levels of organizational skills to frame cogent answers, higher levels of recall about the subject matters, more integrative knowledge and, of course, good writing skills (Zeidner, 1987). Where an exam entirely made of short-answer or essay questions may not be considered practical, combining the common methods of multiple choice and true/false questions with one or two essay questions may not only help to evolve the communication skills of the student, but it may also help the instructor to evaluate the course by determining whether or not the student can actually synthesize working, productive output from the material provided in the course.

DETAILED EXAMPLES OF WRITING ASSIGNMENTS

For the purposes of providing more specific examples of writing assignments incorporated into IT/MIS courses, this article describes assignments used in two postsecondary schools located in Ohio and Pennsylvania, as well as those found in literature. In MIS survey courses offered at both the undergraduate and MBA level, a semester term paper has proven to be a successful writing assignment. For undergraduate systems analysis and database courses, a semester group project

with a final report write-up has been required. And in some cases, more than one writing assignment is appropriate. For example, a semester group project report and an individual term paper were both required in a graduate-level database course.

An example of a writing assignment currently used in an undergraduate database course is a short event summary paper. The objectives of the short paper are to give students more practice in writing and in critiquing their peers' writing, and to encourage their participation in extra-curricular activities. Students are required to attend at least one of the many outside speaker presentations sponsored by the Miami University Farmer School of Business during a semester. While many of these events have very informative speakers, the sessions are sometimes sparsely attended. Requiring students to attend one of these educational events and to write about their experience is intended to assist in their overall personal development. Students then write a short 300-400-word review of the event attended, including a synopsis of the presentation, an analysis and critique of the speaker's thesis, and a personal reflection about how the speaker's topic was relevant to their IT/MIS education. Moreover, a positive by-product of this assignment is that some students have become so enlightened by these presentations that they voluntarily attend more outside speaker events in the future.

Another example of a writing assignment in an undergraduate database course is a semester group project report. The objective of this assignment is to require students to think about the business purpose for investing in data management systems and to consider the organizational context of the problem domain for which they are designing a database. Students in the course are given explicit guidelines of the types of issues they must discuss and have a significant amount deducted off their project grade if they fail to address this requirement. While the main focus of their semester project is to properly design an

effective relational database, this requirement forces them to think about how communications are part of every systems development project. One of the drawbacks realized up front is that this written part of the project package, which will also include items like data models and query results, will likely be composed by only one (or maybe a couple) of the team members. Hence, the entire group is also required to present their project to the class, which requires, at minimum, that each student practice his or her oral communication skills.

In a graduate program, it is often much easier to incorporate written assignments into the curriculum, as many students now have industry experience and are aware of the communication skills needed to succeed in the workplace. A research paper assignment has been successfully used in a graduate-level IT management course. The objective of the paper is to require students to research an appropriate IT topic beyond what is covered in their textbook and in class to focus on the strategic, managerial, organizational and social implications of investments in IT. These analytical components of the paper, when outlined and explained at the beginning of the assignment, can be used as part of a grading rubric (as discussed earlier) in addition to items such as a clearly defined thesis and argument. The requirement of a thesis forces the student to think in terms of organizational problems and research questions rather than just creating a “data dump” (Bean, 2001, p. 90). In essence, this format requires a deep analysis and synthesis, the type of higher-order thinking instructors should strive for in all IT/MIS courses.

In addition to a thesis, the assignment requires a sequence of deliverables that force students to work on the paper throughout the entire term. The first deliverable is to propose a topic and problem statement early in the semester that includes a discussion of the process of how they formulated their problem statement. Requiring students to write about how they formed their problem state-

ments will force them to think about the development of a problem statement as a process rather than as a finished product. Moreover, it provides feedback so the instructor can guide and coach problem development as a process of asking researchable questions. It may also help to prevent or deter plagiarism, because the student will not be able to simply borrow or purchase (e.g., copy and paste from the Internet) a problem statement. The instructor then reviews the work and makes detailed, written comments about the topic and problem statement, which are then resubmitted with all subsequent submissions.

The second deliverable, due around mid-semester, requires an informal outline; a draft of their introductory paragraph(s), which include a thesis statement; and submission of all drafts created thus far in their writing process (as further protection against plagiarism). Once again, the instructor makes written comments that must be addressed in later submissions. The third deliverable, due 2 weeks before their final submission, is a draft of their complete paper for a fellow student to review and critique within the following week. The first student (i.e., the author) then has 1 week to attend to his or her cohort’s comments (either in the paper or on a separate response sheet) before turning in their final draft for grading. This final draft must be part of a package of all prior submissions that have been reviewed by the instructor, including instructor comments.

By requiring all previous drafts and submissions, the instructor can assess whether students made an honest effort to improve their product as they went through this process. This explicit sequence of steps and deliverables will result in a deeper analysis of a student’s chosen topic, which inevitably will enhance the student’s learning of IT while helping to develop his or her writing and argumentation skills. Moreover, as suggested by writing advocates (e.g., Bean, 2001; Carnes et al., 2001), the instructor should provide a detailed set of grading criteria with the assignment outlining the requirements for an “A” paper and a grading

rubric that provides the checklist to be used for a quick and clear assessment of the paper as it is read to determine the grade. Thus, the student will know up front what is expected. For example, one of the criteria in Table 1 is “the problem statement is well-developed.” On the rubric, the instructor can check “yes,” “no” or “maybe” and provide a brief explanation for answers other than “yes.” This method is usually a much more effective (and efficient) means of assessing each paper rather than making detailed notes in the margins noting relatively minor issues, such as clarity and grammar.

Not all writing assignments have to be conducted outside of the classroom. If an already work-intensive course does not have time during the semester to include a formal paper or group project, smaller in-class writing assignments can be used. For example, an undergraduate introduction to computer security class occasionally includes short writing assignments at the end of a class based on the material discussed in that class or the past several classes. At the end of a class period spent on the discussion of password security and authentication tactics, for example, the instructor may ask students to write an explanation of the necessity of password security for an executive who has limited knowledge and IT background. In addition to practicing writing skills, students are also given the opportunity to try to explain these concepts in basic terms. This exercise also helps the instructor determine if the students truly understand the concepts or are just memorizing facts and figures.

Adding a personal reflective journal requirement to any IT/MIS course is an easy way to incorporate writing into the curriculum. Students may be asked to write in the journal weekly about things such as current events relating to the class or personal reflections on class materials or guest speakers. For example, students can be asked to contemplate how they might use relational databases in their careers, with the goal of having them realize the relevancy of taking a database

design course (this is especially useful for non-MIS majors who might take such a course). Instructors can then collect the journals every few weeks to provide feedback. Again, a rubric can be used as a scoring method. Journals are often a successful way not only to further develop writing skills, but also for instructors to get a feel for student comprehension of the subject matter and perceptions of the course.

As previously noted, short writing assignments can also be used in exams. The same undergraduate computer security class requires students to answer at least one essay question per exam, providing students an opportunity to explain concepts in detail and often argue their opinion. For example, students may be given a brief biography of a company and are then asked to recommend a method of encryption based on the company’s needs and line of business. This recommendation must be directed to a senior manager of a business, who may not be well versed in the need for encryption or computer security methods in general. Another assignment from this course has students designing a written brochure designed to inform middle-school students of ways to protect themselves and their computers while online. Both assignments allow students to provide an appropriate explanation of a topic to an audience outside of their field and demonstrate their comprehension of its application.

The 2004 survey published by the College Board (2004) reports that corporations express dissatisfaction with the writing of recent college graduates, including the academic styles of writing students are taught, which is often unsuited to workplace needs. While the assignments mentioned above do improve writing skills, it is important to focus also on writing that will help prepare students for the workplace. Kretz (2005) argues that assignments that reflect a client-based pedagogy can be useful for business students. We believe this applies to IT/MIS courses as well. A client-based pedagogy “focuses on helping students to understand and respond effectively

to real-world clients and their organizational contexts” (Kreth, 2005, p. 52). Offering students the opportunity to write a proposal for an IT project for a specific company or in response to an organizational problem allows students to analyze the needs of a real-world audience, research relevant information related to the project and practice writing in a style appropriate for the business world, unlike a traditional term paper. One example of this type of writing assignment is taken from a 300-level application of e-commerce technologies course. Students are required to write a paper addressing an area of investigation of personal interest. Examples include an analysis of the presence of electronic markets in a given industry or an overview of an emerging technology not covered in the text. Students frame the report as a summary of research into the opportunities/problems associated with an emerging technology or electronic market applied to a specific consulting project scenario provided by the instructor. Additionally, students must write in a manner that persuades management that the conclusions/recommendations are sound and logically developed (including providing evidence that supports their thesis).

It is often easier to assign client-based assignments in graduate-level courses, because graduate students frequently have some experience in the industry. In a graduate-level impact of technology course, which discusses the influence of technology implementation, students are assigned to reflect on case studies from companies that describe a real-world technology implementation in the workplace. This reflection often allows students to think about the impact from a new perspective and focus on reasons why new technologies are not always adopted as planned, and helps to prepare students for another assignment later in the semester that is focused on planning for and managing an IT implementation project.

AVOIDING PLAGIARISM

Faculty in non-writing-intensive areas have rarely had to deal with plagiarism, so adding a writing requirement to the IT/MIS curriculum often takes them into uncharted waters. An awareness of plagiarism and its hold on colleges and universities in today’s Web-based world is necessary before jumping head-first into writing assignments.

In a recent *New York Times* article, a student from Duke University said that using a small paragraph that has been cut and pasted from the Internet and slightly altered as part of his research paper is “no big deal . . . it’s not cheating” (Zernike, 2002, p. A10). This acceptance of cutting and pasting seems to be common among college students. The same Duke student explained that “as long as I can manipulate it to be my words, change a few, it’s not cheating” (Zernike, 2002, p.10). Information technology, specifically word processing software and the Internet, has allowed students to copy full paragraphs, change a couple of words, and think that they have done nothing wrong. This form of plagiarism is identified by Iverson, Flanagan, Fontanarosa, Glass, Giltman, Lantz, Meyer, Smith, Winker and Young (1998) as “mosaic plagiarism,” but it is also known as “patchwriting” (Howard, 1999) or “paraphragiarism” (Levin & Marshall, 1993).

Moreover, Western academicians indicate that international students often have different notions about plagiarism (Fox, 1994). Evans and Merhout (2004) explain that countries having a more collaborative work style may view plagiarism issues differently than Western countries that focus on individual contributions. Bean (2001) elaborates on Fox’s discussion and further explains that some international students are surprised by the Western acknowledgement that other “individuals can ‘own’ [their original] words and ideas” (p. 43).

Given Western students’ changing view of plagiarism thanks to the availability of Internet

resources and the cultural views brought by international students, it is imperative to make a note on the course syllabus and discuss plagiarism with all students at the beginning of any class that contains writing assignments. It is also wise to check suspicious submissions by doing a Google search on strings of text that seem out of character for the student writer.

The best way to avoid plagiarism is in the design of an assignment where a statement against plagiarism is a necessary component to bring attention to the seriousness of this issue. Requiring multiple drafts of a document, creating assignments that are specific to a school or region and requiring students to use and cite library resources in the document also can be effective ways to avoid plagiarism. Another effective method is to teach proper citation in class or request a class session with a campus librarian.

CONCLUSION

Writing assignments are both appropriate and beneficial for students in MIS and IT courses. Specific examples of writing assignments that have been successfully implemented, including short papers, group projects, research papers and in-class writing, have been discussed. To create employable graduates, faculty must begin to take responsibility for the development of the whole student, and not simply accept responsibility for discipline-specific skills only. Key to the success of incorporating writing into a curriculum is providing clear grading requirements to students as well as feedback. Plutsky and Wilson (2001) suggest some critical success factors for writing across the curriculum, including developing standards for writing and assessment, and providing training programs for faculty. Accordingly, we offer this chapter as a resource that MIS/IT faculty can use as a starting point for incorporating writing into their own courses.

REFERENCES

- American Association of School Librarians (ALA) and Association for Educational Communications and Technology (AECT) (1998). *Information power: Building partnerships for learning*. Chicago: ALA.
- Bean, J. C. (2001). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom*. San Francisco: Jossey-Bass Publishers.
- Bloom, B., Englehart, M., Furst, E., Hill, H., & Krathwohl, D. (Eds.). (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain*. New York: David McKay Company.
- Bonwell, C., & Eison, J. (1991). *Active learning: Creating excitement in the classroom* (ASHE-ERIC Higher Education Report No. 1). Washington, DC: The George Washington School of Education and Human Development.
- Business professionals unprepared as writing responsibilities increase. (2005, October 12). *Business Wire*. Retrieved January 20, 2006, from the Lexis-Nexis Academic Universe database at http://web.lexis-nexis.com/universe/document?_m=85e5491d2f2565ddaade097ca5a67119&_docnum=1&wchp=dGLbVzz-zSkVb&_md5=98e65ed2e4518f527729deb7c05ac21c
- Canavor, N., & Meirowitz, C. (2005). Good corporate writing: Why it matters, and what to do. *Communication World*, 22(4), 30-33.
- Carnes, L., Jennings, M., Vice, J. & Wiedmaier, C. (2001). The role of the business educator in a writing-across-the-curriculum program. *Journal of Education for Business*, 76(4), 216-219.
- College Board. (2004). *Report of the National Commission on Writing for America's families, schools and colleges: Writing, a ticket to work or a ticket out*. Retrieved January 20, 2006, from [www](http://www.collegeboard.com).

Writing-Across-the-IT/MIS Curriculum

- writingcommission.org/pr/writing_for_employ.html
- Coray, G. (2000). Rubrics made simple. *Science Scope*, 23(6), 38-40.
- Epstein, M.H. (1999). Teaching field-specific writing: Results of a WAC survey. *Business Communication Quarterly*, 62(1), 29-41.
- Evans, D., & Merhout, J.W. (2004). Impacts of IT on human behavior in library settings. In M. Khosrow-Pour (Ed.), *Innovations through information technology* (pp. 112-114). Proceedings of the 2004 Information Resources Management Association International Conference, New Orleans, LA.
- Fox, H. (1994). *Listening to the world: Cultural issues in academic writing*. Urbana: National Council of Teachers of English.
- Gelinas, U.J., Rama, D.V., & Skelton, T.M. (1997). Selection of technical communications concepts for integration into an accounting information systems course: A WAC case study. *Technical Communication Quarterly*, 6(4), 381-401.
- Howard, R. (1999). The new abolitionism comes to plagiarism. In L. Buranen & M. Roy (Eds.), *Perspectives on plagiarism and intellectual property in a postmodern world*. New York: State University of New York.
- Iverson, C., Flanagan, A., Fontanarosa, P., Glass, R., Giltman, P., Lantz, J., Meyer, H., Smith, J., Winker, M., & Young, R. (1998). *American Medical Association manual of style: A guide for authors and editors (9th ed.)*. Baltimore: Williams and Wilkins.
- Kreth, M. L. (2005). A small-scale client project for business writing students. *Business Communication Quarterly*, 68(1), 52-59.
- Levin, J., & Marshall, H. (1993). Publishing in the Journal of Educational Psychology: Reflections at midstream. *Journal of Educational Psychology*, 85, 3-6.
- Malveaux, J. (2003). Workplace 2003: What's next for graduating seniors? *Black Issues in Higher Education*, 20(6), 35.
- Merhout, J. W. (2004). Integrating writing requirements into MIS courses. In M. Khosrow-Pour (Ed.), *Innovations through information technology* (pp. 299-301). Proceedings of the 2004 Information Resources Management Association International Conference, New Orleans, LA.
- Nelson, J. (1992). Case study: Teaching learning skills as a foundation for technical training. *Educational & Training Technology International*, 29(2), 1992, 89-93.
- Ochsner, R., & Flower, J. (2004). Playing devil's advocate: Evaluating the literature of the WAC/WID movement. *Review of Educational Research*, 74(2), 117-141.
- Parrish, D. (1998). One day, my son, all these key skills will be yours. *New Statesman*, 11(530), 21.
- Plutsky, S., & Wilson, B.A. (2001). Writing across the curriculum in a college of business and economics. *Business Communication Quarterly*, 64(4), 26-41.
- Technology industry suffers as writing responsibilities increase by one-third. (2005, October 31). *Business Wire*. Retrieved January 20, 2006, from the Lexis-Nexis Academic Universe database at http://web.lexis-nexis.com/universe/document?_m=fb37fa73b3172cfcec69f71e824ad360&_docnum=1&wchp=dGLbVzz-zSkVb&_md5=26e32a3862cbcd254ec79f84954b017c
- Thompson, H. M. (2005). Ideas, information, and organization: Connecting information literacy and writing. *School Library Media Activities Monthly*, 21(7), 48-50.
- Tynjala, P., Mason, L., & Lonka, K. (2001). Writing as a learning tool: An introduction. In G. Rijlaarsdam (Series Ed.), P. Tynjala, L. Mason, & K. Lonka (Volume Eds.), *Studies in writing:*

Volume 7: Writing as a learning tool: Integrating theory and practice (pp. 7-22). Dordrecht: Kluwer Academic Publishers.

Weimer, M. (2001). Foreword. In J.C. Bean (Ed.), *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom* (pp. xvii-xx). San Francisco: Jossey-Bass Publishers.

Zeidner, M. (1987). Essay versus multiple-choice type classroom exams: The student's perspective. *Journal of Educational Research*, 80(6), 352-358.

Zernike, K. (2002, November 2). With student cheating on the rise, more colleges are turning to honor codes. *New York Times*, p. A10.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 83-98, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 6.27

Management of Telecommunications Services: A Vital New Content Area and a Course Model for the College Business

Faye P. Teer

James Madison University, USA

Young B. Choi

James Madison University, USA

Harold B. Teer

James Madison University, USA

ABSTRACT

Telecommunications companies are facing a challenge in satisfying changing customer demands related to telecommunications services. Historically, the industry challenge was managing the changing technology; today, the industry must also focus on the management of telecommunications services. The purpose of this chapter is twofold: (1) to provide an argument for the importance of the management of telecommunications services as a vital new course area at the university level, and (2) to describe one possible model for a new undergraduate course, Management of Telecommunications Services. The chapter is targeted towards university faculty and administration and

corporate representatives responsible for technology education. The ultimate goal of the course is to align university curriculum with the needs of the telecommunications industry and provide the industry with entry-level information technology (IT) employees who have an understanding of the fundamentals of the management of telecommunications services.

INTRODUCTION

The deregulatory impact of the 1996 Telecommunications Act resulted in fierce competition for customers by telecommunications firms. This competition has intensified, and in order to

increase the size of their customer base, many telecommunications companies are striving to create a competitive advantage through an increased variety of service offerings. These telecommunications companies hope that by adding new types of services to their existing ones they can achieve economies of scope (Grover & Saeed, 2003).

As telecommunications companies face challenges in satisfying customer demands related to telecommunications services, telecommunications providers have been forced to rethink the fundamental way they do business. Historically, the industry was driven by the management of changing technology; today, the industry also has to focus on the management of telecommunications services. Hall (1996, p. 10) summed up the new challenge facing the telecommunications industry regarding the management of telecommunications services: "... services are now being defined in terms of what they provide to users. For suppliers, this requires a radical change of perspective, from being technology providers to becoming service providers, which must also be reflected in the approach to management."

The turmoil in today's telecommunications industry's services sector is a reflection of the state of the service sector in the United States (U.S.). In the U.S. economy, where services account for 73% of the gross domestic product, the entire service sector is in a constant state of change that is causing upheavals in the traditional ways of doing business (Lovelock & Wright, 2002).

Top managers in the telecommunications industry recognize the crucial importance of the effective management of customer services. One industry person noted that, "Several years of good-quality communication service can be shattered in a few minutes if the customer care processes are poor" (Adams & Willets, 1996, p. 1).

In response to the changing critical success factors for telecommunications companies, the field of management of telecommunications services began in the mid 1990s with the initiation of

research and applications geared toward providing better management of telecommunications services. Managing the services that telecommunications providers deliver to their customers is defined by Adams and Willets (1996, p. 29) to mean "the entire customer-service spectrum, including order handling, service quality, problem handling, billing, service development and so on." Adams and Willets stress that, to satisfy customers' requirements, the effective management of telecommunications services involves the continuous rebalancing of three objectives: (1) reduction of cost; (2) improvement of service quality; and (3) reduction of time-to-market of new services (1996).

Organizations are beginning to realize that adequate attention to the service management function can bridge the gap between the technological functions (element management and network management) and the business management function. Telecommunications industry organizations must effectively manage services to satisfy the level of quality services demanded by customers. In turn, effective service management can generate more revenue and have a positive impact on the successful business management function. The Telemanagement Network (TMN) Framework illustrates the four managerial functions of an organization in the telecommunications industry. A pyramid representing the TMN Framework is composed of four layers, listed here in descending order: Business Management, Service Management, Network and Systems Management, and Element Management (Adams & Willets, 1996, p. 28).

Because service management in the telecommunications industry is not well understood, attention is now being directed to management of telecommunications services. Ward said that for the telecommunications industry, service management remains its least understood area, and that, "The next frontier is service management" (Ward, 1998, p. 157).

This chapter will provide support for the growing importance of the management of telecommunications services as a vital new course area at the university level and describe one possible model for a Management of Telecommunications Services course.

WHY MANAGEMENT OF TELECOMMUNICATIONS SERVICES IS A VITAL AREA OF STUDY

A review of the literature provides ample evidence supporting the significance of the management of telecommunications services as a vital area of study for IT majors. This section will discuss four key factors driving the increasing importance of managing telecommunications services and several important responses by the telecommunications industry. These key factors include: (1) increased competition in the telecommunications industry; (2) unmet service needs of customers; (3) telecommunications industry recession; and (4) the unique complexities of the telecommunications industry.

Increased Competition in the Telecommunications Industry

The first key factor is the high level of competition in the telecommunications industry. Today's telecommunications industry is described as "a scene of global hyper-competition" (Korhonen & Ainamo, 2003, p. 2). The key to survival in the competitive telecommunications industry is to make certain that an organization's learning outpaces that of their competitors (Johnson & Jakeman, 1997, p. 234). In the telecommunications industry, one critical success factor in outpacing competitors is effective management of customer services. Successful telecommunications organizations will be the ones that effectively manage customer services (Adams & Willetts, 1996).

Unmet Service Needs of Customers

The second key factor is the unmet service needs of customers. In the mid 1990s, many telecommunication providers strived to secure more customers and generate more revenue by introducing a plethora of services. However, the present level of telecommunications services offered by many telecommunications service providers does not fully satisfy the various customers' requirements (Adams & Willetts, 1996; Forouzan & Fegan, 2003; Korhonen & Ainamo, 2003; Rosenbush & Elstrom, 2001). A resulting problem is that the customers' needs may not be met or customers may not adequately understand the services offered.

Telecommunications Industry Recession

A third factor is the worldwide recession that the telecommunications industry has experienced during the last several years (Eyers & Hahn, 2002; Shannon & Schenker, 2003). A recently authored paper by Malcolm Russell, a strategic business manager with Agilent Technologies (Russell, 2003), argued that if the telecommunications industry is to move forward from its current recession, it needs to focus less on technology for its own sake and more on telecommunications services.

Unique Complexities of the Telecommunications Industry

The fourth key factor is the unique complexities of the telecommunications industry and the inherently intangible nature of telecommunications services. For any service-intensive industry, management of customer services is a challenge. In the telecommunications industry, the nature of the product itself makes the management of services especially difficult. Adams and Willetts

(1996, p. 1) point out that telecommunications “service providers are nearly invisible” and their product “is probably the most intangible product any company might sell.” Furthermore, there are unique complexities present in the telecommunications industry that makes service management much more challenging than any other service-based industry. One such complexity is the proprietary nature of many of the existing systems used to manage telecommunications services; these older systems lack the flexibility and quick reaction time necessary in today’s dynamic telecommunications industry (Lewis, 1999). Adams and Willets described additional unique complexities of the telecommunications industry that impede effective management of services: (1) Telecommunications involves an extensive service delivery chain that is becoming more complex as the industry changes shape; (2) service providers operate on the leading edge of new technology, while dragging along plants and processes that can date back 100 years; and (3) the communications industry is becoming increasingly distributed as geographical boundaries are stretched (1996).

Industry and Firm Responses

In addition to the response by individual firms to addressing challenges in the management of telecommunications services, the industry as a whole responded by founding the TeleManagement Forum (TM Forum) and the TM Forum’s Universities Program. Recognition of the need for better management practices within the telecommunications industry was the impetus that led to the founding of the TM Forum. TM Forum is a “non-profit global organization that provides leadership, strategic guidance and practical solutions to improve the management and operation of information and communications services” (TeleManagement Forum, 2004). Today, TM Forum has a membership of more than 340 companies, most of whom are considered the leading firms in

the worldwide telecommunications industry.

Additionally, the TM Forum is in the initial stages of broadening its mission to include partnering with universities and university faculty by developing TM Forum’s Universities Program (The Charter, 2003). The TM Forum’s Universities Program was established July 31, 2003, to facilitate the formation of much-needed closer working relationships between TM Forum, university faculty and other academic participants. This relationship is designed to assist in promoting teaching and research efforts in the area of the management of telecommunications services and in aligning university curriculum with telecommunications industry needs. Some of the specific goals related to the management of telecommunications services for this new university program are: providing a forum for sharing information pertaining to management of telecommunications services; providing assistance in the teaching of the management of telecommunications services topics; providing new outlets for faculty publication; and sponsoring faculty research (Members of the TM Forum’s Universities Program, 2003).

Currently, a diverse set of universities throughout the world has joined TM Forum’s Universities Program. The number of member universities is expanding rapidly and includes those listed in Table 1.

This new focus on service management must be understood and addressed by those responsible for the telecommunications curriculum in universities. To help meet the immediate needs of the telecommunications industry, universities should begin to educate entry-level employees who have a strong foundation in management of telecommunications services. Such employees can more quickly attain leadership roles in customer service, where they can assist in effectively managing customer services. To align the knowledge and skills of entry-level telecommunications employees with the needs of the industry, this chapter proposes a university course, the Management of Telecommunications Services.

Table 1. Member universities of TM Forum's Universities Program

| Country | Universities |
|----------------|---|
| Croatia | University of Zagreb |
| Ireland | Trinity College Dublin |
| Korea | Pohang University of Science and Technology (POSTECH) |
| Spain | Universitat Politecnica de Catalunya |
| Russia | St. Petersburg State University of Telecommunications |
| UK | University College London, University of Glasgow |
| U.S. | James Madison University; Stevens Institute of Technology; University of Maryland, College Park |

A PROPOSED MODEL FOR THE MANAGEMENT OF TELECOMMUNICATIONS SERVICES COURSE

As a response to the growing importance of the management of telecommunications services, we describe one possible model for a Management of Telecommunications Services course. The proposed course model is based on prior industry experience in research and development in the telecommunications industry, on recommendations by IT professionals, and on experience in teaching the introductory telecommunications course. This model has been proposed and will be used in a course at our university. Since there is an immediate need in the industry for entry-level employees who possess a better understanding of the fundamentals of managing telecommunications services, the course described in the proposed model is intended for the undergraduate level. However, it could be readily adapted to suit the needs of graduate students.

In both the 1997 and 2002 IS Model Curriculum guidelines, developed by a nationwide committee of IT professionals and faculty, it was recommended that universities offer a required introductory telecommunications course (IS, 1997, 2002). An examination of the Web sites of universities and informal conversations with colleagues at professional meetings indicate that

a growing number of schools are requiring the introductory telecommunications course as part of the IT degree program (Choi & Teer, 2003). Since many IT programs now have a qualified person to teach the undergraduate telecommunications course, those telecommunications professors should be qualified to teach the Management of Telecommunications Services course.

The proposed Management of Telecommunications Services course is designed to give IT undergraduates an awareness of the issues of service management in the telecommunications industry; an understanding of the core technologies interfacing the management of services; and a survey of current management best practices.

The course model is presented in three parts: (1) course content, (2) teaching resources, and (3) course structure.

Course Content

The rationale for including certain topics in the course content is based on: (1) a careful review of the Model Curriculum Guidelines of IS 1997 and 2002 (IS, 1997, 2002) and, in particular, the material in section IS 2002.6: Networks and Telecommunications (IS, 2002); and (2) recognition of the action items needed to address the key industry factors driving the importance of managing telecommunications services. The following general topics are recommended for the

Management of Telecommunications Services course. Under each general topical area are the specific topics to be included.

Fundamental managerial concepts related to services in the telecommunications industry:

1. Introduction
2. What is the management of telecommunications services?

The rationale for why effective management of telecommunications services is needed:

3. Service management requirements of providers of telecommunications services
4. Service management perspectives of private network operators

The technical components of the interface of telecommunications core technologies and the management of telecommunications services:

5. Integration of telecommunications services
6. Systems interoperability as it relates to management of telecommunications services
7. Integration architecture as it relates to management of telecommunications services
8. Service management systems framework

The crucial industry leadership role of TM Forum:

9. TM Forum

Technical topics are addressed with real-world, hands-on experience:

10. Business case design for better service management
11. Individual and group research project

Framework, principles and future directions for telecommunications services:

12. Toward an effective service management paradigm
13. Practical implementation principles for successful management and evaluation of services
14. Future directions in the management of telecommunications services.

TEACHING RESOURCES

Most of the available reference material for the management of telecommunications services is in the form of (1) industry targeted books, (2) online journals and magazines, (3) magazines and newsletters, (4) journals, and (5) Internet resources. Since the management of telecommunications services only became an area of major industry concern in the mid-1990s, there are management of telecommunications services books aimed for an industry audience, but there are no textbooks and related ancillary materials for the university market.

Books. Numerous books were reviewed for material relevant to a course in the management of telecommunications services. We found seven books that contained at least one good chapter on the management of telecommunications services. Information on these seven books, including the depth of coverage of management of telecommunications services topics, is given in Table 2.

We believe *The Lean Communications Provider* (Adams & Willets, 1996) to be the seminal work for the management of telecommunications services. Even though it is presently out of print, it can still be purchased and is available in many libraries. The topics included and depth of coverage of those topics makes this an excellent resource book for the teaching of the management of telecommunications services. This four-part book is based on technical contributions from the members of TM Forum and includes a balance of technical components and managerial issues.

Management of Telecommunications Services

Table 2. Books relevant to Management of Telecommunications Services course

| Authors | Title | Year | Publisher | Coverage of Management of Telecommunications Services |
|--|--|--------------------------------|----------------------------|--|
| Hallows, R.D. | <i>Service Management in Computing and Telecommunications</i> | 1995 | Artech House | Throughout the book; Chapters 1-12 |
| Adams, E.K. Willets, K.J. | <i>The Lean Communications Provider – Surviving the Shakeout through Service Management Excellence</i> | 1996 | McGraw-Hill Inc. | Throughout the book; Chapters 1-23 |
| Hall, J. (Ed.) | <i>Management of Telecommunication Systems and Services</i> | 1996 | Springer-Verlag | Chapter 1 Introduction and Chapter 4 Examples of Service Management |
| Ward, E.P. | <i>World-Class Telecommunications Service Development</i> | 1998 | Artech House | Chapters 1-22 |
| Strouse, K.G. | <i>Marketing Telecommunications Services: New Approaches for a Changing Environment</i> | 1999 | Artech House | Part V Customer Focus Chapter 14 Customer Care Chapter 15 Customer Profiling and Data Management Chapter 16 Customer Loyalty and Managing Churn |
| Odon, A. Ward, K. Savolaine, C. Daneshmand, M. Hoath, P. | <i>Telecommunications Quality of Service Management: From Legacy to Emerging Services</i> | 2002 | Inspec | This book surveys the key issues related to the delivery and management of customer quality of service. This book covers especially topics of consumer and user groups and comparisons of performance. |
| Carr, H.H. Snyder, C.A. | <i>Management of Telecommunications – Business Solutions to Business Problems Enabled by Voice and Data Communications</i> | 2003 2 nd Ed. | McGraw-Hill/Irwin Inc. | Chapters 12 and 13 (Part 4 Managing Telecommunications) |
| Korhonen, T.O. Ainamo, A. (Eds.) | <i>Handbook of Product and Service Development in Communication and Information Technology</i> | 2003 | Kluwer Academic Publishers | Chapter 3 User Centered Design of Telecommunications Services |

The book's first part, "When Service is Your Business," introduces: (1) the emergence, definition and importance of the management of telecommunications services; (2) service management requirements; and (3) the perspectives of service providers and private enterprise network operators.

The second part, "It's All about Integration," covers: (1) service integration and the architecture for service management; (2) the interoperability

between different service management systems; and (3) barriers to excellent service management.

The third part, "It's Best Not to Go It Alone," emphasizes the importance of cooperation with other organizations in the global telecommunications environment.

The fourth part of the book, "Getting to Excellence," covers: (1) the purpose of TM Forum and the importance of a common model for effective

communication among participating members; (2) the service management business process model; (3) major service areas in telecommunications, such as order handling, problem handling, performance reporting, billing and the transition of business process agreements to technical specifications; and (4) a systematic approach on the issues of software platform modeling, interoperability, legacy systems and conformance requirements.

Online Journals and Magazines. Online journals and magazines provide current material on the issues involved in the management of telecommunications services. Some of the more noteworthy publications are:

1. *Institute of Electrical and Electronic Engineers (IEEE) Communications Surveys and Tutorials* (www.comsoc.org/livepubs/surveys/index.html)
IEEE Communications Surveys and Tutorials is the free IEEE ComSoc (Communications Society) online magazine for generalist throughout the field of communications and communications networking. Readers are the people involved in research and development, deployment, or instruction in fields related to communications.
2. *Telephony Online* (www.internettelephony.com/)
Telephony is the leading publication for all communications service providers: new and incumbent, wired and wireless. It delivers insightful and thoughtful coverage of the news, technologies and business strategies driving the industry for more than 70,000 providers. Major topics are access technology, finance, back office, optical, broadband services, regulatory, enterprise and wireless.

Magazines and Newsletters

1. *Telecommunications Magazine* (www.telecoms-mag.com)
Telecommunications Magazine is aimed at satisfying the information needs of service providers, and is targeted mainly to professionals at the decision-making level. A version for the 'Americas' and one for the 'International' markets are published, and provide the latest news on broadband access, optical networking, service provisioning, monitoring analysis, and wireless and service providers.
2. *IEEE Communications Magazine* (www.comsoc.org/pubs/commag/)
IEEE Communications Magazine provides timely information on all aspects of communications: technology, systems, services, market trends, development methods, regulatory and policy issues, and significant global events. It is also available online and is a publication of the IEEE Communications Society. This magazine features issues in March each year on Telecommunications Management.
3. *Service Management Europe Magazine* (www.servicemanagement.co.uk/pages/index.cfm?pageID=872)
Published by **Penton Media Europe**, this is the UK's premier high-tech field service publication. It features a wide range of articles offering in-depth analysis and insights into the spectrum of existing and emerging service challenges that decision makers face today.
4. *Service Management Europe Newsletter* (www.servicemanagement.co.uk/newsletters/index.cfm)
This newsletter complements the *Service Management Europe Magazine* by providing regular issue-driven, electronic newsletters (*SM News*), so that subscribers remain in constant touch with what is happening.

Journals

1. *International Journal of Services and Standards (IJSS)* (www.inderscience.com/catalogue/s/ijss/indexijss.html).

IJSS presents current practice, models and theory in services and standards development, design, management, implementation and applications. The objectives are to develop, promote, and coordinate the development and practice of services and standards. *IJSS* aims to help professionals working in the field of service and standards, academic educators, and policy makers to contribute, disseminate knowledge and learn from each others' work in the area.

2. *Journal of Service Research* (www.rhsmith.umd.edu/ces/Journal_of_Service_Research.html#board)

This multi-disciplinary journal has an international service research scope. The journal's mission is to be the leading outlet for the most advanced research in service marketing, e-service, service operations, service human resources and organizational design, service information systems, customer satisfaction and service quality, and the economics of service.

3. *International Journal of Network Management* (www3.interscience.wiley.com/cgi-bin/jhome/5703)

This journal provides practical information for more effective management, operation and maintenance of communications networks. Articles facilitate the readers' evaluation of equipment and systems, provide a detailed description of performance issues, and discuss the advantages and disadvantages of a variety of networking approaches. Target readers are telecommunications managers, engineers, researchers and students of communications technology.

4. *Journal of Network and Systems Management* (www.cstp.umkc.edu/jnsm/)

This journal covers a wide range of telecom-

munications topics, including: architecture; analysis; design; software; standards and migration issues related to the operation, management and control of distributed systems; and communication networks for voice, data, image and networked computing.

Internet Resources. While one has to be cautious about the credibility of Internet resources, there are some excellent sources for the management of telecommunications services. Some of the best are:

1. Telecommunications services management guide (www.digitalfuel.com/TelecomServices.asp)
2. Telecom service management software directory (www.capterra.com/telecom-service-management-software)
3. Telecommunications management – comprehensive directory of useful resources (<http://homepage.tinet.ie/~slevin/tm/tm-info1.htm>)
4. Telecom management information – resource for better telecom cost and information management (www.telecominfo.com/)
5. Tech library – white papers, case studies and product information on hot telecommunications technologies (<http://techlibrary.commweb.com/>)

Course Structure. Delivery methods for the course material and the associated learning activities should be tailored to each professor's preferred teaching style. The suggested course structure outlined here is one that fits our preferences and is deemed to be a generalized model adaptable to most teaching styles.

Lectures utilizing material obtained through books, journals, the Internet, and trade publications should be used throughout the course to assist in building a framework of understanding that will enhance the students' understanding

of assigned readings and projects. The order, frequency and depth of lectures will depend on the professor's preferences and the previously assigned reading material.

As part of the Management of Telecommunications Services course model, three specific course activities are recommended: (1) an individual research project; (2) a group research project; and (3) a hands-on project using service management software.

The syllabus distributed at the beginning of the semester should include the detailed assignment guidelines for the individual research project and the group research project, a description of the deliverables and the evaluation criteria. It is recommended that the performance of each individual project and each group project be monitored, by requiring students to turn in two or three intermediate progress reports at predefined points in the individual and group research projects. The deliverables from the individual and group research projects should be evaluated on content, format, style, and other predefined criteria.

Individual research project. The instructor should provide students with a list of possible research topics from which they can choose. These topics should coincide with current course content or current issues in the management of telecommunications services. To aid undergraduate students in the literary search necessary for their research, it is suggested that a professional business librarian from the university library be invited to class to provide a tutorial on performing a literary search.

Group research project. After completing an individual research project, group research projects should be assigned to groups of three or four students. The group research project will be useful in stimulating students' learning of new and interdisciplinary concepts in the more flexible and comfortable learning environment of the peer education process. This will also provide students

with experience in working in teams, a skill that they need to further develop and practice before entering the workplace.

It is recommended that the group research topic be based on a real-world business and an existing service in that business. Using real-world cases in the group research projects will afford students the opportunity to experience things firsthand, such as realistic content, real-world business objectives, organizational impacts, social values, and ethical issues (Hackney, McMaster & Harris, 2003; Gendron & Jarmoszko, 2003). The research topic can be selected by brainstorming among group members, or the professor can assign them. The students are asked to complete their group research project as follows:

1. Select a target telecommunications service provider (e.g., a particular mobile phone service provider) and one service delivered by that provider (e.g., family calling plan).
2. Survey existing literature regarding the specific service provider and service selected to fully understand what is happening in today's marketplace.
3. Propose new, improved features to the existing service by using available management of telecommunications services techniques learned as part of the course.
4. Suggest new ideas to improve legacy services currently offered to customers.

At the completion of the projects, each group will present the results to the entire class. In addition to a class presentation, utilizing presentation software such as Microsoft PowerPoint, the students should provide the professor with a presentation file, a written project report and a few test questions the group feels the class could answer after listening to the formal presentation. The questions collected from all the groups may be used on the final exam to test the level of understanding of all students on all research project presentations. Such a procedure can be very use-

ful in garnering student attentiveness during all group presentations. The instructor and all class members will evaluate each of the group research projects based on prearranged guidelines.

Hands-on practice using service management software. To enhance the students' understanding of technology and its application in the real world, it is important to give students hands-on experience with technology in a telecommunications lab in the class room (Greca, Cook, & Harris, 2004). Hands-on practice opportunities in which the students actually use service management software will be beneficial in enhancing their understanding of the course's technical components. Depending on the learning environment desired by the professor, the hands-on practice opportunities can be offered as lab sessions or as individual take-home assignments.

Students' hands-on work with software should follow a process designed to foster the incremental building of students' software skills, from basic to advanced. Therefore, it is recommended that students begin with data service management software, then migrate to network monitoring and analysis software; then utilize network management software; and finally try hands-on practice with management of telecommunications services software.

Unfortunately, due to the high cost of software, there is minimal management of telecommunications services software available for the hands-on training of university students. With limited university budgets, the use of downloadable public-domain software meets the needs of universities' telecom labs (Choi, 2003). Although public-domain software specifically for the management of telecommunications services does not appear to be presently available, public-domain data communications network software can be substituted, since data communication network software closely matches the features of management of telecommunications services software. Through the relationship with the industry fostered through the TM Forum's University

Program, telecommunications faculty should be able to eventually secure full-fledged management of telecommunications services software for their universities' telecommunications lab facilities.

CONCLUSION

Since the effective management of telecommunications services is critical in the telecommunications industry, a new Management of Telecommunications Services course is needed to prepare students for the demands made by employers.

An awareness of the importance of the management of telecommunications services and the developed course model will be of interest to three groups. First, researchers in academic communities should be aware of the important role of management of telecommunications services in the industry and the resulting implications for needed IT research. Second, IT curriculum planners will find this information helpful as they strive to design curricula that will meet employee training needs of the IT industry. And third, telecommunications professors need to know the importance of management of telecommunications services and need to have a working course model from which they can begin structuring a course.

The proposed course model is meant to serve as a call to action and to be an initial step toward the development of a needed telecommunications course. Future research on empirical evidence gleaned from students who have participated in this course and feedback from their employers will provide information needed for adjustments and enhancements to the course content and delivery methods.

REFERENCES

Adams, E. K., & Willets, K. J. (1996). *The lean communications provider: Surviving the shakeout*

through service management excellence. New York: McGraw-Hill.

Carr, H. H., & Snyder, C. A. (2003). *Management of telecommunications: Business solutions to business problems enabled by voice and data communications* (2nd ed.). New York: McGraw-Hill/Irwin.

Choi, Y. B. (2003, August 8-10). A Web-based network analysis framework based on the public domain software. *The US-Korea Conference on Science, Technology, and Entrepreneurship*, Pasadena, CA.

Choi, Y. B., & Teer, F. P. (2003, October). A telecommunications service management course model for the college of business. In *Proceedings of the 2003 International Association for Computer Information Systems (IACIS) Conference*, Las Vegas, NV (pp. 1-4).

Eyers, D., & Hahn, W.L. (2002). IT telecom forecast scenarios, 2001-2004. *Dataquest*, December 2.

Forouzan, B. A., & Fegan, S. C. (2003). *Business data communications*. New York: McGraw-Hill Higher Education.

Gendron, M., & Jarmoszko, A. T. (2003). The integration of technology theory and business analysis: A pedagogical framework for the undergraduate MIS course in data communications and networking. *Journal of Information Systems Education*, 14(4), 361-371.

Greca, A. N., Cook, R. P., & Harris, J. K. (2004). Enhancing learning in a data communication and networking course with laboratory experiments. *The Journal of Computing in Small Colleges*, 19(3), 79-88.

Grover, V., & Saeed, K. (2003). The telecommunication industry revisited – The changing pattern of partnerships. *Communications of the ACM*, 46(7), 119-125.

Hackney, R., McMaster, T., & Harris, A.J. (2003). Using cases as a teaching tool in IS education. *Journal of Information Systems Education*, 14(3), 229-234.

Hall, J. (Ed.). (1996). *Management of telecommunication systems and services*. Berlin: Springer.

Hallows, R. D. (1995). *Service management in computing and telecommunications*. Norwood: Artech House.

IS '97. (1997). *Model curriculum guidelines for undergraduate degree programs in IS*. Retrieved December 6, 2004, from www.is2000.org/is97/rev/review1.html

IS 2002. (2002). *Model curriculum guidelines for undergraduate degree programs in IS*. Retrieved December 6, 2004, from http://192.245.222.212:8009/IS2002Doc/Main_Frame.htm

Johnson, T., & Jakeman, M. (1997). *The customer challenge*. London: Pitman.

Korhonen, T. O., & Ainamo, A. (Eds.). (2003). *Handbook of product and service development in communication and information technology*. Boston: Kluwer Academic Publishers.

Lewis, D. E. (1999). A developmental framework for open service management systems. *Journal of Interoperable Communication Networks*, 2(1), 11-30.

Lovelock, C., & Wright, L. (2002). *Principles of service marketing and management* (2nd ed.). Upper Saddle River: Prentice Hall.

Members of the TM Forum's Universities Program. (2003, July 31). *Charter of TeleManagement Forum's Universities Program* (White paper). Pasadena, CA.

Odon, A., Ward, K., Savolaine, C., Daneshmand, M., & Hoath, P. (2002). *Telecommunications quality of service management: From legacy to emerging services*. London: Inspec.

Management of Telecommunications Services

Rosenbush, S., & Elstrom, P. (2001, August). Eight lessons from the telecom mess. *Business Week*, 13, 60-67.

Russell, M. (2003). *Beyond the gloom horizon: The way forward for telecoms*. Agilent Technologies white paper, July 1.

Shannon, V., & Schenker, J. L. (2003, October 10). Chastened mood at telecom trade show. *International Herald Tribune*, 1.

Strouse, K. G. (1999). *Marketing telecommunications services*. Norwood: Artech House.

TeleManagement Forum. (2004). *About the TM forum*. Retrieved December 6, 2004, from www.tmforum.org

Ward, E. P. (1998). *World-class telecommunications service development*. Norwood: Artech House.

This work was previously published in Integrating Information & Communications Technologies into the Classroom, edited by L. Tomei, pp. 216-233, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Section 7

Critical Issues in Information Communication Technologies

This section addresses conceptual issues related to the field of ICT, such as the existence of a gender barrier and the potential of ICT for realizing social justice. Within these chapters, the reader is presented with an in-depth analysis of the most current and relevant conceptual inquiries within this growing field of study. Particular chapters address attitudes toward ICT in high schools, international ICT spillover, and ICT literacy among members of society. Overall, contributions within this section ask unique and often controversial questions related to ICT study and, more often than not, conclude that solutions are both numerous and contradictory.

Chapter 7.1

ICT, Work Organisations, and Society

Gunilla Bradley

Royal Institute of Technology, Sweden

INTRODUCTION

The present fourth period, the network period, is characterised by a convergence of three main technologies (computer technology, telecommunication technology, and media technology) into information and communication technology (ICT). ICT are embedded in many things and the invisible microcomputerisation that once took off with the chips is enhanced through nanotechnology, biotechnology, and wireless technology—often entitled ubiquitous computing. The author presents ongoing changes in work life and presents a theoretical model: The convergence theory on ICT and psychosocial life environment. The convergence model reflects some main ongoing processes in the network society encompassing various spheres of life (professional, private, and public). Sociological theories on the Information Society are discussed in this context as well as theories from the information systems (IS) community. In the Future Trends section the new international collaboration is addressed where research and policy (including politics) develop

goals and strategies to deal with societal and psychosocial changes related to the development, introduction, and use of ICT.

BACKGROUND

The area, Information and Communication Technology and its interaction with social changes on organisational, individual, and societal levels, has in the 2000s received growing attention, due to the depth and wide use of it. This article is mainly based on my latest two books. The first one, *Humans on the Net: ICT, Work Organization, and Human Beings* (Bradley, 2001) was presented at the first European Union (EU) conference, *Work Life 2000*, during the half year when Sweden chaired EU. The second book, *Social and Community Informatics: Humans on the Net* (Bradley, 2006), summarises and updates the authors research over 30 years. It will hopefully serve as a source for people to better understand and contribute answers to questions such as: How will people live, learn, and work in the future ICT

society? In short, key issues within the organisational change/psychosocial life environment, and their interaction with the use of information and communication technology are analysed.

Some sections were presented at the World IT Forum (WITFOR 2003) in Vilnius in August 2003 addressing “Social and Ethical Aspects of the Information Society” and at the conference, “E-society” in Avila, Spain in 2004.

Empirical experiences show that it is important to keep a balance between pure technical research and development in software and hardware technologies, new fields such as nanotechnology and the behavioural and social science disciplines, for example, psychology, sociology, cultural anthropology, and ethnography.

The ICT-related disciplines have so far been focused too much on the “technology push” instead of on human needs and requirements in the development, introduction, and use of ICT. New universities, sometimes called IT universities, are appearing in many European countries trying to bring together disciplines from the traditional university and disciplines from the technical university to facilitate a necessary rethinking and reorientation of research and development (R&D), sometimes resulting in new centres directly entitled “Humans in the ICT Society” focusing on the human, organisational, and societal aspects of ICT use.

THE NETWORK ERA: CONTINUOUS AND ACCELERATED CHANGES IN THE DESIGN OF ORGANISATION, WORK TASKS, AND MANAGEMENT

The main changes during the network period are summarised in the next five sections and are mainly based on Bradley (2001) and further developed in Bradley (2006). They are primarily derived from our research in the developed countries.

Accelerated Changes at Work in the Net Era

More flexible work processes have appeared regarding both the professional role itself and leadership. Further, the professional role, the learning role, and the role of citizen are becoming more and more integrated. Repetitive jobs and physically strenuous jobs, including routine work, are disappearing and a total upgrading of qualifications has occurred. In parallel with this, the organisation has become flattened out. In an international perspective more work tasks are becoming similar because software programs are sold world-wide and the work tasks are carried out in a more and more similar way.

Organisational structures as networks have become more and more common. Psychosocial and organisational aspects of networking have come into focus in recent research.

Network Organisations are Like Crocheted Table Cloths

- A crocheted lace cloth is a good model for the developing and future structure of how the world—social systems, organisations, and official authorities—will look. The network era has been established and networks interact more and more wirelessly. It is possible to crochet all the time: each new loop (computer) is connected to another loop through the same yarn (tele-technology).
- Power can both be centralised and decentralised in the network structures, but the process is invisible.
- The distribution of power is now possible in quite a deep sense as competence transfers to the periphery, out to the production level.
- The hierarchical structures of companies that mirrored industrialisation and industrial technology during the mainframe period of the computerisation era are fading away.

The present trend toward the flattening of hierarchies can, according to Aulin's law of requisite hierarchy, be explained by the increasing regulatory abilities of individuals and organisations, due to such factors as better education, management, and technological support (Heylighen & Joslyn, 2001). Another way to express this is that hierarchical regulation and hierarchical organisations are built into information systems and ICT.

Network Organisations: New Communication Patterns

Some examples of what characteristics the network organisations have and how people are affected are:

- direct communication between the various levels of the organisation
- barriers between idea and execution are disappearing
- reallocation of power in the organisation
- continuous changes of structure and roles
- openness to the surrounding world
- multidimensional virtual culture

Decreasing Core Workforce in the Flexible Company

At the centre there is a core workforce of permanent full-time employees who enjoy a wide range of employment rights and benefits; however, the core workforce is decreasing. The other growing part is the peripheral workforce. It consists of part-time staff, self-employed consultants, subcontracted and outsourced workers, and temporary and agency employees. Some of these "knowledge workers" are key resources, while others are exchangeable. Through the network organisational structure they might have very strong positions in the company because of their expertise or social contacts, although this is unseen. Power is invisible in these new forms of organisations: power has no

outward manifestation and is not reflected to the same extent as before in properties and gadgets linked to leadership.

Hence more and more organic organisational structures are developing, with a focus on flexible work processes, including dynamic networks for capital and human resources (compare the network organisations above). Economic systems are being created where the present boundaries are increasingly becoming eroded. Advanced ICT support is used for various forms of collaboration. More and more individuals function as self-governing company units.

Reflections

There are both positive and negative impacts on the individual. One critical point is that too much responsibility is put on the individual who:

- loses permanent employment
- has to manage his/her own competence development
- has to market himself/herself
- is expected to take on any position and swallow job enlargement
- is expected to be creative – with little compensation
- is a unit in a competitive world market

One might ask if this means the freedom from paid work in a traditional sense. Other questions are: Should our school system prepare for fostering free agents or portfolio individuals? Should school and learning prepare young people for acting proactively in meeting the ongoing unhealthy development? From an ethical point of view individual responsibility is "a word of honour". People need a basic security as (employees) citizens. Regarding the role as workers and citizens, there is a need for balance between a strong society and strong individuals. Few persons are strong throughout life. The importance of thinking in terms of

sustainability both regarding environment and sustainable human beings is becoming clear.

The Home Becomes a Communication Sphere

The big challenge in the near future is the home in a broad sense, as many human roles are converging to one life role, and the home is more and more understood in terms of virtual space as well as physical. Driving forces are converging embedded technologies. The following trends are enforcing the home as a communication sphere, where the home could be regarded as an extended family centre, a care centre, a multimedia centre, a centre for democratic dialogue, a marketplace, a learning centre, and an entertainment centre.

The Occurrence of an Accelerated Tempo

Research shows that there are reasons to talk about ICT stress or Internet stress. Certain ICT stress is related to the fact that there is an increased dependency on computers and networks and an increased expectancy that these technologies are functioning well. Stress phenomena in the Internet world are information overload, contact overload, demands for availability, lack of organisational filters, and difficulty of separating noise from essentials, changing level of expectations, and an altered perception of time and space in general.

THEORIES ON ICT AND ORGANISATIONAL AND SOCIETAL CHANGE

Theoretical models on “Computer Technology and Changes and Work Life” were developed by the author (Bradley, 1977, 1986/1989) and were empirically tested in three large work organisations in Sweden, representing three main historical periods of computer technology (from

mainframe computers to microcomputerisation). The psychosocial work environment was considered in terms of the following perspectives: three levels of analyses (individual, organisational, and societal), objective and subjective work environments, interplay between the levels of analysis, interplay between objective and subjective work environments, interplay between working life and private life, and a life-cycle perspective.

The roots are in social psychology and organisational theories the way these disciplines were interpreted in the Nordic countries at the time. A main perspective is that the environment/structure on various levels is affecting the individual, but she/he can also impact the society on these levels. The concepts of the model include structural factors, our perception of these, and intervening variables that explain reactions but also have to be focused at the use and introduction of ICT.

Psychological variables were used as general terms covering a number of intermediate, psychologically relevant variables such as the level of aspiration, weight attached to specific work-environment areas. Psychosocial environment referred to the process involving the interaction between the objective environment and the subjective one and, essential concepts within the psychosocial work environment included factors such as contact patterns and communication, organisational structure and design, work content and workload, participation in decision making, promotional and development patterns, salary conditions and working hours. Theories, methods, and results from the RAM programme were summarised in “Computers and the Psychosocial Work Environment” (Bradley, 1989) and appear also in “Social and Community Informatics” (Bradley, 2006), since the measures and tools are still relevant for studies of the social and organisational impact of ICT, but now are applicable in the broad life environment.

The present network period is based strongly on the convergence and integration of three main technologies: computer technology, tele-technol-

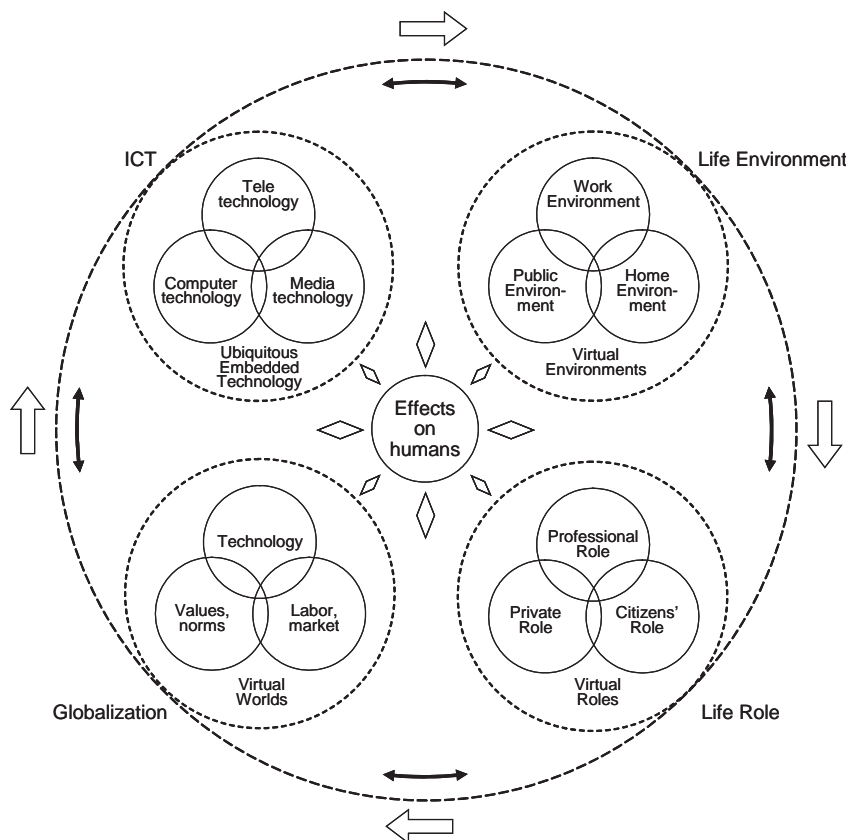
ogy, and media technology. The convergence process (see Figure 1) is enforced all the time by smaller, cheaper, and more powerful components. ICT is more and more being used in almost every activity and embedded in more and more places (ubiquitous computing). Converging circles are reflecting graphically the ongoing process.

Both convergence and interactions are important features in the model. Convergence here means a move towards a common content. Interaction means that technology interacts with the social world with values and beliefs. There is also an ongoing interaction between the “clusters of circles”.

The convergence model on “ICT and the Psychosocial Life Environment” is a graphical illustration of ongoing changes in the Net Society. It is presented in detail in Bradley (2006). Some comments concerning the model in Figure 1 will follow, and the description of structures with reference to concepts (1-5) in the outer circle in the figure.

1. Globalisation: A convergence is occurring between technology, economy, norms/values, and labour market and is entitled globalisation. The geographical span is changing. At present our work life is mainly based

Figure 1. Convergence model on ICT and psychosocial life environment (Bradley, 2005, in press)



- on national and international trade which will be more and more without limits in the future and will take global forms. Electronic commerce and electronic marketplaces are creating a strong change factor behind the structure of work life. The geographical space in the future is both global and beyond—including virtual reality (VR).
2. **ICT:** A convergence of computer technology, telecommunication technology, and media technology is occurring to become what is entitled ICT. Knowledge is managed in new ways. In the 2000s there are multiple channels to choose from: word of mouth, writing, audio visual, and electronic. In the future metachannels, for example, metamedia of VR and controlled reality environments (environments that are manipulated and managed in VR) will become more frequent. In the latest wars it has sometimes been unclear what could be “manipulated reality”.
 3. **Life Environment:** A convergence of work environment, home environment, and public environment are converging to a life environment, where the public issues tend to merge into our homes. A new emphasis on certain dimensions in the psychosocial environment occurs. New dimensions are appearing in the psychosocial environment. Openness for unforeseen implications is required.
 4. **Life Role:** Professional role (work life) and private role (private life) and citizen’s role (public life) converge to become a Life Role. Role and role formation are central concepts in social psychology and represents a level between structures and the individual. The concept “role” is a system of social norms that is directed to an individual as a member of a group or as belonging to a limited category of people. The concept “role” appears where psychology and sociology meet. It is also important that individuals can influence and form their roles.
 5. **Effects on Humans:** Effects on the individual become more multifaceted and complex. This is valid both regarding the psychological and the physical effects on the individual. The way humans handle their situation can roughly be categorised as active or passive reactions. In the Figure 1 this is represented by the circle in the middle, “effects on humans”, with two-way arrows around as a flower showing an interaction. In consequence, the individual is affected by ICT, the Life Environment with its three subenvironments, the Life Role with its three subroles, and globalisation with its three components of values, technology, and labour market. But as an individual, that person can also influence the technology, the environment, and his/her own role and phenomena on the organisational and societal level, and the new virtual reality (see the following).
- Four circles representing VR are marked with dotted lines and surround the four clusters of converging circles. These circles reflect our participation in cyberspace on various levels. In the lower left part in Figure 1, Virtual worlds is a concept that refers to the global level. Within the concept of ICT, the step taken by applied embedded and ubiquitous technology make the technology more hidden for the individual and in the society as a whole. Virtual environments in the upper right part of Figure 1 is already a common concept. Finally, virtual human roles are appearing, which in a more extreme form could be another personality that people play, for example, avatars.
- The thin double-directed arrows represent interaction, and the broader one-directed arrows represent the main direction for the movement and the process described in the circle model. Transferred to actions people can, in the professional role, private role, and citizen’s role influence our

life environment on various levels of analyses (see also Future Trends section).

How do the convergence theory on ICT and the psychosocial life environment relate to other theories on the information society? What do other theories conclude about the information and communication society (ICTS)?

Frank Webster (1995), in *Theories of the Information Society*, provides a point of departure of an interrogative and sceptical view of the concept of an information society (IS). His approach is to start from contemporary social theories instead of social impact approaches. The following are categorised as pro-IS theories: post-industrialism, postmodernism, flexible specialisation, and the information mode of development. The following are against IS theories: neo-Marxism, regulation theory, flexible accumulation, the nation state and violence, and the public sphere. Webster brings forward five definitions of IS which represent criteria for the new society, by its own or combined: technological, economical, occupational, spatial, and cultural. References to some main theories are given in the following: Anthony Giddens (1990, 2000), Herbert Schiller (1993), Jurgen Habermas (1989).

Webster raises the question whether what dominates now is a break or continuity and his conclusion is that there are still features of a capitalist continuity, but also a shift in orientation with some novel form of work organisation and some change in occupational pattern. But there is no system break witnessed so far (Webster, 1995). However a group of theorists categorised as postmodernists (Barthes, Baudrillard, Vattimo, & Lyotard) point out that the information society contains a quite new type of society—a paradigm shift. Jensen (1999) has identified four various directions that for him seems to be plausible for the future: the dream society; the green society; a world of conflict; a world with no changes. He argues that the dream society encompasses the end of human kind's multi-millennium epoch of

material domination and the beginning of the first postmaterialistic era. This is very much in contrast with the view that for a long time people will fight towards the so called digital divide.

The most quoted research during the latest years has been Castells' book on the Network Society. In his latest book (Castells, 2001), he analyses the digital divide from a global perspective.

From the convergence theory (Figure 1) and associated empirical research together with the sociological theories mentioned above on ICT and societal change, the conclusion can be made that up to the beginning of year 2000 there is a continuity as well as new paradigm shift. In other words there are opportunities to influence the direction that will dominate in the future. The question is rather if people are able and willing to engage themselves on various levels of actions.

Theories in the field of this article come from many academic disciplines, academic communities, and cultures which have different perspectives and focus. What are the contributions from the IS community? For many years the focus was in development and design of information systems, and later on, the introduction and use of information systems. The tele-technology and media technology parts of the concept ICT were not addressed for many years. Some contributions after 2000 are as follows.

Melville, Kraemer, and Gurbaxani (2004) have developed a model of IT business value and thereby chose the resource-based view of the firm, which is often used in management literature and international business. They applied the integrative model to synthesise research about IT business value and developed propositions for future research in the field. The principal finding from their analysis was that IT is valuable, but the extent and dimensions are dependent on internal and external factors, including complementary organisational resources of the firm and its trading partners, as well as the competitive and macroenvironment.

Their conceptual model is comprehensive and shows the complexity of the field. It is integrative but is not interactive in the sense that interactions between theoretical levels of analysis are discussed. The following main concepts are of IT resources, technological IT resources, human IT resources, and complementary organisational resources. The other concepts are business processes and performance with focus on competitive environment: industry characteristics, trading partner resources, and business processes. Within a macroenvironment are country characteristics and similar concepts.

Schulze and Orlikowski (2001) have explored the discourse on virtual organising and identified a number of metaphors which characterise various aspects of vitality. They examined the various metaphors in the practitioner-directed literature on virtual organising and concluded that the discourse contained a multiplicity of different metaphors. The identified metaphors were virtual organising as a platform, as existing in space, as composed of bits, as operating as a community, and as engaging in a network of relationships. They suggest that due to the absence of experiences to guide practice, these images are shaping people's views of and actions towards virtual organising. They then analysed these metaphors with regard to aspects of organising, meaning, source, examples, affordance, and challenge. From the conclusion that metaphors are powerful tools of social constructions, they mean that researchers and practitioners should be aware of the critical implications and of unintended consequences.

Another strand of research in the IS literature is user acceptance theory (Davis, Bagozzi & Warshaw, 1989). Van der Heijden (2004) discusses the differences in user acceptance models for productivity-oriented and pleasure-oriented information systems, hence emphasising various values.

In response to the criticism of IS research different types of approaches have been applied, for example, grounded theory, use of the discipline

ethnography, structuration theory, and activity theory to study the design, development, and use of ICT.

Networks of various ICT related academic schools sharing some common perspective form world-wide networks, for example, Network for Value Sensitive Design, Community Informatics Research (CIRN), The International Conference on the Social and Ethical Impacts of Information and Communication Technologies (ETHI-COMP).

In summary, critical research has been more common outside the IS community, but this is changing. Walsham (2005) argues the need for IS research which is critical and aimed at making a better world with technology. He draws implications for actions in terms of research agenda, teaching activities, publishing, and institution building. A better world with ICT should not mean better in purely economic terms, but also related social and spiritual welfare globally. A critical approach is, according to Walsham, a perspective that includes, for example, the social construction of "truth", historical and cultural contingency, and power relations. He concludes that global futures in general, and the IS field in particular, are not predetermined, but result from our own efforts and actions.

FUTURE TRENDS

People are living in a society deeply and broadly affected by the new technology. It might be harder to identify both risks and opportunities at present and for the future. A new generation exists, which has grown up in the digital environment. There are reasons today to go back to classics in research; for example, there are no more work environments in the traditional sense – they are dissolving, although phenomena identified in research in working life, in which the Nordic Countries were very active for many years, have

to be reviewed with a new perspective. How are the human needs of influence, belonging, and meaning met in the new structures and communication patterns?

Regarding “Effects on Humans” (compare Figure 1), important questions for the future are: how is ICT changing our identity and self-perception, social competence, creativity, integrity, trust, dependency, balance between emotional and rational components, balance between female and male, and involvement and alienation?

One way to summarise the discussion on the ICT society and the individual is to address psychosocial processes. These could be formulated as research questions or policy statements. By now there are reasons to start up normative research which later on could be discussed across wider cultures. It concerns the classic question if research is value-free, which at an early stage was challenged by many scholars and with strong arguments.

- Normatively, ICT should contribute to enrichment in the social contact between people and should be used to prevent social isolation and facilitate integration.
- ICT should contribute to a greater autonomy for the individual and prevent stress reactions. Control or freedom is a classic issue often described in the terms of “privacy, integrity”.
- ICT should facilitate information access for all and support individual learning, but at the same time prohibit various kinds of overload, for example, information overload and contact overload.
- ICT should contribute to the deepened development of true human qualities and be used to provide time for people to develop themselves as human beings.
- ICT should contribute to both environmental sustainability and human sustainability.
- E-conflicts must be avoided. E-cooperation and peace is a major goal.

In the Vilnius Declaration at the World IT Forum, the major goals are seen as:

- Bridging the digital divide between rich and poor in the world, urban and rural societies, men and women, and different generations
- Ensuring the freedom of expression enshrined in Article 19 of The Universal Declaration of Human Rights and other such instruments
- Reducing poverty through the use of education and ICT
- Facilitating the social integration of excluded segments of societies
- Respecting linguistic and cultural diversity
- Fostering the creation of public domains with full respect of intellectual property rights
- Supporting communities in fighting illiteracy
- Encouraging e-governance and e-democracy initiatives
- Improving the quality of life through effective health service systems
- Protecting the local and global environment for future generations

There are academic discourses on most of the concepts embedded in the main goals above, for example, digital divide, sustainability, integration, quality of life, and e-democracy. Theories and empirical research in the field have to be balanced with action-oriented, value-oriented research.

WSIS (World Summit on the Information Society) is an opportunity for a wide range of actors to develop principles and prioritize actions that would lead to democratic, inclusive, participatory, and development-oriented ICT societies at the local, national, and international levels. Meetings will continue.

CONCLUSION

With distributed computer power, strong telecommunication (for example, the Internet) and mobile equipment, there is an inherent opportunity for deepening democracy and strengthening individuals and their influence on society. However, there is also an increasing risk of enforcing centralisation and misuse of power. Issues on organisational design and management—especially classics in participation design—are now important areas for R&D, and are valid not solely for the working life and professional role. The organisation and management of our role as private persons and as citizens are becoming crucial.

Within disciplines such as Informatics a discussion of focus in research and development is taking place. Both analysis and design need to address not only the work process and management connected to the sphere of production life, but also people's life environment and the psychosocial life environment. Not only professional roles, but also our roles as citizens and private persons are going through a deep change. Community research in a broad sense comes to the fore, with respect to both physical and virtual communities. Analysis and design of ICT and societal systems at the local level and globally become important. There is also a need for new and additional actors at the deeper and broader integration of ICT in the society (children, elderly, and consumer organisations). Educational programs on community informatics and social informatics are appearing in many academic institutions.

Many academic communities are addressing the complex issue of "ICT and Work Organisation and Society", for example, ODAM within IEA (Organisational Design and Management), ETHICOM, CIRN, CSCW society, and subtracks within HCII (Human Computer Interaction International), and Working Groups within IFIP (International Federation of Information Processing). ECIS (European Conference on Information Systems) and the correspondent international

ICIS (International Conference on Information Systems) are becoming more open to these issues during the latest years. Research becomes easily fragmented and hard to overview. However, new journals are appearing with a broad cross-disciplinary perspective. New centres are established, and widening definitions of disciplines are occurring in parallel with a harder specialisation, especially within electronics and hardware. Hopefully this article will serve as opening the door to a field of research with accelerated speed of change and complexity. There is a need for a much stronger support internationally for cross-disciplinary, cross-cultural, and action-oriented research on the topic, "ICT for Deepening of Humane and Societal Qualities".

REFERENCES

- Bradley, G. (1977). *Computer technology, work life, and communication*. Stockholm: Liber (In Swedish).
- Bradley, G. (1989). *Computers and the psychosocial work environment*. London/Philadelphia: Taylor & Francis.
- Bradley, G. (2001). *Humans on the Net—Information and communication technology (ICT) work organization and human beings*. Stockholm: Prevent. ISBN 91-7522-701-0.
- Bradley, G. (2003). ICT for deepening human and societal qualities. *Proceedings of WITFOR 2003*.
- Bradley, G. (2006). *Social and community informatics: Humans on the Net*. London: Routledge.
- Castells, M. (2001). *The Internet galaxy*. Oxford, UK: Oxford University Press.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology:

A comparison of two theoretical models. *Management Science*, 35(8), 983-1003.

Giddens, A. (1990). *The consequences of modernity*. Cambridge, UK: Polity.

Giddens, A. (2000). *Runaway world*. London: Routledge.

Habermas, J. (1989). *The structural transformation of the public sphere*. Cambridge, UK: Polity.

Heylighen, F., & Joslyn, C. (2001). Cybernetics and second order cybernetics. *Encyclopaedia of Physical Science & Technology* (3rd ed.), 4, 155-170.

Jensen, R. (1999). *The dream society*. New York/London: McGraw-Hill.

Khakhar, D. (Ed.). Witfor 2003 (World IT Forum) White Book. Key note contributions and panel discussions from the 8 commissions. Luxemburg (2004). IFIP Press.

Melville, Kraemer, & Gurbaxani (2004). Information technology and organisational performance: An integrative model of IT business value. *MIS Quarterly*, 45(2), 283-322.

Schiller, H. (1993). Public way of private road? *The Nation*, 12, 64-66.

Schultze, U., & Orlikowski, W. J. (2001). Metaphors of virtuality: Shaping an emergent reality. *Information and Organization*, 45-77.

Walsham, G. (2005). Development, global futures and IS research: A polemic. *Journal of Strategic Information Systems*, 14(5), 1513.

Webster, F. (1995). *Theories of the information society*. London: Routledge.

Van der Heijden (2004). User acceptance of hedonic information systems. *MIS Quarterly*, 28(4), 695-704.

KEY TERMS

E-Society: A coherent term referring to a society where information and communication technology deeply and broadly have penetrated and become integrated in the society and its substructures, for example, workplaces, homes, authorities, communities with use of the present terminology, which in the next step could be changed. The prefix “E” refers to electronic communication and/or electronics. Other similar terms used are ICT society, digital society, information society, and computer society. Electronic society or e-society can involve societies that use electronic communications technology over a broad spectrum, for example, the Internet, extranet, e-mail, e-books, databases, and mobile phones.

Convergence: Convergence here means a move towards a common content.

Net, The: Net may mean fibers woven in a grid-like structure, as in fishing net or crocheted cloth. It most often refers to the network (see Network) or Internet (see Internet). In this article it mainly refers to a virtual place where digital information is transmitted and stored and where digital communication has taken place. The term is used for the hardware, software, and structure.

Network Organisation: A computer network is a system for communication between computers. These networks may be fixed (cable, permanent) or temporary via, for example, modem. To network is to interact socially for the purpose of getting connections or personal advancement. Many people network for jobs and information. To get a job in the present economy, it is important to have a strong network. The Internet is the largest of the existing networks. The term network has been transferred to organisational theory and refers to organisations characterised in this article.

Psychosocial: Psychosocial environment refers to the process involving the interaction between the objective environment and the subjective one. Essential concepts within the psychosocial work environment include factors such as contact patterns and communication, organisational structure and design, work content and workload, participation in decision making, promotional and development patterns, salary conditions, and working hours.

Role: The position, task, or function a person has in a certain context and the norms and expectations which are associated with this position or task. Every person has a set of roles which is played in various contexts, for example, professional role, private role, citizen's role. When various roles are hard to combine, a role conflict appears.

Software: Computer software (or simply software) is that part of a computer system that consists of encoded information as opposed to the physical computer equipment (hardware) which is used to store and process this information. The term is roughly synonymous with computer program but is more generic in scope. Software has historically been considered an intermedi-

ary between electronic hardware and data. As computational science becomes increasingly complex, the distinction between software and data becomes less precise. Software may at present be considered an interface between hardware, data, or software.

Stress: Medically speaking, stress is a combination of adjustment measures that is the organisms' reaction to frustrations and other sources of irritation in its surroundings. Stress in everyday speech normally refers to the harmful reactions, even if stress also can be a positive reaction. Stress often refers to the concepts of over-stimulation and under-stimulation. Stress occurs when an individual sees a situation as threatening and cannot reduce his/her frustration by means of socially acceptable and generally appropriate behaviour.

Work Organisation: Refers to the structure of a working place and includes the methods used to allocate work, the basis for decision making and organisational aids. Work organisation is also a part of the social and psychosocial work environment.

This work was previously published in Encyclopedia of Digital Government, edited by A. Anttiroiko & M. Malkia, pp. 969-977, copyright 2007 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 7.2

A Time Series Analysis of International ICT Spillover

Juan Juan Zhang

National University of Singapore, Singapore

Sang-Yong Tom Lee

Hanyang University, Korea

ABSTRACT

This article studies the role of international spillover of information and communication technology (ICT) in economic growth. We examine the performance of ten countries from 1982 to 1999. By empirically analyzing the relationship between total factor productivity (TFP) and domestic and foreign ICT investment with time series analysis tools, we find limited evidence that there exist international ICT spillovers for a group of countries. Further, we discuss the possible ICT policies to improve productivity and balance out a win-win situation for both ICT spillover sending and receiving countries.

INTRODUCTION

Nowadays, ICT is considered an extremely important factor that contributes to the accelerated rate of productivity of a nation, especially in many newly industrialized economies (NIEs) and developing countries. ICT is the combined utilization of electronics, telecommunications, software, networks, and decentralized computer workstations, and the integration of information media (Granville, Leonard, & Manning, 2000), all of which impact firms, industries, and the economy as a whole. ICT is comprised of a variety of “communication equipment” which includes radio, TV, and communication equipment and

software. Therefore, ICT investment includes “investments in both computer and telecommunications, as well as related hardware, software and services” (Dedrick et al., 2003, p. 4).

In recent years, the combination of computer and telecommunication equipment helps and enables businesses and organizations to share and exchange huge amounts of information. It also eliminates vast amounts of paperwork and speeds up transaction processes by the Internet, Intranets and other networks. In addition, technology and computer production has been a high growth sector in many countries. The ICT industry itself can be a source of economic growth and jobs (Kraemer & Dedrick, 2001). Consequently, it is widely believed that ICT investment helps to enhance productivity and economic growth.

ICT capital exhibits both traditional and non-traditional effects (Dedrick, et al., 2003). As traditional capital, ICT's returns accrue primarily to the firms, industries, or countries that make the investment, and diminish with continuing investment. Contrarily, due to its informational and transformational roles, ICT capital is similar to knowledge capital (Dedrick et al., 2003). ICT capital, if used properly, facilitates knowledge creation. We define knowledge capital as the data, information, knowledge, and wisdom necessary to support and grow an organization or economy. ICT enhances the productivity of employees, and therefore contributes positively to the generation of knowledge capital. Since knowledge capital is not rivalrous and has public goods properties, it leads to potential “spillovers.”

Grossman and Helpman (1991) define spillovers as follows: “By spillovers, we mean that (a) firms can acquire information created by others without paying for that information in a market transaction, and (b) the creators (or current owners) of the information have no effective recourse, under prevailing laws, if other firms utilize (the) information so acquired.” From this definition of spillover, one may derive that ICT spillover is an increase in social benefits without compensating

the ICT investors. If we regard investors as a national economy as a whole, then we have the concept of “international ICT spillover.” In other words, international ICT spillover is an increase in national productivity due to ICT investments in foreign countries.

ICT spillover emerges when social returns on investment exceed their private returns, creating situations in which investment in ICT becomes an innovator or investor, thereby, also benefiting other parties (Leeuwen & Wiel, 2003). “The Information Technology Boom” has given rise to many discussions about the potential of ICT to yield production externalities. Production spillovers or externalities can show up in the form of rent (pecuniary) spillovers or in the form of so-called technology/knowledge spillovers. These arise from the fact that knowledge and technology have some public good characteristics—knowledge capital can be owned and used by many parties simultaneously, leading to potential spillovers (Leeuwen & Wiel, 2003).

Globalization and rapid communications among innovators in different locations facilitate the process of invention and the spread of new ideas across different countries. Scholars have concluded that R&D is transferred from the innovating country to other countries mainly through trade, which helps to stimulate the receiving countries' economic growth. Many researchers have also tried to prove ICT spillovers among firms or industries within a country. However, to our knowledge, studies on international ICT spillovers are rare. Therefore, our main research question is whether foreign ICT investments, just like R&D expenditures, will have spillover effects on domestic productivity growth.

In this article, we would like to examine the relationship between international ICT spillovers and national productivity growth. This article would fill the literature gap on ICT spillovers at the country level. A sample of 10 countries was chosen based on data availability. We deployed time series analysis. If the existence of ICT

spillovers at country level is empirically proven, it may have strong policy implications especially for developing countries.

The organization of the article is as follows: The next chapter is a review of relevant studies in productivity and technology spillovers. Section 3 presents the methodological framework. Section 4 shows a brief discussion of the data sources. The following Section 5 discusses the empirical findings, and comments on the possible limitations. Finally, Section 6 concludes the article with a few thought-provoking issues on policy implications.

LITERATURE REVIEW

TFP as a Measure of Productivity Growth

Total factor productivity (TFP) is not a new concept in the studies on economic growth. Most authors track its origin back to Solow's (1957) empirical work, the so-called "Solow's Residual." TFP is believed to be a residual of production growth, which cannot be explained by increases in factors of input. The unexplained output growth should contain the contribution of new technology (such as R&D, IT, etc.), improved management, and more efficient markets and institutions (Evenson, 1997). TFP as a measurement of technological change is vital because technological change is believed to be the ultimate cause of long-term economic growth (Carlaw & Lipsey, 2002).

The implementation of TFP, or Solow's Residual, offers a better measurement of actual productivity attributed to technology. The majority of earlier research used tangible outputs such as GDP, national wealth, revenue, and other perceptible values in their analysis. These output measures might not have captured ICT's entire contribution to an economy's productivity. Since it had been widely acknowledged that ICT usage provides a wide range of intangible impacts,

such as better processes, improved products, and enhanced services, Solow's Residual better appraises the efficiency of IT, providing better data than using GDP directly.

Technology Spillovers

Technology has become a ubiquitous topic in economic growth theory. Even before technology became so prominent in the mainstream theory, pioneers in the empirical field, like Griliches (1979) and Scherer (1982), were aware of the influence an industry's technology generation can exert on the productivity of other industries, through so-called technology spillovers. In the 1980s and 1990s, many studies confirmed their main findings that technology spillovers have significant productivity effects (Los, 1997).

Technology spillovers are said to exist if market partners receive productivity benefits from technologies developed by others, although there is no monetary compensation for the technology transfer (Meijl & Tongeren, 1999). ICT and R&D can be treated as important technological knowledge. To a large extent, technological knowledge generates public good. The use of a unit of knowledge by one research employee does not prevent other researchers from using it (knowledge is non-rival); however, technological knowledge such as R&D can be appropriated only to a certain extent (knowledge is partly non-excludable) (Mankiw, 2001). Danny Quah defines knowledge-products as "computer software, new media, electronic databases and libraries, and Internet delivery of goods and services" (Granville, Leonard, & Manning, 2000). Hence, both ICT and R&D have the common characteristics of knowledge capital.

Endogenous Growth Model to Estimate Technology Spillovers

An *Endogenous growth model* assumes that technology investment is like knowledge capital investment. Recent developments of endogenous

growth models have stressed the role of knowledge spillovers in generating growth (Lucas, 1988; Romer, 1986). The endogenous theory of growth suggests that technological innovations are becoming increasingly important contributions to economic growth (Evenson & Singh, 1997).

Coe and Helpman (1995) argued that endogenous growth models emphasize innovation and trade as vehicles for technological spillovers, thus permitting developing countries to catch up to industrialized ones. The role knowledge plays in technological progress has been the subject of much recent attention in the economic growth literature. Several studies find that the returns from investment in knowledge are positive; they are greater than returns from investment in equipment, infrastructure, and machinery (Madden & Savage 2000; Griliches, 1994; Nadiri, 1993).

In 1995, Coe and Helpman extended Grossman and Helpman's (1991) "Product variety" model of innovation to show that national productivity increases with the accumulation of both domestic and foreign knowledge (Bayoumi, Coe, & Helpman, 1996). The new knowledge, which prevents diminishing return on capital stock, is produced by investment in technology (Evenson & Singh, 1997). Hence, an endogenous growth model is a very suitable means to measure knowledge capital and technology spillover on economic growth.

If the study result does conclude that ICT spillover exists and is positive and significant, this finding would have important implications for national trade liberalization and economic integration policy. For example, Madden, et al. (2000) argue that ICT is an important source of international knowledge transfer in an emerging global information economy. International trade in ICT equipment and services generates direct productivity benefits through lower transaction costs and improved marketing information, as well as other indirect benefits due to accelerated information and knowledge diffusion across borders (Jussawalla & Lambertson, 1982; Antonelli, 1991). As such, ICT and trade policy are becoming

priorities for many governments and international agencies endeavoring to improve national productivity and economic growth (European Bank for Reconstruction and Development, 1995; Spiller & Cardilli, 1997).

R&D Spillovers

R&D is technological knowledge (Mankiw, 2001), sharing the same characteristic of knowledge capital with IT. As a generator of new technology, the effect of R&D spillover is significant in terms of productivity. Grossman and Helpman (1991) suggested that spillovers from R&D might be one possible engine of endogenous growth in recent years. Much research has been done regarding R&D spillovers both at disaggregate and aggregate levels.

Luukkainen and Niininen (2000) stated that researchers have demonstrated that R&D performed by the original innovating company generates widespread value in the economy through spillovers. Braconier & Sjöholm (1997) suggested that spillovers from R&D exist within industries, both nationally and internationally. The empirical evidence further suggests that intra-industry spillovers are confined to industries that are relatively R&D intensive.

Coe and Helpman (1995) and Engelbrecht (1997) demonstrate an empirical relationship between accumulated R&D expenditures and TFP, and show that the benefits of R&D can spill across countries through trade. These findings have implications for countries considering trade liberalization and economic integration policies. Evenson & Singh (1997) examined the contribution of international technological spillovers using panel data from eleven Asian countries over the period 1970 to 1997. By deploying the new endogenous economic growth models, they offered new insights into the growth process. A country's productivity growth not only depends on its domestic R&D investment but also on the R&D investment from its trading partners. Countries

benefit from purchasing and imitating technology created in other countries as well.

ICT Spillovers at Firm and Industry Level

IT investment, with its informational and transformational roles, is similar to knowledge capital and may generate considerable economic externalities from both network externalities and knowledge spillovers (Dedrick et al., 2003; Mun & Nadiri, 2002). Romer (1986) argued that the knowledge that enables a firm or an industry to adopt advanced technology successfully would naturally spill over to other firms or industries. Knowledge from ICT capital is often diffused by entities such as technology user groups, academic institutions, management consultant firms, and, especially, labor mobility. It is often the case that competing firms rapidly copy ICT investments made by innovative firms (Dedrick et al., 2003).

Leeuwen & Wiel (2003) have argued that ICT spillovers predominantly materialized at the firm level via production efficiency gains arising from the streamlining or upgrade of internal business processes or improved communications. The emergence and rapid development of the Internet is a good example. The Internet increased the ability of firms to transfer information among themselves. Luukkainen and Niininen (2000) also concluded that technology spillovers among firms would increase both customer and competitor benefits.

The empirical results of Mun and Nadiri's study (2002) of US private industries over the period 1984-2000 showed that computerization of an industry's customers and suppliers reduces both labor and material costs for the whole industry. They also found that industries in the services sector enjoy more benefits from ICT spillovers than industries in other sectors because of their high ICT capital intensity and composition of inter-industry transaction.

Results might be substantially different in different industry sectors. An important question is whether there are spillovers from IT-producing industries to IT-using industries. As stated by Ganley, Kraemer, and Wong (2002), the correlation between production of ICT and use of ICT is confined to specific scenarios. There is evidence of a positive spillover effect from ICT production to ICT spending among most developed countries, and a negative spillover effect in East Asian producer countries. They argued that it is because East Asian countries are trapped in low margin ICT manufacturing sectors, that their ability to build their resources in design, ICT services and software development is stifled. Contrarily, the US and other developed countries, where their ICT production has a variety of scope, enjoy a positive effect from IT-producing to IT-using industries.

HYPOTHESES, METHODOLOGY, MODEL, AND FRAMEWORK

Hypotheses

The objective of this study is to determine if ICT investment from foreign countries does, indeed, contribute to domestic economic growth. To investigate the long term relationship among variables, we first deploy the Cobb-Douglas production function. The Cobb-Douglas functional form can be viewed as a linear approximation of the actual underlying production function. It has been shown to be a good approximation in the ICT and productivity contexts by Dewan and Min (1997). It is pervasive in the productivity research literature. The production function approach has been widely used in previous studies of ICT impact on firm performance (Loveman, 1994; Brynjolfsson & Hitt, 1995). Typical production requires labor (L) and capital (K). Hence, we have the following production function:

$$Y = A(E, S) f(K, L) = A(E, S) K^\alpha L^{1-\alpha}, \quad (1)$$

where Y is GDP or output, K is the aggregate capital stock, and L is the labor force. $0 < \alpha < 1$ is the share parameter, representing the share of production contribution elasticity. A is a technology shift parameter, which is a function of the national specific (knowledge) capital, E , and the spillover effects, S . A is also known as the Total Factor Productivity, or Solow's Residual. It is what economists used to refer to when discussing that part of a country's economic productivity which remains "unexplained," but suspected to be a result of technology. Using the Cobb-Douglas production function in Equation (1), Solow's Residual A , can be derived as:

$$A = Y / K^\alpha L^{1-\alpha} = A(E, S). \quad (2)$$

Since data on output (GDP), capital stock, and labor input are acquired, and α is approximated by the share of profit in total output, Solow's Residual can be determined from Equation (2). Economists tend to place the value of α between 0.3 and 0.4. In this article, the value of this share parameter is set to $\alpha = 0.3$ because it is more commonly used.

Now, since the national knowledge capital is a function of domestic ICT investment, and the spillover effect is a function of foreign ICT investment, Equation (2) can be rewritten as follows:¹

$$\ln TFP_t = \beta_0 + \beta_1 \ln DICT_t + \beta_2 \ln FICT_t + \varepsilon_t \quad (3)$$

where t denotes years, $DICT$ is domestic ICT investment, and $FICT$ is foreign ICT investment.

In Equation 3 we may see the impact of domestic and foreign ICT investment on total factor productivity. Hence, we posit our main hypotheses as follows:

Hypothesis 1: Domestic ICT investments would cause an increase in total factor productivity

(TFP). In other words, domestic ICT investments would contribute to national economic growth.

Hypothesis 2: Foreign ICT investments would cause an increase in total factor productivity (TFP). In other words, there exists a spillover effect.

Causality Test

Although hypotheses look simple to test, due to the nature of time series data, we cannot perform the test by estimating Equation (3) with the ordinary least squares (OLS) method. Statisticians and econometricians know that if time series variables are non-stationary and not co-integrated, the OLS results are spurious. In other words, one can never trust the OLS results unless time series variables are either non-stationary or co-integrated.

Accordingly, the implementation of time series analysis tools in this research is aimed to eliminate the spurious regression problems. Before the co-integration tests between ICT investments and TFP, we implement the Augmented Dickey-Fuller (ADF) test to determine whether the variables are stationary (Dickey, 1979). For example, if the order of integration is 2, that is, $I(2)$, the series becomes stationary after the second differences.

If the variables ($\ln A$, $\ln DICT$, and $\ln FICT$) are integrated in different orders, we conclude easily that the variables are not co-integrated. If the variables are non-stationary, but integrated in the same order, then we need to determine whether they are co-integrated. In this case, we perform the Johansen Co-integration test.²

Depending on whether they are co-integrated, different tests would be necessary to determine the causal relationship between the two variables. If the variables are co-integrated, we deploy the vector error correction model (VECM) and the regular Granger Causality test is conducted for non-cointegrated variables. Also, another benefit of adopting causality tests is that we don't need to

worry about intermediating variables from ICT investment to TFP.

When variables are co-integrated, there still can be disequilibrium in the short run. Hence, the vector error correction model (VECM) has to be applied before implementing the causality test. Applying VECM, which is a VAR in first difference with the addition of a vector of co-integrating residuals, results in the so-called Pairwise VEC Granger Causality Test, in contrast to the Standard Granger Causality.

$$\ln A_t = \gamma_1 ECT_{t-1} + \sum_{i=1}^n \alpha_i \ln A_{t-i} + \sum_{i=1}^m \beta_i \ln ICT_{t-i} + u_t, \tag{4}$$

$$\ln IT_t = \gamma_2 ECT_{t-1} + \sum_{i=1}^p \lambda_i \ln ICT_{t-i} + \sum_{i=1}^q \mu_i \ln A_{t-i} + v_t, \tag{5}$$

where $\ln ICT$ is either $\ln FICT$ or $\ln DICT$, and ECT is the error-correction term, which is the residual of the co-integration equation and explains short-term disequilibrium among the variables. Also it is assumed that the disturbances u_t and v_t are uncorrelated.

When variables are not co-integrated, then we perform the standard Granger Causality test that does not include the error-correction term. If the variables are non-stationary, we need to difference the series to make it stationary (Granger, 1969). Corresponding to the stationary time series data of $\ln A$, $\ln DICT$, and $\ln FICT$, the causality test involves estimating the following VAR (Vector Auto-regression) models:

$$\ln A_t = \sum_{i=1}^n \alpha_i \ln A_{t-i} + \sum_{i=1}^m \beta_i \ln ICT_{t-i} + u_t, \tag{6}$$

$$\ln IT_t = \sum_{i=1}^p \lambda_i \ln ICT_{t-i} + \sum_{i=1}^q \mu_i \ln A_{t-i} + v_t, \tag{7}$$

We select the lag structure of the model based on Akaike Information Criteria (AIC), as reported by the EVIEWS software package. Using the models (4) and (5), or (6) and (7), we perform the

Granger Causality test that $\beta_1 = \beta_2 = \dots = \beta_m = 0$. It follows that, if the computed F statistic exceeds the critical value at the chosen level of significance, the null hypothesis is rejected, thus there exists the causal relationship of $FICT \rightarrow A$ (Hypothesis 2) or $DICT \rightarrow A$ (Hypothesis 1).

DATA AND VARIABLES

We selected 10 countries based on the data availability. Each country consists of annual time series data for 4 main variables—GDP(Y), Capital (K), Labor (L), and Information Technology Investment (IT):

- *Developing Countries:* China, India, and Malaysia
- *Newly Industrialized Economics (NIEs):* Korea, Hong Kong, and Singapore
- *Developed countries:* Finland, Ireland, Japan, and the US

The time series data are selected from 1982 to 1999, a total of 18 years. GDP (Constant 1995 US dollars), capital stock, and labor data were obtained from World Development Indicators (WDI). However, WDI only provides value for Gross Fixed Capital Formation (Constant 1995 US dollars), which is actually gross domestic fixed investment (denoted by I), not really the capital stock we need to calculate for TFP. Thus, an adjustment to data of the capital variable is essential. Non high-tech capitals are commonly depreciated with a 10% rate annually. The individual annual values are derived as $K_t = I(t) + (1-\delta) \times K_{t-1}$, where $\delta = 0.1$ the depreciation rate.

Relative difficulty and complexity occurs in collection of ICT data, a long time sequence is necessary in order to implement time series analysis tools. Apparently, data unavailability for ICT investment is quite common in the 1980s, especially for developing countries. Hence, we use telecommunication investment (1981-1999)

Table 1. Basic statistics of A, DICT, and FICT

| Country | lnA | | lnDICT | | lnFICT | |
|----------------------|----------|-----------|----------|-----------|----------|-----------|
| | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. |
| China | 4.408481 | 0.273329 | 21.28123 | 1.772508 | 24.55728 | 0.337422 |
| India | 4.536943 | 0.119301 | 21.04040 | 0.572088 | 24.60669 | 0.409038 |
| Korea | 6.649668 | 0.156121 | 21.75028 | 0.592708 | 24.57595 | 0.402875 |
| Hong Kong | 7.143254 | 0.155160 | 19.83525 | 0.989156 | 24.62541 | 0.406478 |
| Singapore | 7.080996 | 0.218419 | 19.35520 | 0.648559 | 24.62970 | 0.411739 |
| Malaysia | 6.116630 | 0.155212 | 20.27137 | 0.783519 | 24.62069 | 0.409316 |
| Finland | 7.339356 | 0.098926 | 20.07135 | 0.454712 | 24.62446 | 0.412509 |
| Ireland | 7.278669 | 0.198050 | 19.43815 | 0.390441 | 24.62951 | 0.412832 |
| Japan | 7.602688 | 0.072753 | 23.54201 | 0.588513 | 24.21258 | 0.340114 |
| United States | 7.534318 | 0.046924 | 23.79587 | 0.109261 | 23.99497 | 0.681412 |

Table 2. ADF unit root test summary

| Economies | lnA | lnDICT | lnFICT | Co-integration Test Implemented Next |
|------------------|------|--------|--------|--------------------------------------|
| China | I(2) | I(2) | I(2) | Yes |
| India | I(2) | I(2) | I(2) | Yes |
| Korea | I(2) | I(2) | I(2) | Yes |
| Hong Kong | I(2) | I(2) | I(2) | Yes |
| Singapore | I(2) | I(2) | I(2) | Yes |
| Malaysia | I(2) | I(2) | I(2) | Yes |
| Finland | I(2) | I(2) | I(2) | Yes |
| Ireland | I(2) | I(2) | I(2) | Yes |
| Japan | I(2) | I(2) | I(1) | No |
| US | I(2) | I(2) | I(2) | Yes |

* The significant level of the ADF unit root test is 1%.

from the International Telecommunication Union (ITU) as a proxy for ICT investment. The Foreign ICT investment variable (FIT) is calculated by summing up all the ICT investments except the domestic one. Table 1 summarizes the basic statistics for *A*, *DICT*, and *FICT*.

EMPIRICAL RESULTS

Discussion and Analysis of Statistical Findings

Table 2 shows the basic results of the unit root test on the time series of *DICT*, *FICT*, and *TFP* (or *A*).

Table 3 illustrates the principal findings from the co-integration and causality tests for the sample countries. The variables are co-integrated in most of countries except Japan. Therefore, we apply the vector error correction model for

them. For Japan, we use the standard Granger Causality test. The results for causality test vary across countries.

If the causal relationship of a certain country from *DICT* to *TFP* (Hypothesis 1) or *FICT* to *TFP* (Hypothesis 2) is significant, it is indicated in the second column of Table 3. As one can see in that column, Hypothesis 2 is supported, i.e., there exist positive and significant international spillover effects for Ireland, Korea, Singapore, the United States, and China.

Except for China, the other four countries are notable for governmental efforts to boost ICT industries. The governments provide adequate funding for education and universities and technology institutions contribute major advances in technology innovations and inventions in all four countries. In the meantime, each country has well-trained ICT specialists and workers in ICT-sectors have built up their knowledge base. From the hardware point of view, the telecom-

Table 3. Summary of the principal findings

| Country | Causality Test Results | Test Model |
|-----------|------------------------|----------------|
| China | FICT→A* | VECM |
| India | DICT→A*** | VECM |
| Korea | DICT→A* FICT→A* | VECM |
| Hong Kong | No | VECM |
| Singapore | DICT→A*** FICT→A** | VECM |
| Malaysia | No | VECM |
| Finland | DICT→A*** | VECM |
| Ireland | FICT→A*** | VECM |
| Japan | DICT→A** | Standard Model |
| US | DICT→A** FICT→A** | VECM |

* significant at 10% level

** significant at 5% level

*** significant at 1% level

munication infrastructure and networks are well established.

These four countries all promote trade liberalization and globalization. Therefore, knowledge and advanced information technologies can be comparatively easier to transfer to these countries. At the same time, because of their already established telecommunication infrastructures and human capital, such as education, the ICT investment in foreign countries is not only being transferred, but is also more promptly digested and absorbed (transformed) by the local workforce. Hence, foreign ICT spillovers occurred and the effects are positive and significant.

It is a bit surprising to see that China belongs to this group, because the openness of its economy is limited and telecommunications infrastructure is still restricted compared to other countries. However, China also thinks highly of education. Its human capital is already well established, so that China's local labor forces follow relatively easily what other countries are doing. This may explain why foreign ICT investment has positive impact on China's productivity.

Finland does not have international spillover in our empirical result while its domestic ICT investment causes TFP growth. Finland's government invests a large amount of capital in knowledge and information technology and achieves a huge payback for the investment in economic performance. Thirty years ago, 70% of Finland's exports were wood and paper products. Now, more than 50% of the country's exports are knowledge-intensive products. For instance, Nokia, a telecommunication giant, contributes 4% of Finland total GDP, 35% of total business sector R&D and 25% of the total exports. Compared to Finland's strong contribution of domestic ICT investment, the effect of foreign ICT investments seems less significant.

Japan, the second largest economy in the world and the largest exporter of technology products, did not have the co-integrated relationship between ICT and TFP. Also, only domestic ICT invest-

ment causes national productivity growth while foreign ICT investment does not. This may be due to Japan's special situation of ICT industry. For example, NTT DoCoMo is using its unique standard Personal Digital Cellular (PDC) for 2G mobile phone, which was developed and used only in Japan. Now, as Japan is using WCDMA for 3G mobile phone standard following worldwide trend, we may see international spillover for Japan in the future.

Moral of the Story: ICT Maturity and Network/ Path of Infrastructures

The creation of new ICT knowledge by one firm/industry/country is assumed to have a positive external effect on the production of opportunities for other parties because it is possible to create a large pool of ICT knowledge when the technologies are being used by many parties. With more trade of ICT products and higher mobility of international labor forces, ICT knowledge can be transferred faster and more easily. After being absorbed by local labor forces, ICT spillover effects will take place.

Shapiro and Varian (1999) argued that ICT value does not simply mean implementation of hardware or software, but ICT usage that needs a certain period of time for users to train themselves until they find ICT useful. Put simply, ICT investment generally requires a learning period for users before gains occur. In general, creating an ICT knowledge base requires a longer time period than ICT implementation. ICT-matured countries benefit more from information technology because of the ICT knowledge base. For instance, Singapore and Korea enjoy foreign ICT spillovers much more than Malaysia.

Furthermore, the contribution of ICT investment is a product of individual efforts taking place in a network context where the infrastructure and communication technology, together with changing externalities in the use of ICT, affect

the historical paths taken in shaping the growth of ICT contributions (Shapiro & Varian, 1999). David (1990) also argues that ICT may require substantial changes in complementary infrastructure (e.g., human and knowledge capital, global communications infrastructure, etc.) before the generation of output. In other words, the networks and paths must be built up before benefits of spillover from other countries occur. Therefore, the two main conditions for the existence of ICT spillovers are ICT maturity and networking, which create paths of infrastructures and telecommunications.

Limitations

We have had difficulties in finding a good time series dataset of ICT investments. Relatively better samples were telecommunications investments. Still, we have 19 years, which is just acceptable for time series analysis. In the future, we need to collect longer series of data and will see whether the findings are still robust. Also, telecommunications investments may not be sufficient to reflect the full effect of foreign ICT spillovers towards domestic economic growth.

Another limitation is the number of countries for the analysis. The sample set only contains 10 economies because of data availability. Foreign ICT spillover is limited among the 10 countries, but not in a worldwide aspect. In future study, more countries should be included to generalize the results.

CONCLUSION AND IMPLICATIONS

Productivity is the amount of goods and services produced from each hour of a worker's time. The key role of productivity is to determine a nation's living standards. Policymakers who want to encourage growth in standards of living must aim to increase their nations' productivity by encouraging rapid accumulation of the factors of production and ensuring that these factors are em-

ployed as effectively as possible. From time series analysis, we found the limited evidence of international ICT spillovers which would contribute to economic growth. This article lets the policy makers and scholars look at another dimension of productivity growth, i.e., spillovers.

The ICT spillovers would create a mutually beneficial situation across countries. With productivity growth, the total wealth and welfare of the receiving countries will be higher, which may result in stronger purchasing power in those countries. With stronger purchasing power, these countries would likely purchase more goods, services, and advanced technology from sending countries to further improve their living standards and productivity. Hence, both parties benefit from the spillover effects and it is a win-win situation. ICT spillovers would have very important implications in economic development plans. Thus, international organizations, such as United Nations and World Bank, could formulate possible ICT policies to enhance ICT spillovers by promoting free trade, globalization, and so on.

At the same time, policymakers of each country would consider foreign ICT spillover as a key factor of economic growth. For countries with limited ICT investment, foreign ICT investments may be a good source of productivity growth. They should open up the domestic market, encourage imports and exports, remove trade obstacles, support trade liberalization and globalization, build up ICT infrastructures, and promote education and train their labor force to let foreign ICT investment more easily spill over into domestic industry.

REFERENCES

- Antonelli, C. (1991). *The diffusion of advanced technologies in developing countries*. OECD, Paris.
- Bayoumi, T., Coe, D., & Helpman, E. (1996). *R&D spillovers and global growth*. Center for

- Economic Policy Research Discussion Paper, No. 1467, CEPR, London, UK.
- Braconier, H., & Sjöholm, F. (1997). *National and international spillovers from R&D: Comparing a neoclassical and an endogenous growth approach*. Working Paper Series in Economic and Finance No. 211, December 1997.
- Brynjolfsson, E., & Hitt, L.M. (1995). Information technology as a factor of production: The role of differences among firms. *Economic Innovation New Technology*3(3), 183-199.
- Carlaw, K. I., & Lipsey, R.G. (2002). Productivity, technology and economic growth: What is the relationship? *Journal of Economic Surveys*17(3), 457-495.
- Carr, N.G. (2003). IT doesn't matter. *Harvard Business Review*81(5), 41-49.
- Coe, D., & Helpman, E. (1995). International R&D spillover. *European Economic Review* 39, 859-887.
- David, P.A. (1990). The dynamo and the computer: An historical perspective on the modern productivity paradox. *The American Economic Review*80(2), 355-361.
- Dedrick, J., Gurbaxani, V., & Kraemer, K.L. (2003). Information technology and economic performance: A critical review of the empirical evidence. *ACM Computing Surveys*35(1), 1-28.
- Dewan, S., & Min, C. (1997). The substitution of information technology for other factors of production: A firm level analysis. *Management Science*43(12), 1660-1675.
- Dickey, D.A., & Fuller, W.A. (1979). Distribution of the estimation for auto-regressive time series with a unit root. *Journal of the American Statistical Association*74, 427-431.
- Engelbrecht, H. (1997). International R&D spillovers, human capital and productivity in OECD economies. *European Economic Review* 41, 1479-1488.
- European Bank for Reconstruction and Development. (1995). *Transition report update*. EBRD, London.
- European Commission. (2000). The EU economy 2000 review. *European Economy*, No. 71.
- Evenson, R.E., & Englander, A.S. (1994). *International growth linkages between OECD countries*. Economic Growth Center, Yale University, New Haven, CT. (Mimeograph),.
- Evenson, R. E. (1997). Industrial productivity growth linkages between OECD countries, 1970-90. *Economic Systems Research*9(2), 221-231.
- Evenson, R. E., & Singh, L. (1997). *Economic growth, technological spillovers and public policy: Theory and empirical evidence from Asia*. Center Discussion Paper No. 777, Economic Growth Center, Yale University.
- Ganley, D., Kraemer, K.L., & Wong, P.K. (2002). Spillover effects of production of IT on use of IT. *Proceedings of the 26th Hawaii International Conference System Sciences* (HICSS'03)
- Granville, B., Leonard, C., & Manning, J. (2000, October). Information technology and developing countries: Potential and obstacles. Tokyo Club Meeting, Munich, Germany, 19-20.
- Greene, W.H. (2000). *Econometric analysis* (4th ed.). Prentice Hall.
- Granger, C.W.J. (1969). Investigation causal relations by econometric models and cross-spectral method, *Econometrica* 1969, 37, 424-438.
- Griliches, Z. (1979). Issues in assessing the contribution of research and development to productivity growth. *The Bell Journal of Economics*10, 92-116.
- Griliches, Z. (1994). Productivity, R&D and data constraint. *American Economic Review*84(1), 1-23.

- Grossman, G., & Helpman, E. (1991). *Innovation and growth in the global economy*. Cambridge, MA: MIT Press.
- Johansen, S. (1988). Statistical analysis of co-integrating vectors, *Journal of Economic Dynamics and Control*12, 231-54.
- Johansen, S. & Juselius, K. (1990). Maximum likelihood estimation and inference on co-integration with applications for the demand for money. *Oxford Bulletin of Economics and Statistics*52, 169-210.
- Jorgenson, D. W., & Stiroh, K.J. (2000). Raising the speed limit: U.S economic growth in the information age. *Brookings Paper Economic Actions*1(1), 125-211.
- Jorgenson, D. W. (2001). Information technology and the U.S economy (Presidential address to the American Economic Association). *American Economic Review* 91(1), 1-32.
- Jussawalla, M., & Lamberton, D. (1982). Communication economics and development: An economics of information perspective. In M. Jussawalla, D. Lamberton. (Eds.) *Communications, economics and development*. Elmsford, NY: Pergamon Press.
- Kraemer, K., & Dedrick, J. (2001). *IT-led development in Singapore: From Winchester Island to intelligent island*. Working paper #ITR-123, Center for Research on Information Technology and Organizations, Graduate school of Management, University of California, Irvine.
- Kumaresan, N. & Miyazaki, K. (2002). Integrated technologies as spillover infrastructures—Understanding the hidden dynamics of knowledge distribution in an innovation system. *Information Journal of Innovation Management*6(1), 25-51.
- Lee, S.Y., Gholami, R., & Tong, T.Y. (2005). Time series analysis in the assessment of ICT impact at the aggregate level—lessons and implications for the new economy. *Information and Management*42(7), 1009-1022.
- Leeuwen, G. V., & Wiel, H. V. D. (2003). Spillover effects of ICT. *CPB Report* 3, 24-30.
- Los, B. (1997, October). *The empirical performance of a new inter-industry technology spillover measure*. Working Paper, University of Twente, the Netherlands.
- Loveman, G. W. (1994). An assessment of the productivity impact of information technologies. In T.J. Aleen & M.S. Scott Morton (Eds.). *Information technology and the corporation of the 1990s: Research studies*. Cambridge: Oxford University Press, 48-110.
- Lucas, R.E.B. (1988). On the mechanics of economic development. *Journal of Monetary Economics*22(1), 3-42.
- Luukkainen, S., & Niininen, P. (2000). *Technology intensive services and national competitiveness*. VTT Group for Technology Studies, Working Papers 46.
- Nadiri, M.I. (1993). *Innovations and technological spillovers*. National Bureau of Economic Research Working paper No. 4423. NBER, Cambridge, MA.
- Madden, G., & Savage, S. J. (2000). R&D spillover, information technology and telecommunications, and productivity in ASIA and the OECD. *Information Economics and Policy*12, 367-392.
- Madden, G., Savage, S.J., & Bloxham, P. (2001). Asian and OECD international R&D spillovers. *Applied Economics Letters* 8, 431-435.
- Mankiw, N.G. (2001). *Principles of economics* (2nd ed.). Harcourt College Publishers.
- Meijl, H. V., & Tongeren, F. V. (1999). *Endogenous international technology spillover and biased technological change in the GTAP model*. GTAP Technical Paper No. 15.

Mun, S.B., & Nadiri, M.I. (2002, October). *Information technology externalities: Empirical evidence from 42 U.S industries*. Working paper 9272, National Bureau of Economic Research.

Roach, S.S. (1987, April). *American's technology dilemma: A profile of the information economy*. Morgan Stanley Special Economic Study.

Romer, P. M. (1986). Increasing returns and long-run growth, *Journal of Political Economy*. 94(5), 1002-37.

Scherer, F.M. (1982). Inter-industry technology flows and productivity measurement. *Review of Economics and Statistics*64, 627-634.

Shapiro, C., & Varian, H. R. (1999). *Information rules: A strategic guide to network economy*. Harvard Business School Press.

Solow, R.M. (1957). Technical change and the aggregate production function. *Review of Economics and Statistics* 39(3), 312-320.

Solow, R.M. (1987). We'd better watch out. *New York Times Book Review*, July 12, 36.

Spiller, P., & Cardilli, C. (1997). The frontier of telecommunications deregulation: Small countries leading the pack. *Journal of Economic Perspectives*11, 127-138.

Stiroh, K. J. (2001). What drives productivity growth? *Economic Policy Review*7(1), 37-59.

ENDNOTES

¹ The reason we use logarithm of the variables is to create a linear functional form for estimation. This equation is also consistent with the Coe and Helpman (1995) specification of TFP.

² We skip the details of ADF test procedure and Johansen Co-integration test procedure. Please refer to Dickey(1979) and Johansen and Juselius (1990), respectively.

This work was previously published in Journal of Global Information Management, Vol. 15, Issue 4, edited by F.B. Tan, pp. 64-78, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.3

From Information Society to Global Village of Wisdom?

The Role of ICT in Realizing Social Justice in the Developing World

Sirkku Kristiina Hellsten
University of Birmingham, UK

ABSTRACT

This chapter is about the role of ICT in global justice. It will analyze, firstly, the epistemological relationship between new information, knowledge and wisdom. Secondly, it examines the ethical relationship between information technology and the values and ideals that are attached to its use and applications. Thirdly, the chapter studies theoretical and practical obstacles that have prevented the developing countries, particularly in Africa, from fully benefiting from the enormous possibilities provided by the new ICT in relation to realizing human capabilities, well-being and better standards of living and social justice. The analysis applies Amartya Sen and Martha Nussbaum's capability approach to the distribution and use

of the ICT in global context. Finally the chapter examines how global and the local inequality is maintained by the international information and technology markets, and how the distorted international markets as well as misguided local policies tend to create further division between "information rich" and "information poor."

INTRODUCTION

Globalization is the catchword of the day, and the worldwide requirement for more direct democracy, good governance and respect for human rights is at the core of the new millennium's development strategies. In order to fulfill these goals in global social, economic and political cooperation and

development, access to information, knowledge and channels of reciprocal communication are of critical importance. Globalization of economy has been made possible and further expands through the business applications of the Internet and other information and communication technologies. The latest information and communication technology (ICT), which can be used for fast creation, acquisition, storage, dissemination, retrieval, manipulation and transmission of information, could greatly help the marginalized, less affluent countries to benefit from the positive side of globalization and to help them promote local and global democracy and participate more efficiently in the global economy. ICT could provide us powerful means for sharing our global prosperity. However, presently the trends of economic globalization have not led to either to more equal local and global access either to ICT or to the information it transfers. Instead, the Information Age has led to what has come to be called the digital divide between the affluent and the poor, the connected and disconnected, the developed and less developed (Sarrocco, 2002; Warschauer, 2003; Young, 2003).¹

Despite the fact that new telecommunication technology undeniably has advanced rapidly and more and more people around the globe have today direct access to it and to the information it conveys, there are still vast regions in the world which have either no access or very limited access to these new means of communication and information exchange. The limited access is due to various structural, distributive, economic and political problems that have prevented the equal spread of modern technology, as well as its efficient implementation across the world. Some of these obstacles can be overcome through better and fairly planned distributive and implementation policies. Many of these places without access to the latest ICT may, in fact, have very restricted means for even local, let alone global, connections through more traditional information channels such as mail, newspapers and books, telephone,

television, and radio. On the other hand, in many parts of the third world even those affluent and materially well developed countries, which now have access to the ICT, have not succeeded in using new technology internally and internationally to consistently promote national benefit, human well-being and the common good. Instead the technology available and the information it provides are still mostly shared by elites, the already influential, affluent and educated sections of the population. The poor and illiterate, and those in acute need, tend to remain beyond the information reach; local, and particularly rural, development and quality of life gain very little from the new technology.

This chapter focuses on two interrelated issues: firstly, it analyzes the relationship between new information technology and the values and ideals that are attached to its use and application. In this context, this chapter will study the relationship between information, knowledge and power in relation to the ideals of the “knowledge society” and what could be called the “global village of wisdom.” It argues that in global ICT policies there is a need to pay more attention to the realization of human resources and well-being in the development, use and distribution of ICT. In the existing politico-philosophical frameworks, this would mean a shift from the neo-liberal market economy towards the promotion and realization of human capabilities as presented by the capability approach to human well-being constructed by Amartya Sen (1985, 1993, 2001) and Martha Nussbaum (1987, 1992, 1993).

Secondly, the chapter takes a look at the theoretical and practical obstacles that have prevented the developing countries, particularly in Africa, from fully benefiting from the enormous possibilities provided by the new ICT in relation to human capabilities and better standards of living. It will examine how the local and global digital divide between the information-rich and information-poor is created and maintained by international information and technology markets, as well as

by political ambitions. Finally the chapter considers the role of culture and tradition in adoption, allocation and use of new technology.

INFORMATION VS. KNOWLEDGE SOCIETY: IDEALS AND PRACTICE

The developments in new information and communication technology are in general taken to suggest not only efficiency, convenience and productivity but also utopian possibilities—new fortunes to be made, new careers and new lifestyles and, above all, progress that entails revolutionary democracy and increasing equality. This means that, particularly in the West, new information technology is usually seen to provide us with a fast, vast and environmentally friendly “information superhighway” that gives everybody across the world direct access to the sources of influence and the centers of power. In the most optimistic dreams, the possibilities brought to us by technological advancement are believed to mean the actualization of “a global village” which eventually leads us to a new age of wisdom which promotes democratic participation and social justice.

While this utopian ideal of information age may be shared by many ICT enthusiasts, there is no one agreed model of the information society that serves as the standard for sustainable and desirable development. Instead, the significance of the Information Age is that it is a global, diverse and multicultural reality. Thus, in order to realize the utopian visions and ideals, there is an urgent need to clarify further how the values we are striving for can be related to practice in various economic, political and cultural circumstances, as well as in globalization of ICT markets themselves. If we are to use the new information technology in order to strive for what we could consider as the ideal of the “knowledge society,” we need to reflect on

the values involved in the developmental realities in various global and local contexts.

Before that we need to clarify the values involved in the information utopias by making a clear distinction between what we have come to call “information society” and what we could call a “knowledge society,” which, in an international context, could be also extended into a “global village of wisdom,” based on the maximum use of not only physical, but also—and maybe particularly—intellectual and moral human capabilities.

Theoretically, I base this ideal of a “global village of wisdom” on the theoretical framework of the capability approach introduced by Amartya Sen (1990, 1992, 1999) and Martha Nussbaum (1987, 1992, 1993). The capability approach defends the moral appropriateness of the concept of well-being measured in terms of valuable human functioning and capability. More generally, it concentrates on our freedom to promote objectives we have reason to value, such as democracy, human rights and equality. According to Sen and Nussbaum, human capabilities that define human well-being, and should be the goal of development and distribution, are first—such basic capabilities as life and health. Second are capabilities relating to integrity, thought, emotions, practical reason, affiliation/participation, control over one’s fate/environment. There are extensive studies on the capability approach in development. This chapter, however, does not try to analyze or criticize Sen’s or Nussbaum’s arguments in detail, but rather to search for ways of applying the capability approach as a criterion for a fair distribution of ICT in the global context. The reason for this choice of approach is that my main aim is to look for alternative approaches to global distribution and implementation of ICT. While problems in using a capability approach are important to take into account, the space available in this chapter does not allow me to go into these in detail, but leaves them to the critical reader’s further assessment.

Using a capability approach as a normative ethical framework for distribution and implementation of ICT means that we need to reconsider the role of ICT in relation to what people can do with the new technology or what the technology can do for them in different cultural, political and economic settings, and geographic or environmental conditions, rather than assume that technological development has some intrinsic value, as the most eager proponents of information society appear to assume. Thus, if the distribution and implementation of global ICT policies would set the realization of human capabilities and the formulation of human capital at the core of ICT strategies, the presently digitally marginalized populations need not only to get access to necessary technology but also to gain the means to process the information available into knowledge that empowers them to participate actively and democratically in local, national and international development. Today, however, both the technology, and the data, information, intelligence, ideas, facts and figures it transfers, are often considered as commodities that are to be bought, sold and traded in expanding markets, rather than as basic goods in the Rawlsian sense (Castells & Himanen, 2002, pp. 2-3; Stovel, 1984).

Commercialization of information and knowledge is based on neo-liberal or libertarian market rationality that focuses on economic and technological development. It tends to pay less attention to the wider and more even realization of human capital and human capabilities in local and global contexts.² ICT and information trade is then, in many senses, the final result of the Information Age transition from an industrial economy to information economy, in which information itself is seen as raw material. The latest ICT, for its part, can provide not only the means of production, but also its own markets. Technological means, know-how and access to information will then shape the characterization of nations by digital divide as either (information-) rich or (information-) poor, and their categorization accordingly

as developed or underdeveloped. This division, however, in most cases tends to be based on the physical access to ICT rather than on political, social and economic benefits of such technology (Jimba, 1999, pp. 79-83; Warschauer, 2003; Young, 2003).

If we want instead strive for the ideal of a “knowledge society” or “global village of wisdom,” we need to see both technology and information as essential instruments in realizing the various human resources that they themselves can be used to develop each nation culturally, and in a locally sustainable manner. Information and communication technology could play a central role in realizing this ideal, but only if more attention is paid to the development of human capabilities and social, political and economic inclusion that can be realized with the help of the new technologies. At the moment the focus, however, tends to be on the advancement of technology itself and the markets of technology, rather than on the use of technology to improve the worldwide, reciprocal access to all markets.

IT: MEANS FOR DEVELOPMENT OR AN END OF DEVELOPMENT

The millennium development goals emphasize good governance, human rights, democracy and social justice. In order for these goals to be convincing, they are to be striven for in both the local and the global context. While the gap between developed and developing countries has been gradually narrowing, the least developed countries (LDCs), still often marginalized in (local) technological development, are failing to catch up with ICT and, thus, are bypassed by its benefits. ICT, for its part, is directly related to both national and international development, because ICT brings the means to communicate beyond the interpersonal level and makes geographical distances between continents and states disappear. Since ICT today goes far beyond mass media

communication and offers possibilities for change, knowledge and new perspectives on development, it permits rapid dissemination of ideas, values and processes, supplements education, science, health care, culture and, above all, economic interaction and markets. It provides the potential for two-way exchanges of information to learn what people really need, and to manage resources and data to facilitate the production and distribution of prosperity and wealth. Thus, while it is evident that ICT clearly cannot be used to solve all the problems of developing countries, it represents a potential that can be used to actualize human resources and human well-being in the form of capabilities within less affluent countries (Annan, 2003; Stover, 1984, p. 3).

If information age policies emphasized the realization of human capabilities, there would be a need to make a clear distinction between the concepts of information, knowledge and wisdom in our strategic plans and policies. The capability approach attempts to give human well-being a content that goes beyond rights and rational choice. Instead it focuses on the basic human condition by defining well-being in terms of valuable human “functionings” and capabilities that make our (ability to make) any choices possible (Nussbaum, 1992, pp. 202-246; Crocker, 1992, pp. 589-590; Sen, 1992, 2001).³ This approach moves from mere technical protection of rights to the promotion of “human flourishing” by defending the moral appropriateness of the holistic concept of human well-being measured in terms of human capabilities. Thus, our rights, as well as our responsibilities, should be set in a context that increases our capabilities and promotes various human functionings—in a teleological sense, as the human beings that we (essentially) are. Thus, human capabilities provide fundamental moral categories for the evaluation of resource distribution that goes beyond protection of rights or satisfaction of needs and sets human beings in a wider social context. The capability approach then concentrates on our freedom to promote objectives we have reason to value, such

as participation/democracy, human rights and the value of equality. According to Sen and Nussbaum human functionings and capabilities define human well-being and, thus, can be seen as the goal of distribution of social and material resources—in the end these resources include our moral and legal rights. By human functionings, they mean a person’s physical and mental states or “beings” and activities or “doings.”

There are many extensive studies on the capability approach in development, as well as critical analysis of some of its problems. In this chapter my purpose, however, is not to reintroduce or criticize Sen’s or Nussbaum’s arguments in detail or to point out theoretical differences and dispute between the two. Instead, I am searching for ways of applying the capability approach as a basis for a model for an ethical justification, where fewer of the needed resources and commodities can sometimes be better than their abundance, depending on their proper use for realizing human capabilities. In their search for a foundation for an ethic, Nussbaum and Sen both reject an “externalist” account that would depend on a metaphysical or scientific realism that purports to give, as Crocker has stated, a “God’s eye view” of the way things, including humans, are in themselves. Sen and Nussbaum suggest that what we need instead is an “internalist” foundationalism. This, in part, means that we start digging from within human experience and discourse to find the things that we do and should count as intrinsically worthwhile in our human lives. We must ask what are the things that are so important that, without them, we would not count a life as a human life. This allows us to move from objective value statements on the value of human life to the value of human functionings and capabilities.

Thus, despite various criticisms presented against the capability approach, the value statements regarding human capabilities can still be considered fairly objective and universal in a sense that they are valid for all human beings, since basically all rational humans consider their

capabilities and well-being valuable—no matter how they might otherwise react to cultural differences and/or difference in resources and to the various rights-based distributive frameworks for resources. In relation to the ICT, it then requires us to consider not only the distribution of resources but also the overall capabilities that can be realized with these resources.⁴

DEMOCRACY, WISDOM, AND INFORMATION

In political philosophy, modern pluralistic democracy, particularly when described as a reciprocal social contract between morally autonomous, rational and reasonable individuals who rule themselves in their own interests and by their own considerations, values and decisions. This description leaves the individual participants in a context based on self-interest and promotion of one's own benefits. However, working democracy should be based on decision-making and self-government of enlightened citizens. This enlightenment is possible only if the decision-makers have a chance to realize all their human potential, that is, all their human capabilities.

This definition is not often an accurate picture of political reality, but it does give us the abstract ideal of modern democracy that we are hoping to realize in practice in our societies (Weinberger, 1995, p. 218). The formula of democracy can then be stated as follows: a functioning democracy presupposes a form of political liberty that realizes human capabilities in a manner that guarantees the participation of enlightened citizen in public matters. An enlightened citizen is not the same as a knowledgeable or well-learned citizen. A moral agent with full human capabilities differs from a mere self-interested and rational decision-maker who attempts to maximize his or her personal benefits (Clark, 2000, p. 84; Weinberger, 1995, pp. 218-222). Political liberty postulates freedom

of individual will and the individual's own commitment to use this will to promote good—not merely the promotion of one's own good, but also the good of society in a form of sustainable and democratic development. Freedom of individual will, for its part, postulates a capacity for critical reasoning as well as knowledge of the options and alternatives available. This means that “knowledge search” has to go hand in hand with “knowledge use,” which should, in turn, aim for wisdom.

One of the first steps towards solving some of the problems of the world's poorest countries is to find a way towards more democratic governance. ICT can play a central role in enhancing democracy if it is used to disseminate information freely, to provide open communication channels for mutual dialogue and unrestricted participation, and to enhance the responsiveness and accountability of those in public positions. However, in this context its use has to be tied to the realization of human capabilities at several levels. This means that in global ICT policies we need not merely focus on distribution of technology to those who have not previously had access to it, but we also need to pay attention to the use of technology—both in the form of training as well as in its content and goals.

This is a vicious circle. The democratic ideal does not work unless it gets the support of enlightened citizens. Ignorant, uneducated or merely self-interested leaders and citizens can use technology for counter-productive purposes and for their personal benefit rather than for the promotion of public good and public interest, all with are part of overall capabilities of human kind. Thus, ICT should be considered as the means to realize the essential human capabilities (from basic capabilities, to life and health in general, to more the complex combination of practical and theoretical reasoning, moral agency and social participation) needed to build and maintain any democratic process. It should not be seen as merely a means for participation. Participation without

commitment to the democratic values of freedom, equality, moral autonomy and tolerance does not lead to social wisdom.

In order to understand the role of ICT in today's globalized world, we need to pay more attention to the complex relationship between knowledge, wisdom, democracy and power, as well as to the relationship between human capabilities and individual citizens' political (and moral) agency. A proper place to start is the relationship between the concepts of "information" and "knowledge." According to the classical Platonic definition, knowledge is a true, justified belief. By this very definition knowledge is given some intrinsic, positive value, that is, it is considered to be both justified and true. The same value judgment does not apply to what we call information. In fact, the value of information depends on what we do to change it into knowledge and wisdom. Information can be relevant or irrelevant; it can be honest or dishonest; it can be straightforward or misleading; it can be entertaining or educating. In other words, it can be justified or unjustified, true or false. Also information coming from different directions can feed our beliefs, but, in order to test or justify these beliefs, we usually need interactive, critical dialogue with others.

The relationship between information and knowledge can be summarized as follows: knowledge is information that is produced by our critical reasoning and tested by our communicative actions. Knowledge is then always more than pieces of information that are distributed in the media and computer networks. The idea of knowledge includes the human ability to produce and process information and judge its validity with the help of social dialogue. However, in the Information Age the very concept of knowledge has become more and more directly embodied in new technology. Thus, its usefulness appears to depend increasingly on the context of its application. This means that the production of knowledge is no longer centralized in the institutions of science and research or the media, but rather in the institutions

with political and economical power. The focus on the acquisition, access and use of knowledge has become instrumental in economic and political activities. It is less often seen to be the intrinsic part of global human capital formulation that promotes well-being by helping to realize human capabilities in various circumstances (Clark, 2000, p. 84; Castells & Himanen, 2002).

KNOWLEDGE, POWER, AND DEMOCRACY

From the earlier-noted analysis of ICT in distribution of information and in production of knowledge, we can move to the relationship between knowledge and power. Because of its influence and usefulness for us, knowledge is also often equated with social power. In practice this is still the case in most parts of the world. With knowledge we can control not only our own but other people's lives; we can get authority over those who know less. This authority we can use either to dominate or to serve our communities. Thus, the obstacles—whether these are technological, economic, political, or cultural—in the way of the free flow of information are also obstacles in realizing human capital and human capabilities.

The main obstacle is related to the gain and use of power, which, for its part, is directly related to the concept of knowledge. Knowledge as power has traditionally held an intrinsically positive value. However, those who have access to and control of knowledge, and know how to apply it, can use the power knowledge gives them either in a positive and constructive way, or in a negative and destructive way, in regard to the ideals we have set for ourselves. We can use power to suppress and control others by keeping them in ignorance, or we can use it to pass on and share information and to promote individual freedom and democratic practices. If power and authority are used wisely, both developing and post-industrial countries can recognize the ideal of enlightened democracy that

realizes the wide variety of human capabilities equally, locally and globally.

Thus, when and if information is turned into knowledge and knowledge into power, there is still no guarantee of equal and just political order. This is because democracy can work only if a nation's leaders and citizens use their personal social power with wisdom. Wisdom, however, is often difficult to come by in a modern market-led information age—regardless of whether we are talking about post-industrialized or developing countries. Wisdom, after all, does not follow directly from our access to information, from our capability to turn this information into knowledge, or from the power this knowledge gives us. Wisdom is a result of the development of the moral and social consciousness that integrates our intellectual capacities with our ethical outlooks and with our sense of justice, which is related to understanding the responsibility that comes with knowledge that is turned into power. Because the ideal of modern pluralist democracy is generally defined as the self-government of rational and reasonable autonomous moral and political agents, just as there is no knowledge without “knowers,” there is no working democracy without wise and morally responsible citizens, whether at the grass-roots or the leadership level. Therefore, if we set full realization of human capabilities in all their forms as our goal, any discussion of development of a global knowledge society that is based on the more efficient and equal use of ICT cannot be detached from the civic, professional and ethics education.

FREE MARKETS AND GLOBAL ETHICS

If human capabilities as the basis for increasing well-being were to be the goal of the ICT distribution, advancement, access and use, there would be a need to change the focus from business and economic benefits to education and civil partici-

pation. This does not apply merely to developing countries, but also to affluent information societies. Participation in global democracy does not follow directly from the number of Internet or mobile connections, though having them available naturally helps the process. As Warschauer (2003) has noted, access to technology does not guarantee its efficient or beneficial use. Thus, the practical problem is that the prevailing information society policies seldom follow the formula of democracy or pay enough attention to the human capabilities that are to be realized by and for democracy. They too often disregard the fact that the data that is disseminated and stored in information networks and in new media can be processed into knowledge and wisdom only by critical and autonomously developed human reasoning.

While access to relevant information has a central role in the globalized economy and profitable markets, free-market practice, civic education and democratic ideals do not always go hand in hand, particularly when technological advancement and information resources often do not reach those who need them most and would benefit from them most. Instead, free markets tend to enforce the development of information society and lead to the marginalization of groups of people in a manner that prevents all citizens from realizing their capabilities as rational, moral and political agents in the first place. If the distribution and use of ICT is left to the care of the invisible hand of market forces, the resulting society will tend to be fragmented by egoistic pursuits and self-interest. The division to the haves and the have nots, that is those who have access to technology and information and know how to use it for their benefit and those who are left to be socially and politically even more disconnected from the centers of power, knowledge and influence than they were before (Gauthier, 1986, pp. 11-30; Rawls, 1972, pp. 3-22, 54-81; NAME, 1993, pp. 11-39; Reiman, 1990, pp. 25-29; Weinberger, 1995, p. 218).

One main problem is that often technology is itself offered as a cure to the economic mar-

ginalization. Improved economy, for its part, is regularly needed in order to get into the technology markets. Thus, there appears to be no direct connection between globalized information economy and global justice. Instead, people, particularly in affluent countries, who have access to all the information channels possible are not using the information they receive, or the knowledge they process out of this information, to share their prosperity and abundant resources any more equally and in a way that will diminish global suffering. The fact that we can now, through satellite connection of television, radio, mobile phones and the Internet, get information more easily, more quickly and more accurately about any natural disasters, famines, victims of war and conflict, sufferers of diseases, or about any human agony that happens anywhere in the world, has not radically increased our solidarity or changed our habits in sharing our prosperity with those who are in urgent need and/or live in absolute poverty. The question then remains: if we cannot use the new ICT to take up our global responsibilities in affluent countries, how can we expect this technology to bring about local equality in the form of shared power and other essential resources in the underprivileged countries which have much fewer resources available, much poorer infrastructure, less efficient and inclusive educational systems, and limited civic participation? If we are not using ICT to enhance human capabilities at the local or global level, it can become a part of the problem rather than a solution for world inequality.

GLOBAL OBSTACLES: PROSPECTS AND PROBLEMS IN INTERNET USE

Knowledge is still power in the hands of a few—globally as well as locally speaking. Knowledge and know-how guarantees power and influence also in international relations. International dia-

logue and the free flow of information both play a vital role in local and global social, political and economic development. Thus, new ICT could help us to increase efficiency and productivity, improve democracy and promote human rights. Access to new information and telecommunication technology could be used to empower the poorest and the weakest by helping them to connect with each other, share their problems and find solutions together and empower them economically and politically (Annan, 2003; Heldman, 1994, pp. 328-330; Hudson, 1997, pp. 179-205; Sarrocco, 2002; UNESCO, 2002; Williams, 1991, pp. 38-50; Wresch, 1996, pp. 23-91).⁵ Since people no longer have to travel physically in order to communicate, exchange essential information, share knowledge or participate in different types of decision-making processes, we now have a realistic and unique chance to establish a global village of wisdom and social justice. At present, however, despite some positive development and the ambitious information society strategy papers with their global ethical guidelines and public rhetoric on social responsibility, the “information gap” and “digital divide” between industrialized and developing nations, and between the rich and poor in general is widening further (Annan, 2003; Gore, 1995; European Union, 1995 & 1997-2002; Sarrocco, 2002; UNDP, 2001; World Bank, 1999).⁶ Instead of providing essential channels of interactive communication to those who need it most, new information technology is still for the most part connecting those who are better off and better connected to start with. Simultaneously in many parts of the world, the worst-offs have become even more disconnected from the centers of influence, power and resources (Heldman, 1994, pp. 264-265).⁷

Even in this information age, many of those who are living in isolated rural areas around the Third World have never read a book let alone a newspaper. About half of the world’s population has never made a telephone call. Once again markets play an essential part in this inequality.

For instance, in a poor nation local publication is minor, because production costs are high compared to those in industrialized countries. Paper prices are high, because most of the paper has to be imported; printing costs are high because all local presses are small and slow; editorial expenses are high because few people have editorial or design experience. While costs are high, sales are small and profits practically non-existent.⁸ The problems are similar with telephone services. For instance, in Africa, still the poorest continent, the cost of getting a phone line and making telephone calls is, in absolute terms, higher and, in relative terms, extravagantly higher than in the United States or in Europe.⁹ And even if one could get access to a telephone line and could afford to pay for the calls, it is not always possible to get an open line when wanted. Reasons for this are due to criminality (bugging of phone lines, looting of copper wire, cutting of cables, corruption with licenses and billing) and erroneous technology (Hudson, 1997, pp. 182-183).

Statistics also show that even if the know-how and technology are already there and there are some signs of change, the distribution of the latest telecommunication technology is globally and locally still very uneven. In 1996 about 700,000 people in Africa had access to the Internet, which meant that Tokyo had almost twice as many telephones lines than the whole African continent. The number of lines has rapidly grown; during 2000, sub-Saharan Africa passed the threshold of one telephone per 100 inhabitants. In the same year, all African countries achieved connection to the Internet. According to a report by the UN Information and Communication Technologies Task Force (UNICT) in September 2002, the proportion of Africans with Internet access rose by 20% between January 2001 and 2002. However, altogether only 0.2% of Africa's population has Internet access, and the lack of infrastructure and affordability has centralized these connections in the bigger cities and business centers.¹⁰ In Tanzania, for instance, the best connectivity

is essentially in Dar es Salaam, Arusha, Moshi, Mwanza and Zanzibar, all of which are centers of business, tourism and international events. Government institutions are still the most backward in connectivity. Many local government offices in smaller towns have no Internet, fax, mobile, or even fixed line connections.¹¹

The increase in the Internet use in Africa does not match the proliferation of mobile phones on that continent, mainly because of the lack of fixed line technology. More Africans possess mobile phones than fixed line telephones, making the continent one of the very few regions in the world where this is the case. As a result of the mobile explosion, dilapidated fixed line infrastructure has suffered further as many governments and companies believe that the continent can skip the fixed line era and move straight into the mobile age. While mobile connections can help to expand access to the Internet in the long term, it makes access to the Internet more difficult in the short term. Mobile connections in third world countries are still unreliable, very slow for Internet use, and relatively very expensive (Ford, 2003, p. 52; Parker, 2001).¹²

Another option for wider Internet access and use would be to design computers that can be used away from electricity distribution grids. Such technology would enable potential users to bypass the inefficiencies of downstream power grids. Some initiatives are already beginning to put the concepts of non-grid dependent PCs into the Mtabila refugee camp in Tanzania, where people have been given access to the Internet as a result of a new source of electricity generation. The camp lies well away from the existing Tanzanian power distribution grid, so power is being generated using methane gas produced by fermented cow dung. However, there are no signs yet that computers powered by solar energy, for instance, are to be widely available in the near future (Ford, 2003, pp. 53-54; Sarrocco, 2002).

All in all, the mobile phones and other telecommunication devices available are still very

unevenly distributed both globally and locally. In poor developing countries, it is mostly only the wealthy people who have access to new information technology and telecommunication services. The gaps are even greater between urban and rural areas. For instance, in Africa there are almost three times as many fixed telephone lines per 100 people in the largest city of the lower-middle-income countries than there are in their rural areas, and more than seven times as many lines per 100 people in the largest city of the low-income countries as there are in their rural areas. These gaps are even more significant given the fact that more than 50% of the population, and as much as 80% in the poorest countries of the world, lives in rural regions (Ford, 2003, pp. 52-54; Hudson, 1997, pp. 180-181; Kyaruzi, 2003, p. 8).

Thus, obstacles in access to information and knowledge, which are related to the global economic inequalities, are also connected to local conditions. In most parts of the developing world, the very same obstacles that we could overcome with the help of new information technology are the ones that prevent its widespread use in the poor parts of the world. Geographic isolation with no reliable means of transportation, lack of infrastructure, together with ignorance and poverty, mean that there are very few people who could use even the traditional communication channels, let alone the new technology. This means that providers must charge exorbitant fees to make up for their high investment costs. Because most private companies have to play according to the rules of market rationality, service providers are locked in charging higher prices in regions where there are fewer customers and where connections are more difficult to establish. Therefore, the use of new technology such as the Internet or cellular phones in much of Africa remains limited to a minuscule elite, often consisting mainly of foreigners or others who can afford the relatively high costs. This keeps demand low, which means lack of competition and little interest from private investors, which, in turn, keeps

the prices unaffordable to the wider public at the grass-roots level.

What makes the situation even more difficult is the fact that not only is information technology and its allocation led by market forces, but information has itself turned into a commodity one has to pay for. The more valuable the information is the more people are willing to pay for it. This, once again, results in a market mechanism that makes it certain that the poor have even less chance of obtaining the most wanted and vital information.¹³ In summary, the vicious circle is created by lack of infrastructure, unfavorable regulatory environment, high pricing, and an uncompetitive market structure, which cannot be broken without decisive intervention that focuses on the realization of human capabilities rather than the invisible hand of the globalized economy.

GOOD FELLOWS' NETWORKS: MEMBERSHIP OF THE GLOBAL VILLAGE

One of the cruder ironies of the Information Age is that rich people get their information practically free, while poor people pay dearly for every morsel, be it a telephone call, a newspaper, a drive to the store, postal services or use of the Internet (Wresch, 1996, pp. 117-136; World Bank, 1999). Thus, the vast majority of information and communication channels are still today accessible only to those who live in the industrialized world, or in the prosperous urban centers of the developing countries. Access to information and communication all around the world remains elitist, since our virtual membership of the "global village" may make us close our eyes to the injustice just outside our own doors.

Thus, ironically enough, the new communication technology that was to be used to connect people with each other has created a digital divide, which actually often efficiently "disconnects" many from the problems of their own societies.

A large part of the information people receive in developing countries through such international channels as the Internet, cable and satellite broadcast, fax and telephone lines, mobile. The information they receive can be quite one-sided, and sometimes even biased. It presents the views and lifestyles of those who rule the commercial markets, entertainment industry, news media—that is, the views of the financial, political and industrial powers, mostly, those of the North and the West. Movies, television, international news agencies and publishers and the Internet all spread information that originates in the Western world, especially in the United States. This means that the information received in the developing world is often very limited in its scope. It is not an exaggeration to say that, for the better-off who live in urban centers of many developing countries, it is often easier to know what is happening on the other side of the world than to find out what is happening in the slums or villages just a few miles away from them.¹⁴

While the developed countries rhetorically demand that developing countries support the free flow of information, they evidently do not mean that information is going to be cost-free for them. Neither do they mean that information is free to flow in any direction (Wresch, 1996, pp. 117-136; Ford, 2003, pp. 52-53). After all, if we seem to live in a particularly productive time in the history of science, there is a wide division of those who are admitted in the global science community. Countries of the industrialized world do not pay much attention to scientific and research done in the developing world, unless they are involved in that research or are giving funding for particular research projects. Local scientists working in local universities without international financial support or connection networks have a much harder time in getting their results published internationally than do many of their Western colleagues. Consequently, when their work does not get international recognition, it easily loses its chance to be further developed.

Information from developing countries that could be spread to the important research centers of the world and processed further into important knowledge that in the end could benefit everyone is often partially disregarded (Wresch, 1996, pp. 79-91). Only if it is regarded more fully could it consistently contribute to the realization of human capabilities and a holistic view of well-being. When information is used merely commercially or as technical means for information production, the goals of wisdom and full human development are set aside or ignored.

Thus, it appears that many Western countries have maintained their role not only as technological or economic advisers, but also as “intellectual advisers” and “the sources of proper knowledge.” Instead of looking for equal partnership, the industrialized world tends to tell the third world how to do things, to put conditions on aid and give or take information it sees as suitable for its own purposes. As a result lots of important local knowledge is wasted and lost.

LOCAL OBSTACLES: LOCAL POLITICS AND AMBITIONS

In addition to the unequal distribution of information technology and information itself, there are other local cultural and political obstacles that prevent us from turning the information society into a global community of wisdom and that further widen the global gap between “the information privileged” and “the information beggars.”

While new communication technology could provide citizens a channel to get involved in public matters and policy decisions, the ruling elite of many developing countries use this technology merely for their own purposes and for their own personal benefit. This is often due to authoritarian political orders in which the head of the state (or the ruling elite) declares a country a democracy. In reality, however, “politics of no choice” is practiced. Often there is only one serious political party

and policy line and no real room for opposition. In this one-party “illiberal” democracy, the distinction between party and the state (or government or regime) is blurred and corruption, bribery and nepotism become common problems. The ruling elite lack the links to the problems of most of the society, particularly to those of rural populations. Nor do they encourage citizen involvement in public matters.

The only real citizen involvement in governance of a nation is often through taxes. The governments of many developing countries originally set high taxes on the new information and communication industry, basing these taxes on the attitude that the latest information technology is a luxury rather than a necessary and integral part of overall development. The tendency to prioritize basic services, such as building roads, educational facilities and health care units, sometimes disregards the possibilities that new communication technology could have in establishing these very services more quickly and more efficiently. However, it should be noted here that recently changes in this attitude have been evident and that taxing of ICT has become more customer friendly.

Nevertheless, earlier taxing policies have influenced the slow progress in nationwide adoption, distribution and use of ICT in the developing countries. For instance in Tanzania the rate of import duty on information technology accessories used to be the highest in East Africa, because computers were for a long time considered as luxury items rather than an integral part of setting up a working infrastructure in all fields of development. The heavy taxing made most Tanzanians unable to buy computers privately, and this led to a digital class divide in society. Even today many local educational institutions, including those that specialize in the use of new computer technology, have to wait until someone donates them the technology (often already outdated or short-lived and unable to give students

up-to-date know-how or access to the most advanced information/data/media resources). High taxes also prevented many computer centers from registering themselves officially. The result of this was usually inferior teaching and/or high fees. Import duty on a computer was, only a couple of years ago, 20% of its value, and a further 20% was charged for value-added tax. As well as these taxes, international shipping costs had to be paid. Thus, in the United States, one of the richest industrialized countries, a new computer can be sold at US\$1000 or even less, while in poor countries like Tanzania the price of the same computer is almost double, unless you settle for an out-dated model or used computer (Heldman, 1994).¹⁵ However, the heavy taxes on ICT do not prevent foreign residents and big businesses from obtaining the latest technology—usually tax exempt. In Tanzania the situation has recently changed with tax policy change and with the recognition that ICT is an essential element in the overall development of the country and not merely a luxury commodity (Mutula, 2001, 2002).

In many other developing countries with stricter authoritarian political order there are other coarser reasons for the heavy taxes and high prices on new technology. Some rulers simply prefer to keep most of the citizens ignorant and uneducated in order to secure their own position and power. History has shown that most of the totalitarian regimes take very tight measures to control information and citizen communication.¹⁶ In many third world countries, for instance, there has been a tendency to protect existing power structures and hierarchies by limiting access to information and by suppressing the capabilities to process information into useful knowledge. As long as the citizens believe in their own “under-development,” social and political hierarchies can be maintained. Official documents are stamped confidential, secret, for limited distribution, depending on who we think deserves and has the right “to know” about particular issues. Infor-

mation that is distributed widely is often trivial, misguided or unclear. For example, in various African countries the passing and distribution of information has turned out to be one of the biggest obstacles in developing “good governance” and participatory democracy.

People in positions of power and influence are protecting their authority by blocking, distorting and censoring information so that people’s capabilities are not sufficiently realized so that they can efficiently and plausibly evaluate government actions, functions of state institutions and policies, monitor business management, and, in general, demand their rights, recognize their duties or complain about the misuse of power. Thus, the idea of an information “revolution” can be directly related to political revolution, which may not be appealing to many leaders. Instead, information and knowledge, with the help of the new technology, can be used to cover up corrupt activities that increase rather than decrease global and local inequality (Mutula, 2001, 2002). After all, when people do not know what is happening around them and when they are not informed about the abuses of political power, or if they do not understand how the political system works, they are much easier to control and keep satisfied. People who are disconnected from the outside world are less likely to stand up for their rights, fight against injustice and demand political change. One central question is then—while there were increasing technical possibilities for e-democracy, would the cultural and political context welcome wider participation and more open and transparent politics? Here again, in relation to the capability approach, new directions in national policies would help to find such a focus. When people participate and can more fully realize the capabilities they have, the leaders themselves learn to understand the benefits that democratic regime can bring to the whole society, and not feel threatened by giving power to people rather than hanging on to it as long as they can.

CULTURE AND TRADITION

All the previous text is at least partly related to the attempts of many countries to maintain their cultural independence and to avoid what they consider to be the negative effects of globalization. In some cases governments set restrictions and censorship on the Internet, since these are seen to import the culture of globalization, consumerism and Western individualism. In contemporary Iran, for example, while the use of Internet is encouraged up to a degree and its possibilities are seen as positive for the spread of the Islamic culture and ideology, the sites that are considered to pass on Western propaganda, moral deterioration or otherwise culturally or politically harmful materials and information are blocked and access to them is denied.

In relation to this, it is evident that in addition to economics and politics, culture plays an important role in development and in the adoption of new technology. Some cultures are more recipient to change and promote technical progress, while others are more oriented towards traditional wisdom. According to well-known philosopher from Ghana, Kwasi Wiredu, this is no accident. Instead, it is due to the cultural differences in worldviews and attitudes towards technology and mechanics. Wiredu (1980) notes that, for many African communities, development does not often mean merely the acquisition of sophisticated technology and material benefits; it also means searching for the intellectual and social conditions that will permit internal, positive freedom for human beings in the form of self-realization. In their search for self-development many African peoples simply do not care about new technology. When development is seen as self-development, learning about mechanical and technological details loses its importance. This is almost the opposite of the Northern view, which conceives development as external rather than internal progress. On the other hand, there has

been some local resistance to modernization in a sense that it is seen to be a sign of further cultural colonization of developing countries.

These differences in attitudes are, at least in part, based on very distinctive intellectual traditions and value systems. If we make some very wide generalization, we could note that the Northern and Western countries have, at least ever since the Enlightenment, had a very individualist, atomistic and mechanistic world-view, which has traditionally equated a human being with a machine.¹⁷ Many non-Western cultures, for their part, have more collectivist value systems which emphasize social harmony and communal interdependency, with understanding of the wholeness of the universe and our social interdependence. In the Western individualist culture the emphasis on reason and rationality requires that we constantly seek more specialized and specific information, which we can turn into scientific knowledge about the way world really is. In many more collectivist cultures with more holistic worldviews and value systems, knowledge about the world can better be achieved by understanding of the whole, with the help of mystical experience that computers and mobile phones cannot produce. In such cultures too much outside information can, in fact, be seen as taking attention away from our internal powers, personal moral development and wholesome wisdom. This is not always the way, however; some of the most technologically advanced countries are based on very holistic worldviews and have very collective social structures, for example, Japan and the technologically fast developing nations of southeast Asia. However, the personal or cultural experiences of the new technology might be very different. In the Eastern context, the idea of virtual reality may be seen as a sign of the holistic nature of the universe and the interconnectedness of (physical, intellectual and mental) human capacities with the immaterial dimensions of our world, while in the more atomistic Western worldview virtual reality may be seen merely as a

device that provides us with the means to extend physical senses and capabilities further across our material world.

The Western emphasis on reason as the source of knowledge gives value to specialized data, that is, external information. In many other cultures the knowledge of the world is rather accomplished by inner awareness, that is, internal information. Achieving the understanding of the interdependence of all things requires us to empty our minds rather than fill them up with distracting piecemeal information. From an African point of view, for instance, the Western world may be seen to conceive knowledge as political and economic power, and thus it tries to monopolize, patent and commercialize all the knowledge it can produce. Since the Industrial Revolution, Westerners have used knowledge to control nature and to exploit it. In many parts of Africa knowledge is equated with moral and social wisdom and understanding the profound interdependence of people and nature and the universe as a whole.

Humans do not produce knowledge about nature. Instead they discover it with the help of the nature itself. While, in the Western worldview, wise men create or produce more knowledge, in Southern cultures it is often “the knowledge” that makes people wise. And wise men know that knowledge should not be used to technologically and commercially suppress and manipulate nature, but to live in harmony with it. After all, humans are merely partners or shareholders, with all other creatures, inanimate objects and invisible forces, in the resources of the earth, of which knowledge itself is one (Tangwa, 1999, p. 276).

Thus, different cultural traditions are often based on very different metaphysical outlooks and thus, may have very distinct views of knowledge and wisdom. People with different cultural backgrounds may therefore have very different ideas and ideals for how to form a global knowledge society. People coming from individualist cultures may see the holistic respect for universal

harmony as inefficiency and primitive ignorance, while people from collectivist cultures may take the emphasis on individuals as arrogance and morally indifferent selfishness (Wiredu, 1980, pp. 53-59, 83, 105).

Understanding cultural differences is an integral part of global development. Part of this understanding requires that we accept that neither attitude towards technology is, in itself, superior to the other. Instead, both have their strong and weak sides and have a lot to learn from each other. While the Northern and Western mechanistic view is eager to develop new means to conquer nature, its emphasis on efficiency and profit often leads to environmental destruction, social inequality and moral indifference in an endless market race. While the Southern holism may not take full advantage of the technological progress and may sometimes disregard individuals' special practical abilities and rights, it can also encourage environmental harmony, social solidarity and personal peace.

Here discussion on human capabilities can also help us to overcome some cultural differences and different understandings of human well-being and good living. As noted in the beginning, people may have very different view of whether the aim of development is material, spiritual or social, but most human capabilities we are looking after in life are universal. We might have different cultural, political or economic contexts to realize them, but, nevertheless, our goals are shared. Thus, promoting human capabilities as the end that justifies the distribution and implementation of ICT should not mean that we have to adopt one global culture, but rather that, with the help of new technology, we have equal capacities to understand, promote and maintain our different cultural values and practices within a context of modern globalized world.

PRIMITIVE AS AN IDEAL?

If we are to build a global society of knowledge and wisdom, different cultures have many important lessons to learn from each other. However, instead of seeing local in global, very often there are hasty polarizations made between modern and traditional. Instead of promoting the best parts of both, people (individuals or groups of people) are forced to make a dichotomized choice between modern and traditional ways of life.

These fallacious polarizations lead to cultural conflicts and to assumptions that local and global are incommensurate. When the fundamental differences in metaphysical, ethical or social outlooks of different cultures are not fully understood, there is a danger that we justify clear injustices as cultural diversity. Also, sometimes people from highly industrialized countries with materialistic values may be skeptical about the value of technological progress as such. Instead, they may romanticize traditional ways of life as resistance movements against technology and consider those who do not have modern technological access to outside world as noble savages.

In fact, those who defend traditionalism and set against modernization are not always residents of technologically and economically less developed countries. Quite the contrary, in many instances it is the information-rich rather than the information-poor who may envision the primitive way of life as an escape from the modern world and the information and consumption anxiety it creates. Some may even themselves sometimes join "the disconnected," on a desert, in a jungle or in the mountains for few days or even weeks.

The difference between the information-rich and the information-poor, however, is that the rich ones always know how and have enough resources to get back to civilization when the times get too rough. Anytime they want to, they can get back to their phones, faxes and communicators, drive

their cars back to cities, and take an airplane back home. The idealized noble savage is usually isolated, poor, and in many other ways disabled. They have no hope for a better life, nor do they have any control over their fate, which is often decided for them by others living in the centers of power and influence. In most cases and most areas people have not chosen their own isolation. The poor simply lack the options to live in any other way (Wresch, 1996, p. 136). Helping these people to get connected with the outside world, and become involved in matters concerning their own lives, is not an attempt to rob cultural traditions; it may be the only way to maintain those traditions. It increases their chances to realize the full set of human capabilities and to see the plurality of human existence and well-being. Keeping people disconnected and ignorant may respect cultural difference, but shows moral indifference. It clearly blocks people from using their full potential, in whatever cultural, social, and material environment they live in.¹⁸

CONCLUSION

New ICT can play a central role in helping developing countries to improve their standard of living and quality of life in relation to realizing human capabilities. However, markets alone cannot bring the technology to those who would most benefit from it and technology alone cannot bring about positive changes. Instead, technology can be made to be a vehicle of positive or negative affects, depending on our personal values and goals, and our cultural beliefs and norms. Information technology can just as easily be used to gain one-sided market benefits or to impose a dominant political culture on different people as it can be used to build a just world order that promotes tolerance, equality and social justice. If we look for new ways to share our global prosperity, it is essential that we make a clear difference between means and ends in the advancement, application

and distribution of ICT. An alternative normative framework that gives a promising start in finding new options for distribution and implementation of ICT is capability ethics that remind us that all material resources are a mere means—never the end in themselves—towards holistic well-being. Since ICT brings together in an intriguing manner both material resources as well as intellectual development, it is important to be clear about what are looking for in our attempts to create global connections. Are we realizing human capabilities and building a global village of wisdom? Or are we creating a superficial global information culture that focuses on market exchange of hardware, software, data, time and social relations?

While it is clear that world neo-liberal economic policies play a central role in global injustice, the Western neo-liberal market capitalism and cultural imperialism cannot alone be blamed for the existing inequalities within developing countries. In many developing countries governments abuse power and resources, as well as people's commitment to tradition. If we are serious about building a global knowledge society, we therefore need to consider first what the ideal of the knowledge society is and how it is related to the realization of human capabilities which are the basis of a working democracy and the moral development of any society. Second, we need to understand the fundamental differences between cultural traditions. Third, we have to conceive technology as a means to better quality of life as well as to more open cultural dialogue, instead of seeing it as an end in itself. If we want to build a global knowledge society, we have to acknowledge that technology *per se* is always value-neutral and, thus, all of us share the social responsibility to develop and use it for the common good and the realization of human capabilities, as is suggested by application of capability ethics to the global distribution and implementation of ICT. While this approach certainly needs to be further studied and its potential problems taken into account, it at least can give us a starting point for debates

on global distribution, particularly in relation to technological advancement.

While there is no clear indication that any comprehensive change in our attitudes is to be expected immediately, keeping the dialogue going is important. Without any change the present trends of global development show that while Internet and other new telecommunication technologies reach more and more people rapidly, at least as many people are at the same time losing their connections to the sources of essential information, local knowledge and basic political participation and power to influence their own fate. This not only deepens material inequality, but also widens further the digital divide and communication gap between the information-rich and the information-poor.

REFERENCES

- AfricaOnline. (2003). *Facts and history*. Dar es Salaam.
- Andinilike, M. (1999, October 4). Reflections: 25 percent private TV, radio coverage in Tanzania. *Daily News*, p. 7.
- Annan, K. (2003). *IT industry must help bridge global digital divide*. Digital Divide Network. Retrieved November 5, from <http://www.digitaldividenetwork.org/content/stories>
- APC (Association for Progressive Communications). (2003). *Women's survey*, Part I. Retrieved June 2003 from <http://communty.web.net/apc-women/part1.html#4>
- Castells, M., & Himanen, P. (2002). *The information society and the welfare state: The Finnish model*. New York: Oxford University Press.
- Clark, N. (2000). Public policy and technological change in Africa: Aspects of institutions and management capacity. *Journal of Economic Studies*, 27(1/2), 75-93.
- Cohen, G. A. (1993). Equality of what? On welfare, goods and capabilities. In M. Nussbaum & A. Sen (Eds.), *The quality of life*. Oxford, UK: Clarendon Press.
- Crocker, D. (1992). Functioning and capability: The foundations of Sen's and Nussbaum's development ethic. *Political Theory*, 20(4), 584-612.
- European Union. (1995). *Green paper on copyright and related rights in the information society*. Retrieved November 5, 2005, from <http://europa.eu.int/scadplus/leg/en/lvb/l24152.htm>
- European Union. (1997-2002). *Towards knowledge based Europe: European Union and information society*. Retrieved June 12, 2002, from http://europe.eu.int/information_society/eeurope/index_en.htm
- Ford, N. (2003, July). Africa joining the IT revolution. *New African*, 52-54.
- Gauthier, D. (1986). *Morals by agreement*. Oxford, UK: Clarendon Press.
- Gore, A. (1995). Information superhighway. *World Almanac and Book of Facts*. NJ: Funk and Wagnalls.
- Grant Lewis, S. (1992). Microcomputers adoption in Tanzania and the rise of a professional elite. In S. Grant Lewis & J. Samoff (Eds.), *Microcomputers in African development: Critical perspectives*. Boulder, CO: Westview Press.
- Heldman, R. (1992). *Global telecommunication: Layered networks, layered services*. New York: McGraw-Hill.
- Heldman, R. (1994). *Information telecommunications: Networks, products and services*. New York: McGraw-Hill.
- Hobbes, T. (1962). In M. Oakeshott (Ed.), *Leviathan*. New York: Collier MacMillan. (Originally published 1651)

From Information Society to Global Village of Wisdom?

- Hudson, H. (1997). *Global connections: International telecommunications infrastructure and policy*. New York: Van Nostrand Reinhold/Thomason.
- Jimba, S. (1999). Information technology and underdevelopment in the Third World. *Library Review*, 48(2), 79-83.
- Kyaruzi, I. (2003, June 13). Mobile telephony, bandwidth use doubles in Africa. *Business Times* (Tanzania), p. 8.
- Miller, S. (1996). *Civilizing cyberspace*. New York: ACM Press.
- Molosi, K. (1999, October/November). Making the Internet work for Africa. *Computers in Africa*, 37-38.
- Mutula, S. (2001). Internet access in East Africa: A future outlook. *Library Review*, 50(1), 28-34.
- Mutula, S. (2002). The cellular phone economy in the SADC region: Implication for libraries. *Online Information Review*, 26(2), 79-92.
- Mwakaleba, L. (1999, July 5). Why many Tanzanian computer schools remain unregistered. *Business Times* (Tanzania), p. 8.
- Ngonji, R. (2003, June 23). Mobile phone customers still await government word. *The Guardian*, p. 7.
- Njau, A. (1999, October 30). Business people challenged to use Internet services. *Business Times* (Tanzania).
- Nussbaum, M. (1987). *Nature, function, and capability: Aristotle on political distribution* (WIDER working paper 31). Helsinki, Poland: UNU/WIDER.
- Nussbaum, M. (1992). Human functioning and social justice: In defense of Aristotelian essentialism. *Political Theory*, 20(2), 202-246.
- Nussbaum, M. (1993). Non-relative virtues: An Aristotelian approach. In M. Nussbaum & A. Sen (Eds.), *The quality of life*. Oxford, UK: Clarendon Press.
- Parker, B. (2001). Puppet on a string—Africa's spineless Internet topology. *Nairobi, Africaonline holdings*. Retrieved June 4, 2003, from <http://www.africaonline.co.tz>
- Perry, J. (1996). Introduction to *On the Internet*, Nov/Dec—Developing Countries. Retrieved May 3, 2002, from www.napanet.net/~janetp/articles
- Rawls, J. (1972). *A theory of justice*. London: Oxford University Press.
- Reiman, J. (1990). *Justice and modern moral philosophy*. New Haven, CT: Yale University Press.
- Sakaguchi, T., & Dibrell, C. C. (1998). Measurement of the intensity of global information technology usage: Quantitizing the value of a firm's information technology. *Industrial Management & Data Systems*, 98(8), 380-394.
- Sarrocco, C. (2002). *Improving IP connectivity in the least developed countries*. Retrieved November 5, 2003, from <http://www.itu.int/osg/spu/ni/ipdc>
- Sen, A. (1985). *Commodities and capabilities*. Amsterdam: North-Holland.
- Sen, A. (1990). Justice: Means versus freedoms. *Philosophy and Public Affairs*, 19(2), 11-121.
- Sen, A. (1992). *Inequality reexamined*. Oxford, UK: Clarendon Press.
- Sen, A. (1993). Capability and well-being. In M. Nussbaum & A. Sen (Eds.), *The quality of life*. Oxford, UK: Clarendon Press.
- Sen, A. (2001). *Development as freedom*. Cambridge, UK: Cambridge University Press.
- Stover, W. J. (1984). *Information technology in the third world. Can IT lead to humane national development*. Boulder, CO: Westview Press.

Tangwa, G. B. (1999). Genetic information: Questions and worries from an African background. In A. Thompson & R. Chadwick (Eds.), *Genetic information, acquisition, access, and control*. New York: Kluwer/Plenum.

UNCTAD. (2004). *UNCTAD E-Commerce and development report 2004*. Retrieved November 5, 2005, from http://www.unctad.org/en/docs/ecdr2004_en.pdf

UNDP. (2001). *The UNDP world development report 2001*. Retrieved January 10, 2005, from <http://hdr.undp.org>

UNESCO. (2002). *Medium-term strategy 2002-2007. Communication and information*. Retrieved November 5, 2004, from http://portal.unesco.org/ci/en/file_download.php/aab035d458fac5197544ca1ff10c5d5bCommunication+and+Information+Strategy.pdf

Vesely, M. (2003, July). New technology for an old continent. *African Business*, pp. 20-21.

Warschauer, M. (2003, August). Demystifying the digital divide. *Scientific American*, pp. 34-39.

Weinberger, O. (1995). Information and human liberty. *European Journal of Law, Philosophy and Computer Science*, 2(1).

Williams, F. (1991). *The new telecommunications: Infrastructure for the information age*. Ontario, Canada: Maxwell Macmillan.

Wiredu, K. (1980). *Philosophy and an African culture*. Cambridge, UK: Cambridge University Press.

World Bank. (1998/99). *The world development report: Knowledge and development*. Washington, DC.

Wresch, W. (1996). *Disconnected: Haves and have-nots in the information age*. New Brunswick, NJ: Rutgers University Press.

Young, J. R. (2001). Does “digital divide” rhetoric do more harm and good? *The Chronicle for Higher Education. Information Technology*, 48(11). Retrieved November 5, 2005, from <http://chronicle.com/free/v48/i11/11a05101.htm>

ENDNOTES

- ¹ The term “digital divide” may be defined as the gap between individuals, households, businesses and geographic areas at different socio-economic levels, with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities. There are divisions between those individuals and businesses who can enjoy the advantages of the information age, and those who are still waiting to see these benefits. The concept of “digital divide,” however, has been questioned as making a normative distinction between the technology savvy and technology ignorant.
- ² When, for instance, we talk about knowledge workers, we mainly refer to those who can manipulate, control, transfer and store the growing amounts of data and information, and not to those who are working intellectually in order to process and distribute relevant knowledge out of all the information available. In the information society true knowledge is often the by-product of information markets rather than a valuable goal in itself.
- ³ According to Sen (1992, p. 42), functionings belong to the constitutive elements of well-being. Capability reflects freedom to pursue these constitutive elements and may even have a direct role in well-being itself, in so far as deciding and choosing are also parts of living.

- ⁴ See, for example, Sen (1985, pp. 6-11; 1990, pp. 113-114; 1993, pp. 30-50). There is no escape from the problem of evaluation in electing a class of functionings. This is particularly problematic in choosing the objects or commodities of distribution. Whose capabilities should have priority, and at what level? The focus has to be related to underlying concerns and values, in terms of which some deniable functioning may be important and others quite trivial and negligible. Many functionings are of no great interest to a person; for example, using a particular washing powder is much like using any other washing powder (Sen, 1993, pp. 31-32). For a criticism of Sen's capability approach, see Cohen (1993).
- ⁵ The new information and communication channels could promise poor countries a better life in the following ways: schools and hospitals could be assisted with online access to information resources all round the world. Computer conferencing and electronic mail could enable students to participate in distance learning projects, seminars and tutorials in vocational schools or universities on the other side of the globe. Scientific researchers and doctors who lack the money to subscribe to leading journals and other publications could keep abreast of the latest work in their fields. Information on health issues could prevent and help to cure many illnesses. Health care workers in isolated areas could receive information on possible epidemics. They could also get distant specialists to diagnose rare conditions and recommend the proper treatments through telemedicine. The poor themselves could learn how better take care of their health and their children's health through access to professional health education and information, that, for instance, helps them to leave behind harmful practices based on ignorance, misinformation or coercion. Local journalists, news offices, development agencies and non-governmental organizations (NGOs) could use new technology to collect and disseminate essential information for rural areas. Information on local government policies and legal matters as well as access to national and international news could, for instance, help people to prevent abuse of power and educate them about their social and legal rights. Also businesses, large and small, would be able to market their goods widely, receive vital information about local and global market conditions, pricing and financial management or they could hunt for foreign partners cheaply. See also APC (2003) and Perry (1996).
- ⁶ Several international and regional organizations have undertaken new projects to bring the benefits of the information technology revolution to the developing world. These projects are often aimed at improving the access capacity of the least developed countries and providing their populations with equipment or multi-purpose telecenters and the knowledge necessary to use information resources. Among these are the ITU Multipurpose Community Telecenter pilot projects in Benin, Mali, Mozambique, Tanzania, Uganda and elsewhere sponsored by ITU, ICRC, UNESCO, UNDP and by national and private entities.
- ⁷ Multinational corporations have become more information-oriented, but they are also taking over the information markets. Now most of the exchange of information between countries is no longer controlled and regulated by governments, but by local individuals have become more tied to the information provided by the international corporations and local businesses have become more dependent on their multinational partners.
- ⁸ If people can read and can afford newspapers or books, they often have to buy imported

ones, written by foreigners and published in a foreign language. For instance, in Tanzania, no history books were published at all by 1980. Thus, if Tanzanians wanted to learn about their own nation's history, they had to learn it from foreigners.

⁹ Miller (1996, p. 371) refers to how the prices spread piracy and vice versa, creating a vicious circle in technology and information markets in developing world.

¹⁰ The world distribution of online connections in 1999 was: World – 134 million (2.4% of the total population); Africa – 1.2 million (0.1% (excluding South Africa)); Asia – 22 million (0.6%); South America – 4.5 million (1.3%); North America – 70 million (14.9%); Europe – 34 million (4.7%) (In many Scandinavian countries, the percentage is considerably higher, now reaching close to 40% of the population) (Molosi, 1999). Since 2000, there were only about 580,000 regular Internet users in the LDCs, representing less than 1% of the population and 0.16% of global Internet users (Sarrocco, 2002).

¹¹ Based on an interview with a Tanzanian *Business Times* ICT journalist, Samuelson Makilla in Dar es Salaam, 1 July 2003. His suggestion of a solution to poor connectivity was based on joint-ownership of a satellite link sponsored by donor and a local stakeholder conglomerate.

¹² Internet connections are slow and commercially fragmented. For example, an e-mail to Somalia from Kenya may go by satellite to the U.S., under the Atlantic by fiber-optic cable to Europe and the Middle East and back up by another satellite from the United Arab Emirates and then to Somalia. Multiple strands of bandwidth connect individual Internet service providers to the central thoroughfares of the Internet, mainly in the U.S. and in Europe. Each international ISP connection costs many thousand dollars to maintain. Most of sub-Saharan Africa in

connected by satellite, which brings echoes and delays to Internet traffic.

¹³ Thus, at present the Information Age is not an age of equality and justice. The poor have enormous obstacles to overcome before they can even get to the global sources of useful information. Not only do they have to be able to read and write in their native language, but also they have to be educated enough to understand at least one foreign language (usually English). Then they have to have access to sources of information and they have to be able to pay for the information they are looking for. However, paying \$US49 a year for the *Wall Street Journal* (US\$29 to print subscribers) in a country where the average income is much less than \$US50 a month is a rather irrational choice.

¹⁴ Even local television and radio stations and the local press often use the same stories because they are easier and cheaper to get than those gleaned by sending a local reporter abroad or to hard-to-reach parts of their own country. Stories about Third World countries are reported mostly by journalists and researchers from the industrialized world. Thus, they present a Western point of view and Western concerns about development aid, natural catastrophes, war, poverty, famines. Positive success stories are seldom reported and traditional wisdom from local sources is usually overlooked (Wresch, 1996, pp. 23-41).

¹⁵ Local development policies can affect poorer members of society adversely. As information education has taken hold in developing countries, priority has been given to the increase of food production and economic resources. Many of the poorer people have been forced to give up some of their land holdings to enable the growth of a more educated society.

¹⁶ Many conservative or fundamentalist religious nations have accepted the use of new

From Information Society to Global Village of Wisdom?

technology itself, but mainly for their own propaganda purposes and they have blocked people's access to, for instance, what they consider to be sexually or politically sensitive data. Sometimes they may deny individuals' access to anything other than government information and may even spread misinformation about opposing views and possible enemies of the state.

¹⁷ See, for instance, Hobbes (1962), whose work presents the Western mechanical position on the norms of social and political order.

¹⁸ Within many traditional societies old social harmony is based on strict social hierarchy and suppression. The poorest and the weakest are often women living in patriarchal societies. They have the least chance to access external information and educate themselves in order to improve their lives. They are too exhausted from work, too sick from serious diseases, gender violence and continuous childbearing, and they are too suppressed and brain-washed by traditions

to attempt to fight for their position in life. Everything these women know and learn comes from their physical environments and focuses on everyday survival. In a local village in the middle of Africa, for instance, the ideas of global village or virtual reality do not make much sense. Not only are these concepts obscure, but the reasoning behind them seems totally incomprehensible. People there see themselves as members of smaller and closer physical communities, hardly even as citizens of any particular state. They certainly do not relate to abstract cosmopolitanism and see themselves as citizens of the world, while, at the same time, they may hold a holistic worldview that acknowledges individuals as not only physical but also spiritual parts of the universe as represented in the world/nature around us. In such circumstances, direct spiritual connection, not technological devices, is needed to mediate needs, wants, hopes, desires, and despair.

This work was previously published in Information Technology and Social Justice, edited by E. Rooksby and J. Weckert, pp. 1-28, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 7.4

What Kinds of Organisations do We Want to Build in Africa with Information Communication Technology?

Rembrandt Klopper

University of Zululand, South Africa

ABSTRACT

In the first half of this contribution, the author focuses on what information communication technology (ICT) could be implemented in Africa in order to integrate the continent into the emerging global culture and associated economy. In the second half, he assesses the state of ICT implementation in Africa. The emergence of worldwide information and communications technology (ICT) networks in the last quarter of the 20th century has steadily effected vast and permanent changes with regard to how people in free market open societies communicate, work, do business, and spend their leisure time. In spite of the recent bursting of the dot com bubble and increasing strains experienced in the ICT

manufacturing sector, advances in information technology and telecommunications (ICT) will continue to reshape the major institutions of society in the 21st century. This ought to lead to a more efficient way of life for at least some people. However, it is not clear whether this “progress” will actually be satisfactory for all. There are many more facets to the application of ICT than simple business efficiency. This chapter asks, “after 50 years of ICT, what kind of society do we want to create for ourselves, and what level of choices are available to individuals and corporate entities?” As was pointed out at the EU meeting in Lisbon in 2000, we need to be particularly aware of the potential for ICT to improve the lives of those who are disadvantaged.

INTRODUCTION

It has increasingly become clear that ICT plays an important role in how society develops. This is apparent from the plethora of initiatives we have seen in the past few years ranging from computer applications in business, education, transport, government, and medicine—to mention only a few areas of application. This relentless application of information and communications technology (ICT) has developed a momentum during the past 50 years during which personal computing has developed and grown in the workplace, and at home to an extent that could not have been envisaged when the first business computers went on sale in 1952. Despite the obvious importance of this technology in shaping the way we live, work, and play, we hardly ever hear the question asked, “*What kind of society do we want to build with our ICT?*” We seem content to have the providers of ICT shape the institutions that will ultimately determine the quality of our lives.

IT: The Shape of Things to Come

The central role of technology in shaping our society is not disputed by many. In fact, there is the argument that technology is a primary driver of history (Smith & Marx, 1994). This type of notion implies that we are on a technological treadmill, which gives us very little option, but to adopt technological innovations as soon as possible. This view suggests that we cannot escape from racing after each new wave of technology. And although in a number of ways this view is clearly true, we suggest that we are actually in a position as individuals to make important decisions about the society we actually want or believe to be appropriate. We may not have complete control over how technology influences our society, but at the same time neither do we have no control at all.

The first step in deciding how we might like to see ICT implemented in the future is to have a view of how the technology will develop in the

medium term. To look into the future and suggest what we can and perhaps should be achieving with the help of ICT is no mean task. There is an old quip sometimes made by stand-up comic entertainers (which has also been attributed to the quantum physicist Niels Bohr); “Prediction is always difficult; especially prediction about the future.” And when it comes to the application of ICT, the ability to predict is especially daunting. Furthermore, there is also an interesting admonition against prediction in Dante Alighieri’s *Inferno* where he suggests that the 8th level of hell—the second worst out of nine levels—is reserved for futurists and fortune tellers (Jacoff, 1993). It is also very sobering to remember the famous remark of Lincoln Steffens upon his return from the Soviet Union in 1919, “I have seen the future, and it works.” It is just as well that Steffens wasn’t attempting even a rudimentary course in prediction or forecasting.

Therefore, from fear of the fires of hell or just simple embarrassment about being wrong, this author will not attempt to foretell the future of ICT, but will instead identify potential trends based on the technological options presently available to us. The options are of course many and it can be very difficult to see which are real and which are just figments of the imagination of technicians, the digitrati, and others. It is always interesting to remember how wrong important people have been when they spoke about how computers might develop in the future. For example, Thomas Watson Sr., the founding father of IBM said, “There is a world market for five computers!” Ken Olsen, the founder of Digital Computer Corporation said rather to his regret one supposes, “Who would ever want a computer in their home?” Also, let us remind ourselves of Bill Gates’ contribution to these faux pas “Who could ever need more than 640K of memory?” Furthermore, in this chapter we are not just interested in the technology but rather in how it will be used in our society, which actually makes forecasting even more problematical.

However, we need to start with a view on how the technology will develop in the short and medium terms. From a pure technological point of view, there is every prospect that computers and telecommunications technologies—the bedrock of the IT revolution—will continue to improve in leaps and bounds. Computers will no doubt relentlessly continue to become more and more powerful. Moore's Law is alive and well and living in Silicon Valley and other parts of the world. At the current time, no foreseen limit is envisaged to this law. Our capacity to process and store data seems virtually limitless. It is now being said that we are producing some one to two exabytes¹ of data per year. This will no doubt continue to grow. In the next five to ten years, even greater advances in computing and memory power may be derived from the suggested amalgamation of biotechnology and electronics. Telecommunications will continue to become faster and faster. This will be done while the price of the equipment and facilities will continue to fall. This does not necessarily mean that computers will become cheaper as such, but rather that the price will probably stay at about the same level with much more power being provided for the same amount of money.

A more fundamental problem with IT adoption relates not to whether communications technologies will improve, but to human problems around IT adoption in Africa. The real question is whether the potential users of ICT in urban and rural communities of Africa would be willing to incorporate ICTs into their daily lives. The answer probably is that regardless whether they live in urban or rural communities, most Africans would adopt ICTs if they consider them to provide a cost effective and sustainable way of solving a range of problems that beset their daily lives. Those problems are formidable: all-consuming poverty fuelled by unemployment, drought, diminishing land resources, poorly developed health care and educational resources, rudimentary transport in-

frastructures, local political and global economic exploitation, and so on.

As economies of scale make established technologies evermore affordable and because conscious efforts are presently being made to develop a new generation of light, affordable, and ergonomically efficient ICT, increasing numbers of African consumers will be willing to invest in ICT—provided that they even faintly believe these instruments will enable them to break the grip of poverty and isolation on their lives.

On the telecommunications front we will see bandwidth increase and prices fall dramatically, provided that governments deregulate telecommunications to ensure that the monopolistic stranglehold of telecommunications providers is broken through competition in the market place. In deregulated economies, international phone calls are charged in pennies an hour.² This will completely open up communications in a way hard to currently envisage. Technology changes such as this will impact Telco's and their employees as traditional pricing models break down video-on-demand will become a reality as will domestic and mobile video conferencing, probably even from wristwatch type devices as envisaged in the Dick Tracey stories, will eventually become ubiquitous.

It appears that nearly everyone on the planet (at least in the more developed countries) actually wants mobile teleconferencing in some form or another. The mobile phone has become a very much superior version of the security blanket by which those who are lonely and who need to feel connected to others anywhere in the world can do so instantly. The mobile telephone has changed the focus of communication to the individual rather than a particular location.

It also seems that many people want to be able to talk using the most modern and fashionable handset and in this respect, a piece of telecommunication equipment has become a personal fashion accessory. As a result of this attitude to-

wards these hand sets, it is estimated that there are more than 100 million discarded mobile phones in the United Kingdom alone, awaiting ecologically clean disposal. Furthermore, it is interesting to note that the race for new features accompanying these handsets and the corresponding generation of additional revenue streams can have interesting consequence. The advent of mobile phones capable of taking and sending pictures or video clips has led to a variety of enterprises banning their use. Banks, schools, gyms, and exclusive nightclubs³ for example have all barred the taking of pictures or video footage on their premises.

Not only do we put computers and telecommunications abilities into many in all kinds of domestic devices, we also install tracking chips into our pets and our children's clothes. Sooner or later, someone may even propose that we put a microprocessor and a telecommunication device into a diagnostic toothbrush, enabling it to report problems to the dentist and to schedule an appointment, and in between even doubling as a telephone!

Remotely operated electronics is increasingly being used by the authorities for crime control. Great Britain already uses thousands of closed circuit television cameras (CCTVs) in urban communities, linked to computer networks and other telecommunication devices to detect criminal activities, to enhance private and public security, and to serve as evidence by helping to identify perpetrators. On the other side of the Atlantic, there is disagreement between the president of the USA and Congress about the legitimacy of co-opting Internet service providers to enable the Federal Government to monitor the communications of American citizens as part of ongoing an anti-terrorist campaign.

The recent upsurge of phishing e-mail messages and the successful swindling of banks and governments are examples of evasive criminal behaviours, as are evermore innovative ways trading in pornography over the Internet. There is little doubt that in the next ten years smart

computers and telecommunications devices will exist, many of which have not yet been invented at this stage as a ubiquitous part of a global fully wired society. The jury is still out on where citizens will eventually draw the line between being willing to be under constant surveillance for safety's sake, and insisting on the right of individual privacy.

Where communication networks with proper bandwidth permit fast electronic communication, we are beginning to integrate intelligent decision making protocols in networked appliances that form part of smart kitchens and other intelligent devices throughout our homes (Herper, 2001, Levinson, 2003). Ovens, kettles, and climate control devices can already be operated remotely, curtains drawn and TVs or audio devices activated via cell phones, or baths filled to just the right level and temperature as we approach our homes at the end of the day. During the day, our fridges will have placed orders for us with our grocers, supermarkets, or fast food vendors, to be delivered just in time as we arrive at our homes, kept clean by roving bots.

Fault detection will be incorporated into many of our domestic appliances, which will alert us about worn out equipment. We will use the technology in an attempt to remove as many domestic chores as we can as we become more efficient in our home life. Hopefully, not many of us will buy these fully wired homes as they will take away much of the familiar routine that actually constitutes human life. But they will be on the market for those who want them and who have a lot of spare cash to buy them, as they will not come cheap—at least initially. Of course, it will also be necessary to be trained in how to use one of these at home. Perhaps one day some entrepreneurial university will offer a master's degree: *Mastering your fully wired home*. In a similar vein, smart communication devices are disappearing off our desktops into our clothes and bodies, soon to be followed by companion robots (Cowley & Kanda, 2005; Klopper, 2005).

Generally, software use will become more user-friendly and intuitive. This will allow computers to undertake many more tasks for us. On the advanced software side, we will make progress with artificial intelligence (Kehal & Khurshid, 2001). Computers will not only dominate chess tournaments, but will take on and eventually become champions in the game of Go. We will produce more intelligent programs, which will increasingly help us in many different situations from medicine to banking, and travel selection to cooking. The computer will indeed help us make smarter decisions. It is however worth noting that sometimes smart decisions are at the expense of wise decisions, which generally need a broad and long term perspective and which often have to cope with paradoxes—one aspect of human thought that will remain a challenge to computers and companion robots for a while yet. It is thought that in the next 5 to 10 years we will make some progress towards a robotic or silicon brain. However, in all probability the quintessential essence and extreme complexity of human intelligent decision-making will elude us for the foreseeable future. Until we understand natural intelligence it is not likely that we will be able to fully master artificial intelligence. Given the reality that human cognition is a continent of which we have only begun to explore the beach on which we landed, Arthur C Clarke's estimate that by 2001 there would be mature artificial intelligence (AI) that could interact with human intelligence, represented by HAL in Clarke's visionary film *2001: A Space Odyssey* was clearly quite overoptimistic. Sophisticated and mature AI will almost certainly be only realized by the middle of the 21st century, if not in hundreds of years' time. Gene Roddenberry's fictional portrayal of the android *Data* in the Star Trek series, set about three hundred years in the future, is probably a more reasonable estimate of when mature AI could be available.

On the business front, ICT has been well established and should grow in leaps and bounds,

making organisations more efficient. There will of course always be computer project failures with the concomitant lost of money. But on the whole information technology investment will continue at an increasing rate and it will turn out to be successful. DotComs and e-business will probably play a lesser role (Remenyi, 2001) while applications such as knowledge management (Depres & Chauvel, 2001) will become increasingly important.

Computers will interface with the public more and more. As a consumer, it will become harder and harder to find a human assistant to talk to. We will buy increasingly either on the Web or through a telephone or via some sort of electronic interface. It will become hard to find a bank staffed by people rather than ATM type devices. Companies will continue to increase their fees to those of us who want to deal with human assistants. Furthermore, we will buy just about every type of ticket from a machine, or download prepaid tickets remotely onto our cell phones or credit card size cash cards. Train tickets, bus tickets, airline tickets, theatre tickets, and meal tickets will be dispensed by machines 24 hours per day and seven days a week. This could be seen as the siliconization of relationships between entrepreneurs and clients. Many companies see this as an improvement in efficiency. But for some people, siliconization is simply a synonym for depersonalisation and for many depersonalisation means a reduction in service. As the application of information technology and telecommunications continues to show good returns for their organizations the so-called productivity paradox (Brynjolfsson, 1993; Willcocks & Lester 1998) will be seen for the misunderstanding that it was. Computers will insinuate themselves into every aspect of the organisation whereby these machines will automatically reorder inventory, plan production, redesign products and reschedule vehicles, and so forth. Customer relationship management (CRM) will come into its own and will ultimately play a significant role in driving the day-to-day affairs

of the business (Leavitt & Whistler, 1958).

In fact, with regard to corporate entities, the pervasive nature of ICT is pushing business organisations towards embedding technology deeper and deeper within their business models. For competitive reasons, there is increasing pressure to be more cost effective and ICT is seen as a central way of achieving this. The application of this technology can be with little or no concern for the individuals whose jobs are either lost or dumbed down. Seeing this through the technologic determinism lens, we could say that at present it seems that businesses do not have much choice as to whether or not they embrace this technology. If a particular business refused to “modernise” and its competitors so do then it could be forced out of the market place. It can be seen that the logic of the market has now begun to drive the logic of technological determinism.

To add to this situation, it is important to note that to prosper, businesses will increasingly need to have the capacity to interact seamlessly with other enterprises and dynamically create and dissolve relationships (Kalakota, 1998). This is most effectively facilitated by ICT. There are many examples of enterprises extending beyond their boundaries and acting as a virtual enterprise using ICT as the primary facilitator. Thus, the pressure to use ICT is nothing less than enormous and this has been reflected in the sales figures of this industry sector over the past decade.

When this trend is examined in detail, the concerns of business with generating a demand for their product or service, selling, and delivering their product to the customer, getting paid, managing the relationship with the customer, conforming to regulatory requirements, and managing the relationship with the shareholders, all lend themselves greatly to facilitation by ICT. If we look at each of these generic areas in a business, we can see an almost endless list of possibilities for ICT applications. Even if the enterprise has reservations about the use of this technology and does not want to continually chase after and adopt

the latest ICT, the technological determinist argue that they may have no choice due to inevitable disruption of the traditional business paradigm by ICT. It is relatively clear that in order to survive, enterprises have to and will have continue adopting new technology that gives them a temporary advantage over their competitors.

Given the reality of this determinist approach, the choice facing the corporate sector is how ICT can be introduced and how these systems will be put in place, and how sound policies for their use and governance will be developed. This concern is reflected in the current focus within large enterprises on project and program governance, enterprise architecture, and program office concepts. This emphasis allows the enterprise to manage the application of the technology within the context of the corporate strategy, processes, rewards systems, organisation, technology, and measures. In addition, while a lot of research indicates that the technology should be put in to support of business change, a number of organisations appear to be forcing change through the organisation using the technology. Of course, this sometimes leads to poor systems or even to outright failure of ICT projects.

A hard line technological determinist would say that given these circumstances, there is no choice but to chase after the technology and that individual employees need to enthusiastically embrace the new systems by becoming an early adopter of technology, and make full use of it. But this a rather simplistic and incomplete view of the issues involved. Given the above, it is clearly hard to argue against the fact that ICT is rapidly becoming ubiquitous to the point at which it will be a central facilitator to virtually every aspect of our lives. But there are still real choices as to how we implement ICT. For example, as business continues to siliconise,⁴ so relationships change. The human-machine interface changes attitudes as well as work practices. As mentioned before, the highly impersonal ATMs, ticket vending machines, and Web sites become the client interface.

Telephone systems with multiple menu options may well be efficient from the company's point of view, but we have never heard one single phrase from a client in praise of them. It is hard to find any discussion on this type of issue. In general, this debate is simply avoided. Many corporate systems are either not ergonomic or simply downright user-unfriendly. Repetitive strain syndrome has now become an accepted complaint for office workers. Fortunately, the use of computers to monitor too closely individual work practices is unacceptable. But despite these issues, there seems to be an unquestioned implicit assumption that ICT leading to efficiency is simply good. But this is clearly not always the case. It is not at all clear that the users of ICT always obtain more satisfaction from their work or deliver a better level of service to the organisation.

Furthermore, large swathes of people are almost automatically left out of this ICT driven type of world (Morino, 2001). In general, those who are in any way traditionally disadvantaged have reduced access to ICT. One important group that is paid very little attention is people with disabilities. Virtually no accommodation is currently made for such individuals. Examples of this abound. Few Web sites have facilities for the visually impaired. Few ATMs are placed at a convenient level for those in wheelchairs. Few organisations make braille or voice recognition systems available for blind individuals.

Yet, for people with disabilities, ICT can radically change their lives through emerging neuro-informatics, the melding of electronic, and neurological signalling (Klopper, 2005). In the case of the blind or visually impaired, it is now possible to facilitate their reading of computer screen using various high-tech assistive technologies. Speech input, screen readers have changed the way people communicate. Furthermore predictive text, typing aids, and alternative input devices are available.

If accessibility is not taken into account during the design of technology, it becomes very

difficult and expensive to retro-fit it. Clearly, it is desirable that all individuals can obtain the maximum benefit from the developments in ICT and this was recognised by The European Commission when it stated that "It is accepted that in today's Information Society 'learning to use technology' and 'learning to learn' with technology is necessary" (EU, 2000a). In the European context, national government in member countries is expected to encourage this by ensuring that teachers can provide the necessary skills training and by encouraging teachers to teach using technology. Furthermore, the EU has recognised the importance of the issue of inclusion. The EU commission has examined the opportunities, which an ITC empowered society could bring "the information society promises new digital opportunities for the socially disadvantaged" (EU, 2001). For the socially marginalized, technology could educate and inform, bring people closer together and provide them with new services—of course basic computer literacy and access to technology would be necessary. These issues were highlighted at the Lisbon Summit in March 2000 where the challenges of the Information Society and the actions needed to address them were defined in the eEurope Action Plan (EU, 2000b).

So the application of ICT opens up a lot of important issues and we will be forced to face a number of choices. We will need to think hard about our basic values and what sort of society we really want or need to create. We could create a highly siliconised society where the only issue is how to be more efficient in the market place. We could ignore personal preferences as to how people want to work and we can just pay for redundancies and repetitive strain syndrome cases. We can disregard our customer's dislike of telephone menus etc. This is the sort of world where we chase after technology for technology's sake not caring for the human impact of what we are doing.

On the other hand, we could be much more sensitive to individual preferences and also we

could create a society where we use technology to enable people to overcome difficulties, to provide high-tech assistive technologies to people with disabilities, to provide support and education and to minimise exclusion. Furthermore ICT can be used to inform those who are struggling for freedom. In this world, we actually face the question of whether we get a better feeling from buying from a machine or drawing cash from an ATM or obtaining information from the Web than we do from having real live people help us. We also face up to the fact that although machines are generally more reliable than mere people, when they breakdown they can have a greater and more catastrophic effect than an inadequate people based service. Remember the last time your credit card was swallowed by an ATM in a far away town leaving you on a Saturday night without cash and without your credit card. Of course, most of us know about having back up arrangements or business continuity plans to use the modern parlance. But even that doesn't always work! Perhaps we will need to cultivate a culture that understands there is more to life than efficiency. Therefore, we need to seriously ask the question and face the implications of its answer: *Do we actually want to deal with machines rather than people?* We can withhold our business from those who want as much siliconisation as possible just to maximise their profit.

It is beyond the scope of this chapter to definitively state what kind of society we want to create for ourselves globally. However, it is clear from the information provided above that we feel that ICT should be used in a sensitive way that bears in mind the preferences and aspirations of the individual. It is also clear that ICT could play a very significant role in improving the circumstances of disadvantaged people including those with disabilities. We argue that not enough attention has been given to this and that it is now necessary to move quickly on this front. It is hoped that this article will generate a more debate and discussion as to how this may be achieved.

THE STATE OF INFORMATION COMMUNICATIONS TECHNOLOGY IN AFRICA

Introduction

As the deal with the Second Network Operator in South Africa takes shape, many questions will remain in the minds of the consumers of information communications technology (ICT), be they private individuals or business, about what benefits may be realised from the deal. However, at the same time we must not ignore the ICT trends unfolding in Africa and in particular within South Africa. There has been significant increase in the consumption of mobile telephony over the last 3 years, throughout Africa. BMI-TechKnowledge estimated in 2003 that the mobile content component of the ICT market was the second largest market segment—estimated then at about R150million a year. The main source of this revenue was from SMS content downloads such as ring-tones and icons ⁽¹⁾.

Despite the growing appetite for connectivity, there is still a large portion of the African population that does not have a consistent means of access to connectivity. In a publication on www.bridges.org, one of the definitions given for this digital divide is “*a lost opportunity, with disadvantaged groups being unable to effectively take advantage of ICT to improve their lives—what really matters is how the technology is used, and its incredible potential to improve quality of life for disadvantaged groups; effective use requires computers, connections, training, locally relevant content, and real applications of the technology to fit immediate needs.*”

Understanding the consumption patterns and drivers of ICT, as well as the appetite for ICT, will in the future play a key role in the quest to close the Digital Divide within Africa. In this context, it is believed to be pertinent to first examine ICT in Africa, what is driving it, and where the energy currently resides. With this in mind, a fine balance must be maintained in developing

First World Business Systems to service a Third World Market.

A View of ICT in Africa

Intent

There is a need to address the knowledge economy in Africa if there is to be any progress in closing the Digital Divide. While there is acceptance and recognition by bodies such as New Partnership for Africa's Development (NEPAD) to accelerate broad-based growth and development, Africa generally lacks the resources, policies, and institutions to draw benefit from the knowledge economy.

The developed world provides the majority of theory and understanding of the information age whereas very little comes from Africa in terms of primary research which can be used to develop ICT policy formulation and strategy.

From this background, Research ICT Africa (RIA) was formed as an initiative of the Learning Information Network and Knowledge Centre of the University of Witwatersrand (LINK). The quoted definition of what RIA is, is extracted from their March 2004 ICT Sector Performance in Africa publication as being "An ICT policy and regulatory resource base for decision-makers in the public and private sectors and civil society, developing public-interest research findings through the networking of researchers at African universities."

General Findings

These initial findings have revealed that although there has been a growth in the access to telephony within the majority of African countries, this has been via mobile technology rather than the conventional more affordable fixed-line telephony.

Data available from the International Telecommunication Union regarding fixed line and mobile telephony trends in Africa between 1995 and 2003 (accessible at <http://www.itu.int/ITU-D/ict/publications/world/world.html>), reveal that

of 43 African countries surveyed by 2003, 78% of them had more mobile than fixed subscribers, that almost 70% of African telephone subscribers used mobile telephony, that by 2001 mobile subscription overtook fixed line subscription, and that by 2003 for every 100 inhabitants there were 3 fixed line subscribers, compared with 6.2 mobile subscribers.

Two clear examples of this are Kenya and South Africa where there has been a decrease in fixed-line subscribers of 0.61% and 10% respectively over the period of exclusivity protecting the Public Switched Telephone Network (PSTN). Both Kenya and South Africa have experienced dramatic local-call tariff increases, which has been mirrored by fixed-line disconnections. Cameroon is likewise experiencing similar trends with a decrease in income of over 40% for the fixed-line operator over a three-year period. However, in the case of South Africa, the decrease in fixed-line subscriptions has been accompanied by continuing profitability by the semi-privatised national fixed-line operator. It appears that this may be partly ascribed to their focussing more on the lucrative business market than on investing in network roll-out.

In Africa, although there are reform models in place in terms of ICT and fixed-line policy in particular, the cost of access remains extraordinarily high. Whereas in the Northern hemisphere, the communications cost is on average 3-5% of per capita income, in Africa it reaches highs of 36% of per capita income.

The result of this is to restrict access to the Internet in an extreme manner. Although there is a very large mobile footprint, the cost effectiveness of Internet via this mode is still prohibitive. Information provided by the International Telecommunication Union (at <http://www.itu.int/ITU-D/ict/publications/world/world.html>) correlates Internet access costs, stated in US\$, with the number of Internet users for Cameroon, Ethiopia, Kenya, Rwanda, South Africa, Uganda, and Zambia for 2002. From the data provided,

Figure 1. Growth in mobile subscription in Africa between 1995 and 2003

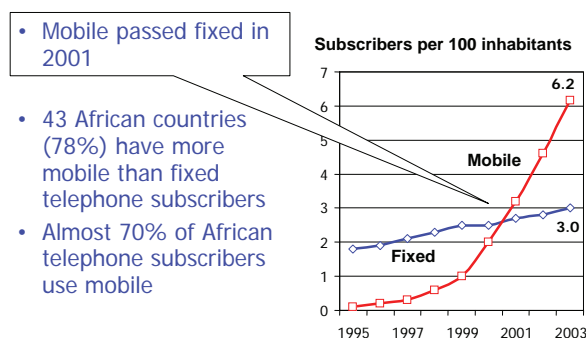
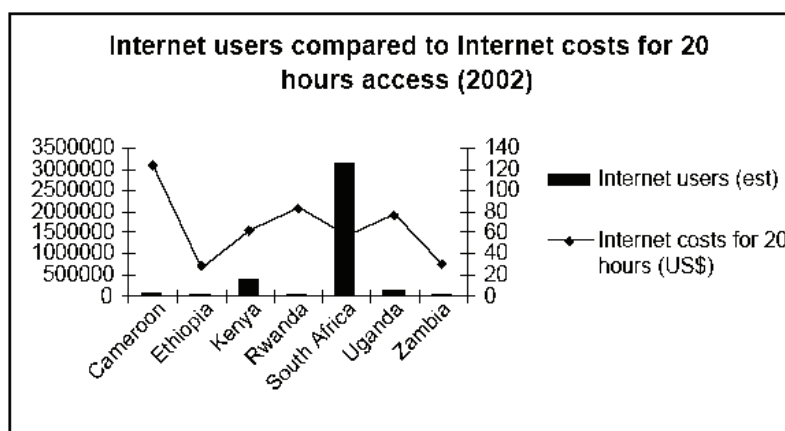


Figure 2. A comparison of Internet usage and Internet costs in seven African countries in 2002



one can infer that there is no direct correlation between Internet access costs and number of users because Ethiopia and Zambia respectively have hardly any users (below 20,000), in spite of having of the lowest access costs per 20 hours of access, and conversely South Africa has by far the largest group of Internet users (round about 130,000), in spite of having relatively high Internet access costs.

In countries such as Cameroon and Rwanda, Internet access via Internet Cafe's remains the preserve of the fixed-line operator and it is es-

timated that there are some 450 cyber cafes in major centres of Cameroon.

Ethiopia on the other hand has adopted a strong monopoly model when they created the Ethiopian Telecommunications Company and the Ethiopian Telecommunications Agency. Despite having a population of some 70 million, there is still an extremely low network development with a waiting list, which represents nearly 85% of capacity. There is a fixed phone teledensity of only 0.6% and an Internet penetration rate of only 0.0001%, possibly the lowest in the world.

A Perspective of ICT Penetration in South Africa

On the following pages is a perspective of what the ICT penetration picture in South Africa looks like. As can be seen from the tables below, the information was produced in the main to include 2003. The 2004 data has as yet not been made available by the ITU. The extent of the impact of the Second Network Operator is as yet unknown and whether or not there will be real saving achieved by the average man in the street remains to be seen. There are hopes that there will be some form of financial benefit realised by the consumer and that as voice over Internet protocol (VoIP) becomes a reality that further connectivity benefits both in terms of bandwidth and cost will be experienced.

Main Line Subscriptions

Main line subscriptions, the conventional copper landline subscriptions, have traditionally

been provided by the semi-privatised Telkom. Information provided by the International Telecommunication Union (available at <http://www.itu.int/ITU-D/ict/publications/world/world.html>) shows that in South Africa, main line subscriptions peaked in 1998 at 5075.4k subscriptions and that the average number of lines per 100 people has remained the same as in 1996, suggesting that the increased subscription rate has remained in line with the growth of the population.

Cellular Subscriptions

Cellular subscription is a wireless service offered by three service providers in South Africa, Vodacom, MTN, and Cell-C. Although these three ostensibly offer an independent telecommunications service, they all three have licensing agreements with Telkom in terms of legislation and infrastructure. They rely on Telkom in terms of infrastructure and other licensing agreements. International Telecommunication Union data (available at <http://www.itu.int/ITU-D/ict/publica->

Table 1. Main line telephone subscriptions in South Africa and the rest of Africa between 1996 and 2003

| Main Line Subscriptions | | | | | | |
|-------------------------|---------|---------|---------|---------|---------|---------|
| | 1996 | 1997 | 1998 | 2001 | 2002 | 2003 |
| SA | 4258.6 | 4645.1 | 5075.4 | 4924.5 | 4844.0 | 4895.0 |
| Africa | 13411.4 | 14775.9 | 16442.3 | 21015.5 | 22706.9 | 24711.9 |
| | 31.75% | 31.44% | 30.87% | 23.43% | 21.33% | 19.81% |
| Lines per 100 People | | | | | | |
| | 1996 | 1997 | 1998 | 2001 | 2002 | 2003 |
| SA | 10.56 | 11.27 | 12.05 | 11.05 | 10.66 | 10.55 |
| Africa | 1.92 | 2.07 | 2.26 | 2.66 | 2.81 | 3.01 |

Table 2. Cellular subscriptions in South Africa and the rest of Africa between 1996 and 2006

| Cellular / Mobile Subscriptions | | | | | | |
|---------------------------------|--------|--------|--------|---------|---------|---------|
| | 1996 | 1997 | 1998 | 2001 | 2002 | 2003 |
| SA | 953.0 | 1836.0 | 3337.0 | 10787.0 | 13702.0 | 16860.0 |
| Africa | 1150.8 | 2262.6 | 4156.9 | 25330.7 | 36970.0 | 50803.2 |
| | 82.81% | 81.15% | 80.28% | 42.58% | 37.06% | 33.19% |

What Kinds of Organisations do We Want to Build in Africa

Figure 3. Comparison of number of SMS messages per subscriber per month in eight African countries in 2002

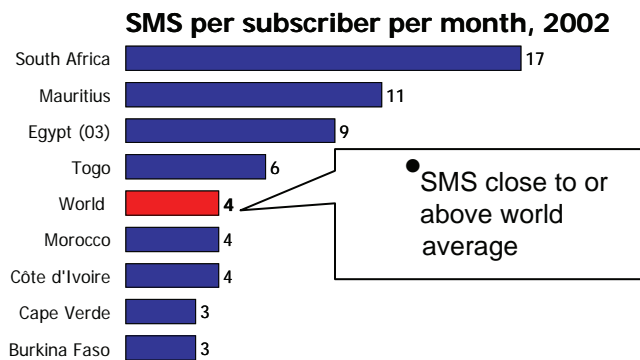


Table 3. Aspects of Internet density in South Africa and the rest of Africa in 2001 and 2002

| Internet Density | | | | |
|------------------|----------|--------|--------|---------|
| 2001 | Hosts | Users | PC's | per 100 |
| SA | 238462.0 | 2890.0 | 3100.0 | 7.0 |
| Africa | 273836.0 | 6118.7 | 7849.0 | 1.1 |
| | 87.1% | 47.2% | 39.5% | |
| 2002 | Hosts | Users | PC's | per 100 |
| SA | 198853.0 | 3100.0 | 3300.0 | 7.3 |
| Africa | 243171.0 | 9988.2 | 9453.0 | 1.3 |
| | 81.8% | 31.0% | 34.9% | |

Figure 4. Comparison of main line subscription between South Africa and the rest of Africa between 1996-2003

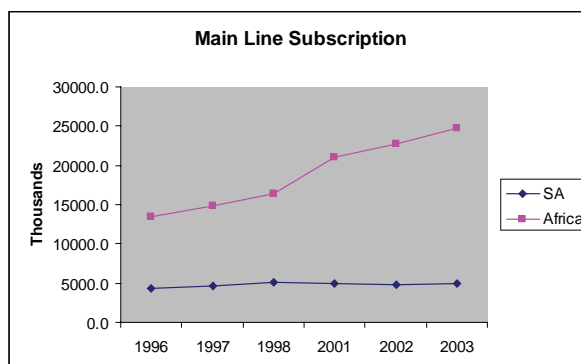


Figure 5. Comparison of cellular subscriptions between South Africa and the rest of Africa between 1996 and 2003

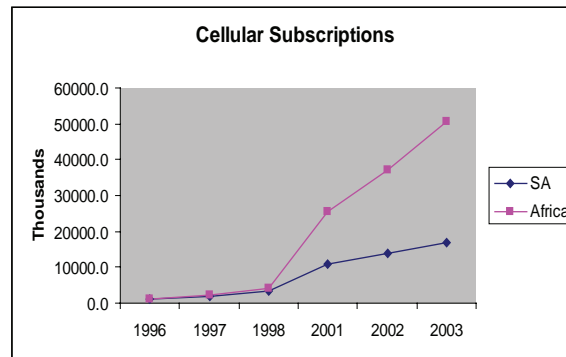


Table 4. Comparison between South African main line and cellular descriptions between 1996 and 2003

| South African Main Line vs Cellular Subscriptions | | | | | | |
|---|---------|---------|---------|---------|---------|---------|
| | 1996 | 1997 | 1998 | 2001 | 2002 | 2003 |
| Main Line | 4258.6 | 4645.1 | 5075.4 | 4924.5 | 4844.0 | 4895.0 |
| Cell | 953.0 | 1836.0 | 3337.0 | 10787.0 | 13702.0 | 16860.0 |
| | 446.86% | 253.00% | 152.09% | 45.65% | 35.35% | 29.03% |

tions/world/world.html), show persistent strong growth in South African mobile subscriptions between 1996 and 2003, growing from 953K to 16860k subscribers over that time period.

Along with these impressive growth statistics, we see that there is a very high rate of SMS usage in the mobile world. In 2002, South African mobile subscribers on average sent 17 SMS messages per month, in comparison with a world average of only 4 SMS messages per month.

Internet and PCs

Data provided by the International Telecommunication Union (available at <http://www.itu.int/ITU-D/ict/publications/world/world.html>) reveal that there is no differentiation between

privately owned PCs and non-privately (business, government, NGOs etc.) owned PCs. This applies equally for Internet subscription and usage. The data shows that South Africa has a higher Internet density than the rest of Africa. The major reason for this seems to be the lack of fixed line infrastructure in the rest of Africa in comparison to South Africa.

Analysis of Reflected Data

Data obtained from International Telecommunication Union's subscription Web site is summarised by means of two graphs below. The first graph shows that between 1996 and 2003, main line subscriptions in South Africa remained flat in South Africa while at the same time having grown in

What Kinds of Organisations do We Want to Build in Africa

the rest of Africa. Compared to Africa as a whole, South Africa shows an increase of nearly 184%, this suggesting that the SA market is behaving differently to the continental trend.

In contrast to this, as shown on the second graph, there has been a substantial upswing in the take-up rate of cellular or mobile telephony in South Africa as well as in the rest of Africa, with Africa's rate being substantially higher. This implies that there is an escalation in African consumption rate, but that this does not imply that the SA market has necessarily levelled out. If one compares the two graphs, the results could be interpreted to indicate that Africa is playing catch-up. With SA only having 36.36 cellular units per 100 people in 2003 and a decreasing Main Line consumption, it would indicate that there is both the appetite and scope for further market growth.

Comparing the two means of telephony, it becomes clear that the appetite in South Africa is definitely in the mobile environment and not the fixed line environment and as such. Investment focus should be accordingly aligned.

With reference to Internet and the ownership of personal computers, there appears to be a large market opportunity for ICT growth both from an Internet and from a PC perspective. Firstly, what we see is that there are more PC's than there are Internet users, implying that the market has not been fully tapped from that perspective. However,

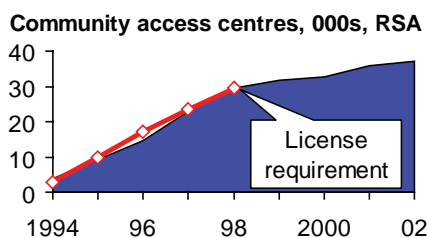
the penetration of the PC into the market as a communications device is lagging far behind that of the fixed lines and mobile telephony. At this stage, the reason for this may very well be a question of affordability rather than one of appetite.

Again, it is interesting to note that in excess of 80% of Internet hosts in Africa are in South Africa. But, the same trend displayed in the mobile environment may well be playing out in the Internet environment, where between 2001 and 2002, there has been a significant change in the ratios of South African hosts and users relative to the rest of Africa, suggesting that Africa is playing catch-up in this environment as well.

With Internet access costs being effectively determined by the monopolistic Telkom as infrastructure provider, and with the South African government showing little inclination to deregulate the local telecommunications market, as can be seen from the fact that Internet access costs are twenty times higher in South Africa than in Europe and the USA, affordability is an important issue in Africa and South Africa. Where there is an economic as well as a digital divide, there have been significant steps taken in providing communication technology to these less privileged markets, as can be seen in the graph below.

Using 2002 as the cut-off period for this exercise, between fixed lines, mobiles, PCs, and CA (Community Access Centres), there were some 21.881 million ICT devices for a population of

Figure 6. Increase in community access centers in South Africa between 1994 and 2002



some 45.45 million, which could imply that only 48% of the population had access to ICT. From the perspective of a developing nation, this may look impressive, but more than that, it illustrates the immense opportunity for further growth and acceleration in the field of ICT in South Africa.

CONCLUSION

Two main points emerge from this analysis. Firstly, mobile communications will continue to exceed fixed line growth in Africa. Secondly, there is very little chance of Internet growth if it is based on fixed line deployment in Africa.

The conclusion that Internet growth in Africa will depend on non-fixed-line infrastructure has significance in two dimensions. Firstly, the Digital Divide focuses attention on bringing connectivity to the masses, but is mobile connectivity sufficient to fully close this gap? The cost of bringing connectivity and information to the masses via mobile is prohibitive for a third world country so in reality it is not about availability but about the ability to provide access cost effectively. Secondly, given that this scenario seems set to play out into the foreseeable future, it must have implications for financial institutions like Absa (Amalgamated Banks of South Africa). Consideration must be given to the extent of market reach via the Internet vs. the market reach via mobile. Accordingly, planning for the future and investment in the appropriate technologies should be carefully considered. This is not only from a back-office view when rolling out into Africa, but also from a user interface view.

Alliances with key stakeholders remains critical in order to ensure that the developments in African ICT are brought into business strategy on an ongoing basis to ensure that we remain at the forefront of banking in Africa.

REFERENCES

- Brynjolfsson, E. (1993). The productivity paradox of information technology. *Communications of the ACM*, 36(12), 67-77.
- Cowley, S. J., & Kanda, T. (2005). *Friendly machines: Interaction-oriented robots today and tomorrow*. *Alternation* 12.1a of 2005, 79-105
- Depres, C., & Chauvel, D. (2001, November 8-9). *The thinking behind the action in knowledge management*. The 2nd European Conference on Knowledge Management, Bled (pp. 133-154).
- EU. (2000a, February), Communication from the Commission "Strategies for jobs in the Information Society."
- EU. (2000b, June), eEurope 2000, *An Information Society for all*, Action Plan.
- Herper, M. (2001). *Smart kitchens: A long way off*. *Forbes.comTM*. Retrieved from <http://www.forbes.com/2001/12/21/1221networking.html>
- International Telecommunication Union Sector Performance in Africa. (2004, March). *International telecommunications union; Free statistics*. Retrieved from <http://www.itu.int>
- Jacoff, R. (1993). *The Cambridge companion to Dante: Introduction to the inferno*. New York: University of Cambridge Press.
- Jackson, P., & Curthoys, N. (2001, September 27-28). E-Government: A theory of public sector reform. In *Proceedings of the European Conference on E-Government*, Trinity College Dublin (pp. 209-216).
- Kehal, M., & Khurshid, A. (2001, November 8-9). Artificial intelligence applications and implications in knowledge management. In *Proceedings of the 2nd European Conference on Knowledge Management*, Bled (pp. 255-268).

- Klopper, R. (2005). Future communications: Mobile communications. *Cybernetics, Neuro-Informatics and Beyond*, Alternation 12.1a of 2005, 121-144
- Leavitt, H., & Whistler, T. (1958, November-December). Management in the 1980's (HBR No 58605).
- Levinson, M. (2003). Smart appliances, really slow networks. *CIO Magazine*, Ideas 2003, *Future Technology*, January 1, 2003. Retrieved from <http://www.cio.com/archive/010103/46.html>
- Morino, M. (2001). *From access to outcomes: Raising the aspirations for technology initiatives in low-income communities*. Retrieved from www.morino.org/divides/execsum_report.htm
- Mach, M., & Sabol, T. (2001, September 27-28). Knowledge-based systems for support of e-democracy. In *Proceedings of the European Conference on E-Government*, Trinity College Dublin (pp. 269-278).
- McGovern, G. (1999). *The caring economy*. Dublin: Blackhall Publishing.
- Pellissier, R. (2001). *Searching for the quantum organisation*. Cape Town: Juta.
- Remenyi, D. (2001). *Business models for e-business*. Working Paper Series, Henley Management College, UK
- Smith, M., & Marx, L. (1994). *Does technology drive history?* Cambridge MA: The MIT Press.
- Telkom. (2003). Delivering on strategy (EU, 2001) Commission Staff working paper "E-inclusion—the information society's. Potential for social inclusion in Europe," Brussels, September 2001
- Willcocks, L., & Lester, S. (1998). *Beyond the IT productivity paradox: Assessment issues*. Maidenhead: McGraw Hill.

ENDNOTES

- ¹ The term *exa* denotes 10^{18} . It is truly quite hard to imagine the implications of anything this size. The volume of data represented by this is truly quite impressive.
- ² Telephone calls between the United Kingdom, the United States of America and Australia to mention only three such distant countries, now cost only one penny a minute if callers use special cost reducing services.
- ³ Clearly, the rich and famous do not want to be photographed in the leotards or on the dance floor.
- ⁴ Perhaps a more descriptive word for the ubiquitously use ICT?

This work was previously published in Managing Information Communication Technology Investments in Successful Enterprises, edited by S. Lubbe pp. 1.-20, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.5

Computing and ICT Literacy: From Students' Misconceptions and Mental Schemes to the Monitoring of the Teaching–Learning Process

Antonio Cartelli

University of Cassino, Italy

ABSTRACT

Three main questions guided the author in the writing of this chapter: Is there the need for a widespread and in-depth ICT literacy in mankind? What has to be meant for ICT literacy? And are there special problems in students' learning of ICT topics? And last but not least: How can ICTs themselves improve teachers' work and students' learning on ICTs? The introduction answers the first question and shows how difficult the search can be for solutions to the problem of the digital divide. The answer to the second question comes from a short survey of the experiences that some institutions made for the introduction of basic computing skills and ICT literacy in school curricula. In the meantime the problems that the students usually meet while attending computer programming and ICT literacy courses are described. Finally the author reports the results of some experiences involving the use of ICTs in teaching

and describes how he arrived to hypothesize the adoption of action research strategies, of Web technologies and data mining techniques for the monitoring of the teaching-learning process and its improvement.

INTRODUCTION

In today's society, often defined the knowledge society, the mastery of ICTs (information and communication technologies) is considered very important for future citizens. It is well known, in fact, that computers and communication are everyday more and more present in human life, and that mankind has to be skillful in its use to win the challenge of contemporary and future complexity. As an example of the above remark, lifelong learning and the number of rights everyday needing the basic ICT skills can be considered: in the former case the continuous update of

personal knowledge and skills is more and more, depending on the cleverness in ICT use; in the latter case e-government, e-commerce, e-learning, and so forth are good examples of the relevance that ICTs will have in the exercise of the citizens' rights, both today and in the future.

The importance of ICT influence on mankind has already been analyzed in various contexts, and the term digital divide has been adopted to describe the gap existing between developed and underdeveloped countries. As an example, the words of Malloch Brown (2001), of the UNDP (United Nations Development Program), are reported here:

“...Now, the Internet has become both the fuel and the vehicle for a dramatic spread in democracy, intensifying demand for and supporting the spread of genuinely transparent and participatory and more efficient systems of government at both the national and global levels. The number of democracies worldwide has doubled in little more than a decade. But in too many countries, institutions remain fragile, services are weak, officials unaccountable. And the lack of a democratic dividend—in terms of jobs and better services—has been undermining public faith in these new systems, particularly among the poor. ICT offers real hope in all these areas, offering greater citizen input into decision making and better social services for all....”

Alternatively, it must be noted that digital divide was recently evidenced at different extents in developed countries. Warschauer (2003), for example, stated that digital divide is a social problem marking the differences among social classes (80% of high-income families in the U.S. connect to the Internet, while only 25% of low-income families do) and ethnic groups (55% of the White population in the U.S. uses ICTs, but only 31% of the African-American population and 32% of the Hispanic population do the same). He also stated that there isn't a unique digital divide

marking the difference between “people who can” and “people who cannot” access computing and ICTs. What is more, he argued that there isn't a unique factor responsible for the separation among the different social groups and their ICT use. In other words ICTs alone cannot be identified only with the equipment to be inserted in the poorest contexts or with the people training; there are in fact many examples of failing experiences based on the above assumptions.

From what has been said to this point, it can be deduced that the digital divide is one of the contemporary pedagogical emergencies (Cartelli, 2004), and great efforts have to be made in everyday teaching to guarantee the diffusion of an effective ICT culture. The author's experience with the use of ICTs for the monitoring of the didactic process will show how the same ICTs can be turned into powerful instruments for improving the efficacy of teaching-learning processes and will help people in overcoming the problems they meet when they attend computing or computer programming courses.

BACKGROUND

During the last two decades, all disciplines made progress in analyzing phenomena and developed new paradigms for interpreting reality. As a consequence the traditional procedure of transferring disciplinary knowledge into teaching practice led to a continuous revision of school programs and curricula.

On the other hand many psycho-pedagogical hypotheses were developed to explain the ways people build new knowledge when starting from previous knowledge, and experimental techniques were applied to individuals and communities to find new strategies and instruments for improving teaching.

One of the results of the above experiments was the discovery of misconceptions and mental

schemes in students' minds and more in general in people's minds.

A good survey of the research on misconceptions and mental schemes can be found at the MLRG (Meaningful Learning Research Group, 2004) Web site (www.mlr.org), where the proceedings of some conferences on misconceptions, wrong ideas, and meaningful learning are partially reported. Those studies collect research carried out all over the world and concern differently aged people, from pupils, to middle school, high school, and university students (sometimes they also include workers, professionals, and teachers).

Two main aspects clearly emerge from the above experiences (Cartelli, 2002b):

- a. Preconceptions, misconceptions, and mental schemes can be found in all domains of human knowledge; most parts of the investigated fields concern scientific knowledge such as mathematics, physics, statistics, computer science, chemistry, biology, natural sciences, cosmology, and so forth, but there is a relevant number of studies (and that number is still growing) investigating the wrong ideas that students show with language, literature, history, and other human sciences,
- b. Two main approaches can be adopted in such studies: a former one, labeled by Driver and Erickson (1983) as ideographic or naturalistic, analyzes the pupils' reasoning and more generally the ideas that people show when they explain phenomena with no reference to scientific paradigms—that is, they only evaluate the internal coherence of the people's concepts and ideas; the latter one, defined by the same authors, concerns people who already approached scientific topics (or were beginners), and evaluates the correctness of their ideas with respect to the scientifically accepted ones.

Regarding ICTs and especially computer science, the following events intervened in making more complex the situation: (1) the exponential growth with the time of the discipline topics (i.e., during the last three decades), (2) the spreading of personal computing, (3) the revolution in human-computer interaction induced by graphics interfaces, and (4) the Internet.

The main results of the studies carried out during last two decades concern the presence of wrong ideas and misconceptions in students attending computer programming courses (du Boulay, 1986; Soloway & Spohrer, 1988). More recently it looked as if the introduction of special GUI (graphic user interfaces) and WYSIWYG (what you see is what you get) strategies could help novices in overcoming the above difficulties, but the results of other studies did not agree with this hypothesis, and showed the presence of preconceptions and misconceptions, even with the new human-computer interaction (Ben-Ari, 1998; Christozov & Mateev, 2003).

COMPUTER SCIENCE TEACHING AND COMPUTING LITERACY: A SURVEY

It must be noted that before digital divide evidence, many scholars (mostly computer scientists) already assigned great importance to the introduction of computer science elements in the curricula of high schools or junior high schools (at least in Western countries). On the other hand, it must be said that there has never been a general agreement on the computing topics to be taught in the schools; nevertheless, professional associations (ACM and Computer IEEE, first of all) produced syllabi or suggested different solutions in this respect.

The most important consequence of the above uncertainties was the lack of a unique proposal for the planning of the introduction of comput-

ing teaching in education. As an example the analysis of the Italian situation will be reported in the following section (Cartelli, 2002c), and the results of some experiences the author led with his students will be discussed.

The Italian Experience in Computing Teaching

In 1985 the Italian Ministry of Education collected the results of many research projects on computer use in education which were carried out all over the country and which stated that computer science could be used in high school education in the following ways: (a) as an instrument to automate the school administration, (b) as an instrument to help teachers in their work or a resource for students, and c) as a knowledge amplifier to develop reasoning and problem-solving skills in the students.

Among other things it was supposed that computer science could help students in: (a) problem analysis and formalization of its solutions (algorithmic), (b) use of data structures, (c) coding of procedures in computer instructions, and 4) use of CAI (computer-assisted instruction) and CAL (computer-assisted learning) tools. In other words the adoption of all Taylor's (1980) metaphors—tutor, tool, and tutee—in everyday teaching was suggested.

To make concrete the above proposals, the National Plan for Computer Science (PNI—Piano Nazionale di Informatica) was started. This plan was devoted to a revision of the mathematics and physics curricula in the first two years of high school, with the main aim of developing computing knowledge and skills in the more general context of the above disciplines. The same plan had two phases: a former one for the training of a task force (mostly teachers already involved in computing teaching experiences), and a latter one that used the above staff members in training courses for the other teachers.

A few years later a new document of the Ministry of Education analyzed the results of the PNI application and suggested the reconsideration of the introduction of new technologies in education. (It must be noted that the ministry now adopted the term new technologies in place of the previous computer science). The different terminology has its roots in a paper of V. Midoro, G. Olimpo, and D. Persico (1996) at the ITD-CNR (Institute for Technologies in Education—National Research Council); they proposed the term didactic technologies to describe computer use as a special case of technology introduction in education, and focused on the use of special tools for supporting class work more than on computer programming and related skills. Because of the above change, the Ministry of Education in 1997 began a new project called PSTD (a triennial plan for the development of didactic technologies). This project mainly involved primary and junior high schools, and gave to these schools the funds needed to create multimedia computing laboratories for teachers and students.

Recently, mostly yearly, statistical analyses on the evolution of the ICT presence and use in the schools were carried out. The most relevant results can be summarized as follows: (a) all the schools have at least a PC (if not a computer room) and Internet access, (b) a relevant number of teachers (more than 50%) attended or are attending computing literacy courses (mostly online), (c) only a few teachers (less than 10%) systematically use the Internet in their teaching work, and (d) a very little number of students (less than 15%) systematically use ICTs and especially the Internet at school.

Misconceptions and Mental Schemes in Computer Programming

If computer programming is considered very useful in the development of problem-solving and planning skills, the author's experience as a

computing teacher in a high school (the Italian Technical High School, with a specific computer science curriculum) shows how difficult the teaching of the above topics can be.

It is well known, in fact, that computer programming is a complex task for students and that it requires great effort from them (Lemut, 1993), but it is less known that the students' difficulties can persist notwithstanding the change in methods and techniques the teachers can adopt in their work, and that many students also manifest the same incorrect ideas after attending specific make-up courses.

Some computer programming topics (related to imperative languages like Pascal and C) for which students evidenced wrong ideas are reported below (Cartelli, 1994, 1996):

1. The range of the numerical data types: The students almost never verify the correctness of a variable data type if the result of an automatic calculus differs from the handmade one.
2. The use of the cyclic structures (for...to... loop, etc.): Many students cannot write the correct statements for an iterated sum containing a total variable (often they put a specific assignment for that variable after the end of the loop), or would like to use the for...to... structure much more than the other ones (and also when it is impossible to use it).
3. The use of conditional statements: While composing these statements the students always write the relationships among the variables and dislike the use of Boolean variables, when explicitly asked to use these variables they tend to relate them with the values true and false (for example they write: if A = true then ... with A Boolean variable),
4. The use of the structured data types (arrays): Many students cannot manage the single

elements of an array (they use the whole array in input, output, or calculus operations) and almost never succeed in writing the correct statements for finding the least or the greatest values in an array.

5. The subprograms: The students often insert in a function or a procedure many statements better belonging to the main program.
6. The recursion: This is one of the most difficult topics to be taught and learned, and often the students confuse iteration with recursion.
7. The abstract data types (stack, list, queue, tree, etc.): The students have a few problems in understanding the theory and the application principles for these topics, but have great difficulties in the use of the pointer variables for the management of the same data types.

Other problems can be found in logic programming, OOP (object oriented programming), and data file management, so it clearly appears that almost all computer programming fields evidence teaching-learning problems, requiring a great attention from professors and students.

A good aid in the improvement of the teaching-learning process is represented from the individual and group strategies a teacher can adopt in the class (it should be noted that the author's classes, like most nationwide, had no more than 28 students). In the former case the tools making transparent the execution of an algorithm by means of the visualization of the variables' values and the evolution of the system's states are very useful in helping students to overcome some difficulties; in the latter case the individual and social constructivist strategies usually adopted in communities of learners (Brown & Campione, 1994) can lead students to the meaningful learning of the proposed topics (Greening, 2000) (participated lessons, class discussion of problem finding and solving, group discussion of case

analysis, individual and group discussion and evaluation of the procedures to be used, individual and group adoption of metacognitive strategies, cognitive apprenticeship strategies, construction of distributed expertises).

It must be also noted that when both of the above strategies are applied in a class with great success (the measure of such a success is usually taken from the results of the periodic and ending tests the students are submitted to), there is no guarantee for the students' overcoming the problems reported above. The students can in fact show difficulties and make errors, after having attended the above courses, when asked to answer special or misleading questions (Cartelli, 2002a).

ICT Literacy Misconceptions

If there is common agreement on the difficulties the students meet in computer programming study, it is important to note that computing literacy is not seen in the same perspective. Instead, it is commonly seen as a vocational training involving the following topics: computer structure and computer use for data management (use of an operating system), communication (the Internet use), and office automation (word processing, calculus, presentation tools, database management systems).

The author does not agree at all with the above point of view (he is persuaded there is no computing literacy without a computing culture), but his opinion has no relevant influence on the knowledge, the abilities, and the skills people must obtain at the end of a basic computer science course. On another hand, the computing associations joining the CEPIS (the European computing professionals association) greatly supported proposal of a definition of a unique syllabus for basic computing skills; the ECDL (European computer driving license) is now the standard de facto for computing literacy in Europe.

Nevertheless, no syllabus can delete the following question: Are there wrong ideas, misconcep-

tions, and mental schemes in computing literacy or basic computing courses? In the author's opinion this situation is very similar to the computer programming one, and there are many topics needing a great deal of attention from teachers and trainers (Christozov & Mateev, 2003). In fact, the experience the author had in vocational and basic university courses (with first-year students of the educational and social courses at the Faculty of Humanities) evidenced the presence of wrong ideas on the following topics (Cartelli, 2002a):

- **Input/output, memory, and processing units:** Very often the students do not recognize the category of a given device when they are asked to specify it.
- **Operating systems:** When asked to specify what this is, most of the students chose the wrong answer, "It is an integrated hardware/software system that makes the PC active," instead of right one, "It is the set of the programs letting [the] user manage the computer resources."
- **Icons and pointers:** When asked to specify what these are, many students selected the less right answers, "Images letting the user access the computer parts" and "Instruments for the displacement of the objects on the desktop or in a window," instead of the right answer for both questions: "They are the instruments of the computer-human interaction."
- **The Internet:** Many students state "It is a communication system based on the use of the telephone" rather than "It is a communication system based on computer networks."
- **The Web:** When asked to explain what it means to browse the Web, many students state "to connect to the Internet" rather than "to use a special program like the MS Explorer or the Netscape browsers to see Web pages."

With respect to computer programming experience, some differences can be noticed: (a) the wrong ideas reported above were obtained from the students' answers to written tests, (b) the number of the students attending the lessons was now higher than in a computer programming situation, and (c) individual and social constructivist experiences were planned and carried out with the help of an e-learning platform and with the cooperation of tutors (who managed online and presence work), but very little ameliorations in the students' ideas could be observed at the final examinations.

E-Learning and Computing Literacy

What has been reported in the above section needs further explanation for its implications. It should be noted, in fact, that the misconceptions were detected during long-term teaching and the results of former experiences led to the development of a special information system for the monitoring of the didactic process (it is a dynamic Web site interfaced with a relational database storing all information coming from the students' browsing of the site). The didactic materials of previous basic computing courses (Cartelli & Ruggiero, 2000, 2001) were integrated into the information system, which was planned taking into serious consideration the results of the research on students' misconceptions and mental schemes.

The system, very similar by its features to an e-learning platform, offered—together with a well-structured knowledge tree of the topics to be taught/learned—the following functions: (a) various communication areas implementing virtual environments for teachers/professors, tutors, and students; (b) a careful management of the students' evaluation and assessment tests; and (c) two functions for the analysis of the students' access to the course materials and their use of the communication services.

The management of all information in the site was guaranteed from five user levels or selected

accesses: (a) the system administrator, (b) the professors, (c) the tutors, (d) the students, and (e) the researchers and scholars (who could only retrieve the information on the students' access to the course materials).

The two information retrieval functions to be used for students' monitoring had the following features:

1. The former one reported the number of times that a single student or a group of students accessed the site's pages until the query date (the numerical data were reported in the tree structure of the site).
2. The latter one gave the sequence of each student's access to the Web site, ordered by date and hour of access. It could also report the messages the student left in the electronic blackboard, in the chat, in the forum, and in the case study areas, and let the teachers compare all the data stored in the same time interval.

After a first positive test of the system on a limited number of students (66), the study was extended to the students attending two first-year courses. The high number of students (more than 350) now made the continuous monitoring of the didactic process impossible and didn't allow an instantaneous control of students' incorrect ideas if the data stored in the system were available for further elaborations (they were analyzed after the end of the courses).

Strictly speaking the experiment was positive for the students—there was only a 20% loss of students at final examinations, and more than 65% of them had positive if not excellent scores.

Alternatively, the subsequent analysis of the students' access to the course's Web pages confirmed the presence of a relevant number of persons still showing misconceptions and wrong ideas. Other results emerging from that analysis were: (a) there is always a good correlation between the highest scores at the assessment test,

and the systematic and repeated browsing of the online materials; and (b) little score increments from the entry to the last test are always related to successful browsing of the online materials.

CONCLUSION AND FURTHER HINTS

The results of the above experiences clearly show: a) the implications ICTs have on the meaning of knowledge both to an individual and a disciplinary extent, b) the computer science topics that should be taught in school, and c) the innovations that must be introduced in everyday class work for the improvement of the teaching-learning process.

Regarding the first point, it must be noted in the author's opinion that psycho-pedagogical hypotheses looking at learning as a static and definitive process need a deep revision. It has been shown that individual knowledge, also when well settled and consistent with discipline knowledge, can be neglected by individuals and can lead to misconception.

As a consequence, teaching and didactic research have to evolve together, and the question on the topics to be taught must be replaced with the following question: Do we have to accept the risk of misconceptions and mental schemes in students' minds and hypothesize a cyclical teaching process leading to a continuous amelioration of the proposed topics, or do we have to carefully plan a deeper analysis of the discipline themes soon leading to a right disciplinary knowledge? In both cases new instruments for a more efficient monitoring of the teaching-learning process are needed.

In the author's opinion a good move in this direction comes from the systematic adoption of Web technologies interfaced with information systems. These systems could store all students' operations, and produce descriptive and inferential statistical analyses on the data stored. An indirect evidence for this need comes from the results of

the experience reported in the last section where the continuous monitoring of the didactic process was impossible because of the lack of statistical analysis features in the two available functions (which only reported the data stored in the system, without making any elaboration on them).

Furthermore the use of the above information system will make possible the systematic adoption of the action-research strategies by the teachers. It will revert the usual strategies until now adopted in the management of the teaching-learning process because, with respect to well-established methods, it will be event driven; that is, the students' learning styles, profits, and scores will be the phenomena to be observed and translated in indices describing the environment within which the teaching-learning process will be continuously re-planned. The statistical analysis of the data stored in the information system will give:

1. the change in the time of the features of a single student (by means of indices describing well-defined behaviors and learning styles);
2. the change in the time of the features of the students' groups, such as the classes and the whole schools; and
3. the change in the space of the features of the students' groups, that is how different environments can influence the evolution of the students' learning models.

In other words data mining strategies could be applied to the analysis of the teaching-learning process, and great improvements will follow for the management of that process and for the students' results.

REFERENCES

Ben-Ari, M. (1998). Constructivism in computer science education. *Proceedings of the 29th SIGCSE Technical Symposium on Computer*

Science Education (pp. 257-261). New York: ACM Press.

Brown, A.L. & Campione, J.C. (1994). Guided discovery in a community of learners. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 229-270). Cambridge, MA: MIT Press.

Cartelli, A. (1994). Misconcetti e schemi alternativi in informatica. In A. Andronico, G. Casadei, & G. Sacerdoti (Eds.), *Proceedings of DIDAMATICA 1994—Informatica per la Didattica* (pp. 87-102). Cesena, Italy: Il Ponte Vecchio.

Cartelli, A. (1996). Analisi di alcuni schemi mentali in studenti di informatica. In A. Andronico, G. Casadei, & G. Sacerdoti (Eds.), *Proceedings of DIDAMATICA 1994—Informatica per la Didattica* (pp. 64-78). Cesena, Italy: Il Ponte Vecchio.

Cartelli, A. (2002a). Didattica, tecnologie Web e apprendimento: Analisi e prospettive. In A. Andronico, A. Chianese, & B. Fadini (Eds.), *Proceedings of DIDAMATICA 2002—Informatica per la Didattica* (pp. 169-176). Naples, Italy: Liguori.

Cartelli, A. (2002b, June 18-22). Web technologies and sciences epistemologies. In E. Cohen & E. Boyd (Eds.), *Proceedings of the IS 2002 Conference* (pp. 225-238), Cork, Ireland. Retrieved December 21, 2004 from ecommerce.lebow.drexel.edu/eli/2002Proceedings/papers/Carte203Webte.pdf

Cartelli, A. (2002c). Computer science education in Italy: A survey. inroads *SIGCSE Bulletin (ACM Quarterly)*, 34(4), 36-39.

Cartelli, A. (2003). Didactics and Web technologies: A proposal for the monitoring of the didactic process. In F. Malpica, A. Tremante, & N. Sala (Eds.), *Proceedings of the EISTA 2003 Conference—Education and Information Systems: Technologies and Applications* (pp. 225-238), Orlando, Florida: IIIS.

Cartelli, A. (2004). *Pedagogia, didattica e nuove tecnologie: Tre saggi per una rivoluzione annunciata*. Quaderni del Centro di Facoltà per le TIC e la didattica on line 1. Cassino, Italy: U. Sambucci.

Cartelli, A. & Ruggiero, S. (2000). Misconcetti e Web: Un sito dedicato all'autovalutazione ed all'autoapprendimento. In A. Andronico, G. Casadei, & G. Sacerdoti (Eds.), *Proceedings of DIDAMATICA 2000—Informatica per la Didattica, Sezione Lavori Scientifici* (pp. 123-133). Cesena, Italy: Il Ponte Vecchio.

Cartelli, A. & Ruggiero, S. (2001). Un'esperienza di formazione a distanza: Il progetto icaro. In A. Andronico, A.M. Fanelli, G. Piscitelli, & T. Roselli (Eds.), *Proceedings of DIDAMATICA 2001—Informatica per la Didattica, Sezione Lavori Scientifici* (pp. 121-129). Bari, Italy: G. Laterza.

Christozov, D. & Mateev, P. (2003). Warranty as a factor for e-learning success. In E. Cohen & E. Boyd (Eds.), *Proceedings of IS + IT Education 2003 Conference* (pp. 491-495). Retrieved December 21, 2004 from ecommerce.lebow.drexel.edu/eli/2002Proceedings/papers/Carte2003Webte.pdf

Driver, R. & Erickson, G. (1983). Theories in action: Some theoretical and empirical issues in the study of students' conceptual frameworks in science. *Studies in Scientific Education*, 10(37).

du Boulay, B. (1986). Some difficulties of learning to program. *Journal of Educational Computing Research*, 2(1), 57-73.

Greening, T. (2000). *Computer science education in 21st century*. New York: Springer-Verlag.

Lemut, E., du Boulay, B., & Dettori, G. (1993). *Cognitive models and intelligent environments in learning programming*. NATO ASI Series 111. New York: Springer-Verlag.

Computing and ICT Literacy

Malloch Brown, M. (2001). *Democracy and the information revolution*. Retrieved October 9, 2001, from www.digitaldividenetwork.org/content/stories/index.cfm?key=192

MLRG (Meaningful Learning Research Group). This Web site reports the titles of the papers presented at four different international meetings on misconceptions and meaningful learning: Proceedings of the Misconceptions in Science and Mathematics, Second Misconceptions Proceedings, Third Misconceptions Proceedings, and Proceedings of "From Misconceptions to Constructed Understanding" Conference. Retrieved April 19, 2004, from www.mlrg.org

Midoro, V., Olimpo, G., & Persico, D. (1996). *Tecnologie didattiche. Metodi e strumenti innovativi per la didattica*. Ancona, Italy: Menabò.

Soloway, E. & Spohrer, J.C. (1988). *Studying the novice programmer*. Mahwah, NJ: Lawrence Erlbaum.

Taylor, R. (1980). *The computer in the school: Tutor, tool and tutee*. New York: Teachers College Press.

Warschauer, M. (2003). Verso l'uguaglianza informatica. *Le Scienze (Italian Edition of Scientific American)*, 421(September), 62-67.

This work was previously published in Technology Literacy Applications in Learning Environments, edited by D. D. Carbonara, pp. 37-48, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.6

ICT in Schools: What is of Educational Value?

Aidan Mulkeen

National University of Ireland, Ireland

ABSTRACT

This chapter considers how information and communication technology (ICT) can be used to achieve educational value in schools, and encourages teachers to focus on approaches that promote higher-order thinking. It examines the reasons for use of ICT in schools, and argues that clarity of thinking is needed in the face of popular beliefs about ICT. While highlighting the ways that ICT can contribute to important learning objectives, the chapter stresses that many uses of ICT may have little educational value. It argues that the real value of ICT in schools is in enabling more challenging learning activities that develop higher-order thinking, and offers a simple diagram that teachers can use to evaluate their use of ICT. Various ways in which basic technology can be used to promote higher-order thinking are explored. Finally, the chapter considers the factors within a school that are likely to encourage and sustain worthwhile uses of ICT.

INTRODUCTION

Across the world, there is a rush to include information and communication technology (ICT) in schools. In almost every country there is an ICT strategy, and teachers are being trained to use ICT. Teachers and schools leaders are keen to get the best possible benefits from ICT, and wonder how they should be using it. The aim of this chapter is to identify where the benefits lie, and to identify the general principles of how ICT can best be used.

WHY ICT IS IMPORTANT

Before identifying the best uses, we must first be clear about what we are trying to achieve. National ICT strategies often reflect a series of different aims for ICT. In general, four different rationales for use of ICT can be seen. These can be described in general terms as the economic,

the social, the pedagogical, and the knowledge society rationales.

The economic rationale is perhaps the most obvious. ICT is increasingly a part of working life for many people. As Negroponte (1995) has so eloquently argued, the development of digital technologies is having an impact on economic structures, changing the way businesses operate, where businesses locate, and even allowing a whole range of new businesses to emerge. ICT skills are seen as important in helping to grow the kinds of business that rely on technology. As a result, developing ICT in schools is a key plank of economic development and competitiveness strategy for many countries.

The social rationale centers on the concern that in the spread of ICT skills, some people will be left behind. Technology is becoming a more important part of everyday life. The numbers of computers are increasing dramatically, as they become cheaper and more powerful (OECD, 2001, pp. 12-13). More and more people use ICT as a main source of their information about the world. By 2001, U.S. Internet users were spending more time online than reading newspapers or magazines, and 45% of Internet users even reported a reduction in their time watching TV as a result of their Internet usage (Jupiter Communications, cited in OECD, 2001, p. 14). As ICT becomes more pervasive and more frequently used, those without ICT skills may become increasingly disadvantaged or marginalized by their lack of skill.

The argument is almost parallel to the argument for literacy. In a society where few people can read, lack of literacy may not be a major barrier, as few things will be written down. Once writing is used by enough people, then those without literacy are at a disadvantage. They may not have the same access to information and may have to rely on others to get information for them. Imagine being illiterate 100 years ago, before radio and television. To find out about jobs or opportunities, or to hear political or public news, you would have to hear from someone else who could read.

The same argument can be applied to ICT. Those with good ICT skills have easy access to information about jobs, economic opportunities, learning opportunities, and news from a variety of perspectives. Of course, those without ICT skills have a variety of other media like newspapers and radio to choose from, but they are at a disadvantage in terms of the speed of access and the range of material they can access. For this reason, ICT is often described as a literacy, and the skill gap is seen as a major cause for concern. As Tom Alexander, then head of the Center for Educational Research and Innovation at OECD, stated:

...there are profound concerns now about the gaps opening up between the ICT 'haves' and 'have-nots,' between those who reinforce their access to, and use of ICT in education what they have and do at home, and those who have little of either. The gaps may become every bit as profound as earlier forms of rigid social and education selection. (Alexander, 1999)

In this view, the rationale for having ICT in schools is to ensure that all young people get some exposure to ICT. If this does not happen, then there is a risk of a digital divide between those with ICT literacy and those without. Universal experience of ICT while at school is made more important by the uneven patterns of access to ICT at home. In most societies the richest and best-educated groups are also most likely to have home computers (Russell & Drew, 2001; Ginsberg, Sabatini, & Wagner, 2000). As a result, if schools do not act to redress this imbalance, the benefits of the digital age may fall to the already privileged social groups.

ICT as a Teaching Tool

Educators also make a pedagogical case for ICT. This view argues that ICT can be used to support teaching and learning. In this case, the aim is not to teach ICT skills, but to use ICT to teach

other parts of the curriculum. ICT as a tool to enhance learning takes a variety of forms. For some people, it means using the computer as a tutor, asking the learner questions, and providing feedback to his/her answers. Examples of this approach can be seen in a variety of educational software, ranging from freeware available for download to sophisticated integrated learning systems (ILS). Others have seen the potential of ICT in the development of more open learning environments where exploratory learning could be facilitated. Examples include the seminal LOGO program, designed to provide an environment for learning mathematical and logical skills (Papert, 1980). This constructivist approach to learning may also be facilitated by use of “content free” software such as word processors (Underwood & Underwood, 1991). Use of such software has been reported to increase motivation and result in student work that is longer, better presented, and of better quality (Stradling, Simms, & Jamison, 1994). More recently, the development of the World Wide Web has brought additional possibilities for education. The vast range of material online can be used to enrich teaching. Perhaps more significantly, the Web can be used to allow students to research topics for themselves (OECD, 2001b, p. 22).

Following the rapid development of the Internet and the World Wide Web, new thinking has emerged that is centered on the concept of a knowledge society. This thinking begins with the idea that pervasive technology will change the kinds of things we need to learn in schools. If we have virtually unlimited information at our fingertips, do we really need curricula so reliant on recall of a set body of facts? In some cases we may even be teaching out-of-date factual material prescribed in a curriculum, while the students have easy access to more relevant and current material online.

Equally, it is clear that access to the Internet does not displace the need for education. In fact, making sense of the material you find online is

often quite difficult. In our technological age, we have made information easier to get, but harder to digest. The information available online is difficult to handle for a number of reasons.

First, the material is hidden. The Web can be compared to a huge library, but without an index, and without sections for each topic. Most people either rely on some favorite site that they visit regularly, or they use search engines to find material.

Second, the material is of varied quality. Searching for any given topic, you may find a range of sites. Even when the irrelevant sites are disregarded, you may be left with a wide range of material, some aimed at junior classes in primary schools, and others aimed at postgraduate students. Some may be commercial sites, selling a product. Different sites may reflect different views, different interpretations of history, or different scientific paradigms.

Third, the material on the Web is often read out of context. When you pick up a book, you can read the chapters systematically, or at least look at the contents and see the context in which a particular page is presented. On the Web, search engines often bring the reader to a specific page, presenting just a single item without the sequence or context in which it belongs.

The citizen of a knowledge society may therefore require a different kind of education. They may have less need to memorize large quantities of factual data. On the other hand, to succeed in a world where they are constantly presented with a flood of unstructured and decontextualized information, they may need high levels of other skills. These might include:

- Information-retrieval skills, including searching and refining searches.
- The ability to assess information and select the most relevant, accurate, and appropriate material.
- The ability to interpret, synthesize, and develop a context for information.

These objectives are reflected in the Australian national goals for schooling in the twenty-first century, which includes the expectation that when students leave school they should:

- have the capacity for, and skills in, analysis and problem solving;
- have the ability to communicate ideas and to collaborate with others;
- have qualities of self-confidence, optimism, high self-esteem;
- have employment-related skills and positive attitudes towards lifelong learning; and
- be confident, creative, and productive users of new technologies. (Adelaide Declaration, 1999)

Critics: Risk of Low-Level Thinking

These arguments for the use of ICT in education, or some combination of them, have been widely accepted by governments and education authorities, which continue to invest heavily in ICT. But the drive to put computers into schools has also met with criticism from some writers. One of the frequent themes in the criticism is concern about the quality of work done with ICT. Stoll (1999, p. 4), for example, argues that much of what is done with computers in schools is not very challenging and may be less valuable than what it displaces. Healy (1998, p. 190) also expressed concern. She agrees that the analytical skills outlined above are increasingly important, but she suggests that the use of ICT in schools may actually retard the development of those skills, by providing instant answers and allowing little time for reflection. In addition, working with computers may displace working with real objects (Healy, 1998, pp. 220-221).

These concerns about the quality of work done with ICT raise serious challenges. We cannot simply assume that all uses of ICT in schools are worthwhile. Instead, we must seek the uses that

offer educational experiences that are genuinely more valuable than what is displaced.

Some people are so enthusiastic about ICT that they would argue that any use of ICT is valuable, as it provides useful experience of the technology. However, that view does not stand against the rationales for use of ICT identified above. If ICT is being introduced to help develop a competitive economy, then it is true that giving students sophisticated experiences of the technology may help them to develop technology skills. But surely not all uses of the computer will provide anything that could be described as industry-relevant skills. In the most extreme example, if students used a repetition task administered on the computer, how could this be seen as providing experiences of ICT that would help in economic development or employment? Taking a broader view, industry might benefit more from young employees with good mathematical and scientific understanding, a high level of good sense or logic, and the ability to communicate well. If a student has these, surely he/she can learn the basics of word processing very quickly.

Similarly some very primitive ICT training in school may do little to bridge the digital divide. If the key skill for participation in an information society is good information-handling skills, then simply learning to browse the Web is of little benefit.

Types of Use of ICT: The Value Grid

These are not reasons to avoid using ICT in schools. Rather, they present an argument that we should focus our use of ICT on those types of use that promote the really valuable kinds of education. The diagram below shows one representation of where these valuable areas lie.

The bottom of the grid represents different types of uses of ICT in terms of whether they are concerned with learning about the technology, or concerned about using the technology to achieve

other educational aims. Thus, learning to operate a particular package would be located on the left side, and using ICT to learn history would be on the right.

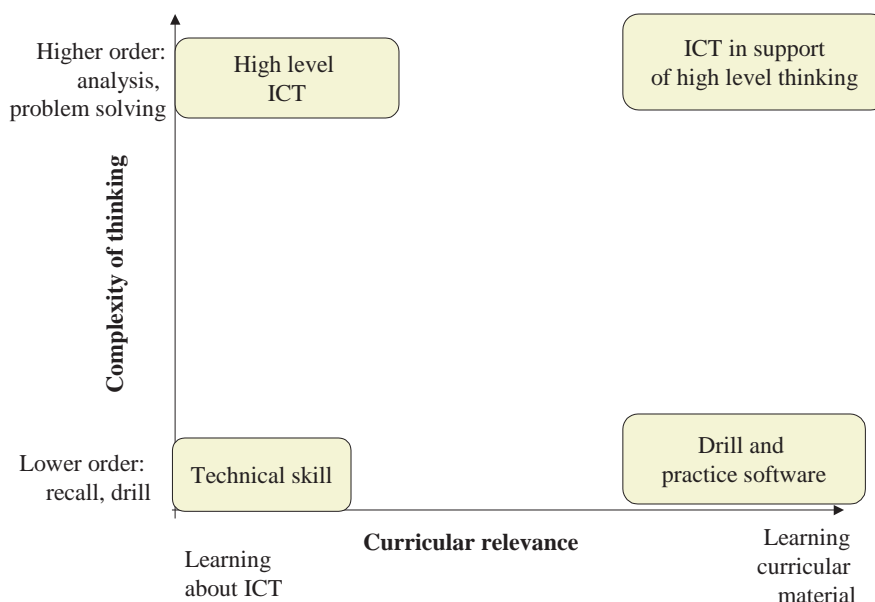
The vertical part of the diagram is used to classify uses of ICT in terms of the level of thinking or analysis involved. Uses that demand higher-order thinking skills are at the top of the scale, while uses involving only memory or repetition are at the bottom.

A few examples may help to illustrate these classifications. If a teacher is using ICT to teach the basics of word processing, and teaching this by working systematically through all of the menus one by one, then this is classified as learning about the computer, and involving only low-level thinking, and so is placed on the bottom-left of the graph. If a teacher is using a drill-and-practice program to reinforce basic recall of facts, then this belongs on the bottom right, involving lower-order thinking but aimed at curricular learning.

If students were doing a project making a complex interactive Web site, this might be classified as involving higher-order skills, but focused on learning about ICT, and so be located in the top-left corner. If they were making a Web site that reported their research in history, that might be located in the top-right corner, as a task that was both challenging and curricular.

It is difficult to make absolute determinations about where each type of activity is located, as the real value of an activity depends a good deal on the subtleties of how it is organized. Take, for example, searching the Web to look for information on a particular topic. This could be a high-level task, involving students in finding material, making assessments of the value of the material, and developing a synthesis of their findings. On the other hand it could be a task involving cutting and pasting without even reading the material found, and have little educational value at all.

Figure 1. The ICT value hierarchy



So which uses are of value? It depends on why we want ICT in schools. If we are introducing ICT to help build an ICT industry, then obviously the activities in the top-left corner are important, and the top right may be useful in helping to build good thinking skills. If the aim is to bridge the digital divide, then any of the uses along the top, those that involve developing high-level analytical skills, are likely to be useful. If the aim is to use ICT to support learning of other topics, then clearly the activities at the top right are important.

But what of the activities at the bottom of the grid, the activities involving only lower-order thinking. Do they have any place in schools? Let's start at the bottom left of the grid, with the teaching of basic ICT skills. At first glance this seems to be a worthwhile area to include. After all, one might argue that without the basic skills, it is impossible to do the more challenging tasks. But this argument leads to a lot of monotonous teaching of very low-level operational skills in schools, and sometimes the schools never find the time for the more valuable high-level uses. In reality, the level of technical skill needed to be able to engage in challenging activities with ICT is very low. Many challenging activities require only basic word processing or the ability to search the Web. Given the speed with which the operational skills can be learned when needed, and the speed with which the details of packages change, there is little to suggest that spending a lot of school time on basic skills represent a good use of resources.

The other popular use of ICT at the bottom of the grid is the use of ICT as a "drill-and-practice" activity to teach or reinforce basic skills. This may involve rehearsal of factual material, testing of factual knowledge, or doing repetitive mathematical tasks. Teachers and students often find these activities motivating, and believe that they are valuable in teaching or learning factual material. There is no doubt that repetition is an

effective way of learning factual material, but it does little to promote understanding or the development of higher-order skills. It therefore does little to serve any of the aims for which ICT is included in schools.

So far, the argument of this chapter has been that ICT is an expensive innovation introduced into schools for economic, social, or pedagogical reasons. To address any of these rationales, it is the higher-order uses of ICT that are needed. Yet sadly, much of the use of ICT in schools is located at the lower end of the grid. These uses may have some value, but they do little to address the reasons why ICT is important in the first place.

So why is so much of the use of ICT directed at these lower-level uses? In part this is because not enough thought is going into why we are using ICT. Often use of ICT is driven by a general uncritical belief that ICT is a good thing. Sometimes this belief is supported by parents, who frequently encourage the use of ICT in schools without a clear analysis of why they believe it is of value (Selwyn, 2001).

Instead of this uncritical acceptance of ICT, we need to be much more demanding of it. We need to recognize that some uses of ICT are actually contra-educational, because they displace more valuable activities. Take for example the teacher who uses a computer drill package to teach the outcomes of an experiment, instead of actually getting the class to perform the experiment. In this case, an educational activity involving higher-order thinking has been displaced by one involving only memory. This is not intended to discourage use of ICT. There are plenty of educationally valuable activities which can be enabled by ICT. However, while recognizing the potential, it is important not to become uncritical enthusiasts. Any teacher considering use of ICT should start with this question: Which uses of ICT will help to move the educational experience into the higher parts of the grid?

WHERE ARE THE REAL BENEFITS?

The preceding section has looked at the reasons that are advanced for the introduction of ICT in schools, and has made the argument that the real benefits lie in uses of ICT that promote higher-order thinking. Assuming that you are convinced by this argument, the next logical question is how ICT can be used to promote the development of these higher-order skills. The answer often lies in the subtleties of how ICT is used.

The basic argument here is that ICT does not have any specific inherent value. It cannot be said that ICT enhances learning or detracts from learning. Instead, the value of ICT depends on the way it is used. The same technology, even the same applications, can be used either to enhance the quality of teaching and learning, or to reduce learning to a memory exercise. Finding the best uses of technology is complex. There are no absolute answers, as the best use depends on the teacher, the context, and the topic. Nevertheless, there are some general principles that can guide the search for the best practices. It seems intuitively obvious that we learn more when we do something to process material, than we do when we sit and passively listen to it. It is similarly obvious that when we are more interested, we put in more effort. We may be more interested in tasks that are real, or have some external purpose, than in tasks that are artificial tasks, invented by the school for no other purpose than to set a task. These basic premises suggest that we should seek teaching activities which involve:

- a. students constructing, organizing, or developing the material; and
- b. an interesting project or task, preferably an authentic project or task that has a function outside of the confines of the classroom, and preferably a task for which there is a real audience.

There are some characteristics of ICT that lend themselves to these types of useful educational activity. The sections below consider some common applications of ICT, and where they may have a role to play.

Word Processing

Word processing provides a very interesting example of how the same technology can be used in very different ways. Word processing is probably the most frequently used application of personal computers, and in many countries it is the most used software within schools (Mulkeen, 2002). Some of the use of word processing involves learning to work the software, often based on copy-typing material from worksheets or books. This is an effective way to teach the various functions and controls of the package, but does nothing to develop higher-order thinking.

The Quality of Output

Word processing also has characteristics that may be useful to a teacher trying to develop higher-order skills. Firstly, it allows students to produce work that is visually of high quality; this can be helpful in motivating students. For many students, working on a word processor is more motivating than working on paper. Part of this motivation comes from the novelty of working with computers, and as such may be short lived. But a more interesting part of the motivation derives from the ability to produce professional-looking work. Most teachers have probably experienced the satisfaction of seeing a document (perhaps a thesis or project) in printed form and the pride that comes from producing work that looks good. Imagine how much greater the satisfaction can be for those whose handwriting is uneven and messy. Word processing may be particularly helpful in developing writing skills in those with poor handwriting.

This effect has been noted in the U.S. in the ACOT schools (Apple Computers, n.d) and in the UK in the schools in the portables pilot project (Stradling et al., 1994). In these cases, it is not suggested that students use the word processor all the time and avoid learning to write well by hand. But using the word processor allows the skills of composing and spelling to be separated from the task of actually forming the letters. In this way, learners can be encouraged to write more and longer pieces of text without waiting for their handwriting to catch up.

This principle may appear to benefit only learners at the early stages of developing writing skills, but of course the motivational power of presentation can be of use at many levels. Take for example a school that asks each student to write a short story, and then produces these stories as a school magazine for distribution to parents. The task that the students are set is to write a story, and this could equally be done with paper and pen. The extra dimension added by the technology is that it is produced to a high quality, and can then be copied and distributed, providing a real audience for the work.

The Mutability of Text

A second major feature of work produced on a word processor is that it can easily be changed. This characteristic of the changeability or “mutability” (OECD, 2001b) of text opens up a range of possibilities. A few different studies have reported a fascinating pattern, that students who type their work produce longer work and use more evidence to support their arguments (Stradling et al., 1994; Mulkeen, 1998). How could this be? One explanation for this may be that when students type their work, they are able to add new ideas at any point. Thus for students who do not have a clear idea of all of the points they want to make in advance, a word processed document can become an evolving structure onto which ideas are hung, rather than a linear document.

Writing is one of the key skills in a modern society, and many jobs require the ability to produce clear written reports. Skilled writers draft and redraft their work, producing a series of improving versions before the finished product. Yet much of traditional school writing is a one-shot process. In this traditional model, students write material, then the material is marked by a teacher, and the students cast a cursory glance at the marks. It seems logical that if we want to teach students to write well, they should have the experience of reworking their documents in response to feedback. The process of producing the second draft can involve more learning than the first. Even the process of repairing minor grammatical and typographical errors can help to focus students on the accuracy of their work. One very interesting study (Gardner, Morrison, & Jarman, 1993) suggested that students who spent a lot of time using a word processor were more accurate in their spelling and punctuation even when handwriting. This is clearly not a feature of simply using the word processor, but a reflection of a structure where students were required to return to their work and correct these errors, thereby developing greater accuracy. In one project, teachers even deliberately devised tasks that involved students in redrafting texts, with a view to teaching them the skill of developing a document (Gardner et al., 1993).

One of the benefits of the ability to change the text is the ability for a teacher to break a writing task into a series of sub-tasks. A language teacher might, for example, ask students to do a small creative writing task, using the word processor. In the first response to the work, the teacher might consider only the story line and the vocabulary. Once some work had been done on these, a second review of the work might focus on grammar. This type of separation of tasks helps to build student confidence, as they are not presented with all the difficulties at once, and it also allows classes to focus on a particular aspect of the work.

Collaborative Writing

Another dimension to the ability to change text is that it facilitates projects involving collaborative writing. Much of the writing at school is done by individual students, yet we know that in the world outside of education, writing is often done by a group and that some of the best ideas evolve from collaborative activities. Within a school context, collaboration can help students to help each other, building confidence and skill. Writing with pen and paper severely discourages collaborative writing, because the only way that text can be merged or adapted is to rewrite the whole thing. By contrast, word processors make collaborative writing easier. Collaborative writing can take a series of forms. In one model, the students sit around a computer and discuss what they want to say, with one person typing the text as it is agreed. Alternatively, students may work on different parts of a text, and then exchange materials and review the materials, before finally assembling the completed document.

Because documents can be transmitted so easily (and cheaply) using e-mail, the technology facilitates collaborative writing at a distance. Schools can now easily collaborate with schools in other locations to engage in collaborative writing tasks. These provide an external motivation for enhanced effort, by providing an external audience for the work. Working together at a distance can also be a powerful way to build understanding in a cross-community or cross-border context.

Two examples will illustrate the potential. In the Irish Tech Corps, two primary schools decided to use a school magazine as a means to encourage student writing. The schools were located in different cities, 150 miles apart. In each class, each student was asked to do a piece of creative writing on the word processor. Each school then produced a class magazine containing all of the work from their own school, and selected highlights from the other school. The schools each sent copies of the magazine to the parents in their own school,

and sent extra copies to the partner school. Thus each child had produced a piece of work that was published and sent home as part of a magazine, and the best writers were further rewarded by seeing their work reproduced in the magazine of another school. This low-cost and very simple project was highly motivational for the children involved, and resulted in great effort being taken with the work (Mulkeen, 1998).

Collaboration at a distance is used in a more formal way in the Dissolving Boundaries project, where schools on each side of the Irish border use ICT to work together on joint projects. The project can be focused on any areas that the teachers and students agree, but the impact is to provide a motivational and authentic task on which the teachers can build real curricular learning while at the same time providing an ongoing contact that helps to build mutual understanding (Austin, Abbott, Mulkeen, & Metcalf, 2003).

Word Processing and Higher-Order Thinking

Word processing, then, is not simply a matter of exchanging handwriting for typing. Instead it offers a new and very different way of writing, writing that can be continuously reshaped and reedited as required. At the same time it produces a very professional-looking product, which is motivating for students. These characteristics of the word processor make it an ideal tool for promoting the higher-level thinking skills identified earlier as so important.

As anyone who writes can attest, organizing your thoughts to produce coherent text is a most challenging task. Writing often forces ideas to be developed with more clarity, and highlights the weaknesses in unclear thinking. Asking students to write their understanding of an issue is therefore a very complex task, which involves making a synthesis of multiple sources, making judgments about what is important, and imposing a structure on the material.

Using a word processor to write allows the writer to experiment with alternative structures, struggle with alternative phrasing, and think more deeply about the choices being made in the writing process. More profoundly, the word processor allows teachers to set tasks that are of a bigger scale, that can be reshaped and modified as new ideas emerge. In short, the word processor makes it easier for students to do project work.

Project work is an attractive approach for a number of reasons. Firstly, it challenges each student to do some creative thinking and to develop ideas and structures for themselves. Secondly, it allows each student to work at their own pace, and at their own level of understanding. Thirdly, the quality of presentation, combined with the ability to improve the document as ideas emerge, means that the output is very rewarding for the student.

This is the essence of the importance of the word processor. It is at its most valuable when used by teachers to delegate more of the responsibility, research, and creativity to the learners. Where this approach works well, it has striking beneficial effects on learners. The ACOT schools, for example, reported increases in the quality of students' work, beyond what the teachers thought was possible. The benefits go beyond simply the quality of work produced. The ACOT schools reported that learners grew in confidence and developed as more autonomous learners (Tierney et al., 1992).

Presentation Software

A very similar set of characteristics make presentation software (such as Microsoft's PowerPoint) useful. Presentation packages allow students to make high-quality presentations with attractive visuals. As with word processing:

- a. The quality of the finished product is attractive and motivating for students.

- b. The ability to change and develop the work allows complex material to be built up gradually, and allows the teacher to guide development by focusing on one aspect at a time.
- c. The ability to change the structure means that different sequences and structures can be tried easily.
- d. The software facilitates groups or collaborative work, as students can merge pieces done separately, and can modify work done by their colleagues.

As with word processing, learning to work the package offers relatively little challenge. The real potential of the software is its ability to inspire and enable students to work on challenging projects.

There are two important differences between presentation packages, and word processors and presentation packages. First, the presentation package is primarily intended to accompany a verbal presentation. Verbal communication is an important skill, and one that, in some traditions, has received less emphasis in school than written communication. Yet many of the important events in life (job interviews, meetings, etc.) demand the skill to present ideas cogently in verbal form. Students, particularly the students with poor verbal skills, are often reluctant to practice making presentations verbally. Even confident speakers are often reluctant to speak in a second language, and so this software is of particular relevance for language teachers. Presentation packages provide an easy way to encourage students to make verbal presentations. The students often become engaged with the technology and want to present, just to show off their product. In addition, the sequence of slides can help presenters to make their presentations even when nervous. Finally, the requirement to have a prepared presentation forces students to plan and research a verbal presentation.

The second important characteristic of presentation software is that it is primarily visual. Much

school work requires that students express their ideas in words, either written or verbally. Visual presentations give students the opportunity to express ideas in a visual form, using pictures or diagrams.

Teachers can use presentation packages to encourage students to do some research, organize their ideas, and make a presentation to the class. Where this is done, the students may be motivated by the opportunity to make a visual presentation, and by the sense of a real audience for their work. Where this has worked well, teachers have reported high levels of motivation, and benefits in quality of work, verbal skill, and confidence (Mulkeen, 2003b; Austin et al., 2003). As with word processing, the argument is not that the software is inherently valuable or that it produces learning gains. The argument is that the software facilitates and enables a teaching method that involves students doing meaningful and challenging projects for a real audience.

The Internet

One of the most exciting dimensions to ICT in recent years has been the development of the Internet. In most countries the Internet forms a key part of ICT strategy for education. National policies often prioritize increased Internet connectivity for schools. In practice, teachers use the Internet in very different ways, and many do not use it at all. The key uses of the Internet can be divided into three broad categories:

- The Internet as resource library (the World Wide Web).
- The Internet as a communication channel.
- The Internet as a place to publish.

The Internet as Resource Library (the World Wide Web)

The World Wide Web (WWW) can be seen as the biggest library in the world. The number

of Web sites is far greater than the number of resources any school library could hope to hold, and the Web has the additional advantage that it is growing and being updated all the time. The Web therefore provides a resource of enormous potential to schools. Students can use it to access more timely, up-to-date materials than in textbooks, and at the same time can have access to a far greater variety of materials than are found within the school.

Following the arguments presented earlier, the key aim of our use of ICT in education should be to promote higher-order thinking skills. Access to a wide variety of sources presents an ideal opportunity to use teaching methods based on students doing research for themselves. Ideally students could find a variety of material, maybe including different perspectives or even opposing views, and make their own synthesis of what they find, based on their analysis and assessment of the material.

However, there are some difficulties. School libraries are generally small collections of carefully selected and classified material seen as appropriate for the students. By contrast, the Web is enormous, but has no central editor, so it is a library without an index, and the material is neither arranged systematically nor selected for its suitability. This presents a series of problems for school use. The first and most obvious is that students can wander into unsuitable material, which often means pornography, but could equally be racist, or material inciting hatred or terrorist acts. There is an enormous volume of pornographic material on the Web, and some of it is specifically designed to present itself to innocent users searching for other things. While there are filtering products available, these are not entirely effective, and schools may be concerned that some unsuitable material may slip through (OECD, 2001b).

Even where relevant material is found, it may not be useful. Material on the Web is at all levels, ranging from material published by primary

schools, to leading-edge research. While this is one of the great strengths of the Web, it also means that a student may be presented with material at a variety of different levels, which may be difficult to handle. School texts are carefully written in age-appropriate language and are careful to explain each term when it is first used. Students accustomed to such carefully refined and selected material may find it difficult to adjust to interpreting material in more complex language.

A third difficulty is that the Web presents material out of context. In a book, the argument is built up systematically. It is assumed that the reader can see the chapters in sequence, and concepts that are explained in one chapter can be used in later chapters. The Web presents information out of context. When using a search engine, the reader is often presented with material from the middle of a text, without always having easy access to the preceding pages.

A further difficulty with the Web is that much of the material can be copied and pasted electronically into other documents. While this makes it an ideal research tool for the motivated student, there is always the risk that the less motivated will simply copy material without understanding it.

These characteristics of the Web make it problematic as a resource for student research. Teachers often report difficulties with students:

- a. wandering into unsuitable material;
- b. getting distracted by irrelevant material;
- c. getting overwhelmed by a series of snippets of information and being unable to make a coherent synthesis; or
- d. falling into the copy-and-paste trap, where material is copied but not necessarily read or understood.

Teachers respond to these problems in a variety of ways. Some conclude that the Web is not a useful learning tool, and simply avoid using it. These teachers may wonder why all

the emphasis on connectivity is justified. Other teachers argue that learning to deal with a huge volume of decontextualized information and make some sense of it is a key skill in an information age, and so it is important that we develop those skills in our students. Of course it is unrealistic to expect that students can simply be “thrown in at the deep end” and expected to develop such skills themselves.

Teachers have tried different ways to make use of the resources of the Web. It may be helpful to see these as a scale with very open and unstructured approaches on one side, and very controlled use on the other. At one extreme there is totally unstructured Web research. In this model, students take a topic and are asked to search for useful material and report their findings. This approach requires that the students do the most thinking for themselves, and so has the greatest potential for learning and especially for the development of those important higher-level thinking skills. However, this approach also has the greatest risk of going wrong, as students can wander into the wrong material or fail to develop a worthwhile understanding of the material.

At the other end of the scale, there are highly controlled ways that teachers can make use of the resources available on the Web. One possibility is that the teacher might search the Web, find useful material, and bring it into the classroom. Alternatively the teacher might direct the students to a specific Web page and ask them to read through the material. These uses are highly controlled and so carry a much lower risk of going wrong. However they also offer much less opportunity for students to be challenged by the material or to have to develop analytical skills for themselves.

In between these two extremes, teachers have tried to develop ways of guiding students to use the Web more effectively, while leaving them with the challenge of finding and processing the material for themselves. One of the interesting models is the WebQuest.¹ A WebQuest is a semi-

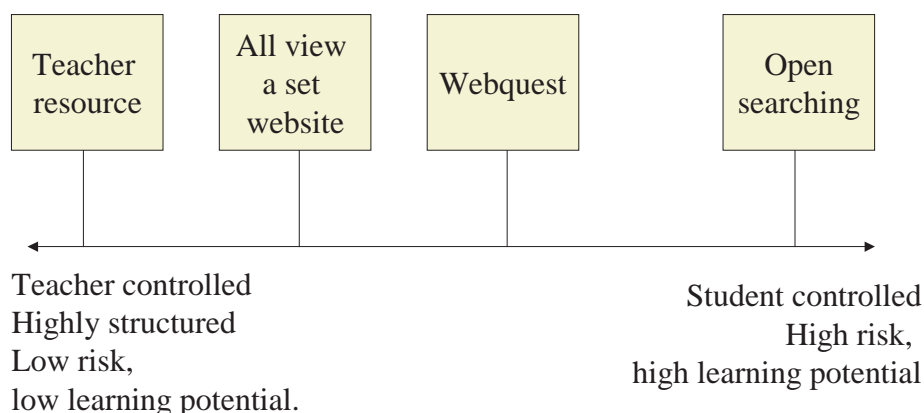
structured research activity, based on the idea that students are given a topic and a series of names sites, and required to develop a verbal presentation on the topic. This structure does not necessarily develop Web searching skills, but it does guide students to the relevant sites, and requires them to read, analyze, and synthesize the information. The model can be used at any level and with any age group. Increasingly, teachers are developing WebQuests and publishing them on the Web, so other teachers can avoid some of the preparatory work and begin by using or modifying an existing WebQuest.

The resources of the Web are not confined to material students can read. Some sites offer interactive activities that can be very engaging. Increasingly, the Web is the mode of distribution for educational software. Where software used to be packaged as a CD-ROM for sale to schools, it is now often available as a download. Much of the material involves a payment before it can be used, but there is still a good deal of material that is available free of charge. This material often falls into one of two main types—tests and simulations. Online texts or multiple-choice quizzes are very

popular both with students and with Web developers (Mioduser, Nachmias, Lahav, & Oren, 1999). For the developers, they are one of the easiest kinds of material to produce. For students they are interesting and engaging, and they provide a useful self-check on learning. Students often prefer to be assessed by machines, because the machine is non-judgmental, and to be measured by it is less intimidating than to be measured by a teacher (NCET, 1996). However, if the aim is to develop higher-order thinking, then online tests are often less than ideal. Many are focused on recall of factual information (the easiest kind of multiple-choice test to devise) and are little more than a modern form of rote learning.

Simulations are less common and more difficult to produce. However, when they are well designed, they offer the student the opportunity to adjust different variables and see the impact on an overall system. The ability to “play around” with the variables contributes to the development of students’ understanding of the relationship between variables. The weakness of the simulations is often their very open nature. Some students may need guidance or some semi-structured tasks

Figure 2. Approaches to Web resources



to help them to experiment thoroughly with the simulation and to get the most from it.

The Internet as a Communication Channel

The focus of the previous section was on the use of the Internet as a resource. The Internet can also be used as a means of communication. This may not involve use of the Web, but may instead involve technologies like e-mail, computer conferencing, and videoconferencing. These are most frequently used to communicate with another school, a relationship that provides reciprocal benefits for both schools involved. One of the most obvious uses of inter-school linkage is in the area of language learning, especially where the schools are each learning the language of the other.

But this kind of linkage has a value beyond language learning. First, any kind of link to another school provides an audience for the work of the students. Having an audience is motivational for learners and encourages extra effort to produce better quality work. Second, linkage with another school provides an opportunity for building understanding across divides of culture, geography, or history. In the Dissolving Boundaries project in Ireland, schools in Southern Ireland are linked with schools in Northern Ireland, and students work together to do curricular projects. The project research suggests that this approach of ongoing interaction over a sustained period is very effective in building a sense of knowing the other students, and a sense that they are “just like us” (Austin et al., 2003). Even when the link is not intended to bridge barriers of historical conflict, there is much to be gained from linkage with another school.

In designing a link with another school, it might be imagined that videoconferencing would be superior to e-mail. Videoconferencing has the advantages of immediate response, moving pictures, and the novelty of a relatively unfamiliar

technology. However, e-mail too has its advantages. First, the communication is asynchronous and so is easier to schedule. Second, communication can be based on individuals communicating with individuals, allowing richer communication than a videoconference, which is more likely to involve larger numbers. Third, the written communication, although slower, may allow more space for reflection than a live videoconference (Austin et al., 2003).

The Internet as a Place to Publish

The Internet also has a value as a place to publish student work. While many schools have a Web site, this is often simply produced by teachers as a public statement about the school. From a learning viewpoint, the real power of the Web may be its potential to turn students into publishers. Encouraging students to produce projects that are published online has four attractive features:

1. It provides a real, and potentially very large, audience for the work. As noted earlier, having an audience is an important contributor to motivation and hence to the amount of effort invested in the project.
2. Publishing on the Web also raises the possibility of feedback from readers. It is very easy to ask readers of a Web site to send a message of response. Schools that have produced material that is of interest to others (such as local history) have often received very gratifying feedback from readers that were unknown to them. Messages from unknown readers further contribute to the sense of an authentic audience.
3. It provides a publishing platform that allows multimedia publications. Publication in a school newsletter may be restricted to text, or at best, color pictures. Publication on a Web site can include sound, moving images, animation, and a range of forms of expres-

sion. These can of course be distractions, but they can also add to the motivation and effort, as long as the focus remains on the intellectual content.

4. Web publishing does not have to follow the strictly linear form of conventional publication media. Publication on paper usually involves forcing interconnected ideas into a linear structure that is not quite ideal. Publishing on the Web allows ideas to be interconnected in a variety of ways, and so in some ways is closer to the way we think.

Numerous projects in different countries encourage student publication on the Web. Some even offer prizes and publicity for winning entries (see, for example, www.thinkquest.org).

Spreadsheets, Databases, and Datalogging

The discussion up to this point has centered on writing, and on students engaging in projects that are presented in writing or verbally. There are other applications that allow students to develop their understanding of numerical information. The most frequently used are probably spreadsheets, databases, and datalogging. In each case, the key characteristic is the ability to change things and observe the impact of the change. This characteristic of mutability allows students to experiment with numerical information.

With spreadsheets, one of the particularly powerful applications is the ability to draw graphs from numerical data. This can be used to give students an insight into graphs, but also to gain an insight into numerical patterns. Take for example the expression:

$$X^2 + 4X - 8$$

The ability to graph that expression provides an insight into the expression itself. Of course, it

could be done by hand, but it is likely that if it is done on a spreadsheet, a greater range of numbers will be included. More importantly, once it is in the spreadsheet, it is very easy to try alternatives. One could ask what would happen if the expression began with “minus X^2 ”? Or what if it began with X^3 ? These “what if” questions are an important part of exploring mathematical expressions and are greatly facilitated by the computing power of the spreadsheet.

The graphing power of the spreadsheet also has uses outside of Mathematics. Spreadsheets can be used to make graphical representation of landforms in Geography, such as the cross section of a river, or translating contour lines into a cross section of a land area.

Spreadsheets and databases can also be used to analyze and correlate research data. A very good example of the power of this kind of analysis to facilitate student discovery emerged from the portables pilot project in the UK. Year 6 pupils in a primary school began to carry out a comparative study of the weathering of different types of rock, using the gravestones in two cemeteries. They entered information about the types and age of the stones used, and graded each entry according to how weathered it looked. Subsequently this information was transferred to a spreadsheet and plotted as graphs and charts for comparison with local headstones. While collecting data on the field trip, some pupils noticed the predominance of certain family names on the headstones. This led to a discussion about how to organize databases in order to facilitate searching and sorting. This project went on to involve an exploration of the impact of industrial pollution (by communicating with students in other regions) and an analysis of the age at death, which led to an exploration of social history (Stradling et al., 1994).

This principle of using ICT to facilitate students in doing research is further enabled by the use of datalogging equipment. Datalogging effectively attaches the computer to sensors, and the computer

collects readings from the sensors at intervals. These allow students to carry out experiments that would otherwise not be possible, and to achieve more accurate findings than with conventional methods. Examples include:

- measuring the heat in endothermic and exothermic reactions;
- measuring the acceleration due to gravity;
- correlating the light intensity and temperature throughout the day; and
- measuring heat loss in liquids stored in different containers.

A full description of the potential of datalogging is beyond the scope of this chapter, but the interested reader may find more information, and example of good practice, on the Web.

These are only some of the uses of ICT that can support the development of higher-order thinking. The aim of this section has not been to provide an exhaustive list of the possibilities, but to provide enough ideas to illustrate the key messages about how to get the best from ICT. These key messages can be summarized as follows:

- Good use of ICT is use that pushes students towards developing higher-order thinking.
- Good use is not tied to any one application or package, but is dependant on how the package is used.
- Key skills to encourage are evaluation, analysis, synthesis, problem solving, and exploration. By contrast, applications that focus mainly on recall are likely to do little to develop higher-order skills.
- ICT can facilitate approaches that focus more on students doing project work that is educationally challenging. Two key characteristics of ICT were noted consistently:
 - Mutability: The ability to change and develop work continually.

- Audience: The ability to present work to an audience outside the classroom.

MAKING IT HAPPEN: HOW SCHOOLS BEGIN TO MAKE GOOD USE OF ICT

This chapter began by looking at the reasons why ICT is important, and focused on the importance of developing higher-order thinking, no matter which rationale is used for the introduction of the technology. The focus then moved to the question of how ICT can be used to develop such skills. The main argument has been that ICT can be used to develop higher-order thinking skills in students. But it is also clear that not all of the uses of ICT achieve that aim.

Reaching those higher-order skills often demands a change in the teaching method. The basis of the shift is a transfer of responsibility to the learner. In each of the example activities described, the use of ICT has not been focused on ICT per se, but has been aimed at using the technology to encourage students to engage in challenging work. The technology was used to motivate and encourage students by providing a real audience for the work done. Students were encouraged to think more deeply about their work by the ability to change and reshape it. Students were encouraged to research material for themselves, and so to evaluate and process the material. Finally, students were enabled to do exploratory research for themselves through spreadsheets, databases, and data logging.

These may be summarized as a shift towards a more student-centered style of teaching, with an emphasis on students taking responsibility for their own learning, and on students constructing and developing their own understanding of the material.

Despite the weight of evidence pointing to the potential of ICT to facilitate higher-order student tasks, and the vast investment in ICT in schools, the reality is that in many countries the progress has been disappointing. Although schools have more equipment than they had a decade ago, and more time is spent in computer rooms, it is not clear that in all schools the technology is being used to promote high-level student thinking. In many cases ICT is being used to teach basic ICT skills or for routine rote learning tasks.

So, what does it take to encourage the use of ICT to achieve those more valuable goals? When teachers are asked why they do not make more use of ICT to support their teaching, one of the most frequent replies is that they do not have enough access to equipment at school. While equipment-rich projects were reporting a change in teaching method (ACOT, 1996) and other schools were reporting that lack of equipment was the barrier, it is not surprising that the idea of ICT as a catalyst emerged, and people began to suggest that provision of ICT could lead to a change in pedagogy.

More recent studies have shown that ICT infrastructure is not the answer. A major international study of ICT in schools showed that the schools that were using a student-centered approach tended to have higher levels of equipment than average, but that there were also other schools with high levels of equipment that were using very traditional didactic approaches (Pelgrum & Anderson, 1999). A series of OECD case studies of schools innovating with ICT revealed that schools use ICT for very different purposes, and that there was little evidence that ICT had caused a shift in pedagogy. ICT had played a major role in helping to support a change in pedagogy in some schools, but it had not started the change (OECD case studies are available online at www.oecd.org). These studies call into question the idea that ICT is the catalyst for change.

Other studies have focused on the idea that the use of ICT to promote student-centered learning is primarily a result of teacher beliefs. In the U.S., Becker (1999) reported that the use of ICT by teachers was associated with a “constructivist orientation” in the teacher.

The case studies of ICT as an innovation suggest that getting the best from ICT depends on a complex web of factors. Even with the same levels of equipment, some schools make better use of ICT than others. But there are also differences within schools, as some teachers begin to make use of ICT sooner than others. In most of the case study schools, even where ICT was well developed, some teachers still avoided using it, and the schools often made arrangements to exchange classes to work around them. So it seems that there are some issues at school level that can encourage or discourage use of ICT, and other issues at the level of the individual teacher.

At the level of the individual teacher, some of the key issues are:

- Easy access to ICT;
- A reliable technical infrastructure;
- Sufficient technical skill to feel confident with the technology; and
- A good pedagogical purpose for the technology. This includes believing that the technology is of real value, and having a good idea about how to use it.

Failing to have any one of these may inhibit the use of ICT by an individual teacher.

Making use of ICT takes time, as teachers need time to prepare their work and time to get familiar with the software. Some dedicated and enthusiastic teachers manage to make good use of ICT even when these conditions are not satisfied, but these teachers are unusually proactive, and often feel isolated and unsupported. The more usual and less dynamic teachers are unlikely to

start using ICT unless it becomes part of a wider school movement. Where schools have successfully gone beyond the “lone pioneer” stage, this has often been associated with a few key factors at the school level.

First, the school leader plays an important role. The drive provided by enthusiastic school management can allow other difficulties to be overcome. The school principal can facilitate teacher meetings, ensure resource availability, and ensure that timetabling and other arrangements are adjusted to facilitate the adoption of ICT. Perhaps more importantly, the sense that use of ICT is an innovation supported by the management is motivating for teachers, and encourages teachers to explore the possibilities.

Second, teachers are often supported in their first steps with ICT by an enthusiast or “ICT champion” within the staff. This is sometimes a formal role, perhaps that of ICT coordinator. In other cases a teacher assumes the role voluntarily. Either way, the presence of a mentor that is supportive and encouraging can greatly facilitate teachers in the early stages of adoption of ICT. This mentor serves a dual role, by providing a point of contact for discussing the pedagogy to be employed, and by solving minor problems with the technology that might otherwise stop the innovation entirely.

Third, teacher adoption of ICT is often encouraged by participation in professional development activities in the school, with colleagues. In most countries, teachers are offered or required to attend training courses in ICT. This kind of training has some benefits, but often fails to address the specific context of the individual school. By contrast, training for the staff conducted in the school has the double advantages of:

- a. addressing the context (infrastructure, etc.) of the school, and
- b. providing an opportunity for staff to come together to consider the possibilities of ICT

as a group. This has often helped to provide a “critical mass” of interested teachers.

CONCLUSION

This chapter began with a question; the question was why ICT is important in schools. It is clear that there is a good deal of ambitious talk about ICT, and that much of this may be overstated. ICT is justified by a series of rationales, based generally on the economy, society, and pedagogy. In each case, it was argued, ICT is only of value if it reaches the higher-order thinking skills.

Using ICT in the classroom does not automatically address these higher-order skills. Many applications of ICT involve learning low-level operational skills or memorizing facts. But there are ways in which ICT can be used to develop higher-order thinking. Many of these involve encouraging students to engage in project work, or work which requires them to discover, assess, and construct information.

Getting the higher-order benefits is not a question of technology, but one of pedagogy. ICT can help. Many of the ideas described would be much more difficult to implement without the technology. But it is also clear that the technology is not the driver. Making the best use of ICT depends on a series of factors, but one central issue is the teacher’s beliefs about teaching. If a teacher is convinced that students can learn well through the kinds of student-centered work described here, then the teacher is much more likely to find a way to implement it. By contrast, where teachers cannot see the value of this approach, any amount of infrastructure can be used to support more traditional didactic practices.

This has a series of implications. For teachers, the key is to focus on how ICT is used, rather than on how much or how often it is used. Quality of use does not depend on the sophistication of the task, but on the sophistication of the thinking involved

in completing it. Using the illustration in Figure 1, teachers should seek to move their use of ICT further towards the top of the graph—towards the higher-order thinking.

For schools, the key is to encourage teachers towards the appropriate uses. If there is not a school-wide interest in ICT, then it is difficult for individual teachers to feel supported to experiment with the possibilities. If the general view of ICT is as a technical skill area, then it is difficult for teachers of other subjects to begin to use it as a pedagogical support. One key task is to build a school vision of the potential of ICT in achieving the important aims; leadership, ICT champions, and whole-school work seem important steps in this direction.

REFERENCES

- ACOT. (1996). *Teaching learning and technology: A report of 10 years of ACOT research*. Apple Computers.
- Adelaide Declaration on National Goals for Schooling in the Twenty-First Century. (1999). Retrieved from <http://www.curriculum.edu.au/mceetya/nationalgoals/>
- Alexander, T. (1999). New OECD initiatives on ICT, education and learning. *Proceedings of the Dissolving Boundaries, ICT and Learning in the Information Age Conference*, Dublin, Ireland.
- Apple Computers. (n.d.). *High school writing. Apple K-12 effectiveness report no. 5*. Retrieved from www.apple.com/education/k12/leadership/effect5.html
- Austin, R., Abbott, L., Mulkeen, A., & Metcalf, N. (2003). Dissolving boundaries: Cross national cooperation through technology in education. *The Curriculum Journal*, 14(1), 55-84.
- Becker, H. (1999). *Internet use by teachers: Conditions of professional use and teacher-directed student use*. Teaching, Learning and Computing: 1998 National Survey Report #1, Center for Research on Information Technology and Organizations, USA.
- Gardner, J., Morrison, H., & Jarman, R. (1993). The impact of high access to computers on learning. *Journal of Computer Assisted Learning*, 9(1), 2-16.
- Ginsberg, L., Sabatini, J., & Wagner, D. (2000). *Basic skills in adult education and the digital divide. Learning to Bridge the Digital Divide*. Paris: OECD.
- Healy, J. (1998). *Failure to connect*. New York: Simon and Schuster.
- Mioduser, D., Nachmias, R., Lahav, O., & Oren, A. (1999). *Web-based learning environments (WBLE): Current pedagogical and technological state*. Research Report No. 54, Science and Technology Education Center, Tel-Aviv University, Israel.
- Mulkeen, A. (1998). *Irish Tech Corps—External review*. Report of the External Evaluation of Irish Tech Corps.
- Mulkeen, A. (2002). *ICT school census*. A Report to the National Center for Technology in Education.
- Mulkeen, A. (2003b). *SchoolSat: Satellite Internet access for schools*. Pedagogical evaluation report. Report to the European Space Agency and the National Center for Technology in Education.
- NCET (National Center for Educational Technology). (1996). ILS phase II evaluation report. NCET.
- Negroponte, N. (1995). *Being digital*. London: Hodder and Stoughton.
- OECD. (2001). *E-learning, the partnership challenge*. Paris: OECD.

- OECD. (2001b). *Learning to change*. Paris: OECD.
- Papert, S. (1980). *Mindstorms: Children, computers and powerful ideas*. New York: Basic Books.
- Pelgrum, W. (1993). Attitudes of school principals and teachers towards computers: Does it matter what they think? *Studies in Educational Evaluation*, 19(2), 101-127.
- Pelgrum, W., & Anderson, R. (1999). *ICT and the emerging paradigm for life long learning: A worldwide educational assessment of infrastructure, goals and practices*. Amsterdam: International Association for the Evaluation of Educational Achievement.
- Russell, N., & Drew, N. (2001). ICT access and use. Research Surveys of Great Britain, DFEE Research Brief No. 252.
- Selwyn, N. (2001). Promoting Mr. Chips: The construction of the teacher/computer relationship in educational advertising. *Teaching and Teacher Education*, 17, 3-14.
- Stoll, C. (1999). *High tech heretic*. New York: Doubleday.
- Stradling, B., Simms, D., & Jamison, J. (1994). *Portable computers pilot evaluation report*. National Foundation for Educational Research, NCET.
- Tierney, R. J., Kieffer, R., Stowell, L., Desai, L., Whalin, K., & Moss, A. (1992). *Computer acquisition: A longitudinal study of the influence of high computer access on students' thinking, learning, and interactions*. Apple Classrooms of Tomorrow Research Report No. 16, Apple Computer, California.
- Underwood, J., & Underwood, G. (1991). *Computers and learning: Helping children acquire thinking skills*. Oxford: Blackwell Publishers.

ENDNOTE

- ¹ The WebQuest model was developed at San Diego State University. Details are available at <http://edweb.sdsu.edu/webquest/>.

This work was previously published in the Handbook of Research on Literacy in Technology at the K-12 Level, edited by L. Tan & R. Subramaniam, pp. 73-93, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 7.7

ICT, Knowledge Construction, and Evolution: Subject, Community, and Society

Antonio Cartelli

University of Cassino, Italy

ABSTRACT

After a short introduction on the hypotheses scholars developed for explaining knowledge construction and evolution in mankind, the role that ICT is playing on this phenomenon is described. From the results of many studies and from the separation today well settled between human knowledge and corporate knowledge, the idea of a tri-partition of knowledge contexts arises and is developed and analyzed. The idea of three different kinds of knowledge receives good support from the observation of the effects of ICT on individuals, communities/organizations, and society; it sounds as the confirmation for the three different contexts of knowledge construction and evolution the author hypothesizes. The experiences described in this chapter show how ICT, while playing a relevant role in each of the above environments, influences all the others and determines a continuous evolution of knowledge in the three contexts. The hypothesized perspec-

tive opens to new interpretations for knowledge phenomena, leads to the overcoming of misleading learning explanations, and gives a strong impulse to the planning of projects for the introduction of ICT in education.

INTRODUCTION

The 20th century has marked the transformation of the philosophical definition and explanation of knowledge into a different one, mostly depending on the ideas emerging from human disciplines like psychology, pedagogy, anthropology, sociology, etc. (i.e., many contributions are also due to biology, neurophysiology and cybernetics). Two main ways for interpreting knowledge construction and evolution affirmed during last decades: the former one mostly looking at the individual, the latter one emerging from corporate and organization studies.

In what follows the above perspectives are analyzed and the role IT and ICT had in explaining knowledge construction are recalled.

Theories for Knowledge Development in Individuals

J. Piaget and D. P. Ausubel were among the first scientists stating the importance of subjects' mental actions in cognitive processes. They assigned a great role to subject-reality interaction for the explanation of knowledge development and evolution; for this reason they are also considered cognitivists and precursors of constructivism; the same scholars, on another hand, assign a little or no role to social and cultural interactions in knowledge construction.

J. Piaget hypothesized different stages in cognitive development, for example, he stated that the evolution of knowledge in a subject is marked by the transition from a first stage to the following one; this process is the result of the interaction between the individual and the environment and is based on adaptation processes marked by the assimilation of new stimuli in old mental schemes and by the accommodation of old mental schemes into new ones (Piaget, 1971, 1973). He also hypothesized the existence of a genetic epistemology to explain the genesis of knowledge in mankind, for example, the individual cognitive development runs parallel to history of science and the analysis of pupils' ideas can be used to explain the origin of scientific concepts.

D. P. Ausubel, on another hand, accepted and developed the idea of knowledge construction emerging from the addition of new knowledge to pre-existing knowledge (formerly proposed by Gagné); the bases of his theory can be found on the following three elements:

1. The internal coherence of the topic to be learned
2. The existence of a net of pre-existing concepts the new topic has to connect to

3. The subject's bent to receive and accept the new topic

He also hypothesizes the distinction between meaningful learning and mechanical learning and states that the difference between them rests on the existence of subsumers (special units of previous knowledge making the construction of new knowledge easier), which have great influence on the insertion of new information units into pre-existing knowledge (Ausubel, 1990).

The ideas of J. Piaget and D. P. Ausubel have been verified, integrated and, sometimes, contradicted from further scientists but have retained all their importance for the role they assigned to individuals in knowledge management and development. A different basis moved D. H. Jonassen (1994), who founded the project of learning environments on the following statements:

1. Knowledge construction is based on individual and social influences.
2. Meaningful contexts support problem solving skills (which have to be derived from real situations).
3. Cooperation between student and teacher and among peers is at the basis of learning processes.

Further studies introduced the concepts of multiple intelligence (Gardner, 1993), learning styles (McLellan, 1996), and cognitive flexibility (Spiro & Jehng, 1990) to consider the complexity of the cognitive phenomenon into individuals.

The importance of context and social effects on individuals' knowledge development has been stated in many recent studies, often under the influence of Vygotskij and Leont'ev hypotheses (Varisco, 2002). Most relevant results of these studies concern two specific models of the knowledge transition from the concrete to the abstract: (a) the cognitive apprenticeship, and (b) the expert practical thinking. The former hypothesis rediscovered the well known apprenticeship properties

(i.e., modeling, coaching, scaffolding, and fading properties of training in Renaissance studios), and integrates them with the following new principles: articulation, reflection, and exploration. The latter one, mostly due to S. Scribner research (1997), evidences the properties of the expert thinking in a given context with respect to the novice one; main traits of the expert thinking are:

1. Use of the context's elements concerning the problem to be solved
2. Use of economic strategies in the finding of solutions
3. Use of well settled knowledge units and skills in the definition of problem solving strategies

The most comprehensive theory about the influence of social phenomena on human knowledge and learning is the E. Wenger's social learning theory (1998). This theory has at its bases the following principles:

1. Individuals are social beings and are the focus of the learning action.
2. Knowledge is a specific aspect of competence.
3. Knowledge is the expression of the participation.
4. Meaning is the product of learning.

If the above ideas are mostly concerned with the effects of learning actions on individuals it has to be noted that E. Wenger looks at communities as autonomous realities and, for him, communities of practice coincide with learning communities.

Corporate and Organization Knowledge Theories

While starting from Wenger's research on communities of practice recent studies analyze knowledge

construction in those communities for the importance they have in corporate and organizations. In other words, a theory of knowledge construction and development in communities has been developed, autonomously from the hypotheses on individuals reported in the above paragraph.

Among the starting points for these studies there are Wenger's (2004) basic elements marking a community of practice:

1. **Shared Identity Domain:** Where membership implies a commitment to the domain, and therefore a shared competence that distinguishes members from other people.
2. **Community:** Because in pursuing their interest in the domain, members engage in joint activities and discussions, help each other, and share information; for example, they build relationships enabling them to learn from each other.
3. **Practice:** Because members of a community of practice are practitioners; they develop a shared repertoire of resources for example, experiences, stories, tools, ways of addressing recurring problems (in short a shared practice).

Furthermore, the analysis of knowledge development in communities of practice inside organizations and the study of corporate knowledge construction and transmission led some authors to state the basic principles for knowledge management. S. Denning (2000), for example, proposed the following remarks (usually known as knowledge management laws):

1. Knowledge is the key factor for the organization surviving
2. Communities of practice (CoPs) are the core of any knowledge sharing program
3. Virtual communities need presence interaction
4. Professional enthusiasm sways CoPs

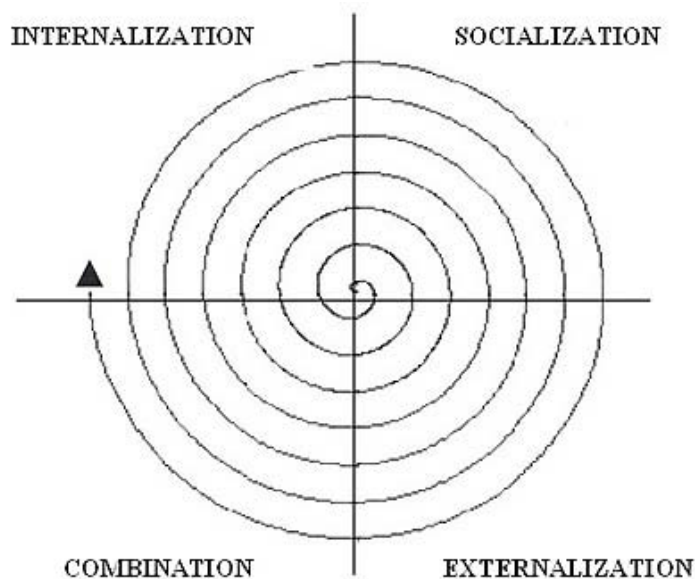
5. Knowledge management activates bi-directional and dynamic information flows inwards and outwards organization
6. Experience and story telling animate and strengthen knowledge sharing

With respect to studies on individuals' knowledge development, new hypotheses were now developed to explain knowledge features and structure within communities and organizations. I. Nonaka and N. Konno (1999), for example, based their ideas on the definition of two different kinds of knowledge: (a) tacit knowledge, which is deeply-rooted in actions and experiences of community's members and can be only difficultly codified, transmitted and shared; (i.e., it is the individuals' know how marking the skills of the community), and (b) explicit knowledge, which is the community's knowledge and can be easily formalized, represented, transmitted and shared.

In regards to learning organizations (i.e., organizations continuously developing new knowledge), I. Nonaka and H. Takeuchi (1995) developed a model for knowledge construction and evolution strongly based on the tacit and explicit knowledge transformations. This model is made by four phases (which initials give the name SECI to it):

1. Socialization: It is the informal process of letting tacit knowledge be shared (often in a non-verbal way). It has features very similar to the modeling phase of apprenticeship and to the on-the-job-training used in many organizational contexts.
2. Externalization: It transforms tacit knowledge in explicit concepts and is the crucial phase of knowledge construction. Formal language, metaphors, and analogies play an important role in helping people making explicit their know how.

Figure 1. SECI cycle for learning organizations



3. **Combination:** It inserts the newly built concepts into organization's knowledge and connects them to previous knowledge, so increasing the knowledge of the community and of the organization.
4. **Internalization:** It closes the cycle by making internal the explicit knowledge and transforms it into know how for the organization. The cycle is now ready for starting again with socialization of tacit knowledge, etc. and the model describing the knowledge evolution process is reported in Figure 1.

The Role of IT and ICT on Knowledge Construction and Evolution

In regards to the influence of IT and ICT on individual teaching-learning processes, it can be useful to remember here the contributions of R. Taylor and L. Galliani. The former one proposed three metaphors for computer use in education: tutor, tool, and tutee (Taylor, 1980), the latter one extended these metaphors while considering the great deal of software tools developed in last decades (Galliani, Costa, Amplatz, & Varisco, 1999). At the end of such an integration, tutor appellation describes the experiences people can make under behaviorist and cognitivist influence with the help of special programs like CAI, CAE, and CAL tools, or with the help of Artificial Intelligence software like ICAI and ITS. Tool metaphor includes special software for analyzing large amounts of data and browsing specific contexts (usually provided with authoring and co-authoring functions). Tutee metaphor mainly includes programs for the creation of special developmental environments, such as micro-worlds made by Papert with LOGO. Together with computer metaphors, meta-cognitive ideas must be remembered. Strictly speaking, they suggest that computer use stimulates functions' development more than learning topics so that meta-cognitive attitudes and learning are better

developed in students systematically working at the computer (Cornoldi & Caponi, 1991).

Furthermore, ICT influence on individuals' knowledge development can be summarized in the following ideas:

1. H. Rheingold (1994) introduced the definition of virtual communities to describe the set of individuals who use the Net for interpersonal communication and knowledge construction.
2. D. de Kerckhove (2000) defined connective intelligence as the set of strategies and cognitive skills developed from individuals contextually to ICT use.
3. P. Lévy (1996) stated that collective intelligences well characterize the situation emerging from the increase in the individuals' communication speed due to the Net and from the great amount of information freely available in it.
4. A. Calvani and M. Rotta (1999) suggest that ICT introduce hypertext and multimedia features in the knowledge structure while the Net extends the social negotiation aspects of knowledge.

On another hand, the impact of ICT on learning environments is mostly due to the role it can play in educational contexts:

1. Repository for information and documents of every kind (CMS—Content Management System)
2. System for the management of Learning Objects (LMS—Learning Management System)
3. Virtual environment letting individuals interact and build communities of learners (CSCLS—Computer Supported Collaborative Learning System)

In communities and especially corporate and organizations, knowledge management has seen a

great application and use of ICT for the collection, organization, sharing and analysis of community knowledge. The tools adopted as instruments for the application of knowledge management principles are devoted to knowledge discovery, and knowledge audit (usually based on knowledge mapping) together with the planning and carrying out of knowledge networks.

G. Trentin (2004) hypothesizes for networks, and especially for the Internet, the role of technical infrastructure letting communities build a shared memory (i.e., shared knowledge basis supporting professional CoPs).

TOWARDS NEW MODELS FOR KNOWLEDGE CONSTRUCTION AND EVOLUTION

At this point of the discussion two main kinds of knowledge can be recognized: the individual and the community ones. They are also marked from different hypotheses concerning the ways they are built up and the involvement of ICT in their management. In the author's opinion, the above separation is still inappropriate to describe today's knowledge phenomenon and a tri-partition of knowledge definitions and environments can be proposed: individual knowledge, community knowledge, and social (scientific) knowledge. In what follows, the reasons for the above hypotheses are reported but the need for a reconciliation of methods and results coming from the different knowledge structures and environments is also evidenced.

First of all, the results on misconceptions and mental schemes are reported to explain the separation between individual and social knowledge (this last one being considered equivalent to scientific knowledge). Soon after the results of the studies concerning a special community of students are analyzed and last, the interaction among all above knowledge environments is described and the positive effects individuals, communities and

science, derived each other from that experiences is discussed.

Individual, Community, and Social Knowledge

Theories reported in the introduction for the analysis and explanation of knowledge management in individuals have at their basis the identification of the knowledge naturally built by subjects (either autonomously or under the effect of an educational program), with scientific and disciplinary knowledge.

During the past decades, the amount of discoveries in all fields of human knowledge produced an exponential growth in the number of sciences analyzing phenomena and many new disciplines were born. Teachers and professors, while submitting new topics to their students, often adopted and still use a different perspective with respect to Piaget's genetic epistemology, they usually start from the history of disciplines to build school curricula and create learning paths for education (i.e., discipline logic structure is proposed as a natural scheme for knowledge construction in individuals).

The positivistic hypothesis that an increase in the number of topics to be taught and the introduction at earlier stages of education of many concepts could help mankind in reaching new and more advanced frontiers of knowledge, showed very soon all its limits. Many studies on misconceptions and mental schemes evidenced, in fact, how difficultly subjects build the right scientific concepts (MLRG, 2005). The same studies evidenced the presence of wrong ideas in differently aged and skilled people (including teachers) and how difficult can be the finding of the right strategies for helping people in overcoming the difficulties they meet in the study of sciences or in interpreting phenomena.

Three main aspects clearly emerge from the above studies (Cartelli, 2002):

1. Wrong ideas involve all domains of human knowledge; the investigated fields concern in fact scientific topics pertaining mathematics, physics, statistics, computer science, chemistry, biology, natural sciences, cosmology, etc. but there is (and is still growing) the number of studies investigating the wrong ideas the students show with language, literature, history, and many other human sciences.
 2. Wrong ideas can be found in people all over the world and no relevant differences can be detected while passing from East to West or from North to South.
 3. Two main approaches can be recognized in the above studies: a former one called ideographic or naturalistic, which analyzes pupils' reasoning and the ideas people show when explaining phenomena, with no dependence from scientific paradigms (i.e., only the internal coherence of people's concepts and ideas is evaluated and the name of natural mental schemes is adopted for them); the latter one, involving people who already approached scientific topics (or were beginners), which evaluates the correctness of people's ideas with respect to scientifically accepted ones (the name of preconceptions and misconceptions is now adopted for wrong ideas).
- b. Only little segments of scientific knowledge can be shared within the members of a given community.
 - c. When students in a class correctly build scientific knowledge in a given domain (with the help of constructivist strategies and technological environments) special ambiguous situations can lead to the detection of misconceptions and wrong ideas in their knowledge.

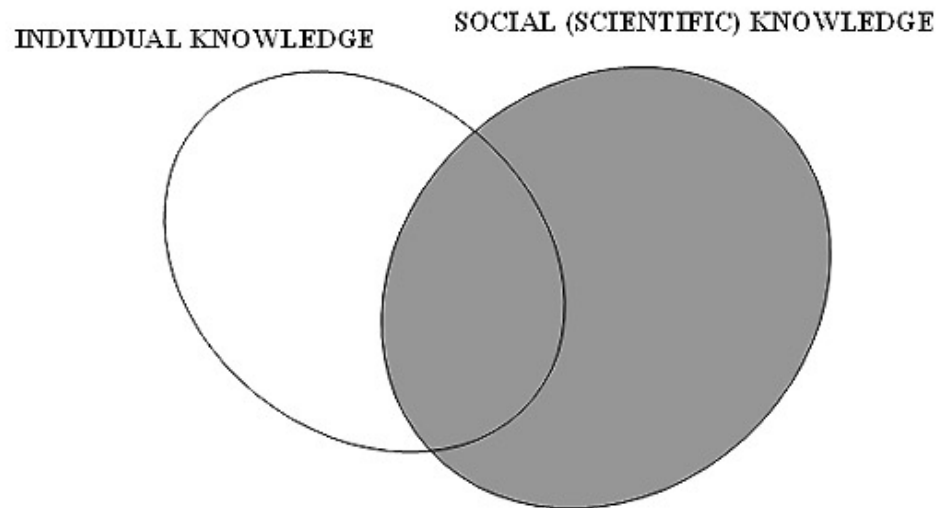
In other words, the high specialization of knowledge in every discipline, the very large amount of elements marking scientific knowledge and the presence of preconceptions, misconceptions, and mental schemes in individuals, all play a relevant role in stating that scientific knowledge (i.e., knowledge certificated and validated from scientific community) is the knowledge of mankind (i.e., a construction of mankind continuously evolving and growing like any human artifact or technology) and not the knowledge of a single individual. Subjects can use scientific knowledge to explain phenomena, and usually do so by adopting the paradigms that the scientific community developed and accepted for that phenomenon (in a given context and time and until new paradigms appear more suitable for the explanation of the same phenomenon); but it has to be noted that the use of such knowledge has very little, if any, element in common with the developmental and evolutionary process of individual knowledge. All the above arguments lead, in the author's opinion, to the following conclusion: individual and scientific knowledge are very different and scientific knowledge is better defined as social knowledge (if we identify mankind with society and look at the contribution to scientific knowledge development from individuals and communities with the time).

Two experiences the author made during the past years with High School and University students confirm what has been stated until now and give support to the idea of a separation between individual knowledge and social knowledge (this last one being identified with science and discipline knowledge) (Cartelli, 2005). In other words, individuals' knowledge can never be identified with scientific knowledge, because:

- a. Only a few subjects can be considered really skilled in a scientific domain.

The draft in Figure 2 synthesizes individual and social-scientific knowledge and the dependencies between them. They surely have common

Figure 2. Separation between individual and social knowledge



parts but don't superpose each other and have elements pertaining specifically to each of them (individual and society-science).

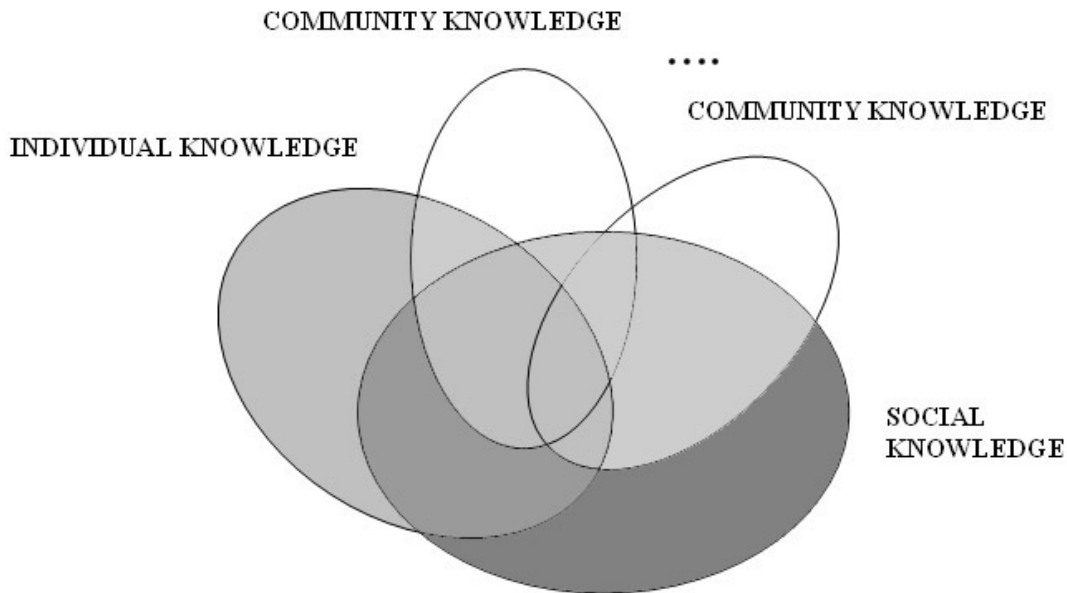
If the above scheme correctly describes knowledge inter-dependencies while looking at individual and society, (mankind) it is certainly inappropriate for the explanation of knowledge phenomena if corporate and organizations' experiences and theories are considered (i.e., the results from studies on communities of practice don't benefit from the above hypothesis). This difficulty disappears if autonomous community knowledge for each CoP a subject belongs to is hypothesized; in such a case, in fact, together with the rules governing individual and social knowledge management, the rules reported in the first paragraph for CoPs can be adopted to explain community knowledge phenomena. A new scheme for the description of the different kinds of knowledge can then be drawn and within it one or more community knowledge find their right place. Figure 3 drafts the author's hypothesized

tri-partition among individual, community, and society/scientific knowledge.

The tri-partition in Figure 3, where multiple communities are reported, finds an explication in the rules governing community knowledge: For example, an individual can belong to different CoPs and can contribute in developing different knowledge in each of them, but the rules governing each CoP and knowledge construction and development within it are just the same (and are derived from Wenger's characterization of a CoP).

The above tri-partition has a relevant influence on further studies concerning knowledge construction and evolution because it states the existence of different fields and methods of investigation for the research in each of the three environments. Furthermore, it implies a great attention to possible results from the same research, for the effects the results obtained in a field can have on all the others. In other words scholars and scientists can now concentrate their efforts on the different ways knowledge (individual, com-

Figure 3. Distribution among subject, communities and society of the components of human knowledge



munity, and social/scientific) is built and evolves, without forgetting the consequences the results they obtain in one of the above fields can have on all the others. A question poses suddenly: what role does ICT play in this way of looking at the knowledge phenomenon? Does it operate across all knowledge specifications (individual, community, and society) or pertain especially to one or more of them? It is perhaps too early to give a definite answer to these questions but in what follows the experience the author made with some students is reported and an attempt for answering to the above questions is made.

STUDENTS' COMMUNITIES AND ICT: THE CASE OF PALEOGRAPHY

What is reported below is the result of the author's work at the Faculty of Humanities of the Uni-

versity of Cassino-Italy, while cooperating with M. Palma, professor of Latin paleography. The cooperation between a researcher in education technologies and a scholar in paleography can seem, and perhaps is, unusual but is the result of the common persuasion that Internet, and ICT more in general, changed the well settled connection and temporal dependency between research and teaching. Before the Internet, in fact, there were separated times and spaces for research and didactics, now they can be contemporary and can reinforce each other.

The experiences the author made and is still carrying out mostly concern the planning and carrying out of special information systems (mostly based on Web sites) both for researching and teaching.

Among them, the most relevant ones and those which have a greatest relevance for their consequences on the hypothesized knowledge

tri-partition are: (1) Bibliography of Beneventan Manuscripts (BMB), an information system hosting the bibliography of manuscripts written in the South Italy national script during the Middle Ages and (2) Women Copyists and Written Culture in the Middle Age, a dynamic Web site interfaced with a database containing women and manuscripts' data.

The Bibliography of Beneventan Manuscripts

The BMB experience (Bibliografia dei Manoscritti Beneventani—Bibliography of Beneventan Manuscripts <http://edu.let.unicas.it/bmb/>) started in 1992 with the main aim of collecting the quotations of Beneventan manuscripts (i.e., medieval books written in the South Italy national script) by means of a MS-DOS program called BIBMAN. In 1997 a first Web site was developed to make it faster and easier for scholars to download new bibliographical data (nearly monthly).

Recently many problems depending on the BIBMAN program induced to plan and carry out a new Web site: the BMB online (Cartelli & Palma, 2004). It is an information system where differently allowed people can store the quotations of Beneventan manuscripts, so that it can be freely queried by general users.

Persons entrusted with the task of collecting the quotations of Beneventan manuscripts are grouped into three categories:

1. Contributors: Who can access a special Web area where they can write, modify, and delete bibliographical data for the materials assigned to them
2. Scientific Administrators: Who can manage all data and write, modify, and certify bibliographical materials, this last operation being done only once because certified records cannot be subsequently accessed for revision

3. System Administrator: Who is allowed to do all operations including the modification or deletion of certified data

The access to certified bibliographic materials is possible according to different query pages: (a) by author's name, (b) by manuscript, (c) by contributor, or (d) by one or more words or part of them concerning title, location, or bibliographical abstract of a given publication.

It has to be noted that the following are implemented in the system also: (1) a closed communication subsystem made by an electronic blackboard letting contributors involved in the collection of bibliographical data exchange messages and texts among themselves, (2) some special functions, available only to system administrator, for the production of the printed version of the data yearly collected.

The Web Site “Women and Written Culture in the Middle Ages”

Main aim of the dynamic Web site on women copyists (<http://edu.let.unicas.it/womediev/>) was to systematize the data emerging from former research while leading to an instrument which could help scholars finding new elements for further studies (Cartelli, Miglio, & Palma, 2001).

Data appearing relevant to the scientific community were:

1. For every scribe: (a) the name of the woman as it appears in manuscripts, (b) her qualification (i.e., if it is known, whether she was a nun or a lay), and (c) the date or the period she belonged to (up to the 15th century)
2. For the manuscripts: (a) their shelf mark (i.e., town, library, and number of the manuscript), (b) the place and the country where they were written, (c) the date or the period they belong to, (d) the authors and titles of the texts, and (e) the bibliography or its source of information

Furthermore, it appeared important to show for each woman, the manuscript/s she wrote and vice-versa and, if possible and available, at least an image of the copyist's hand. The site has not produced until now any printed bulletin or other periodical printed matter and is made of two separated sections: the former one being operated only by editors, who access it by a personal ID and a password (to insert, modify, and delete the data stored in the database), thus ensuring the scientific validity of the information reported there; the latter one at everyone's disposal to obtain the list of all women and manuscripts in the database, or to make queries concerning women and manuscripts with specific qualifications.

Results from Researching and Teaching with ICT in Paleography

The systems and Web sites described above were carried out from the author in different times but they were suddenly introduced in everyday teaching and researching work. The number of students participating each time in the experiences described below was very little (in the best case there were 19) so that students' features, performances, and behaviors could be carefully analyzed each time. Main activities the students were involved in have been:

1. After having attended the basic courses on cataloguing, they were asked to become contributors for BMB online and to produce bibliographical materials. The discussions they had with administrators, professors, and among themselves, the use they made of the electronic blackboard and of the e-mail services for the exchange of messages and, last but not least, the chance of working in little groups on the same problems helped them very much in acquiring the knowledge and in developing the skills they would need (as paleographers) in their everyday work.
 2. They not only used the materials reported in the Women Copyists Web site for their study, but were also charged of the description of manuscripts and of the collection/digitization of plates reproducing texts written from women (i.e., they learned to distinguish the different hands of women copyists and their way of writing manuscripts while practically working on the manuscripts and translating them in digital documents). Furthermore, the number of bibliographic notes coming from scholars all over the world has grown with time; main consequence of this unexpected interest for women copyists has been the need for the planning of a new information system (still under development) helping the virtual community born around this theme to continue the study of women copyists (it has to be noted that the system has already been modified since its origin).
- The effects produced from above activities on the teaching-learning processes will be analyzed in what follows looking at the three different components of knowledge described above: the individual, the community, and the social (scientific) ones.
1. In regards to single students, and especially the knowledge and skills each of them developed while attending paleography course, it can be stated that ICT, and especially Web technologies and information systems, contributed to creating constructivist learning environments which helped them very much. Furthermore, the careful analysis of students' behaviors during lessons, exercises, laboratory activities, and examinations led the author to deduce that the following skills, never observed before in a paleography's course, could be detected: talent in working in a group (in traditional courses it was a very rare experience), easier

facing of complex tasks (thanks to the help each student could have from colleagues) and raising of the individuals' peculiarities within the community. In other words, the results of the studies by A. L. Brown and J. Campione (1994) and J. Lave and E. Wenger (1991) on communities of learners (CoLs) were fully confirmed.

2. In regards to communities of practice (CoPs) and especially learning organizations, a new model for knowledge development emerged. First of all, it has to be noted that each class or group of students involved in the above experiences was a real CoP (the three elements marking for Wenger a community of practice were in fact observed). Furthermore, the information systems described above had two main features: (a) they helped students and scholars in their everyday research work, and (b) they implemented the best practices researchers developed while accomplishing their studies and obliged students to respect times and procedures in those practices. To better understand the meaning of the above assertions, the BMB online case is analyzed (Cartelli, 2004) in a greater detail: when a student/contributor aims at writing a bibliographic card he or she has to follow the procedure implemented into the system. For example:

- a. He or she has to be authorized to analyze the documents (books, papers, magazines, Web sites, etc.) probably containing the citations of Beneventan manuscripts.
- b. Once scientific administrators attribute documents for the analysis, contributors can compile bibliographic card/s.
- c. Compiled card/s must be reviewed and approved from BMB scientific administrators.

- d. Approved card/s can finally be accessed from general users querying the data base.

The above steps can be seen as the formalization and implementation into the information system of the practices BMB editors adopted before the creation of the Web site (also if, at that time, they used a MS-DOS software for the management of bibliographies) and let us state they help community in covering and completing the SECI cycle. In other words, the BMB online system makes the socialization, externalization, combination, and internalization of community knowledge easier, and, what is more, it implements the community practices, (i.e., the processes leading to the creation of the bibliography shared by people working on Beneventan manuscripts). It also has to be noted that if BMB editors cannot be considered a learning organization at all (i.e., they are not continuously developing new knowledge/practices to share among the members of the community), the elements of at least a cycle of the Nonaka and Takeuchi's SECI model can be recognized in the development of community knowledge and a new element can be added to the former ones: the implementation of communities' practices by means of ICT.

If the BMB online experience can be only partially compared with Nonaka & Takeuchi's SECI model, as applied to paleographers' community, what happened with the site Women and written culture in the Middle Ages (i.e., the changes in its structure following one another with the time), better support the idea of a new model for the cyclic structure describing knowledge evolution in organizations (at least in the special case under analysis). The Women copyists Web site was modified accordingly to the database structure at least two times:

1. When it was made the first time it had only one table containing data concerning both

women and manuscripts, as it was explicitly asked from the paleographers who commissioned its planning and carrying out (paleographers liked a system letting them make their everyday operations easier and faster and asked for a system implementing only and exclusively their knowledge/practices). After the introduction of some information in the system and after the analysis of the stored data, the need for a revision of the structure of that system became evident (i.e., the first SECI cycle came to its end, after socialization, externalization, combination, and internalization of knowledge/practices).

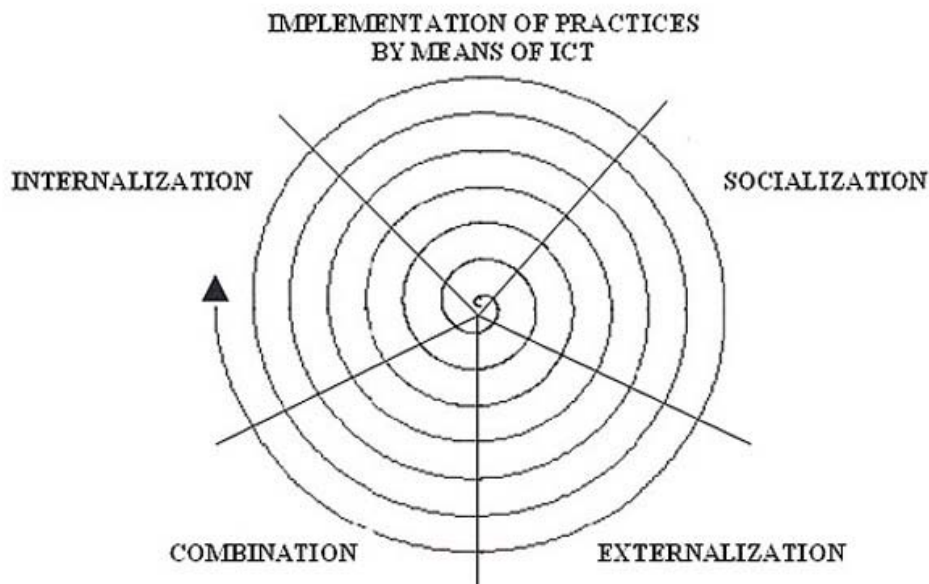
2. The end of the first SECI cycle showed the limits of the system (which were also the limits of former practices) and required changes in the database structure: it had to be split into three tables, former data had to be translated into the new structure and new FORMS had to be made for managing data and for querying the system (i.e., new

data structures were needed, new practices emerged and their implementation by means of ICT in the new system was asked, to let a new SECI cycle start).

Once ready, the new system has been used by editors for managing women and manuscripts data and now, while it is coming to the end of the second SECI cycle, the need for further changes in the structure of the system is emerging; i.e., it difficultly manages external contributions, like the ones coming from scientists and scholars who don't belong to the community.

As a conclusion, at least in the paleographic community (but there is no reason for limiting the above idea to this unique case), the above remarks suggest that the cycle marking the evolution of the community knowledge must be based on a further element with respect to the four initially stated. The new structure of a model inheriting the basic elements of I. Nonaka and H. Takeuchi hypothesis lays, as suggested above, on the fol-

Figure 4. New model for knowledge evolution in CoPs



lowing elements: Implementation of communities' practices by means of ICT, Socialization, Externalization, Combination, and Internalization (as reported in Figure 4).

In regard to social (scientific) knowledge and the influence the above information systems had on it, only a remark is needed. The above information systems are not static in their content and continuously evolve by addition of new information, with the support of individuals and communities involved in their management; the validation of the information stored within them by scientific committees lets us state that they represent a source of scientific knowledge freely available on the Net for students, scholars, and everyone interested in them. As reported above, in fact, both BMB online and Women and written culture in the Middle Ages sites have a public section letting general users freely access data stored in their databases and retrieve them. In other words, they contribute in the construction and diffusion of scientific knowledge concerning manuscripts and the disciplines studying them.

CONCLUSION AND FUTURE TRENDS

It is probably too early to say if the new model hypothesized from the author for knowledge development in organizations can be applied to every kind of community of practice and learning organization as it is, but some conclusions can be drawn.

First of all, it has to be noted that the implications of this study concern all elements involved in the knowledge phenomenon: subjects, communities, and society (science). Subjects' knowledge and skills evolve due to the individuals' belonging to community and society, but they give a valid contribution to community and society (scientific) knowledge evolution too. In regard to communi-

ties, a special attention must be devoted to CoPs, CoLs, and virtual communities for the influence each of them can have on the others:

1. Communities of practice can be virtual. Subjects with special interests in the community's work/practice can, in fact, become members of the community by means of ICT without physically knowing the members of the community. The only requirement seems the level of their basic skills, which must be adequate to those of the community, to guarantee their entrance and permanence in the community.
2. Implementation of practices by means of ICT can help teachers/professors in the creation of new constructivist learning environments and can help students in developing meaningful learning of discipline topics and new skills (very common in CSCLS).
3. Studies on CoPs and CoLs until now, carried out separately, can cooperate and integrate themselves in explaining knowledge phenomena in the two different contexts: corporate and school/university.

At last, the creation of systems letting students freely access scientific knowledge in efficient ways gains new importance so that Semantic Web, ontologies, and learning management systems appear a real need more than an academic exercise. Undoubtedly advanced education (university courses) and lifelong learning can take great advantage from instruments similar to the ones adopted in the author's experiences and the results of paleography students can be obtained also in other contexts. Perhaps the simple transfer of the experiences will not be enough to guarantee the success of the educational process and a reorganization of teaching, new planning strategies for didactics and new functions and meanings for teachers' work will be needed.

REFERENCES

- Ausubel, D. P. (1990). *Educazione e processi cognitivi*. Milan: Franco Angeli.
- Brown, A. L., & Campione, J. C. (1994). Guided discovery in a community of learners. In K. Mc Gilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 229-270). Cambridge, MA: MIT Press.
- Calvani, A., & Rotta, M. (1999). *Comunicazione ed apprendimento in Internet, didattica Costruttivistica in rete*. Trento: Erickson.
- Cartelli, A. (2002, June 17-19). Web technologies and sciences epistemologies. In E. Cohen & E. Boyd (Eds.), *Proceedings of IS and IT education 2002 Conference*, Cork, Ireland. Retrieved August 16, 2004, from <http://ecommerce.lebow.drexel.edu/eli/2002Proceedings/papers/CarTE203Webte.pdf>
- Cartelli, A. (2004). Open source software and information management: The case of BMB online. In M. Khosrow-Pour (Ed.), *Proceedings of IRMA 2004 International Conference: Innovations through information technology* (pp. 1023-1024). Hershey, PA: Idea Group Publishing.
- Cartelli, A. (2005). Computing and ICT literacy: From students' misconceptions and mental schemes to the monitoring of the teaching-learning process. In D. Carbonara (Ed.), *Technology literacy applications in learning environments* (pp. 37-48). Hershey, PA: Idea Group Publishing.
- Cartelli, A., Miglio, L., & Palma, M. (2001). New technologies and new paradigms in historical research. *Informing Science (The International Journal of an Emerging Discipline)*, 4(2), 61-66.
- Cartelli, A., & Palma, M. (2004). BMB online: An information system for paleographic and didactic research. In M. Khosrow-Pour (Ed.), *Proceedings of the IRMA 2004 Conference: Innovations through information technology* (pp. 45-47). Hershey, PA: Idea Group Publishing.
- Cornoldi, C., & Caponi, B. (1991). *Memoria e metacognizione*. Trento: Erickson.
- de Kerckhove, D. (2000). *La pelle della cultura*. Rome: Editori Riuniti.
- Denning, S. (2000). *The springboard: How storytelling ignites action in knowledge-era organizations*. Boston: Butterworth-Heinemann.
- Galliani, L., Costa, R., Amplatz, C., & Varisco, B. M. (1999). *Le tecnologie didattiche*. Lecce: Pensa Multimedia.
- Gardner, H. (1993). *Multiple intelligences: The theory in practice*. New York: Basic Books.
- Jonassen, D. H. (1994). Thinking technology: Towards a constructivist design model. *Educational Technology*, 34(4), 34-37.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.
- Lévy, P. (1996). *L'intelligenza collettiva: Per un'antropologia del cyberspazio*. Milan: Feltrinelli.
- McLellan, H. (1996). Being digital: Implications for education. *Educational Technology*, 36(6), 5-20.
- Meaningful Learning Research Group (MLRG). (2005). *Abstracts, lists of works presented in four different international conferences*. Retrieved December 27, 2004, from <http://www.mlrg.org>
- Nonaka, I., & Konno, N. (1999). The concept of Ba: Building a foundation for knowledge creation. In J. W. Cortada & J. A. Woods (Eds.), *The knowledge management book 1999-2000*. Boston: Butterworth-Heinemann.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies*

create the dynamics of innovation. New York: Oxford University Press.

Piaget, J. (1971). *L'epistemologia genetica.* Bari: Laterza.

Piaget, J. (1973). *La costruzione del reale nel bambino.* Florence: La Nuova Italia.

Rheingold, H. (1994). *Comunità virtuali: Parlare, incontrarsi, vivere nel cyberspazio.* Milan: Sperling & Kupfer.

Scribner, S. (1997). Head and hand: An action approach to thinking. In E. Tobach et al. (Eds.), *Mind and social practice: Selected writings of Sylvia Scribner.* Cambridge: Cambridge University Press.

Spiro R. J., & Jehng I. C. (1990). Cognitive flexibility and hypertext: Theory and technology for the nonlinear and multidimensional transversal of complex subject matter. In D. Nix & R. Spiro (Eds.), *Cognition, education, and multimedia:*

Exploring ideas in high technology (pp. 163-205). Hillsdale, NJ: Lawrence Erlbaum.

Taylor, R. (1980). *The computer in the school: Tutor, tool, and tutee.* New York: Teachers College Press.

Trentin, G. (2004). *Apprendimento in rete e condivisione delle conoscenze.* Milan: Franco Angeli.

Varisco, B. M. (2002). *Costruttivismo socio-culturale: Genesi filosofiche, sviluppi psico-pedagogici, applicazioni didattiche.* Rome: Carocci.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* Cambridge: Cambridge University Press.

Wenger, E. (2004). *Communities of practice: A brief introduction.* Retrieved December 27, 2004, from <http://www.ewenger.com/theory/index.htm>.

This work was previously published in Teaching in the Knowledge Society: New Skills and Instruments for Teachers, edited by A. Cartelli, pp. 33-53, copyright 2006 by Information Science Publishing (an imprint of IGI Global).

Chapter 7.8

Attitudes Towards ICT in Australian High Schools

Kaylene Clayton
Griffith University, Australia

INTRODUCTION

Information and communication technology (ICT) is integrated into almost every daily activity. Yet, few females today are choosing ICT based careers; a large percentage prefer to work in “pink collar” jobs such as childcare, education, and nursing. A recent report (Queensland Government, 2004) states that the average weekly earnings of full-time female workers in ICT, personal services, education, and health careers are \$883.30, \$513.10, \$802, and \$854.20 respectively. Furthermore, even though females consistently earn less than males, female ICT workers record the highest average earnings for all female occupations. Not only are females rejecting the financial rewards associated with ICT careers in favor of jobs that are seen to have a high human concern, they are also denying their voice in the creation and development of future technologies and applications. However, why are they shunning ICT study and careers? How does their educational environment and their perceptions of ICT impact ICT study and career choices? This article explores these

questions through the 2003 case study of Year 9 and 12 students, teachers and guidance officers at two co-educational schools in Queensland, Australia. Data was collected from 490 participants through questionnaires and six students and four teachers took part in interviews. Two theoretical frameworks, organizational culture and information quality, were used as a lens to view the situation.

BACKGROUND

The longstanding debate over whether females are not engaging in ICT careers because they are biologically not suited to technical work (essentialism), or that they have been nurtured to believe that they are not suited to technical work (social construction), continues to be contested. However, new theories, including Trauth's (2002) theory of individual differences, are emerging to address the flaws and gaps within these theories. The under-representation of females in ICT is also not a global phenomenon; there are cultural

pockets in the world, including Mauritius, where females represent a relatively equal proportion of the ICT vocational and educational cohort (Adams, Bauer, & Baichoo, 2003). However, it is a well-documented problem in Western cultures, including Australia.

Research shows that females are methodically guided away from technical fields during school through classroom culture, traditional gender roles and other societal pressures (Gorski, 2002). Some of the enduring ICT stereotypes are that ICT professionals are Caucasian males with antisocial tendencies (Countryman, Feldman, Kekelis, & Spertus, 2002; Güler & Camp, 2002) and that ICT is boring and “geeky” and involves working long hours in social isolation, (Joshi & Kuhn, 2001; Myers & Beise, 2001; Newmarch, Taylor-Steele, & Cumpston, 2000). Popular media has enabled mass reinforcement of these established and often undesirable ICT stereotypes and there is a distinct lack of both fictional and real ICT role models who are given media coverage (Multimedia Victoria, 2001). Job security is also important to senior school students (Multimedia Victoria, 2004). Today’s youth witnessed the “dot-com” boom and skills shortage followed by mass redundancies and unemployment in ICT during the bust. This episode was highly publicized by the mass media, but the recovering ICT job market has not been given the same level of publicity. According to the Oliver Group director, the technology sector grew almost 56% in the twelve months from March 2004 (Foreshe, 2005). Anecdotally, many students and their parents believe that the ICT job market is still depressed and express surprise when informed about the recovering market.

Many students lack information about ICT work and exhibit little understanding of the nature of ICT jobs (von Hellens, Nielsen, & Beekhuyzen, 2004). They do not know about established ICT occupational roles, such as being a computer scientist, let alone the new opportunities that are being created and thus do not know how their talents

and skills apply in that field (Jepson & Peri, 2002). However, describing the ICT area, including job roles and areas is a non trivial exercise, even for experts in the area (Spencer, 2003). Australian students are also receiving limited information about ICT subjects and choices available to them (Van Der Vyver, Crabb, & Lane, 2004). Students have been exposed to ICT integrated into the general school curriculum, but few have a clear idea of what is involved in ICT subjects (Sheard, Lowe, & Markham, 2001). Compounding the issue within vocational education, career advisors often admit to struggling to understand ICT jargon and job descriptions (Standley & Stroombergen, 2001) leading to the lack of confidence in giving ICT career advice (Multimedia Victoria, 2001).

The way that the ICT curriculum is introduced and the learning environment impacts on the ICT attitudes of students is of high concern. It is imperative that the curriculum provides future ICT students with coursework which interests both sexes whilst providing them with the appropriate skills to enter ICT career paths (Güler & Camp, 2002). Yet, many students report negative opinions of ICT specific subjects and general dissatisfaction with the ICT curriculum (Carey, 2001; Multimedia Victoria, 2001). These opinions could be partially because the predominant content of ICT subjects in schools involve word processing and spreadsheets (Downes, 2004) providing the students with a skewed perception of the true nature of ICT careers (Multimedia Victoria, 2001). ICT educators must not only focus on good teaching, but they must also evaluate whether the subject is seen to be challenging, useful and interesting (Mitchell, Sheard, & Markham, 2000). The ICT learning environment has a number of unique features including a predominantly male teaching cohort, who usually have a science or mathematical background, and a curriculum and associated assessment and exercises driven largely by masculine interests (Logan, 2004). Also, according to Carey (2001), teachers presently receive

little or no training in the ways that technology can be used to create an equitable, innovative and engaging learning environment.

IMPACTS ON ICT PERCEPTIONS

Organizational Culture

Culture is the product of a social environment and evolves through the course of social interaction (Hofstede, 1997, p. 5; Morgan, 1998, p. 130). Cultural influences can shape perceptions about ICT, how ICT is used, and in turn the potential entrants to vocational and occupational areas in ICT and related fields (Harris & Wilkinson, 2004). Allaire and Firsirotu (1984) created a conceptual framework to assist in the analysis of organizational culture that consists of three inter-related components: a cultural system; a socio-structural system; and the individual actors.

The cultural system is a system of shared and meaningful symbols, which is shaped by its surrounding society and organizational history (Allaire & Firsirotu, 1984). There were a number of symbolic artifacts specific to ICTs that were observed amongst the responses from teachers and students, including terminology such as “hacker,” “geek,” “nerd,” and “square” when talking about ICT workers. The students linked ICT success with these symbolic artifacts when 24% of Year 9 students and 41% of Year 12 students stated that it was necessary to be nerdy/geeky to be successful in ICT careers. However, these symbolic artifacts are commonly used in a negative social context and tend to deter students from engaging in activities that would have them labeled as such. Other common beliefs repeated in teacher comments were that computers are seen as toys for boys and tools for girls. Female teachers also identified with these beliefs and one commented: “[computers are] strictly a tool to be used, not to be aspired to.” If computers are continually

portrayed as something serious, rather than enjoyable, this may explain the reluctance of students to become involved in ICT. Students and teachers often regarded ICT subjects as being difficult with some students rejecting ICT subjects out of concern for their academic results and university entrance scores.

The socio-structural system consists of management strategies and policies and formal structures (Allaire & Firsirotu, 1984). All schools must comply to a certain level, with standardizing educational policies of the government, but the way that the curriculum is developed and delivered can affect the way in which the subject is viewed. The cost of providing and maintaining ICT resources and infrastructure is an issue and the lack of financial and physical resources affects the delivery of the ICT curriculum and how it is (negatively) perceived by the students and teachers. One teacher also felt that if a student was ICT inclined then that they would find alternative ICT resources outside of the school. Yet, in low socio-economic areas, many families still do not have access to computers at home and rely on schools and libraries to provide those resources. Many teachers and students complained about the quality and quantity of resources available, with only 25% of teachers at one school saying departmental budgets allowed the purchasing of adequate resources to deliver the curriculum. Teachers also commented that students sometimes cause further damage to broken computers out of frustration or boredom.

Personnel, classroom availability, and timetabling were other ICT resource issues that caused tension. Students were foregoing ICT subjects because of timetabling conflicts saying that “[ICT subjects] have to be sacrificed to fit other first priority subjects in.” Teachers also identified that ICT subjects were the most time consuming to prepare for. “It needs more preparation time because things change so rapidly ... I could go back to teaching chemistry tomorrow and yes, the

syllabus has changed fractionally, but the basic chemistry hasn't changed in 50 years and the level we teach at high school won't change." Another teacher also conceded that it was difficult to foster and maintain student interest in relation to ICT saying, "it's hard to interest them because they have computers and the Internet at home."

Individual actors bring their own experience, personality and legacy to an organization and depending on their status can contribute and mold reality (Allaire & Firsirotu, 1984). Students have their own motives in relation to whether or not they enroll in ICT study and factors influencing these motives include enjoyment of the area, career aspirations, and opinions of friends, family, and role models. When students were asked what influenced their career decisions, the top responses included family and friends, but also high on the list was TV shows. Most students found that ICT subjects were boring, but others planned to combine ICT with other interests: "... this is a way of doing music and technology at the same time." When students were asked about the most appealing factors for an ideal career, the top response was interesting work followed by high salary and working with/meeting other people. These factors recognize social, remuneration and lifestyle aspects of future careers and are generally opposite to what ICT is perceived to involve.

Information Quality

Individuals often have differing opinions, wants and needs, and as such, each individual's definition of quality may vary significantly (Garvin, 1984). Schools are required to teach a certain amount of core information, but the way that this information is taught will differ between different schools and teachers. A teacher reiterated this when asked whether the ICT curriculum prepares students for ICT careers: "Depends which school." Some schools do not offer compulsory foundation ICT subjects in Year 8, whilst others do. Consequently,

students who need to make informed decisions about subject selections in Year 9 and 11 may be disadvantaged at schools who do not offer these foundation subjects. Students also recognized the impact of foundation subjects on subject decisions in senior high school. Comments included: "in Year 9 we do Web pages and in Year 10 we do programming and that whole last semester of programming is like an introduction to IPT [a senior ICT subject]" and "you do math from Grade 1, but you don't do computer programming from Grade 1; you don't know what you are walking into."

Teachers are expected by society to have a wide range of knowledge, skills, and ability in their area of teaching. However, the rapid changes in ICT create problems for ICT teachers. Teachers also recognized the need for qualified ICT teaching staff. One teacher also told of his entry into the ICT classroom: "I arrived in my second school as a third year teacher and the computer teacher had gone away on leave for 6 or 12 months and they said, 'you're young, here is the computer room, you are teaching the class tomorrow' ... and that was my first introduction to computers." ICT teachers also recognized that the ICT curriculum was dated and lacked relevancy, possibly because of the limitations of subject texts. One teacher also commented that the senior ICT subject "is too narrow a context for the modern use of computers ...". Students also expressed general dissatisfaction with the ICT curriculum saying that it was boring and that theory outweighed the practical work. Another problem with ICT subjects in high school is that they are not a prerequisite for tertiary ICT study. Teachers and guidance officers also face difficulties with is the changing job roles in ICTs. As advisors, if they are not well informed, it is difficult to understand how they could give accurate, current, and reliable ICT career information to the students. Who is educating the students about their ICT career options?

FUTURE TRENDS

Investigation into the declining number of females entering ICT study and career paths has been underway for over two decades. Today, we are no closer to finding a solution to this problem, as we were twenty years ago. In fact, the decline of females entering ICT tertiary education is becoming worse over time. Previous studies, including this one, have investigated various points of view and factors that may influence female ICT career decisions. Some of the factors identified include national and organizational culture, lack of or poor quality ICT career information, societal influences, discriminatory work environments, practices and policies along with the need for appropriate ICT role models. Another complicating factor is that the world and the ICT industry are not static. If you add to this volatile mixture, the changing and individual needs of the girls, the puzzle becomes increasingly complex. While these studies have contributed by identifying these issues and making recommendations for change, some which have been instituted, this complex social problem has not been solved.

These factors, however, cannot be looked at in isolation. All things being equal, it would be expected that girls who are given the same information and experience the same social and cultural values and information, would have similar career goals and paths. However, this is not the case. Could it be that we are concentrating on the negativity of this problem rather than celebrating the positive outcomes that already have been achieved? Perhaps researchers in this area need to reverse the question and ask the individual girls already enrolled in ICT subjects and careers, what drew them to the area and what drives them to achieve and succeed. Additionally, individual personalities and academic abilities cannot be disregarded when investigating career choices and the declining female ICT cohort. Individuals have distinct personal likes and dislikes; it has to

be remembered that some females, and males for that matter, will never find ICT interesting, and it is an exercise in futility, to change them.

CONCLUSION

Although the ICT industry is known for its cyclic nature, people working in it are generally well remunerated and seen as being in a position of power and status because of the enormous role that ICT plays in business and everyday life. These benefits of working in the ICT industry, along with having a voice in the design and use of ICT, can impact positively on the quality of life and the lifestyles that women and their families experience. This study found that Australian girls are continuing to reject ICT careers partially due to negative perceptions and stereotypes. There also is a lack of adequate resources and trained ICT teachers passionate about teaching ICT, and students are frequently rejecting ICT subjects because they are seen as dull, boring and not meeting their needs. They are also rejecting the opportunity to work in ICT careers because of school experiences, the lack of accurate, meaningful, and timely ICT career information and positive role models. Finally, the influence of popular media on career decisions is an important area that should be exploited. Perhaps, in the future we may see shows about sophisticated and powerful women in ICT careers leading to increased ICT interest. We can only try.

REFERENCES

- Adams, J. C., Bauer, V., & Baichoo, S. (2003). An expanding pipeline: Gender in Mauritius. *ACM SIGCSE Bulletin*, 35(1), 59-63.
- Allaire, Y., & Firsirotu, M. E. (1984). Theories of organizational culture. *Organizational Studies*, 5(3), 193-226.

- Carey, P. (2001). *Girls and technology in the secondary school*. Perth, Australia: Catholic Education Office of Western Australia.
- Countryman, J., Feldman, A., Kekelis, L., & Spertus, E. (2002). Developing a hardware and programming curriculum for middle school girls. *ACM SIGCSE Bulletin*, 34(2), 44-47.
- Downes, S. (2004, June 25-28). *Into the new millennium: Why do students decide to study IT?* Paper presented at the Informing Science and Information Technology Education Joint Conference, Rockhampton, Australia.
- Foreshew, J. (2005, April 3). *IT jobs bounce back in March*. The Australian IT. Retrieved from <http://australianit.news.com.au/articles/0,7204,12722139%12722135E12715306%12722135E%12722135E%12722135E,12722100.html>
- Garvin, D. A. (1984). What does “product quality” really mean? *Sloan Management Review*, 26(1), 2-43.
- Gorski, P. C. (2002). How computers STILL cheat girls. *The Education Digest*, 68(3), 23-27.
- Gürer, D., & Camp, T. (2002). *Investigating the incredible shrinking pipeline for women in computer science—Final Report* (version 4). Retrieved February 16, 2003, from www.acm-w.org/documents/finalreport.pdf
- Harris, R., & Wilkinson, M. A. (2004). Situating gender: Students’ perceptions of information work. *Information Technology & People*, 17(1), 71-86.
- Hofstede, G. (1997). *Cultures and organizations: Software of the mind*. Sydney, Australia: McGraw-Hill.
- Jepson, A., & Peri, T. (2002). Priming the pipeline. *ACM SIGCSE Bulletin*, 34(2), 36-39.
- Joshi, K. D., & Kuhn, K. (2001, April, 19-21). *Gender differences in IS career choice: Examine the role of attitudes and social norms in selecting IS profession*. Paper presented at the ACM SIGCPR Conference, New York.
- Logan, K. A. (2004, June, 24-26). *A case for single-sex classrooms in computing*. Paper presented at the International Symposium GIST (Gender Perspectives Increasing Diversity for Information Society Technology), Bremen, Germany.
- Mitchell, M., Sheard, J., & Markham, S. (2000, December 4-6). *Student motivation and positive impressions of computing subjects*. Paper presented at the Australasian Computing Education Conference, Melbourne, Australia.
- Morgan, G. (1998). *Images of organization* (Executive ed.). San Francisco; Thousand Oaks, CA: Sage Publications.
- Multimedia Victoria. (2001). *Reality bytes*. Retrieved March 31, 2003, from <http://www.mmv.vic.gov.au/cvnewsletter>
- Multimedia Victoria. (2004). *Attitudes to ICT careers and study among 17-19 year old Victorians*. Retrieved March 15, 2005, from www.mmv.vic.gov.au/year12research
- Myers, M. E., & Beise, C. M. (2001, April 19-21). *Nerd work: Attractors and barriers perceived by students entering the IT field*. Paper presented at the ACM SIGCPR Conference, New York.
- Newmarch, E., Taylor-Steele, S., & Cumpston, A. (2000). *Women in IT—What are the barriers?* Retrieved April 7, 2003, from www.detya.gov.au/iae/analysis/womeninit.htm
- Queensland Government. (2004). *Profile Queensland women: A statistical snapshot*. Retrieved December 12, 2004, from http://www.women.qld.gov.au/Docs/Profile_Queensland_Women/Profile_Qld_Women.pdf
- Sheard, J., Lowe, G., & Markham, S. (2001, November 12-15). *Educating students in IT course options: An impact evaluation*. Paper presented

at the International Conference on Computers in Education, Seoul, Korea.

Spencer, S. (2003, February 19-20). *Can you do addition? Questioning the domain of IT*. Paper presented at the Australian Women in IT Conference, Hobart Tasmania.

Standley, J., & Stroombergen, L. (2001). *21st century women and understanding the future research report*. University of Nottingham Research Report. Retrieved February 17, 2003, from <http://www.e-skills.com/cgi-bin/cms.pl/95>

Trauth, E. M. (2002). Odd girl out: An individual differences perspective on women in the IT profession. *Information Technology & People*, 15(2), 98-118.

Van Der Vyver, G., Crabb, D., & Lane, M. S. (2004, June 25-28). *Factors influencing the decision to choose information technology preparatory studies in secondary schools: An exploratory study in regional/rural Australia*. Paper presented at the Issues in Informing Science and Information Technology, Rockhampton, Australia.

von Hellens, L. A., Nielsen, S. H., & Beekhuyzen, J. (2004). An exploration of dualisms in female perceptions of IT work. *Journal of Information Technology Education*, 3.

KEY TERMS

Essentialism: The belief that traits are biologically determined and do not vary between individuals or genders.

Guidance Officer: A person whose role in a high school is to assist students with career information and guidance, assess students with special needs and provide students with support and personal counseling.

ICT: Information and communication technology is a broad grouping of technologies which include IT and telecommunications. Areas incorporated include computer science, software development, the study of organizations and society, mobile telephony and networks.

ICT Role Model: A person who has an interest, background, or career in ICTs whose behavior, attitude, or achievements make them worthy to be admired or imitated.

Pink Collar Jobs: Jobs that generally have a female dominated workforce such as: nursing, cleaning, childcare, primary school teaching.

Social Construction: Hypothesizes about the way that we analyze and categorize our experiences that influence and form our understanding of reality in our own social context.

Symbolic Artifacts: A way of making things known by signs and symbols which can include language.

This work was previously published in Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 44-49, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 7.9

A Comparative Analysis of Online and Traditional Undergraduate Business Law Classes

Daniel J. Shelley

Robert Morris University, USA

Louis B. Swartz

Robert Morris University, USA

Michele T. Cole

Robert Morris University, USA

ABSTRACT

The trend in academia to online learning has gained momentum in the past decade, due in part to the cost of higher education, a changing student profile, lack of traditional classroom space and the recognition that distance learning has created a new paradigm of instruction. Universities wishing to maintain or expand enrollments need to be able to respond effectively to the educational

needs of working adults, students in the military and residents of rural communities as well as of other countries. Online (Internet-based) course offerings constitute a creative and increasingly popular response to these challenges. As more and more institutions of higher learning offer online courses, the question arises whether they are, or can be, as effective as courses offered in the traditional classroom format. Answering the question has been the focus of several studies.

Our study compared students enrolled in both online and traditional classroom versions of one business law course where all elements were the same except for the instruction format. The study found no significant difference between the two formats with regard to student satisfaction and student learning. The findings support earlier comparisons of online and traditional instruction modes

INTRODUCTION

Robert Morris University (RMU) in Pittsburgh, Pa., has continued to develop and offer an increasing number of online course offerings to meet the needs of working students, its traditional student base. In 1999, RMU offered 25 online courses. In 2006, the number of online courses grew to 220. With the elimination of the federal restriction on online education (the “50% rule”) in 2006, online course offerings can be expected to grow exponentially. Ensuring instructional quality and learning effectiveness while doing so will be the challenge.

RMU is a private university with an enrollment of approximately 6,000 students. Founded in 1921, the university has experienced rapid growth in the last two decades. It supports six schools, with the School of Business being the largest. A large number of undergraduate and graduate course offerings in this school have had online course development as a focus for several years. A number of courses are available to the students in both traditional and online formats. For the past 3 years, the course Legal Environment of Business (BLAW 1050) has been popular in both formats.

Overview of BLAW 1050

The course is designed to enable students to develop an understanding of the American legal system and attain a working knowledge of ethics,

contract law and consumer protection to a degree sufficient to be useful in business and consumer transactions. The course also helps students better comprehend the rules of conduct they can reasonably expect others to follow, as well as the conduct others may expect from them in various business situations. In this course, students acquire an awareness of their legal rights and responsibilities and gain the ability to apply legal principles to help solve business and consumer problems.

Online vs. Traditional Instructional Issues

In any discussion of online and traditional course delivery and development, some obvious and fundamental differences will be acknowledged by instructors. In general, the traditional course is taught in a structured classroom, the students are physically there, all instruction is in real time and the instructor is present for the class meetings. In the online format, the class is taught in a cybernetic environment, instruction does not have to be in real time, the students are not present in one place, and the instructor monitors most of the activity from a distance.

In defining distance education, Desmond Keegan (1996) identified six significant elements of online learning: separation of the teacher from the student; placement with an educational organization; use of technology to convey content and unite instructor with learner; two-way communication that facilitates student-initiated conversation; potential for face-to-face meetings for social as well as instructional purposes; and participation in an “industrialized form of education” (Keegan, 1996, p. 44).

The fundamental differences between online and traditional instruction pose some major challenges and concerns for course instructors and educational institutions. Online teaching forces the instructor to assume a new teaching role and necessitates reappraisal of the traditional teacher-student relationship. In fact, online teaching

requires the instructor to rethink and reorganize the existing teaching paradigm. The institution must find different ways to monitor the quality of instruction.

In most cases, conveying the basic content to students in the online format is easy to accomplish. A greater challenge is getting the instructional quality of the online course to match, or exceed, the instructional level of the traditional class. It is not sufficient for the online instructor to have an understanding of the technological skills and course development tools alone. He or she must have a strong sense of course design and an understanding of good pedagogy, as well. Good pedagogy is generally accepted by educators to involve: 1) a high level of learner activity, 2) a high level of student interaction, 3) a format for motivation, and 4) a well-structured knowledge base.

As online instruction gains acceptance, researchers have begun to test the proposition that online instruction can indeed incorporate the principles of good pedagogy and effective course design. Schulman and Sims (1999) studied students enrolled in five separate courses, each offered in both the online and traditional formats. Both sections of each course were taught by the same instructor. In their sample, they found that students learned as well online as they did in the traditional classroom environment. This particular study compared the course assessments and final outcomes of both instructional scenarios.

In his 1999 book, *The No Significant Difference Phenomenon*, Thomas Russell reviewed 355 research reports, papers and summaries on the subject of online vs. traditional learning. He found no significant difference in grades, satisfaction or effectiveness when “e-learning” was compared to traditional teaching (Russell, 1999). R.C. Ryan’s study at the University of Oklahoma compared the online and traditional versions of the course entitled, *Construction Equipment and Methods (CNS 4913)*. The final grades for the two groups were not significantly different and survey results

indicated that students perceived no difference in the quality of the instruction (Ryan, 2000). Other studies have found little or no difference between online and classroom learning when such issues as race, gender, technological and academic backgrounds, and socioeconomic status were taken into account (Navarro & Shoemaker, 2000).

Yet, Rivera and Rice (2002) reported that while several studies (including Russell’s 1999 work) have demonstrated that online and traditional courses were found to be comparable with regard to cognitive factors (learning, performance and achievement), the same could not be demonstrated consistently with regard to student and instructor perceptions and satisfaction with online learning.

Our study relied on satisfaction surveys and grade comparisons to assess whether online instruction was as satisfactory as traditional instruction and if student learning were the same or better with online vs. traditional instruction in the area of business and, in particular, business law.

Online Business and Law Courses

Discussing the challenges to the instructor and developer of online law-related courses, Kathy Marcel noted that the best online courses were instructor-facilitated, student-centered and highly interactive (Marcel, 2002). The design of an online law course, as with the design of any online course, is critical. The instructor’s role is one of designing a learning experience and guiding students through the process. Marcel found that in fact, many law instructors tend to work very well with the facilitative aspect of good online course development. Marcel argued that because of the nature of their profession, law professors teaching online courses tended to expect students to be engaged and not merely passive learners. The suitability of teaching law courses online was even more evident, she found, with regard to upper-level law courses, because these courses themselves often rely on case studies, projects and Socratic dialog.

Suanpang, Petocz and Kalceff (2004) addressed the comparison of student attitudes when taking a business statistics course in the online and traditional formats. Working with 230 students (N=112 in the online format, and N=118 in the traditional format), both quantitative and qualitative data were analyzed. The study concluded that "... students taught online develop strongly positive attitudes towards learning statistics, which influence their learning and make understanding statistics easier for them than for students taught in the traditional mode" (Suanpang et al., 2004, p. 17).

Cassel (2003), after having taught law online for more than 6 years, concluded that online learning matched or exceeded traditional environments in several respects. In her experience with online learning, the level of student-professor and student-student interaction through asynchronous (threaded discussion) and synchronous (chat/e-mail) methods was higher than in the traditional classroom setting. Additionally, the various audio and video options enhanced the learning environment for students. Cassel also pointed out a consideration often overlooked as an advantage of the online format; that is, with online learning, classroom and classmate distractions, interruptions and basic annoyances are not present, thus allowing the learner to focus more completely on the subject matter and activities. Shelley concurs. His pilot study of RMU's move to place its entire core undergraduate history courses online demonstrated student satisfaction with the online format, course content, sequencing, as well as with the textbook (Shelley, 2005).

Both Cassel (2003) and Marcel (2002) describe the advantages of online instruction for effective legal instruction. Although focusing on the use of voice-recognition software to enhance online law courses, K.H. Miller (2004) also found that legal education, thoughtfully designed, could be delivered effectively online. Some would argue, as Kristine Ellis does in *A Model Class* (2000), that designing a law course requires going back

to the basics. That would mean constructing an online law program that would teach students how to formulate and deliver a legal argument and to analyze and systematize case decisions.

Why This Study?

Bernard, Abrami, Lou, Borokhovski, Wade, Wozney, Wallet, Fiset and Huang (2004) note in their analysis of studies comparing distance and classroom instruction that the value of such studies lay in their usefulness in determining the impact on desired outcomes, lending credibility to the innovation (online learning in this case) and providing focus for further developments.

The available evidence seems to indicate that, if carefully designed, an online course would offer a comparable, if not better, learning environment for students than the same course presented in the traditional format. However, little has been published on the online delivery of undergraduate business law courses. In a post-Enron environment, incorporating the principles underlying Sarbanes-Oxley into undergraduate law courses intensifies the need for effective instruction in business law. But is teaching business law online as effective as teaching business law in the classroom?

Weaver-Kaulis and Crutsinger (2006) cite considerations of accreditation, budget and accountability as stimulants in the increased attention on documentation of student learning beyond the traditional grading system and the impetus for faculty-driven assessment programs.

In their study of student performance, Frantz and Wilson (2004) note that the increased scrutiny of legislators and accrediting bodies, particularly in business schools, has intensified the need for research into determinants of success. Specifically, they remark on the lack of research on legal studies courses in business schools — "a surprising void given the importance of legal studies to business education" (Frantz & Wilson, 2004, p. 225). This

study seeks to address that void by examining the effectiveness of one core business law course taught both online and in the classroom.

Determining how well students are learning is critical in any educational setting. It is of particular significance to RMU's School of Business, which is in the midst of its Association to Advance Collegiate Schools of Business (AACSB) accreditation process. Measurement of student learning is central to the review of current course offerings and to the development of new ones. Student satisfaction with the learning environment not only contributes to student retention, but it also serves as a measure of faculty performance and pedagogical effectiveness.

Research Questions

This study looked at four research questions:

1. Does student satisfaction with the course overall differ significantly between the online format and the traditional class format?
2. Does student satisfaction with the instructor differ significantly between the online format and the traditional class format?
3. Does student satisfaction with the course structure differ significantly between the online format and the traditional class format?
4. Does student learning differ significantly between the online format and the traditional class format?

METHODOLOGY

Study Structure

The course examined was BLAW 1050, which is required for every business major at RMU. The course is offered in both the online and traditional classroom formats. For this study,

the same professor taught each section of BLAW 1050 surveyed, using the same textbook, required readings, activities, projects, exams, and assessment for both groups.

Comparative data was drawn from four online sections of the course (two in 2004, one in 2005 and one in 2006) and two traditional sections in the spring of 2005. Fifty-eight of the 64 enrolled students completed the online sections of BLAW 1050 (N=58), or 90.6%. Forty-six of the 49 enrolled students in the traditional sections completed the course (N=46), or 93.8%. The total number of students receiving grades for BLAW 1050 during the study period was 104 (N=104), or 94.5%.

Although student retention was not a focus of this study, it should be noted that of the 64 students enrolled in the online sections of BLAW 1050, six withdrew, for a retention rate of 90.6%. The retention rate for the traditional sections was higher, at 93.8%. Of the 49 who enrolled, 3 withdrew.

Course Design

The online sections of BLAW 1050 were developed using the eCollege format. RMU uses eCollege because it is considered to be a more student-friendly platform for e-learning than Web CT or Blackboard. All students taking an online course at RMU are required to complete the Online Learning Training Module prior to being registered for the class. All online sections of the course were developed and maintained by the instructor involved in this study. The online format employed available instructional tools, including digital drop boxes, document share areas, synchronous and asynchronous dialog, e-mail and online assessment. The textbook readings were enhanced and supplemented with lecture notes and illustrations of key points. The classroom sections of BLAW 1050 used the same syllabus as the online course and had the same assignments and assessments. The same topics used in the threaded discussions in the online

format were used in real time in the traditional classroom format. The online format of BLAW 1050 employs both asynchronous tools, such as threaded discussion, and synchronous tools, such as e-mail.

Sample/Participants

The study sample consisted of those students enrolled in the four online sections of the 2004, 2005 and 2006 BLAW 1050 courses and the two traditional sections of the same course in 2005 and who responded to the survey. Respondents from the online sections numbered 33 (N=33). Respondents from the traditional sections numbered 13 (N=13). The total number of participants for this study was 46 (N=46).

Instrumentation

A 24-question satisfaction survey with a five-point Likert scale (Appendix A) was distributed in each class. The survey was administered by the instructor after grading was completed. Participation was voluntary. Thirty-three of the 58 online participants responded, for a 56.9% return rate. Thirteen of the 46 students in the traditional courses completed their surveys, for a return rate of 28.2%. Total number of students participating in the survey was 46 (N=46). The higher rate of return from the students in the online courses might have been due to the ability to respond electronically vs. having to return the survey physically, as was required of students in the traditional classes.

Questions 1-13 applied to students both in the online course and in the classroom course and were answered by both groups. In addition, space was provided on the survey for comments or suggestions to enable both groups to make further observations on the content and quality of the courses.

Question 1 asked if the student felt he or she had learned the subject material. Questions 2 and

10 focused on the performance of the course instructor. Questions 3 and 4 focused on the quality of the selected textbook. (These survey responses were not included in the analysis.) Questions 5-9 and 11-13 dealt with issues involved directly with the course structure.

Participant responses from the online and classroom sections were aggregated and compared. Responses to question 1 formed the basis for comparison for Research Question 1. Responses to questions 2 and 10 formed the basis for comparison for Research Question 2. Responses to questions 5-9 and 11-13 formed the basis for comparison for Research Question 3. Questions 14-25 were designed specifically for the online students and were not asked of students in the traditional course. Final grades from the online and traditional classroom courses formed the basis for comparison for Research Question 4.

The structure of the survey allowed for both quantitative and qualitative data to be analyzed. The survey was available in a template to students who took the course online and in hard copy for students who took the course in the traditional setting.

The study used SPSS for data analysis. For each research question, an independent-samples t-test was run. Within the context of this study, "satisfaction" is defined as having met expectations as demonstrated by the student responses. "Learning" is defined as having acquired knowledge of the subject matter as evidenced by the course grades.

RESULTS

Research Question 1: Does student satisfaction with the course overall differ significantly between the online format and the traditional class format?

Aggregated mean score for the online sections 4.4242

Aggregated mean score for the traditional sections 4.6154

Please see Table 1.

Research Question 2: Does student satisfaction with the instructor differ significantly between the online format and the traditional class format?

Aggregated mean score for the online sections 4.5385

Aggregated mean score for the traditional sections 4.6154

Please see Table 2.

Research Question 3: Does student satisfaction with the course structure differ significantly between the online format and the traditional class format?

Aggregated mean score for the online sections 3.8920

Aggregated mean score for the traditional sections 3.8846

Please see Table 3.

Research Question 4: Does student learning differ significantly between the online format and the traditional class format?

Aggregated mean score for the online sections 2.9871

Aggregated mean score for the traditional sections 2.7609

Please see Table 4.

CONCLUSION

In their meta-analysis of the empirical literature comparing distance and classroom instruction, Bernard et al. (2004) found that the differences between the two modes of instruction were not substantive. They analyzed 232 studies measuring student achievement, attitude and retention. They found the effect sizes to be basically zero on all three measures and wide variability due in part to the disparity in the degree of rigor in the

studies analyzed. Some applications of distance education were better than classroom instruction; some were worse.

Our study found no statistically significant differences between the online and traditional instructional/learning formats with regard to any of the research questions. Student satisfaction with the course overall and with the instructor was slightly higher in the traditional classroom format than with the online format (mean scores of 4.6154 to 4.4242 and 4.6154 to 4.5385, respectively).

Student satisfaction with the course structure was slightly higher in the online format as opposed to the traditional format (mean scores of 3.8920 to 3.8846). The mean scores for student learning in the online courses were slightly higher than for those in the traditional classes (2.9871 to 2.7609). The results reinforce Russell's "no significant difference phenomenon."

Survey results also supported findings in the earlier work by Schulman and Sims and Ryan with regard to research questions 1-13 on student satisfaction with the course, instructor and course design of BLAW 1050. An independent-samples T-test was used to analyze the survey data for each of the questions. Survey responses were grouped according to purpose of the question (course, instructor, text, structure). Responses to the questions on the text were dropped because they were not relevant to the four research questions posed.

Student input under "Comments/Suggestions" was comparable, with the exceptions that students in the online courses also referenced the online features (positively) and that students in the traditional class setting commented on the outside assignments and exams. Seventy-two percent of the online students who participated in the study also added comments, compared with 69% from the students in the traditional classroom setting. The comments are included in Appendix B.

Study limitations include the sample sizes and the difference in participation rates. More than half (56.9%) of the students in the online courses

A Comparative Analysis of Online and Traditional Undergraduate Business Law Classes

Table 1. Student satisfaction with the course overall

| | T-test for Equality of Means | |
|---------------------------------|------------------------------|----------------------|
| | t N=46 | Sig. (2-tailed) N=46 |
| VAR0002 Equal Variances Assumed | -.885 | .381 |

Table 2. Student satisfaction with the instructor

| | T-test for Equality of Means | |
|---------------------------------|------------------------------|----------------------|
| | t N=46 | Sig. (2-tailed) N=46 |
| VAR0002 Equal Variances Assumed | -.460 | .647 |

Table 3. Student satisfaction with the course structure

| | T-test for Equality of Means | |
|---------------------------------|------------------------------|----------------------|
| | t N=46 | Sig. (2-tailed) N=46 |
| VAR0002 Equal Variances Assumed | .053 | .957 |

Table 4. Student learning

| | T-test for Equality of Means | |
|---------------------------------|------------------------------|-----------------------|
| | t N=104 | Sig. (2-tailed) N=104 |
| VAR0002 Equal Variances Assumed | 1.299 | .197 |

participated, while only 28% of the students in the traditional courses participated. This may be attributed to differences in the ease of participation between the two. The online students could respond electronically, while the students who took the course in a traditional environment needed to return the survey by mail or to the instructor.

Fowler (2005) suggests that experience with online instruction now leads to a different dis-

course, asking, “Are on-site courses as effective as online?” (Fowler, 2005, p. 1). This study does not really answer that question. Students in both the online and traditional courses liked the course, liked the instructor and felt they had learned the material. The final grades suggest that students in both the online courses and the traditional courses mastered the material equally well.

Clearly, additional studies comparing online with traditional learning environments, using larger samples, need to be conducted. Further investigation of online instruction vs. traditional classroom instruction of business law courses needs to be done before any definite conclusions can be made as to whether online should replace or simply supplement classroom learning. Both the Bernard et al. analysis (2004) and the Phipps and Merisotis study for the Institute on Higher Education Policy in 1999 argue that more rigorous studies need to be designed for researchers to be able to answer the question, "Is there a difference?"

REFERENCES

- Bernard, R.M., Abrami, P.C., Lou, Y., Borokhovskii, E., Wade, A., Wozney, L., Wallet, P.A., Fiset, M. & Huang, B. (2004). How does distance education compare to classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research*, 74(3), 379-439.
- Cassel, E. (2003, January). Teaching and learning law online. *Modern Practice: FindLaw's Practice and Technology Magazine*. Retrieved October 27, 2004, from http://practice.findlaw.com/archives/teaching_0103.html
- Ellis, K. (2000, December). A model class. *Training*, 37(12).
- Fowler, D. (2005, March). Are on-site courses as effective as online? *Online Cl@ssroom*, March.
- Frantz, P.L. & Wilson, A.H. (2004). Student performance in the legal environment course: Determinants and comparisons. *The Journal of Legal Studies Education*, 21(2), 225.
- Keegan, D. (1996). *Foundations of distance education* (3rd edition). London: Routledge.
- Marcel, K. (2002). Can law be taught effectively online? *JURIST*, December. Retrieved May 5, 2005, from <http://jurist.law.pitt.edu/lessons/les-deco2.php>
- Miller, K.H. (2004). The law catches up with distance learning. *THE Journal*, 31(7), 31-34.
- Navarro, P & Shoemaker, J. (2000). Policy issues in the teaching of economics in cyberspace: Research design, course design, and research results. *Contemporary Economic Policy*, 18(3), 359-366.
- Phipps, R. & Merisotis, J. (1999). *What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education*. Washington, D.C.: The Institute for Higher Education Policy.
- Rivera, J.C. & Rice, M.L. (2002). A comparison of student outcomes and satisfaction between traditional & Web based course offerings. *Online Journal of Distance Learning Administration*, V(III).
- Russell, T. (1999). *The no significant difference phenomenon*. Chapel Hill: Office of Instructional Telecommunications, North Carolina State University.
- Ryan, R.C. (2000). Student assessment comparison of lecture and online construction equipment and methods classes. *THE Journal*, 27(6).
- Schulman, A.H. & Sims, R.L. (1999). Learning in an online format versus an in-class format: An experimental study. *THE Journal*, 26(11), 54-56.
- Swartz, L. B. & Knapp, M. T. (1994). Designing environmental and consumer safe products for the 21st Century. *SAM Advanced Management Journal*.
- Shelley, D.J. (2005). Developing, implementing and assessing a university level online U.S. history course. In *Proceedings of the 8th IASTED International Conference on Computing and Advanced Technology in Education*, 312-314.

A Comparative Analysis of Online and Traditional Undergraduate Business Law Classes

Suanpang, P., Petocz, P. & Kalceff, W. (2004). Student attitudes to learning business statistics: Comparison of online and traditional methods. *Educational Technology & Society*, 7(3), 9-20.

Weaver-Kaulis, A. & Crutsinger, C. (2006). Assessment of student learning outcomes in FCS programs. *Journal of Family and Consumer Sciences*, 98(1), 74-81.

APPENDIX A. SURVEY

LEGAL ENVIRONMENT OF BUSINESS

Please answer each question based on the following scale:

5=Strongly Agree 4=Agree 3=Moderately Agree 2=Agree Slightly 1=Do not Agree

1. I feel I learned a great deal about the Legal Environment of Business 5 4 3 2 1
2. I feel that the instructor was well prepared for this course 5 4 3 2 1
3. I feel that the course followed the text book 5 4 3 2 1
4. I feel that the text was a good choice for the course 5 4 3 2 1
5. I feel that the overall layout of the course was easy to follow 5 4 3 2 1
6. I feel that the weekly assignments were fair and reasonable 5 4 3 2 1
7. I feel that there should be more outside assignments for this course 5 4 3 2 1
8. I feel that the quizzes that were given in the course were fair 5 4 3 2 1
9. I feel that the course examinations created anxiety 5 4 3 2 1
10. I feel that the instructor was accessible and easy to contact 5 4 3 2 1
11. I feel it was easy to respond and participate in discussions 5 4 3 2 1
12. I feel that I was able to concentrate and pace myself throughout the course 5 4 3 2 1
13. I feel that the course format allowed for easy interaction with my classmates 5 4 3 2 1

The following questions should be answered by **online students ONLY**:

14. I feel that the online quizzes and exams with the ability to review correct answers helped me understand the material 5 4 3 2 1
15. I feel that the threaded discussions added to the course quality 5 4 3 2 1
16. I feel that the curriculum in the course was well-organized and followed a logical progression 5 4 3 2 1

A Comparative Analysis of Online and Traditional Undergraduate Business Law Classes

17. I feel that the Announcements and e-mails set forth clear instructions and expectations 5 4 3 2 1
18. I feel that the instructor made it clear what work was required and what work was optional 5 4 3 2 1
19. I feel that quizzes are a beneficial part of an online course 5 4 3 2 1
20. I feel that the mini-lectures and text provide the appropriate information to achieve the goals set forth on the instructor's syllabus 5 4 3 2 1
21. I feel that the course "due dates" made it easy for me to plan my schedule 5 4 3 2 1
22. I feel that the Doc Sharing was useful and helpful to me 5 4 3 2 1
23. I liked that the e-mail responses from my instructor were private 5 4 3 2 1
24. I feel it is easier for me to learn in an online course than in an on land course 5 4 3 2 1
25. Besides this course, how many other online courses have you taken? _____

Comments/Suggestions

Other Comments

**APPENDIX B.
LEGAL ENVIRONMENT FOR BUSINESS
SURVEY RESPONSES TO "COMMENTS/SUGGESTIONS"**

24 of the 33 students who took the course online and who responded to the survey also added comments:

- Really liked the course; would have liked more threaded assignments and readings; text made for students; did not like "cute" names for cases
- Due date feature and private e-mail instructor responses a big plus; whether online is better depends on the subject matter
- Online worked well; learned more in threads and reading than in taking the exams
- Loved this class
- Really enjoyed the class
- Schedule for exams and quizzes too rigid for busy lives
- Enjoyed class and instructor; one of the best at RMU; learned a lot

A Comparative Analysis of Online and Traditional Undergraduate Business Law Classes

- One of the better classes; open discussions fostered by instructor incorporated current events into the course
- Too restrictive on access dates for assignments and exams
- Overall liked the course; problem with “proofreading” and phrasing of questions
- Pace good; glad did not use “chat” features; most organized taken; liked due date check list to plan ahead
- Enjoyed the course; learned a lot through the threaded discussions and weekly quizzes; online —fantastic, will continue to sign up
- Enjoyed course tremendously; first completely online course — hope others go as smoothly
- Enjoyed first online course very much; workload a bit heavy, but that is to be expected in a fully online course
- Loved this course; threaded discussions most beneficial; appreciated that assignments graded promptly; based on this online experience, wish could have taken entire degree online
- Informative instructor; course planner helped a lot — better than any syllabus; more interaction with this professor than with any other at Robert Morris; would recommend; tough class, need to pace yourself
- Need more time for essays for poor typists
- Enjoyed course; learned a lot, although grade did not reflect it
- Liked the way course set up. Easier to learn and to say what I wanted. “... am now even considering becoming a lawyer ...”
- Great instructor, accessible and willing to answer questions; first online course, felt very comfortable; threaded discussions forced creativity; course harder than originally thought “... wish I would have taken it in a classroom just so I could get more interaction and asked questions as they arose, but for my first online class, I think it went pretty well.”
- Course a success “... wish I had the option of taking another online class ...”
- Learned a lot; “... will remember a lot of the content due to the online class environment”; liked due dates, well organized; liked individual responses to threads; greatly enjoyed the class; online allowed for flexibility needed
- Great class; loved having it online
- Enjoyed doing the work in the online setting; able to concentrate more and work at own pace; test-taking better without other students around.

Nine of the 13 students who took the course in the traditional classroom setting who responded to the survey also added comments:

- Really enjoyed the class; not easy, lot of information; only suggestion would be to add some visual aids
- There should be more outside assignments for those who are not great test takers; that would allow for more points while grasping the material
- Appreciated the abridged book; text and instructor informative; homework manageable; outside assignments not necessary, am a good test-taker
- Within time limits, course taught very well; basic understanding of the law; easy to follow using the book; professor’s knowledge of real-life situations made it easier to follow

A Comparative Analysis of Online and Traditional Undergraduate Business Law Classes

- Really enjoyed the class; exams were difficult since the questions were long and needed to be reread; should be more assignments to compensate for the exam grades
- Course not that hard; lot of reading and studying; one of the best classes so far — enjoyed it thoroughly
- Really liked the class; learned a great deal and was challenged; material interesting, examples helped; still remember a great deal of what was taught
- More out-of-class assignments to add to the experience and ability to retain the information and would eliminate the anxiety of cramming for an exam
- Had to study a lot, but remember pretty much.

This work was previously published in International Journal of Information and Communication Technology Education, Vol. 3, Issue 4, edited by L. Tomei, pp. 10-21, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.10

Concerns with “Mutual Constitution” A Critical Realist Commentary

Alistair Mutch

Nottingham Trent University, UK

ABSTRACT

The case for “analytical dualism” as a means of approaching sociotechnical action is presented as an alternative to accounts which tend to conflate agency, structure, and technology. This is based on the work of Margaret Archer, whose work is in turn located in the traditions of critical realism. Her commitment to analytical dualism, which stresses both the importance of time in analysis and the emergent properties of structure, is argued to give a firmer purchase on the notion of context than the alternatives based on, for example, the work of Giddens and Latour.

INTRODUCTION

I want to start from the premise that what concerns many researchers in this area is how best to conceptualise the nature of “context.” From the point of view of those researching informa-

tion systems (broadly constituted), the concern is to avoid what they perceive as being, at best, an over-emphasis on technical factors and, at worst, the charge of technological determinism. They are keen, therefore, to emphasise the importance of the organisational, social, and cultural context in situating the development and use of technological artefacts. In this they are joined by those studying information behaviour who are concerned with moving away from a simple model of an “environment” in which behaviours are selected “rationally” towards the ongoing interaction of context and action. In this endeavour, the notion of “mutual constitution” is seductive, and the seduction is reinforced by those whose concepts are turned to for support. For some, this is the actor-network theory (ANT) of Bruno Latour and others, where there is a strong emphasis on action embedded in networks. For those working in this tradition, the removal of the hyphen from “socio-technical” is a deliberate act designed to stress the ineradicable coupling of the social and

the technical. “Sociotechnical” action, therefore, represents the solution of the problem of context by its conflation into networks of actants. Not all analysts in this area, however, would wish to go so far, and so, as in other areas of the study of organisation, the theorist of choice is often Anthony Giddens and his notion of “structuration.” What is taken from this is the mutual constitution of structure and agency, where structures form the ever-present conditions for the production and reproduction of agency. The strength of such notions is their emphasis on the irrevocable interconnections between action and context, but their weakness, it will be argued, is a tendency to privilege action over context. That is, when we explore these approaches in a little more detail, we find that they do not help as much as we might like in the specification of context. These criticisms will be addressed briefly but, as they have been considered elsewhere (Jones, 1999; Mutch, 2002), the main part of the argument will be devoted to the presentation of an alternative approach. The contention is that ideas drawn from the philosophical tradition of critical realism, and specifically from the application to social theory by the sociologist Margaret Archer, are of much more value both in specifying what we mean by context and in conceptualising the relationship between context and action. This is, therefore, an act of what Basil Bernstein (1996) calls “secondary recontextualisation.” That is, the aim is to introduce some of the ideas and show how these can help existing approaches. Accordingly, after a brief introduction to some of the key tenets of critical realism, we look in a little more detail at what Archer has to say about the nature of structures (our “context”) and the relationship of structure to agency (our “action”). The key argument is that, whilst there is no society (and hence no technology and no information) without people, the challenge is to examine the interaction between the structures which people create (including information and technology) and the subsequent action in which people engage. These

more general ideas are then explored in the context of writings on organisations and technology. It is important to stress here that critical realism does not purport to be a substantive theory of either of these two domains; rather, it offers some conceptual clarity on ontological and epistemological issues, which can further help the development of domain-specific theories.

For Latour, the “classic” question of the relationship between agency and structure is a case of asking the wrong question. His focus is on the enrolment of a variety of actors (sometimes “actants,” to distinguish non-humans from humans) in networks of greater or lesser scale and scope (Latour, 1993). The consequence is an extremely helpful language for describing processes that, in the hands of the adept, can be illuminating, but can also lead simply to the production of more or less interesting stories. The particular value from ANT is the notion of “being specific about technology,” but what we tend to get is an excellent language for describing process with the fading of context into the background (Montiero & Hanseth, 1995). It may be for these reasons that rather more attention is paid to the work of Giddens (Walsham, 1992; Yates & Orlikowski, 1992). We need to be cautious here: it is not the purpose of this article to review the way in which Giddens has been employed, but we can take the comment of Hasselbladh and Kallinikos to stand in for many similar examples:

“It is not our task to defend structuration theory. However, we would like to observe that the analysis undertaken by Barley and Tolbert... does not have much in common with Giddens’ basic ideas.” (Hasselbladh & Kallinikos, 2000, p. 716; e.g., Phillips, 2003, p. 221)

What is it, however, that people seem to be drawing from Giddens? It would appear to be the notion that structure is important in forming the context which both enables and constrains action. A series of concepts are provided (structures of

Concerns with “Mutual Constitution”

signification, legitimation, and domination) which provide a more finely grained conceptualisation of structure. However, whether what people take from Giddens and what is actually in Giddens are the same is open to some question. This revolves around Giddens’ conception of structures as “memory traces” instantiated in action. This is a rather weak conceptualisation of structure, possibly weaker in practice than those who use it care to acknowledge (Jones, 1999). A rather large claim might be that in practice those who use Giddens are using the notion of structure in the rather stronger sense than Margaret Archer uses it. She has been one of Giddens’ most trenchant critics, but before turning to her work, we need to briefly explore some key tenets of critical realism, as this might be an unfamiliar set of ideas to many.

CRITICAL REALISM: AN INTRODUCTION

We need to be clear at the outset that critical realism is a philosophical tradition that sees itself as “under-labouring” for other theories in both the natural and social sciences (Sayer, 1992). For these reasons, it is strictly speaking incorrect to talk about a critical realist analysis of organisations, technology, information, or any other phenomenon. Rather, substantive theories that address these domains can use the resources for conceptual clarity (Cruickshank, 2003b). At its heart, critical realism is an endeavour concerned with ontology. The realism indicates that the tradition asserts that there is a reality independent of our knowing of it which has intransitive status. However, it rejects the notions drawn from what we might term scientific realism in the natural sciences, or positivism in the social sciences, that there is any direct access to this reality. Even in the natural sciences, where experimental closure can be reached in some cases, our knowledge of reality is not a reflection. Rather, it involves acts of interpretation at all stages, from observation through to theory

building. Much of our progress in the latter moves through the creative use of language, especially of metaphor (Lewis, 1999; Lopez, 2003). So critical realism makes bold claims about ontology, but is altogether more relaxed about epistemology. Here, there can be multiple contending ways of knowing. Whether one is better than the other depends on its relation to what it is that we seek to know, not on its internal features. Within these basic conceptions, critical realism argues for an ontology of depth. That is, it pays due attention to the emergent nature of phenomena. Thus, in the work of Stephen Rose (1993) on the brain, memory is a system property of the brain which emerges from material substance, but which is not reducible to particular parts of that material. Critical realism is, then, anti-reductionist in method and places emphasis on emergence and systemic properties at the relevant level of enquiry. It also suggests that we need to distinguish between the empirical, the actual, and the real. For critical realists, the empirical are simply surface sensations that are the product of deeper mechanisms. What actually happens may be disguised by these surface manifestations. However, the actual in its turn is produced by the real mechanism, and it is these mechanisms which analysts and scientists seek to explore. The object of study, therefore, should be the underlying mechanisms that produce surface manifestations, mechanisms which might not be apparent. They may, for example, only be activated in certain circumstances, or their impact may be confounded by the workings of counter-mechanisms (as noted later, we will often talk of “tendencies” rather than mechanisms in looking at the social world).

These propositions are derived in large part from the studies in the philosophy of science carried out by Roy Bhaskar (Collier, 1994). However, Bhaskar also has a considerable concern with human activity, and developed a Transformational Model of Social Activity which drew on the work of Giddens. This work has led to the emergence of an interest in his ideas in a number of domains

in the social sciences, with prominent figures being Andrew Sayer (2000) in geography and Tony Lawson (2003) in economics. However, the most trenchant critic of Bhaskar’s use of Giddens — and the theorist to develop the ideas in the most detail in the social domain — has been Margaret Archer. Archer is a sociologist of education who has developed since the 1970s a set of rich and complex ideas which found their fullest expression in a series of (to date) four books (Archer, 1995, 1996, 2000a, 2003). These are closely interlinked, but deal with separate aspects of the relationship between agency, structure, and culture. She terms this the “morphogenetic” approach — “morpho” being the element stressing change, “genetic” emphasising the importance of agency. There has been a move over the series towards a greater degree of concern with the nature of agency, but always with a strong focus on the objective characteristics of the context in which agency operates. In the comments below I am forced to simplify what is a complex body of work, with the twin aims of introducing the work (possibly sending people to the originals) and exploring how it might form a better set of concepts for the exploration of context than notions of mutual constitution.

Let us start with the nature of structures. Archer (1995) identifies two prevailing approaches to the nature of structure and agency. One is that which she terms “downward conflationism,” which she finds in traditions such as structuralism, where social action is, as it were, simply “read off” the nature of structure. In such approaches agency becomes a mere epiphenomenon, with agents merely the bearers of structure. In such a situation the task of analysts becomes simply to find the keys to unlock the code of structure, which once discovered will reveal all the answers. Those approaches which deploy forms of technological determinism might exhibit some of these attributes, where social consequences are seen to flow inevitably from the fact of technical implementation. The other dominant approach,

developed often in opposition to structuralist approaches, is one which places all the attention on the interaction of agents and sees structures as either irrelevant or, again, a mere transient by-product of action. Her targets here are those which operate under the broad rubric of “methodological individualism” and she has been particularly concerned to counter the claims of rational choice theorists (Archer, 2000b). These she would term “upwards conflationists” and these approaches would, in turn, be rejected by Giddens. His structuration theory is designed to avoid the false polarity engendered by either of the approaches we have outlined, but, Archer argues, in his formulations he falls into the trap of what she terms “central conflationism.” The problem here is that in eliding the differences between agency and structure, in arguing for their mutual constitution, Giddens removes the analytical purchase which can be gained from holding the two terms apart. Archer stresses the notions of emergent properties and temporality in arguing for a stronger conception of structure, which then leads to her argument for “analytical dualism.” Her argument is that, whilst structures are created by people, those people are not “those here present now.” That is, the structures that are produced by social interaction then take on objective status for future rounds of social interaction. Their emergent properties, emergent from but not reducible to the previous actions of social actors, have causal powers in shaping and enabling future projects. What do we mean here by “structure?” Archer suggests a number of components — roles, organisations, institutions, and systems — that are inter-related and have primacy, depending on the context of analysis. This allows us some purchase on the relationship between the local and the global. Archer (1996) also further elaborates her account by considering the relationship between structure and culture. She is concerned in her account of culture to explode what she terms the “myth of cultural integration,” the notion that culture presupposes an integrated and necessarily

Concerns with “Mutual Constitution”

harmonious set of relations, and suggests a need to analyse culture as a set of propositions about the world, some of which can be in logical contradiction with each other. We will take this notion of contradiction further below, but having presented an outline of the formation of structure (to use that as a shorthand just now for the combination of structure and culture), we have to consider the implications for agency.

Archer (1995) argues that for the purpose of analysis, we need to hold agency and structure apart. This “analytical dualism” is quite clear in recognising that concrete situations will involve elements of agency and structure in complex interactions. She suggests that the way of getting at such situations is to engage in the production of analytical narratives that aim to tease out the relationship between agency and structure through a series of what she terms “morphogenetic” cycles (the “morpho” referring to the potential for change, the “genetic” referring to agential involvement). In each such cycle we start with the prior structural conditioning, exploring how this shapes and enables social interaction. In turn, such interaction elaborates structures, either by changing them or, perhaps more frequently, reproducing and confirming them. In considering how structures form the context for action, we need to return to the logical relations of contradiction and complementarity. Such relations can exist within structures (such as within the institutions of law or the family), within cultures (such as contending ideas of the family), or between structures and cultures (such as when practices of family life are in distinction to theories about how that practice should be conducted). Archer is anxious to argue that the existence of logical contradictions does not necessarily mean a clash between social groups. Such contradictions may lie unnoticed and “unactivated” if there are no actors with the interest in deploying them. What such combinations of contradictions and complementarities give us (and Archer explores various combinations in considerable depth) are logics for situated action.

Such logics may not be picked up upon, perhaps because social groups lack the weight to be able to deploy them. They may suggest logics of action, but there is no inevitability about them. However, actors who chose differently will have to pay opportunity costs, and their choices may bring them to accept other logical connections which they had not appreciated. So, for example, one argument might be that certain assumptions about how to go on are inscribed into software (Melucci, 1996). This inscription then confronts those who use the software with a “natural” and relatively easy path to follow. However, they may choose to do otherwise and create innovative uses. However, such uses have opportunity costs in terms of the effort needed to, say, customise the software. In turn, these innovative uses form the context for future rounds of social interaction. However, this is to make some assumptions about the nature of social action and those who participate in it, and so we need to consider what Archer has to say about agency.

A prime concern in Archer’s work has been to counter both individualistic, rational choice models of agency and the over-socialised accounts that produce only “cultural dopes.” Her argument is that we need to consider more carefully what we take agency to be, and she suggests a tripartite division into persons, agents, and actors. She starts with the embodied person, emergent from but not reducible to their biological constitution. These persons are strong evaluators, able to form and pursue value-laden projects and to reflect on their progress towards them (Archer, 2000a). Such reflection, however, takes different forms, forms which Archer (2003) relates to modes of internal conversation. We all use, she argues, internal conversation to reflect on our projects, but the forms which such conversations take differ, and in differing affect our relations with the objective world of structure and culture that we face. This is to take a different line from Giddens (1991), whose emphasis is on the knowledgability of all actors, and from others, such as Bourdieu (1990),

who place a stronger emphasis on the shaping of dispositions to act. Archer suggests that there are potentially three categories of reflexivity, all with different impacts on the degree to which persons will collide with structures. Some she terms “conversational reflexives.” These rely on others to complete their internal conversations, and so they rely on a community of others who share their background assumptions. These people will avoid conflict with structures by seeking to steer away from it. Others are “autonomous reflexives,” who conduct their conversations with themselves and take a strategic approach. These form the social actors whose pursuit of projects will lead them into collision with structures, leading to structural elaboration or change. The third category is that of the “meta-reflexive” — persons who reflect on their own reflexivity. They are, argues Archer, society’s conscience, evaluating structure and culture against a moral yardstick and finding them wanting. (Archer recognises a fourth category, that of the “fractured reflexive,” who for some reason is not able to conduct a satisfactory internal conversation and is so condemned to remain a passive primary agent, at the mercy of buffeting forces).

Whilst these conversations and evaluations take place at the level of the person, they are clearly shaped by the category of agency. For Archer (1995) this is a collective category, and is one partially constituted by involuntary positioning. By unequally distributed chance, persons are positioned in various categories of “primary agency” — as men or women, young or old, and so forth. In some cases, action is not needed to attribute primary agency — the simple fact, Archer argues, of an aging population has an influence on wider structures, regardless of whether there are common bonds or perceptions of them amongst the elderly. However, of course, such bonds can emerge and can lead to “corporate agency,” which is when a group of agents perceives a shared interest in joint action to further what they seem

to have in common. Such agency then shapes the persons who engage in it, by, for example, giving them access to differential resources of language with which to conduct their internal conversations (Mutch, 2004). It also forms the preconditions for the role of the actor. This is the individual engaged in social action, shaped and enabled by objective constraints. This could be the occupation of a particular role, the expectations for behaviour in which have been shaped by previous occupants and by the emerging body of knowledge and ideas about how to go on in such a role. These suggest ways in which the actor should go on. The person is, of course, free to do differently, but only if the costs for so doing are paid.

This, then, is a broad sketch of Archer’s bold and sophisticated arguments about the relationship between agency and structure. To recap, they make strong claims about the nature of both structure and agency. They posit the existence of structures as possessing emergent properties which have causal powers. Such structures form the context in which action takes place. That action is undertaken by strong evaluators, with intentions to act formed by their value-laden moral projects. Such projects may cause them to collide with existing structures, reproducing them or challenging them in the process. Structures provide strong situational logics of action, but the simple existence of either contradiction or complementarity in these logics has no necessary consequence for action. Whilst such an approach still insists on the “mutual constitution” of “the parts and the people”, it suggests that we need to hold them apart in order to explore the inter-relationship between them over time. The stress is on the construction of analytical narratives that pay attention to the unfolding of cycles of interaction between agency and structure over time. It should be clear that this is a different perspective on “mutual constitution,” but what implications does this have for the study of organisations, information, and technology?

CRITICAL REALISM: IMPLICATIONS

We need to repeat again the warning that critical realism is not about replacing or creating anew substantive theories of particular social domains. It is entirely compatible with the reworking of existing theories, using the ontological clarity that critical realism claims to offer. We also need to recognise that Archer’s work is a work of social theory, in which the objects of attention are societies in the process of change over large tracts of time and space. However, she would claim that her approach could be deployed at a number of levels of analysis; part of the challenge for those interested in the analysis of organisations, information, and technology is to show how this might be done. It starts, argues Cruickshank (2003b), through the construction of domain-specific meta-concepts through the immanent critique of existing bodies of work. It is not the purpose of the present argument to construct such concepts, nor is there the space for such an endeavour. However, it is possible to point to some avenues for exploration. There have already been some rather limited initial forays, but it should be clear from them that the enterprise is in its infancy (Ackroyd & Fleetwood, 2000; Cruickshank, 2003a; Lopez & Potter, 2001). Two substantial bodies of work which offer material for these endeavours that are worthy of further review are labour process theory and the new institutionalism. A wide body of work has been produced under the stimulus of labour process theory, initially inspired by Braverman’s (1974) deskilling thesis, but often departing far from his original concerns. From this work has emerged the current focus on critical management studies, as well as much other valuable work on the nature of organisations. What unites much of this otherwise very disparate work is the focus on conflict and power in organisations. In recent years much of this perspective has been brought to bear on the expanding area of “knowledge management” (Prichard, Hull, Chumer, & Willmott, 2000). An example that

has considerable relevance for those exploring information and technology in organisations is the careful exploration of the impact of organisational politics on the deployment of Lotus Notes in a pharmaceutical company presented by Hayes and Walsham (2000). This is of importance when set against much of the literature on information use in organisations, when the context, as in Choo (1998), is only lightly sketched in and is simply seen as the placeholder for individual behaviour. However, for many of the excellent empirical studies emerging out of this critical tradition, the context is largely confined to organisational boundaries, with the broader social and cultural context being little explored. If we wish to seek examples of bodies of work that could potentially tie organisations more tightly into their broader context, then the work of the new institutionalists might be of some interest.

The new institutionalism in organisational analysis is a broadly North American phenomenon, with its roots in the rejection of rational choice models (Scott, 2001; Powell & DiMaggio, 1991). This gives it something of a shared agenda with some of Archer’s (2000b) concerns. What is also interesting is the way that in some incarnations it is concerned with relating what happens in organisations to broader forces, particularly in situating action in the context of taken-for-granted understanding about appropriate forms for action and structure. The problem is that in this endeavour, such forces become all powerful and the organisation becomes reified into a unitary body whose actions are largely determined by these taken-for-granted assumptions (DiMaggio, 1998). From the perspective of Archer’s morphogenetic approach, the problem is an excessive focus on culture, with institutions being conceived of as cognitive constructions shorn of their material and social dimensions. These forces are then given excessive weight, in an example of what she would term “downwards conflationism.” The space for agency, both within organisations and on behalf of organisations, is

radically reduced. Such criticisms are articulated by many who work within the parameters laid down by the tradition, notably in recent years by Lounsbury and Ventresca (2003) in their calls for a “new structuralism.” Whilst we might argue that any form of structuralism is a dangerous path to follow, the resources presented by Archer would seem to be valuable for these internal critics; in turn, the arguments presented by these critics are of value in suggesting some elements of a distinctly critical realist approach.

One concern is that, broadly speaking, these approaches give relatively little weight to the inter-twined problematic of information and technology. Archer, for example, has barely anything to say about technology, save for a brief mention in considering theories of post-industrial society (Archer, 1990). However, her approach of analytical dualism based on emergent properties seems to fit well with the perspective elaborated by Andrew Feenberg in his *Questioning Technology* (2001). Feenberg’s work appears to have little impact in our domain, judging by the paucity of citations, but he too starts by recognising the merits of accounts based on constructivist approaches. However, these, he argues, neglect to place their findings in a broader political context. Feenberg, as a political philosopher working in the tradition of Critical Theory, is anxious to provide an account which situates technology in a broader context in order to further a project of democratising communicative practices (Feenberg, 1991). Now, we might recognise a wide range of problems with this project, particularly its reliance on Habermasian idealism, but for our current purposes, the interest is in Feenberg’s account of the nature of technology, in which he argues for a two-level model, which can be recast in the form of analytical dualism. In this case, what is important is to pay equal attention to the constitution of technologies and their implementation in practice, which can be best done by holding the two apart. For Feenberg, the two moments

are “primary instrumentalisation”, which has to do with the constitution of the artefact, and “secondary instrumentalisation,” which has to do with realisation. For each, Feenberg suggests a number of attributes.

For the process of constitution, Feenberg suggests that there is a process of the decontextualisation of some features from their original context so that they can be integrated into a technical system. This depends in turn on reductionism, in which “de-worlded things are simplified, stripped of technically useless qualities, and reduced to those aspects through which they can be enrolled in a technical network” (Feenberg, 2001, p. 203). This enables the object to be considered as an autonomous one, subject to technical laws. This then gives the artefact its seemingly purely technical quality; it has been rendered as such by a process which returns it back to the world as seemingly being not of it. However, in order to be part of that world again, the artefact has to be part of a social process that is more familiar to accounts given from, for example, actor-network theory, with Feenberg using terms such as “enrolment” to construct his account of realisation. For example, he notes:

“To function as an actual device, isolated, decontextualised technical objects must be combined with each other and re-embedded in the natural environment. Systematisation is the process of making these combinations and connections, in Latour’s terms, of ‘enrolling’ objects in a network.” (Feenberg, 2001, p. 205)

He also suggests moments in this process of mediation and concretisation. In mediation, ethical and aesthetic considerations supply new qualities to the technology which help to accommodate it to the new context. In concretisation, the technologies are combined with working practices to form new ways of working — ways of working that are clearly a prime concern of those working in this

Concerns with “Mutual Constitution”

domain. Feenberg’s approach is then an attempt to combine what we have learned through processual views of technology and a concern with the broader context. From the perspective of critical realism, the concern is not with the account of technology, which seems helpful, but with the legacy of Critical Theory. Here again, the ideas of Archer can form a more robust view of structure, but Feenberg’s work provides resources which could help to repair the gap caused by the lack of consideration of technology. The importance here is in the emphasis on both the objective character of the technology as it appears to the user and the potential for reinterpretation in the course of social action.

CONCLUSION

I have argued that ideas derived from critical realism, and in particular the morphogenetic approach of Margaret Archer, have a considerable amount to offer students of organisation, information, and technology. Whilst such ideas start from the premise that it is human activity that is central to the creation of society, they offer a better approach to the intertwined relationship of information and technology than rather vaguer notions of “mutual constitution.” They do so by offering a stronger conception of structure than, for example, Giddens. By using the notion of emergent powers and stressing the centrality of time, they draw a stronger picture of structure and culture, forming an objective context that humans face in their engagement in social action. However, persons can choose — based on their strong evaluation of their personal projects as value laden — to confront or shy away from such structures, although they cannot avoid their implications entirely. As agents, such persons are placed involuntarily in particular positions, positions which shape their interests and resources. Deploying these resources as social actors, they

can act in ways other than their interests and the logic of their situated action would suggest, but only if they are prepared to incur the opportunity costs of their actions. Such is only a brief sketch of the richness and complexity of these ideas. It needs to be stressed that ideas such as these are still under development and elaboration in their home domain of social theory. Their application in the realm of organisations is in its infancy, but such an application is not a question of starting from scratch. Rather, I have tried to point to some existing ideas and approaches which would form a part of any more fully formulated perspective. The work of formulating such a perspective continues, but what can we say at this stage that it offers students of information and technology?

At a very simple level, we could argue that more attention to these ideas would help in sensitising researchers to certain aspects of context that they ought to be aware of. The conceptual clarity offered by the stronger sense of structure would seem to gel better with the way that researchers seem to conceive of structure in practice than notions drawn from Giddens. However, theories also carry with them logical entailments that go further than sensitisation (Stones, 1996). For critical realism the aim of research is the uncovering of the causal powers that are at operation, albeit that in the human domain we would express these as tendencies rather than as laws. We would also be tentative in our approach, recognising that our conclusions, in open systems, can only be corrigible and provisional. However, we would lay a particular stress on the importance of time. To construct an analytical narrative which seeks to explain the tendencies at work, we need to explore a sufficient stretch of time. A criticism of much work that focuses on implementation would be the timescale of the research. This would be in two aspects. One would be that the period examined before the particular focus of the research is relatively short. From the discussion above, it is clear that this period needs to be

long enough to be able to appreciate the shaping of the context that action takes place in. Secondly, insufficient attention is often paid to the period of social action itself and to the subsequent structural elaboration. Often this is because the pace of change at different levels of analysis is compressed, with the impression being given that taken-for-granted social practices change at the same pace as organisational routines (Barley & Tolbert, 1997). Social realism can help us here with its notions of stratified reality and careful attention to definitions. However, even at the level of situated action at the micro level, our analyses are often too quick to conclude that a particular instantiation is a “success” or a “failure,” when we are only looking at a brief snapshot. Given that we are aware of the plasticity of technology and the creative ability of users, albeit it within more or less strong contexts, we need to allow time to unfold to be able to see if what we are recording are durable effects or mere growing pains.

REFERENCES

- Ackroyd, S. & Fleetwood, S. (2000). *Realist perspectives on management and organisations*. London: Routledge.
- Archer, M. (1990). Theory, culture and post-industrial society. In M. Featherstone (Ed.), *Global culture* (pp. 97-119). London: Sage Publications.
- Archer, M. (1995). *Realist social theory: The morphogenetic approach*. Cambridge: Cambridge University Press.
- Archer, M. (1996). *Culture and agency. The place of culture in social theory*. Cambridge: Cambridge University Press.
- Archer, M. (2000a). *Being human: The problem of agency*. Cambridge: Cambridge University Press.
- Archer, M. (2000b). Home economicus, Homo sociologicus and Homo sentiens. In M. Archer and J. Tritter (Eds.), *Rational choice theory* (pp. 36-56). London: Routledge.
- Archer, M. (2003). *Structure, agency and the internal conversation*. Cambridge: Cambridge University Press.
- Barley, S. & Tolbert, P. (1997). Institutionalization and structuration: Studying the links between action and institution. *Organization Studies*, 18(1), 93-117.
- Bernstein, B. (1996). *Pedagogy, symbolic control and identity: Theory, research, critique*. London: Taylor & Francis.
- Bourdieu, P. (1990). *The logic of practice*. Cambridge: Polity.
- Braverman, H. (1974). *Labour and monopoly capital: The degradation of work in the twentieth century*. New York: Monthly Review Press.
- Choo, C.W. (1998). *The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions*. New York: Oxford University Press.
- Collier, A. (1994). *Critical realism: An introduction to the philosophy of Roy Bhaskar*. London: Verso.
- Cruickshank, J. (2003a). *Critical realism: The difference it makes*. London: Routledge.
- Cruickshank, J. (2003b). *Realism and sociology: Anti-foundationalism, ontology, and social research*. London: Routledge.
- DiMaggio, P. (1988). Interest and agency in institutional theory. In L. Zucker (Ed.), *Institutional patterns and organizations: Culture and environment* (pp. 3-19). Cambridge, MA: Ballinger.
- Feenberg, A. (1991). *Critical theory of technology*. New York: Oxford University Press.

Concerns with "Mutual Constitution"

- Feenberg, A. (2001). *Questioning technology*. London: Routledge.
- Giddens, A. (1991). *Modernity and self-identity: Self and society in the late modern age*. Cambridge: Polity.
- Hasselbladh, H. & Kallinikos, J. (2000). The project of rationalization: A critique and reappraisal of neo-institutionalisation in organization studies. *Organization Studies*, 21(4), 697-720.
- Hayes, N. & Walsham, G. (2000). Safe enclaves, political enclaves and knowledge working. In C. Pritchard, R. Hull, M. Chumer, & H. Willmott (Eds.), *Managing knowledge* (pp. 69-87). Basingstoke: Macmillan.
- Jones, M. (1999). Structuration theory. In W. Currie & B. Galliers (Eds.), *Rethinking management information systems* (pp. 103-135). Oxford: Oxford University Press.
- Latour, B. (1993). *We have never been modern*. Hemel Hempstead: Harvester Wheatsheaf.
- Lawson, T. (2003) *Reorienting economics*. London: Routledge.
- Lewis, P. (1999). Metaphor and critical realism. In S. Fleetwood (Ed.), *Critical realism in economics: Development and debate* (pp. 83-101). London: Routledge.
- Lopez, J. & Potter, G. (2001). *After postmodernism: An introduction to critical realism*. London: The Athlone Press.
- Lopez, J. (2003). *Society and its metaphors: Language, social theory and social structure*. London: Continuum.
- Lounsbury, M. & Ventresca, M. (2003). The new structuralism in organizational theory. *Organization*, 10(3), 457-480.
- Melucci, A. (1996). *Challenging codes: Collective action in the information age*. Cambridge: Cambridge University Press.
- Monteiro, E. & Hanseth, O. (1995). Social shaping of information infrastructure: On being specific about the technology. In Orlikowski et al. (Eds.). (1996). *Information technology and changes in organizational work* (pp. 325-343). London: Chapman Hall.
- Mutch, A. (2002). Actors and networks or agents and structures: A critical realist critique of actor-network theory. *Organization*, 9(3), 477-496.
- Mutch, A. (2004) Constraints on the internal conversation: Margaret Archer and the structural shaping of thought. *Journal for the Theory of Social Behaviour*, 34(4), 429-445.
- Phillips, N. (2003). Discourse or institution? Institutional theory and the challenge of critical discourse theory. In R. Westwood & S. Clegg (Eds.), *Debating Organization* (pp. 220-231). Oxford: Blackwell.
- Powell, W.W. & DiMaggio, P. (1991). *The new institutionalism in organizational analysis*. Chicago: University of Chicago.
- Prichard, C., Hull, R., Chumer, M., & Willmott, H. (2000). *Managing knowledge: Critical investigations of work and learning*. Basingstoke: Macmillan.
- Rose, S. (1993). *The making of memory. From molecules to mind*. London: Bantam.
- Sayer, A. (1992). *Method in social science: A realist approach*. London: Routledge.
- Sayer, A. (2000). *Realism and social science*. London: Sage Publications.
- Scott, W.R. (2001). *Institutions and organization*. London: Sage Publications.

Stones, R. (1996). *Sociological reasoning: Towards a past-modern sociology*. Basingstoke: Macmillan.

Walsham, G. (1992) *Interpreting information systems in organisations*. Chichester: John Wiley & Sons.

Yates, J. & Orlikowski, W. (1992) Genres of organizational communication — a structural approach to studying communication and media. *Academy of Management Review*, 17(2), 299-326.

This work was previously published in the International Journal of Technology and Human Interaction, edited by B. C. Stahl, Volume 1, Issue 3, pp. 60-72, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.11

Emotional Digitalization as Technology of the Postmodern: A Reflexive Examination from the View of the Industry

Claus Hohmann

Bergische Universitaet Wuppertal, Germany

ABSTRACT

This article introduces emotional digitalization as a phenomenon of future information systems. It argues that emotional digitalization is a progress that will lessen the gap between technology and humanity, as well as between computer and man. The author develops and verifies his assumption besides theoretical references arising from his experiences with the information technology within the BrandLand Autostadt.

INTRODUCTION

“The inmost force/which binds the world, and guides its course“ is no longer only a philosophical thought or religious voice, as in Goethe’s “Faust,” verse 382-383. But they are also not just bits and bytes, cable and monitors. The connection of these elemental substructures of modern civili-

zation first shows where the path must go. The functional elements of our daily life must subordinate themselves to our principles of thought and aesthetics. And they must also appeal to the people in an aesthetic, as well as communicative and sense. The modern, as a synonym for freedom and democracy, could thereby obtain a new dimension — to become an ethical entity. The technology of the third millennium must also define the new standards.

As the postmodern breaks down the barriers between art and pleasure, it breaks through the wall between technology and emotion. The aesthetic sensation from looking at, for example, a corporate homepage, accessible to all, suggests a fundamental change in the meaning which will be attributed to the presentation of technology today, when in direct comparison with the functional-rationalistic views of modern, purely informational Web sites. The Autostadt, Volkswagen’s new communication platform for marketing and

culture, is on several levels a culmination of different developments, which operate under the term “postmodern” and therefore contribute to theoretical discussion.

This radical change of the basic conditions of our life has put us on a path which will be indicated by a catchy, yet imprecise phrase: “post-modernity.” The rationalization of the modern is being counteracted by the pluralization of our culture and humanization of technology, which was demanded, but not achieved, by the modern (Giddens, 1995). With Anthony Giddens, whose critique is applied here, we regard “posthistory” as “a succession of immanent changes,” in order to face the prevalent conceptual dilemma (Giddens, 1995). One focuses the view to information technologies and sees that the humanization has an effect, particularly on aesthetics. And here alongside the desired effects lies a formidable danger: does IT go in the same ambivalent direction as the classic technologies, and will it give the manipulators of this world a leg up?

THE WORLD TODAY AND TOMORROW

The core problems of the industrial society (saturated markets, over-indebtedness, mass unemployment, etc.) demanded drastic mental reorientation and have at the same time uncovered innovation potentials. Spirituality and mental dimensions begin to replace the abstraction — the dream becomes a legend. The new technologies of the third millennium must also surrender to these new demands. With help from the most current technologies, we learn to tell stories. Contrary to the findings of Lyotard from the end of the great narrations of history¹, one could also speak about a fragmentation, which transfers this narration from people to technology, especially the digital technologies. With a new neologism, one speaks of the necessity of a “homuter society,” which is in a position to propitiate the people with (information)

technologies (Haefner, 1984). Haefner uses this term freely in order to verbalize his skepticism of the possibilities of future developments, which was obtained during the Cold War. However, we could also read it with a conscious hope.

Thus, a great possibility of the future lies in the development of technologies, stimulating creativity and inspiring thoughts. For example, the aesthetic layout of an intranet and the constantly used user interfaces eases the employee’s accessing of the media, prevents fatigue from using information and inspires emotions in the exposure to IT in everyday work. The effect is to state a higher degree of identification to the corporation, a more emotional, eventually better relationship to the employer and, ultimately and ideally considered, an increased labor efficiency accompanied by increased happiness. In this manner, IT of the postmodern can manage the reconciliation of the contradictions between technology and art, which are unimaginably present in the modern.

The IT of the present has the function of supporting the thoughts and actions of the individual and not to automate their work in order to eventually replace them. Comparably, the focus should be put on the installation of technologies that will save time. IT must be used to support work processes in order to optimize the concrete procedures and reduce the time requirements. Networked, Web-based systems with access points for all employees could be a first step. Important here are the user interfaces, which are adjusted to the work processes, aesthetically configured, self-explanatory, intuitive and can be understood spontaneously, thereby helping save time and increase room for further assignments.

The same exposed meaning, which electrification and mechanization had for the modern, could be digitization and computerization in the postmodern. The unreality, which challenges our terminology and understanding in increased measure, seems to be a display of something new in relation to the more palpable technological ad-

vances of the modern. We see, in this transition of information technology, a movement for a new understanding of our time, which can be labelled as “postmodern,” which is in this sense, in the shadows of abstract, fragmentary, and simultaneously emotional media. Thereby, no clearly differentiated epochs or outlined theories should be suggested — it should continue to deal with a change in our perception and “Lebenswelt.” In doing so, we understand postmodern as the “conscious of a socio-historical transition”² and not as a “meta-historical category” of each epoch.³

One of the basic requirements of this transition is the change from a technology that replaces the people to a technology that supports the people because they “understand” it. Thereby, it is imperative to restore various elements of IT, from management decisions and business processes down to connections with trade and commerce, to an original understanding of “experience.” The anchor of the complicated, indiscernible world in tangible lives can show in this manner how postmodernity can be made visible. The metaphor can be helpful to establish the meaning behind the experience.

POSTMODERNITY AND IT

The implementation and deployment of aesthetics in the technological area is a characteristic of the realization that IT is anchored fast in our world and no longer accepted as a modern achievement of an exceptional position outside our consciously experienced everyday life. This insight allows changed societal requirements to be inferred, but what about the above meaning is postmodern? Important is our understanding after the liberation from a conditioned past in a (self-) conscious act. As the technologies of modernity stand out due to their distinctiveness and are clearly contrasted with the people and their emotional world in which they coldly, precisely, and rationalistically fulfill

their duties, the IT of postmodernity goes down a different path.

With the integration of aesthetics and emotion, the digitization completes the circle and appears as a new quality. This is only successful because IT has already begun to reflexively examine and question itself and its success, and not in the least can be measured as a clearly calculated result of other factors. A basic requirement, therefore, is the development of technology that supports activities with which people are discontent as a result of the holistic pursuit of new goals, with the focus on the people. IT must be there for the people, not the other way around, and it must be aware of this. It must be noticeable, but not necessarily visible.

When the technologies in our new world function imperceptibly and no longer distort the view of the contents from the surface, new space for aesthetics and emotion is created. Technological progress can and must give the people more time, space and capacity for creativity and to unleash their imagination to make the fundamental, structural change perceptible and understandable⁴. In sociological terms, postmodernity seems to accompany the departure from middle-class feudalism. Information technology, which has been more or less privatized by the personal computer (PC), can also lead to further democratization and contribute to free communication, but it can also lead to chaos by making corporations unmanageable.

Thus, in the end the various technology images of “two cultures,” which are “Lebenswelt”- and system-orientated, according to Charles Percy Snow, should be brought into unison⁵. But in order to accomplish this, technology will be considered as a social phenomenon, with the help of metaphor and symbolization⁶. The symbols must orient themselves on the life-world, in that they become a part of the life-world. Just as modernity, with its dichotomies and ambivalences, can be said to be a failure in dialect, it is conceivable that the discussion in the postmodern, founded in the defi-

inition of difference⁷, will reveal endeavors leading to the harmony between the various positions. Contrary to Lyotard's assertion, unanswerable contradictions, which lie in the open availability of information, could strengthen the democratizing tendencies of information technologies⁸.

WITH THE EYES OF INDUSTRY

With the beginning of the new millennium, the world changes its vision. The blind trust of technology has a conscious practice of giving way to its possibilities. For example, Volkswagen's new corporate platform culture and marketing-the Autostaalt allows this change, which is currently being experienced by industry and society, to be precisely identified. With this example, we want to discuss the topic of postmodernity from the view of information technology, in order to stimulate further thoughts from the industry. Progress is nowadays something completely different, as it questions itself. Reflexivity and self-criticism take the place of the unconscious self-awareness of modern advances. Technology along with the information technology of modernity has undertaken a rapid development, which leaves the people and their imagination helplessly behind. In the physical sense, it is completely impossible to grasp IT, and an attempt at understanding it requires shifting the focus from a purely technical, modern-rational meaning to the interpersonal: addressing emotions via aesthetics, design and a process-logical functioning.

In practical industrial terms, the example of a "gated community," such as the Autostadt, is used here to illustrate this transformation and discuss postmodernity in the digital light of information technology⁹, in order to stimulate further ideas. The Volkswagen Group's Autostadt presents itself as a holistic concept, which includes all details in a complex structure: "There are no details in the execution"¹⁰. The mass tourism and amusement parks shape the leisure time culture of moder-

nity, but the Autostadt vastly transcends this. It integrates, specifically with the involvement of IT, the science of the world of industry with the goal of getting through to the people.

The privatization of technology has extended continually since the 1980s the influence and impact of IT to all areas of life, but especially to the areas of personal computers and music and television technologies, and also to all other levels of everyday life. With the Autostadt, the attempt is made to take on these societal changes and harmoniously unite them. In the Autostadt, the ubiquity of IT starts with the central purpose of the corporation, namely the delivery of new cars from the Volkswagen Group to its customers. The delivery process is completely supported by digitization. From the ordering to the handing over of the new Volkswagen to the customer, IT technologies are deployed to support the process. Already in the sales dialog, the employee, by making use of online applications, is enabled to have a virtually intimate discussion, having a positive impact.

Also presentations, such as the LupoShow (a dramatic laser show demonstrating the internal functions of an automobile via cross-section model), the SunFuelLab (a plant computer, which generates personally assigned biofuels) or the NavigationsSpiel (a virtual Labyrinth), are entirely digitally controlled. However, even internal support processes such as the lighting controls in the buildings and at events, the watering of the on-site parks and the digital menus in the restaurants are based on IT technologies and displayed systematically. In all of these areas, IT supports the employees, as it is deployed in order to assist them in effectively accomplishing their work and saving time.

Naturally, this all comes with limits: the Autostadt has not realized certain global interactivity, and their video arts suggest only a portion of the "Iconic Turn" of these years¹¹, but even with the example of the Autostadt, it's clear that the practical IT supports a form of the philosophy of

imagery. The Autostadt is thereby also active in the area of bringing to life aesthetic contents in the framework of its marketing scene, and in this lies a threshold experience.

Entities such as the Autostadt must have come into existence, not as a storm of individual thoughts, but rather as a logical consequence of the mentioned societal changes. The Autostadt is then an answer to the liberation of the postmodern individual, unique to the VW Group, and thereby not a blueprint that can be taken as a model for others. In doing so, what can the technology accomplish?

The industry serves here as an aesthetic-philosophical realization, and in the case of the Autostadt, the first deliberate BrandLand. The societal developments have encouraged, if not called for, the opening of more subtle theme parks. Others have just been, or are yet to be, opened: Daimler-Chrysler, the BMW-World and Dr. Oetker, just to name a few from the nearby surroundings. With the help of IT, the economy of aesthetics and art can be greatly improved.

The interfaces of the IT, acting as the window to foreign worlds, allow a new “cultural relocation” in the sense of “immobile mobility”¹², which places the people back in the focus. This liberation of the realm of reality expands, in a virtual manner, the consciously experienced world of the individuals, which would be impossible without IT. The people learn, experience, fulfill desires (and generate new desires) and expand their horizons via purposefully installed, yet unconsciously experienced, IT. The IT gives the phenomenology of perception¹³ a new, different touch. Multiperspective observation possibilities allow a concrete regard to objects and forms of interactivity. In this way, IT allows us to consider something from all sides, without forcing us to change our, or its, location.

The Autostadt is also a symbol for a trend. Corporations today present themselves differently. But what exactly is the Autostadt?

THE AUTOSTADT PROJECT

At a crucial interface, residing between the company and society, and with the old factory in the background in order to illustrate the coexistence of industry and BrandLand, the Autostadt is presented as a landscaped park with integrated, individually configured brand pavilions, where nature and technology are connected in an aesthetic manner so that the relevance of the corporate values are consciously absorbed by the people via the polyvalently applied presentations. The fundamental concept does not view art as a decorative end in itself, but rather as “a link between designed environments and the visitor experiencing them”¹⁴.

*The borders between art and presentation are blurred in this regard. Culture, understood as a variable system of seeking truth and orientation relating to a variety of artistic forms of expression, education, and living, is finally the added value, which allows the Autostadt to obtain visitors. Thereby, it shows itself as an innovative cultural platform in a new understanding of the marketing of experiences and events*¹⁵.

In this context, great significance is given to the development of innovative technologies, as the visible, evident use of digitization would inevitably undermine the functioning of the entire concept of the Autostadt based upon art and aesthetics. The organizational level of the Autostadt has therefore been deliberately made invisible and moved to underground tunnel systems and cable ducts. This form of understatement certainly gives the nearly ambitious technology a poetic touch. And just one step further are the Web-based information systems of the Autostadt with aesthetic aspects taking priority over self-portrayal. User-friendly IT gives the individuals freedom. Obvious complexity, by contrast, puts them in chains.

The glass auto-towers with their transparent aesthetics give the sublimity back to the

technology and astonish the observer, yet their architecture, infused with aesthetics, prevents fright from their size, which large technologies commonly provoke. And in the park, the straight line, as the enemy of everything living, is already conceptually forbidden. Intuition and emotionality operate in the place of regularization and rationalization. The Autostadt triggers as the identification location of a momentum, that which is required of good advertisements (Jung & von Matt, 2003). In doing so, it takes in the danger of a novel logo-centric aberrance, as the brand, for which the logo is emblematic, outshines the product (Klein, 2001). What happens here is the becoming of a metaphor. The BrandLand, with its architecture, becomes a metaphor for the contents, the values of a corporate group, and simultaneously for the manner in which the underlying IT will be deployed in the postmodern.

The implementation of these requirements in the framework of the superior philosophy of a customer-oriented, personal technology seems to be a success. With examples such as the CCC (Customer Care Center) and the IAS (Integrated Autostadt System), the changed awareness with regard to the integration of technology in the personal and organizational relationships allows itself to be realized. It becomes clear that the path to a new, more emotional technology is possible and necessary. The Autostadt takes the first important steps on this long path. Beginning with the installation of networking and dataflow, which are not visible anywhere on the grounds of the park, to the artistic arrangement of the exhibits, which utilize the technical possibilities of imagery, sound and movement without seeming intrusive, and even with the Internet presence, which gives preference to aesthetics over self-presentation, technology gains acceptance and meaning in the service to ideas and content.

THE DIGITAL HEART: INVISIBLE NETWORKS

Embedded in a concept of future-oriented service is where the heart of the Autostadt beats. The “digital heart” is thereby probably only a paradox. Technology no longer presents itself, but rather it puts itself in the service of the people and subordinates to them. Digital technology, originally considered to be cold and sober, should become communicative and people-oriented, only to appear on the surface when necessary. This new “warmth” of the digital world can be transferred from the visitor to the relationship to the Volkswagen Group, and serves as a branding strategy based upon emotions. This is related to the paradigm shift in which technology is expected, regardless of its importance, to adapt to the people and act in the background like a good butler or referee.

The beautifully maintained park should have a convincing effect on the guests, positively touching the senses. Together with the architecture, it subliminally conveys an important message of the corporation; perfection. Thereby, it should convey a constant ability to renew itself. This breaking-out of the limits of style has the goal of higher quality and better service: the guest should feel well taken care of, safe and understood. But in order to ensure that this “emotional work” produces the “right” emotions, the IT systems are trusted with the responsible task of ensuring that the customer is served flawlessly. As the computer, with its algorithmic, binary-coded thinking, simplifies the concept of rationality, IT in the postmodern society can once again combine information with emotion and come across with a humanized approach (Glaser, 1994). “The chip-revolution,” says Glaser, “with its algorithmic, binary-coded thinking, made the concept of rationality radically one-sided” —with the danger of dehumanization, but yet the postmodern society still combines information and emotion (Glaser, 1994).

With the example of the Autostadt, it is recognizable that steps for a realization of the postmodern are just passable in the area of IT. Whereas the postmodern is concerned comparatively little with reality, the people-conscious deployment of IT shows that the path to a new, more emotional technology is possible and necessary. Endeavours such as the Autostadt take the first steps on this long path. To a far greater extent than in previous decades, today one's wishes, demands and requirements constitute the parameters of successful process engineering.

The human aspect, particularly in such a service-oriented environment, assumes absolute priority. Thus, the Autostadt is not to be understood as a demonstration of technology; but rather as putting itself in the service of, and subsequently subordinating itself to, the people and the demonstration. In other words, without IT much of the Autostadt would not have been realizable, and thereby cannot be dismissed, but still presents itself in a gentle understatement. Due to this fact, it is explainable why the CTO (Chief Technology Officer) of the Autostadt is not an IT-specialist, but rather pursues psychodynamic and organizations-logical aspects in the exposure of IT in the Autostadt and thus sees his emphases in this area.

IT AND POSTMODERNITY IN THE AUTOSTADT

The Autostadt is, as the communication platform of the Volkswagen Group, the actual location of direct dialog between the producer and the consumer, the meeting point for the VW Group and its brands. The values of Volkswagen and the delivery of its automobiles will be "staged" here. The "stylistic device" of the Autostadt is infused with emotions and the urbanistic overall concept is based on the paradigm "structure and event." Every square meter is staged, and nature and

technology meet in a dialog, which is significantly supported by IT.

The IT in the Autostadt constantly produces new, surprising, emotion-awakening effects. For this reason, it is correct to assume that the actual core process of the Autostadt is the "process of generating feelings," which should then be subsequently visualized. Based on its philosophy, the Autostadt pioneers new and surprising trails in the world of IT. A paradigm shift takes place, which can rightly be referred to as "emotional digitization."

The concurrence of park, buildings, exhibits, staff and events results in a unity of the main components of emotional stimulants at the Autostadt. The conveyance of perfection is an attribute for which most individuals strive. In this sense, the charisma of the park positively influences the senses and subliminally conveys an important message of the corporate group. The buildings are also in accordance, as they portray a measure of perfection. They are constructed as entirely modern and stylistic. The visitor discovers methods of construction which are seldom, if ever, to be seen in normal surroundings. Beside the perfection, a new effect develops: the progress, orientation to new pathways, and the ability to continually reinvent itself.

With images, metaphors and sequences, the corresponding philosophies of the brands will be conveyed in the individual pavilions, giving further impulses to the above characteristics. In addition, in the events, the impossible will often be made possible with style. Further stylistic devices are also present in the perfection and progress. The Autostadt would like to inform the customer of new trends, acting as the trendsetter for the corresponding impulses.

For example, the POIs (Points of Information) are central components of the information landscape, but in the Autostadt, the POIs are elements of the Lebenswelt. The highly complex network computer with its front-end software allows itself to be intuitively understood and operated. The

guests are not only using systems, but they are experiencing technology. The POIs approach the visitor and they adapt to the user's size and position. Direct contact with the touchscreen can be seen as a metaphor for human interaction with the invisible network of information technology. As "emotional engineering," this connection can be understood as a link between the complexities of IT, human gestures and aesthetics. The physically present technologies undergo an emotional exchange with the intellectual techniques to allow the visitor interactive comprehension.

We strive for understatement — that is how we see post-modern IT, which is what makes it possible to "produce" emotions in this context in the first place. Digital technology must be communicative and people-oriented. The complex system structure clearly shows the workload involved in making IT "invisible." How is it possible to control something that is nearly invisible? Or to state it more clearly, how is the Autostadt itself capable of identifying possible malfunctions at the earliest point in time? Solutions have been found for this. With the bidirectionally media control system "Creston," the presentations and the technology are systematically monitored. Thus the technology becomes self-referential.

All employees of the Autostadt have access, via PC workstations or central lounges for the Web-based intranet, to all information, e-mail and the Internet. The technology would better be described as "experienced" rather than "used." This proves that the possibilities of digitization can be used and exploited to prepare the visitor for what they will experience. The invisible, unobtrusive digital elements can help make sure people will not be forgotten, even in a technological environment. Even the demand of philosophy for avant-garde art "within scientific-technical modernization rationality" can only be fulfilled where technology creates space (and scope) for art and aesthetics.

THE FUTURE OF IT

Has postmodernity found its end in the attempt to unify its differences? Have we at least reached a new level of the postmodern, with our humanization-oriented technology? And we continue to ask: where will information technology go from here? We no longer pull levers, we push a virtual button on a touchscreen and in the real world a reaction follows; a lamp goes on, a door closes or a lawn sprinkler starts watering. The same fascinating moments offered by technology in its early mechanical stages are now being provided by virtual technology. Is modernity simply repeating itself on a higher, more abstract level, or is this the beginning of something new?

In the interactive worlds of virtual media, something like a metaphor crystallizes itself out of reality. Due to IT, we experience and learn things that would normally be far out of reach. And what comes along are the new medias demand and encourage a strengthened inclusion of aesthetics in our daily life, and as each is more unobtrusive, its effect becomes stronger. Thus, the success of IT lies in its inclusion in our daily life, which must take place without obstruction and recognition.

The Internet presence of the Autostadt connects a demand of aesthetics to the POIs. The design quality, in which both Web-based systems will communicate informative content and interactive elements, has already been awarded prizes from, among others, New York and Cannes. In an intranet, which is (regarding its public sister) conceptionally and aesthetically behind in nothing, the employees can inform themselves about all-important concerns of the corporation. Standards will also be set here, almost unnoticeable to the public.

The formative characteristic of this aesthetic demand is not the eye-catching distinctive feature, but rather the opposite: the enjoyable appearance, the pleasing control of the view and the (visual) self-explanatory function and order, which lie

behind the contents. These aesthetics in the simulation of contents is effectively “unmodern” in a cultural sense, as a principal departure from rationalization. The people experience IT, they use it subconsciously. IT, as a medium, will be internalized and no longer understood and perceived as a “machine,” a tool, or means to an end. IT will become a medium for emotions and information. The visualized aesthetics of virtual worlds serve in the same way as the aesthetic architecture in the Autostadt.

One could also see the Autostadt as a metaphor, but it was not planned this way. It is a frame of reference for the characteristics and symbols of the postmodern world (not only for the area of IT). Everything – the automobile, as well as the art – will be presented in a different, atypical context. The character systems interlock virtually, and what results is a BrandLand as a liminal space, an area of the threshold, a location of change and the intervention – the barely apprehensible space between the world, which causes a threshold experience of the senses. A location, where we can foretell the future, without being able to see it.

What remains? The IT has taken a significant step: it has become a production factor; it has retreated to the background of business processes, because an IT-networked implementation is the prerequisite for “the social dimension of processes.” The workforce can no longer continue to work autistically. Interdisciplinary qualities such as commercial knowledge and organization talent are vital, at least in strategically decisive positions. The supporting IT does not serve as only the acceleration of postmodern phenomena such as globality and mobility, but it also serves – in a far more readily available manner – as the bridge between the aestheticizing and emotionalizing of our everyday world!

But it will not stop here. It is conceivable that IT in future mechanical engineering will not exist as a purpose in its own right, but will produce tools (systems) for the generation of products, to transfer knowledge. This forces everyday aspects back

in the place of revolution, and finally integrates IT permanently into our postmodern world. In spite of all the risks of abuse and autonomy that accompany IT, the possibilities are there.

REFERENCES

Albrecht, H. (1993). Technik – Gesellschaft – Zukunft. In H. Albrecht & C. Schönbeck (Eds.), *Technik und Gesellschaft (=Technik und Kultur Bd. 10)* (pp. 451-474). Düsseldorf, Germany: VDI-Verlag.

Bauman, Z. (1992). *Moderne und Ambivalenz: Das Ende der Eindeutigkeit*. Hamburg: Junius Verlag GmbH.

Bauman, Z. (1999). *Unbehagen in der Postmoderne*. Hamburger Edition, Hamburg, Germany.

Bhabha, H. (Ed.). (1990). *Nation and Narration*. London: Routledge, Taylor & Francis Books.

Bhabha, H. (Ed.). (2000). *Die Verortung der Kultur*. Tübingen, Germany: Stauffenburg Verlag.

Derrida, J. (1972). *Die Schrift und die Differenz*. Frankfurt/Main: Suhrkamp.

Eco, U. (1986). *Nachschrift zum Namen der Rose*. dtv, München.

Flusser, V. (1993). Digitaler schein. In Ders.: “Lob der Oberflächlichkeit. Für eine Phänomenologie der Medien” (= Schriften Bd.1), Bollmann, Mannheim, Germany. pp. 272-285.

Funke-Kloesters, B. (2004). *Autostadt GmbH: Marketing und Kultur*. Wolfsburg: Unveröffentlichter Text.

Giddens, A. (1995 &1990). *Konsequenzen der moderne*. Oxford: Suhrkamp, Frankfurt/Main.

Glaser, H. (1994). *Industriekultur und Alltagsleben: Vom Biedermeier zur Postmoderne*. Frankfurt/Main, Germany.

Haefner, K. (1984). *Mensch und Computer im Jahre 2000: Ökonomie und Politik für eine humane computerisierte Gesellschaft*. Birkhäuser Verlag AG, Basel, Boston, Stuttgart.

Jung, H., Jean-Remy von, M. (2002). *Momentum: Die Kraft, die Werbung heute braucht*. Berlin, Germany: Lardon Verlag.

Klein, N. (2001). *No logo! Der Kampf der Global Players um Marktmacht: Ein Spiel mit vielen Verlierern und wenigen Gewinnern*. München, Germany: Goldmann Verlag.

Kreuzer, H. (Ed.). (1987). *Die zwei Kulturen: Literarische und naturwissenschaftliche Intelligenz*. C.P. Snows These in der Diskussion”, dtv / Klett-Cotta Verlag, München, Germany.

Lyotard, J. (1986). *Das Postmoderne Wissen*. Wien, Austria: Passagen Verlag.

Lyotard, J. (1989). *Der Widerstreit*. München, Germany: Fink Wilhelm Verlag.

Maar, C., & Burda, H. (2004). *Iconic turn*. Köln, Germany: Dumont Literatur und Kunst Verlag.

Merleau-Ponty, M. (1966). *Phänomenologie der Wahrnehmung*. Berlin, Germany: Gruyter Verlag.

Schütz, A., & Luckmann, T. (1984). *Strukturen der Lebenswelt*. Bd.2, 197. Frankfurt/Main, Germany: Utb Verlag.

Snow, C. (1967). *Die zwei Kulturen: Literarische und naturwissenschaftliche Intelligenz*. Stuttgart: Klett Verlag.

Valery, P. (1924). *Eupalinos ou l'Architecte*. In *Architectures, edité par Gallimard*. Paris, France.

Zima, P. (1997). *Moderne – Postmoderne: Gesellschaft, Philosophie, Literatur*. (p.18). Utb Verlag, Tübingen, Basel.

ENDNOTES

- ¹ Cp. Jean-Francois Lyotard: *Der Widerstreit*. München, 1989. pp. 225-226: “Don’t ‘we’ explain ourselves anymore — and let it be with bitterness or rejoicing — the great explanation from the end of the great explanations? Is it sufficient that the thinking of the end of history thinks according, so that it remains modern? Or is post-modernity the business of an old man who searches through the trash can of usefulness for leftovers ... and therefore ... wins his promise of change!”
- ² Peter V. Zima: *Moderne – Postmoderne. Gesellschaft, Philosophie, Literatur*. Tübingen, Basel 1997. p. 18 – For Zima, “postmodernity“ is embossed by the crisis of the modern value system. – The term “Lebenswelt” encompasses the entire spectrum of an individual’s or society’s life, experiences and understanding.
- ³ Umberto Eco: Nachschrift zum “Namen der Rose.“ München, 1986. p. 77: “One could say that every epoch has had its post-modernity, as one had said that every epoch has had its Mannerism (and perhaps, I ask myself, is post-modern the modern name for Mannerism as a meta-historical category).”
- ⁴ Cp. Helmuth Albrecht: *Technik – Gesellschaft – Zukunft*. In: Helmuth Albrecht/Charlotte Schönbeck (Ed.): *Technik und Gesellschaft (=Technik und Kultur Bd.10)*. Düsseldorf, 1993. pp. 451-474. here p.452: “Airplane and automobile, radio and television, and especially the modern electronic based upon computers have effectively changed our world and society in the short time of only three generations.”
- ⁵ Cp. to C.P. Snow and the debate of his thesis, especially Helmut Kreuzer: *Literarische und Szientifische Intelligenz*. In: the same (Ed.): *Literarische und naturwissenschaftliche Intelligenz. Dialog über die ”zwei Kulturen“*. Stuttgart, 1969. pp. 128-142. – Cp. also

- Charles Percy Snow: Die zwei Kulturen: literarische und naturwissenschaftliche Intelligenz. Stuttgart, 1967.
- ⁶ Cp. Alfred Schütz/Thomas Luckmann: Strukturen der Lebenswelt. Bd.2. Frankfurt/Main, 1984. p.197: "The symbolic meanings are also – fixed to certain objects bearing significance – memories of experiences in atypical realities, which are brought from other states to the normal state of the everyday life."
- ⁷ Cp. Zygmunt Bauman: Unbehagen in der Postmoderne. Hamburg 1999. p.63. – Cp. also Zygmunt Bauman: Moderne und Ambivalenz. Das Ende der Eindeutigkeit. Hamburg, 1992. p.128: "Freedom, equality, brotherliness was the battle call of modernity. *Freedom, difference, tolerance* is the ceasefire formula of post-modernity. And when tolerance evolves into *solidarity*, the ceasefire could actually evolve into peace." – Ccp. also Jacques Derrida: Die Struktur, das Zeichen und das Spiel im Diskurs der Wissenschaften vom Menschen. In: the same: Die Schrift und die Differenz. Frankfurt/Main, 1972. pp. 422-442.
- ⁸ Cp. Jean-Francois Lyotard: Das postmoderne Wissen. Wien, 1986. p.152: "There is no scientific secret."
- ⁹ Vilém Flusser: Digitaler Schein. In: the same: Lob der Oberflächlichkeit. Für eine Phänomenologie der Medien (= Schriften Bd.1). Hrsg. v. Stefan Bollmann und Edith Flusser. Bensheim und Düsseldorf, 1993. pp. 272-285.
- ¹⁰ Paul Valery: Eupalinos ou l'Architecte. In: Architectures. Paris, 1924. p. 87: "Il n'y a point de détails dans l'exécution."
- ¹¹ Cp. for example Bazon Brock: "Quid tum". Was folgt aus dem Iconic Turn. In: Christa Maar / Hubert Burda (Ed.): Iconic Turn. Köln 2004. pp. 323-332.
- ¹² Cp. Homi K. Bhabha (Ed.): Die Verortung der Kultur. Tübingen, 2000. p.1: "Beginnings and ends are arguably the primary myths of the middle ages; but in *fin de siècle*, we find the moment of change, where time and space meet and complex configurations of difference and identity, of past and future, inside and outside, inclusion and exclusion procreate."
- ¹³ Maurice Merleau-Ponty: Phänomenologie der Wahrnehmung. Berlin, 1966.
- ¹⁴ Cp. for the following: Brigitte Funke-Kloesters: Autostadt GmbH: Marketing und Kultur. Wolfsburg, 2003. [unv.] p. 12.
- ¹⁵ Ibid. p. 12

This work was previously published in International Journal of Technology and Human Interaction, Vol. 3, Issue 1, edited by B. C. Stahl, pp. 17-29, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.12

Optimality–Theoretic Lexical Mapping Theory: A Case Study of Locative Inversion

One-Soon Her

National Chengchi University, Taiwan

ABSTRACT

Locative inversion verbs seem to share the same argument structure and grammatical function assignment (i.e., <th-OBJ loc-SUBJ>) cross-linguistically. This article discusses the nature of argument-function linking in LFG and demonstrates how the Lexical Mapping Theory (LMT) rendered in Optimality-Theoretic (OT) terms, where argument-function linking is governed by universal violable constraints that consistently favor the unmarked function, accounts for locative inversion straightforwardly. Within this OT-LMT, locative inversion is due to a universal morphosyntactic constraint, and language variation in locative inversion is due to the difference in its relative ranking. This account also offers a potential explanation for the markedness of the locative inversion construction.

INTRODUCTION

The locative inversion construction, as shown in Figure 1, cross-linguistically has similar characteristics in discourse information packaging, which allows the more familiar information to precede the less familiar information (Ackerman & Moore, 2001b; Birner, 1994; Cheng, 1983; Tan, 1991). Between the canonical construction in Figure 1a and the inverted form of 1b, along with the switch of focus from the locative to the theme, is the change in syntactic function assignment. An example from Chinese is given in the figure. The theme role in Figure 1a is assigned the subject function and locative an oblique function; the canonical linking is, thus, <th-SUBJ loc-OBL>. In the inverted Figure 1b, however, the locative is the subject, while the theme now occupies the object position (Her, 1990; Huang, 1993; Huang & Her, 1998; Tan, 1991).

Figure 1.

- a. Amei zuo zai tai-shang.
Amei sit at stage-top
'Amei is sitting on the stage.'
- b. Tai-shang zuo-zhe Amei.
stage-top sit-ASP Amei
'On the stage is sitting Amei.'

Figure 2.

- a. A-lendo-wo ku-ba-bwer-a ku-mu-dzi. (p.3 (2b))
2-visitor-2 those 17 SB-REC-PST-come-IND 17-3-village
a' 'Those visitors came to the village.'
- b. Ku-mu-dzi ku-ba-bwer-a a-lendo-wo. (p.3 (1b))
17-3-village 17 SB-REC-PST-come-IND 2-visitor-2 those
b' 'To the village came those visitors.'

Figure 3.

- a. Tai-shang kanqilai zuo-le henduo ren.
stage-top appear sit-ASP many person
'On the stage appears to be sitting many people.'
- b. Tai-shang you zuo-zhe henduo ren ma?
stage-top YOU sit-ASP many person Q
'Is it the case that on the stage was sitting many people?'

This <th-OBJ loc-SUBJ> argument-function "mismatch" was first identified and convincingly argued for in locative inversion verbs in Chichewa (Bresnan, 1994; Bresnan & Kanerva, 1989) and in English (Bresnan, 1989; Tan, 1991). Examples in Figure 2 are from Bresnan and Kanerva (1989).

The subjecthood of the inverted locative phrase tai-shang "stage-top" in Figure 1b is evidenced by the fact that it is a bare NP and occupies the usual position for subjects. This is further confirmed by the usual raising test. As shown in Figure 3, tai-shang "stage-top" is, indeed, the raised subject,

while the “demoted” theme in the post-verbal position, also a bare NP, must be recognized as the object (see Figure 3).

Chinese data thus further confirm Bresnan’s (1994) observation that cross-linguistically, locative inversion verbs share an identical argument structure <th loc> and the function assignment of the canonical <th-SUBJ loc-OBL,> in Figure 1a and the inverted <th-OBJ loc-SUBJ> in Figure 1b. This article aims mainly to account for the syntactic assignment of the argument roles in locative inversion verbs.

In any syntactic theory that aims at characterizing UG, it would be a considerable compromise to simply leave the syntactic assignment of argument roles to lexical idiosyncrasies (Pesetsky, 1995). This article focuses on how the syntactic assignment of argument roles is accounted for universally in the syntactic theory of Lexical Functional Grammar (LFG). This article is organized as follows. The first section discusses how argument-function linking is accounted for by the lexical mapping theory (LMT) in LFG. We will also demonstrate how certain versions of this theory do not account for the locative inversion data from Chinese and English straightforwardly. Furthermore, we will demonstrate how the theory can be improved upon for more consistency and computational efficiency. In the second section we propose a revised LMT formulated as declarative constraints in Optimality-Theoretic (OT) terms. The locative inversion data from Chinese is then accounted for in the third section. The fourth section consists of a discussion on the implications of this study, and the fifth section concludes the article.

The goal of the article is, thus, two-fold: (1) to come up with a universal lexical mapping theory based on violable declarative constraints in OT terms; and (2) to account for Mandarin locative inversion within this comprehensive OT-LMT.

LEXICAL MAPPING THEORY

LFG mainly posits three distinct, parallel planes of grammatical description: the argument structure, the functional structure, and the constituent structure (Bresnan, 2001; Dalrymple, 2001; Falk, 2001). The argument structure, or a-structure, consists of the predicate’s thematic and non-thematic argument roles, while the constituent structure, or c-structure, represents the configurational structure, which is the surface structure and allows no syntactic derivation. The functional structure, or f-structure, is the locus of grammatical information, such as grammatical functions (e.g., SUBJ and OBJ), case, person, number, gender, and so forth. The linking of these structures, each with a distinct formal nature, is constrained by correspondence principles. The lexical mapping theory (LMT) is the UG component that constrains the linking between a-structure roles and f-structure functions. The f-structure thus can be viewed as the interface level that links the a-structure and the c-structure. An argument role thus is linked to a grammatical function in the f-structure, which, in turn, is linked to a certain c-structure configuration. The lexical mapping theory (LMT) is the subtheory within LFG, which constrains the syntactic assignment of a-structure roles.

The pioneering work by Levin (1987) started the exploration of more principled accounts to replace the earlier stipulated function-changing rules in LFG. The first comprehensive formulation of LMT was proposed in Bresnan and Kanerva (1989). Since then, even though the essential underpinning assumptions have remained largely stable, the issue of argument-function linking, especially its precise formulation, has yet to be resolved (Butt & King, 2000). A number of different versions of the theory have been proposed (Ackerman, 1992; Ackerman & Moore, 2001a; Alsina, 1996; Bresnan, 1989, 2001; Butt, Dalrymple & Frank, 1997; Her, 1998; Huang, 1993;

Zaenen, 1987), among others. A review of these existing versions is clearly outside the scope of this article¹. Instead, we will outline mainly the version that seems to be the most widely circulated, found in Chapter 14 of Bresnan (2001), which, in turn, is based largely upon Bresnan and Zaenen (1990)².

The Theory of A-Structure

Conceptually, LMT consists of two components: the theory of a-structure and the mapping constraints. LFG assumes a universal hierarchy among a-structure roles in terms of their relative prominence in the event denoted by the predicate. This scale descends from the most prominent agent role to the least prominent locative role (Bresnan & Kanerva, 1989, 1992)³ (see Figure 4).

The most prominent role in an a-structure is called the “logical subject” and is designated \hat{O}

(pronounced “theta-hat”). In Figure 5, the two-place predicate break requires two argument roles in a-structure, agent (also \hat{O}) and theme; the three-place predicate put requires agent (again the \hat{O}), goal, and theme. Roles in a-structure, by convention, descend in prominence according to the thematic hierarchy.

Grammatical functions (GFs) that can be linked to argument roles are called argument functions. In Figure 6, LFG distinguishes argument functions (shown in bold) from non-argument functions (in italics).

It is important to note that in structure-oriented theories, such as Transformational Grammar (TG) and all its later incarnations, notions such as subject and object are secondary and are derived from structural configurations. In contrast, in relation-oriented theories, such as Relational Grammar (RG) and LFG, these are primary notions in syntax. However, in LFG, argument functions

Figure 4. Thematic hierarchy

agent > beneficiary > experiencer/goal > instrument > patient/theme > locative

Figure 5.

a. *break* < x y > (x = ag, y = th)
 b. *give* < x y z > (x = ag, y = go, z = th)

Figure 6.

TOP FOC SUBJ OBJ OBJ_θ OBL_θ⁴ ADJUNCTS

are further decomposed by two binary features: [r] (whether the function is restricted to having an argument role) and [o] (whether the function is objective) (see Figure 7).

In this system, each argument function is composed of exactly two features and natural classes can be identified, as shown in Figure 8. Furthermore, assuming the minus feature to be the unmarked value, a markedness hierarchy also can be obtained.

Similar to the intrinsic classification of argument roles in Bresnan and Kanerva (1989), Bresnan (2001) assumes that the underlying lexical semantics partially determine the syntactic assignment of different event participants. The universal classification shown in Figure 9 is

proposed to capture these predetermined choices of grammatical function assignment.

Cross-language variation in the syntactic assignment of a-structure roles is thus subject to the above universal constraints. The agent role, for example, as a non-patientlike role, is classified [-o] by Figure 9c and is thus not associated with OBJ canonically. Patient and theme roles, with the [-r] classification, are associated canonically with either SUBJ or OBJ. Under the assumptions in Figure 9, each role in the a-structure is assigned one and only one feature for syntactic function assignment, as morpholexical processes are not allowed to add syntactic features. Language-specific morpholexical operations are allowed, however, to alter the “lexical stock” of an a-structure by

Figure 7. Feature decomposition of argument functions

| | | |
|----|------|------------------|
| | -r | +r |
| -o | SUBJ | OBL _θ |
| +o | OBJ | OBJ _θ |

[±r] = (un)restricted [±o] = (un)objective

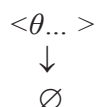
Figure 8. Markedness hierarchy of argument functions

SUBJ[-r -o] > OBJ[-r +o]/OBL_θ[+r -o] > OBJ_θ[+r +o]

Figure 9. Semantic classification of a-structure roles for function

- a. patientlike roles: $\theta \rightarrow [-r]$
- b. secondary patientlike roles: $\theta \rightarrow [+o]$
- c. other semantic roles: $\theta \rightarrow [-o]$

Figure 10. Passivization



adding, suppressing, or binding thematic roles (Bresnan, 2001). Passivization, for example, suppresses \hat{O} , the most prominent role, from syntactic assignment (see Figure 10).

In summary, the theory of a-structure renders the argument roles a given predicator requires into an a-structure representation, where roles are listed in a descending order in prominence, and each role is assigned exactly one feature specification for function assignment. The second component in LMT (i.e., the universal set of mapping constraints) then determines exactly which GF each role is assigned to.

Mapping Principles

Argument-function linking is subject to certain universal constraints; otherwise, each argument role is freely mapped onto any and all GFs with compatible features. Bresnan (2001) proposes the principles shown in Figure 11.

- a. Subject roles:
 - (i) $\hat{\theta}_{[-\theta]}$ is mapped onto SUBJ when initial in the a-structure; Otherwise,
 - (ii) $\theta_{[-r]}$ is mapped onto SUBJ.
- b. Other roles are mapped onto the lowest compatible function in the Markedness Hierarchy.

Figure 11. Mapping principles (MPs)

Two more well-formedness conditions (WFs) are needed in addition to the mapping principles in order to further constrain the non-deterministic argument-function linking: the function-argument biuniqueness constraint and the subject condition:

- Function-Argument Biuniqueness. Each a-structure role must be associated with a unique function, and conversely.
- The Subject Condition. Every predicator must have a subject.

The function-argument biuniqueness constraint ensures a strict one-to-one mapping relation between roles and functions. Computationally, it forces a deterministic assignment to an “unattached” GF between the two GFs with which a role is compatible. The subject condition serves the obvious purpose to ensure that one role in a-structure must be mapped to SUBJ. This condition also forces a deterministic choice when a role’s syntactic assignment is compatible with SUBJ and some other function and when all other roles in the a-structure, if any, are incompatible with SUBJ.

We demonstrate how three different types of verbs receive correct argument-function linking in the LMT just described. An unaccusative verb is given in Figure 12, while an unergative verb is illustrated in Figure 13. A typical transitive verb is given in Figure 14.

Figure 12.

Bing hua le.
ice melt ASP
'The ice has melted'

'melt < x >' (x = th)
SC: [-r]

S/O
MPs: S
WFs: S

Figure 13.

Mama xiao le.
Mama laugh ASP
'Mama laughed.'

'laugh < x >' (x = ag)
SC: [-o]

S/OBL_θ
MPs: S
WFs: S

Figure 14.

Amei mai changpian.
Amei sell record
'Amei sells records.'

'sell < x y >' (x = ag, y = th)
SC: [-o] [-r]

S/OBL_θ S/O
MPs: S O
WFs: S O

Improvement to the Conventional LMT

There are several areas at the theoretical level upon which the conventional LMT may be improved. First, the uniform underspecification of each role with exactly one syntactic feature can be relaxed to allow the formalism to be more expressive, yet without compromising its formal power. This classification scheme also may be too rigid in that it does not allow the possibility of agentive objects, which have been observed in several languages (Bresnan, 2001; Dalrymple, 2001). A desirable improvement to the theory is to allow such linking possibilities and, at the same time, be able to express the marked nature of such a linking as agent-OBJ.

As for the mapping principles, two disjunctions are observed. The first one is in the mapping principles of subject roles: a disjunction exists between $\hat{O}[-o]$ and $\theta[-r]$, each a stipulation for linking to SUBJ. In a more general theory of UG, it would be desirable not to include such function-specific linking conditions. Notice also the specification that $\hat{O}[-o]$ be the initial role in the a-structure. This principle thus must refer explicitly to the ordering in the a-structure⁵. The second disjunction is found between subject roles

and non-subject roles. For the former, a qualified role is mapped to SUBJ (i.e., the most prominent GF). However, on the contrary, non-subject roles must be linked to the least prominent compatible GF. A consistent principle for all roles would make a simpler and more general theory.

Finally, note that the Subject Condition in LFG states explicitly that every clause must have a subject. Similar constraints are also necessary in other syntactic frameworks; for example, the same is accomplished by the Extended Projection Principle (EPP) in Transformational Grammar and the Final-1 Law in Relational Grammar. However, as it often has been noted, such an inflexible stipulation may not be empirically accurate⁶. As cited in Ackerman and Moore (2001a), clauses may truly be without a subject (Babby, 1989; McCloskey, 2001). Bresnan (2001) thus hinted that this condition should perhaps be stipulated as a parameter. Again, ideally, a UG theory should be able to account for such subjectless clauses and their marked nature at the same time.

Assuming that the conventional LMT takes the same position advocated first in Alsina and Mchombo (1993) and does not allow morphological operations to add features, this version of LMT described previously also does not seem to account for locative inversion straightforwardly.

Figure 15.

Amei zuo zai tai-shang.
 Amei sit at stage-top
 ‘Amei is sitting on the stage.’

‘sit < x y >’ (x = th, y = loc)
 SC: [-r] [-o]

 S/O S/OBL_θ
 MPs: S OBL_θ
 WFs: S OBL_θ

Figure 16.

Tai-shang zuo-zhe Amei.
 stage-top sit-ASP Amei
 ‘On the stage is sitting Amei.’

‘sit < *x* *y* >’ (*x* = *th*, *y* = *loc*)
 SC: [-r] [-o]

 *O *S

As shown in Figure 16, the argument-function linking of <th-OBJ loc-SUBJ> in the locative inversion construction cannot be obtained, even though the canonical linking of <th-SUBJ loc-OBL,> is accounted for in Figure 16. Therefore, it would make sense empirically to allow morphological processes in the theory to alter syntactic assignments by adding features, as proposed in Zaenen (1987), Ackerman (1992), Markantonatou (1995), and Her (1998, 2003). The default locative classification employed by Bresnan and Kanerva (1989) and Bresnan (1989), which assigns loc[-r] when th is focused, likewise can be viewed as such a feature-adding morphological operation. In the fourth section, we also will discuss the advantages of feature-adding morphological operations from the standpoint of expressivity and formal power.

In the second section, we will propose an LMT in OT terms, thus an OT-LMT, that attempts to incorporate the desirable improvements suggested here.

AN OPTIMALITY-THEORETIC LMT

Optimality Theory has exerted great influence over the field of phonology; however, its appli-

cation in syntactic theory is still in its infancy. Recently, there have been some explorations within the OT-LFG framework (aka Optimal Syntax [Bresnan, 2000]). From the OT point of view, OT-LFG can be seen as OT with a universal LFG as GEN. From the point of view of LFG, a constraint-based grammatical framework, generalizations are interpreted in OT terms with (violable) constraints ranked in relation to one another (Sells, 2001). A number of studies have been carried out within this general framework (Mikkelsen, 2003; Sells, 2001). There also have been efforts to render argument-function linking in OT terms (Butt et al., 1997; Lødrup, 1999).

An OT-LFG Overview

Bresnan (2000) depicts the basic structure of OT-LFG, or Optimal Syntax, where LFG’s correspondence theory of parallel structures serves as a model for GEN. The standard OT-LFG assumes input to be “a (possibly underspecified) feature structure representing some given morphosyntactic content independent of its form of expressions” (Bresnan, 2000). An example is given in Figure 17, which assumes I saw her as its optimal form of expression. Note that in the input structure, <*x*, *y*> is the a-structure of see

Figure 17.

Input f-structure: *I saw her.*

| | |
|-----------------|--|
| | PRED 'see <x, y>' |
| GF ₁ | PRED 'PRO' PERS 1 NUM SG _x |
| GF ₂ | PRED 'PRO' PERS 3 NUM SG GEN D FEM _y |
| TNS | PAST |

and GF1 and GF2 are unspecified grammatical functions that argument roles with which x and y are associated.

The candidate set comprises pairs of f-structure and corresponding c-structure (and perhaps other corresponding planes of information) generated by the LFG grammar (Bresnan, 2000; Kuhn, 2001). For ease of presentation, I am simplifying the matter by taking the input to be an a-structure <x y>, and a set of <x-GF1 y-GF2> pairs as candidates in OT-LMT, which is a module within OT-LFG that constrains argument-function linking specifically. The candidates are evaluated by a universal set of lexical mapping constraints. The output is taken to be the most harmonic, or optimal, candidate pair; namely, the one with the least (serious) violations (Kuhn, 2001).

A Comprehensive OT-LMT

The OT-LMT proposed here modifies and expands the LMT component in Bresnan (2001) and is

based specifically on the particular formulation of LMT in Her (1997), Huang and Her (1998), and Her (2003), where syntactic feature assignments are simplified, and the multiple mapping principles and well-formedness conditions in the conventional LMT are all unified into a single consistent mapping principle. Here, I will take this further and reinterpret the entire simplified LMT as a set of Optimality-Theoretic constraints and thus offer a comprehensive OT-LMT.

Crucial to the theory are two prominence scales discussed earlier: a universal thematic hierarchy and a markedness hierarchy of grammatical functions (GFs) (see Figures 18 and 19).

Mapping constraints are classified into three categories: well-formedness constraints on argument roles, well-formedness constraints on argument functions, and constraints on linking. Note that we are ignoring athematic arguments in this article⁷. “R” is thus a thematic role in a-structure, and “F” is a corresponding grammatical function. We first examine the well-formedness

constraints on the representation of argument roles (see Figure 20).

UniqRol ensures the uniqueness of each and every role in the a-structure and thus rules out a-structures like <ag ag th> and <th loc loc>. DescendRol further formalizes the a-structure representation, where argument roles descend in prominence. For example, given the locative verb sit and its two roles, theme and locative, in a-structure, <th loc> is the only well-formed representation; <loc th> is ill-formed. Two corresponding constraints are proposed for argument functions (see Figure 21).

UniqFun ensures the uniqueness of each and every function in the a-to-f mapping; thus, both of the following are ill-formed: <θa-SUBJ θb-SUBJ>, and <θa-OBJ θb-OBJ>. DescendFun penalizes a candidate with a violation of the descending order in prominence. For example, because SUBJ outranks OBJ, <θa-SUBJ θb-OBJ> has 0 violation and is favored over the inverted <θa-OBJ θb-SUBJ>, which incurs one violation. Thus, given n GFs in a candidate form, there are at most n – 1 violations as there are n – 1 consecutive pairs (Kuhn, 2001). Inversion is still possible, given that all OT constraints are violable in order

Figure 18.

ag > ben > go/exp > inst > pt/th > loc

Figure 19.

SUBJ[-r -o] > OBJ[-r +o]/OBL_θ[+r -o] > OBJ_θ[+r +o]

Figure 20. Well-formedness constraints on argument roles

- a. **UniqRol**(R_a, R_b): Given <..R_a-F_a..R_b-F_b..>, R_a ≠ R_b
- b. **DescendRol**(R_a, R_b): Given <.. R_a-F_a R_b-F_b..>, R_a > R_b in prominence

Figure 21. Well-formedness constraints on grammatical functions

- a. **UniqFun**(F_a, F_b): Given <.. R_a-F_a..R_a-F_b..>, F_a ≠ F_b
- b. **DescendFun**(F_a, F_b): Given <.. R_a-F_a R_b-F_b..>, F_a ≥ F_b in prominence

to satisfy higher-ranked constraints, including language-specific morphosyntactic operations. (We will discuss the possibility of a language-specific component in the next section.) Next, we move on to the general constraints on the linking between roles and functions.

The two constraints in Figure 22, *LinkRol* and *LinkFun*, ensure that each expressed role is linked to a GF and that each GF is linked to a role. A role that is not linked to an argument function causes incompleteness, while an argument function that is not linked to an argument role in a-structure causes incoherence. Notice that there is no need to specify a constraint just to ensure that a role is linked to a GF with compatible features. This is accomplished automatically by the universal constraints on the morphosyntactic properties of argument roles shown in Figure 23.

LinkPtTh reflects the unaccusative hypothesis that cross-linguistically the primary patient/theme is encoded as an unrestricted [-r] GF (i.e., SUBJ or OBJ) (Bresnan & Kanerva, 1989; Bresnan & Zaenen, 1990; Zaenen, 1993)⁸. *LinkRolRes* captures the generalization that a non-patient/theme

internal argument prefers the syntactic assignment of a thematically restricted function. Finally, *LinkUnobj* and *LinkUnres* consistently favor the assignment of a role to the most unmarked function, SUBJ, [-r -o]⁹. Each function thus may have zero to two violations. These two constraints together are more general and insightful than the previous Subject Condition, which simply stipulates that every clause should have a subject.

Note that *LinkRolRes* does not apply to agent, the external argument. Being the highest-ranked role, it is linked to SUBJ due to *LinkUnobj* and *LinkUnres*. This thus accounts for the fact that, for the majority of the world's languages, agent cannot be realized as an object. However, given the violable nature of these constraints and their variable ranking, the possibility of agent-OBJ does exist as a marked morphosyntactic option. This reflects the insight of Falk (1989) cited in Lødrup (2000) that in Norwegian, "what has been called external theta roles are in fact structurally unspecified theta roles" (p. 173).

I will follow the standard view in OT and assume that these constraints are universal, but their

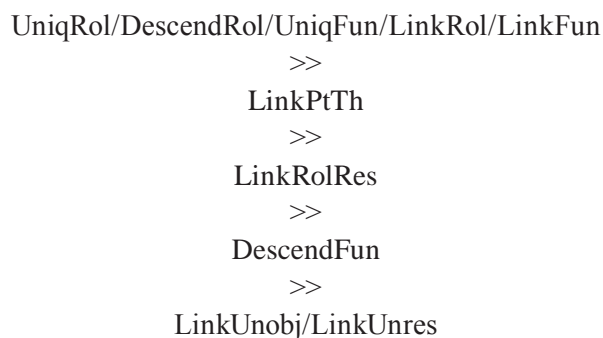
Figure 22. General constraints on argument-function linking

- a. **LinkRol**(R, F): Given <..R..>, R is linked to an F such that <..R-F..>.
- b. **LinkFun**(F, R): Given <..F..>, F is linked to an R such that <..R-F..>.

Figure 23. Specific constraints on argument-function linking

- a. **LinkPtTh**(R, F): Given <..R-F..>, where R = *pt/th*, F is [-r]
- b. **LinkRolRes**(R, F): Given <..R-F..>, where R ≠ $\hat{\theta}$, F is [+r]
- c. **LinkUnobj**(R, F): Given <..R-F..>, F is [-o]
- d. **LinkUnres**(R, F): Given <..R-F..>, F is [-r]


Figure 24. OT ranking of lexical mapping constraints (Chinese)



ranking may be language-specific. For Chinese, I propose the ranking shown in Figure 24.


An Illustration of OT-LMT

We will now look at the lexical mapping of three different verbs in their canonical active construction as examples: “melt<th>,” “laugh<ag>,” and “sell<ag th>.” To save time and space, the (many) candidates that violate any of the five highest-ranked well-formedness constraints will be excluded and we only will be concerned with the

lower five. Following standard OT notation, in Figure 25, a violation is marked with “*”; a “fatal” violation causing a candidate to lose in evaluation is highlighted with “!”. The shaded area covers the constraints that are no longer relevant in the evaluation of a particular candidate, and finally, the  sign indicates the optimal selection.

The candidate C1, <th-SUBJ>, with no violation, is clearly the optimal selection, where SUBJ is an unrestricted [-r] function allowed by LinkPtTh, and also the unmarked [-r -o] function preferred by LinkUnobj and LinkUnres.

Figure 25. Input a-structure: ‘melt <th>’

| | Candidate | LinkPtTh | LinkRolRes | DescendFun | LinkUnobj | LinkUnres |
|--|------------------------|----------|------------|------------|-----------|-----------|
|  C1 | <th-SUBJ> | | | | | |
| C2 | <th-OBJ> | | | | *! | |
| C3 | <th-OBL _θ > | *! | | | * | * |
| C4 | <th-OBJ _θ > | *! | | | * | * |

Optimality-Theoretic Lexical Mapping Theory

Next, we turn to the a-structure of an unergative verb “laugh<ag>” (see Figure 26). Here, the only relevant constraints are LinkUnobj and

LinkUnres, which again select SUBJ, the unmarked function.

Again, the candidate with no violation (C1) is the optimal selection.

Figure 26. Input a-structure: ‘laugh <ag>’



| | Candidate | LinkPtTh | LinkRolRes | DescendFun | LinkUnobj | LinkUnres |
|--|------------------------|----------|------------|------------|-----------|-----------|
|  C1 | <ag-SUBJ> | | | | | |
| C2 | <ag-OBJ> | | | | *! | |
| C3 | <ag-OBL _θ > | | | | | *! |
| C4 | <ag-OBJ _θ > | | | | *! | * |

Figure 27. Input a-structure: ‘sell <ag th>’

| | Candidate | LinkPtTh | LinkRolRes | DescendFun | LinkUnobj | LinkUnres |
|--|--|----------|------------|------------|-----------|-----------|
|  C1 | <ag-SUBJ th-OBJ> | | | | * | |
| C2 | <ag-SUBJ th-OBL _θ > | *! | | | | * |
| C3 | <ag-SUBJ th-OBJ _θ > | *! | | | * | * |
| C4 | <ag-OBJ th-SUBJ> | | | *! | * | |
| C5 | <ag-OBJ th-OBL _θ > | *! | | | * * | * |
| C6 | <ag-OBJ th-OBJ _θ > | *! | | | * * | * |
| C7 | <ag-OBL _θ th-SUBJ> | | | *! | | * |
| C8 | <ag-OBL _θ th-OBJ> | | | | *! | * |
| C9 | <ag-OBL _θ th-OBJ _θ > | *! | | | | * * |
| C10 | <ag-OBJ _θ th-SUBJ> | | | *! | * | * |
| C11 | <ag-OBJ _θ th-OBJ> | | | *! | * * | * |
| C12 | <ag-OBJ _θ th-OBL _θ > | *! | | * | * | * * |

The final example, *sell*, is a transitive verb with an agent role and a theme role. Again, Figure 27 excludes candidates that violate any of the five highest-ranked constraints.

Among the candidates, C1, <ag-SUBJ th-OBJ>, is the optimal selection, even though it does violate one of the two lowest-ranked constraints (i.e., LinkUnobj) due to the linking of theme to OBJ, a function with the marked feature [+o]. All other candidates, however, violate at least one higher-ranked constraint. Note that a candidate a-structure where both roles are linked to the unmarked function, thus <ag-SUBJ th-SUBJ>, violates the highest ranked UniqFun and, therefore, is not included in the figure.

AN OT-LMT ACCOUNT OF LOCATIVE INVERSION IN CHINESE

We first apply the OT-LMT to the canonical a-structure of the locative verb. The theory correctly predicts the following optimal argument-function linking: <th-SUBJ loc-OBL_θ>, shown in Figure 28.

With C2, <th-SUBJ loc-OBL_θ>, as the optimal selection, this constraint ranking obviously does not account for locative inversion, which is represented by candidate C4, <th-OBJ loc-SUBJ>. An additional constraint is needed.

The constraint shown in Figure 29 draws on the insight found in the default rule for focused

Figure 28. Input a-structure: ‘sit <th loc>’


| | Candidate | LinkPtTh | LinkRolRes | DescendFun | LinkUnobj | LinkUnres |
|--|---|----------|------------|------------|-----------|-----------|
| C1 | <th-SUBJ loc-OBJ> | | *! | | * | |
|  C2 | <th-SUBJ loc-OBL _θ > | | | | | * |
| C3 | <th-SUBJ loc-OBJ _θ > | | | | *! | * |
| C4 | <th-OBJ loc-SUBJ> | | *! | * | * | |
| C5 | <th-OBJ loc-OBL _θ > | | | | *! | * |
| C6 | <th-OBJ loc-OBJ _θ > | | | | *! *! | * |
| C7 | <th-OBL _θ loc-SUBJ> | *! | * | * | | * |
| C8 | <th-OBL _θ loc-OBJ> | *! | * | | * | * |
| C9 | <th-OBL _θ loc-OBJ _θ > | *! | | | * | * * |
| C10 | <th-OBJ _θ loc-SUBJ> | *! | * | * | * | * |
| C11 | <th-OBJ _θ loc-OBJ> | *! | * | * | * * | * |
| C12 | <th-OBJ _θ loc-OBL _θ > | *! | | * | * | * * |

Figure 29.

LinkLocInv(R, F): Given a-structure $\langle R_a - F_a R_b - F_b \rangle$, where $R_a = th[foc]$ and $R_b = loc$, F_b is $[-r -o]$.

Figure 30.

- a. Herikoputa ga yama no ue ni orimashita.
helicopter NOM mountain POSS top LOC land
'A helicopter landed on top of the mountain.'
- b. Yama no ue ni herikoputa ga orimashita.
mountain POSS top LOC helicopter NOM land
'On top of the mountain landed a helicopter.'
- c. *Yama no ue ga herikoputa o orimashita.
mountain POSS top NOM helicopter ACC land
'On top of the mountain landed a helicopter.'

theme posited by Bresnan and Kanverva (1989) and also faithfully reflects Bresnan's (1994) observation on the universals of locative inversion verbs. Given the fact that the complement of the predicator usually carries the discourse function of marking the less familiar information and that the subject is the default grammatical function for topic or more familiar information, the locative inversion operation forces the locative to map onto SUBJ such that the focused theme can surface as a complement of the locative verb. With this constraint in place, we now have an important decision to make; that is, whether to posit LinkLocInv as a language-specific constraint. Recall that locative inversion is found in many languages, and locative inversion verbs share an identical a-structure and function assignment. However, locative inversion certainly does not occur in all

languages. In non-configurational languages with extensive case-marking for grammatical relations (e.g., Korean and Japanese), locative inversion may not be found (Huang & Her, 1998). Figure 30 depicts a Japanese example.

Notice that even though the locative phrase indeed may invert positions with the subject and thus affect the focus in Figure 30b, its grammatical functions remain the same. In other words, locative inversion does not affect argument-function linking. Recall the standard OT view that constraints are universal and that only their ranking is subject to variation. Therefore, if we follow the standard OT view and posit LinkLocInv as a universal constraint, languages such as Japanese also must be accounted for, but only with a different ranking of the same constraints. This is the path we will explore. Figures 31 and 32 show the

Figure 31. OT ranking of lexica mapping constraints (Chinese, revised)

LinkPtTh
 >>
 LinkLocInv
 >>
 LinkRolRes
 >>
 DescendFun
 >>
 LinkUnobj/LinkUnres

Figure 32. Input a-structure: 'sit <th[foc] loc>' (Chinese)



| | Candidate | LinkPtTh | LinkLocInv | LinkRolRes | DescendFun | LinkUnobj | LinkUnres |
|--|---|----------|------------|------------|------------|-----------|-----------|
| C1 | <th-SUBJ loc- OBJ> | | *! | * | | * | |
| C2 | <th-SUBJ loc- OBL _θ > | | *! | | | | * |
| C3 | <th-SUBJ loc- OBJ _θ > | | *!* | | | * | * |
|  C4 | <th-OBJ loc- SUBJ> | | | * | * | * | |
| C5 | <th-OBJ loc- OBL _θ > | | *! | | | * | * |
| C6 | <th-OBJ loc- OBJ _θ > | | *!* | | | ** | * |
| C7 | <th-OBL _θ loc- SUBJ> | *! | | * | * | | * |
| C8 | <th-OBL _θ loc- OBJ> | *! | * | * | | * | * |
| C9 | <th-OBL _θ loc- OBJ _θ > | *! | ** | | | * | ** |
| C10 | <th-OBJ _θ loc- SUBJ> | *! | | * | * | * | * |
| C11 | <th-OBJ _θ loc- OBJ> | *! | * | * | * | ** | * |
| C12 | <th-OBJ _θ loc- OBL _θ > | *! | * | | * | * | ** |

Figure 33. OT ranking of lexical mapping constraints (Japanese, Korean, etc.)

LinkPtTh
 >>
 LinkRolRes
 >>
 DescendFun
 >>
 LinkUnobj/LinkUnres
 >>
 LinkLocInv

Figure 34. Input a-structure: 'land <th[foc] loc>' (Japanese)

| | Candidate | LinkPtTh | LinkRolRes | DescendFun | LinkUnobj | LinkUnres | LinkLocInv |
|--|---|----------|------------|------------|-----------|-----------|------------|
| C1 | <th-SUBJ loc- OBJ> | | *! | | * | | * |
|  C2 | <th-SUBJ loc- OBL _θ > | | | | | * | * |
| C3 | <th-SUBJ loc- OBJ _θ > | | | | *! | * | ** |
| C4 | <th-OBJ loc- SUBJ> | | *! | * | * | | |
| C5 | <th-OBJ loc- OBL _θ > | | | | *! | * | * |
| C6 | <th-OBJ loc- OBJ _θ > | | | | *! *! | * | ** |
| C7 | <th-OBL _θ loc- SUBJ> | *! | * | * | | * | |
| C8 | <th-OBL _θ loc- OBJ> | *! | * | | * | * | * |
| C9 | <th-OBL _θ loc- OBJ _θ > | *! | | | * | ** | ** |
| C10 | <th-OBJ _θ loc- SUBJ> | *! | * | * | * | * | |
| C11 | <th-OBJ _θ loc- OBJ> | *! | * | * | ** | * | * |
| C12 | <th-OBJ _θ loc- OBL _θ > | *! | | * | * | ** | * |

revised ranking we propose for Chinese. Notice that LinkLocInv outranks LinkRolRes and is outranked by LinkPtTh. Again, we continue to ignore the five highest-ranked well-formedness constraints.

We also need to point out that LinkLocInv is irrelevant in the selection of the canonical in Figure 28, because there, the theme is not focused. Now, to account for the data from languages like Japanese, where the focused theme does not result in mismatches of the function assignment of argument roles, we posit the ranking in Figures 33 and 34. Notice here that LinkLocInv is outranked by all other constraints.

DISCUSSION

This section discusses three issues in further detail. The first issue relates to the nature and the scope of the OT-LMT proposed in the article. The second issue concerns the potential advantages that the OT-LMT may have over the conventional LMT. Finally, we explore some of the directions for further research concerning the OT-LMT.

Morphosyntactic vs. Morpholexical Processes

Given the often idiosyncratic nature of language-specific lexical information, it is not yet clear how the technical integration of the lexicon should be envisaged in OT syntax, in general (Kuhn, 2001). This article clearly does not address this larger issue. In order to have an insightful lexical mapping theory in OT syntax, we first must be explicit about its nature and scope. The OT-LMT envisioned here is part of a universal OT-LFG theory that constrains argument-function linking. In other words, it constrains the syntactic function assignment of argument roles required by a predicator. Thus, this OT-LMT, as it is currently formulated, has nothing to say about morpholexical processes that alter the “lexical stock” in

a-structure (Bresnan, 2001; Bresnan & Kanerva, 1989). Therefore, it is purely morphosyntactic in nature and scope. Crucially, Ackerman (1992) differentiates and characterizes morpholexical and morphosyntactic operations as follows:

Morpholexical (Operations), affect the lexical semantics of predicates by altering the semantic properties associated with predicates...Morphosyntactic (Operations), assign features supplemental to those supplied by IC assignment¹⁰: these operations can affect the final GF assignments to arguments but cannot affect the lexical semantics. (p. 56)

Morpholexical operations thus are word-formation processes that produce predicates with an altered inventory of argument roles, or a-structures, which serve as input to OT-LMT. Morphosyntactic operations, however, are within the proper domain of LMT. Assuming that only morpholexical operations may be language-specific, the OT-LMT proposed thus universally governs how argument roles are mapped to GFs, with constraints that may vary from language to language only in terms of ranking. Thus, as Huang and Her (1998) have argued, given the nature of syntactic assignment of argument roles in the theory, it, in fact, makes the theory more coherent by allowing syntactic feature assignment in morphosyntactic operations. This is precisely how we treated locative inversion. Similar proposals that allow morphological processes to affect syntactic assignments by adding features are found as early as Zaenen (1987) and Her (1990) and later in Ackerman (1992), Markantonatou (1995), Her (2003), among others.

Allowing feature-adding morphosyntactic operations, in fact, also offers a computational advantage. Morpholexical operations constitute a much more powerful formal device computationally in that they are not subject to the general monotonicity condition that information only can be added but cannot be deleted or changed

(Bresnan, 1990; Falk, 2001)¹¹. Monotonic morphosyntactic operations with the feature-adding capacity enable a formalism that is more consistent and also more expressive, without any increase in its formal power. Empirically, such operations also have been adopted to account for syntactic variations in several languages; for example, Greek (Markantonatou, 1995), Chinese (Huang, 1995; Her, 1999), and English (Zaenen, 1987).

We will now illustrate this view of the OT-LMT with two more constructions from Chinese that are related to locative verbs. The first one is a passivized locative construction. Three-place transitive predicates like *xie* “write,” with the argument structure <ag th loc>, do not allow inversion in spite of the locative role it requires.

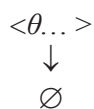
However, there may be locative inversion if the agent role is suppressed. This is observed in Chinese (Huang & Her, 1998) and other languages (Bresnan, 1989; Bresnan & Kanerva, 1989). The examples in Figures 35 and 36 are from Chinese and English.

Recall that passivization, repeated in Figure 36, suppresses the logical subject. In effect, it gives rise to an argument structure <ag th loc>, precisely that of a locative inversion verb. Locative inversion, therefore, is allowed, as in Figure 35c. Passivization thus falls outside of the realm of LMT and is regarded as a language-specific operation. One indication of its language-dependence is in the indirect expression of the suppressed agent role as an adjunct; for example, the English

Figure 35.

- a. Amei xie le yi ge zi zai qiang-shang.
Amei write ASP a CL character at wall-top
‘Amei wrote a Chinese character on the wall.’
- b. *Qiang-shang xie le yi ge zi Amei.
wall-top write ASP a CL character Amei
*‘On the wall was written a Chinese character (by) Amei.’
- c. Qiang-shang xie le yi ge zi.
wall-top write ASP a CL character
‘On the wall was written a Chinese character.’

Figure 36. Passivization



by-expression (Bresnan, 1994). Chinese, however, does not allow such indirect expressions¹².

The second construction we will examine is the transitivized locative verb. It has been noted that, in Chinese, a two-place locative verb with an argument structure <th loc> in fact allows its locative phrase to be a PP or an NP. The locative phrase thus may be alternatively mapped onto OBL or OBJ, (Huang & Her, 1998). This, however, is not allowed in English, as shown in Figures 37 and 38.

Huang and Her (1998) treat this function change as a morphosyntactic variation of the same argument structure; thus, <th-SUBJ loc-OBL,> in Figure 37 and <th-SUBJ loc-OBJ> in Figure 38. However, further evidence indicates that this view may be incorrect and that locative transitiv-

ization involves a morpholexical change, instead. In other words, without the preposition *zai*, the argument structure is, in fact, no longer <th loc>. Note that the presence of the locative preposition *zai* requires a place noun as its complement in Figure 39. In Chinese, certain nouns are place nouns inherently, such as *xuexiao* “school,” *zheli* “here,” and *gongyuan* “park,” and thus can be the complement of preposition *zai* directly. Non-place nouns, however, must form a constituent with a locative affix such as *-shang* and *-xia*, or a locative noun such as *shangmian* and *xiamian*; or there must be a place noun as the complement of locative preposition *zai*. Notice in Figure 40 that the object required by the transitivized verb *zuo* “sit” and *shui* “sleep” is free of this restriction.

Figure 37.

- a. Amei zuo zai yizi-shang.
Amei sit at chair-top
'Amei sits on the chair.'
- b. Amei shui zai diban-shang.
Amei sleep at floor-top
'Amei sleeps on the floor.'

Figure 38.

- a. mei zuo yizi-shang.
Amei sit chair-top
'Amei sits *(on) the chair.'
- b. Amei shui diban-shang.
Amei sleep floor-top
'Amei sleeps *(on) the floor.'

Figure 39.

- a. Amei zuo zai yizi-*(shang).
Amei sit at chair-top
'Amei sits on the chair.'
- b. Amei shui diban-*(shang).
Amei sleep floor-top
'Amei sleeps on the floor.'

Figure 40.

- a. Amei zuo yizi.
Amei sit chair
'Amei sits *(on) the chair.'
- b. Amei shui diban.
Amei sleep floor
'Amei sleeps *(on) the floor.'

Figure 41. Locative transtivization

$\langle th\ loc \rangle \rightarrow \langle ag\ th \rangle$

Therefore, it is clear that the objects in Figure 40 do not denote the location where the theme that undergoes the movement ends up; rather, they are the entities that receive the action denoted by the verbs. To account for this construction, I propose a morpholexical operation (see Figure 41).

Two more syntactic tests, shown in Figures 42 and 43, confirm that this argument structure

is now $\langle ag\ th \rangle$: passivization and resultative compounding.

In the passive construction, the suppression of the agent results in the theme role's "promotion" to SUBJ, as seen in Figure 42. In Figure 43, the single composite role, formed by the binding of the theme role of the action verb and the theme of the result state verb, maps to SUBJ (Her, 2004)¹³.

Based on the prevailing evidence, locative transitivity should be treated as a morpholexical operation that alters the lexical stock of an argument structure, and, as such, it is again outside of the realm of the OT-LMT proposed here.

According to the previous discussion, it is now possible to indicate exactly how the OT-LMT system is envisaged as the module in LFG

that links the lexical semantic structure and the syntactic structure of a predicator (Bresnan & Kanerva, 1989; Bresnan & Zaenen, 1990). The particular conceptualization of the a-structure assumed here, as shown in Figure 44, is based on Bresnan (1996, 2001), which, in turn, follows Baker (1983).

Figure 42.

- a. Yizi bei zuo le.
Chair BEI sit ASP
'The chair has been sat *(on).'
- b. Diban bei shui le.
Floor BEI sleep ASP
'The floor has been slept *(on).'

Figure 43.

- a. Yizi zuo-lan le.
Chair sit-threadbare ASP
'The chair is threadbare from (over)sitting.'
- b. Diban shui-kua le.
Floor sleep-collapse ASP
'The floor was slept on and collapsed.'

Figure 44.

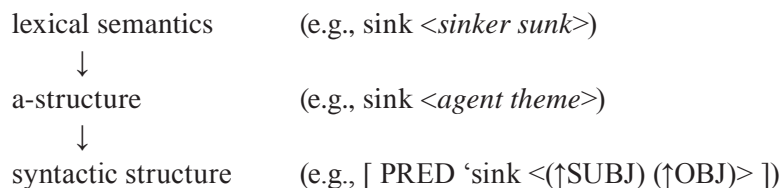
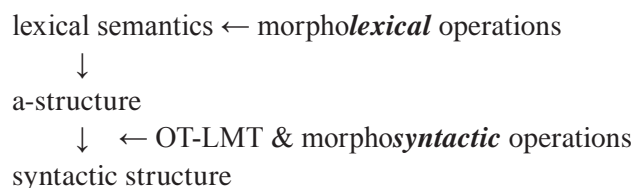


Figure 45.



The a-structure is a lexical syntactic representation with the minimally necessary information on the syntactic arguments of a predicator, such as the number of arguments, their thematic and syntactic types, and their hierarchical organization. As shown in Figure 45, the a-structure “sink <ag pt>” states that the verb sink requires two arguments, one of the type agent and the other theme, and also that agent is thematically more prominent than theme. The a-structure thus contains information necessary for the final syntactic manifestation or more precisely, the mapping of agent and theme to SUBJ and OBJ, respectively.

Morpholexical operations interact specifically with lexical semantics and, as such, are outside the proper domain of the LMT, while morphosyntactic operations are part of the LMT, which constrain the syntactic assignment of a-structure roles. All OT-LMT constraints thus are conceived to be morphosyntactic and universal in nature, while morpholexical operations may be language-specific.

Potential Advantages of OT-LMT



The OT-LMT proposed here targets specifically at the universal constraints on argument-function linking. We leave the OT formulation of morpholexical operations to further research. In

this section, we discuss some of the advantages that the OT-LMT may afford.

We start from the fact that all OT constraints are declarative. In the conventional LMT, the two subject conditions must apply sequentially, not simultaneously, to prevent $\theta[-r]$ from mapping to SUBJ, when $\hat{O}[-o]$ is present. Likewise, only after the mapping of the subject role can other roles be mapped. In contrast, all constraints in OT-LMT apply declaratively and, thus, simultaneously. Furthermore, in the conventional LMT, all roles are uniformly assigned exactly one feature for function assignment, while the OT-LMT allows a more expressive system with only the patient/theme role pre-assigned to unrestricted functions. This OT-LMT thus allows the possibility of agent-OBJ as a marked morphosyntactic selection, which is ruled out in the conventional LMT.

Recall also that two disjunctions are observed in the conventional LMT: the disjunction between the two principles of subject role mapping and the disjunction between subject roles and non-subject roles. The OT-LMT, however, consistently favors the unmarked values for all roles. This characteristic ultimately may lead to the replacement of the stipulation in the Subject Condition while preserving its insight. Thus, in general, this revised LMT formulated in OT formalism offers a potentially more consistent and simpler computational system¹⁴.

Figure 46.

| | Candidate | LinkPtTh | LinkLocInv | LinkRolRes | DescendFun | LinkUnobj | LinkUnres |
|--|---------------------------------|----------|------------|------------|------------|-----------|-----------|
|  C2 | <th-SUBJ loc-OBL _θ > | | | | | | * |
|  C4 | <th-OBJ loc-SUBJ> | | | * | * | * | |

As noted earlier, the LinkLocInv constraint proposed in the OT-LMT account essentially reflects the insight of Bresnan and Kanerva’s (1989) locative default, which assigns loc[-r] when th is focused. Thus, both accounts are descriptively equivalent in explicating locative inversion in the various languages observed, Chinese included. However, Bresnan and Kanerva’s (1989) account would need to state that languages like Japanese and Korean lack the mechanism of linking loc to [-r]. The OT account, on the other hand, has the advantage of a more general solution in attributing the presence or absence of locative inversion in a language to the relative ranking of LinkLocInv, which, like all OT constraints, is universal¹⁵.

Finally, we will indicate exactly how the OT-LMT better reflects the intuition that the locative inversion construction of <th-OBJ loc-SUBJ> is marked in comparison to the canonical locative construction of <th-SUBJ loc-OBL_θ>. In Figure 46, we examine the constraints that each of the two violates.

Notice that the canonical form constitutes only one violation of one of the two lowest-ranked constraints. The inverted form, on the other hand, violates two of the higher-ranked constraints, LinkRolRes and DescendFun, in addition to one of the two lowest-ranked constraints. Nonetheless,

even with such violations, the inverted form still outranks all other candidates. It is, therefore, still the optimal choice, in spite of its markedness. The OT-LMT is, therefore, more expressive and flexible, accounts for a wider range of data, and reveals the (un)markedness of different linking relations. It is, in short, a simpler, more consistent, and more general theory.

Directions of Further Research

Considering its limited number of principles, LMT is a relatively small theory but with ambitious goals. In the previous sections, an OT version of the theory has been laid out and tested against cross-linguistic data of locative inversion, as generalized by Bresnan (1994). However, there are locative constructions closely related to locative inversion that have not been covered. For instance, locative inversion might bear some relation to sentences with an expletive subject and a locative argument (Bresnan, 1994). Figure 47 is an example from French¹⁶.

The expletive subject is an athematic argument, and, as such, it must receive an intrinsic [-r] classification by the very nature of thematic restrictedness [r], (Bresnan, 2001). Given its initial position, it invariably links to SUBJ¹⁷. Similar

to the locative inversion discussed earlier, this construction also indicates that the object function of the theme role renders it more focal than the oblique locative role. An athematic argument in the a-structure is indicated by an underscore outside of the angled brackets, while thematic arguments are within the angled brackets. Thus, the a-structure of Figure 47 is “arrive _<th[foc] loc>.” An expletive subject also may be associated with the linking of agentive objects. Figure 48 is an example from French.

Similar phenomena also are observed in Bantu languages (Demuth, 1990; Demuth & Mmusi, 1997; Harford, 1990; Machobane, 1995). All these issues are important and interesting but cannot be adequately addressed in the current article.

Further research is needed on how the a-structure “arrive _<th[foc] loc>” and “work _<ag[foc]>” come about, whether they are morphologically or morphosyntactically related to “arrive <th loc>” and “work _<ag[foc]>,” respectively, and how best to incorporate such relations within the OT-LMT proposed here.

Further development of this OT-LMT also will need to address the issue of secondary patient-like roles as a parameter of variation in double object constructions, known as the Asymmetrical Object Parameter (AOP) (Alsina & Mchombo, 1993; Bresnan, 2001). In a non-AOP language, all patient-like roles are linked to an unrestricted function, while AOP languages must link the secondary patient/theme to an object function.

Figure 47.

Il est arrivé beaucoup de gens à la plage
 it is arrived many of people at the beach
 ‘There were many people arriving at the beach.’

Figure 48.

Il travaille deux mille ouvriers dans cette usine
 it works two thousand workers in this factory
 ‘There are two thousand workers working in the factory.’

Figure 49.

Asymmetrical Object Parameter (AOP):

* $\theta \theta \Rightarrow \theta \theta$
 $[-r] [-r] \quad [-r] [+o]$

An additional constraint may be necessary, and constraint ranking then may reflect this variation. This asymmetrical object parameter is stated in Figure 49.

Finally, the OT-LMT developed here needs to be applied to a much wider range of data cross-linguistically; for example, complex predicates in various languages (Abaitua, 1988; Ackerman, 1992; Alisina, Bresnan & Sells, 1997; Her, to appear; Ishikawa, 1985), the valence-changing morphemes and inversion constructions in Georgian (Blevins, 2005; Harris, 1981; Holisky, 1981), among others. A solid analysis of some of these facts would be a significant test of the linking theory proposed here.

CONCLUSION

In this article, we set out to accomplish two goals. The more ambitious one is to come up with a simpler and more general lexical mapping theory in OT terms, or OT-LMT. The second one is to test this theory and account for locative inversion in Chinese, English, and Chichewa on the one hand and Japanese and Korean on the other hand. Following the standard view in Optimality Theory, the mapping constraints we proposed are all universal, and language variation in locative inversion is accounted for by different constraint rankings. The OT-LMT we proposed is the UG component that constrains the argument-function linking, or morphosyntactic processes. It thus does not govern language-specific morpho-lexical processes, such as passivization, locative transitivization, and resultative compounding. Locative inversion, on the other hand, involves only morphosyntactic operations and, therefore, is accounted for within the OT-LMT.

In summary, the OT-LMT we proposed not only covers a wider range of empirical data, but it also affords a simpler, more consistent, and more general theory.

ACKNOWLEDGMENTS

I am genuinely grateful to the three anonymous reviewers for their insightful comments and exceedingly generous suggestions, and also to Adams Bodomo for his encouragement. I also thank Nissa Hui-shan Lin for discussions on OT. However, I am solely responsible for the content of the article. Research reported in this article has been funded partly by NSC grants 92-2411-H-004-024 and 93-2411-H-004-006. Part of the research for the article was done while I visited the School of Information Technology, Bond University in 2003 and 2004. I thank the dean, Professor Ron Davison, for his kind and continuous support.

REFERENCES

- Abaitua, J. (1988). *Complex predicates in Basque: From lexical forms to functional structures*. Unpublished doctoral dissertation, Department of Languages and Linguistics, University of Manchester.
- Ackerman, F. (1992). Complex predicates and morpholexical relatedness: Locative alternation in Hungarian. In I. Sag, & A. Szabolcsi (Eds.), *Lexical matters* (pp. 55-83). Stanford, CA: CSLI Publications.
- Ackerman, F., & Moore, J. (2001a). Dowtyian proto-properties and lexical mapping theory. In *Proceedings of the 6th International Lexical-Functional Grammar Conference*, Hong Kong.
- Ackerman, F., & Moore, J. (2001b). *Proto-properties and grammatical encoding: A correspondence theory of argument selection*. Stanford, CA: CSLI Publications.
- Aissen, J. (1999). Markedness and subject choices in optimality theory. *Natural Language and Linguistic Theory*, 17, 673-711.

- Alsina, A. (1996). *The role of argument structure in grammar*. Stanford, CA: CSLI Publications.
- Alsina, A., Bresnan, J., & Sells, P. (Eds.). (1997). *Complex predicates*. Stanford, CA: CSLI Publications.
- Alsina, A., & Mchombo, S. (1993). Object asymmetries and the Chichewa applicative construction. In S. Mchombo (Ed.), *Theoretical aspects of Bantu grammar* (pp. 17-45). Stanford, CA: CSLI Publications.
- Asudeh, A. (2001). *Linking, optionality, and ambiguity in Marathi*. In Sells (Ed.), pp. 257-312.
- Babby, L. (1989). Subjectlessness, external subcategorization, and the projection principle. *Zbornik Matice Srpske Za Filologiju i Lingvistiku*, 32, 7-40.
- Baker, M. (1983). Objects, themes, and lexical rules in Italian. In L. Levin, M. Rappaport, & A. Zaenen (Eds.), *Papers in lexical-functional grammar*. Indiana: Indiana University Linguistics Club.
- Birner, B. (1994). Information status and word order: An analysis of English inversion. *Linguistic Inquiry*, 17, 347-354.
- Blevins, J. (2005). *Thematic inversion in Georgian*. University of Cambridge. Retrieved June 15, 2005, <http://www.cus.cam.ac.uk/~jpb39/drafts/tig.pdf>
- Bresnan, J. (1989). The syntactic projection problem and comparative syntax of locative inversion. *Journal of Information Science and Engineering*, 5, 287-303.
- Bresnan, J. (1990). Monotonicity and the theory of relation-changes in LFG. *Language Research*, 26(4), 637-652.
- Bresnan, J. (1994). Locative inversion and the architecture of universal grammar. *Language*, 70, 72-131.
- Bresnan, J. (1996). *Lexicality and argument structure*. Paper presented at Colloque de Syntax et Semantique, Paris. Retrieved June 15, 2005, from <http://csli-www.stanford.edu/users/bresnan/>
- Bresnan, J. (2000). Optimal syntax. In J. Dekkers, F. van der Leeuw, & J. van de Weijer (Eds.), *Optimality theory: Phonology, syntax and acquisition* (pp. 334-385). Oxford: Oxford University Press.
- Bresnan, J. (2001). *Lexical-functional syntax*. Oxford: Blackwell Publishers.
- Bresnan, J., & Kanerva, J. (1989). Locative inversion in Chichewa: A case study of factorization in grammar. *Linguistic Inquiry*, 20, 1-50.
- Bresnan, J., & Kanerva, J. (1992). The thematic hierarchy and locative inversion in UG: A reply to Schachter's comments. *Syntax and Semantics: Syntax and the Lexicon*, 111-125.
- Bresnan, J., & Zaenen, A. (1990). Deep unaccusativity in LFG. In K. Dziwirek, P. Farrell, & E. Mejias (Eds.), *Grammatical relations: A cross-theoretical perspective* (pp. 45-57). Stanford, CA: CSLI Publications.
- Butt, M., Dalrymple, M., & Frank, A. (1997). An architecture for linking theory in LFG. In *Proceedings of the LFG97 Conference*. Stanford, CA: CSLI On-line Publications. Retrieved June 15, 2005 from, <http://csli-publications.stanford.edu/LFG/2/lfg97-toc.html>
- Butt, M., & King, T. H. (Eds.). (2000). *Argument realization*. Stanford, CA: CSLI Publications.
- Cheng, R. (1983). Focus devices in Mandarin Chinese. In T. Tang, R. Cheng, & Y. Li (Eds.), *Hanyu jufa yuyixue lunji* (pp. 50-102). Taipei: Student Book Co.
- Dalrymple, M. (2001). *Lexical functional grammar*. New York: Academic Press.

- Demuth, K. (1990). Locatives, impersonals and expletives in Sesotho. *The Linguistic Review*, 7, 233-249.
- Demuth, K., & Mmusi, S. (1997). Presentational focus and thematic structure in comparative Bantu. *Journal of African Languages and Linguistics*, 18, 1-19.
- Dowty, D. (1991). Thematic proto-roles and argument selection. *Language*, 67(3), 547-619.
- Falk, C. (1989). On the existential constructions in Germanic languages. *Working Papers in Scandinavian Syntax*, 44, 45-59.
- Falk, Y. (2001). *Lexical-functional grammar: An introduction to constraint-based syntax*. Stanford, CA: CSLI Publications.
- Grimshaw, J. (1990). *Argument structure*. Cambridge, MA: MIT Press.
- Harford, C. (1990). Locative inversion in Chisona. In J. Hutchison, & V. Manfredi (Eds.), *Current approaches to African linguistics* 7 (pp. 137-144). Foris: Dordrecht.
- Harris, A. (1981). *Georgian syntax: A study in relational grammar*. Cambridge: Cambridge University Press.
- Her, O.-S. (1989). An LFG account for Chinese BEI sentences. *Journal of the Chinese Language Teachers Association*, 24(3), 67-89.
- Her, O.-S. (1990). *Grammatical functions and verb subcategorization in Mandarin Chinese*. Doctoral dissertation, University of Hawaii, 1991.
- Her, O.-S. (1997). *Interaction and variation in the Chinese VO construction*. Taipei: Crane Publishing.
- Her, O.-S. (1998). Lexical mapping in Chinese inversion constructions. In *Proceedings of the LFG98 Conference*. Stanford, CA: CSLI Online Publications. Retrieved June 15, 2005, from <http://csli-publications.stanford.edu/LFG/3/lfg98.html>
- Her, O.-S. (1999). Interaction of thematic structure and syntactic structures: On Mandarin dative alternations. *Chinese Languages and Linguistics Vol. V: Interaction*, 373-412.
- Her, O.-S. (2003). Chinese inversion constructions within a simplified LMT. In A. Bodomo, & K. K. Luke (Eds.), *Journal of Chinese Linguistics Monograph No. 19: Lexical-Functional Grammar Analysis of Chinese*.
- Her, O.-S. 2004. Argument-function linking in resultatives. *Concentric: Studies in Linguistics*, 30(2), 1-34.
- Her, O.-S. (to appear). *Argument-function mismatches in Mandarin Chinese: A lexical mapping account*. Natural Language and Linguistic Theory.
- Holisky, D. A. (1981). *Aspect and Georgian medial verbs*. New York: Caravan.
- Huang, C.-r. (1993). Mandarin Chinese and the lexical mapping theory: A study of the interaction of morphology and argument changing. *Bulletin of the Institute of History and Philology*, 62(2), 337-388.
- Huang, H.-t. (1995). *Lexical mapping theory: Mandarin dative shift and locative inversion*. Unpublished master's thesis, National Chengchi University, Taiwan.
- Huang, H.-t., & Her, O.-S. (1998). Mandarin locative inversion and relation-changing rules. In S. Huang (Ed.), *Selected papers from the second international symposium on languages in Taiwan* (pp. 287-304). Taipei: Crane Publishing.
- Ishikawa, A. (1985). *Complex predicates and lexical operations in Japanese*. Unpublished doctoral dissertation, Department of Linguistics, Stanford University.

- Kaplan, R., Riezler, T. H., King, T. H., Maxwell, J. T., III, Vasserman, A., & Crouch, R. (2004). Speed and accuracy in shallow and deep stochastic parsing. In *Proceedings of the Human Language Technology Conference and the 4th Annual Meeting of the North American Chapter of the Association for Computational Linguistics, (HLT-NAACL'04)*. Boston, MA.
- Kuhn, J. (2001). *Generation and parsing in optimality theoretic syntax: Issues in the formalization of OT-LFG*. In Sells (Ed.), pp. 313-366.
- Kuhn, J. (2003). *Optimality-theoretic syntax: A declarative approach*. Stanford, CA: CSLI Publications.
- Lee, H. (2001). *Markedness and word order freezing*. In Sells (Ed.), pp. 63-128.
- Levin, L. (1987). *Toward a linking theory of relation changing rules in LFG* (Report No. CSLI-87-115). Stanford, CA: CSLI Publications.
- Li, Y. (1995). The thematic hierarchy and causativity. *Natural Language and Linguistic Theory*, 13, 255-282.
- Lødrup, H. (1999). Linking and optimality in the Norwegian presentational focus construction. *Nordic Journal of Linguistics*, 22(2), 205-229.
- Lødrup, H. (2000). Underspecification in lexical mapping theory: The case of Norwegian existentials and resultatives. In M. Butt, & T. H. King (Eds.), *Argument realization* (pp. 55-83). Stanford, CA: CSLI Publications.
- Machobane, M. M. (1995). The Sesotho locative constructions. *Journal of African Languages and Linguistics*, 16, 115-36.
- Markantonatou, S. (1995). Modern Greek deverbal nominals: An LMT approach. *Journal of Linguistics*, 31, 267-299.
- Maxwell, J. T., III, & Kaplan, R. M. (1991). A method for disjunctive constraint satisfaction. In M. Tomita (Ed.), *Current issues in parsing technology* (pp. 173-190). Dordrecht: Kluwer Academic Publishers.
- Maxwell, J. T., III, & Kaplan, R. M. (1993). The interface between phrasal and functional constraints. *Computational Linguistics*, 19(4), 571-590.
- Maxwell, J. T., III, & Kaplan, R. M. (1996). An efficient parser for LFG. In M. Butt, & T. H. King (Eds.), *Proceedings of the LFG96 Conference* [online].
- McCloskey, J. (2001). On the distribution of subject properties in Irish. In W. D. Davies, & S. Dubinsky (Eds.), *Objects and other subjects: Grammatical functions, functional categories, and configurationality*. Dordrecht: Kluwer Academic Publishers.
- Mikkelsen, L. H. (2003). Reanalyzing the definiteness effect: Evidence from Danish. *Working Papers in Scandinavian Syntax*, 69, 1-75.
- Pesetsky, D. (1995). *Zero syntax: Experiencers and cascades*. Cambridge, MA: MIT Press.
- Prince, A., & Smolensky. (2004). *Optimality theory: Constraint interaction in generative grammar*. Oxford: Blackwell Publishers.
- Sells, P. (Ed.) (2001). *Formal and empirical issues in optimality theoretic syntax*. Stanford, CA: CSLI Publications.
- Sharma, D. (2001). *Kashimiri case clitics and person hierarchy effects*. In Sells (Ed.), pp. 225-256.
- Simpson, J. (1991). *Warlpiri morpho-syntax: A lexicalist approach*. Dordrecht: Kluwer Academic Publishers.
- Tan, F. (1991). *Notion of subject in Chinese*. Unpublished doctoral thesis, Stanford University.
- Ting, J. (1998). Deriving the Bei-construction in Mandarin Chinese. *Journal of East Asian Linguistics*, 7(4), 319-354.

Zaenen, A. (1987). *Lexical information in LFG: An overview*. Palo Alto, CA: Ms. Xerox-PARC.

Zaenen, A. (1993). Unaccusativity in Dutch: Integrating syntax and lexical semantics. In J. Pustejovsky (Ed.), *Semantics and the lexicon* (pp. 129-161). Dordrecht: Kluwer Academic Publishers.

Zaenen, A., & Engdahl, E. (1994). Descriptive and theoretical syntax in the lexicon. In B. T. S. Atkins, & A. Zampolli (Eds.), *Conceptual approaches to the lexicon* (pp. 181-212). Oxford: Clarendon Press.

ENDNOTES

¹ See Bresnan (2001, chapter 14) for a brief exposition of other formulations.

² Falk (2001) also presents a concise introduction to LMT and a more precisely defined theory of argument roles. Dalrymple (2001) offers more examples in her introduction to the theory.

³ The concept of thematic hierarchy is well-established (Grimshaw, 1990; Li 1995). The hierarchy in “The Subject Condition” also might be derived from the proto-role properties proposed by Dowty (1991) (Ackerman & Moore, 2001b; Bresnan, 2001).

⁴ Note that following Zaenen and Engdahl (1994), the two propositional argument functions COMP and XCOMP are treated as instances of OBL.

⁵ Note that \hat{O} refers to the most prominent role in the a-structure. The fact that it is also the left-most role within the angled brackets is inconsequential. \hat{O} is usually also the initial role, unless there is an initial athematic argument.

⁶ Alsina (1996) also argues that the function-argument bi-uniqueness condition, which is fully integrated in the OT-LMT proposed later, is too strong.

⁷ A constraint for athematic roles must restrict such roles to [-r]. Alternatively, a constraint may be proposed to outrank LinkFun in Figure 22b and thus allow a GF in a-structure to be unmatched.

⁸ An additional constraint is needed for the secondary patient/theme, which restricts the secondary pt/th to [+o]. Again, we will ignore this issue in this article.

⁹ DescendFun and DescendRol effect a parallel alignment between the thematic hierarchy and the markedness hierarchy. This parallel alignment is similar to a harmonic alignment, but with an important difference. In a harmonic alignment, according to Prince and Smolensky (2004), the correspondence between a more prominent element on one scale and a less prominent element on the other is worse than the correspondence between two elements that are equal in prominence (Aissen, 1999; Asudeh, 2001; Lee, 2001; Sharma, 2001). Thus, it is better for agent, the most prominent role, to link to SUBJ, the most prominent function, and likewise for locative, the least prominent role, to link to OBJ. However, in our scheme here, due to LinkUnobj and LinkUnres, a more prominent GF is favored, regardless of the prominence of the role.

¹⁰ IC refers to the intrinsic classification of argument roles. See Figure 7.

¹¹ Therefore, as I have proposed elsewhere (Her, 2003), morpholexical operations likewise can add features and, thus, alter syntactic assignments of argument roles, besides changing the lexical semantics of a predicator.

¹² See Her (1989) and Ting (1998), among others, for compelling arguments against viewing the *bei*-NP phrase as a PP by-phrase.

¹³ In fact, the same concept of suppression in passives is used here, as well. See Her (2004) for details of mapping the composite role, formed by two roles, to a single GF.

¹⁴ Note that I am only referring to computational efficiency in formulation and formalism, not in practical terms of an actual computational implementation. See Kuhn (2003) for extensive discussions on the computational aspects of OT. However, there is little practical evidence for the computational efficiency of a large-scale OT implementation of a grammar, as there seems to be no such practical systems yet. For the computational efficiency of LFG in general, see Maxwell and Kaplan (1996, 1993, 1991); for LFG in practice, refer to

Kaplan, et al. (2004). I thank the anonymous reviewer who made this point and provided the references.

¹⁵ I thank another anonymous reviewer for pointing this out to me.

¹⁶ I thank the anonymous reviewer who suggested this direction of further research and provided this French example and its discourse analysis.

¹⁷ Refer to Bresnan (2001, section 14.1) for a more in-depth discussion on athematic arguments in raising constructions.

This work was previously published in the International Journal of Technology and Human Interaction, edited by B. C. Stahl, Volume 2, Issue 1, pp. 67-94, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.13

Trusting Computers Through Trusting Humans: Software Verification in a Safety–Critical Information System

Alison Adam

University of Salford, UK

Paul Spedding

University of Salford, UK

ABSTRACT

This article considers the question of how we may trust automatically generated program code. The code walkthroughs and inspections of software engineering mimic the ways that mathematicians go about assuring themselves that a mathematical proof is true. Mathematicians have difficulty accepting a computer generated proof because they cannot go through the social processes of trusting its construction. Similarly, those involved in accepting a proof of a computer system or computer generated code cannot go through their traditional processes of trust. The process of software verification is bound up in software quality assurance procedures, which are themselves subject to commercial pressures. Quality standards, including military standards, have procedures for human trust designed into them. An action research case study of an avionics system within a military

aircraft company illustrates these points, where the software quality assurance (SQA) procedures were incommensurable with the use of automatically generated code.

INTRODUCTION

They have computers, and they may have other weapons of mass destruction. Janet Reno, former US Attorney General

In this article our aim is to develop a theoretical framework with which to analyse a case study where one of the authors was involved, acting as an action researcher in the quality assurance procedures of a safety-critical system. This involved the production of software for aeroplane flight systems. An interesting tension arose between the automatically generated code of the software system (i.e., ‘auto-code’—pro-

duced automatically by a computer, using CASE [Computer Aided Software Engineering] tools from a high level design) and the requirement of the quality assurance process which had built into it the requirement for human understanding and trust of the code produced.

The developers of the system in the case study designed it around auto-code—computer generated software, free from ‘human’ error, although not proved correct in the mathematical sense, and cheaper and quicker to produce than traditional program code. They looked to means of verifying the correctness of their system through standard software quality assurance (SQA) procedures. However, ultimately, they were unable to bring themselves to reconcile their verification procedures with automatically generated code. Some of the reason for this was that trust in human verification was built into (or inscribed into [Akrich, 1992]) the standards and quality assurance procedures which they were obliged to follow in building the system. Despite their formally couched descriptions, the standards and verification procedures were completely reliant on human verification at every step. However these ‘human trust’ procedures were incompatible with the automated production of software in ways we show below. The end result was not failure in the traditional sense but a failure to resolve incommensurable procedures; one set relying on human trust, one set on computer trust.

Our research question is therefore: How may we understand what happens when software designers are asked to trust the design of a system, based on automatically generated program code, when the SQA procedures and military standards to which they must adhere demand walkthroughs and code inspections which are impossible to achieve with auto-code?

The theoretical framework we use to form our analysis of the case study is drawn from the links we make between the social nature of mathematical proof, the need to achieve trust in system verification, the ways in which we achieve

trust in the online world, the methods of software engineering, and within that, the software quality movement and the related highly influential domain of military standards.

In the following section we briefly outline the social nature of mathematical proof. The next section discusses the debate over system verification which encapsulates many of the ideas of mathematical proof and how such proofs can be trusted by other mathematicians. The article proceeds to consider ‘computer mediated’ trust, briefly detailing how trust has been reified and represented in computer systems to date, mainly in relation to the commercial interests of e-commerce and information security. Trust is particularly pertinent in the world of safety-critical systems, where failure is not just inconvenient and financially damaging, although commercial pressures are still evident here, but where lives can be lost. The model of trust criticised by e-commerce critics is more similar to the type of trust we describe in relation to safety-critical systems, than one might, at first, expect. Understandably, we would like to put faith in a system which has been mathematically proved to be correct. However computer generated proofs, proofs about correctness of computer software, and automatically generated code are not necessarily understandable or amenable to inspection by people, even by experts. The question then arises of whether we can bring ourselves to trust computer generated proofs or code, when even a competent mathematician, logician, or expert programmer cannot readily understand them.

Following this, we describe the evolution of software development standards and the SQA movement. We argue that the development of quality assurance discourse involves processes of designing human ways of trusting mathematical evidence into standardisation and SQA. Military standards are an important part of the SQA story, having consequences far beyond the military arena. Standards are political devices with particular views of work processes inscribed (Akrich, 1992) in their design. We note the way that military

standards, historically, moved towards formal verification procedures only to move back to rely more on 'human' forms of verification such as code walkthroughs and inspections in the later 1990s. The story is shot through with a tension between finding ways to trust the production of information systems and finding ways to control them. Formal methods, based on mathematical proof offer the promise of control, but only if we can bring ourselves to trust a proof generated by a machine rather than a proof constructed by another person. We present the background to the case study in terms of a description of the complex 'post cold war' military and commercial environment. This is followed by a description of the action research methodology employed in the project, an outline of the case study and an analysis of the case study findings in terms of our theoretical framework. In the conclusion we briefly note that mathematicians and others are gradually finding ways of trusting computers.

THE SOCIAL NATURE OF MATHEMATICAL PROOF

At first sight, the concept of mathematical proof appears to be relatively simple. The idea of a logical and rigorous series of steps, leading from one or more starting positions (previous theorems or axioms) to the final conclusion of the theorem seems to be the basis of mathematics. The concept of mathematical proof leading inexorably to true and incontrovertible truths about the world is very compelling. It is not surprising that we would like to apply the apparent certainty and exactness of mathematical approaches to computer programming. However if we consider briefly how agreement on mathematical proof and scientific truth is achieved by communities of mathematicians, then the social and cultural dimension of proof, as an agreement amongst trusted expert witnesses, reveals itself.

With the epistemological and professional success of mathematical proof, many of the cultural processes which go into making a proof true sink from consciousness and are only rendered visible in times of dispute; for example as in claims to the proof of Kepler's conjecture or Fermat's last theorem (Davies, 2006; Kuhn, 1962; Singh, 1997). Only on the margins then do we call into question our ability to trust these people when a mathematical proof cannot be agreed to be true by an expert community of mathematicians, as sometimes happens.

The apparently pure and abstract nature of mathematical proof fairly quickly breaks down when we inspect it more closely. In particular, when there is disagreement about a proof, the nature of proof is revealed as a social and cultural phenomenon; the matter of persuading and convincing colleagues. DeMillo, Lipton, and Perlis (1977, p. 208) wrote

Mathematicians talk to each other. They give symposium and colloquium talks which attempt to convince doubting (sometimes hostile) audiences of their arguments, they burst into each others' offices with news of insights for current research, and they scribble on napkins in university cafeterias and expensive restaurants. All for the sake of convincing other mathematicians. The key is that other mathematicians are inclined to listen!

This traditional approach towards mathematical proof, which could be described as one of *persuasive rigorous argument between mathematicians leading to trust*, is not the only way to address the idea of proof. A quite different approach appeared in the 1950s and was based on the work on logic developed by Bertrand Russell and others in the 1930s and used the newly invented electronic computer. This new logic-based approach was not dependent on the computer, but the computer's speed and accuracy had a major impact on its application to the proof

of theorems in replacing the persuasive rational argument of competent mathematicians with a *formal* approach which sees any mathematical proof as a number of steps from initial axioms (using predicate logic), to the final proof statement (based purely on logical inference) without the requirement of a human being.

Many proofs can be completed by either method. For instance, many persuasive rigorous argument proofs can be converted to formal proofs (MacKenzie, 2004). It should be emphasised, however, that there is a real difference between the two types of proof. We are not simply talking about a machine taking on the role of a competent mathematician. Some proofs which are readily accepted by mathematicians rely on arguments of symmetry and equivalence, analogies, and leaps of imagination, which humans are very good at understanding but which a formal logic approach cannot replicate. Symmetry and analogy arguments of this type cannot be established by formal methods based on logical progression because symmetry relies on understanding semantics and cannot be gleaned from the syntax of a proof.

Whereas the persuasive rigorous argument, the ‘human’ approach, has been used for thousands of years, the formal or ‘computer generated’ approach has been in use for only about half a century. Clearly, the two methods are not treated in the same way by the expert community of mathematicians. With a rigorous argument type of proof, although one may expend much energy convincing one’s colleagues of the validity of the proof, the *potential* for coming to agreement or trust of the proof is there. Essentially, in trusting that a mathematical proof is correct, mathematicians are demonstrating their trust in other competent mathematicians. However, expert mathematicians clearly have trouble bringing themselves to trust computer proofs, for good reason, as a computer cannot explain the steps in its reasoning (Chang, 2004).

COMPUTER SYSTEM VERIFICATION: TRUST AND THE SOCIAL

The preceding section contrasted the *use* of computer technology in a claimed proof: the formal method and the human ‘rigorous argument’ approach to proof. Although this is not the same thing as the proof or verification of a computer system *itself*, in other words the formal, computer generated proof that the computer system matches the specification, the question of whether we can trust the computer is exactly the same.

The idea of *proof* or *verification* of a program is quite different from simply testing the program. Typically, a large suite of programs might have thousands or millions of possible inputs, and so could be in many millions or even billions of states. Exhaustive testing cannot be possible. If a computer system is to be used in the well-funded and high-profile military field to control a space craft, aeroplane, or a nuclear power station, it is highly desirable if the system can be actually *proved* to be correct, secure, and reliable. Since testing, although vital, can never prove the system’s correctness, more mathematical methods involving the notion of proof became of great interest in the late 1960s and have remained so ever since.

In fact the history of the verification of computer systems echoes that of mathematical proof, with basically the same two approaches: those who support the rigour of formal methods and those who believe that the purely formal, mechanised proof lacks the crucial element of human understanding (Tierney, 1993). In a paper to an ACM Symposium, DeMillo et al. (1977) argued that the two types of proof were completely different in nature, and that only the persuasive rigorous argument proof with its strong social aspect will ultimately be believable and capable of earning *trust*.

COMPUTER-MEDIATED TRUST

In ethical terms, trust is a complex phenomenon and is essentially a human relationship (Nissenbaum, 1999; Stahl, 2006). We think of trust in terms of a trustor who does the trusting and a trustee who is trusted. The trustee does not of course have to be human, but Nissenbaum (1999) suggests that the trustee should be a being to whom we ascribe human qualities such as intentions and reasons, what might be termed an ‘agent.’ Trust allows meaningful relationships and a vast range of intuitions to work. Nissenbaum (1999) argues that when we are guaranteed safety trust is not needed: ‘What we have is certainty, security, safety – not trust. The evidence, the signs, the cues and clues that ground the formation of trust must always fall short of certainty; trust is an attitude without guarantees, without a complete warrant.’ Intrusive regulation and surveillance are attempts at control and bad for building trust.

This generalised definition of trust clearly maps onto our description of mathematicians trusting proofs. They may not have complete certainty over the correctness of a mathematical proof, but they have good reason to trust a competent member of the community of expert mathematicians. Therefore they can trust the proof supplied by such a person.

Understandably, there has been much interest in trust in the online world, both in terms of online security and trust in e-commerce transactions. Nissenbaum (1999) suggests that excessive safety controls, say in e-commerce, may encourage participation but they limit experience: ‘Through security we may create a safer world, inhospitable to trust not because there is distrust, but because trust cannot be nourished in environments where risk and vulnerability are, for practical purposes, eradicated.’

Stahl’s (2006) take on trust in e-commerce shows another example of the intangible human nature of trust, which has become reified and commodified, so that it can be measured and

exchanged in machine transactions. Like Nissenbaum (1999), Stahl points to the way that a trustor does not have complete control over a trustee; vulnerability and uncertainty must be accepted in a trusting relationship. This of course includes business transactions, and is especially important in e-commerce as many of the traditional ways of developing trust are absent from online transactions. Trust becomes a way of generating profit; small wonder that trust, including technological ways of creating trust and maintaining it, has been of so much interest in e-commerce. In the world of e-commerce research, trusts lose its relational aspects and becomes a form of social control. ‘If trust is limited to calculations of utility maximisation in commercial exchange, then most of the moral underpinnings of the mechanisms of trust become redundant. Trust changes its nature and loses the binding moral quality that it has in face-to-face interaction.’ (Stahl, 2006, p. 31)

Although, on the face of it, Nissenbaum’s and Stahl’s arguments on the problems of online trust in e-commerce are not the same as the issue of trust described in the body of this article, there are important congruencies which are very directly applicable to our characterisation of trust. Whether it is a human trusting another human or an expert mathematician trusting another expert mathematician to supply an accurate proof, the same relationship between trustor and trustee obtains.

For Nissenbaum and Stahl, the issue is what happens to trust when it is commodified within an online relationship. In other words, what happens when the human-trusting-human relationship is mediated by technology? In this article we also consider what happens when the human-trusting-human relationship—in terms of a human trusting another human’s mathematical proof, or computer program—is replaced by a human having to trust a machine. Of course, in this trustor-trustee relationship, the trustee, that is, the machine, cannot be understood in the way that another person can be.

The pressure to create computer-mediated trust is completely bound up with commercial pressures. The maximisation of profit drives the reification of trust in e-commerce. Similarly in the world of military avionics we describe, it is the commercial pressure of building systems more cheaply and faster which provides the impetus to turn over proofs, testing of programs, and automatic generation of code to a machine. A third aspect of similarity between Stahl's and Nissenbaum's view of computer-mediated trust and ours relates to the tension between trust and control. This is clearly present in the debate over trust in e-commerce. But it is also present in software quality discourse as we discuss below.

In the following section we briefly discuss some of the ways in which human trust has traditionally been built into procedures designed to verify program correctness, and how this can be seen to mirror an ideal group of mathematicians agreeing upon a mathematical proof.

BUILDING TRUST INTO A COMPUTER SYSTEM

We argue that, historically, much of the development of the software engineering discipline can be understood in terms of the development of procedures, through which we can convince ourselves to trust, and control, the development of information systems and the production of software. For instance, Myers' (1979) classic book on software testing explores the topic of human testing in detail, justifying methods such as formal *code inspections* and *code walkthroughs*. The differences between the two methods depend on different usages of the terms 'inspection' and 'walkthrough,' but the important point is that both involve a small group of professionals carefully reading through code together. We argue that this can be viewed as an imitation of the social (persuasive rigorous argument) form of proof described earlier where 'mathematicians talk to each other'

in symposia and colloquia and so on (DeMillo et al., 1977). The original programmer should be in the group, analogous to the mathematician demonstrating a proof or principle to expert colleagues. The aim (as originally suggested by Weinberg [1971]—an 'egoless' approach) is to discover as many errors as possible rather than to try to demonstrate that there are none. So the team is to act as an idealised group of 'Popperian' scientists looking for 'refutations' (Popper, 1963). Under such an approach, one can never be entirely sure that the code is correct. But, as the walkthrough proceeds, the original programmer and the code inspection team can gradually come to trust the code as bugs are weeded out and fixed.

Myers claims positive advantages of code inspections and walkthroughs, including the value of the original programmer talking through the design (and thus spotting the errors). He also notes the ability of human testers to see the causes and likely importance of errors (where a machine might simply identify symptoms) and also the likelihood that a batch of errors will be identified simultaneously. Also the team is able to empathise with and understand the thought processes of the original programmer in a way which a machine arguably cannot. Importantly, the team can be *creative* in its approach. In working together they also, inevitably, form something of a sharing and trusting community (even if it is disbanded after a day or two).

The lesson gleaned from human verification techniques, such as walkthroughs and code inspections, is that these have been regarded, for some time, as reliable, if not exhaustive, ways of ensuring reliability of software.

SOFTWARE QUALITY ASSURANCE AND MILITARY STANDARDS FOR SOFTWARE

The software verification techniques of code walkthroughs and inspections are important parts

of the armoury SQA. Effectively, we argue that SQA is a branch of software engineering which formalises and standardises the very human methods of trust, and ultimately control outlined above, which we need to build into software engineering procedures. The SQA movement is an important part of the story of the growth of software engineering because of its quest for rigour and control of potentially unruly programs and programmers.

First of all, SQA offers a promise of rational control over software, the software development process, and those who produce software. Software quality criteria include features for directing, controlling, and importantly, measuring the quality of software (Gillies, 1997). ‘Qualification’ is achieved when a piece of software can be demonstrated to meet the criteria specified in these quality procedures. An important aspect of SQA involves demonstrating that software meets certain defined independent standards.

The development and adherence to software standards is a very important part of the story of SQA. Generic industry standards are available, but also of much interest—particularly for the case study set out later in the article—are military standards. Indeed, the defence industry is so influential that Tierney (1993) argues that military standards influence software engineering far beyond applications in defence. Hence military standards are a very important part of SQA, and ultimately are important in formalising ways in which designers of computer systems can come to trust the systems and the production of correct software.

A number of military standards have been developed to regulate and control the use of software in defence applications. For instance, US standards DOD-STD-2167A (1988), MIL-STD-498 (1994), and ISO/IEC 12207 (1995) respectively established the requirements for software development and documentation in all equipment to be used by the US military (and effectively that of all Western armed forces),

introduced object oriented development (OOD) and rapid application development (RAD), then broadened the scope of international standards to include acquisition and maintenance. (DSDM Consortium, 2006).

The relevant UK standard 00-55, (MoD, 1997) *Requirements for Safety Related Software in Defence Equipment*, was published in 1997 and echoes much of MIL-STD-498, but moves the discussion on provably correct software in a particular direction. At first sight, this seems highly significant to the current argument, because it clearly expressed a preference for *formal* methods, in other words mathematical procedures whereby the software is proved to be correct by a machine (MacKenzie, 2001).

Tierney (1993) argues that the release of UK Defence Standard 00-55 in draft in 1989 had the effect of intensifying the debate over formal methods in the UK software engineering community. It devoted as much space to regulating and managing software development labour processes as the techniques and practices to be used for formal designs. This reinforces our argument that SQA is concerned with control of work processes and those who perform them, the software developers. On the one hand, many argued that mathematical techniques for software development and verification could only ever be used sparingly, as there simply was not enough suitable mathematical expertise in most organisations and it increased software quality at the expense of programmer productivity. On the other side, those from a more mathematical camp argued that there was commercial advantage in proving software correctness as errors could be trapped earlier in the software development cycle (Tierney, 1993, p. 116).

Designed into the MoD (UK Ministry of Defence) standard was a view of safety-critical software as an important area of regulation and control. Some of the reason for this was a change in its own organisation from the 1980s. The UK government sought to open up work traditionally

done in-house by the MoD in its own research establishments to private contractors (Tierney, 1993, p. 118). Given that it had to offer its software development to the private sector, it built in ways of controlling it within its defence standards (Tierney, 1993, p. 118). Further political impetus was offered by the introduction of consumer protection legislation in the UK in the late 1980s which required software developers to demonstrate that their software had not contributed, in the event of an accident enquiry, and that they had demonstrably attended to safety. Thus we can see that in Def Stan 00-55, politics, in the shape of the MoD's need to open up software development to the private sector and also to avoid being held responsible for inadequate software in the event of an accident, played an important role.

However, more significantly, this document has itself been superseded in 2004 by (draft) standard 00-56 (MoD, 2004). Def Stan 00-55 has now become obsolete. The changes involved in Def Stan 00-56 are of great interest, in that the preference for formal method is lessened. In the new standard, it is accepted that provably correct software is not possible in most cases and that we are inevitably involved in a human operation when we attempt to show that code is reliable in a safety-critical environment. Without a more detailed consideration of the history of formal methods in the UK over the last decade, which is beyond the scope of the present article, a strong claim that the move back to more human methods of verification might be difficult to sustain. Nevertheless it is interesting to note the way that Def Stan 00-5, with its emphasis on formal approaches and attendant onerous work practices, has been consigned to the history books with a clear move back to human verification.

CASE STUDY CONTEXT

The case study relates to a large European military aircraft company (MAC) with which one

of the authors was engaged as a researcher in a joint research project, lasting around three years, during the mid to late 1990s. A high proportion of the senior management were men and its culture was masculine in style, particularly emphasising an interest in engineering and technical mastery (Faulkner, 2000). Indeed there was much interest, pleasure, and admiration for elegant products of engineering (Hacker, 1991). When one of their fighter planes flew over (an event difficult to ignore on account of the engine noise), offices would clear as employees went outside to admire the display of a beautiful machine. A certain amount of military terminology was used, sometimes ironically, in day-to-day work. A number of employees had links with the armed forces. MAC was exclusively involved in the defence industry, with the UK's MoD being its largest customer and other approved governments buying its products.

As a manufacturing company in an economy where manufacturing was in steep decline and with its ties to the defence industry, if a major defence contract went elsewhere, jobs would be on the line. Despite the 'hi-tech' nature of its work, MAC had a traditional feel to it. The company had existed, under one name or another, right from the beginning of the avionics industry. The defence industry, and within that the defence aerospace industry, faced uncertain times as the UK government was redefining its expectations of the defence industry in post-Cold War times. It quickly came to expect much clearer demonstrations of value for money (Trim, 2001). Therefore, the 'peace dividend' brought about by the end of the Cold War meant uncertain times for the defence aerospace industry as military spending was reduced significantly (Sillers & Kleiner, 1997). Yet, as an industry contributing huge amounts to the UK economy (around £5 billion per annum in export earnings Trim (2001, p. 227)), the defence industry is hugely important in terms of revenue and employment. Defence industries have civil wings (which was the case with MAC) and it was seen as important that the

defence side of the business did not interfere with civil businesses. For instance, BAE Systems is a partner in a European consortium and was pledged £530 million as a government loan to develop the A3XXX aircraft to rival the USA's Boeing 747 (Trim, 2001, p. 228).

Although not strictly a public sector organisation itself, its location in the defence industry put MAC's business in the public sector. However, in the UK, views of public sector management were undergoing rapid change in the mid 1990s and it was seen as no longer acceptable that the taxpayer should underwrite investment (Trim, 2001). Such firms were required to be more competitive and to be held more accountable financially. Hence, quality management and value for money were becoming key concepts in the management repertoire of the UK defence industry from the mid 1990s onwards. As we discuss in the preceding section, this was at the height of the UK MoD's interest in formal approaches to the production of software. In a climate where post-Cold War defence projects were likely to demand a shorter lead time, there was considerable interest in speeding up the software development process.

Computer technology and related activity clearly played a central role in MAC. One division of MAC, the Technical Directorate (TD), developed most of the airborne software (much of it real-time). This software clearly has a central role in ensuring aircraft performance and safety. Around 100 people were involved in developing systems computing software. It was in this division that Software Development System (SDS), a safety-critical airborne software system for flying military aircraft, was developed.

Research Methodology

The methodological approach of the research was based on action research (Myers & Avison, 2002). As several successful participant observation studies in technology based organisations have been reported in the literature (Forsythe, 2001; Low

& Woolgar, 1993; Latour & Woolgar, 1979), an ethnographic approach holds much appeal. However, a strict ethnographic approach was neither feasible nor desirable in this study. As someone with technical expertise, the researcher could not claim to be the sociologist or anthropologist, more typical of reported ethnographic studies of technological systems (Low & Woolgar, 1993; Forsythe, 2001). This also meant that he was not 'fobbed off' by being directed into areas that the participants thought he wanted to look at or where they thought he should be interested in as happened in the Low and Woolgar (1993) case study. Based in the Quality Assurance Division (QAD) in the SQA team, early in his research, the researcher proved his technical credentials by helping run a workshop on software metrics and this helped to gain him full inclusion in the technical work. Although as a technical researcher, rather than a social researcher, it was arguably difficult for him to maintain the 'anthropological strangeness' which ethnographers look for in explaining the common sense and every day logistics of working life. In any case, he had been invited, through this research, to make a contribution to the improvement of SQA procedures. Therefore the research can be characterised as a form of action research (Baskerville & Wood-Harper, 1996), where potential improvements to SQA were to be seen as the learning part of the action research cycle.

Although action research receives a mixed press from the IS research community (Baskerville & Wood-Harper, 1996; Lau, 1999), it is nevertheless seen as a way of coming to grips with complex social settings where interactions with information technologies must be understood within the context of the whole organisation. Baskerville (1999) notes the growing interest in action research methods in information systems research. Two key assumptions are that complex social settings cannot be reduced for meaningful study and that action brings understanding (Baskerville, 1999). The culture of MAC was extremely complex, as we characterise above and

discuss again in what follows. Arguably, key elements would be lost were the researcher to have adopted a more distant role, relying on interviews and questionnaires rather than becoming fully immersed and contributing to the detail of the project. The researcher adopted an interpretivist approach, looking to the interpretations of the other participants of the research. But by allowing for social intervention he became part of the study, producing shared subjective meanings between researcher and subjects as coparticipants in the research (Baskerville, 1999).

For a period of over one year out of the three that the whole project lasted, the researcher spent, on average, one day per week working with MAC staff with access to a variety of staff across the organisation, and was therefore able to participate in a range of meetings and workshops and to gain a familiarity with the individuals concerned. This could not easily have been gained from interviews or surveys. These events included meetings where software quality staff considered quality policy, such as the implication of international standards, to broader meetings where technical staff were considering development methods in detail. Free access was allowed to relevant policy and development documents. This permitted an overview of the detailed practices and culture of this large and complex organisation.

Analysis of Case Study Findings

The initial remit of the researcher was to work with staff to optimise the use of software quality assurance within the organisation. The use of cost benefit analysis was originally suggested by senior management. Given our characterisation of the UK defence industry's particular focus on management of quality and value for money, as described above, it is entirely in keeping with the industry's changing needs that the researcher was initially directed into these areas. The researcher viewed it as problematic to assign monetary cost to SQA activities, and even harder to assign

monetary benefits. However, these concerns were never addressed directly in the project as it soon emerged that there was greater interest in a new approach to software development being pioneered by MAC.

Ince (1994, p. 2-3) tells the story of a junior programmer's first day in a new job. A senior programmer shows him around, advising him where to buy the best sandwiches at lunchtime, where to find the best beer after work, and other similarly important matters. Then the senior colleague points to a door. 'Whatever you do don't go through that door, the people there have been given the job of stifling our creativity.' The door, of course, led to the quality assurance department.

The staff of MAC's Quality Assurance Division expressed some similar feelings, albeit less dramatically. They wanted to act as consultants, offering a measure of creativity to the technical development process, although safely wrapped in appropriate quality assurance processes, but all too often they felt like the police. The strong awareness of the safety-critical nature of software development, and the related fairly advanced organisation of quality assurance in MAC, thanks in no small measure to the necessity to adhere to MoD standards, meant that SQA was never going to get quite the negative press that it attracted in Ince's (1994) anecdote. Nevertheless, there was still some feeling that the Quality Assurance Division could be brought on board in a project some time after the Technical Division had time to do the creative part.

Hence, TD had been prototyping the new SDS system for about a year when they decided to bring in Quality Assurance Division. As we explain below, the newness of the style of development in SDS made it unclear how it was to be quality assured. Unsure of how to proceed, the SQA manager turned to the researcher for suggestions. The researcher now became involved in investigating the use of the new software development approach, which would involve the inclusion of

computer generated program code ('auto-code') in safety-critical airborne software systems, leading to the approval of the new approach and its incorporation into MAC's software quality assurance systems.

Although there has been a long tradition of using computers to aid the process of software engineering itself, such CASE tools (Pressman, 2005) have not generally been used to generate safety-critical code (this was always written by human programmers). The new MAC SDS was an ambitious system whose targets were principally to reduce avionics systems development time by 40% and the cost by 30%, whilst maintaining the very high quality standards necessary for computer-based system which fly—and therefore can crash—military aircraft.

A key aspect of SDS was process integration using an integrated modeling environment. There was consequentially a heavy reliance on automated methods. A specification was developed in a formal modeling language and this generated programming code automatically. In particular, automatic code generation was eventually to lead to aircraft flying 'auto-code' in safety-critical systems. Two aspects of SDS stand out in the climate of defence spending of the mid 1990s. First, there was pressure to reduce costs and show value for money. Second, the use of formal methods in computer programming received a huge boost in the mid-1990s through the Defence standard DEF Stan 00-55 which mandated the use of formal methods base approaches in safety-critical software. It is not surprising that there was considerable interest in a system which offered the promise of considerably reduced software production times.

MAC invested a great deal of money and time in SDS in the hope that the improved time-scales which SDS promised, together with reduced costs, could keep major current aircraft developments on course. This was particularly important in an environment of political intervention and considerable public interest and concern over escalating costs

and delivery times in the public sector, including the defence industry. These benefits could only accrue to MAC if the quality, that is, correctness of the software, could be assured.

SDS was heavily dependent on software (CASE) tools. MAC had used these for many years, and had procedures in place for their qualification (i.e., acceptance) in certain circumstances. However, these applied to mission-critical rather than safety-critical systems. Furthermore, the movement towards auto-generated code led to a different environment than one where tools improved and speeded up the design process, but where failure would show up and be merely time-wasting. There was seen to be a need for a major improvement/update of these procedures, a quantum change, before they would be acceptable for safety-critical applications.

Some tools being used had major world-wide user communities, associated academic conferences, and came from supposedly secure and reliable suppliers. Others might not be so well supported, both intellectually and commercially. (For instance, it might be no use having an ideal tool if the supplier was small and unlikely to survive for many years.) Methods already existed for supplier qualification. These methods were undertaken by software quality staff. However, the qualification of these suppliers could be a crucial issue in the qualification of the tool and ultimately the integrity of the avionics system. The issue was not merely one of qualification, it was also one of *demonstration* of qualification to customers. Ultimately, the need in some sense to *prove* the new methods became paramount. Hence we can see that quality procedures did not just involve procedures, such as code walkthroughs through which software teams could persuade themselves to trust program code, they also applied to the question of choosing and trusting suppliers.

A number of meetings took place with members of the SDS team. This discussion was very useful for an understanding of SDS and gave the researcher a richer understanding of the SQA

needs. It soon became apparent that the necessary fundamental problems with SQA in SDS were going to be difficult to answer.

The difficulties were centred around two conflicting ideas. The first of these was that for the *persuasive rational argument* approach to be successful there would be a need for a group of professionals to participate in code walkthroughs, with consequent discussion and persuasion. On the face of it, this was simply not possible, since the computer which wrote the auto-code could not take part in such a discussion. Alternative approaches were considered. Clearly there would be a stage before the auto-code (at the requirements specification level) where human agents were involved, but this was found to be too high level to meet the relevant military standards (the US MIL-STD-498 [1994] and the UK standard 00-55 [MoD, 1997]). Both standards are very specific about the exact conduct of the necessary walkthrough. It had to be a *code* walkthrough.

On the other hand, for the *formal proof* approach method to work, there would first need to be such a formal proof. This did not seem within the capability of the QAD itself, despite the division being quite well resourced. MAC referred back to the auto-code tools suppliers, but once again there was no such proof and no realistic possibility of achieving such a proof. Although MAC was an important customer for the auto-code tool suppliers, they were not prepared to expend the necessary resources. Furthermore, a 'weakest link' argument demonstrates a fundamental flaw with the formal approach in computer systems. If the auto-code tool itself could be formally verified, it would then become necessary also to consider the operating system on which the tool would run and the hardware systems involved. Potentially this could involve a seemingly infinite regression of hardware and software systems having to be proved correct, where the system is only as good as its weakest link. Frustration grew as no solution was forthcoming and ultimately SDS was shelved indefinitely.

We have argued that mathematical proof is essentially a human achievement between members of the expert mathematical community who are persuaded of the correctness of mathematical proofs because they trust each other. These processes of trust are replicated in the procedures that have been developed in software engineering, and within that, software quality assurance. As part of the defence industry, developing safety-critical systems, MAC had highly developed SQA procedures which were obliged to follow international military standards. Their code walkthroughs, which are analogous to the ways mathematicians achieve trust in a proof, were an important part of such quality procedures. Formal methods offer the promise of an attractive certainty and control over software production and hence control over the work processes of human programmers. They also offer the promise of automatic verification of software systems which, potentially, could be much cheaper than traditional human based approaches to the verification of software through traditional SQA procedures.

SDS achieved very little despite the huge efforts put into it by the many people working for MAC. Although it was not, at the time, formulated in such stark terms, success was elusive because an attempt was being made to achieve the impossible: namely using auto-code whilst being held to quality assurance procedures which demanded code walkthroughs which could not possibly be achieved in an auto-code system. Attempts were made to consider formally proving the correctness of the auto-code. In addition to supplier reluctance, this raised the spectre of the infinite regress. If one looks to proving the auto-code correct, then the operating system must be proved correct, the hardware platform and so on.

This was at the height of interest in formal methods for safety-critical systems for defence, a view embodied in Def Stan 00-55. The rise of formal methods is crucially linked to the defence industry. The interest in formal methods and automated approaches arrived as pressure

mounted on Western governments to prove cost effectiveness due to the changing nature of defence developments after the end of the Cold War and the need to avoid litigation for software that might be implicated in an accident. Yet the difficulties of applying formal methods in systems of any level of complexity and the need to trust the program code acted as a spur to maintain complex human centred software quality assurance procedures.

CONCLUSION: TRUSTING COMPUTERS

There is much evidence that we already *do* trust computers in many walks of life without formal proof or other formal demonstration, even to the extent of trusting safety-critical systems such as the ‘fly by wire’ software in the Boeing 777 airliner, two million lines of code which have not been fully proved (Lytz, 1995). Expert mathematicians have begun to accept computer generated proofs, albeit in qualified ways (Chang, 2004). As MacKenzie (2001, p. 301) argues, ‘moral entrepreneurs’ of computerised risk ensure that warnings about computerised risk are heeded so that safety-critical software is avoided and, where it is unavoidable, much care is taken over its development. Military standards, so detailed about the use of formal methods in software design and attendant work processes in the 1990s, have moved a decade later to be much less prescriptive about the work methods of ensuring software quality, thereby allowing for the crucial element of human inspection in order that the software may be trusted. As Collins (1990) notes, we are remarkably accommodating to computers, making sense of them and involving them in our social networks, and will continue to find imaginative ways of doing so. This echoes Nissenbaum’s (1999) view that we may trust computers if we can treat them as ‘agents.’ We may meaningfully ascribe intentions and reasons to them.

In this article we have sought to tell a story of trust, in particular how software may be trusted when it is not produced by a human programmer. This involves consideration of a complex set of discourses including the question of mathematical proof and how proof is achieved within mathematical communities. We see a similar need to replicate such human processes of trust in trusting computer systems. We have argued that the making of standards to be applied within software quality assurance procedures shows ways in which mechanisms of trust are inscribed in software standards. Our case study, an action research project in a military aircraft company, demonstrates the difficulties which occur when quality assurance procedures involving code walkthroughs—procedures with built-in human trust mechanisms—are incommensurable with a system which relies on auto-code. The climate of defence research and spending was a major influence, both on our case study and the wider development of standards. There is a continued tension between needing to trust and trying to control: trusting the software and controlling its production. The story which we tell here is one of continuing human ingenuity in finding ways of trusting computer software.

REFERENCES

- Akrich, M. (1992). The de-scription of technical objects. In W. E. Bijker & J. Law (Eds.), *Shaping technology/building society: Studies in sociotechnical change* (pp. 205-224). Cambridge, MA/London: MIT Press.
- Baskerville, R. Investigating information systems with action research. *Communications of the Association for Information Systems*, 19(2). Retrieved October 5, 2006, from http://www.cis.gsu.edu/~rbaskerv/CAIS_2_19/CAIS_2_19.htm

- Baskerville, R., & Wood-Harper, A.T. (1999). A critical perspective on action research as a method for information systems research. *Journal of Information Technology*, 11, 235-246.
- Chang, K. (2004, April 6). In math, computers don't lie. Or do they? *New York Times*. Retrieved October 5, 2006, from <http://www.math.binghamton.edu/zaslav/Nytimes/+Science/+Math/sphere-packing.20040406.html>
- Collins, H.M. (1990). *Artificial experts: Social knowledge and intelligent machines*. Cambridge, MA: MIT Press.
- Davies, B. (2006, October 3). Full proof? Let's trust it to the black box. *Times higher education supplement*.
- De Millo, R.A., Lipton, R.J., & Perlis, A.J. (1977). Social processes and proofs of theorems and programs. In *Proceedings of the 4th ACM Symposium on Principles of Programming Language* (pp. 206-214).
- DSDM Consortium. (2006). White papers. Retrieved October 5, 2006, from http://www.dsdm.org/products/white_papers.asp
- Faulkner, W. (2000). The power and the pleasure? A research agenda for 'making gender stick.' *Science, Technology & Human Values*, 25(1), 87-119.
- Forsythe, D.E. (2001). *Studying those who study as: An anthropologist in the world of artificial intelligence*. Stanford University Press.
- Gillies, A.C. (1997). *Software quality: Theory and management* (2nd ed.). London/Boston: International Thomson Computer Press.
- Hacker, S. (1989). *Pleasure, power and technology: Some tales of gender, engineering, and the cooperative workplace*. Boston: Unwin Hyman.
- Ince, D. (1994). *An introduction to software quality assurance and its implementation*. London: McGraw-Hill.
- Kuhn, T.S. (1962).** *The structure of scientific revolutions*. **University of Chicago Press.**
- Latour, B., & Woolgar, S. (1979). *Laboratory life: The social construction of scientific facts*. Princeton University Press.
- Lau, F. (1999). Toward a framework for action research in information systems studies. *Information Technology & People*, 12(2), 148-175.
- Low, J., & Woolgar, S. (1993). Managing the socio-technical divide: Some aspects of the discursive structure of information systems development. In P. Quintas (Ed.), *Social dimensions of systems engineering: People, processes and software development* (pp. 34-59). New York/London: Ellis Horwood.
- Lytz, R. (1995).** **Software metrics for the Boeing 777: A case study.** *Software Quality Journal*, 4(1), 1-13.
- MacKenzie, D.A. (2001).** *Mechanizing proof: Computing, risk, and trust*. Cambridge, MA/London: MIT Press.
- MacKenzie, D.A. (2004).** *Computers and the cultures of proving*. Paper presented at the Royal Society Discussion Meeting, London.
- Ministry of Defence (MoD). (1997). Requirements for safety related software in defence equipment Retrieved October 5, 2006, from <http://www.dstan.mod.uk/data/00/055/01000200.pdf>
- Ministry of Defence (MoD). (2004). Interim defence standard 00-56. Retrieved October 5, 2006, from <http://www.dstan.mod.uk/data/00/056/01000300.pdf>
- Myers, G.J. (1979). *The art of software testing*. New York: Wiley.
- Myers, M.D., & Avison, D.E. (Eds). (2002). *Qualitative research in information systems: A reader*. London: Sage Publications.

Nissenbaum, H. (1999). Can trust be secured online? A theoretical perspective. *Etica e Politica*, 2. Retrieved October 5, 2006, from http://www.units.it/~etica/1999_2/nissenbaum.html

Popper, K.R. (1963). *Conjectures and refutations*. New York: Harper.

Pressman, R. (2005). *Software engineering: A practitioner's approach* (6th ed.). London/New York: McGraw Hill.

Sillers, T.S., & Kleiner, B.H. (1997). Defence conversion: Surviving (and prospering) in the 1990s. *Work Study*, 46(2), 45-48.

Singh, S. (1997). *Fermat's last theorem*. London: Fourth Estate.

Stahl, B.C. (2006). *Trust as fetish: A Critical theory perspective on research on trust in e-com-*

merce. Paper presented at the Information Communications and Society Symposium, University of York, UK.

Tierney, M. (1993). The evolution of Def Stan 00-55: A socio-history of a design standard for safety-critical software. In P. Quintas (Ed.), *Social dimensions of systems engineering: People, processes and software development* (pp. 111-143). New York/London: Ellis Horwood.

Trim, P. (2001). Public-private partnerships and the defence industry. *European Business Review*, 13(4), 227-234.

Weinberg, G. (1971). *The psychology of computer programming*. New York: Van Nostrand Reinhold.

This work was previously published in International Journal of Technology and Human Interaction, Vol. 3, Issue 4, edited by B. C. Stahl, pp. 1-14, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.14

Propagating the Ideal: The Mobile Communication Paradox

Imar de Vries

Utrecht University, The Netherlands

ABSTRACT

In this chapter, visions of mobile communication are explored by focussing on idealised concepts surrounding wireless technology. By examining sources on the development, marketing, and use of wireless technology, I contextualise these visions within earlier accounts of ideal communication found in media history and isolate the regularities that are part of these accounts. On close examination, a paradox reveals itself in these regularities, one that can be described as resulting from an uneasiness in the human communication psyche: an unfulfilled desire for divine togetherness that clashes with individual communication needs. While the exact nature of this paradox—innate and hardwired into our brains, or culturally fostered—remains unknown, however, I assert that the paradox will continue to fuel idealised ideas about future communication technology. I conclude with the observation that not all use of mobile technology can immediately be interpreted as transcendental, and that built-in locational awareness balances the mobile communication act.

INTRODUCTION

In October 2003, two British climbers were caught in a blizzard on a Swiss mountain. Rachel Kelsey and her partner Jeremy Colenso, both experienced climbers, were forced to stop behind a large rock at 3000 meters up and wait for the weather to clear. They soon realised that their chances of finding the abseil points in heavy snow were very slim, which meant they were stuck. They texted five friends, one of whom received the message in London at 5 a.m. and immediately notified the rescue services in Geneva. After having to wait another 36 hours because the conditions were too severe for the rescue team to pick them up, the two climbers were finally rescued (Allison, 2003).

The idea that Earth is becoming entirely networked is not new,¹ but the characteristics of mobile communication media have—just as with the first wireless revolution in the beginning of the 20th century²—fiercely fuelled the Western notion that through better communication technology all problems of communication will—finally—be solved (Peters, 1999). The “anywhere, anytime, anyhow, anyone” slogan, subliminally attached

to every mobile apparatus, opens up a vision of a universally accessible communication space, in which the exchange of information comes to stand for the single most important condition of human progress. More than at any other time in history, this human progress is thought to depend on technological progress.

Rescue stories as those described in the opening paragraph play their part in keeping the idea alive that improvement through technological progress can be measured. The conventional wisdom is that human lives are the single most valuable things we can think of, and if new technology can help save them, it must be treasured. Moreover, if new technology such as mobile telephony makes possible a way of life that is never forsaken of human contact—which therefore is taken as safe because there will always be someone who can help—this technology is surely poised to be seamlessly adapted to and integrated in our being (Katz, 2003). Through the remediation of older dominant forms of communication and entertainment technology, the mobile device (or personal digital assistant (PDA) or smart phone, as it is increasingly being called by mobile phone operators and providers) does seem to try to provide an ultimate extension of the natural balance of our sense organs (Levinson, 1997, 2004). Future visions of mobile communication strive for setting up globally accessible meeting points that cater bodiless but perfect interaction, and ultimately for opening up a communication space in which everyone is represented.

This is the inherently human dream of reaching an ideal state, which is cunningly exploited by advertisements, telecom operators, service providers, and the like. We know it is a dream, and we know that we are confronted by it day after day. It will probably haunt us for centuries to come. However, just as “our desire for each other [is] a poor substitute for the primary Eros—and therefore doomed to fail” (Campe, 2000), so are our telecommunication media substitutes for the primary closeness—and bound to fail (Vries,

2005). The end result of this is a tragic search for ideal communication through a continuous so-called improvement of communication technologies, a search that will never end.

This chapter will investigate the paradox of this eternal futile quest that we seem to keep embarking on, and will do so by looking at how mobile discourse is framed within quest-ending narratives. By analysing texts from influential scholars such as Pierre Lévy, Howard Rheingold, and Paul Levinson, we will get a grasp of how idealised ideas of the power of new communication technology have pervaded the mobile realm. From there, an attempt is made to single out the recurrent elements in those ideas, whose pervasiveness in our culture will then be examined. Finally, we will look at a few current trends in mobile cooperation techniques that potentially realise certain ideals of communication, albeit in a more pragmatic sense than a sublime one.

UNWIRING THE KNOWLEDGE SPACE

So far, it has mainly been cyberspace and its accompanying access points in the form of personal computers and laptops that are associated with potentially establishing the universally accessible communication realm. However, with the amount of mobile phones growing at an enormous pace,³ the mobile device has with stunning speed become an essential tool to establish and maintain social networks, as well as managing all kinds of data flows. In this capacity, the device seems perfectly poised to morph itself into the logical choice of medium when accessing the ever-expanding Über network, the Internet.⁴ Wherever, whenever, whatever: downloading or uploading information on the move, sharing news events as they happen with your carefully filtered online friends, checking in on your favourite weblog while lying on the beach; it is already possible and will be even more so when the devices grow into always-on

mode. It is at this point where Pierre Lévy’s (1997) imaginative collective intelligence, located in what he calls the knowledge space, starts to come into its own on an immense scale.

Lévy describes the evolution of earthbound living as being immersed in a succession of four types of space, in which man’s identity is determined by the tools and symbols predominantly available in that space (see Table 1). The knowledge space is the fourth—and final—space in which we have come to live, and can best be seen as an informational cloud, a “space of living-in-knowledge and collective thought” (Lévy, 1997, p. 140). An important premise for its existence, growth, and preservation is that people interact with the informational cloud by adding, changing, and retrieving data in whatever way possible.⁵ It is to “unfold and grow to cover an increasingly vast and diverse world” (Lévy, 1997, pp. 111-112), ultimately creating a universally accessible information realm. Already, we can recognise this vision in descriptions of the multiple thrusts behind both the Internet and the mobile revolutions, such as those found in marketing publicity and open source movements’ manifests alike.

Lévy’s hierarchical description of the four levels of space invoke Borgmann’s (1999) distinction between information about (“my shed can be found next to the willow tree”), for (“this is how you build a cathedral”), and as reality (“hi, I am Imar’s avatar, shall we start exchanging data?”). Both Lévy and Borgmann show us historical

shifts that expose a dematerialising transition of the dominant form of information. Although—as is conspicuously evident from the title of his book *Holding on to Reality*—Borgmann warns us for a Baudrillard-like potentially dangerous split between information about/for reality and information as reality, Lévy is not so much concerned about the danger of leaving reality behind, as he frames the knowledge space firmly within the other three spaces: “[It is n]ot exactly an earthly paradise, since the other spaces, with their limitations, will continue to exist. The intention of collective intellect is not to destroy the earth, or the territory, or the market economy” (Lévy, 1997, p. 141).

Paradise or not, Lévy cannot help but describe the knowledge space in terms of “a u-topia ... waiting to be born,” “a cosmopolitan and borderless space,” “an electronic storm,” and “a sphere of artifice shot through with streaks of light and mutating signs” (Lévy, 1997, pp. 138-141), thereby mimicking the eccentric cyberpunk style of William Gibson’s *Neuromancer*. There is undeniably a religious element visible in the way Lévy writes about the knowledge space, in which information is to be uncoupled from its static base. This dematerialising movement fits perfectly with the transcendental nature of going wireless: liberating things by releasing them from their carriers (be it wires, paper, or the brain) promises more opportunities to interconnect those liberated entities, as they form free-floating nodes in a dynamic

Table 1. Succession of spaces according to Lévy (1997)

| Space | Identity |
|------------------------|---|
| Nomadic Space of Earth | totems, lineage |
| Territorial Space | territorial inscription |
| Commodity Space | position within the domains of production and consumption |
| Knowledge Space | skill, nomadic cooperation, continuous hybridization |

network. In the end, in its most radical form, the idea is that every node can be connected to all others, providing instant and perfect transferral of whatever form of data.

As asserted previously, although the knowledge space is self-regulated and its transcendental nature gives rise to the supposition that it might leave the other spaces behind, Lévy holds that it cannot be entirely separated from the three preceding spaces. Moreover, in a circular movement—“a return of the earth to itself,” as Lévy (1997, p. 141) calls it—the knowledge space connects back to the first space through the recurrence of the nomadic identity. Again, this is a characteristic that is typically found in the mobile device, as has been shown by scholars in recent literature (Gergen, 2003; Kopomaa, 2000; Meyrowitz, 2003). The multiple social roles we possess are called upon in increasingly diverse geographical and social environments when a mobile device is carried along: we can perform parental tasks while at work, we can keep in touch with friends while on vacation, and we can consume entertainment while sitting in classrooms. Slowly, urban design is responding to the diminishing need to build strict and fixed divisions between sites for work, leisure, and family, creating heterogeneous zones in which the individual’s social status is defined by the type of communication he or she engages with. The use of mobile technology therefore does not entail a full-circle return to the nomadic in the sense that it forces us to change location in order to find more fertile ground, as was the case in Lévy’s first earthly space, but it forces our locations to adapt to our dynamic modes of being.

The transcendental and nomadic nature of the knowledge space calls for an intricate investigation of the points where it meets other spaces, and of the materiality of these meeting points. Considering the ease with which the mobile device has found its place as the essential data tool, such meeting points, which according to Rheingold (2002) seem to call for a “marriage of bits and atoms” (p. 100) or for us to be able to “click on reality,” (p. 95)

are set to be facilitated by the smart phones of the future. Or, as we will see in the next section, this is how it is envisioned in idealised ideas of communication.

THE LURE OF THE IDEAL

Although he admits to being utopian, and has subsequently tried to capture the dynamics of the collective intelligence in a formal language in order to make it more visible and tangible, Lévy has been criticised for painting an exaggeratedly pretty picture, ignoring the tough reality of political, economic, social, and other factors that influence the way communication technology is developed, produced, distributed, and used. In the fourth chapter of their book *Times of the Technoculture: From the Information Society to the Virtual Life*, Robins and Webster (1999) accuse Lévy of “promot[ing] and legitim[izing] the prevailing corporate ideology of globalization,” and hold that “there is a desperate need for a richer debate of knowledges in contemporary societies — in place of the shallow, progressivist marketing that attaches itself to the cyberculture slogan (and reflects the hegemony of corporate interests)” (Robins & Webster, 1999, pp. 225, 227). In the same chapter, the aforementioned Rheingold receives similar flak for his—supposedly uncritical—belief in the Internet as a means of restoring communities.

However, Lévy and Rheingold are influential writers and are certainly not alone in taking an optimistic and idealised view on the possible contributions new communication technology can make to finally bring people together in an intelligent collective—nor will they be the last. If the years between the launch of the world’s first graphic Internet browser in March 1993 and the crash of the dotcom boom in early 2000 marked the building up of the cyberspace hype, then the subsequent years can be characterised as having been labelled the new and improved mobile or

wireless era: countless press releases, research papers, news articles, advertisements, books, radio shows, and television programmes have heralded mobile technology as the ideal solution to many communication problems. Two books I would like to bring to the fore in this respect are *Smart Mobs: The Next Social Revolution* by Howard Rheingold (2002) and *Cellphone* by Paul Levinson (2004), as their structures show interesting similarities with Lévy's (1997) approach—and with it, the same dangerous tendency to overestimate communication technology's power to fulfill longtime ideals of communication.

Comprised of a large series of anecdotal, interview, and travel journal material, *Smart Mobs* intends to uncover the characteristics of the “next social revolution,” which is to be cranked up by the new mobile devices that “put the power of instant and ubiquitous communication — literally—within everyone's grasp” (Rheingold, 2002, back cover). Describing an impressive amount of trends, experiments, news reports, and commercial projects within the global realm of mobile telephony and computing, Rheingold shows how “technologies of cooperation” have an inherent tendency to group people together—and where there is a group, there are opportunities to learn, create, or topple over. The well-known (albeit somewhat overused) example of the protest demonstration in the Philippines in 2001, in which more than 1 million people were rallied by text messages to oppose Joseph Estrada's regime, is used by Rheingold as a key argument in describing a pivotal cultural and political moment: the power of mobile, ad hoc social networks is not to be underestimated; it can even influence politics on a momentous scale! To be fair, Rheingold's argument does not hinge upon this example alone; next to three other activist movements, he also mentions the squads of demonstrators that, thanks to mobile coordination, won the “Battle of Seattle” during a World Trade Organization meeting in 1999. These movements, however, have been minor in impact and longevity, and

do not appeal to the imagination as much as the Philippine regime change does. It is therefore that *Smart Mobs* focuses mainly on events and projects that contain a clearly visible potential to change things; after all, what better way is there to show that the social impact of mobile technology is not only measurable, but can also be described in terms of setting in motion an unstoppable voyage towards a better future?

Other examples of what the consequences of ubiquitous mobile communication might be are equally carefully chosen for their provocative nature. Among the phenomena that await us, Rheingold (2002) names WiFi neighbourhoods; wearable computing that makes our environment aware of our presence and can react accordingly; RFID tags that provide contextual information on any object; and swarm intelligence that makes possible useful emergent behaviour. He does his best to convince us of the inherent potential of these things to fundamentally change the way we are living—and does so with an obligatory nod to the possibility that some of those changes might not be as pleasurable as we would like—but fails to go much further beyond stating the mantra together is good. The majority of Rheingold's examples, however tangible and useful they may be within their own context, are used to construct a vision of a futuristic world in which the possibility to connect things (people and machines) is most highly rated. To connect is to solve, to evolve, to come closer to the ideal of sublime togetherness.

Levinson's *Cellphone*⁷ is another very good example of how opportunistic ideas found in much cyberculture literature have been transferred to the mobile realm. Not wasting any time, the book's subtitle, which is as subtle as it is provocative, already promises to tell us “[t]he story of the world's most mobile medium and how it has transformed everything” (bold in original). Working from within his Darwinian approach to media evolution—only the fittest media persist in the human environment—Levinson holds that “the cellphone has survived a human test,”

and that the human need it satisfies is “as old as the human species — the need to talk and walk, to communicate and move, at the same time” (Levinson, 2004, p. 13). This need, which “even defines the human species” (Levinson, 2004, p. 13), is satisfied by the mobile device to such an extent that Levinson foresees the end of the digital divide; the rise of new and more honest forms of news gathering and dispersal; and the birth of a smart world.

The most important (and obvious) characteristic Levinson stresses is that the mobile device blurs the boundary between inside and outside, rendering it unnecessary to confine ourselves to brick and mortar rooms when we want to call someone or find information. The consequence of this blurring is that it will enable us to “do more of what we want to do, be it business or pleasure, pursuit of knowledge, details, companionship, love,” and that it will make “every place in the world in which a human may choose to thread ... well-read, or ‘intelligent’” (Levinson, 2004, pp. 60-61). Dubbing this intelligent world a “telepathic society”—accompanied by the obligatory but hollow disclaimers that “our progress ... will be tough going at times” (Levinson, 2004, pp. 60-61) and that the mobile device not only solves things but generates new problems of privacy as well—Levinson sides with previous visions of emerging all-encompassing intelligence that have proved to be vulnerable to easy critique, including the Noosphere of Teilhard de Chardin (1959), the morphic fields of Sheldrake (1989) and the global brain of Bloom (2000). As we will see in the next section, the recurrence of these ideas is not coincidental.

RESEARCHING REGULARITIES

Clearly, optimistic visions of new futures are often met with scepticism, but this does not stop them from reoccurring through time; especially when new information and communication me-

dia find the limelight. To understand why this “almost willful, historical amnesia,” as Mosco (2004, p. 118) calls it, occurs, it is necessary to investigate the underlying regularities of such idealised claims, and to map the basic elements that make up those regular elements. By focusing not on a new medium itself—nor on what it is that makes it unique—but on the path that lies before that medium, we can get a detailed view of the moments in time that mark significant contributions to the medium’s earlier discourse. This can best be achieved using the so-called media archaeology approach, which aims to prevent historical amnesia by “(re)placing [the histories of media technologies] into their cultural and discursive contexts” (Huhtamo, 1994). Doing so, the emphasis is shifted “[f]rom a predominantly chronological and positivistic ordering of things, centered on the artefact, ... into treating history as a multi-layered construct, a dynamic system of relationships” (Huhtamo, 1994). It is these relationships that can clarify the intricate ways in which idealised regularities in the dynamic communication media discourse may have changed face, but not their core.

Huhtamo proposes to call the regularities *topoi*, or topics, which he defines as “formulas, ranging from stylistic to allegorical, that make up the ‘building blocks’ of cultural traditions.” He stresses that these *topoi* are dynamic themselves: “they are activated and de-activated in turn; new *topoi* are created along the way and old ones (at least seemingly) vanish” (Huhtamo, 1994). In other words, *topoi* are highly political and ideologically motivated. As an example of a *topos* found in media history, Huhtamo considers the recurrent “panicky reactions” of public being exposed to visual spectacles, and finds these in illustrations of the *Fantasmagorie* shows at the end of the 18th century, in reports of the showing of the arriving train in the Lumière brother’s *L’Arrivée d’un train à La Ciotat* (1895) and in the stereoscopic movie spectacle *Captain EO* in Disneyland. There is, of course, a danger

of over-interpreting historical sources that may well have served another function than to give an accurate account of what actually happened, but this is exactly Huhtamo's point: "unrealized 'dream machines,' or discursive inventions (inventions that exist only as discourses), can be just as revealing as realized artefacts" (Huhtamo, 1994). The Lumière showing may well not have created any panic at all, but it still remains a poignant reference, a media myth that is repeatedly used in numerous books, articles, and essays in which the reception and impact of new media is discussed. Media archaeology tries to expose these dubious but persistent stories, to collect and dust off forgotten elements of a medium's history by looking at discursive connections, however weak those connections may be. By looking at the many levels on which the discursive construction of a communication technology presents itself, media archaeology bridges the revolutionary gaps that are often found in teleological historiographies of that technology.

This archaeological approach has been put to practice by several scholars in recent years,⁸ and has so far been successful in revealing and critically analysing media topoi such as the desires for immediacy, presence, liveness, and simultaneity. The most powerful (or overarching) topos, however, is the gnostic longing to transcend earthly life by improving technology, and to create a Universal Brotherhood of Universal Man. This ultimate topos unites every imaginable description of fulfillment, perfection, pureness, and harmony, and can be found in accounts of every communication medium, in every stage of its development, production, distribution, and use. The dream to finally fulfill the ultimate topos through improvement of communication technology can be comprehensively traced through media history, as many scholars (Mattelart, 2000; Mosco, 2004; Peters, 1999) have already shown. As I have written elsewhere, "[w]ireless telegraphy was seen as 'the means to instantaneous free communication'; telephony seemed to promise banishment of dis-

tance, isolation and prejudice; radio would pave the way for contact with the dead and television would transform its viewers into eyewitnesses of everything that went on in the world" (Vries, 2005, p. 11). With every development, be it technological, political, economical, or social, the regularities in discursive accounts of older media have been passed on to newer versions, thereby changing form but not essence.

The argument here is that mobile technology fits into a long line of media in which a limited set of regularly used modes of reflection determines the discursive domain of media reception. By analysing the discursive construction of mobile technology and comparing it to that of previous communication media, we can get a grasp of the topoi that have flourished or been revived—be it essentially unchanged or in disguised form—and of those that have floundered or been abandoned. Some of the most interesting indicators of these topoi are to be found in rationalisation techniques people use when explaining why they buy mobile phones, or what they are mainly going to use them for. On the surface, these explanations mostly point to very pragmatic reasons. Field study has shown that common justifications for acquiring a mobile phone are business, safety, and security (Palen, Salzman, & Youngs, 2000). On a deeper psychological level, however, these pragmatic reasons can be tied to fears of solipsism, a desire to increase the amount and strength of communication channels in the social network, and a wish for greater control over one's overall connectivity and availability. Just as we have seen in Rheingold's *Smart Mobs*, a need for the potential to increase togetherness is expressed in the mobile discourse, reflecting the ultimate topos of ideal communication.

The hints of religious elements present in these uncovered communication ideals is not surprising; just as Ludwig Andreas von Feuerbach stated in the middle of the 19th century that God is the projection of the human essence onto an ideal, so is an ultimate communicative Being

One a projection of a human essence onto communication ideals. The religious motifs continue to exist today: authors such as Erik Davis (1998) and David Noble (1997) have written elaborate accounts of how contemporary technological discourses are still undeniably intertwined with religious beliefs, despite the widely held notion that since the Enlightenment these categories have slowly but surely separated. Such is the case with the topos of ultimate togetherness: the fears and desires disseminated by that topos are exponents of a mixture of the autonomous behaviour of the liberated Cartesian subject on the one hand, and a dream of a bodiless sharing of minds, described by Peters (1999) as angelic communication, on the other. This is a deeply paradoxical mixture, however. Angelic communication shows all the hallmarks of a divine togetherness: with no physical borders and direct one-on-one mappings of minds, every entity will ultimately know and be the same. This loss of individuality collides with the search for more control over one's individual connectivity found in the modern subject's autonomous behaviour. Both angelic communication and complete autonomy are idealised opposite poles on the same scale, and will therefore remain forever out of reach.

THINKING THROUGH PARADOX

The crux of the communication paradox can be described as an uneasiness in the human communication psyche, born out of the tension between the desire for ideal communication and the knowledge of never being able to reach that goal. This is not to say that every individual always wants to strive for perfection. Moreover, reaching perfection may not be what would actually be beneficial for human kind, as many dystopian answers to utopian projects, proposals, and literature have shown; there is no room for individuals or deviations in a society that can only function perfectly if every citizen is synchronised in the

grand scheme.⁹ Still, the paradox holds, as even in dystopian visions the utopian looms; in the end, Armageddon, the ultimate dystopian event, does nothing more than to destroy old structures in order to lay the foundation for a new, perfect one. A similar argument can be made for a dominant part of the communication media discourse: New media strive for the abolishment of old media in order to provide improved togetherness (Bolter & Grusin, 1999).

As we have seen in the previous section, the successive observations that the development phase and subsequent promotion of communication media are almost always framed within idealised expectations, that these are always accompanied by dystopian rebuttals, and that this process of touting and dismissing keeps reoccurring through time, give rise to the assumption that there is a steady undercurrent present, a topos that can be described as an idea of ideal communication that drives humankind to keep searching despite guaranteed failure. The objection to this assumption might be that this process is merely a marketing mechanism, but such a mechanism can only work if it addresses a human longing, one that is sensitive to promises of solving the communication tension.¹⁰ The question, then, is whether the paradoxical attitude towards communication technology is innate, or if it is just a temporary, culturally sustained concept of progress left over from the Enlightenment, which, at some time in the future, is to be replaced by another concept. If it is innate, we will not be able to escape it; if it is not, we might be able to understand how to change or manipulate the structures in which the paradox resides.

To ask the question of innateness is to enter the realm of epistemology, the study of how we can know the world around us. Until the middle of the 18th century, this field had known two fairly opposed visions: the rationalist and the empiricist view. The rationalist Innate Concept thesis holds that there are some concepts that are already in our minds when we are born, as part of

our rational nature. The notion that we can have a priori knowledge, that we have some innate awareness of things we know to be true that is not provided by experience, rests on the premise that the concepts used to construct that knowledge are also innate. Empiricists, however, argue that there are no innate concepts, and that experience alone accounts for the raw material we use to gain knowledge. The most well-known proponent of empiricism, John Locke, wrote that humans are born with a blank mind, a *tabula rasa*, which is written onto by experience. Knowledge, therefore, is not brought to consciousness by experience, but is provided by that experience itself.

This distinction largely disappeared toward the end of the 18th century when the two views were brought together by Emmanuel Kant, who divided reality into the phenomenal world (in which things are what they appear to us to be, and can empirically be known) and the noumenal world (in which things are what they are in themselves, and where rationalism rules). According to Kant's transcendental idealism, innate concepts do exist, but only in the noumenal world, where they remain empirically unknowable. Arguably, these innate concepts are philosophical in nature and therefore proof of their existence remains hard to formulate, but this does not mean innateness is always metaphysical. For instance, genetic theory, a late 20th century science, claims to provide empirical evidence for the existence of innate mechanisms in cognitive evolution: Human brains are not *tabula rasa*, but prestructured in specific ways so that they can learn things other organisms can not. While some elements of evolutionary psychology (EP) are highly controversial,¹¹ it is increasingly accepted that we all come wired with what Chomsky (1957) has called a Language Acquisition Device (LAD): Not only do we possess an innate capacity to learn, but also an innate set of universal language structures. This means that, independent of our social, cultural, or ethnic environment, we already know how language works before we even speak it. It is on this

level that we have to look for the communication paradox if we believe it to be innate: Are we in some way hard-wired to have a tendency to long for goals that are impossible to reach, to be fascinated by things that are and yet are not? Is there some sense of divine togetherness that we come programmed with, that is at some point in time to be fulfilled but keeps slipping away when we think we come close? The long history of trying to overcome distance and time through the use of media makes a strong argument for such a claim, especially when looking at the positivist discourse this search is usually framed in.

Seen this way, the topos of increased togetherness through idealised communication is but one manifestation of a central paradoxical tendency generated by our brains, albeit one of the most dominant. An imaginative account of how this paradoxical core pervades all aspects of life is found in Hofstadter's (1979/1999) *Gödel, Escher, Bach: An Eternal Golden Braid*. In the new preface in the 20th anniversary edition Hofstadter stresses the paradoxical motive for writing the book by stating that he had set out to "say how it is that animate beings can come out of inanimate matter" (Hofstadter, 1979/1999, p. xx). Introducing so-called strange loops, instances of self-reference that can often lead to paradoxical situations, Hofstadter shows that these loops can not only be found in math, perspective drawings, and music, but also—and this is his main argument—in the very essence of conscious existence itself. Without paradoxes, it seems, life as we know it could not exist. A similar argument is made by Seife (2000), who explores our uneasy relationship with zero and infinity in *Zero: The Biography of a Dangerous Idea*. Innocent as they might seem, in many situations in many times the notions of zero and infinity have been difficult to grasp, use, and explain; to such an extent even that people have equated them with the work of God and ignored them as not allowed by God at the same time. It was through the use of zero and the infinite that Zeno could create his paradoxical race, in which

Achilles never overtakes the tortoise, and it is zero and the infinite that plague contemporary physicists' current understanding of our universe. Opposite poles that invoke as well as fight the paradoxical will always be with us, because we are born out of a paradox, Seife concludes.

EP is a relatively young field, and as such has not yet found very stable ground. The argument that there is a universally active module in our brain that triggers—or is even responsible for—a life with paradoxes is therefore to be very cautiously approached. As asserted previously, it may well be that our paradoxical attitude towards communication is not the manifestation of an innate concept, but of a culturally constructed one. A helpful nongenetic argument for the paradoxical inclination is found in existentialist theories, especially in Heidegger's treatment of *Gelassenheit* (releasement) and Sartre's description of *mauvaise foi* (bad faith). Whereas the former concept deals with fully accepting one's Being-in-the-world as something that has no intrinsic goal or pre-given content, as something that can only receive its significance through the meaning one chooses to give to it, the latter is the result of not accepting the open-ended nature of our existence, of continuously asking "why"? and trying to find the answer outside of one's own will. Such a denial of things-as-they-are and things-as-they-happen actively feeds and sustains a two-pole system, in which paradoxes reside: There is no coincidence when everything happens for a reason, and there is no sense when everything is contingent. People with bad faith—and there are a lot, according to Sartre—often face and cannot accept the most fundamental paradox: Sometimes things are just what they are, even when they are not.

Now all these observations may seem a far cry from our day-to-day experience of using mobile phones, but whenever we transfer any information in any way we are positioned as a node in a communication network, one that exists foremost because we as humans seek contact. We hope

and strive for this contact to be instantaneous, clear, under control, and ideal, even when we want to mislead or deceive the other person; if we manage to use the medium and channel in such a way that it serves our intent, the contact has been ideal for its purpose. The desire is for a technologically induced complete fulfillment, which is omnipresent in mobile discourse. There is never any certainty about having reached this ideal state, however, as we have seen. The communication paradox makes sure that something always gets in the way of pure experience.

THE RETURN OF LOCATION

In light of this knowledge, the best way we can act, as Peters (1999) also argues, is to embrace the impossibility of ideal communication and make do with what forms of communication we can realise. The transcendental nature of wireless technology may at times lure us into thinking we have come close and need just a little push in the right direction, but this would be like chasing a mirage. What then are the elements of more appropriate pragmatic approaches to using new communication technology, ones that defy the urge to hand out idealised promises? Some interesting trends in recent innovative wireless concepts show that the independency of locality, the characteristic that seemingly constitutes the essence of mobile telephony, can be turned on its head. Where the most pure form of communication is equated with a bodiless presence and is therefore situated in a nondescriptive anywhere, part of the current crop of wireless projects inject exactly this sense of locality into the mobile communicative act. The resulting location based services (LBS) are put to use in a variety of ways: backseat games that merge road context with virtual content (Brunnberg & Juhlin, 2003), portable devices that support the tourist experience by supplying on the spot information (Brown & Chalmers,

2003), systems that provide virtual annotation of physical objects (Persson, Espinoza, Fagerberg, Sandin, & Cöster, 2002), and mobile phone applications that can sense the proximity of people on your buddy list (Smith, Consolvo, Lamarca, Hightower, Scott, Sohn, et al., 2005). Of course, all these projects in some way reflect a drive towards making things easier, quicker, better, or simply more enjoyable, and therefore do not completely escape paradoxical idealised thinking, but they do not ostentatiously try to transcend our present experience of communication by denying its inherent grounding in lived space and time.

Another area where mobile phones are undeniably making a difference without having to resort to metaphysical musings is in developing countries. By leapfrogging older communication technology—in most cases this concerns landlines that had been too expensive to be installed nationwide—mobile technology is used to quickly set up cheap networks, thereby facilitating measurable boosts to local economies and communities. The mobile networks do not instantly connect all parts of a country, but remain localised in existing urban or rural environments. This localisation is further strengthened by the fact that, less tempted to use the mobile device to mix different social locales into one heterogeneous zone, as is more the case in Western metropolitan areas, people in these developing countries tend to see the mobile more as a landline that happens to be wireless. If there would have been a landline the impact would have largely been the same, something communication theorist Jonathan Donner (2003) concurs with. He conducted several field studies in Rwanda, and found that the use of mobile phones by Rwandan entrepreneurs enhanced their ability to do business, but also to satisfy their emotional and intrinsic needs. This is mostly due to the mere presence of a communication channel, and not to the mobile's intrinsic essence. Again, the underlying idealised implication is that appointments, deals, and transactions can occur faster and more streamlined when people are increasingly

brought together in whatever way, but in cases such as those in Rwanda the results of introducing wireless technology are clearly visible and do not remain mostly theoretical.

CONCLUSION

With the global proliferation of mobile communication devices, a reinvigorated sense of ubiquitous connection possibilities has emerged. Covering large parts of the Earth, a networked informational skin seems set to revolutionise our way of living. The key new paradigm that is stressed in this “mobilisation” of the world is the ability to tap into an all-encompassing knowledge space, thereby making information addition, retrieval, and communication virtually instantaneous. The fundamental driving force behind this endeavour can be ascribed to a desire for establishing connections to everyone or everything in whatever way possible, a bodiless omnipresence. The radical consequences of this—almost angelic—desire are affecting traditional modes of interaction such as dialogue and dissemination.

This dream of idealised communication is subconsciously stressed by the dominant image of wireless communication that is found in advertisements, press releases, books on social change, government policies, and the like. Promises that things will get better, fuel our impatience when contemporary technology fails to deliver. In other words, the desire for ideal communication itself is part of a paradoxical system found in all layers of our existence. The dream can never be realised, and will therefore continue to recur through time. Whether we will be able to change our attitude towards this strange loop depends on its nature: If it is hard-wired into our brains, we will have to live with the paradox forever. If it is not, who knows, we might come to see mobile communication for exactly what it is, a specific but not definitive “Being” of communication.

REFERENCES

- Allison, R. (2003, October 7). Climbers on Alpine ridge rescued by text message. *The Guardian*. Retrieved May 16, 2005, from http://www.guardian.co.uk/uk_news/story/0,3604,1057271,00.html
- Analysys Press Office (2005, May 5). *Mobile penetration in Western Europe is forecast to reach 100% by 2007, says Analysys*. Analysys. Retrieved May 16, 2005, from <http://www.analysys.com/Articles/StandardArticle.asp?iLeftArticle=1897>
- Bloom, H. K. (2000). *The global brain: The evolution of mass mind from the big bang to the 21st century*. New York: Wiley.
- Bolter, J. D., & Grusin, R. A. (1999). *Remediation: Understanding new media*. Cambridge, MA: MIT Press.
- Borgmann, A. (1999). *Holding on to reality: The nature of information at the turn of the millennium*. University of Chicago Press.
- Brown, B., & Chalmers, M. (2003). Tourism and mobile technology. In K. Kuutti & E. H. Karsten (Eds.), *Proceedings of the 8th European Conference on Computer Supported Cooperative Work* (pp. 335-355). Dordrecht: Kluwer Academic Press.
- Brunnberg, L., & Juhlin, O. (2003). *Movement and spatiality in a gaming situation: Boosting mobile computer games with the highway experience*. Interactive Institute. Retrieved May 16, 2005, from <http://www.tii.se/mobility/Files/BSGFfinal.pdf>
- Campe, C. (2000). *Spheres I: An introduction to Sloterdijk's book*. Goethe-Institut Boston. Retrieved May 16, 2005 from <http://www.goethe.de/uk/bos/englisch/Programm/archiv/2000/enpcamp100.htm>
- Chomsky, N. (1957). *Syntactic structures*. The Hague, The Netherlands: Mouton.
- Clark, T. (2004). *Mobile communications and the wireless Internet: The Japanese experience*. Receiver 11. Retrieved May 16, 2005 from http://www.receiver.vodafone.com/11/articles/pdf/11_02.pdf
- Davis, E. (1998). *Techgnosis: Myth, magic, mysticism in the age of information*. New York: Harmony Books.
- Day, R. E. (1999). The virtual game: Objects, groups, and games in the works of Pierre Lévy. *The Information Society*, 15(4).
- Donner, J. (2003). What mobile phones mean to Rwandan entrepreneurs. In K. Nyíri (Ed.), *Mobile democracy: Essays on society, self and politics* (pp. 393-410). Vienna: Passagen.
- Gergen, K. (2003). Self and community in the new floating worlds. In K. Nyíri (Ed.), *Mobile democracy: Essays on society, self and politics* (pp. 103-114). Vienna: Passagen.
- Hofstadter, D. R. (1999). *Gödel, Escher, Bach: An eternal golden braid*. New York: Basic Books. (Original work published 1979)
- Huhtamo, E. (1994). *From kaleidoscomaniac to cybernerd: Towards an archeology of the media*. De Balie Dossiers Media Archaeology. Retrieved May 16, 2005 from <http://www.debalie.nl/dossier-artikel.jsp?dossierid=10123&articleid=10104>
- Katz, J. E. (2003). *Machines that become us: The social context of personal communication technology*. New Brunswick, NJ: Transaction Publishers.
- Katz, J. E., & Aakhus, M. A. (2001). *Perpetual contact: Mobile communication, private talk, public performance*. Cambridge, UK; New York: Cambridge University Press.
- Kopomaa, T. (2000). *The city in your pocket: Birth of the mobile information society*. Helsinki, The Netherlands: Gaudeamus.

Propagating the Ideal

- Levinson, P. (1997). *The soft edge: A natural history and future of the information revolution*. London; New York: Routledge.
- Levinson, P. (2004). *Cellphone*. New York: Palgrave Macmillan.
- Lévy, P. (1997). *Collective intelligence: Mankind's emerging world in cyberspace*. New York: Plenum Publishing Corporation.
- Malik, K. (1998, December) The Darwinian fallacy. *Prospect*, 36, 24-30.
- Mattelart, A. (2000). *Networking the world, 1794-2000*. Minneapolis: University of Minnesota Press.
- Medosch, A. (2004). *Not just another wireless utopia*. RAM5. Retrieved May 16, 2005, from <http://www.rixc.lv/ram/en/public07.html>
- Mosco, V. (2004). *The digital sublime: Myth, power, and cyberspace*. Cambridge, MA: MIT Press.
- Noble, D. F. (1997). *The religion of technology: The divinity of man and the spirit of invention*. New York: A.A. Knopf.
- Palen, L., Salzman, M., & Youngs, E. (2000). Going wireless: Behavior and practice of new mobile phone users. In W. A. Kellogg & S. Whittaker (Eds.), *Proceedings of the 2000 ACM Conference on Computer Supported Cooperative Work* (pp. 201-210). New York: ACM Press.
- Persson, P., Espinoza, F., Fagerberg, P., Sandin, A. & Cöster, R. (2002). GeoNotes: A location-based information system for public spaces. In K. Höök, D. Benyon, & A. Munro (Eds.), *Designing information spaces: The social navigation approach* (pp. 151-173). London; New York: Springer.
- Peters, J. D. (1999). *Speaking into the air: A history of the idea of communication*. University of Chicago Press.
- Rheingold, H. (2002). *Smart mobs: The next social revolution*. New York: Perseus Publishing.
- Robins, K., & Webster, F. (1999). *Times of the technoculture. From the information society to the virtual life*. London; New York: Routledge.
- Seife, C. (2000). *Zero: The biography of a dangerous idea*. New York: Viking.
- Sheldrake, R. (1989). *The presence of the past: Morphic resonance and the habits of nature*. New York: Vintage Books.
- Smith, I., Consolvo, S., Lamarca, A., Hightower, J., Scott, J. Sohn, T., et al. (2005). Social disclosure of place: From location technology to communication practices. In H. W. Gellersen, R. Want, & A. Schmidt (Eds.), *Proceedings of the 3rd International Conference on Pervasive Computing* (pp. 134-141). London; New York: Springer.
- Standage, T. (1998). *The Victorian Internet: The remarkable story of the telegraph and the nineteenth century's on-line pioneers*. New York: Walker and Co.
- Teilhard de Chardin, P. (1959). *The phenomenon of man*. New York: Harper.
- Vries, I. de (2005). Mobile telephony: Realising the dream of ideal communication? In L. Hamill & A. Lasen (Eds.), *Mobiles: Past, present and future*. London; New York: Springer.

ENDNOTES

- ¹ See Standage (1998) for a comparison of the telegraph age with the rise of the Internet.
- ² See Medosch (2004) for an account of how both wireless eras are very similar in the way the technology was received.
- ³ Mobiles in Europe are predicted to exceed Europe's population in 2007 (Analysys Press Office, 2005).

- ⁴ See Clark (2004) for an account of how “educational policy, peer pressure, and most importantly, soaring use of internet-enabled mobile handsets” drive young people in Japan to use mobile phones instead of computers when sending and receiving e-mail.
- ⁵ A fitting current example of an implementation of such a cloud would be Wikipedia, which thrives on user input and moderation. Other methods of knowledge storage and retrieval such as Google and archive.org rely on algorithms and filters, which makes them more archival than dynamic modes of knowledge preservation.
- ⁶ See http://www.aec.at/en/festival2003/wvx/FE_2003_PierreLevy_E.wvx for a Webcast of his lecture at the 2003 Ars Electronica conference, in which he presented the system of this formal language.
- ⁷ Levinson prefers to call the device a cell-phone instead of a mobile phone, because “[it] is not only mobile, but generative, creative.” On top of that, it “travels, like organic cells do,” and it “can imprison us in a cell of omni-accessibility” (Levinson, 2004, p. 11). I tend to use mobile device, as this category includes not only the mobile (or cell) phone, but also smart phones and PDAs.
- ⁸ Huhtamo names Tom Gunning, Siegfried Zielinski, Carolyn Marvin, Avital Ronell, Susan J. Douglas, Lynn Spiegel, Cecelia Tichi, and William Boddy (Huhtamo, 1994).
- ⁹ Eager to show that a collective intelligence does not mean a loss of individuality, Lévy acknowledges that it is important to ask, in Day’s words, “how we can pass from a group mentality characterised by a modern notion of the mass (and with that, mass broadcasting) to a collective intelligence wherein persons may remain individual and singular” (Day, 1999, p. 266).
- ¹⁰ Claims that support the idea of a universal disposition towards what mobile communication is supposed to be about can be found in Katz and Aakhus (2001).
- ¹¹ Malik (1998) criticises EP because it can be used to explain sexual and racial discrimination as “biologically meaningful.” Because our genes have not been able to keep up with cultural evolution, the EP argument goes, we are “stone age men in a space age world,” and therefore cannot help but to exhibit hunter-gatherer behaviour. Malik claims that this would completely deny the fact that culture has evolved out of natural selection too, and that we consciously make choices.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 1-19, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.15

A De–Construction of Wireless Device Usage

Mary R. Lind

North Carolina A&T State University, USA

ABSTRACT

In this article, wireless technology use is addressed with a focus on the factors that underlie wireless interaction. A de-construction of the information processing theories of user/technology interaction is presented. While commercial and useful applications of wireless devices are numerous, wireless interaction is emerging as a means of social interaction—an extension of the user’s personal image—and as an object of amusement and play. The technology/user interaction theories that have driven the discussions of computer assisted communication media are information richness, communicative action, and social influence modeling. This article will extend this theoretical view of wireless devices by using flow theory to address elements of fun, control, and focus. Then, these technology/user interaction theories are used with respect to wireless devices to propose areas for future research.

INTRODUCTION

Within the United States, wireless devices have become ubiquitous communication devices. Yet, in Europe and the Far East, these devices are not only widely used as communication devices, but as vehicles of commerce and of entertainment. It is widely known that the GSM telecommunications standard is not fully implemented in the United States, inhibiting the development of wireless applications by firms to support their mobile customers. Yet, there seems to be more to this than telecommunication standards. This article will examine social behavioral issues that affect wireless usage and propose a model to better understand this usage.

Wireless devices, serving as transmitters of information at a reasonable cost from point to point without being tethered to a wired line, are profoundly impacting how we communicate and perform work (Rudy, 1996). Little research exists on how to design wireless technologies to better

support wireless communications and applications (Te'eni et al., 2001). Research on information technology design finds that the technology should be fit to the user's task needs (Senn, 1998, Swanson, 1988). Since wireless devices provide a tool for convergence of voice, text, audio, photos, videos, and data (Yager, 2003), it is critical that the design of these wireless devices fits the multiple modes of data exchange and usage supported by the wireless devices.

Models to explain information technology design and adoption are rooted in the assumptions of the usefulness and usability afforded by the technology (Davis, 1989, Swanson, 1988), where the context for these technology design and adoption models is the workplace. As information technologies have become pervasive throughout the culture (Gaver, 2005), these technologies, while still an instrument to perform work more efficiently, have become a means of social networking, diversion, and entertainment for the homo luden (Huizinga, 1950). Yet along with this play aspect, the homo luden also gains control of his/her personal space. These aspects of mobile information technologies, usefulness, usability, play, and control will be explored in this article to determine how these dimensions of mobile information technology interaction can enable flow (Csikszentmihalyi, 1975) and enable homo ludens (Huizinga, 1950) to seamlessly process information for work and for play. Huizinga (1950) notes that play influences the culture of the players as well as Gaver (2005) observes that pervasive, "ambient" technologies also shape the culture in which the technologies are used. In this article, the discussion focuses on the use of these wireless technologies that have become artifacts representative of work, social, and play activities in our everyday cultural contexts, and how these same cultural contexts, in turn, are shaped by the wireless artifacts, and through this interaction, the enactment of additional uses for the wireless devices.

THEORETICAL FOUNDATION FOR WIRELESS MEDIA USAGE

Two theoretical approaches will be examined. First, the view of wireless devices as communication media based in information richness theory is presented, followed by the theoretical view of wireless devices using the social networking theory perspective. Secondly, wireless media will be addressed as objects of play and of control. Finally, a model is developed showing the bidirectional impact of wireless devices as artifacts that influence culture and the resulting culture that in turn impacts perceptions of the wireless artifacts.

Media Richness Theory

The rational choice model contends that users select the most effective medium for data exchange. Media richness theory (Daft & Lengel, 1984; Lind & Zmud, 1991) proposed that managers will use richer media in ambiguous contexts and the leaner media for more structured tasks. For example, face-to-face media that permit the transmission of nonverbal clues and immediate feedback will be used in contexts that are unclear and need to be sorted through in order to reduce the ambiguity of the context. In information richness theory (Daft & Macintosh, 1981; Daft & Weick, 1984; Daft & Lengel, 1984), it was proposed that communication channels vary in their ability to convey information and meaning. This theory suggests a continuum where the richest channels are those that provide for more face-to-face interaction and feedback, allowing for the communication of nuances, often unspoken, in adding meaning to communication. The leanest channels are those written or printed. Since research into information richness theory has met with conflicting results, especially in the area of e-mail studies, other theories and theory extensions have been explored. Neither voice mail nor e-mail allow for

face-to-face interaction, but voice mail records the actual voice of the speaker while e-mail provides much quicker feedback than printed media. Thus, the underlying media richness theory is the assumption that individuals seek to be efficient communicators and make rational decisions, selecting a communication medium that fits the nature of the information being communicated.

Other theories have addressed the use of media as a social construct (El-Shinnawy & Markus, 1997). Using the social influence model of technology use, Fulk, Schmitz, and Steinfield (1990) proposed that perceptions of communication media, such as richness, are socially constructed. They found that individuals were more influenced in communication channel use and perceptions by their co-workers than by their supervisors. Also, they found that keyboard skill and computer experience were important predictors of perceptions of electronic mail richness. The communication medium became viewed as an artifact that reflects the social circumstances of the communicating partners that in turn impacts the social context for their social network, thus becoming an influence on the culture of that social group.

Ngwenyama and Lee (1997) proposed a critical social theory perspective for communication channel richness using the work of Weick (1969) and Habermas (1984), they posit that the richness of a communication channel is determined by how the person using that channel enacts the channel. Thus, critical social theory advocates the notion that the interpretation of the information conveyed through a channel is in the mind of the receiver. Some may filter complex, rich information and seek to simplify it to fit their simplistic view of the organization. While others may embrace complex, rich information and revel in trying to interpret the many dimensions of often ambiguous but rich information. It cannot be assumed that greater usage means a richer channel. It may just mean that the channel is more accessible or easier to use for short messages than the telephone or

face-to-face media. Thus, critical social theory shows that the enactment of the communication artifact is determined by that individual's context and the individual's perception of that context and as the use of the communication artifact becomes widespread then the culture will develop shared perceptions of its attributes, which can then have a broad impact on the culture.

Communicative Action Theory

The object of most communication is to convey information so that the communicating partners reach a mutual understanding, regarding the topic at hand. Habermas (1984), in his theory of communicative action, addresses the concept of communicative rationality, where a mutual understanding is reached through processes that signal commonalities in culture that promote understanding. Thus, the goal of communication is to reach a common understanding between the communicating parties. However, according to Habermas, different cultural groups may interpret different signals for enacting this mutual understanding. Hence, channel richness for one such group may differ from another group. Thus, communication action theory recognizes that the media are enacted differently in different cultural contexts, but the rational goal is to achieve a common understanding using the medium for communication.

Communication Channel Enactment

Addressing this issue of enacted meaning, Carlson and Zmud (1992) proposed communication channel extension theory and showed that one's past communication experiences, both in terms of the communication channels and the person with whom one is communicating via the channel, will in turn shape one's perception of a communication channel. Thus, different levels of experience with a computer mediated chan-

nel in an organizational context will shape one's perceptions, and use of such computer mediated channels, just as one's past experiences in engaging in face-to-face communication will influence face-to-face communication. This view of channel enactment then shows the circular impact of the channel on the communication content, within a cultural context where the perceptions of the communication partners influence future expectations of that channel.

Flow Theory

A different explanation has been proposed with little relationship to richness theory—flow theory (Trevino & Webster, 1992; Ghani & Deshpande, 1994). In flow theory, the channel is enacted as an article of amusement. Flow theory (Csikszentmihalyi, 1975; Miller, 1973) suggests that a flow state is a playful, exploratory experience where flow is a continuous variable from none to intense. Thus, some communication channels, particularly the computer mediated ones, may enact such playful behavior. Trevino and Webster (1992) proposed that, through flow, the individual has a sense of control of the interaction and thus finds it more interesting. This seems particularly true as the communication medium becomes a tool of commerce and work activity. Thus, control of the interaction engages the attention of the person using that medium. Csikszentmihalyi (1990, p. 4) developed the theory of optimal flow as, “the state in which people are so intensely involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it.” Here, the context, rather than individual differences, is used to explain human motivation (Maehr, 1989; Weiner, 1990), and the focus is on the total concentration on an activity and the enjoyment resulting from that activity (Ghani, 1991; Malone & Lepper, 1987). Wireless devices serve as artifacts of communication and entertainment for many. When not talking on the

wireless device, people are observed looking at the screen for text messages, browsing the Web, playing games, and so forth. These artifacts of our culture have become a source of time absorption for many, as they wait for the next meeting or walk to their destinations.

Further, Csikszentmihalyi (1990, p. 25) characterized flow theory as, “A phenomenological model of consciousness based on information theory.” Consciousness deals with the flow ordering of information regarding intended actions and goals (Parr and Montgomery, 1998). One of the dimensions of flow is the challenge of the experience (Ghani and Deshpande, 1994). Csikszentmihalyi (1990, p. 3) said, “The best moments usually occur when a person's body or mind is stretched to its limits in a voluntary effort to accomplish something difficult or worthwhile.” Ghani and Deshpande (1994) state that a second dimension of flow is control by the users. Csikszentmihalyi (1994, p. 3) states, “We have all experienced times when, instead of being buffeted by anonymous forces, we do feel in control of our actions (on such occasions) we feel a sense of exhilaration, a deep sense of enjoyment.” Turkle (1984) discussed how a computer user may work because of the fun of the interaction, not necessarily to achieve a specific goal. In flow, Csikszentmihalyi (1990) discussed how a person loses their sense of time. So flow enables a person to process information best when the effort expended by the individual is within that individual's control and when the challenge of the experience meets the skills of the person. The interaction with the wireless artifact must match the skill level of the user. The communication and Web browsing aspect of these wireless artifacts are compatible with already learned skills, using wireless artifacts for other activities, such as entertainment or games, requires skills interaction that match those the user will have to insure concentration on the activity. In any case, the control of the wireless artifact is in the hands of the user where this accessibility encourages increased usage.

Psychic-entropy is a counter force to flow in which there is disorder in consciousness. This occurs whenever, “Information...conflicts with extreme intentions or distracts us—from carrying them out.” (Csikszentmihalyi, 1990, p. 36) Anxiety, fear, jealousy, or rage describes disordered experiences. Entropy drains our psychic energy, fragmenting attention. Attention is the process for collecting, storing, and retrieving information. Flow is an experience in which attention is freely invested in the accomplishment of goals allowing the self to develop, increasing complexity (Csikszentmihalyi, 1990). The control afforded by the wireless artifact helps to counter the force of psychic-entropy, giving the user more control over their environment (communication, schedules, messaging), where adjustments can be made in schedules easily, without the user being tethered to land based devices. Parr and Montgomery (1998, p. 27) state “Flow experiences have been characterized as the following, merging of action and awareness; centering of attention on a limited stimulus field; letting go of self-consciousness (transcendence of ego); a feeling of competence and control; having unambiguous goals and receiving immediate, specific feedback; and being intrinsically motivated.” Thus, this aspect of flow looks for balance between one’s goals and one’s skills in achieving those goals. Flow is more closely associated with positive emotions, greater concentration, and a greater sense of control. A person must see that there is something worthwhile to do and that he/she has the ability to do it (Csikszentmihalyi, 1990). As one increases his/her skill level, she/he is motivated to seek out increasingly challenging activities (Mandigo & Thompson, 1998). Csikszentmihalyi (1990) indicates that the flow state is so enjoyable that the participant will want to continue with the activity for the sake of participation.

The communication, enabled by the wireless artifacts, creates a sense of flow for the wireless communities. These communities can achieve collaborative action (Crane, 1972) using the

wirelessly connected communities. The wireless communities are not bounded by space and can connect easily to take action so that the communities are empowered by the collective strength and ability to influence actions in their space. So another aspect of flow enabled by the wireless artifacts is control over collective action.

Flow is about optimizing the happiness that occurs from the everyday immersion in life’s activities, “It is by being fully involved with every detail of our lives whether good or bad, that we find happiness, not by trying to look for it directly.” (Csikszentmihalyi, 1990, p. 2) A key component to the flow experience is participation or active involvement in something. It comes when an individual is participating in an activity that makes a difference in the person’s life. “The concept of flow—the state in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it.” (Csikszentmihalyi, 1990, p. 4) This connectedness to communities can become an absorbing aspect of the wireless artifact. Yet paradoxically, the wireless artifact absorption can be with music, games, or Internet browsing afforded by the wireless artifact, which is largely a nonsocial activity. However, games are increasingly played via online networks, creating online gaming communities.

Much of the experience of finding flow is about order and goals. “When goals are clear, feedback relevant, and challenges and skills are in balance, attention becomes ordered and fully invested.” (Csikszentmihalyi, 1990, p. 31) Here, a defining factor within a flow experience is the ability to recognize and accept clear boundaries in terms of the goals and acceptable behavior. This means that a flow activity must be ordered to some extent by conforming to cultural or social boundaries. “Athletes, mystics, and artists do very different things when they reach flow, yet their descriptions of the experience are remarkably similar.” (Csikszentmihalyi, 1997b, p. 29) Although one person’s

experience with flow may be solitary and pertain simply to their specific circumstances, chances are that the flow is experienced as a member of a social network.

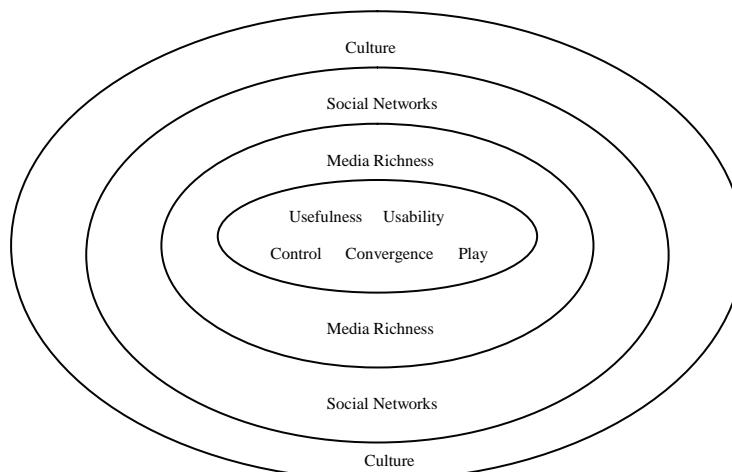
Therefore, within any given flow experience and particularly with usage of the wireless artifact, it is important to pinpoint the organizational frameworks or structural boundaries to which the participants adhere. It is within this willing submission to structural boundaries that highlights an important dimension for understanding the flow experience. What needs do these boundaries fulfill? And if the flow experience is a group activity, how is this mutual submission to ordered rules enhancing the flow experience and leading paradoxically to a freer, happier existence? Submission to overarching rules is found often within games, sports, social networks, and organizations. Membership in these groups brings meaning to its members, whereby meaning is imbued in the artifacts that provide the linkages for these groups. It is through these wireless artifacts, and the resulting linkages within the communities, that trust in the social network develops. While the wireless devices enable multiple modes of

communication between and within the communities, their interactions can be shared using common codes and symbols in text messaging and in gaming communities.

Csikszentmihalyi lays out three main qualities of a flow experience. These are: first, when there is a clear set of goals; second, when immediate feedback is provided; and third when all of a person's skills are being used to overcome challenges. (Csikszentmihalyi, 1997b, p. 29-30)

Because of the total demand on psychic energy, a person in flow is completely focused. There is no space in consciousness for distracting thoughts, irrelevant feelings. Self-consciousness disappears, yet one feels stronger than usual. The sense of time is distorted: hours seem to pass by in minutes. When a person's entire being is stretched in the full functioning of body and mind, whatever one does becomes worth doing for its own sake; living becomes its own justification. In the harmonious focusing of physical and psychic energy, life finally comes into its own. (Csikszentmihalyi , 1997b, p. 31-32)

Figure 1. Wireless artifact



It seems that, during the flow experience, the participant is able to forget about any larger problem and completely focus for the span of time while they are completing their activity. Absorption with games, online chats, blogging, and so forth, all provide clear rules and immediate feedback. In the context where the user's skills match the demands of the interface, the result can be total immersion.

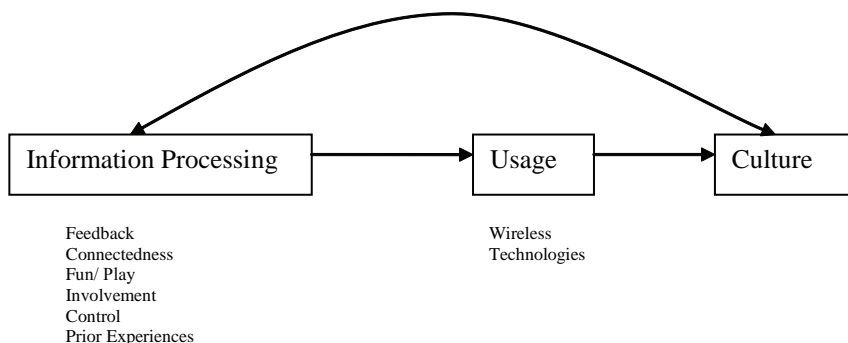
From this discussion of the development of the theory for communications technology interaction and specifically wireless devices based in media richness theory and social network theory, the concept of flow was introduced, providing a multilayer perspective on wireless artifacts. So, in addition to the convergence achieved via the communication media, the media also engage the user by providing means for play and for control over, not only the play and communications activities enabled by the wireless device, but work activities as well. An assumption built into these wireless devices is that they are both useful and useable. The theoretical layers of wireless devices discussed in this section are shown in Figure 1.

Culture and Phratria—Wireless Artifact Interaction

Shiller (1979, p. 29) defines culture as a way of life in which our life's activities shape our culture.

As technologies are adopted within society, these technologies shape our culture. For example, Tomlinson (1991) states, "The relationship implied in this is the constant mediation of one aspect of culture experienced by another: what we make of a television programme or a novel or a newspaper article is constantly influenced and shaped by whatever else is going on in our lives. But, equally, our lives are lived as representations to ourselves in terms of the representations present in our culture." Thus, the wireless technologies as artifacts enable communication, play, scheduling tasks, information search, and so forth, but the artifact itself shapes the culture and the expectations of those in the culture using these wireless devices. Huizinga (1950, p. 12) observed that play affects culture, "It would be rash to explain all the associations which the anthropologist calls "phratria"—for example, clans, brotherhoods, and so forth—simply as play-communities. Nevertheless, it has been shown again and again how difficult it is to draw the line between, on the one hand, permanent social groupings—particularly in archaic cultures with their extremely important, solemn, indeed sacred customs—and the sphere of play on the other." As discussed, these wireless artifacts enable social groupings. In some contexts, these phratria are for work purposes, but in many contexts, these groupings are social and for pleasure. Thus, the play is evidenced in

Figure 2. Model of wireless usage



the form of the type of phratia as well as the type of diversion, such as games or Internet browsing enabled by wireless devices.

Thus, flow applications are those that accomplish a repetitive activity, but do it in a way that makes doing the activity enjoyable, almost effortless with security. Flow applications blend in with our daily lives, causing little disruption. As the widely accepted technology acceptance model (TAM) has shown (Davis, 1989), the user must perceive both usefulness and ease of use, while the flow model adds the dimensions of

enjoyment and control. Table 1 shows the items for assessing usefulness and ease of use. Added to the TAM dimensions are the proposed flow dimensions of enjoyment and control.

Davis (1989) showed that task usefulness and ease of use of the technology are key components of technology acceptance. In flow theory, it is advocated that technology enables a carefree approach to doing a task that is effortless and fun, while enabling greater control. Two other factors affecting use of a specific communication channel are accessibility of the channel (Zmud,

Table 1. Technology acceptance model and flow

| |
|---|
| Usefulness |
| Using technology x enabled me to accomplish tasks more quickly. |
| Using technology x improved my task performance. |
| Using technology x increased my task productivity. |
| Using technology x enhanced my effectiveness while performing the task. |
| Using technology x made it easier to do my task. |
| Technology x is useful in my task. |
| Ease of Use |
| Learning to use technology x is easy for me. |
| I find it easy to get technology x to do what I want to do. |
| My interaction with technology x is clear and understandable. |
| I find technology x flexible to interact with. |
| It is easy for me to become skillful at using technology x. |
| I find technology x easy to use. |
| Proposed Flow Dimension |
| Using technology x was a fun experience for me. |
| While using technology x I felt in control. |
| Using technology x gave me more control over my work activities. |
| Using technology x was a challenge that used my skills. |
| Using technology x was a pleasant adventure. |

Lind, & Young, 1991) and the degree to which the channel affords rapid feedback (Zmud, Lind, & Young, 1991). Few things are more accessible than a wireless device that can be carried in a person's pocket and these devices enable rapid feedback. So, the richness dimension of feedback, identified by Zmud et al. (1991), is an inherent factor discussed by Csikszentmihalyi (1997a) in flow theory.

FURTHER RESEARCH NEEDED

To move beyond using the devices as voice communication devices, applications that enable the dimension of flow are needed. These are applications for the user that enable them to carry out routine activities easily and with a great degree of control and applications that enable the connectedness with phatria. These applications will enable rich transaction exchanges within the phatria, whether the exchange is for social networking, collaborative action, gaming, or for mobile commerce. Applications enable the flow immersion, giving the user control over work activities and play activities. These applications should provide seamless intergration as the user moves from the work space to the play space to the social network space.

From a broad communication perspective, it has been shown that there are systematic differences in communication by gender. Women have a tendency to work harder at maintaining conversation in face to face situations (Fishman, 1983; Meyers et al., 1997). It has been shown that women value connection and cooperation more than men (Meyers et al., 1997), suggesting that this tendency to maintain the conversation level is evidence of insecurity. Both Allen and Griffeth (1977) and Gefen and Straub (1997) have examined the relationship between gender and information processing. Allen and Griffeth (1997), counter to their hypothesis, found that women did not experience information under load as

compared to their male coworkers in a study of 666 workers at a Midwestern telephone company. In the study, roughly 40% were female and about half the workers were hourly employees. Gefen and Straub (1997) found that women perceived electronic mail differently, but in practice, did not use it differently in a study of 392 respondents with three different airlines in three countries. The Gefen and Straub (1997) study showed that the women respondents perceived e-mail to be of higher social presence and more useful than men; however, these same women did not find e-mail easier to use than men and did not, in fact, make greater use of e-mail when measured through self report. Research is needed to determine if gender differences exist in wireless media use.

Certainly gender, culture, and age differences may influence acceptance of wireless media. Examination of these factors, in terms of the expanded TAM model, is needed. Is the greater acceptance of wireless media in Europe and Asia due to technological or cultural factors? Looking at the applications that drive usage of these wireless media, applications are needed that not only simplify work transactions, but are fun to use and not labor intensive in terms of data entry. A new paradigm for wireless applications may be instrumental in promoting flow. A paradigm that recognizes the need for work, play, and control by the user, which in turn, can change the culture of work and play, which through the interconnectedness of the phatria, leads to new uses in terms of work, play, and control for these wireless devices.

REFERENCES

Allen, D. W., & Griffeth, R. W. (1997). Vertical and lateral information processing: The effects of gender, employee classification level, and media richness on communication and work outcomes. *Human Relations*, 50 (1), 1239-1260.

- Carlson, J. R., & Zmud, R. W. (1992). Channel expansion theory and the experiential nature of media richness perceptions. *Academy of Management Journal*, 42(2), 152-170.
- Crane, D. (1972). *Invisible colleges: Diffusion of knowledge in scientific communities*. Chicago: The University of Chicago Press.
- Csikszentmihalyi, M. (1975). *Beyond boredom and anxiety*. San Francisco: Jossey-Bass.
- Csikszentmihalyi, M. (1997a). *Creativity: Flow and the psychology of discovery and invention*. New York: Harpers-Collins.
- Csikszentmihalyi, M. (1997b). *Finding flow: The psychology of engagement with everyday life*. New York: Basic Books.
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row.
- Daft, R. L., & Lengel, R. H. (1984). Information richness: A new approach to managerial behavior and organization design. In L. L. Cummings and B. M. Staw (Eds.), *Research in organizational behavior*. Greenwich, CT: JAI, 6, 191-233.
- Daft, R. L., & Macintosh, V. B. (1981). A tentative exploration into the amount and equivocality of information processing in organizational work units. *Administrative Science Quarterly*, 26, 207-224.
- Daft, R. L., and Weick, K. E. (1984). Toward a model of organizations as interpretation systems. *Academy of Management Review*, 9, 284-295.
- Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, September, 319-340.
- El-Shinnawy, M., & Markus, M. L. (1997). The poverty of media richness theory: Explaining people's choice of electronic mail vs. voice mail. *International Journal of Human-Computer Studies*, 46(4), 443-467.
- Fishman, P. (1983). Interaction: The work women do. In B. Thorne, C. Kramarae, & N. Henley (Eds.), *Language, gender and society* (pp. 89-101). Cambridge, MA: Newbury House.
- Fulk, J., Schmitz, J. A., & Steinfield, C. W. (1990). A social influence model of technology use. In J. Fulk and C. Steinfield (Eds.), *Organizations and communication technology* (pp. 117-140). J. Newbury Park, CA: Sage.
- Gaver, B. (2001, October). Designing for ludic aspects of everyday life. *ERCIM News*, 47. Retrieved from http://www.ercim.org/publication/Ercim_News/enw47/gaver.html.
- Gefen, D., and Straub, D. (1997). Gender differences in the perception and use of e-mail: An extension to the technology acceptance model. *MIS Quarterly*, 21(4), 389-401.
- Ghani, J. A. (1991). Flow in human-computer interactions: Test of a model. In J. Carey (Ed.), *Human factors: Management information systems: An organizational perspective*. 229-237. Norwood, NJ: Ablex.
- Ghani, J. A., and Deshpande, S. P. (1994). Task characteristics and the experience of optimal flow in human-computer interaction. *The Journal of Psychology*, 128(4), 381-391.
- Habermas, J. (1984). *The theory of communicative action, Vol. 1, Reason and the rationalization of society*. Boston: The Beacon Press.
- Huizinga, J. (1950). *Homo ludens*. Boston: The Beacon Press.
- Lind, M. R., & Zmud, R. W. (1991). The influence of a convergence in understanding between technology providers and users on information technology innovativeness. *Organization Science*, 2(2), 195-217.

A De-Construction of Wireless Device Usage

- Maehr, M. L. (1989). Thoughts about motivation. In C. Ames & R. Ames (Eds.), *Research on motivation in education: Goals and cognition* (pp. 299-315). San Diego, CA: Academic Press.
- Malone, T. W., & Lepper, M. R. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. In R. E. Snow & M. J. Farr (Eds.), *Aptitude, learning, and instruction* (pp. 223-253). Hillsdale, NJ: Erlbaum.
- Mandigo, J. L., & Thompson, L. P. (1998). Go with their flow: How flow theory can help practitioners to intrinsically motivate children. *Physical Education, 55*(3), 145-160.
- Meyers, R. A., Brashers, D. E., Winston, L., & Grob, L. (1997). Sex differences and group argument: A theoretical framework and empirical investigation. *Communication Studies, 48*, 19-41.
- Miller, S. (1973). Ends, means, and galumphing: Some leitmotifs of play. *American Anthropologist, 75*, 87-98.
- Ngwenyama, O. K., & Lee, A. S. (1997). Communication richness in electronic mail: Critical social theory and the contextuality of meaning. *MIS Quarterly, 21*(2), 145-168.
- Parr, G. D., & Montgomery, M. (1998). Flow theory as a model for enhancing student resilience. *Professional School Counseling, 1*(5), 26-32.
- Rudy, A. (1996). A critical review of research on electronic mail. *European Journal of Information Systems, 4*(4), 198-213.
- Senn, J. A. (1998). *Information in business: Principles, practices and opportunities*. Englewood Cliffs, NJ: Prentice-Hall.
- Shiller, H. I. (1979). Transnational media and national development. In K. Nordenstreng & H. I. Shiller (Eds.), *National sovereignty and international communication* (pp. 21-29). Norwood, NJ: Ablex.
- Swanson, E. B. (1988). *Information system implementation: Bridging the gap between design and utilization.*, Homewood, IL: Irwin.
- Te'eni, D., Sagie, A., Schwartz, D. G., Zaidman, N. & Amichai-Hamburger, Y. (2001). The process of organizational communication: A model and field study. *IEEE Transactions on Professional Communication, 44*(1), 6-20.
- Tomlinson, J. (1991). *Cultural imperialism*. Baltimore, MD: The Johns Hopkins University Press.
- Trevino, L. K., & Webster, J. (1992). Flow in computer-mediated communication. *Communication Research, 19*(5), 539-574.
- Turkle, S. (1984). *The second self: Computers and the human spirit*. New York: Simon and Schuster.
- Yager, T. (2003). More than a cell phone. *Info-world, 25*(5), 30.
- Weick, K. E. (1969). *The social psychology of organizing*. Reading, MA: Addison-Wesley.
- Weiner, B. (1990). History of motivational research in education. *Journal of Educational Psychology, 82*, 616-622.
- Zmud, R., Lind, M., & Young, F. (1991). An attribute space for organizational communication channels. *Information Systems Research, 1*(4), 440-457.

This work was previously published in the International Journal of Technology and Human Interaction, edited by B. C. Stahl, Volume 3, Issue 2, pp. 34-44, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.16

Virtual Networking without a Backpack?

Resource Consumption of Information Technologies

Justus von Geibler

Wuppertal Institute, Germany

Michael Kuhndt

Wuppertal Institute, Germany

Volker Türk

Wuppertal Institute, Germany

ABSTRACT

This chapter concentrates on the environmental impacts of the increasing use of the Internet. It highlights that the Internet and Internet applications are far from being purely virtual, but are clearly linked to the use of natural resources. With the growth of the Internet's infrastructure there is a seemingly inevitable increase in the resource consumption for the production of electronic equipment and its electricity consumption. A number of conclusions can be made regarding the minimisation of environmental risks and maximisation of e-business' potential to dematerialise. The presented findings are mainly based

on findings derived from research within the Digital Europe project, which was conducted as the first pan-European study of the social and environmental impacts and opportunities of e-commerce and information communication technologies. Supported by the European Commission, the project has been led by the research organisations Fondazione Eni Enrico Mattei in Italy, Forum for the Future in UK and the Wuppertal Institute in Germany.

INTRODUCTION

The transition from an industrial society to a service society proceeding in many countries

Virtual Networking without a Backpack?

of the world is supported by information and communication technology (ICT) and ICT applications. The industrial society was primarily about large-scale production and distribution of goods. Within the service society, added value is increasingly generated from immaterial production factors such as information and know-how, and a large number of functional areas such as the economy, politics, legislation, culture or health depend to an increasing degree on knowledge. Adoption of this knowledge is supported by ICT. Thus ICT can be accounted as a key technology within the service society.

The diffusion of ICT within societies can be illustrated by the adoption of the Internet. Even if only experts knew the medium “Internet” at the beginning of the 90s, it became mass media in the middle of last decade. About 600 million people have gone online in the last 15 years – this is about 10% of the world population. And there are forecasts that there will be 710 million users of the Internet in the year 2004 (e.g., Cyber Atlas, 2003). On average, 81% of EU enterprises accessed the Internet in 2002, and a majority of them had their own Web site or homepage (European Commission, 2003). Even if the initial euphoria about the new technology is subsiding, every day we hear news about large ICT investments, technology innovation and new areas of ICT applications.

As ICT and ICT applications increasingly spread, so do also the ecological problems of this trend appear to become more relevant. For example, increasing Internet use is linked with increasing electricity use. However, ICT is generally not seen to be associated with significant environmental problems. In fact, the opinion predominates that new communication media are just as virtual as their contents. Sometimes it is even seen as an innovation, which would make possible a sustainable and resource-efficient way of life per se.

This chapter highlights the environmental impacts of the increasing use of the Internet.

The following section provides insights into the physical elements of the ICT infrastructure with a specific focus on the Internet, and provides a classification of environmental effects caused by ICT. The subsequent sections discuss the direct and indirect effects as well as the systemic effects on the consumption of natural resources. Finally, conclusions are drawn on how to develop a more resource-efficient information society.

This book contribution is based mainly on findings derived from research within the Digital Europe project. The project was conducted as the first pan-European study of the social and environmental impacts and opportunities of e-commerce and information communication technologies. Supported by the European Commission, the project has been led by the research organisations Fondazione Eni Enrico Mattei in Italy, Forum for the Future in UK and the Wuppertal Institute in Germany. Twelve corporate and regional partners have been involved: AOL Europe, Barclays Bank, EMI, Finmatica, the Global eSustainability Initiative (GeSI), Hewlett-Packard, Welsh Assembly Government, Netscalibur, Projekt Ruhr, Sun Microsystems, Vitaminic and Vodafone. Information on environmental effects of ICT are described by Kuhndt et al. (2003). Further information, for example, specific case study reports on mobile computing, digital music and e-banking can be found on www.digital-eu.org.

ICT INFRASTRUCTURE AND ENVIRONMENTAL EFFECTS

Electronic information processing (e.g., by computers) and telecommunication (telephone, radio, TV) have been separate technologies in the past. However, these two technologies have merged and spread increasingly by means of the digitalisation of previously analogue media (telephones, music, pictures, faxes, etc.) and an increase in digital communication. Among the different technologies connecting digital devices, the Internet is currently

the main ICT infrastructure and seems likely to remain that throughout the near future (e.g., Office of Technology Assessment at the German Parliament, 2002). According to a survey by the Internet Software Consortium (2002), the number of Internet hosts grew worldwide from 30 million at the beginning of 1998 to over 172 million in January 2003, corresponding to a growth of more than 25 million per year.

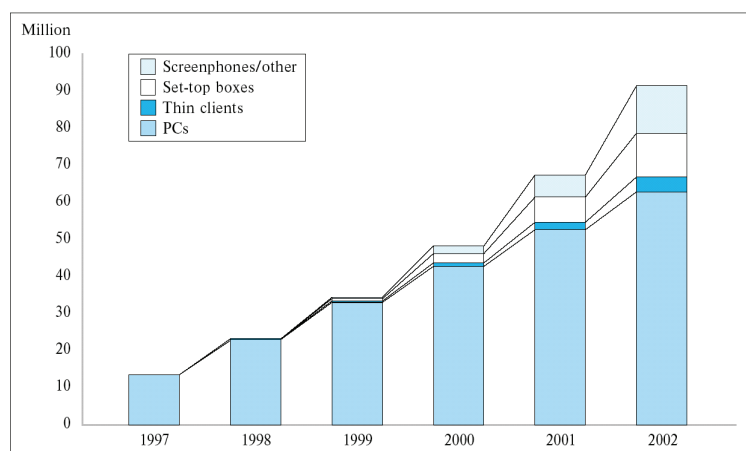
The growth of the Internet goes hand in hand with an increase in ICT infrastructure, which can be illustrated by some examples. Worldwide more than 410 million people have access to the Internet through a personal computer at home (Cyber Atlas, 2003b). It is estimated that there were 117 million PCs in the EU in 2001, 31 per 100 inhabitants (European Commission, 2003). A study by Intel concluded that in 2001 only 4% of the servers were in place that will be needed in 2005 (VDI Nachrichten, 2001). Figure 1 illustrated the spread of “information appliances” in Western Europe, a trend highlighted by EITO as easy-to-use, low-cost tools to access the Internet (EITO, 2000).

The physical infrastructure forming the Internet can, with a certain level of abstraction and

simplification, be broken down into four different categories:

- Network access devices (client side) are used by clients (users) to access the services provided by Internet service and content providers. These services are based on files and programmes stored on servers. PCs and laptops account for the overwhelming majority of devices used to access the Internet. A forecast for the near future sees many more devices such as mobiles, set-top boxes (located on top of a television set as interface between the home television and the cable TV company enabling Internet access, video-on-demand, video games, educational services, database searches, and home shopping), cars and household appliances as forthcoming connection devices.
- Content providing devices: This category basically covers servers. In general, a server is a computer programme that provides services to other programmes on the same or other computers. The computer on which a server programme runs is also frequently referred to as a server, though it may contain

Figure 1. Web access devices by type, installed base, Western Europe, 1997-2002 (EITO 2000)

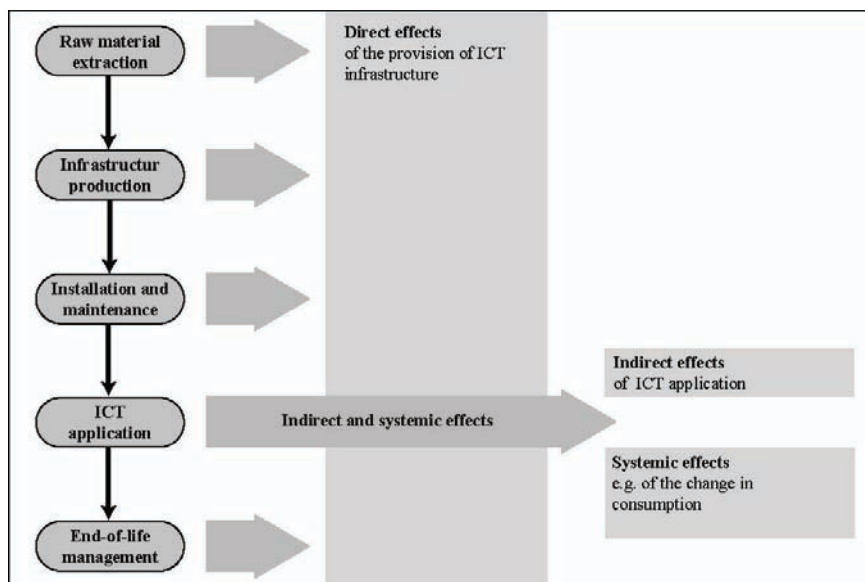


Virtual Networking without a Backpack?

a number of servers and other programmes. Specific to the Web, a Web server is a programme (running on a computer) that serves the files that form Web pages, using the client-server model and the World Wide Web's HTTP protocol (Hypertext Transfer Protocol, defining the rules for transferring files on the World Wide Web). Several other types of servers exist, such as FTP servers, e-mail servers and news servers.

- Intermediate devices include several different devices that enable communication on the net. "Routers," "switches" or "gateways" switch or route traffic on the network – for example from a long-distance network to a local exchange point. "Bridges" connect different networks, "repeaters" receive, amplify and retransmit signals and "firewalls" are programmes located at network gateways or servers that protect the resources from other users and programmes. Until the mid-90s all national Internet traffic in Germany was routed via the US. In 1995 the Deutscher Commercial Internet Exchange (DE-CIX)
- started operating and presently connects all but one major national and many international ISPs. 85% of German and 35% of European Internet traffic is routed over the DE-CIX. The advantage of such a centralised peering point is that traffic within Germany is routed within the country, leading to much faster and less costly data exchange (Deutscher Commercial Internet Exchange, 2001).
- Data transfer media are the "highways" (or sometimes just "country lanes") that transfer the data. Most common are "cables," traditionally made of copper; the newer and much faster ones are made of optic fibre. They range from old-style telephone networks with transfer rates up to 56,000 bps to inter-continental "backbones" with a bandwidth above 1 GBps. A backbone is a large transmission line that carries data gathered from lines that interconnect with it. The Internet is a wide area network (WAN) comprised of a number of backbones – regional networks that carry long-distance traffic. At the local

Figure 2. Environmental effects of ICT



level a backbone is a line or a set of lines that connects local area networks (LANs) to a WAN. On the national level, directional radio is used as well.

Looking more at the environmental effects of ICT, the associated resource consumption can be classified into direct, indirect and systemic effects (see Figure 2).

The direct effects refer to the effects caused by ICT infrastructure and equipment, for example the material consumption for producing PCs and Internet servers or from energy consumption. The reduced need for travelling or office space as a result of telework or the increase in just-in-time deliveries thanks to B2B applications are examples of indirect effects which are caused by the application of ICT. Indirect effects derive from existing desires or habits that are fulfilled through new, ICT-based applications. In contrast, systemic effects stem from new habits or consumption patterns that arise through the use of ICTs, such as the increase in transatlantic freight shipments as a result of online auctions in the US. This contribution highlights the fact that ICT infrastructure and the application of ICT are leading to both positive and negative environmental impacts and represent a recommendation of how to develop

an information society which does not induce an increase in resource consumption.

DIRECT EFFECTS OF ICT INFRASTRUCTURE ON RESOURCE CONSUMPTION

Backpack of ICT Production

While no studies quantifying the material intensity required to build the entire Internet system are known of, we do have some case study research within Digital Europe which highlighted specific components of the communication infrastructure (Geibler et al., 2003). Related studies are from Loerincik, Jolliet and Norris (2002) (on energy consumption and selected emissions) and from US EPA (2001), Atlantic Consulting (1998) or Behrendt et al. (1998) (for life cycle assessment of electronic products).

Regarding the resource consumption for the end appliances a comparative analysis of a handheld and a notebook's production has been conducted (Geibler et al., 2003). The analysis is based on the MIPS methodology (Schmidt-Bleek, 1995). MIPS provides indicators (e.g., abiotic raw material, biotic raw material and water consump-

Table 1. Results of material intensity analysis for production

| Product | Components | Weight (kg) | Abiotic raw materials (kg) | Material intensity of component (kg/kg) |
|--------------------|---------------------------------------|-------------|----------------------------|---|
| Notebook | Device | 3.0 | 398 | 133 |
| | Support items (cables, power adapter) | 0.4 | 31 | 78 |
| | Packaging | 1.3 | 5 | 4 |
| Handheld | Device (incl. modem) | 0.2 | 58 | 290 |
| | Support items (cables, power adapter) | 0.6 | 19 | 32 |
| | Packaging | 0.7 | 5 | 7 |
| Personal Organiser | Paper-based device | 0.4 | 4 | 10 |

tion) to assess the systemwide resource consumption from the cradle to the grave taking in the total mass of material flows at all product stages, from raw material extraction to disposal. By associating the material fluxes connected to energy generation, the MIPS methodology integrates also the energy intensity. A traditional personal organiser has also been analysed to provide a base for comparison with non-electronic tools for mobile communication. The following table shows that the handheld's resource consumption lies between both other products.

As these results show, the efficiency gains from the shift to the handheld are not proportional to the difference in weight. The handheld device (excluding packaging and support items) weighs 200 grams, but its production consumes 58 kg of abiotic, non-renewable raw materials. This yields a factor of 290. For the notebook, this factor is lower: at 133 comprising less than half of it. The high material intensity of the handheld device is a result of the large share of functional materials included in the handheld and the modem. These functional materials have intensive upstream processing demands for components such as PWBs, LCDs, chips and precious metals. Additionally, most of the materials in the electronic devices used arise from abiotic, non-renewable sources. Generally, it can be observed that the production of the paper-based personal organiser consumes by far the smallest amount of resources. The accumulative effects of these material-intensive appliances are visible at the macro-economic level.

A first and very rough estimate by the Wuppertal Institute of the material intensity necessary for producing just the servers installed in Germany came to about 1.7 million tons of abiotic raw materials or 0.2 kg if allocated per hour of Internet use. While this figure can only be regarded as an initial trace of what is to come, it might serve as an indication of the volume of resource flows still to be included if the entire infrastructure were considered.

Transporting ICT has Low Relevance

Transportation from ICT manufacturing to the consumer contributes little to the entire resource consumption caused within the device's life cycle. In the case study for the handheld it accounted for less than 1% of the abiotic raw materials. However, if the transport of components and subcomponents before assembly, possibly by air, were to be considered, transport's contribution to resource consumption would probably be higher. In addition, the consumer habits (transport mode and distance traveled to sales point) constitute an influential factor of the transport related effects.

More Electricity for the Net

In the use phase all Internet infrastructure parts are associated with energy demand, which is an important factor to include when calculating the overall resource consumption of the Internet. Researchers at the Wuppertal Institute and other researchers working on the electricity consumption of Internet infrastructure have highlighted its dimension.

The electricity consumption of the end appliances in the use phase contributes significantly to the resource consumption of the infrastructure (Loerincik, Jolliet & Norris, 2002; Türk, 2001; Türk et al., 2002). The electricity consumption of a single device is determined by the user behaviour (the time spent in active, standby, sleep and charging modes) as well as the device's and charger efficiency. Also the energy source (e.g., coal, oil, hydro, wind) and the technology used for electricity production determine the material use of the device. Within the Digital Europe case study (based on the European electricity mix and on specific assumptions regarding consumer behaviour) the use phase accounts for a resource consumption up to 1.5 times higher than the one of the production phase. The respective figures for a handheld are only a third or half; that is, the

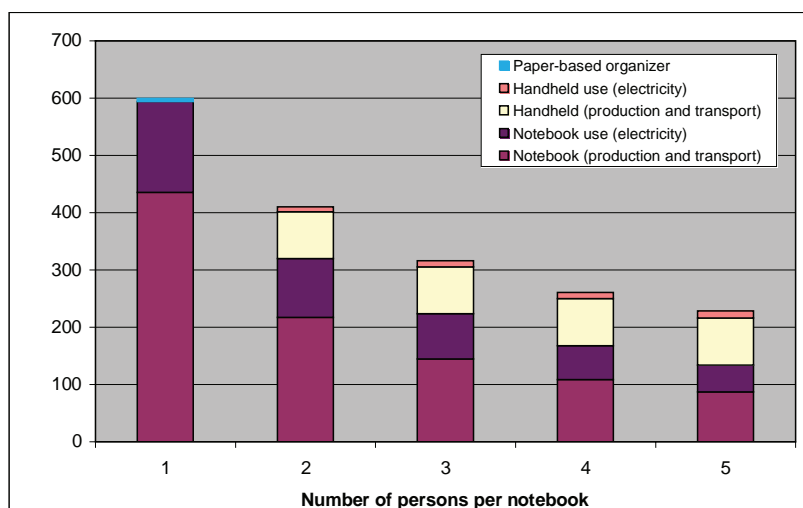
handheld is relatively energy efficient in the use phase. Regarding the service of “mobile information processing” that both products provide, there are differences in the convenience and handling of the information processing. There are mainly “mobility-related” advantages on the handheld’s side, whereas there are “information processing-related” advantages for the notebook. But still, as the users of mobile computing devices do not need (and cannot use) all the functions at one time, the concept of a shared use of the electronic equipment is coming into the picture as an interesting improvement option. Regarding shared use of electronic devices, the question is what raw material savings could be achieved if for example a company provided handhelds to all of its salespeople and promoted sharing of notebooks. This could be compared to a situation where each employee uses an individual notebook (see Figure 3).

The shared use of notebooks and individual use of handheld devices can increase overall efficiency. Starting from the material intensity analysis of the notebook and its assumptions, the

use intensities of the notebooks and the handhelds would increase with each increase in the number of persons sharing a notebook. However, with respect to the related use of abiotic raw materials, the saving attained with notebooks (and paper based personal organisers) is offset by the increasing use intensities illustrated in the figure.

These savings seem to be high. However in practice there are a number of obstacles to the shared use of notebooks and related material saving. For example, in a company where salespeople share electronic equipment, some salespeople will need a notebook when they are travelling. The shared use of notebooks might force other salespeople to come back to the workplace when they need the notebook’s processing capacities. Also, there are a number of changes needed to create shared working places (e.g., additional office equipment), which might be related to additional material intensities. As most of the handhelds are currently used in combination with notebooks, the handheld today is more an add-on device than a substitution for the notebook. As long as consumers demand a notebook or a PC in

Figure 3. Abiotic raw material intensity for sharing notebooks and additional use of handhelds



Virtual Networking without a Backpack?

addition to the handheld, no increase in resource efficiency can take place. But still, the concept of sharing seems to be an opportunity for increased resource efficiency.

On the national level the Internet's electricity consumption is considerable. For example, in Germany the life cycle electricity consumption of the entire Internet infrastructure is estimated to account for almost 2% of national electricity consumption (Thomas, 2002). The future energy demand of the Internet is most likely to increase. Initial estimates of future energy consumption indicate that the electricity demand from the Internet in Germany could increase to 5% of total electricity consumption by 2010. Also, research conducted by Romm in the US and by Aebischer and Huser in Switzerland points to an increase in the demand for energy caused by the entire Internet infrastructure, despite the energy efficiency improvements of individual Internet-enabled activities (Aebischer & Huser, 2000; Thomas, 2002).

The resource consumption associated with the Internet's energy use depends on how the electricity is produced, as shown by research done at the Wuppertal Institute (e.g., by Liedtke et al., 1998 or Manstein, 1996). It is the specific energy mix of a country that determines the associated resource consumption. In Germany, the material flows associated with electricity consumption during the use phase currently account for about 0.5% of nationwide material consumption (Türk, 2001). However, with increasing electricity demand by the Internet, the related resource consumption is most likely to rise.

End-of-Life Aspects of ICT

In the year 1998, 6 million tons of electronic waste had to be disposed of at the European level. The growth rate is at least 3% to 5% per year (European Commission, 2000). In Germany more than 2 million used computers, printers and so forth

accumulate every year. These cause large amounts of waste to be processed, which will be tripled over the middle term. If the electronic waste is disposed of in domestic waste, either it will end up untreated on a dumpsite (thus ensuring that contaminated waste will develop in the future), or will be fed into a "thermal utilization" type of waste incineration plant, the cleaning technologies of which are not designed for this kind of contaminated waste, or they will be transported to developing countries.

Considering the large amount of resources used to produce individual end-user appliances, reuse and recycling as well as the extension of the use phase are important improvement options from a life-cycle perspective. However, the actual number of recycled devices is low. The basis of an efficient recycling scheme includes both a good motivation for the end-user to return products and efficient logistics (take-back and recycling). As the material value of smaller products is reduced and the smaller size of devices allows them to be discarded with household waste, the take-back and recycling systems face major challenges. It is not yet clear what impact the WEEE directive will have on this matter. More practical data and research are needed for reliable evaluation of recycling schemes.

INDIRECT AND SYSTEMIC EFFECTS OF INTERNET APPLICATIONS ON RESOURCE CONSUMPTION

As highlighted in Figure 2, Internet applications have indirect effects as well as systemic effects. Both need to be considered for evaluation of the environmental effects of the broad system of the Internet. This section will highlight the resource consumption with a focus on the e-commerce applications of online banking and the digital provision of music.

Online = Virtual?

The analysis of the indirect environmental effects of e-commerce within the Digital Europe project highlights that the object of the economic transaction (the product or service) is an influential factor for the overall dematerialisation potential of e-commerce. This means that the material intensity of the transaction's object as such determines substantially the influence that e-commerce has on resource efficiency. Thus, e-commerce activities can be divided into product-based and information-based e-commerce, depending on the amount of physical material used to provide the specific service delivered by the product.

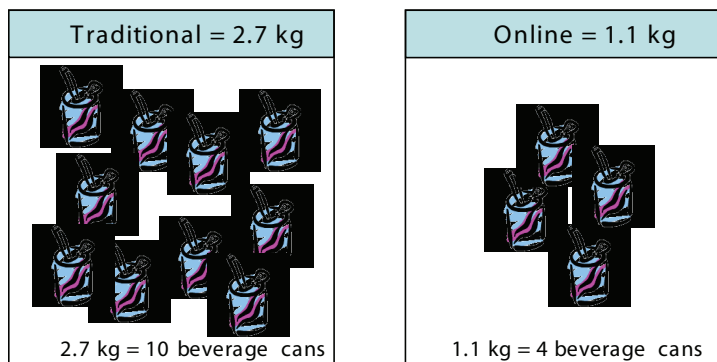
Information-based e-commerce, as one important application of ICT, can – under specific circumstances – provide significant resource efficiency potentials. Information-based e-commerce is not based on a physical product forming the object of the economic transaction. Online banking is one example where resource efficiency gains can be achieved by e-business, as illustrated in Figure 4 (Türk et al., 2003).

Based on the assumptions made in the online banking case study, a traditional payment causes resource flows in the order of 2.7 kg abiotic raw materials, whereas online payment only for 1.1

kg. Comparing these amounts with the amounts of raw materials needed to produce, e.g., beverage cans, we see that the traditional payment uses as much raw materials as the production of 10 cans requires. If the payment is conducted online, the equivalent of only four cans is needed. Assuming that from all 20 million online accounts in Germany (estimations of the number of online accounts are given for example by NUA Internet Surveys (2003)) annually 20 previously traditional payments would be replaced by online transactions, this would account for annual savings of 640 thousand tons of abiotic raw materials, that is, non-renewable resources.

Another example of information-based e-commerce is a music server that can provide a tremendous number of song units to many consumers (see Digital Europe case study on digital music by Türk et al., 2003b). The case study showed that downloading 56 minutes of music over the Internet is more than two and a half times less resource intensive than buying a CD with an equivalent amount of music at a shop. Savings are made at different stages in the process. For a start, a physical CD is replaced by a digital file. The resources needed to produce a CD are associated with an ecological backpack seven times their actual weight. Additionally,

Figure 4. Abiotic resource consumption of banking: Comparing a traditional payment with an online payment



Virtual Networking without a Backpack?

resource flows associated with the production and retail infrastructure as well as with transportation are made redundant. Moreover, resource savings associated with the reduced need for building infrastructure appear to be relevant. Other examples of dematerialised products are centralised voice mailing servers (Reichling & Otto, 2002) or news servers (Reichart et al., 2000).

With virtual products and services, consumers have a far greater influence on life-cycle-wide resource intensity because material intensity is no longer concentrated on the production and delivery phase of the product life cycle. Figure 5 shows how the overall material intensity is distributed among the producer, retailer and consumer when a CD is purchased in a music store (physical shopping), online (online shopping) or an equivalent number of compressed music files are downloaded over the Internet (digital distribution). There is a clear sign of a shift in material intensity down the value chain, making consumers the guardians of the environmental potential of virtual products and services.

In the case of product-based e-commerce, the physical production and delivery of a product takes place in a way similar to traditional shopping. Thus, the related resource consumption can be only partly influenced by ICT, as the production of the product and most of the logistical efforts remain. The resource savings due to e-commerce for products that have a high resource intensity during production are small anyway, since pro-

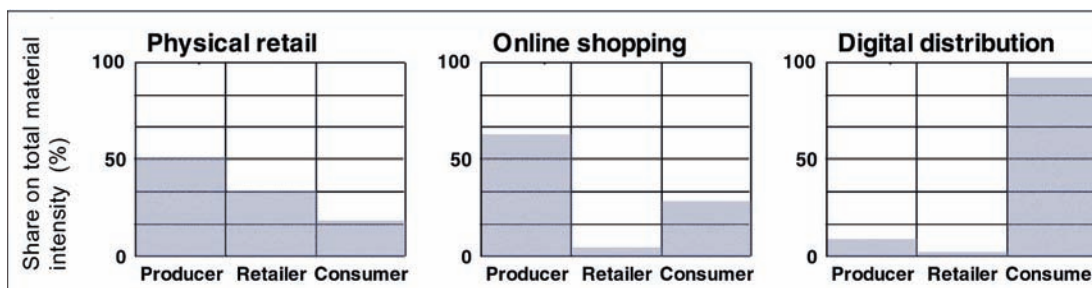
duction will likely dominate the material intensity along the life cycle. Additionally, there is an important difference compared to digitised products: digitised products can be shared by an unlimited number of users if not restricted by any kind of software protection. This means that one “product” can serve many users, adding a functionality that does not exist for traditional products even if they are sold by e-commerce.

Taking a Broader Perspective

Regarding systemic effects, influential factors for the resource consumption are the businesses and consumer habits or rebound effects. As with many other technical applications and services, these factors are important to consider in order to evaluate the full picture of the environmental effects of ICT and e-business. While on a case study level they might not turn out to be of relevance, on a macro level they are likely to be. A few examples are:

- The Internet will reframe markets, enabling companies and consumers to buy globally, which potentially increases transport demand;
- Flat rate internet access might reduce the (economic) incentives for Web users to disconnect from the Internet between sessions, resulting in an increasing energy demand, even if the PC itself is in sleep mode;

Figure 5. Environmental potential of virtual products and services in the case of digital music



- Fast Internet connections might change consumer behaviour and increase overall material intensity, as consumers with a fast Internet connection are more likely to stay online or to download more files.
- Consumers tend to re-materialise digital information. Examples are music files burned on CDs or the tendency to print out most digital documents.

In particular, people's habit to re-materialise is a good illustration of how consumer habits can be rooted in a non-digital world. Information stored only on a remote server or hard-drive is burned onto a CD or printed out on a regular basis. The reasons for this can be manifold, including issues such as trust (Is the information safe? Is a back-up needed?), traditions (important information needs to be filed as a printout) or habits (working with long documents requires a printout). The case study on digital music has highlighted the fact that this habit might offset the savings obtained from digital distribution.

In summary, information-based e-commerce has the potential to decouple economic growth from resource consumption. However, larger savings on a macro scale are not expected at the present situation or in the near future for various reasons (Kuhndt et al., 2003). First, e-commerce is a sales channel built up and maintained in parallel with traditional channels. Second, the number of products that can be reduced to an "informational core" seems to be limited. In the resource intensive sectors such as building, food, clothing and community as well as large parts of health and leisure there are a number of products that are not likely to be digitised. This leaves a fraction of total material consumption in which information-based e-commerce could potentially contribute to a decoupling. Third, under the current framework influencing resource consumption, consumer habits and rebound effects might have a counterbalancing influence. Whether with

changed framework conditions the benefits could outweigh the risks remains an open question.

CONCLUSIONS

The Internet and Internet applications are far from being purely virtual, but are clearly linked to the use of natural resources. It seems that a seemingly inevitable increase in the resource consumption for the production of electronic equipment and its electricity consumption comes with the growth of the Internet's infrastructure. Based on existing research, a number of conclusions can be made regarding the minimisation of environmental risks and maximisation of e-business' potential to dematerialise.

Monitoring Environmental Impacts of Internet and Internet Applications

The quantification of environmental effects caused by ICT technologies is still a major challenge. Having knowledge about environmental effects along the entire product chain is a necessary precondition for the identification of efficient improvement options. Efforts are required to improve macro-level statistical classification systems for ICT infrastructure and applications to provide adequate statistical information. At the company level, opportunities can be the combination of cost accounting systems with internal material flow data (material flow accounting) as well as improved supply chain communication covering the ecological costs of preliminary production and transport.

Greening ICT Hardware

The research within Digital Europe pointed out the importance of ICT infrastructure as a main factor for resource consumption of e-business and e-government. Often, the early manufacturing

Virtual Networking without a Backpack?

stages and the use phase are neglected within evaluations. However, these turn out to be of high relevance for a large share of ICT products and services. Improvement opportunities can be derived from the extension of ICT's lifetime, the promotion of the shared use of ICT equipment, extended warranties or design for environment, as initiated by proactive ICT companies.

Shifting to E-Services

E-commerce can – under specific circumstances – provide significant resource efficiency potentials, especially if physical products are shifted to e-services. Public administration and businesses can be a forerunner in offering e-services as part of their e-government strategies. As well as being a provider of e-services (push-strategy), these organisations could request services instead of products from their suppliers wherever possible (pull-strategy). Societal and technological framework conditions can be enhanced for the uptake of e-service applications. Fast, affordable and reliable Internet connections are a prerequisite, as is the trust in the confidentiality of data transferred via the Net. Besides this, large parts of the population still lack basic e-society literacy. Empowering these groups is a key for a wider uptake of e-services. Scientific assessments should be carried out to determine in which sectors of traditional industry with high resource consumption the use of ICT could enable a dematerialisation noticeable at the macro scale. Such an assessment could help to answer the question as to where it is worthwhile to promote e-services on a larger scale.

Raising Awareness and Changing Habits

The habits of ICT users and their awareness are to an increasing extent decisive for total material intensity. Efficiency gains may even be offset. Examples are re-materialisation of digitised in-

formation or building up of e-channels without reducing traditional ones. E-society literacy is needed, allowing users to handle digital information without re-materialisation. While the younger generation will hopefully grow up with a mindset allowing them to deal with this, training and empowerment might be needed for other population groups. A better understanding of the size and potential impact of rebound effects is urgently needed. Of particular importance is the early integration of information on potential rebound effects in the design phase of products and services, as the main effects are determined there. With the growth of the Internet, global and national framework conditions become more important as a means of limiting undesired rebound effects, such as additional resource or energy consumption.

REFERENCES

- Aebischer, B., & Huser, A. (2000). *Vernetzung im Haushalt, Auswirkungen Auf Den Stromverbrauch*. Bern: Swiss Federal Office of Energy.
- Atlantic Consulting, IPU. (1998). *LCA Report: EU Ecolabel for personal computers*. Third report from study of the product group personal computers in the EU Ecolabel scheme for DG XI of the European Commission.
- Berehndt, S., Kreibich, R., Lundie, S., Pfitzner, R., & Scharp, M. (1998). *Ökobilanzierung Komplexer Elektronischer Produkte*. Berlin: ITZ.
- Commission Proposal COM. (2000). 347 final. Proposal for a Directive of the European Parliament and of the Council on waste electrical and electronic equipment.
- Cyber Atlas. (2003, August). *Global usage*. <http://cyberatlas.internet.com>.
- Cyber Atlas (2003b). *The world's online population, 2003*. <http://cyberatlas.internet.com>.

- Deutscher Commercial Internet Exchange. (2001). <http://www.decix.org>.
- European Commission (2003). *Statistics on the information society. Europe*. Statistics in focus. Industry, trade and services. Theme 4-38.
- European Information Technology Observatory (EITO). (2000). *Frankfurt: European Information Technology Observatory* (Germany).
- Geibler, J.v., Kuhndt, M., & Türk, V. (2002). *Umweltauswirkungen von e-Commerce: Betrachtungen am Fallbeispiel Online-banking*. [Environmental effects of e-commerce: Investigating the case study on line banking]. *Ökologisches Wirtschaften*, 3-4.
- Geibler, J.v., Kuhndt, M., Türk, V., & Ritthoff, M. (2003). *Environmental impacts of mobile computing. A case study with Hewlett Packard*. Report to the European Community. Wuppertal Institute (Germany).
- Greenspan, R. (2002). *EU B2B Expected to Explode*. <http://cyberatlas.internet.com>.
- Hilty, L.M., & Gilgen, P. W. (eds.). (2001). *Sustainability in the information society*. Marburg: Metropolis-Verlag.
- Internet Software Consortium. Internet Domain Survey. www.isc.org.
- Kuhndt, M., Geibler, J.v., Türk, V., Moll, S., Schallaböck, K.O., & Steger, S. (2003). *Digital Europe: Virtual dematerialisation: ebusiness and factor X*. Report to the European Community. Wuppertal Institute (Germany).
- Liedtke, C., Rohn, H., Kuhndt, M., & Nickel, R. (1998). Applying material flow accounting: Eco-auditing and resource management at the Kambium Furniture Workshop. *Journal of Industrial Ecology*, 2(3). MIT Press.
- Loerincik, Y., Jolliet, O., & Norris, G. (2002, November 6-8). Life cycle environmental impacts of Internet. *Proceedings of the Fifth International Conference on EcoBalance. Practical tools and thoughtful principles for sustainability*, 121-123, Epochal Tsukuba, Japan.
- Manstein, Ch. (1996). Das Elektrizitätsmodul im MIPS-konzept [Electricity module for the MIPS concept]. Wuppertal Papers, No. 51, Wuppertal Institute for Climate, Environment, Energy, Germany.
- NUA Internet Surveys. (2003). *Online banking on the rise in Germany*. [Online] Quelle: http://www.nua.com/surveys/?f=VS&art_id=905358742&rel=true.
- Office of Technology Assessment at the German Parliament (TAB). (2002). *Innovationsbedingungen des E-commerce – Die Technischen Kommunikationsinfrastrukturen für den Elektronischen Handel*. [Innovation conditions of e-commerce: The technical communication infrastructure for electronic commerce]. Background paper No. 7. TAB.
- Reichart, I., Hischler, R., Schefer, H., & Zurkirch, M. (2000). *Umweltbelastung durch Internetsurfer, Fernseh Zuschauer und Zeitungsleser*. [Environmental impacts of surfing the Internet, watching TV and reading a newspaper]. St. Gallen: Eidgenössische Materialprüfungs- und Forschungsanstalt, Switzerland.
- Reichling, M., & Otto, T. (2002). Environmental impact of the new economy. In J. Park & N. Roome (Eds.), *Ecology of the new economy*. Greenleaf.
- Romm, J. (1999). *The Internet economy and global warming*. The Centre for Energy and Climate Solutions.
- Schmidt-Bleek, F. (1995). Increasing resource productivity on the way to sustainability. *UNEP Industry and Environment*, October-December, p. 10.

Virtual Networking without a Backpack?

Socolof, M.L., Overly, J.G., Kincaid, L.E., & Geibig, J.R. (2001). *US EPA desktop computer displays: A life-cycle assessment*. US Environmental Protection Agency, 1.

Thomas, S. (2002, February 21-22). *www.internet.co2? GHG emissions of the Internet in Germany*. Presentation at the IEA Workshop: Information and Communication Technology: the Next Challenge for Energy Systems? Paris. Information is based on unpublished results by Stephan Thomas and Dr. Claus Barthel, Wuppertal Institute, Germany.

Türk, V. (2001). *Assessing the resource intensity of the Internet infrastructure: Data analysis for a material-flow oriented approach and first results on electricity consumption*. MSc thesis at the Lund University, Sweden. Retrieved July 17, 2002, from: <http://www.iiee.lu.se/>.

Türk, V., Kuhndt, M., Alakeson, V., Aldrich, T., & von Geibler, J. (2003b). *The environmental and social impacts of ebanking. A case study with Barclays PLC*. Case study within the project Digital Europe: Ebusiness and sustainable development. <http://www.digital-eu.org/>.

Türk, V., Kuhndt, M., Ritthoff, M., & Alakeson, V. (2003). *The environmental and social impacts of digital music. A case study with EMI*. Case study within the project Digital Europe: Ebusiness and sustainable development. <http://www.digital-eu.org/>.

Türk, V., Ritthoff, M., Geibler, J. Von, & Kuhndt, M. (2002). *Internet: Virtuell = umweltfreundlich?* [Internet: virtual = environmentally sound?] In G. Altner, B. Mettler-von Meibom, U. Simonis & E.U. von Weizsäcker (Eds.), *Jahrbuch ökologie 2003*, 110-123. Beck, München.

VDI Nachrichten. (2001, March 30). *Netzknoten Sind Wahre Stromfresser*. [Internet nodes are extreme electricity consumers]. VDI-Verlag, Düsseldorf, Germany.

White, A.L., Stoughton, M., & Fend, L. (1999, December 1-3). *Servicizing: The quiet transition to EPR*. Tellus Institute, Boston, MA, USA. OECD Workshop. Extended and Shared Responsibility for Products: Economic Efficiency/Environmental Effectiveness. Washington, D.C.

This work was previously published in Information Systems for Sustainable Development, edited by L. M. Hilty, E. K. Seifert, & R. Treibert, pp. 109-127, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.17

Cultural Factors and Collective Identity of Women in ICT

Phyl Webb

University of Tasmania, Australia

Judy Young

University of Tasmania, Australia

INTRODUCTION

There is a considerable body of research to support the longstanding problem of a gender imbalance in the ICT industry (Ahuja, 2002; Baroudi & Igbaria, 1994; Cukier, Shortt, & Devine, 2002; D'agostini, 2003; Frenkel, 1991; Moody, Beise, Woszczynski, & Myers, 2003; Nielsen, von Hellens, & Wong, 2000; Nielsen, von Hellens, & Wong, 2001). However it appears there has been little attempt to draw it together to inform the influences and impacts that many women face when employed in the industry. The objective of this article is to examine research focussing on two factors that have impacted on the experiences of women who have established careers in the ICT industry.

GENDER IMBALANCE IN THE ICT INDUSTRY

The authors conducted a search of the literature related to gender imbalance in the ICT industry. From this, it became apparent that the existing body of literature consistently identified a number of elements as representing the existing state of ICT workplaces. It is possible and perhaps probable that some of these elements are conspiring to influence the:

1. Cultural factors typically encountered in ICT workplaces
2. Collective identity of women employed in ICT workplaces

Cultural Factors

In reviewing the gender related ICT literature, an image of the tensions that are at work and could influence and impact on women working within the industry emerges. These factors are, in general, subtle. However, they do make a contribution to enhancing understanding by highlighting potential relationships between social pressures to identify reasons and solutions relevant to the current situation within the industry.

Dominant Male Culture

The idea of ICT as a male dominated industry characterised by masculine language and modes of operation is evident from the literature (Pringle, Nielsen, von Hellens, Greenhill, & Parfitt, 2000; The Women in Science Engineering and Technology Advisory Group 1995). A sense of a shared masculine ownership of the science and technology sector as a whole pervades with the result women can feel marginalised and isolated. One outcome of this is a perception that senior men in industry favour males coming in and regard females almost with suspicion and even derision.

The notion of the IT sector as a male domain has conspired to perpetuate a culture of long working hours and masculine language. von Hellens, Nielsen and Trauth (2001) found that while many women did not see IT as an inherently male domain, they reported situations where they had been challenged as a consequence of their sex. In addition, it was noted that many women do leave IT workplaces if they are unable to deal satisfactorily with male domination. Those who remain can be subjected to inappropriate language, advances and stereotyping within the workplace (Teague, 2000; O'Neill & Walker, 2001).

Competitive Atmosphere

Women working in ICT are constantly confronted by the competitiveness of men in presenting themselves and promoting themselves. The preference of women for connections rather than competition may contribute to the levels of discomfort generated within the competitive environment (Lind, 2000). Men can be aggressive and arrogant in the way they compete and reluctant to admit making mistakes or not knowing something. Women tend to find this approach confronting and a challenge to their self-confidence. In general, they tend to have less confidence in their abilities and may be less likely to attempt new activities or activities that are considered challenging. This can have a detrimental effect as it often precludes women from opportunities to demonstrate themselves in a positive light in the work situation. Since these characteristics are valued within the male culture women are disadvantaged as a consequence (Teague, 2000; Cuny & Aspray, 2000).

Demographics of Women in IT within Organizations

As a group women working in ICT workplaces have less organizational tenure, less job tenure and are younger than their male colleagues. Few women hold senior management positions in the sector (Ahuja & Rodlain, 2000; Baroudi & Igbaria, 1994; O'Neill & Walker, 2001; Pringle et al., 2000; Trauth, Nielsen, & von Hellens, 2000). Results from the Association of Professional Engineers, Scientists, and Managers, Australia (APESMA, 2002) survey showed that in the Australian computer profession women outnumbered men in levels 1 and 2 of responsibility and that their representation began to decrease at levels 3 and 4 of responsibility. Further at the higher levels of responsibility (5 and above) men outnumbered

bered women almost to the extent of two to one (APESMA, 2002). In addition often when women achieve seniority in job title this is not reflected in the opportunity to participate in critical IT decision making in the organization and team leadership (Panteli, Stack, & Ramsay, 1991). The exclusion of women from IT management ranks has implications for their career options and probability of better remuneration (Truman & Baroudi, 1994). The distribution of women throughout middle and lower levels in the industry is significant. Panteli, Stack, and Ramsay (1999) reported that even though they might share the same positional role and title as men, women are not engaged in the same projects. Women are more likely to be engaged in administrative functions (O'Neill & Walker, 2001) or in low status specialities such as merging and tidying databases (Pringle et al., 2000).

Effect of Gender Traits

From the literature, it has become apparent that some researchers have concluded that there are specific gender traits and that the existence of these traits impact on the manner in which women assimilate into ICT workplaces. Venkatesh and Morris (2000) explored gender traits in ICT and suggested that men were interested in how useful technology was while women were interested in how easy it was to use. Another gender trait they identified was that women, more so than men, are influenced by peers and others when making decisions to use technology. Women also have a greater need to belong to a group, a greater interest in personal goals and were more responsive to the needs and feelings of others.

For those women who have already chosen to work in ICT workplaces Holmes (1998) found that while men and women do not differ appreciably in relation to many of their work goals, men consider high earnings, variety and advancement as

more important than women. Ahuja (2002) has suggested women make choices that see them placed in positions and professions considered female friendly and offers that this may be occurring because of the diversity of roles that women fulfil during their lives. Generally, women prefer a greater balance in their lives.

Balancing Work and Family Commitments

Many women successful in the ICT industry appear to have sacrificed family for work. Even where arrangements exist for women to access flexible working arrangements there is a tendency not to do so. Dowse and Underwood (2001) depicted a negative image for the future of the ICT industry for balancing work and family for both men and women. Historically ICT as an industry has not been sufficiently cognitive of the needs of employees trying to balance paid employment with raising a family (Pearl, Pollack, Riskin, Thomas, Wolf, & Wu, 1990; Truman & Baroudi, 1994). The image of the culture of ICT workplaces is one of long hours often worked outside of normal business hours. So enduring and pervasive has this view become that both men and women have come to expect this regime within ICT workplaces to the point where managers have been reported as rebuffing staff complaints about hours worked because that is just the way it is in IT (Nielsen, von Hellens & Wong, 2001, O'Neill & Walker, 2001). However, the long hours are biased against women (O'Neill & Walker, 2001). Women do shoulder a greater share of the parenting responsibility in most families (Dowse & Underwood, 2001) and because of this expectation it is likely to be a severely limiting factor for females in the ICT industry. To be successful in the industry, women typically need to prioritise work over family (Pringle et al., 2000) while others delay having children until later in life (APESMA, 2002).

ICT as a Solitary and Isolating Career

The image of ICT as a solitary and isolating career still endures. Women tend to favor personal interaction and communication and as a consequence a career that conjures up images of isolation and boredom may be perceived as unattractive (Nielsen, von Hellens & Wong, 2001, Trauth, 2002). The dominant image of the computer nerd is that he is incapable of interacting with people (von Hellens, Pringle, Nielsen, & Greenhill, 2000). Interviews conducted by Trauth (2002) with women working in the IT industry revealed that in order for them to be successful they needed to work alone. This is contrary to the need of women to openly communicate and engage in collaborative approaches (Panteli, Stack, & Ramsay, 1991).

Collective Identity

The second major category identified in the literature is based on examples of literature dealing specifically with the characteristics of women employed in ICT workplaces.

Exhibiting Masculine Tendencies

There is a strong sense within the existing literature that women who are successful working within ICT workplaces have a picture of themselves as being different to most women and more like men in some ways (von Hellens, Nielsen, & Trauth, 2001, Webb, 2002). The women interviewed by Trauth, Nielsen, and von Hellens (2000) who had achieved management positions agreed they have personality traits described as masculine. This happened to the extent that a women professor intentionally aligned herself with the sexist males in order to achieve a “shining career” (von Hellens, Nielsen, & Trauth, 2001).

Further, the women who have achieved in ICT workplaces tend to be more competitive and

perhaps as a consequence they do not embrace stereotypical gender roles (APESMA, 2002; von Hellens, Nielsen & Trauth, 2001). They have described themselves as being logical, assertive and task-focussed (Nielsen, von Hellens & Wong, 2001). As one women recounted, to obtain a position in a particular IT organization she felt it necessary to prove that she could ‘drink as many beers as the men’ (Pringle et. al., 2000, p. 4).

Women Who Use Mentors Tend to be More Successful

There is a lack of mentors and mentoring opportunities for women. As a result many women coming into the industry are denied appropriate role models and the support from other women to whom they can relate (Sumner & Neiderman, 2004; Teague, 2000; von Hellens, Nielsen, & Beekhuyzen, 2004). The shortage of mentors is problematic as this support is crucial to provide positive work experiences in the IT industry and an ability to achieve career success (Pearl et al., 1990).

Ahuja and Rodlain (2000) found a likely connection between the success of women in IT, their intention to remain and advance within the field and the effectiveness of mentoring relationships. von Hellens et al. (2002) cited the example of a young IT professional who was fortunate to have a female team leader. This mentor supported her appointment as a project leader that enabled her to demonstrate her capability in the role and gain acceptance in the organization.

Capacity and Willingness to Adopt Adaptive Behaviours

In the ICT work environment, male personnel are established as the benchmark and women are often forced to adopt masculine behaviours to participate let alone succeed (O’Neill & Walker, 2001). From a constructivist viewpoint, Trauth

(2002) states that while women are subject to different social influences, to succeed in the IT environment they need to adjust to work in a male dominated workplace.

From the literature there is an impression that adaptive behaviour may disadvantage a woman in the workplace (Nielsen, von Hellens, & Wong, 2000; Pringle et al., 2000). Pringle et al. (2000) have argued that it should be unnecessary for women to adapt because their organizational and communication skills can challenge the link between technology and masculinity in an IT environment. While this view may have merit the current literature lends little support for the success of women who cannot or will not adapt to the current ICT workplace paradigms.

DISCUSSION

The issues discussed in this article are not claimed to be representative of all actual situations in ICT workplaces. While these have emerged from the literature, it is acknowledged that examples of gender equality cultures do exist in the industry. However, there is ample evidence in the literature to support that generally there is a male dominated culture in the ICT industry.

Gender imbalance is a complex issue and often belies simple explanation and resolution. With respect to the ICT work environment it may be that this domination was established at the very origin of the industry, a time when technology was seen solely as a male activity. Potentially this set a foundation where the notion of homosocial reproduction has perpetuated the situation. Homosocial reproduction implies the politics of the dominant group in the organization will largely drive decisions and actions. While it is possible to change the male domination in the ICT work environment it will be a slow process and to be effective must be embraced by those within the industry. The major barrier is that change will

not happen unless there are a sufficient number of women succeeding in ICT workplaces.

If the dominance of the male culture is not challenged, it is unlikely that change will occur. As long as male dominance remains it is central to maintaining the inequitable demographics of women in IT organizations, the competitive atmosphere, the problems of balancing work and family commitments and the solitary and isolating nature of careers in the industry. While there is evidence to support that gender traits can affect the work experiences of women, a change in culture may be more accommodating to the different attitudes and approaches between the sexes.

From a perspective of collective identity it becomes clear that women who do succeed in ICT are those who are willing to be adaptive and get on with their careers. While this tends to involve the adoption of masculine tendencies as a minority group it is probably the only way they can compete on an equal level.

CONCLUSION

The aim of this article was to present an examination of the literature that reports the impact of cultural factors and the influence of collective identity on women who have established careers in the ICT profession. In so doing, it has highlighted some of the issues that have confronted some of the women who have forged successful careers in ICT.

The benefit of this approach is that it offers information to enable women to be better prepared and informed when contemplating a career in the ICT industry. Perhaps this could prove instrumental in reducing the number of women leaving the industry because they are ill equipped to cope in a male dominated work environment. Potentially this may reduce the negative image of the industry. As such it may attract more women to consider

careers in ICT and, at the same time, stem the high attrition of women from the industry.

REFERENCES

- Ahuja, M. K., & Rodlain, F. (2000, August 10-13). Mentoring relationships, gender, and work-family conflict: The case of IT careers. In *Proceedings of Americas Conference on Information Systems*, (pp. 1976-1980) Long Beach, CA.
- The Association of Professional Engineers, Scientists, and Managers, Australia (APESMA). (2002). *Women in the professions* (Survey Report). APESMA, South Melbourne.
- Baroudi, J. J., & Igbaria, M. (1994). An examination of gender effects on career success of information systems employees. *Journal of Management Information Systems*, 11(3), 181-201.
- Cukier, W., Shortt, D., & Devine, I. (2002). Gender and information technology: Implications of definitions. *Journal of Information Systems Education*, 13(1), 7-15.
- Cuny, J., & Aspray, W. (2000). *Recruitment and retention of women graduate students in computer science and engineering: Results of a workshop organised by the Computer Research Association*. San Francisco: Computer Research Association.
- D'agostini, D. (2003). Where are all the women leaders? *CIO Insight*, 1(40), 67.
- Dowse, S., & Underwood, J. (2001, December 5-7). *Work life balance of IT managers: Finding time for a life*. Australasian Conference on Information Systems (CD-ROM), Coffs Harbour, Australia.
- Frenkel, K. A. (1991). Women and computing. *Communications of the ACM*, 33(11), 34-46.
- Holmes, M. C. (1998). Comparison of gender differences among information systems professionals: A cultural perspective. *The Journal of Computer Information Systems*, 38(4), 78-86.
- Lind, M. R. (2000). Communication channel usage: Is there a gender difference. *Americas Conference on Information Systems* (pp. 1688-1694). Longbeach, CA.
- Moody, J. W., Beise, C. M., Woszczyński, A. B., & Myers, M. E. (2003). Diversity and the information technology workforce: Barriers and opportunities. *The Journal of Computer Information Systems*, 43(4), 63.
- Nielsen, S., von Hellens, L. A., & Wong, S. (2000, July 21-22). *The women in information technology project: Uncovering the pride and prejudices*. The 6th Australasian Women in Computing Workshop, Brisbane, Australia.
- Nielsen, S. H., von Hellens, L. A., & Wong, S. (2001). *The male IT domain: You've got to be in it to WinIT!* Panel discussion at The 12th Australasian Conference on Information Systems (CD-ROM), Coffs Harbour, Australia.
- O'Neill, L., & Walker, E. (2001). Women in the information technology industry: A western Australian view. In *Proceedings the 9th European Conference on Information Systems*, Bled, Slovenia (pp. 118-128).
- Panteli, A., Stack, J., Atkinson, M., & Ramsay, H. (1999). The status of women in the UK IT industry: An empirical study. *European Journal of Information Systems*, 8, 170-182.
- Panteli, A., Stack, J., & Ramsay, H. (1999). Gender and professional ethics in the IT industry. *Journal of Business Ethics*, 22, 56-61.
- Pearl, A., Pollack, M., Riskin, E., Thomas, B., Wolf, E., & Wu, E. (1990, November). Becoming a computer scientist. *Communications of the ACM*, 33, 48-55.
- Pringle, R., Nielsen, S., von Hellens, L., Greenhill, A., & Parfitt, L. (2000, June 26-33). Net gains.

In *Proceedings of the 7th International Conference on Women, Work, and Computerization*, Vancouver, Canada.

Sumner, M., & Niederman, F. (2004). The impact of gender differences on job satisfaction, job turnover, and career experiences of information systems professionals. *The Journal of Computer Information Systems*, 44(2), 29-39.

Teague, J. (2000). Women in computing: What brings them to it, what keeps them in it? *GATES*, 5(1), 45-59.

Trauth, E. (2002). Odd girl out: An individual differences perspective on women in the IT profession. *Information Technology and People*, 15(2), 98-118.

Trauth, E., Nielsen, S., & von Hellens, L. (2000, December 8-10). Explaining the IT gender gap: Australian stories. In *Proceedings 11th Australasian Conference on Information Systems* (CD-ROM), Brisbane, Australia.

Truman, G. & Baroudi, J. (1994). Gender differences in the information systems managerial ranks: An assessment of potential discriminatory practices. *MISQ*, 18(2) 129-140.

Venkatesh, V., & Morris, M. G. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MISQ*, 24(1), 115-139.

von Hellens, L. A., Nielsen, S. H., & Beekhuyzen, J. (2004). An exploration of dualisms in female perceptions of IT work. *Journal of Information Technology Education*, 3, 104-112.

von Hellens, L., Nielsen, S., & Trauth, E. (2001). Breaking and entering the male domain. Women in the IT industry. In *Proceedings of the ACM SIGCPR Conference*, San Diego, CA (pp. 116-120).

von Hellens, L., Pringle, R., Nielsen, S., & Greenhill A. (2000). People, business, and IT Skills:

The perspective of women in the IT industry. In *Proceedings of the ACM SIGCPR Conference*, Chicago (pp. 152-157).

Webb, P. (2002) *Gender imbalance in IS/IT workplaces—A Tasmanian perspective*. Unpublished Honours Thesis. University of Tasmania. Australia.

The Women in Science, Engineering and Technology Advisory Group. (1995). *Women in science, engineering, and technology—A discussion paper*.

KEY TERMS

Collective Identity: Implies the characteristics exhibited by any group of people in specific circumstances.

Gender: The biological division of the sexes. This division does not consider psychological or other facets of the construct gender.

Gender Imbalance in ICT: The state in which there exists a significant difference between the percentage of male and female participation within the ICT industry. This imbalance extends across most levels of appointment within ICT workplaces.

Homosocial Reproduction: A process in which the politics of the dominant group in the organization will largely control decisions and actions.

ICT Careers: A general term associated with the ICT industry that covers a diversity of roles involving technology, information processing and people issues.

ICT Industry: A business sector focussed on supporting computer infrastructure, people, and information processes within and between organizations.

Cultural Factors and Collective Identity of Women in ICT

Organizational Culture: This refers to the shared values, characteristics and rules that govern behavior and attitudes in specific work-place environments. These may be formally or informally applied depending on the nature of the organization.

This work was previously published in Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 160-165, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 7.18

A Cultural Studies Approach to Gender and ICT

Merete Lie

Norwegian University of Science and Technology (NTNU), Norway

INTRODUCTION

This article introduces a cultural studies approach to the field of gender and ICT. This implies an emphasis on the symbolic aspects of technology. Technologies are approached as cultural phenomena to which meaning is attached, but in the sense that they are open to various interpretations. Technology holds a position as a key symbol in Western societies. A key symbol is, in Sherry B. Ortner's terms, a symbol that helps us to sort out experiences and put them into place within cultural categories, and even help us think about "how it all hangs together" (Ortner, 1973, p. 1341). This key symbol has gone through a radical transformation from mechanical machines to ICTs as the leading technologies. An important question is how changing technologies are linked to another key symbol, namely that of gender. Moreover, following from that question, how can you study the relationship of gender and ICTs when both are continually changing?

THEORETICAL KNOTS

My own background is from a Norwegian network of researchers who have been studying gender and technology for the last 25 years. The differences between two Norwegian collected volumes may indicate a changing direction in the understanding of gender and ICT from the 1980s until today. The volume from the 1980s depicts technology as a tool of power in the hands of men (Lie et al., 1988). This provided a clear line of analysis as well as a direction for action to change the imbalance between men and women's access to technology. A volume from the 2000s, however, depicts a cybernetic pattern with threads and knots and loose ends—and may serve as an illustration of a seamless web with neither one distinct pattern nor one direction for change (Lie, 2003).

In our research during the 1980s, we analyzed technology as a means of power within a gendered division of labor. Technology was analyzed as the result of social constructions with in-built gender

divisions, or in David Noble's terms, "frozen culture" (Noble, 1985). At the same time, however, technologies are also messengers, telling us who and what belongs where. During the 1990s, my focus shifted towards the symbolic dimensions of technology and the strong connections between technology and masculinity. As a symbol of masculinity, technology strengthens bonds between men and offers a way of "doing" or "performing" gender. To prove one's competence with technology is to prove one's place as a man among men. This perspective tends however, to be too static and has therefore spurred a search for new perspectives that include changing technologies as well as varying and constantly changing understandings of femininities and masculinities.

Within the field of gender and ICT, most attention has been accorded to women and how one might change their attitudes to technology. Feminists have tried to move away from this one-sided perspective towards regarding it in relational terms, thus drawing attention to technology as the other side of the gender-technology relationship. Instead of changing women, it was argued, one should change technology and the culture of technical institutions. In this way, however, both the concept of gender and that of technology may appear to be given and stable, thus in need of conscious strategies if they were to change. However, what we actually observe is that both are constantly changing. Suffice to mention how computers as calculating machines have been transformed into information and communication devices (Turkle, 1995) and continuing debates about what gender means and proper gender conducts. The challenge is that when we try to find out why gender still matters in relation to ICT, the themes we are dealing with tend to change their shape: gender relations are re-negotiated and new technologies appear. Thus, once we have identified a strategy to include women into the field of ICTs, the whole field is re-configured. Change is therefore obviously, what theories of gender and technology have to include.

Moreover, ICT is no longer an exotic item with the prefix cyber-, alluding to something that is virtual, out of the real world, and exclusively for a minority with access to a cyber society. Today, ICT indicates rather familiar items that are included in the everyday routines of many people, at work, for entertainment, and for social activities. ICT is part of a variety of activities related to different aspects of people's lives. However, we still tend to talk about ICT as if it were one thing.

As mentioned, the studies of gender and ICT have mainly directed the attention at women, and they are often focused on education (cf., Gansmo, 2004; Lagesen 2004). Women's attitudes and relationships to ICT have been studied empirically. It has been said that women's performances are measured against a norm that is set by men, and consequently women are considered to do computing in an inferior way and not up to standards (Corneliussen, 2003; Rasmussen & Håpnes, 1991). The difference is conceptualized in terms of men's more technical approach vs. women's more communicative approach; that is, men are deemed to be interested in and competent at technical matters whereas women are deemed to be interested in chatting and e-mail (Stuedahl, 1998). We may ask, however, whether this feature of "men as norm" does not actually refer to "real men," with varying user patterns, but rather to an abstract "ghost feature" of masculine gender symbolism.

Studies from working life have shown that when masculinity is symbolically linked to different technologies and to technical competence, it is the result of cultural practices (Cockburn, 1983, 1985; Faulkner, 2000; Lie, 1998; Mellström, 2003; Wajcman, 1991). The symbolic association of technology and masculinity is, in other words, not self-evident but must be produced and confirmed continually. This also tells us that gender symbolism is open to change, holding that matters do not "have" meaning but are accorded meaning by actors and within particular contexts (Geertz, 1973). My concern is how gender functions as a

cultural distinction that literally “gives” meaning to technical artefacts and practices.

TECHNOLOGY AS CULTURE

A cultural studies approach to the knot of gender and ICT implies that not only gender but also technology is analyzed as a cultural phenomenon. Technology and culture are conceptualized as interwoven in mutual shaping processes. This mutual shaping can be studied in design and also during the cultural consumption of a new technology. In Norway, a user perspective and focus on cultural appropriation of technology have been prominent in gender and technology research (Berg, 1996; Lie & Sørensen, 1996). This is an approach following the traditions of social shaping or social construction of technology (Bijker & Law, 1992; MacKenzie & Wajcman, 1985;), the point being that a technical device could always have been otherwise. There is no technical necessity that leads to a certain end product, and culture is integrated, literally in-built, in the technical products. Moreover, the concepts of gender and ICT cannot be explored separately because they are intricately interwoven. This implies leaning on the metaphor of a seamless web of technology, culture, and society (Hughes, 1988) and on cyborgian and hybrid conceptualizations that blur the otherwise clear boundaries between nature-culture, both in the sense of sex-gender and human-technical (Haraway, 1991, 1997).

The connection of technology to masculinity has implied that tools are more easily identified as technologies when they belong to the masculine realm, whereas tools associated with women are more ambiguous and may be categorized otherwise, as with kitchenware or sewing-kits for instance. In this way, preconceptions regarding gender are constitutive for what is recognized as technology. Likewise, with technical competence as a characteristic of masculinity, technology has functioned as a device for sorting out gender.

Although we recognize a variety of masculinities, meaning that there are many ways to be identified as “masculine”, a close relationship to technology still remains one of them. However, whereas steel, cogs, and mechanical machinery produced masculine connotations related to muscles and strength, computers are more ambiguous. This ambiguity refers not only to the design of machinery but also to the varied social contexts of ICT use. Thus, the new ICTs could have meant a re- or de-gendering of technology, but the social processes taking place have directed ICTs towards traditionally masculine realms. One example is the linking of computer science to technical institutions; another is the production of software for “boys’ games” (Cassell & Jenkins, 1998). But—it might have been otherwise. The rapid introduction of computers into a wide variety of contexts is contributing to the opposite effect of de-gendering ICTs.

GENDER AS “PRODUCER OF MEANING”

Here, gender is considered as cultural distinctions that are activated to literally “give” meaning to technical artefacts and practices related to them (and vice versa). The cultural categories of masculine and feminine may or may not be in accordance with what particular men and women look like and act like. Since the notions of femininity and masculinity are basic categories of distinction, though culturally specific, gender is a relevant category when technologies are designed, advertised, talked about—in other words, during all stages of a technology’s “life cycle.”

The design of technical artefacts is based upon imagined users and it may make a difference whether the projected users are imagined as men or women. The visions of designers are inscribed in the products, in the sense that “like a film script, technical objects define a framework of action together with the actors and the space

in which they are supposed to act” (Akrich, 1992, p. 208). Such scripts can be deduced from the technical products, and differences that habitually are recognized as feminine and masculine may be identified in the design (Berg & Lie, 1995; Oudshoorn, Sætnan, & Lie, 2001; Rommes, 2002). Designing computer games, for instance, the imagined user is generally a young man, and designers emphasize that what they are after is “a good story”—but not reflecting on the combination of the two statements (Gansmo, Nordli, & Sørensen, forthcoming). Still, the combat heroines like Lara Croft are not only men’s “perfect fantasy girl” but also an ambiguous mixture of male and female.

The design of technologies is, however, only one step in the process of its cultural construction. Even after a piece of technology has assumed a particular form, it still retains interpretive flexibility. Through the media, we get information on what this particular technology is meant to be, why it is important, and what it is useful for. We get other versions via product marketing and through education and information materials. These are ways in which technologies are domesticated within a particular cultural context. Users contribute to the process of domestication when they are adjusting technologies to their own needs and lifestyles; in other words “taming” them when bringing them home (Lie & Sørensen, 1996; Oudshoorn & Pinch, 2003). This is because technologies have to be enculturated in order to function, thus users must accord them meaning and fit them into their lives. Through domestication processes, new technologies are fashioned to users’ daily lives and routines, which in turn are adjusted in relation to the new technologies. Domestication also involves the discussion and demonstration of technologies amongst users. An obvious example is how mobile telephones and PCs have become so visible in our daily lives, and how widely and enthusiastically the use of these objects is discussed and interpreted in everyday conversations.

In the cultural process of defining what ICT is, how it should be used, what ICT skills are, or in other words what “counts” as valuable knowledge and skills, gender functions as a cultural category in sorting things out. In this process of negotiating boundaries, gender is a marker that still functions to sort out high tech from low tech or no tech. The mobile phone, for instance, changed rapidly from a rather exclusive high-tech gadget to being for everyone. We might reason that the gender of the users affected the image of the artifact, as did the young age of the users, in the sense that when women and youngsters were identified as users, it became trivial. With PCs, chatting is often designated as a girlish activity, even if many boys, as well as adults, are active chatters; whereas gaming is held as “a boy thing”, thus making girl gamers invisible (Nordli, 2003). In such ways, new technologies spur processes of boundary work and renegotiations of what is to be considered masculine and feminine.

The concepts applied and the examples given, serve to illustrate the point that neither technology nor gender should be taken for granted. Rather technologies should be studied as artefacts and types of knowledge that are shaped by cultural processes, not only while the technology is being developed and produced, but also by its subsequent use and reputation. Whether a particular technology is considered interesting and accessible or not, is dependent not only on how it is designed, but also on how it is presented to users and interpreted by them. At the same time, gender and gender relations are designed as relational to the different designs of technologies. So gender is not “given” in the sense that it consists of respectively male and female capacities and fields of interest that do or do not fit with technical artefacts and technical skills. What we need to study are processes of gendering (i.e. how gender transfers meaning to artefacts, practices, and places); the negotiations taking place when ICTs are introduced into new contexts or for new audiences; and the flexible

interpretations of gender and technology in such cases.

To take an example: when young teenage girls together talk about computers as something nerdy (Håpnes & Rasmussen, 2003), they tell each other that this is something that we do not need to know anything about: we can ignore it, or, if we want to use it, we should under-communicate the use of it. Accordingly, ICT has a masculine label with negative connotations in a particular age group within which strong gender dichotomies prevail. Still, if a girl is good at it, she may be admired and not considered “nerdy” or masculine because of this interest. The nerd image is available but does not have to be used in a particular context. Moreover, such notions are flexible. Nerd may be used as a negative label, but at the same time some people like to use it, meaning to express that they actually spend a lot of time at computers and therefore possess wide expertise within the field. Likewise, the notion of the hacker has a double meaning, or maybe even triple: a “person without a life,” super expert, or burglar/outcast. Again, several meanings are available as a repertoire one can draw upon. The nerd image is one, but that does not mean that the computer and its users are pinned down once and for all, as nerdy and only that, because there is always interpretative flexibility in cultural matters.

FUTURE PERSPECTIVES

One important change of gendered relations to ICTs is that women are increasingly participating as users. In this sense, ICTs are not linked to masculinity as an exclusive male domain. This trend also contributes to a de-mystification of the field—it is not only for nerdy insiders; rather, it is a technology for everybody. When it comes to developments within the ICT branch, however, this is still dominated by men, and we should therefore be aware of new “divisions within.”

Lagesen (2003) has studied campaigns to attract more women students to computer science whereby one tries to redefine it as a “feminine subject” by stressing the aspect of communication. Lagesen points out that there may be a new trend not simply identifying ICT with masculinity, but towards a division whereby one tries to attract men by emphasizing the T, and detached from I&C, which are advertised as interesting for women.

We may be aware of such cases of re-gendering based on gender dichotomies. Still, I would like to draw attention to how cultural processes of gendering new matters also can take different and unexpected paths. There are a wide variety of possible cultural interpretations. Thus, it is not a good idea to take as a point of departure, that ICT is a masculine matter and ask how we can change that, but rather to seek out other issues from the wider cultural repertoire that can be associated with ICTs.

CONCLUSION

Is it possible to modify the cultural associations of gender and ICT?

Firstly, gender is more than differences between women and men. Gender is also a cultural distinction that provides us with categories that are applied to produce meaning. We literally use gender as a tool to identify ourselves, to identify people we relate to, but also to identify practices, events, and new artefacts. To “give” things gender is to put them into place, like when talking about computers as for instance nerdy/masculine or useful/feminine. We may instead talk about them as exciting and eventful and stress that they are multi-faceted—in other words, strive to attach to them a wider repertoire of meaning that is not one-sidedly gendered.

Secondly, this leads to the question of change in relation to cultural matters. The problem with

culture is that it is the very material we are thinking with. Therefore, it is difficult to deliberately make a change and think differently. Still, there is some variety in the cultural images connected to ICT. What we should be aiming for is to utilize this variety and also to expand the repertoire. We may acknowledge and speak about ICT as a field that includes much more than male nerds and hackers. More attention should be directed at cases where women are active users and designers and where women use ICTs in unexpected ways. Even if these are not the “majority cases,” they are important within a strategy for developing new perspectives on gender and ICT.

REFERENCES

- Akrich, M. (1992). The de-scription of technical objects. In W. Bijker & J. Law (Eds.), *Shaping technology/building society. Studies in socio-technical change* (pp. 205-224). Cambridge, MA: MIT Press.
- Berg, A. B. (1996). *Digital feminism* (STS Report no. 28). Trondheim: NTNU.
- Bijker, W., & Law, J. (1992). *Shaping technology/building society. Studies in sociotechnical change*. Cambridge, MA: MIT Press.
- Cassell, J., & Jenkins, H. (1998). *From Barbie to Mortal Combat. Gender and computer games*. Cambridge, MA: MIT Press.
- Cockburn, C. (1983). *Brothers: Male dominance and technological change*. London: Pluto Press.
- Cockburn, C. (1985). *Machinery of dominance. Women, men and technical know-how*. London: Pluto Press.
- Corneliussen, H. (2003). *Diskursens makt—individets frihet. Kjønne posisjoner i diskursen om data* (The power of discourse—the freedom of the individual. Gendered positions in the discourse of computing). PhD thesis, Bergen: University of Bergen.
- Faulkner, W. (2000). Dualisms, hierarchies and gender in engineering. *Social Studies of Science*, 30, 759-792.
- Gansmo, H. J. (2004). *Towards a happy ending for girls and computing?* PhD thesis, Trondheim: NTNU
- Gansmo, H. J., Nordli, H., & Sørensen, K. H. (Forthcoming). *The gender game. A study of Norwegian game producers*.
- Geertz, C. (1973). *The interpretation of cultures*. New York: Basic Books.
- Haraway, D. (1991). *Simimians, cyborgs, and women: The reinvention of nature*. New York: Routledge.
- Haraway, D. (1997). *Modest_Witness@Second_Millennium*. New York; London: Routledge.
- Hughes, T. P. (1988). The seamless Web: Technology, science, etcetera, etcetera. *Social Studies of Science*, 16(2), 281-292.
- Håpnes, T., & Rasmussen, B. (2003). Gendering technology. Young girls negotiating ICT and gender. In M. Lie (Ed.), *He, she, and IT revisited. New perspectives on gender in the information society* (pp. 173-197). Oslo, Norway: Gyldendal Akademisk.
- Lagesen V. A. (2003). Advertising computer science to women (or was it the other way around?). In M. Lie (Ed.), *He, she, and IT revisited. New perspectives on gender in the information society* (pp. 69-102). Oslo, Norway: Gyldendal Akademisk.
- Lagesen, V. A. (2004). *Extreme make-over? The making of gender and computer science*. PhD thesis, Trondheim: NTNU.

- Lie, M. (1998). *Computer dialogues. Technology, gender, and change*. Trondheim: Centre for Feminist and Gender Studies NTNU 2/98.
- Lie, M. (2003). *He, she, and IT revisited. New perspectives on gender in the information society*. Oslo, Norway: Gyldendal Akademisk.
- Lie, M., Berg, A. J., Kaul, H., Kvande, E., Rasmussen, B., & Sørensen, K. H. (1988). *I menns bilde. Kvinner, teknologi, arbeid* (In the image of man. Women, technology, work). Trondheim: Tapir.
- Lie, M., & Sørensen, K. H. (1996). *Making technology our own? Domesticating technology into everyday life*. Oslo, Norway: Scandinavian University Press.
- MacKenzie, D., & Wajcman, J. (1985). *The social shaping of technology*. Milton Keynes: Open University Press.
- Mellström, U. (2003). *Masculinity, power, and technology. A Malaysian ethnography*. Hampshire: Ashgate.
- Noble, D. (1984). *Forces of production: A social history of industrial automation*. New York: Alfred Knopf.
- Nordli, H. (2003). *The net is not enough. Searching for the female hacker*. PhD thesis, Trondheim: NTNU.
- Ortner, S. B. (1973). On key symbols. *American Anthropologist*, 75, 1338-1346.
- Oudshoorn, N., Sætnan A. R., & Lie, M. (2001). On gender and things: Reflections on an exhibition on gendered artifacts. *Women's Studies International Forum*, 25(4), 471-483
- Oudshoorn, N., & Pinch, T. (2003). *How users matter. The co-construction of users and technologies*. Cambridge, MA: MIT Press.
- Rasmussen, B., & Håpnes, T. (1991, December). Excluding women from the technologies of the future? *Futures*, 1107-1.
- Rommes, E. (2002). *Gender scripts and the Internet*. PhD thesis. Enschede: Twente University Press.
- Stuedahl, D. (1998). Kroppsløs og kjønnsløs? Om kjønnsidentitet på internettet (Bodyless and gender-less? On gender identity on the Internet). *Kvinder, køn og forskning*, (1), 22-33.
- Turkle, S. (1995). *Life on the screen. Identity in the age of the Internet*. New York: Simon & Schuster.
- Wajcman, J. (1991). *Feminism confronts technology*. Cambridge: Polity Press.

KEY TERMS

Boundary Work: Intentional and unintentional efforts to maintain gender divisions.

Domestication: The cultural appropriation of technology.

Gender Dichotomies: Feminine/femininity is defined in terms of being the opposite of masculine/masculinity and vice versa.

Gender Script: Gendered connotations are in-built in the design of a technology.

Gender Symbolism: Cultural associations of masculinity and femininity.

Key Symbol: A symbol that summarises main features of a certain time within a particular cultural context.

Script: Directions for use integrated within the design of a technology.

This work was previously published in Encyclopedia of Gender and Information Technology, edited by E. Trauth, pp. 166-171, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 7.19

Who's Talking Online?

A Descriptive Analysis of Gender & Online Communication

Taralynn Hartsell

The University of Southern Mississippi, USA

ABSTRACT

This preliminary descriptive study investigated the association between gender and online communication and involved participants from an online graduate course. The study implemented a descriptive model in that “student involvement” was assessed by tabulating and recording the quantity and quality of student activity in the discussion threads. Quantity was recorded by the amount of times students posted online comments and the number of words that women and men used to make their responses. In addition, quality was examined by reviewing the content that women and men made concerning topics under discussion. In the end, a difference between the genders was found in that the amount (quantity) women contributed to the discussions exceeded that contributed by the men. Women were also more inclined to give supportive or encouraging remarks than men, and addressed their classmates by name to promote a sense of online community, all which support previous studies.

INTRODUCTION

Delivering courses through the World Wide Web in higher education is a growing trend that has taken precedence at many colleges and universities. As the population of non-traditional students increases and the pervasiveness of computer technology has reached an all-time high in education, delivering online courses has become an alternative medium to offering coursework and degree programs to remote students who are not physically present on campus (Simonson, Smaldino, Albright & Zvacek, 2003). The push for educators to offer more new online courses or adapt existing courses to an online medium will not disappear. In fact, more online courses will be offered to students as an alternative mode for completing their educational degree programs, a circumstance that was incomprehensible 15 years ago (Picciano, 2001).

This trend for promoting online courses in higher education also creates concerns for both the teacher and student. Some of these concerns

include factors such as management, communication, interaction, discipline, and retention (Moore & Kearsley, 1996). Communication is one of these key factors for student success. Studies have looked at student isolation and disillusionment as contributory factors toward impairing student retention and effective learning. Communication between student-teacher and student-student is important toward alleviating the feelings of isolation. Another aspect of communication is participation. There is an assumption that more a student participates in an online course, the better success that he/she will find in acquiring and learning the material related to the course (Picciano, 2001b).

One question that arises concerning online communication is whether gender of the student is a contributing factor toward learning success. Although research has shown that females and males differ in terms of their attitudes toward computer use and computer aptitude, women and men are still both users of computer technology — a direct opposite to the notion that females are not as technologically-inclined as males (Whitley, 1996). In addition, many have voiced that the Internet is a more neutral playing field for both men and women to enjoy. In a sense, the Internet has been claimed to lead toward greater gender equity because of its communication interface (Gorritz & Medina, 2000; Herring, 2001). Furthermore, scholars say that the Internet should be taken seriously to help create opportunities for less powerful individuals to participate with members who are more vocal, especially in asynchronous environments (Balka, 1993; Selfe & Meyer, 1991; We, 1993).

Because research on Web-based instruction is relatively new, particularly in the aspect of communication effectiveness in relation to gender, there is a paucity of research that investigates how women and men communicate online. There are few studies that investigate the use and integration of online communication in reference to gender, but more research needs to be performed

that examines the amount of communication that occurs between men and women (Arbaugh, 2000; Shaw & Gant, 2002; Sullivan, 2001). The old assumption that women are more verbal, and thus more inclined to communicate in online discussions and e-mail needs to be analyzed more closely (Shaw & Gant, 2002; Waldeck, Kearney & Plax, 2001).

This article reports upon a pilot study that investigated gender differences in a distance-learning course on the use of online communication tools. The article is divided into three sections. First, an overview of the study is discussed in addition to providing a summary of the literature. The literature is primarily based upon the area of technology and gender differences in education to help build a theoretical base toward analyzing the influence of gender in online communication activities. Second, the article will explain the results of the study with the gender perspective in mind. Finally, the third section will discuss the implications and recommendations for online instructors who are teaching diversified student populations, particularly those courses that have an even or odd distribution of women and men.

REVIEW OF THE LITERATURE

There are many factors that influence how women and men use computer technology. It has been assumed that women and men differ in their attitudes toward, comfort with, and anxiety levels concerning computer technology (Weiser, 2000). Research has suggested that women and men like to use computers to gain information and complete tasks. The disparities, if any, exist in their interactions with computer technology and how women and men use the tool (McCoy, Heafner, Burdick & Nagle, 2001).

Level of anxiety may contribute toward the use and attitude toward computer technology. According to Whitley (1996), college women exhibited low levels of anxiety when it came to

Who's Talking Online?

computers, but not as low as men. Among these subjects, Whitley found that less anxious men and women were more likely to take computer courses and spend more time on a computer. Namlu (2003) examined whether learning strategies (LS) were factors in controlling the levels of computer anxiety (CA). She concluded that learning strategies, categorized into simple, advanced, and derived LS, seemed to play an important role in handling computer anxiety in that those who had a solid foundation in monitoring their learning progress had lower computer anxiety. Hence, anxiety toward computers in association with learning styles can be contributing factors toward how women and men view computers and how they handle technical troubleshooting.

Differences in how the genders perceive technology also contribute toward varying computer usage. Women tend to view the computer as a tool to achieve and complete tasks (Fiore, 1999). They tend to see computer technology, particularly the Internet, as a way to gather information and to communicate with others or to promote human interaction. In other words, females see the computer as a “tool” to be used for what it can perform. Males, on the other hand, have viewed the computer more as a recreational toy (Shashaani, 1994). According to the Commission on Technology, Gender, and Teacher Education (2000), males tend to view the computer as a “toy” or an extension of the self. For males, computer technology has been predominantly used for entertainment. In a study conducted by McCoy, Heafner, Burdick, and Nagle (2001) that looked at the assimilation of IBM ThinkPads on a university campus, individual computer use was examined through the following categories: tool, communication, resources, entertainment, and total use. These categories were compared between the genders using independent t-tests. What the researchers discovered was that the males were more frequent users in the categories of resources, entertainment, and total use. There was no significant difference for tool use

or communication, meaning that women used the technology for these purposes more than for entertainment. This supports the previous finding that women, more than men, tend to use computer technology as a way to reach out and complete tasks rather than just “playing” with the technology to see what it can do and retrieve information/programs for personal use.

In regard to distance learning technology and Internet access, any gap that may have been in place between the genders seems to have narrowed (Novak & Hoffman, 1998). In fact, recent research has indicated that more females are enrolling in Web-based online courses and programs, with comparable success to males (Ory, Bullock & Burnaska, 1997). In a study investigating the use and attitudes toward asynchronous learning networks (ALN) in a university setting, Ory, Bullock, and Burnaska (1997) discovered that both males and females made equivalent use of ALN and had similar positive attitudes about their experiences. Women also shared a common desire to take more courses that used computers as a result of their experiences with ALN in this situation.

The Internet has been said to be inherently democratic, and thus, leveling traditional distinctions of social status. This, in turn, would create opportunities for those who are often silent to speak out and participate with members of the more powerful group. It has been said that text-based computer-mediated communication allows men and women to participate equally in contrast to traditional patterns of face-to-face conversations. With the absence of physical and auditory cues, the gender of online communicators is irrelevant or invisible (Danet, 1998). This situation could help facilitate free communication between women and men in that gender roles have somewhat been removed.

With the rise of the Internet, researchers have begun to investigate whether gender disparities exist with Internet technology (Shaw & Gant, 2002). Researchers have predicted that males and females will differ in the ways they view and

interact with the Internet, hypothesizing that males will be less anxious and more comfortable using the medium compared to females. This proposition supports the idea that women are more “technophobic” than men in that women are more afraid of technology, and therefore slower to adapt to technological advances (Shaw & Gant, 2002). Although studies have found that males report more experience using the Internet and score higher in areas of comfort, innovativeness, and Internet self-efficacy, this does not explain the growing numbers of women accessing the Internet (Shaw & Gant, 2002). Women are accessing the Internet just as much as men. The explanation could be attributed to how the women may be using the Internet as compared to males. Communication is a motivating factor for women to seek out social interaction online. Men tend to seek information and entertainment through the Internet, which supports earlier studies on gender and computer usage (Hamburger & Ben-Artzi, 2000).

Based on studies of gender differences in communication and technology usage, the encouragement of collaboration in online courses can be quite favorable toward women. Because previous studies in communication patterns have revealed that men tend to communicate on the basis of social hierarchy, and women are more network-oriented and collaborative, a collaborative Web-based environment may help to reverse this process (Kilbourne & Weeks, 1997). Thus, in a setting that is absent of competition, the playing field can be leveled between the genders.

There have been studies that look at the way men and women communicate in terms of online communication. The use of language and tone are primary areas of difference in that men tend to use more aggressive language to assert their point in the discussion as opposed to women (Rossetti, 1998). In addition, women tend to contribute more overt expressions of agreement, appreciation, and support. They also present their assertions indirectly as suggestions (Kuntjara, 2002). Gender differences in online communication suggest that

women prefer a “rapport” style, while men generally speak in the tone of a “report” in that their postings sound as if they are simply providing information (Kuntjara, 2002).

In short, the literature supports the notion that women and men are almost equally equivalent in terms of computer and Internet usage, even though a difference exists in terms of the motives behind the use. Because the literature tends to sustain that communication is the main motive for women to use the Internet, this is an area that needs to be investigated further. The primary question is whether women participate more in online communication than men. In addition, do women’s participation exceed in terms of the quality in that women explain their perspectives/ideas more thoroughly than men? It has been found that the tone and presence of women and men in their conversation styles differ, and thus should be looked at more closely.

STATEMENT OF THE PROBLEM

The goal of this preliminary study was to examine whether online communication differed between the women and men enrolled in a distance-learning course through the use of discussion threads. Discussion threads were the primary communication tool used between students in this study as opposed to e-mail, and thus became the instrument of data collection. Discussion threads allow students and teachers to see the “trail” of thought among individuals, as postings to the discussion threads are made in response to previous postings. The research questions investigated in this preliminary descriptive study included whether women more than men: (a) participated or made postings to discussion threads, (b) supplied more explanation in their responses to support the topic under discussion, (c) provided more informal responses than formal, and (d) tended to provide more supportive/encouraging comments.

METHODOLOGY

Participants

The course under study was a graduate-level instructional technology course in which 15 students were involved. There were seven females and eight males who participated in this study. Of these 15 participants, seven were doctoral level students majoring in educational leadership, six were Master's level students majoring in instructional technology, one in nursing, and one majoring in foreign languages. Other than the six students majoring in instructional technology, the particular course used for this study was considered as an elective or for fulfilling minor requirements. All students were required to interact in discussion threads over a 10-week period that involved topics stemming from the course readings. Each week, two of the participants were responsible for facilitating the discussions and providing opening questions to initiate weekly discussion. Participants were required to contribute at least four postings each week in response to the course material. However, a number of participants posted more than what was required.

Design & Measures

The research design was primarily descriptive in nature and the instrument for data collection was the documentation of the actual discussions that took place across the semester between the men and women. The pilot study implemented a descriptive model in that "student involvement" was assessed by tabulating and recording the quantity and quality of student interactivity in the discussion threads. The intention of the study was not to make generalizations to a larger population, but to report upon the findings discovered in this particular sample. Therefore, the study examined raw data collected from the transcriptions of discussion threads that used a method of calculation rather than employing thick-descrip-

tions to explain the setting. The main purpose of this preliminary study was to help the researcher establish the framework for future explorations on gender differences and online instruction/learning. The intention of this pilot study was not to construct broad generalizations, but to help generate research questions and methodologies that could be used in forthcoming research.

The research design was not qualitative in that it did not go in-depth or describe the meaning of the findings from the perspective of the research participants. Instead, the data were analyzed by simply counting the words or the number of times a participant posted a response. Quantity was recorded by the amount of times that students posted responses to the threads as well as the number of words that women and men used to make their responses. Quality was examined by reviewing the content that women and men made concerning topics under discussion. Tone was also studied because this had been a common factor in the literature in terms of how men used online communication tools as opposed to women. In short, quality of the postings was studied further in detail by looking at who responded to whom, the tone of the posting, and whether the response contributed toward the discussion and was not just a simple, informal comment made to someone.

Procedures

During the fall semester, the online graduate-level instructional technology course was offered through the WebCT medium in which the university had a license. The fall term was the third time in which the course instructor taught the course, although this was the second time in which the instructor decided to use discussion threads. The first time that the instructor used discussion threads as a requirement, the students enjoyed speaking to one another online even though they found the number of postings to be overwhelming at times. Nonetheless, the online students, both women and men, seemed to take

pleasure in the opportunity to socialize with one another through the online discussions.

The discussion thread requirement occurred over a 10-week period. Students in the online course were required to make at least four postings to the weekly discussions, although the opportunity to contribute more was available and optional. Two of the participants were responsible for facilitating the discussion thread each week, and therefore these two individuals would either contribute more to the weekly discussion or they would not. Nonetheless, this was a variable that had to be considered in the findings. The weekly discussion covered topics stemming from the course reading materials. For two of these 10 weeks, the course instructor was the facilitator and offered the initiating questions.

The discussions progressed in an organized manner and occurred through the WebCT's discussion tool feature. Each week, the students had to read two to three chapters within the textbook or from online articles. Based upon the readings, the selected facilitator(s) had to generate questions to open the discussion. After that, the rest of the participants contributed postings of their own in reply to previous messages. The weekly discussions began each Monday and concluded the following Monday, at which point the instructor closed or locked the discussion thread to prevent miscellaneous postings made to the thread.

The discussion threads that occurred each week were then compiled into a text file that displayed who said what and to whom. With these text files of the discussion threads, the postings were broken down by individual participants to help in the calculation of how many times males, as opposed to females, made postings and the number of words made in each posting. The text file was also used to determine whether the postings were in response to someone else's reactions or if a new topic/concern was initiated by the participant. Furthermore, the discussion threads were examined to assess the "quality" aspect of the postings that focused upon two areas: (1) tone

of the posting and (2) the value of information given. Discussions were coded for ascertaining the quality aspect. The coding scheme used the following classifications: (a) I being informal in tone, more like a discussion or rapport style, (b) F being formal in tone, somewhat like a report of the facts, (c) S including supportive/encouraging comments and reacting to personal matters, (d) B including short replies of one to four sentences long or not really addressing content material, and (e) R for postings that directly made reference to course materials. Each discussion posting was coded and some postings had two or more codes ascribed to them because they crossed classifications.

FINDINGS

Results of the study are summarized and organized in terms of the original research questions. Table 1 shows the patterns for the genders are presented by the aggregate of individual weeks as well as the minimum, maximum, and mean scores separated by gender for all 10 weeks of discussion. As predicted, the women participated more in the discussion threads, as can be seen by the number of postings. Overall, the women posted 51 more responses than their male counterparts. In addition, when one examines the minimum, maximum, and mean scores, the women again surpassed their male counterparts in the collective 10-week period. Even for the week that the women did not contribute much toward the discussion, they still made 13 more responses than the men (MIN). These numbers are interesting in that the women composed the minority group in this study, with seven individuals, as opposed to eight men. One would expect to see more postings from the majority group of men because they have an additional member. However, this was not the case.

An independent-samples t-test was conducted to evaluate whether gender did play a role in the number of postings made by the participants. The

Who's Talking Online?

Table 1. Class participation patterns by gender

| Gender | Class postings per week | | | | | | | | | | Total | Min | Max | Mean | |
|----------------|-------------------------|----|----|----|----|----|----|----|----|---|-------|-----|-----|------|------|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 1 | 0 | | | | | |
| Women (n=7) | 53 | 49 | 68 | 44 | 40 | 52 | 98 | 42 | 43 | 6 | 1 | 550 | 34 | 136 | 78.6 |
| Men (n=8) | 36 | 57 | 62 | 50 | 42 | 41 | 59 | 52 | 39 | 6 | 1 | 499 | 21 | 118 | 62.4 |

results were not significant, $t(13) = 1.059$, $p = .05$, and most likely represented a chance occurrence. However, on average, the women did produce more postings to the discussion threads than men. A reason to account for this lack of significance could be to the small sample size, and thus more participants are required to be included in future studies to help validate the t-tests.

Findings from the data also demonstrated that women incorporated more explanation into their postings to support their ideas and opinions. Men tended to get “straight-to-the-point” in their responses, while women wanted to expand and augment what they said through illustrations, experiences, and examples. The results show that women did use more words to explain their responses or defend their ideas as opposed to their male counterparts. In all, the women surpassed the men by over 10,000 words during the 10-week period. Curiously, the men exceeded the women in weeks eight and nine, but not by a great deal in terms of numbers.

For examining the quality of the responses, the discussion postings were coded into five classifications as addressed in the procedures section. The results indicated that women were more outspoken, whether formally or informally. This contradicts previous findings that women tend to be more informal in their responses, because in this sample the women also made more formal

comments as opposed to their male colleagues. In addition, women tend to give more supportive comments. The men did give more brief comments than women. This finding supported the literature that suggests men, more than women, are more direct in their responses.

When the discussion postings were coded, the S code was broken down into several other classifications. The S code had been separated into different categories as (a) E for offering support or encouragement, (b) N for referring to people directly by name, (c) A as making a personal apology, (d) P as reacting to personal matters or responding to incidences not really related to class, and (e) D to indicate disagreement. This stratification helps in understanding what type of support was made by the participants. The results show that women offered more comments that were encouraging and thoughtful. They also directed their comments toward other colleagues by name. Males, on the other hand, exceeded in the area of disagreement, although this was not by a considerable number.

Results for the study show that women, more than men, participated in the discussions. In this case, women made more postings to the discussion threads than males and with greater explanation. In the area of quality, the women also excelled in their responses in terms of content matter and tone. Women also gave more encouraging remarks

to others' comments and addressed individuals by name, indicating a sense of intimacy and amiability. In this area, external variables such as students' majors could have influenced the results, in that majors in instructional technology would offer more comments in response to the issues addressed. However, this was not the case because more males than females happened to be majors in instructional technology. The women were diverse in their concentration fields, which included two instructional technology majors, two educational leadership majors, one foreign languages and one nursing major. Thus, the assumption that instructional technology majors would contribute more because of their familiarity with the subject matter was non-existent in this sample in that the diverse group of women articulated more in terms of depth.

CONCLUSIONS

Before addressing the conclusions to this initial study, limitations need to be discussed. First, the study is not generalizable because of the small sample size. In addition, the participants were part of a convenience sampling and not a true random sample. However, this sample could lead to larger studies because it provided the preliminary basis for identifying exclusive variables to be studied further. Second, this study did not collect the perspectives and reactions from the participants themselves concerning the effectiveness of online communication. A more qualitative approach could be used to obtain such in-depth information to obtain the participants' perception toward online communication, behavior, and learning. Coding of the discussion threads was also a limitation in that an inter-rater reliability test was not performed. Thus, coding conducted by the researcher could be biased. Fourth, participants also served as facilitators in the discussion and this could have skewed the numbers in that some participants contributed more or less

when they were the facilitators. In this particular sample, the facilitators did not differ that much in their contributions, although a few exceeded their normal expectations. Finally, because the participants were required to make four or more postings a week, this could affect the number of postings made across the 10 weeks, in that participation was not always voluntary. If students were concerned with their grades, they would have opted to make more postings than normal. Although limitations existed in this study, this should not discount the findings exposed but be used as questions for further analysis.

This preliminary descriptive study investigated whether online communication differed between the women and men enrolled in a distance-learning course through the use of discussion threads. Four research questions were introduced and answered in this study. The first question asked whether women more than men made postings to the discussion threads. As a result, the female participants made over 50 more postings during the 10-week period than males. Although the independent samples t-test did not indicate this direction, the raw data implied that women in this particular course preferred and enjoyed communicating online. For online courses, instructors should seriously consider integrating online communication tools to help women and men share their ideas to others. This may prevent social isolation that commonly occurs in distance-learning courses.

The second question examined whether women supplied more explanation in their responses to support the topic under discussion. The women did surpass the men by over 10,000 words. This implies that women in the course valued the opportunity to elaborate upon their ideas, opinions, and experiences without the restraint upon length. The finding may also suggest that women enjoy the impartial environment of online communication because they are not obligated to remain within social norms of face-to-face interactions. In short, women can "speak" all they desire because they

Who's Talking Online?

have a closed audience who will not silence them. For online course instructors, communication tools should be used to promote interaction among students from diverse backgrounds. Without the physical and auditory cues, women may feel more inclined to participate. Thus, online participation should be encouraged by the instructor to offer individuals from non-dominant groups the chance to discuss freely their ideas and opinions without the fear of repercussions.

The third question investigated whether women, more than men, used more informal expressions in their responses. When viewing the findings, this was not the case. Women made as many informal responses as they did formal, compared to the men. Women did use the "reporting" format that had been normally reserved for men (Kuntjara, 2002). Men did make briefer statements that supported the literature about men's use of language. However, the important finding was that the women used both. This implies that the women in the course were not afraid to use the more formal tone to prove their point. They were also adaptable in switching between the tones depending upon the topic under discussion. Online instructors should take this into account. Incorporating online debates should not be shied away if course enrollment has more females than males. If these courses have online students who are similar to the participants in this study, women will not have any difficulty taking a more formal approach in defending their ideas.

The last question examined was whether women provided more supportive/encouraging comments than their male counterparts. This was true in that the women contributed more encouraging comments than men. The women also addressed their colleagues by name, which promotes a sense of familiarity and collaboration, something that had been discovered in previous studies (Kilbourne & Weeks, 1997). This implies that the women searched for collaboration and friendship online, and needed the sense of community more than men (Shaw & Gant, 2002). For

online course instructors, communication tools should be used to promote collaboration, such as assigning group activities, discussing reading materials, deliberating over case studies, and so forth. If women feel that they are part of the online community, their learning will be enhanced.

This study only provided the basic foundation of investigating gender differences in online communication. Some findings discovered in this study supported previous literature/studies, while others did not. Future studies should look into these areas that countered previous research because they could illuminate the external variables that may have caused these effects to occur. Further studies should also be conducted to validate and support the findings of this initial study. Investigating a larger sample, using courses that have both undergraduate and graduate students, studying students from various disciplines, and performing more in-depth, qualitative studies should be performed to help support the findings addressed in this pilot study. This study is only the beginning and many more can be performed to investigate the variables in question. With additional support from other investigations, the relationship between gender and online communication can be exposed and pondered.

EDITOR'S NOTE

The author provided additional tables documenting the results of the study. For copies of this supplementary information, please contact the author via e-mail.

REFERENCES

American Association of University Women Educational Foundation Commission on Technology, Gender, and Teacher Education. (2000). *Tech-savvy: Educating girls in the new computer age*. Washington, DC: American Association

of University Women Educational Foundation. <http://www.aauw.org/2000/techsavvy.html>

Arbaugh, J.B. (2000). An exploratory study of the effects of gender on student learning and class participation in an Internet-based MBA course. *Management Learning*, 31(4), 503-519.

Danet, B. (1998). Text as mask: Gender and identity on the Internet. In S. Jones (Ed.), *Cybersociety 2.0: Computer-mediated Communication and Community Revisited*. Thousand Oaks, CA: Sage.

Gorriz, C., & Medina, C. (2000). Engaging girls with computers through software games. *Communications of the ACM*, 43(1), 42-49.

Hamburger, Y.A., & Ben-Artzi, E. (2000). The relationship between extraversion and neuroticism and the different uses of the Internet. *Computers in Human Behavior*, 16, 441-449.

Herring, S. (2001). *Gender and power in online communication*. CSI Working Paper. Retrieved April 22, 2004, from <http://www.slis.indiana.edu/CSI/WP/WP01-05B.html>

Kilbourne, W., & Weeks, S. (1997). A socio-economic perspective on gender bias in technology. *Journal of Socio-Economics*, 26(1), 243-260.

Kuntjara, E. (2002). *Gender issues in information technology communication*. Women in Action, 2. Retrieved March 28, 2004: <http://www.isiswomen.org/pub/wia/wia202/genderissues.htm>

McCoy, L.P., Heafner, T.L., Burdick, M.G., & Nagle, L.M. (2001, April 10-14). *Gender differences in computer use and attitudes on a ubiquitous computing campus*. Paper presented at the Annual Meeting of the American Educational Research Association, Seattle, WA.

Moore, M.G., & Kearsley, G. (1996). Fundamentals of distance education. In M.G. Moore & G. Kearsley (Eds.), *Distance education: A systems view* (first edition, pp. 1-18). Belmont, CA: Wadsworth Publishing Company.

Namlu, A.G. (2003). The effect of learning strategy on computer anxiety. *Computers in Human Behavior*, 19, 565-578.

Novak, T.P., & Hoffman, D.L. (1998). *Bridging the digital divide: The impact of race on computer access and Internet use*. Project 2000, Vanderbilt University. <http://www.2000.ogsm.vanderbilt.edu/papers/race/science.html>

Ory, J.C., Bullock, C., & Burnaska, K. (1997). Gender similarity in the use of and attitudes about ALN in a university setting. *Journal of Asynchronous Learning Networks*, 1(1), 39-51.

Picciano, A.G. (2001). Introduction. In A.G. Picciano (Ed.), *Distance Learning: Making Connections Across Virtual Space and Time* (first edition, pp. 1-20). Upper Saddle River, NJ: Merrill-Prentice Hall.

Picciano, A.G. (2001b). The student perspective. In A.G. Picciano (Ed.), *Distance Learning: Making Connections Across Virtual Space and Time* (first edition, pp. 89-108). Upper Saddle River, NJ: Merrill-Prentice Hall.

Rossetti, P. (1998). Gender differences in e-mail communication. *The Internet TESL Journal*, 4(7). Retrieved April 4, 2004, from <http://iteslj.org/Articles/Rossetti-GenderDif.html>

Selke, C., & Meyer, P.R. (1991). Testing claims for on-line conferences. *Written Communication*, 8(2), 162-192.

Shaw, L.H., & Gant, L.M. (2002). Users divided: Exploring the gender gap in Internet use. *Cyber-Psychology & Behavior*, 5(6), 517-527.

Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2003). Foundations of distance education. In M. Simonson, S. Smaldino, M. Albright, & S. Zvacek (Eds.), *Teaching and Learning at a Distance: Foundations of Distance Education* (second edition, pp. 4-25). Upper Saddle River, NJ: Merrill-Prentice Hall.

Who's Talking Online?

Sullivan, P. (2001). Gender differences and the on-line classroom: Male and female college students evaluate their experiences. *Community College Journal of Research and Practice*, 25, 805-818.

Waldeck, J. H., Kearney, P., & Plax, G. (2001). Teacher e-mail message strategies and students' willingness to communicate online. *J. of Applied Communication Research*, 29(1), 54-70.

We, G. (1993). *Cross-gender communication in cyberspace*. Paper for CMNS 855. Retrieved April

4, 2004: http://www.eff.org?Net_culture/Gender_issues/cross_gender_communication

Weiser, E.B. (2000). Gender differences in Internet use patterns and Internet application preferences: A two-sample comparison. *CyberPsychology & Behavior*, 3, 167-178.

Whitley, B.E. (1996). Gender differences in computer-related attitudes: It depends on what you ask. *Computers in Human Behavior*, 12, 275-289.

This work was previously published in the International Journal of Information and Communication Technology Education, edited by L. Tomei, Volume 1, Issue 1, pp. 42-54, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.20

Who's Talking Online II: Revisiting Gender and Online Communications

Taralynn Hartsell

University of Southern Mississippi, USA

ABSTRACT

This descriptive study investigated the association between gender and online communication that involved participants from two online graduate courses. The study implemented a descriptive model in that “student involvement” was assessed by tabulating and recording the quantity and quality of student activity in the discussion threads. Quantity was recorded by the amount of times students posted online comments and the number of words that women and men used to make their responses. In addition, quality was examined by reviewing the content that women and men made concerning topics under discussion. A difference between the genders was found in that the quantity women contributed to the discussions exceeded the men. Women were also more inclined to give supportive or encouraging remarks than men, and addressed their classmates by name to promote a sense of online community, all of which support previous studies.

INTRODUCTION

Delivering courses through the World Wide Web in higher education is a growing trend that has taken precedence at many colleges and universities. As the population of non-traditional students increase and the pervasiveness of computer technology reaches an all-time high in education, delivering online courses has become an alternative medium to offering coursework and degree programs to remote students who are not physically present on campus (Simonson, Smaldino, Albright, & Zvacek, 2003). The push for educators to offer more online courses or adapt existing courses to an online medium will not disappear. In fact, more online courses will be offered to students as an alternative mode for completing educational degree programs, an occurrence that was inconceivable 15 years ago (Picciano, 2001).

This trend for promoting online courses in higher education also creates concerns for both

the teacher and student. Some of these concerns include factors such as management, communication, interaction, discipline and retention (Moore & Kearsley, 1996). Communication is one of these key factors for student success. Studies have looked at student isolation and disillusionment as contributory factors toward impairing student retention and effective learning. Communication between student-teacher and student-student is important toward alleviating feelings of isolation. Another aspect of communication is participation. There is an assumption that the more a student participates in an online course, the better success that student will find in acquiring and learning the material related to the course (Picciano, 2001b).

One question that arises concerning online communication is whether gender of the student is a contributing factor toward learning success. Although research has shown that females and males differ in terms of their attitudes toward computer use and computer aptitude, women and men are still both users of computer technology—a direct opposite to the notion that females are not as technologically inclined as males (Whitley, 1996). In addition, many have voiced that the Internet is a more neutral playing field for both men and women to enjoy. In a sense, the Internet has been claimed to lead toward greater gender equity because of its communication interface (Herring, 2001; Gorris & Medina, 2000). Furthermore, scholars say that the Internet should be taken seriously to help create opportunities for less powerful individuals to participate with members who are more vocal, especially in asynchronous environments (Balka, 1993; Selfe & Meyer, 1991; We, 1993).

Because research on Web-based instruction is relatively new, particularly in the aspect of communication effectiveness in relation to gender, there is a paucity of research that investigates how women and men communicate online. Few studies investigate the use and integration of online communication in reference to gender, but more research needs to be performed that examines the

amount of communication that occurs between men and women (Arbaugh, 2000; Shaw & Gant, 2002; Sullivan, 2001). The old assumption that women are more verbal and, thus, more inclined to communicate in online discussions and e-mail needs to be analyzed more closely (Shaw & Gant, 2002; Waldeck, Kearney, & Plax, 2001).

This report describes a study that investigated gender differences in two distance learning courses on the use of online communication tools. The chapter is divided into three sections. First, an overview of the study is discussed in addition to providing a summary of the literature. The literature is primarily based on the area of technology and gender differences in education to help build a theoretical base toward analyzing the influence of gender in online communication activities. Second, the report explains the results of the study, with the gender perspective in mind. The third section discusses the implications and recommendations for online instructors who are teaching diversified student populations, particularly those courses that have an even or odd distribution of women and men.

OVERVIEW OF THE LITERATURE

Many factors influence how women and men use computer technology. It has been assumed that women and men differ in their attitudes toward, comfort with and anxiety levels concerning computer technology (Weiser, 2000). Research has suggested that women and men like to use computers to gain information and complete tasks. The disparities, if any, exist in their interactions toward computer technology and how women and men use the tool (McCoy, Heafner, Burdick, & Nagle, 2001).

Level of anxiety may contribute toward the use of and attitude towards computer technology. According to Whitley (1996), college women exhibited low levels of anxiety when it came to computers, but not as low as men. Among these

subjects, Whitley found that less anxious men and women were more likely to take computer courses and spend more time on a computer. Namlu (2003) examined whether learning strategies (LS) were factors in controlling the levels of computer anxiety (CA). She concluded that LS, categorized into simple, advanced and derived, seemed to play an important role in handling CA in that those who had a solid foundation in monitoring their learning progress had lower CA. Hence, anxiety toward computers in association with learning styles can be contributing factors toward how women and men view computers and how they handle technical troubleshooting.

Differences in how the genders perceive technology also contribute toward varying computer usage. Women tend to view the computer as a tool to achieve and complete tasks (Fiore, 1999). They tend to see computer technology, particularly the Internet, as a way to gather information and communicate with others or to promote human interaction. In other words, females see the computer as a "tool" to be used for what it can perform. Males, on the other hand, have viewed the computer more as a recreational toy (Shashaani, 1994). According to the Commission on Technology, Gender, and Teacher Education (2000), males tend to view the computer as a "toy" or an extension of the self. For males, computer technology has been predominantly used for entertainment. In a study conducted by McCoy, Heafner, Burdick and Nagle (2001) that looked at the assimilation of IBM ThinkPads on a university campus, individual computer use was examined through the following categories: tool, communication, resources, entertainment and total use. These categories were compared between the genders using independent t-tests. The researchers discovered that males were more frequent users in the categories of resources, entertainment and total use. There was no significant difference for tool use or communication, meaning that women used the technology for these purposes more than for entertainment. This supports the previ-

ous finding that women, more than men, tend to use computer technology as a way to reach out and complete tasks than just "playing" with the technology to see what it can do and retrieve information/programs for personal use.

In regard to distance learning technology and Internet access, any gap that may have been in place between the genders seems to have narrowed (Novak & Hoffman, 1998). In fact, recent research has indicated that more females are enrolling in Web-based online courses and programs with comparable success to males (Ory, Bullock, & Burnaska, 1997). In a study investigating the use and attitudes toward asynchronous learning networks (ALN) in a university setting, Ory, Bullock and Burnaska (1997) discovered that both males and females made equivalent use of ALN and had similar positive attitudes about their experiences. Women also shared a common desire to take more courses that used computers as a result of their experiences with ALN in this situation.

The Internet has been said to be inherently democratic and, thus, leveling traditional distinctions of social status. This, in turn, would create opportunities for those who are often silent to speak out and participate with members of the more powerful group. It has been said that text-based computer-mediated communication allows men and women to participate equally in contrast to traditional patterns of face-to-face conversations. With the absence of physical and auditory cues, the gender of online communicators is irrelevant or invisible (Danet, 1998). This situation could help facilitate free communication between women and men in that gender roles have somewhat been removed.

With the rise of the Internet, researchers have begun to investigate whether gender disparities exist with Internet technology (Shaw & Gant, 2002). Researchers have predicted that males and females will differ in the ways they view and interact with the Internet, hypothesizing that males will be less anxious and more comfortable using the medium compared to females. This

proposition supports the idea that women are more “technophobic” than men in that women are more afraid of technology and, therefore, slower to adapt technological advances (Shaw & Gant, 2002). Although studies have found that males report more experience using the Internet and score higher in areas of comfort, innovativeness and Internet self-efficacy, this does not explain the growing numbers of women accessing the Internet (Shaw & Gant, 2002). Women are accessing the Internet just as much as men. The explanation could be attributed to how the women may be using the Internet as compared to males. Communication is a motivating factor for women to seek out social interaction online. Men tend to seek information and entertainment through the Internet, which supports earlier studies on gender and computer usage (Hamburger & Ben-Artzi, 2000).

Based on studies of gender differences in communication and technology usage, the encouragement of collaboration in online courses can be quite favorable toward women. Because previous studies in communication patterns have revealed that men tend to communicate on the basis of social hierarchy, and women are more network-oriented and collaborative, a collaborative Web-based environment may help reverse this process (Kilbourne & Weeks, 1997). Thus, in a setting absent of competition, the playing field can be leveled between the genders.

There have been studies that look at the way men and women communicate in terms of online communication. The use of language and tone are primary areas of difference in that men tend to use more aggressive language to assert their point in the discussion as opposed to women (Herring, 1993; Rossetti, 1998). In addition, women tend to contribute more overt expressions of agreement, appreciation and support. They also present their assertions indirectly as suggestions (Kuntjara, 2002). Gender differences in online communication suggest that women prefer a “rapport” style while men generally speak in the tone of a “report”

in that their postings sound as if they are simply providing information (Kuntjara, 2002). Susan Herring (1993) has been investigating gender rhetoric in online communications for quite some time and discovered that the topics of discussion influence the amount and type of participation that women and men contribute. Women tend to participate in discussions that are more associated to the real world than on the abstract and theoretical. Men, on the other hand, tend to be more concerned with receiving information from others and less interested in personal discussion.

Nonetheless, some studies do show the opposite in terms of gender differences in online communication. Kirsteen Monteith (2002) found in her study that women did not hesitate to take control over discussions and were participating equally among themselves. In addition, the women, at times, were dominating the discussions while retaining a collaborative environment. In fact, Monteith discovered that male participants were not the more formal, antisocial and controlling participants. Instead, the men tended to shift toward the collaborative approach by sharing information with others, responding to their female counterparts, and keeping a polite and courteous manner (traditionally a female characteristic). With this gender shift in mind, the Web-based medium does have implications for leveling the ground for all users.

In short, the literature supports the notion that women and men are almost equally equivalent in terms of computer and Internet usage, even though a difference exists in terms of the motives behind the use. Because the literature tends to sustain that communication is the main motive for women to use the Internet, this is an area that needs to be investigated further. The primary question is whether women participate more in online communication than men. In addition, do women's participation exceed men's in terms of quality, in that women explain their perspectives/ideas more thoroughly than men? It has been found

that the tone and presence of women and men in their conversation styles differ and, thus, should be looked at more closely.

PURPOSE OF THE STUDY

The goal of this study was to examine whether online communication differed between the women and men enrolled in two distance learning courses. This particular study has been augmented from an earlier preliminary study published by the researcher (Hartsell, 2005). Discussion threads were the primary communication tool used between student-student in this study as opposed to e-mail, and thus, became the instrument of data collection. Discussion threads allow students and teachers to see the “trail of thought” among individuals, as postings to the discussion threads are made in response to previous postings. The research questions investigated in this descriptive study included whether women more than men: (a) participated or made postings to discussion threads, (b) supplied more explanation in their responses to support the topic under discussion, (c) provided more informal responses than formal, and (d) tended to provide more supportive/encouraging comments.

METHODOLOGY

Participants

The courses under study were graduate-level instructional technology courses in which 25 students were involved. Twelve females and 13 males participated in this study as participants. Of these 25 participants, 12 were doctoral-level students majoring in educational leadership, communications or mathematics; 10 were master's-level students majoring in instructional technology, and one was majoring in nursing, foreign languages

and technology education. Other than for the 10 students majoring in instructional technology, one course used for this study was considered as an elective and/or for fulfilling minor requirements. The other course in this study was an elective for all participants involved. All students were required to interact in discussion threads over a 10-week period that involved topics stemming from course readings. Participants were expected to contribute at least four postings each week in response to the course material. However, a number of participants posted more than what was required.

Design and Measures

The research design was primarily descriptive in nature and the instrument for data collection was the documentation of the actual discussions that took place across the semester between the men and women. The study implemented a descriptive model in that “student involvement” was assessed by tabulating and recording the quantity and quality of student interactivity in the discussion threads. Raw data collected from the transcriptions of discussion threads were examined using a method of calculation rather than employing thick descriptions to explain the setting as in qualitative research.

The research design was not qualitative in that it did not go in-depth or describe the meaning of the findings from the perspective of the research participants. Instead, the data was analyzed by simply counting the words or the number of times a participant posted a response. Quantity was recorded by the amount of times students posted responses to the threads as well as the number of words that women and men used to make their responses. Quality was examined by reviewing the content that women and men made concerning topics under discussion. Tone was also studied, because the literature review indicated that this was a contributing factor in terms of

how men used online communication tools as opposed to women. In short, quality of the postings were studied further in detail by looking at who responded to whom, the tone of the posting and whether the response contributed toward the discussion and not just a simple, informal comment made to someone.

Procedures

Data collection occurred during two different semesters. The discussion thread requirement for each course occurred over a 10-week period. Students in the online courses were required to make at least four postings to the weekly discussions, although the opportunity to contribute more was available and optional. The weekly discussion covered topics stemming from the course's reading materials.

The discussions progressed in an organized manner and occurred through WebCT's discussion tool feature. Each week, the students had to read two to three chapters within the textbook or from online articles. Either a facilitator or the instructor posted questions to the discussion threads each week. The weekly discussions began each Monday and concluded the following Monday, in which the instructor closed or locked the discussion thread to prevent miscellaneous postings made to the thread.

The discussion threads that occurred each week were then compiled into a text file that displayed who said what and to whom. With these text files, the postings were broken down by individual participants to help in the calculation of how many times males, as opposed to females, made postings and the number of words made in each posting. The text file was also used to determine whether the postings were in response to someone else's reactions or if a new topic/concern was initiated by the participant. Furthermore, the discussion threads were examined to assess the "quality" aspect of the postings that focused upon two areas: (1) tone of the posting and (2)

the value of information given. Discussions were coded for ascertaining the quality aspect. The coding scheme used the following classifications: (a) *I* being informal in tone, more like a discussion or rapport style, (b) *F* being formal in tone, somewhat like a report of the facts, (c) *S* including supportive/encouraging comments and reacting to personal matters, (d) *B* including short replies of one to three sentences long or not really addressing content material, and (e) *R* for postings that directly made reference to course materials. Each discussion posting was coded; some postings had two or more codes ascribed to them because they crossed classifications.

RESULTS

Results of the study are summarized and organized in terms of the original research questions. First, participation patterns for the genders are presented by the aggregate of individual weeks in Table 1. Table 2 shows the minimum, maximum, mean and standard deviation scores separated by gender for all 10 weeks of discussion. As predicted, the women participated more in the discussion threads, as can be seen by the number of postings. Overall, the women posted 91 more responses than their male counterparts. In addition, when one examines the minimum, maximum and mean scores, the women again surpassed their male counterparts in the collective 10-week period. Even for the week that the women did not contribute much toward the discussion, they still made 6 more responses than the men (MIN). These numbers are interesting in that the women comprised the minority group in this study, with 12 individuals as opposed to 13 men. One would expect to see more postings from the majority group of men because they have an additional member. However, this was not the case.

An independent-samples *t*-test using the total number of postings as the test variable was conducted to evaluate whether gender played a role.

Table 1. Class participation patterns by gender

| Gender | Class postings per week | | | | | | | | | | Total |
|------------------------|-------------------------|----|----|----|----|----|-----|----|----|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Women (<i>n</i> = 12) | 69 | 73 | 88 | 84 | 62 | 81 | 116 | 56 | 68 | 79 | 776 |
| Men (<i>n</i> = 13) | 54 | 77 | 84 | 77 | 63 | 63 | 81 | 61 | 50 | 75 | 685 |

Table 2. Frequency of postings by gender for all 10 weeks

| Gender | Frequency of postings | | | |
|------------------------|-----------------------|-----|------|-------|
| | Min | Max | Mean | SD |
| Women (<i>n</i> = 12) | 56 | 116 | 77.6 | 16.78 |
| Men (<i>n</i> = 13) | 50 | 84 | 68.5 | 11.79 |

The test was not significant, $t(18) = 1.403$, $p = .05$, and most likely represented a chance occurrence. However, on average, the women did produce more postings to the discussion threads than men. A reason to account for this lack of significance could be due to the small sample size; thus, more participants are required to be included in future studies to help validate the *t*-tests.

A factorial ANOVA was also conducted to evaluate the effects of class (the two courses) and gender on the number of postings made to the discussion threads. The factorial ANOVA indicated no significant interaction between class and gender, $F(1, 21) = .182$, $p = .674$, $\eta^2 = .009$, nor was there a significant effect for gender, $F(1, 21) = 1.585$, $p = .222$, $\eta^2 = .070$. However, there was a significant effect for class, $F(1, 21) = 9.279$, $p = .006$, $\eta^2 = .306$. The difference between the classes could be attributed to the uneven number of participants in each course and that one course had less discussion activity than the other. Be-

cause there were fewer than three groups for the fixed factors, post hoc tests were not conducted in this ANOVA.

Findings from the data also demonstrated that women incorporated more explanation into their postings to support their ideas and opinions. Men tended to get "straight to the point" in their responses, while women wanted to expand and augment what they said through illustrations, experiences and examples. Table 3 presents the number of words used by the women and men in their postings. The results show that women used more words to explain their responses or defend their ideas as opposed to their male counterparts. In all, the women surpassed the men by more than 8,000 words during the 10-week period. Curiously, the men exceeded the women in weeks 1 and 3, but not by a great deal in terms of numbers.

For examining the quality of the responses, the discussion postings were coded into five classifications, as addressed in the procedures section. The

Table 3. Number of words used in postings by gender

| Gender | Number of words per week | | | | | | | | | | Total |
|------------------------|--------------------------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Women (<i>n</i> = 12) | 5,662 | 10,920 | 9,342 | 10,274 | 8,471 | 8,119 | 8,688 | 8,765 | 8,509 | 7,810 | 86,560 |
| Men (<i>n</i> = 13) | 6,142 | 10,089 | 9,396 | 8,688 | 6,884 | 7,398 | 8,339 | 7,276 | 6,326 | 7,679 | 78,217 |

Table 4. Coding of discussion postings by gender

| Gender | Codes | | | | |
|------------------------|----------|--------|---------|-------|--------|
| | Informal | Formal | Support | Brief | Report |
| Women (<i>n</i> = 12) | 576 | 97 | 305 | 223 | 90 |
| Men (<i>n</i> = 13) | 471 | 90 | 162 | 223 | 51 |

distribution of responses according to the codes across the entire 10 weeks can be found in Table 4. The results indicated that women were more outspoken, whether formally or informally. This contradicts previous findings in that women tend to be more informal in their responses, because in this sample the women also made more formal comments as opposed to their male colleagues. In addition, women tend to give more supportive comments, which are broken down in Table 5. Both women and men were equal in terms of posting brief comments.

When the discussion postings were coded, the *S* code was broken down into several other classifications. Table 5 depicts the results in terms of the number of responses that have been coded with an *S*. The *S* code had been separated into different categories as (a) *E* for offering support or encouragement; (b) *N* for referring to people

directly by name; (c) *A* as making a personal apology; (d) *P* as reacting to personal matters or responding to incidences not really related to class; and (e) *D* to indicate disagreement. This stratification helped determine what type of support was made by the participants. The results show that women offered more comments that were encouraging and thoughtful. They also directed their comments toward other colleagues by name. Males, on the other hand, exceeded in the area of disagreement, although this was not by a considerable number.

Results for the study show that women, more than men, participated in the discussions. In this case, women made more postings to the discussion threads than males and with greater explanation. In the area of quality, the women also excelled in their responses in terms of content matter and tone. Women also gave more encouraging remarks

Table 5. Number of postings classified as "S"

| Gender | Support Classifications | | | | |
|------------------------|-------------------------|----------|----------|----------|----------|
| | <i>E</i> | <i>N</i> | <i>A</i> | <i>P</i> | <i>D</i> |
| Women (<i>n</i> = 12) | 145 | 290 | 12 | 57 | 4 |
| Men (<i>n</i> = 13) | 78 | 134 | 7 | 19 | 8 |

to others' comments and addressed individuals by name, indicating a sense of intimacy and amiability. In this area, external variables such as students' majors could have influenced the results in that majors in instructional technology would offer more comments in response to the issues addressed. However, this was not the case, because more males than females happened to be majors in instructional technology. The women were diverse in their concentration fields, which included instructional technology majors (6), educational leadership majors (3) and a foreign languages major (1), nursing major (1) and communications major (1). Thus, the assumption that instructional technology majors would have contributed more because of their familiarity with the subject matter was non-existent in this sample.

CONCLUSION AND IMPLICATIONS

Before addressing the conclusions to this initial study, limitations need to be discussed. First, the study is not generalizable because of the small sample size. In addition, the participants were part of a convenience sampling and not a true random sample. However, this sample could lead to larger studies, because it provided the preliminary basis

for identifying exclusive variables to be studied further. Second, this study did not collect the perspectives and reactions from the participants themselves concerning the effectiveness of online communication. A more qualitative approach could be used to obtain such in-depth information as participants' perceptions toward online communication, behavior and learning. Coding of the discussion threads was also a limitation in that an inter-rater reliability test was not performed. Thus, coding conducted by the researcher could be biased. Finally, because the participants were required to make four or more postings a week, this could affect the number of postings made across the 10 weeks in that participation was not always voluntary. If students were concerned about their grades, they would have opted to make more postings than normal. Although limitations existed in this study, this should not discount the findings but be used as questions for further analysis.

This descriptive study investigated whether online communication differed between the women and men enrolled in two distance learning courses through the use of discussion threads. Four research questions were introduced and answered in this study. The first question asked whether women more than men made postings to the discussion threads. As a result, the female

participants made more than 90 more postings during the 10-week period than males. Although the independent samples t-test and ANOVA did not indicate this direction, the raw data implied that women in these courses preferred and enjoyed to communicate online. For online courses, instructors should seriously consider integrating online communication tools to help women and men share their ideas with others. This may prevent social isolation that commonly occurs in distance learning courses.

The second question examined whether women supplied more explanation in their responses to support the topic under discussion. The women did surpass the men by more than 8,000 words. This implies that women in the course valued the opportunity to elaborate on their ideas, opinions and experiences without the restraint on length. The finding may also suggest that women enjoy the impartial environment of online communication because they are not obligated to remain within social norms of face-to-face interactions. In short, women can “speak” all they desire because they have a closed audience who will not silence them. For online course instructors, communication tools should be used to promote interaction among students from diverse backgrounds. Without the traditional physical and auditory cues, women may feel more inclined to participate. Thus, online participation should be encouraged by the instructor to offer individuals from non-dominant groups to discuss freely their ideas and opinions without fear of repercussions.

The third question investigated whether women, more than men, used more informal expressions in their responses. When viewing the findings, this was not the case. Women made as many informal responses as they did formal compared to the men. Women did use the “reporting” format that had been normally reserved for men (Kuntjara, 2002). This implies that the women in the courses were not afraid to use the more formal tone to prove their point. They were also adaptable in switching between tones depending

on the topic under discussion. Online instructors should take this into account. Incorporating online debates should not be shied away from if course enrollment has more females than males. If these courses have online students who are similar to the participants in this study, women will not have any difficulty taking a more formal approach in defending their ideas.

The last question examined whether women provided more supportive/encouraging comments than their male counterparts. This was true in that the women contributed more encouraging comments than men. The women also addressed their colleagues by name that promoted a sense of familiarity and collaboration, something discovered in previous studies (Kilbourne & Weeks, 1997). This implies that the women searched for collaboration and friendship online, and needed the sense of community more than the men (Shaw & Gant, 2002). For online course instructors, communication tools should be used to promote collaboration, such as assigning group activities, discussing reading materials, deliberating over case studies and so forth. If women feel that they are part of the online community, their learning will be enhanced.

This study only provided the foundation of investigating gender differences in online communication. Some findings discovered in this study supported previous literature/studies, while others did not. Future studies should look into these areas that countered previous research because they could clarify the external variables that may have caused these effects to occur. Further studies should also be conducted to validate and support the findings of this initial study. Investigating a larger sample; using courses that have both undergraduate and graduate students; studying students from various disciplines; and performing more in-depth, qualitative studies should be performed to help support the findings addressed. This study is only the beginning, and many more should be performed to investigate the variables in question. With additional support from other

investigations, the relationship between gender and online communication could be exposed and integrated effectively into distance learning activities.

REFERENCES

American Association of University Women Educational Foundation Commission on Technology, Gender, and Teacher Education. (2000). *Tech-savvy: Educating girls in the new computer age*. Washington, DC: American Association of University Women Educational Foundation. Available at: www.aauw.org/research/girls_education/techsavvy.cfm

Arbaugh, J. B. (2000). An exploratory study of the effects of gender on student learning and class participation in an Internet-based MBA course. *Management Learning, 31*(4), 503-519.

Danet, B. (1998). Text as mask: Gender and identity on the Internet. In S. Jones (Ed.), *Cybersociety 2.0* (pp. 129-158). Thousand Oaks: Sage.

Gorritz, C., & Medina, C. (2000). Engaging girls with computers through software games. *Communications of the ACM, 43*(1), 42-49.

Hamburger, Y.A., & Ben-Artzi, E. (2000). The relationship between extraversion and neuroticism and the different uses of the Internet. *Computers in Human Behavior, 16*, 441-449.

Hartsell, T. (2005). Who's talking online: A descriptive analysis of gender & online communication. *International Journal of Information and Communication Technology Education, 1*(1), 42-54.5.

Herring, S. (1993). Gender and democracy in computer mediated communication. *Electronic Journal of Communication, 3*, 1-16.

Herring, S. (2001). *Gender and power in online communication (CSI working paper)*. Retrieved

November 28, 2005, from <http://rkcsi.indiana.edu/archive/CSI/WP/WP01-05B.html>

Kilbourne, W., & Weeks, S. (1997). A socio-economic perspective on gender bias in technology. *Journal of Socio-Economics, 26*(1), 243-260.

Kuntjara, E. (2002). Gender issues in information technology communication. *Women in Action, 2*. Retrieved March 28, 2004, from www.isiswomen.org/pub/wia/wia202/genderissues.htm

McCoy, L.P., Heafner, T.L., Burdick, M.G., & Nagle, L.M. (2001, April 10-14). Gender differences in computer use and attitudes on a ubiquitous computing campus. *Proceedings of the Annual Meeting of the American Educational Research Association*, Seattle, WA.

Monteith, K. (2002). *Gendered learning and learning about gender online*. Open and Distance Education and Learning at the University of Sterling. Retrieved November 28, 2005, from www.odeluce.stir.ac.uk/docs/Gendered%20Learning.pdf

Moore, M. G., & Kearsley, G. (1996). Fundamentals of distance education. In M.G. Moore & G. Kearsley (Eds.), *Distance education: A systems view* (1st ed., pp. 1-18). Belmont: Wadsworth Publishing.

Namalu, A. G. (2003). The effect of learning strategy on computer anxiety. *Computers in Human Behavior, 19*, 565-578.

Novak, T.P., & Hoffman, D.L. (1998). *Bridging the digital divide: The impact of race on computer access and Internet use*. Project 2000, Vanderbilt University. Retrieved from www.2000.ogsm.vanderbilt.edu/papers/race/science.html

Ory, J. C., Bullock, C., & Burnaska, K. (1997). Gender similarity in the use of and attitudes about ALN in a university setting. *Journal of Asynchronous Learning Networks, 1*(1), 39-51.

Who's Talking Online II

- Picciano, A.G. (2001). Introduction. In A.G. Picciano (Ed.), *Distance learning: Making connections across virtual space and time* (1st ed., pp. 1-20). Upper Saddle River: Merrill-Prentice Hall.
- Picciano, A. G. (2001b). The student perspective. In A.G. Picciano (Ed.), *Distance learning: Making connections across virtual space and time* (1st ed., pp. 89-108). Upper Saddle River: Merrill-Prentice Hall.
- Rossetti, P. (1998). Gender differences in e-mail communication. *The Internet TESL Journal*, 4(7). Retrieved November 28, 2005, from <http://iteslj.org/Articles/Rossetti-GenderDif.html>
- Selfe, C., & Meyer, P.R. (1991). Testing claims for on-line conferences. *Written Communication*, 8(2), 162-192.
- Shaw, L.H., & Gant, L.M. (2002). Users divided: Exploring the gender gap in Internet use. *Cyber-Psychology & Behavior*, 5(6), 517-527.
- Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2003). Foundations of distance education. In M. Simonson, S. Smaldino, M. Albright, & S. Zvacek (Eds.), *Teaching and learning at a distance: Foundations of distance education* (2nd ed., pp. 4-25). Upper Saddle River: Merrill-Prentice Hall.
- Sullivan, P. (2001). Gender differences and the on-line classroom: Male and female college students evaluate their experiences. *Community College Journal of Research and Practice*, 25, 805-818.
- Waldeck, J.H., Kearney, P., & Plax, G. (2001). Teacher e-mail message strategies and students' willingness to communicate online. *Journal of Applied Communication Research*, 29(1), 54-70.
- We, G. (1993). *Cross-gender communication in cyberspace* (paper for CMNS 855). Retrieved November 28, 2005, from <http://feminism.eserver.org/cross-gender-comm.txt>
- Weiser, E. B. (2000). Gender differences in Internet use patterns and Internet application preferences: A two-sample comparison. *Cyber-Psychology & Behavior*, 3, 167-178.
- Whitley, B. E. (1996). Gender differences in computer-related attitudes: It depends on what you ask. *Computers in Human Behavior*, 12, 275-289.

This work was previously published in Integrating Information & Communications Technologies in the Classroom, edited by L. Tomei, pp. 36-50, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 7.21

Cultivating Greater Acceptance of Women in Technology: A Pilot Study

Mara H. Wasburn
Purdue University, USA

ABSTRACT

Many Western nations face a critical shortage of skilled professionals in science, technology, engineering and mathematics (STEM). However, despite abundant opportunities, few women prepare themselves for careers in these fields. Several of those concerned with the problem have proposed that new media programming, such as television dramas with women engineers, computer professionals and/or engineers in leading roles, might help attract more women to STEM fields. This article identifies a theoretical rationale for a media-centered strategy, and describes a pilot study whose data suggest that a media-centered approach might have some success in producing greater interest among women in pursuing STEM careers, particularly information technology (IT) careers.

INTRODUCTION

“It is still news whenever women tackle any job American society traditionally has seen as male” (Vavrus, 2002, p. 11). In July 2005, 15 major American business groups, led by the Business Roundtable, issued a joint statement decrying the declining prominence of the United States (US) in STEM, and calling for the nation to double the number of college graduates in those fields by 2015. The statement cited data indicating that more than 50% of the current US science and engineering workforce is approaching retirement age and that by 2010, if present trends continue, the vast majority of all scientists and engineers in the world will be living in Asia. The report claimed that the scientific and technical capacity of the US has already begun to atrophy, threatening America’s standard of living at home and leadership in the world (Business Roundtable, 2005).

Corresponding concerns for their nation's welfare and standing in the global political economy have been expressed in many countries throughout Western Europe (Femtec, 2002).

It is widely understood that part of the solution to the escalating problem of the shortage of well-trained technical personnel in all advanced industrial nations involves attracting considerably more women to careers in STEM disciplines. In the US, there is substantial occupational segregation by sex. Although women constitute 46% of the labor force, less than one-quarter of the scientists and engineers in the country are women (Mervis, 2000). Precise international comparisons of occupational segregation are difficult, because nations seldom use comparable detailed occupational coding systems (Jacobs, 1993, p. 133). However, available data indicate not only the existence of such a gendered division of labor throughout Western Europe, but also the likelihood of its persistence. For example, while half of all university students in Germany are women, women represent only 34% of all students in the natural sciences and 19% of all students in engineering (Femtec, 2002, p. 2). Similarly, men were found to be over-represented among computer science graduates in all 21 industrial nations considered in a recent study. In the US, the "male over-representation factor" is 2.10; United Kingdom, 3.10; France, 4.57; and Germany, 5.58 (Charles & Bradley, 2005).

Approximately half the potential STEM talent pool consists of women. Therefore, in 2000, a US government commission was charged with developing strategies to attract more women and minorities in STEM careers. The commission reported to the Committee on Science of the House of Representatives that significant barriers to these goals persist (Committee on Science, 2000). Such deterrents range from differing male/female attitudes toward science and technology that begin to diverge as early as elementary and middle school to the absence of women faculty, mentors and fellow students in college and university classrooms

that create a "chilly climate for women" in these areas (AAUW, 2000; Seymour, 1999).

In the field of IT, career opportunities for women abound. Yet despite the obvious advantage of entering this area, there has been a steady decline in the number of computer science bachelors degrees awarded, particularly to women (Camp, 1997). In 1983-'84, more than 37% of the bachelors degrees in computer science were awarded to women. Ten years later, the percentage had fallen to 28%, and it has held relatively steady through the new millennium (Camp, 2002).

An examination of research on women in computer science revealed that emphasis at the post-secondary level is on the social psychological factors that prevent women's inclusion (Dryburgh, 2000). Margolis and Fisher (2002) used the metaphor of a "clubhouse" to describe the extent to which women are excluded from the male purview of computing, and "dreaming in code" as "emblematic of a male standard of behavior in this computer-oriented world." The authors no longer want to try to fit women into this male culture. They issued a call to arms for a revolution in the culture and curriculum of computer science that will encompass and respect the contributions women can make to the discipline.

As young women grow older, fewer of them express interest in studying STEM subjects. The literature refers to a "leaky" pipeline of women from elementary school through graduate studies and employment, eventually leading to their under-representation in the STEM professions. (Freeman, 2004; Jones, Howe, & Rua, 2000.)

A 2003 US National Science Foundation publication described 211 ongoing projects in the country designed to attract and retain women in STEM courses. More than \$90 million had already been poured into these projects. Given the proliferation of such efforts, some measurable effect on the entry and persistence of women in these professions should be expected. However, studies indicate no substantial gains (Freeman, 2004; Huang, Tadolese & Walter, 2000). In fact,

much of the progress that women have made in these areas has stalled or eroded (National Council for Research on Women, 2001). Such findings indicate the importance of developing additional new strategies for attracting more women into STEM programs. One such approach, which is the focus of this article, involves using the mass media to create a more positive understanding of women in these professions.

The approach was the topic of a seminar entitled “Women in Science and Engineering, and TV Drama: Sex, Lives and Videotape” held in November 2004 in London’s Institution of Electrical Engineers. The event was organized by the Public Awareness of Science and Engineering (PAWS) Drama Fund and was supported by six of the United Kingdom’s leading science, engineering and technology organizations. The seminar brought together scientists, engineers, and television drama producers and writers. Its goal was to offer recommendations for helping and encouraging the media to present more well-rounded, up-to-date and attractive images of women in STEM careers through the development of new programming, such as science-based television dramas with women in leading roles.

THEORETICAL RATIONALE FOR A MEDIA STRATEGY

In the 1960s, the international feminist movement helped advance the idea that cultural understandings of gender roles are socially constructed and have to do with ideology and power rather than being “natural.” Feminist scholars began directing attention to the media’s role in making women’s minority status experienced as part of the “natural order of things.” Numerous content analyses found that women were under-represented in the media and portrayed in ways that tended to sexualize, commodify and trivialize them. Such presentation supported an inequalitarian status quo in which women played marginal roles in political,

economic and intellectual life (Brunsdon, D’Acci, & Spigel, 1995; Gunter, 1995; McQueen, 1998; Tuchman, 1978).

The basic theoretical insight that our understanding and experience of the world of everyday life is socially constructed was first fully articulated in the early 1930s by German philosopher Alfred Schutz (1932), who sought to develop a sociological variant of phenomenology. The work gained considerable influence in the US when it appeared in English in 1967. This was one year after Peter Berger and Thomas Luckmann’s theoretically similar study, “The Social Construction of Reality” (1966), had gained the attention of American social scientists. The publication of the two studies corresponded with the height of feminist activity. For example, the National Organization of Women was founded in 1966.

In Schutz’s view, all of us carry in our minds a “stock of knowledge of physical things and fellow citizens, of social collections and artifacts, including cultural objects” (Schutz, 1932/1967, p. 81). This stock of knowledge provides a frame of reference or orientation with which we can interpret objects and events as we conduct our everyday lives. Moreover, the objects and events of the world have no inherent or universal meaning apart from this imposed framework.

For Schutz, our stock of knowledge *is* our reality. It is experienced as the objective world existing “out there,” independent of our will and confronting us as fact. This stock of knowledge has a taken-for-granted character and is seldom the object of conscious reflection. It is understood by us in a common-sense fashion as reality itself. Although we can doubt this reality, we rarely do so, and we cannot do so when we are engaged in our routine activities. This perspective suggests that most of us might feel too busy to attend seriously to the fact that boys monopolize classroom computers or to the low probability that one of the attractive female characters in the enormously popular American television series *Sex and the City* might be a physical scientist,

engineer, mathematician or systems analyst. We would be unlikely to react to the fact that the brilliant, crime-solving mathematician on the series *Numb3rs* could just have easily been cast as a woman without disturbing the plot, or to the fact that *Friends*, one of the all-time most popular television programs of all time, had three prominent female characters: a masseuse, a restaurant owner and a member of the fashion industry. Not one of them was an engineer or a computer scientist. Even the female leads on *CSI, Crime Scene Investigation*, who are forensic scientists using the most advanced scientific and technical methods to apprehend criminals, came to their jobs by chance, rather than by completing formal programs of scientific education.

Schutz contends that we assume other members of our society generally share our stock of knowledge and will experience the world in the same way we do. We assume that others will see the world as being made up of the same types of objects and events, that these objects and events will have the same meaning for them, and that they will respond to them in ways they themselves have learned are appropriate. After all, even today, how many people really believe that being a chemical engineer is just as suitable a career for a woman as being a teacher or nurse?

According to Schutz, we rely on typifications, or “recipes” for action that exist in our culture. These typifications, which are part of our stock knowledge, provide us with ready-made courses of action, solutions to problems and interpretations of the social world. Although the typifications constitute a cultural framework experienced as requiring no further analysis, problematic situations can arise that call the typifications into question. For example, frequently encountering mass media images of reasonably attractive women successful doing “men’s work” might, over time, encourage people to reconsider their views about how “natural” is the traditional gendered division of labor.

In a manner similar to that of Schutz, Peter Berger and Thomas Luckmann (1966) discuss the process by which we create the realities of our everyday lives. They observed that social institutions appear to have an objective reality of their own as given, self-evident aspects of the world. The social world, which is a human product, confronts its producer as an external reality, as something other than a human product. New generations learn about this reality through the process of socialization, just as they learn about other things that make up the world they encounter.

New generations also learn meanings of the social order, which bestows on that order not only cognitive validity but normative legitimacy as well. Socialization involves the simultaneous transmission of knowledge and values. All understandings of the social world carry with them evaluations. Berger and Luckmann’s position rejects the standard distinction between the explanation and evaluation of the social world. Presentation of traditional images, such as those of a gendered division of labor, legitimates that institutional order.

By the time Schutz’s study was published, the power of radio and motion pictures as agents of socialization that could be used to legitimate or challenge social institutions was well recognized worldwide by those in the media industry, as well as by social scientists and national governments (see Blumer, 1933; Cantril & Allport, 1935; Furhammer & Isaksson, 1971; Lacey, 1996). Nevertheless, Schutz fails to discuss the media’s role as a major source of our “stock of knowledge” and as a creator of the typifications on which we rely as we go about our everyday lives. More than three decades later, Berger and Luckmann also ignore the importance of the mass media in legitimating or changing social orders. This is remarkable in light of the vast literature on the influence of television that was produced in the 1960s by cultural critics and feminist theorists, as well as social scientists.

A major constructionist theory focusing on the influence of mediated reality on social behavior was introduced by George Gerbner and his associates in the 1970s and subsequently elaborated on (Genuter, 1995; Gerbner, 1976; Gerbner, et al., 1994; Signorielli & Morgan, 1990). Initial concern was with how the vast amount of violence portrayed on American television exaggerated the fears people have about encountering violence in their own neighborhoods. Later developed as cultivation theory, the approach asserts that, at least among heavy users, television produces a “mainstreaming” effect whereby differences in beliefs in otherwise heterogeneous populations are muted. Heavy television viewers internalize many of the perspectives on the social world presented by television. Such influence occurs as a result of continual and lengthy exposure to television in general, not just exposure to individual programs or genres.

In terms of the works of Schutz (1932/1967), Berger and Luckmann (1966) discussed earlier, television presents typifications which, after prolonged repetitious exposure, the viewing public accepts as accurate representations of social reality. Ubiquitous images come to represent not only the social order but the normative order as well. Viewers use typifications to negotiate the social world by understanding “the natural order of things.” If girls, compared to boys, are never or almost never represented as interested in STEM disciplines in youth-oriented television programming, or seen as enrolled in advanced physics, chemistry, calculus or computer classes, that is the way things are – just natural. Change in the social order is not called for. If women, compared to men, are never or almost never portrayed as scientists, technical experts or engineers on television programs, that, too, is a reflection of “the way things are.” The likely viewer reaction to such under-representation is not dissatisfaction with the apparent inequality, but simple acceptance of the consequences of how “natural” interests and abilities are distributed by sex.

Taken together, social constructionism and cultivation theory clearly suggest an approach to attracting more women to STEM careers. The strategy is to vastly increase media representation of women in these occupations. This should be undertaken in all varieties of programming, including children’s shows, dramas, situation comedies, talk shows, soap operas and even commercials. The goal is to cultivate a social understanding of middle and high school girls enrolled in STEM classes, of women scientists, engineers and technical experts as simply part of the natural social order — as nothing unusual. STEM education and careers can be presented as legitimate spheres of participation for women — areas of professional activity in which women not only *do* but *should* participate.

Positive images of women technology professionals are not necessarily images of bright, articulate, personable, physically attractive people. While, quite obviously, they should not be less attractive than the other characters with whom they interact or others who appear regularly on other programs, the important point is that women technology professionals appear frequently in the full variety of television programs. Young women should be commonly encountered as characters enrolled in technology-rich classes rebuilding computers.

It is important to note that women are not a monolithic group and, consequently, no one approach will work for attracting women to STEM disciplines. In addition to gender, other factors such as race, class, ethnicity and sexual orientation influence education and career choices (Rosser, 1998). This suggests that if a media strategy is to be helpful, it must involve diverse programming appealing to audiences composed of women with diverse demographic characteristics.

Women should be commonly encountered as characters competently doing technologically sophisticated work that is just as legitimately “woman’s work” as it is “man’s work.” This proposal is consistent with research concluding that,

at least in the US, media routinely ignore and/or trivialize women's participation in STEM, and thereby discourage their career aspirations in scientific and technical fields (Potts & Martinez, 1994; Steinke, 1997).

PILOT STUDY

The preceding suggests the hypothesis that television viewers who have encountered images of women technical professionals are more likely to believe that STEM careers are acceptable (legitimate) careers for women than are those who have not seen such presentations. An opportunity presented itself to conduct a pilot study that, though limited in several ways, does shed some new light on the tenability of this suggestion.

Between April 1 and May 15, 2004, the Survey Research Institute at Purdue University conducted as a graduate student training exercise one of its periodic social surveys of the entire continental US via computer assisted telephone-interviewing (CATI) system. In the system, telephone numbers are selected randomly from a list of random digit-dialing telephone numbers that include all area codes and telephone prefixes throughout the US. The CATI system allows graduate student interviewers to record responses into a database while conducting the interview. CATI software prevents a researcher from calling anywhere in the US before 9 a.m. or after 9 p.m. in each time zone.

For each potential interview, the respondent is first asked whether or not he or she is 18. If the respondent is not 18 or older, the researcher asks if anyone in the house is at least 18 years of age. Once an 18-year-old is contacted, the respondent is asked if he or she has enough time to answer the survey. As long as the respondent agrees, the survey is administered. Should a respondent show an interest in taking the survey but state that he or she does not have the time to take the survey, a better time is scheduled in the CATI system and

the respondent is called back at the rescheduled time. Upon completion of the interview, the researcher records the sex of each respondent. In the case that a respondent prematurely terminates the interview, all of the responses up to that point are saved and a callback is scheduled in an attempt to complete the interview.

Four hundred interviews were initiated, of which 284 were completed, for a response rate of 71%. The social survey allocated 30 minutes for questions of the pilot study investigating media images of women technology professionals. Three categories of STEM careers were selected to represent a broad range of specific professions: engineer, research scientist and computer technician. The analysis dealt with the proportion of the sample that had seen actresses playing these occupational roles, an indirect measure of the relative attractiveness of those occupations, and the differences in attitudes toward the acceptability (legitimacy) of various careers for women between those who had and those who had not seen actresses playing those occupational roles on television.

Limitations

Although the sample did randomly include individuals representing a wide range of demographic characteristics, it cannot be considered representative of the entire population of the continental US. Women, in particular, were over-represented: 210 (70.7%), as opposed to 83 (29.2%) male respondents. Since use of the CATI system prevented interviewing young women and men below the age of 18, students are not represented in the sample. Also, due to the necessary brevity and other characteristics of telephone surveys, respondents were asked short questions, some of which were only proxy measures of central concepts, such as the relative attractiveness of women in various STEM occupations, and the terms for those occupations such as "computer technician," which was used to represent a variety of computing-focused careers.

The cumulative effect of encountering numerous positive images over time, central to cultivation theory, could not be explored.

FINDINGS

Data in Table 1 show that more than 90% of the sample had seen actresses portray nurses, medical doctors, lawyers and secretaries. This is not surprising in light of the long-term popularity of medical and legal dramas on US prime-time television. Female secretaries are likely to appear in work contexts in most varieties of television programming.

There is a considerable gap between the frequency with which respondents report seeing actresses portraying those roles and the frequency with which they report seeing actresses portraying other occupational roles, including the three technology roles selected to represent a large cluster of related occupations. Research scientists are seen much more frequently than are computer technicians and engineers. This probably reflects their appearances on several types of television

dramas, including crime, law, mystery and science fiction. The only two occupational roles in which the majority of respondents had not seen actresses were computer technician and engineer. This is certainly due, at least in part, to the comparative rarity that such roles appear in any variety of programming. When decisions are being made as to the careers to assign female characters in television comedies, dramas, soap operas and even commercials, having those characters portrayed as engineers or computer technicians would take advantage of a particular opportunity to establish women in technology as a part of the natural order of things.

How attractive are women technology professionals compared to women in other occupations? The elementary school teacher was selected as the profession for comparison. This is one of the most traditional middle-class occupations, and has had a long history of being gender stereotyped as appropriate for women. Data in Table 2 indicate that the relative attractiveness of women in technology generally is a reflection of the standing of their occupation in the occupational prestige hierarchy. However, there are exceptions. When comparing

Table 1. Question: Would you tell me if you have ever seen actresses on television playing characters with the following professions?

| | Yes (In %) | No (In %) |
|---------------------------|------------|-----------|
| Nurse | 96.1 | 3.9 |
| Medical Doctor | 93.0 | 7.0 |
| Lawyer | 91.2 | 8.8 |
| Secretary | 90.1 | 9.9 |
| Research Scientist | 78.2 | 21.8 |
| Factory Worker | 65.8 | 34.2 |
| Elementary School Teacher | 63.7 | 36.3 |
| Engineer | 50.6 | 49.4 |
| Computer Technician | 44.7 | 55.3 |

n=284

Cultivating Greater Acceptance of Women in Technology

Table 2. Question: I would like you to tell me which of two women, described by their careers, do you think most men would prefer as a spouse or partner?

| | (In %) | Elementary School Teacher (In %) |
|---------------------|--------|----------------------------------|
| Medical Doctor | 64.4 | 35.6 |
| Nurse | 61.3 | 38.7 |
| Lawyer | 49.6 | 50.4 |
| Engineer | 44.2 | 55.8 |
| Research Scientist | 39.1 | 60.9 |
| Computer Technician | 28.2 | 71.8 |
| Secretary | 24.6 | 75.3 |
| Factory Worker | 14.1 | 85.9 |

n=284

respondent perceptions of the attractiveness of a woman who is an engineer or a research scientist with that of a woman who is an elementary school teacher, the latter is more frequently judged more attractive. Generally, engineers and research scientists have more education, higher income and higher occupational prestige than elementary school teachers. Yet, data show that respondents believed most men would prefer an elementary school teacher as a spouse or partner. Such a finding indicates the need to improve the image of women in technology-rich professions.

Are those who have seen actresses in a STEM occupation significantly more likely than others to believe it is an acceptable (legitimate) occupation for a woman? The answer to this question bears directly on the tenability of the theoretical assumption central to this article: Media images of social reality come to be regarded not only as the empirical but also as the normative “natural order of things.”

Respondents were asked the extent to which they agreed with the statement that each of several STEM careers (research scientist, engineer, com-

puter technician) was an “acceptable career for a woman.” The theoretical expectation is that those respondents who had seen an actress on television playing the role of a technology professional would more frequently report that the role is legitimate for a woman than those who indicated they had never seen such a representation. Because attitudes of men and women toward women in technology might be quite different, their responses also were analyzed separately.

In the case of each of the three careers, five comparisons were made: overall between the attitudes of those who had and those who had not seen a representation of a woman in that occupational role on television, between men who had seen and men who had not seen such a portrayal, between women who had seen and women who had not seen such a portrayal, between men who had and women who had seen such a portrayal, and between men who had not seen and women who had not seen such a portrayal.

Data in Table 3 were used to calculate the magnitude of difference in the distribution of attitudes for the overall sample. Chi-square tests

were used to assess the probability that the magnitude of each of the observed differences was due to chance. Due to space limitations, data

used to calculate additional chi-square values are not presented here. However, they are available. Chi-square tests require row and column totals

Table 3. Question: Do you agree or disagree: Is it acceptable for a woman to be a research scientist?

| | Strongly Disagree | Disagree | Uncertain | Agree | Strongly Agree | Total |
|-----|-------------------|----------|-----------|-------|----------------|-------|
| Yes | 0 | 13 | 20 | 92 | 97 | 222 |
| No | 0 | 0 | 4 | 29 | 29 | 62 |

n=284

Chi-Square Values for Comparisons

P value

(.05 or less)

- a. Overall yes vs. overall no 0.25 ns
- b. Men yes vs. men no 0.74 ns
- c. Women yes vs. women no 0.34 ns
- d. Men yes vs. women yes 0.14 ns
- e. Men no vs. women no 0.70 ns

Table 4. Question: Do you agree or disagree: Is it acceptable for a woman to be an engineer?

| | Strongly Disagree | Disagree | Uncertain | Agree | Strongly Agree | Total |
|-----|-------------------|----------|-----------|-------|----------------|-------|
| Yes | 0 | 2 | 3 | 51 | 66 | 122 |
| No | 0 | 5 | 14 | 72 | 71 | 162 |

n=284

Chi-Square Values for Comparisons

P value

(.05 or less)

- a. Overall yes vs. overall no 0.20 ns
- b. Men yes vs. men no 0.21 ns
- c. Women yes vs. women no 0.31 ns
- d. Men yes vs. women yes 0.43 ns
- e. Men no vs. women no 0.37 ns

Cultivating Greater Acceptance of Women in Technology

greater than zero. Consequently, in some tables, strongly disagree and even disagree responses were eliminated in the calculation.

None of the comparisons using the data in Table 3 reveals a statistically significant difference between the attitudes of those who had and those who had not seen an actress portray a research scientist on television. In the case of research scientists, data do not conform to the theoretical expectation.

Data in Table 4 present similar results. None of the five comparisons reveals a statistically significant difference. In the case of engineers, as in the case of research scientists, data do not conform to the theoretical expectations.

Data in Table 5, however, tell a different story. Table 1 showed that fewer viewers had seen an actress on television playing a computer technician than playing any one of the eight other professional roles considered in this study. Table 2

indicated that overall, women who are computer technicians are much less frequently viewed as attractive than women who are engineers or research scientists. Table 5 shows that of the 284 respondents, the majority (53.2%) disagreed with the statement that it is acceptable for a woman to be a computer technician. This is an impressive statistic when contrasted with the corresponding 4.6% for research scientist and 2.5% for engineer. If there is a need to create a more positive view of women technology professionals, computer technicians would appear to be among those in greatest need.

Consistent with theoretical expectations, overall differences in the attitudes of those who saw an actress portray a computer technician and those who did not are statistically significant. Corresponding differences also were found for women but not for men. Significant differences were found between the attitudes of men and

Table 5. Question: Do you agree or disagree: Is it acceptable for a woman to be a computer technician?

| | Strongly Disagree | Disagree | Uncertain | Agree | Strongly Agree | Total |
|-----|-------------------|----------|-----------|-------|----------------|-------|
| Yes | 25 | 32 | 6 | 37 | 27 | 127 |
| No | 54 | 40 | 12 | 33 | 18 | 157 |

n=284

Chi Square Values for Comparisons

P value

(.05 or less)

- a. Overall yes vs. overall no 9.90 E-22 <.001
- b. Men yes vs. men no 0.43 ns
- c. Women yes vs. women no 0.05 <.05
- d. Men yes vs. women yes 1.42 E-10 <.001
- e. Men no vs. women no 5.18 E-14 <.001

women, all of whom had seen a portrayal; and between men and women, all of whom had not seen a portrayal. These results indicate the existence of gender differences in attitudes toward computer technicians (and perhaps toward other STEM occupations as well) and in the apparent ability of media representations to influence perceptions of and attitudes toward women in certain STEM careers. If more women are to be attracted to STEM occupations, it would seem important to influence the perceptions and attitudes of men as well as those of women. It is primarily men who teach classes in STEM disciplines in high schools and colleges; make admission decisions to college and university science, engineering and technology programs; hire scientists, engineers and other technology professionals; and constitute the majority of colleagues with whom women work in these professions.

DISCUSSION AND CONCLUSION

Part of the solution to the shortage of trained scientists, engineers and computer professionals in advanced industrial societies is to attract more women to careers in these areas. One widely discussed strategy for accomplishing this goal is to make such careers more attractive through the use of the media, particularly television. While this proposal makes common sense, several questions have yet to be addressed. These are the concerns of this article. Are there sound reasons to believe that a media-centered approach will achieve some success? That is, what is the theoretical basis for the hypothesis that exposure to positive television images of women as technology professionals will attract more of them to STEM careers? What causal mechanism is involved? Understanding causal dynamics can inform actions taken to produce desired results. What will empirical data suggest about the tenability of the hypothesis? Can we move beyond common sense and anecdotal evidence in evaluating the hypothesis?

The works of social theorists Schutz, Berger and communication researcher Gerbner provide an explanation for our understanding, evaluation and reaction to the social world. Commonly encountered representations of actors, conditions and events in the “real world” come to be understood, correctly or not, as the nature of reality itself. Furthermore, this understanding of the “natural order of things” comes to be accepted as the proper or legitimate structure. Such an understanding provides a guide for social behavior. The theory suggests that if children seldom or never encounter, directly or indirectly through the media, girls in laboratory classes or solving difficult mathematics problems, they are likely to believe that such educational pursuits are naturally the purview of boys. Similarly, if adults seldom or never encounter, directly or indirectly through the media, women scientists, engineers or technicians, they are likely to believe that such careers are “naturally” careers for men.

The social construction of reality perspective and cultivation theory suggest a strategy for attracting more women to STEM careers: Use media to present the public continuously with images of women in a wide variety of technology-rich educational programs and occupations. The object is to cultivate the view of women scientists, engineers, mathematicians and technology professionals, and of young women preparing for those careers, as nothing exceptional. The goal is to construct the socially shared perspective that it is just as “natural” for a woman to be a STEM professional as it is for her to be a medical doctor or a lawyer.

Social constructionism and cultivation theory call attention to the importance of the frequency with which audiences encounter positive media images of women technology professionals. To reach large and diverse audiences, representations must appear in a wide range of television program formats, including soap operas, situation comedies, talk shows, dramas, commercials and arguably, most important of all, programs that

appeal to teenage girls. It is helpful to produce programs that feature strong, competent and otherwise attractive female characters in the role of technology professionals. However, for the most part, positive images of women in technology need not be glamorous. Primarily producing such images might actually discourage women whose self-assessments are not nearly so glamorous from pursuing STEM careers.

This pilot study investigated the tenability of one of two hypotheses derived from social theory and communication research. The first hypothesis states that those who have been exposed to positive media images of women technology professionals are more likely to believe that STEM careers are legitimate careers for women than those who have not been exposed to such images. The second hypothesis states that widespread belief that STEM careers are legitimate careers for women will actually move more women to those careers. Investigating this second hypothesis is beyond the scope of this pilot study.

As noted earlier, although data were drawn randomly from the entire population of the continental US, the sample was too small to be considered representative of the entire country. It certainly cannot be taken as representative of the views of those in other nations. Also, as previously noted, the necessary brevity and other characteristics of telephone surveys imposed further limitations. The cumulative effect of encountering numerous positive images over time, central to cultivation theory, could not be explored. However, while findings are tentative, they are suggestive. Among these are:

1. There may be vast differences in the frequency with which television audiences have encountered representations of women in different STEM occupations.
2. There may be vast differences in public perceptions of the relative attractiveness of various technology-rich occupations.
3. In each of the cases of research scientist, engineer and computer technician, men were more likely than women to agree that the profession is an acceptable career for a woman. This is encouraging since, as noted, those hiring women into these positions and serving as faculty in university courses are more likely to be men than women.
4. Exposure to positive images of women in technology may increase the likelihood that viewers will believe these are acceptable careers for women in the case of some STEM careers (e.g., computer technician) but not others (e.g., research scientist and engineer.)
5. Significantly fewer women than men believe that the computing category of STEM careers, represented by computer technician, is acceptable for women. It might be more profitable to invest more effort in creating positive media images of women in computer-focused careers.

Computer technician emerged from the pilot study as the career category deemed least acceptable to both men and women as being appropriate for a women. Fewer viewers surveyed had seen an actress on television playing a computer technician than playing any one of the eight other professional roles considered in this study. Women who are computer technicians were viewed as less attractive than women in other STEM careers.

Additional research, using a representative sample of the US, more rigorously defined concepts and more sensitive measures is needed to determine whether or not these findings of the pilot study — tentatively suggesting that the media strategy most likely to be effective is one targeting young women likely to be interested in becoming computer technicians — are, in fact, valid. Future research should also include respondents younger than age 18, because it can be useful to know the views of students preparing to select their future

professions. The impact of variables such as age, race and class would also be instructive.

Similar international data are needed to determine whether or not the findings would apply in other countries as well. The findings can be understood as suggesting patterns of beliefs, values and sources likely to be found in the country as a whole. If the findings hold, it would appear that the majority of both men and women find other STEM careers appropriate for women, suggesting that a media strategy would be less effective in raising those numbers, and that other explanations and strategies should be explored.

REFERENCES

- AAUW. (2000). *Tech-savvy: Educating girls in the new computer age*. Washington, D.C.: AAUW Educational Foundation.
- Berger, P.L. & Luckmann, T. (1966). *The social construction of reality: A treatise in the sociology of knowledge*. Garden City: Anchor Books.
- Blumer, H. (1933). *Movies and conduct*. New York: MacMillan.
- Brunsdon, C., D'Acci, J. & Spigel, L. (Eds.). (1997). *Feminist television criticism*. Oxford: Oxford University Press.
- Business Roundtable. (2005). *Tapping America's potential: The education for innovation initiative*. Washington, D.C.: The Business Roundtable.
- Camp, T. (2002). Forward to women and computing. *SIGSE Bulletin*, 34(2), 1-6.
- Camp, T. (1997). The incredible shrinking pipeline. *Communications of the Association of Computing Machinery*, 40(10), 103-110.
- Cantril, H. & Allport, G. (1935). *The psychology of radio*. New York: Harper & Bros.
- Charles, M. & Bradley, K. (2005, August 13). *Women and information technology: Research on the reasons for under representation*. Proceedings of the 100th Annual Meeting of the American Sociological Association, Philadelphia, PA.
- Committee on Science, US House of Representatives. (2002). *A review of the Morella Commission report on recommendations to attract more women and minorities in science and engineering* (Serial No. 106-82). *Education*, 6(10), 1-2. Washington, D.C.: US Government Printing Office.
- Dryburgh, H. (2000). Underrepresentation of girls and women in computer science: Classification of 1990s research. *Journal of Educational Computing Research*, 23, 181-202.
- Femtec. (2002). *Introduction to Femtec: University-based career center for women Berlin, Inc.* Berlin, Germany: Femtec.
- Freeman, C.E. (2004). *Trends in educational equity of girls & women: 2004* (No. NCES 2005-016). Washington, D.C.: US Government Printing Office, US Department of Education, National Center for Education Statistics.
- Furhammer, I. & Isaksson, F. (1971). *Politics and film*. New York: Praeger.
- Genuter, B. (1995). *Television and gender representation*. London: John Libbey.
- Gerbner, G. (1976). *Television and its viewers: What social science sees*. Santa Monica: Rand Corp.
- Gerbner, G., Gross, L., Morgan, M. & Signorielli, N. (1994). Growing up with television: The cultivation perspective. In J. Bryant & D. Zillman (Eds.), *The cultivation perspective* (pp. 17-41). Hillsdale: Erlbaum.
- Gunter, B. (1995). *Television and gender representation*. London: John Libbey.
- Huang, G., Taddese, N. & Walter, E. (2000). *Entry and persistence of women and minorities in college science and engineering* (No. NCES 2001-601). Washington, DC: U. S. Government

Cultivating Greater Acceptance of Women in Technology

Printing Office, US Department of Education
National Center for Education Statistics.

Jacobs, J.A. (1999). The sex segregation of occupations. In G.N. Powell (Ed.), *Handbook of gender and work* (pp. 125-139). Thousand Oaks: Sage Publications.

Jones, M.G., Howe, A. & Rua, M.J. (2000). Gender differences in students' experiences, interests and attitudes toward science and scientists. *Science Education*, 84(2), 180-192.

Lacey, K. (1996). *Feminine frequencies: Gender, German radio, and the public sphere: 1923-1945*. Ann Arbor: University of Michigan Press.

Margolis, J. & Fisher, A. (2002). *Unlocking the clubhouse: Women in computing*. Cambridge: MIT Press.

McQueen, D. (1998). *Television: A media student's guide*. London: Arnold Press.

Mervis, J. (2000). Diversity: Easier said than done. *Science*, 289(5478), 378-379.

National Center for Research on Women. (2001). *Balancing the equation: Where are the women and girls in science, engineering, and technology?* New York: National Council for Research on Women.

Potts, R. & Martinez, I. (1994). Television viewing and children's beliefs about scientists. *Journal of Applied Development Psychology*, 15, 287-300.

Rosser, S.V. (1998). Applying feminist theories to women in science programs. *Signs*, 24, 174-200.

Schutz, A. (1932/1967). *The phenomenology of the social world*. Evanston: Northwestern University Press.

Seymour, E. (1999). The role of socialization in shaping the career-related choices of undergraduate women in science, mathematics, and engineering majors. In C.C. Selby (Ed.), *Women in science and engineering: Choices for success* (pp. 118-126). New York: The New York Academy of Sciences.

Signorielli, N. & Morgan, M. (1990). *Cultivation analysis: New directions in media effects research*. Newbury Park: Sage Publications.

Steinke, J. (1997). A portrait of a woman as a scientist: Breaking down barriers erected by gender role stereotypes. *Public Understanding of Science*, 6, 409-428.

Tuchman, G. (1978). The symbolic annihilation of women by the mass media. In G. Tuchman, A. Kaplan Daniels & J. Benet (Eds.), *Hearth and home: Images of women and the media* (pp. 3-17). New York: Oxford University Press.

Vavrus, M.D. (2002). *Postfeminist news: Political women in media culture*. Albany: State University of New York Press.

This work was previously published in the International Journal of Information and Communication Technology Education, edited by L. Tomei, Volume 3, Issue 1, pp. 22-35, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.22

Are Cross–Gender Conversations in Threaded Discussions Reminiscent of Communicating Across Cultural Boundaries?

David Gefen

Drexel University, USA

Nitza Geri

The Open University of Israel, Israel

Narasimha Paravastu

Central State University, USA

ABSTRACT

At the core of sociolinguistic theory is the recognition that men and women when engaging in an open conversation communicate differently because of their different respective social objectives in communication. Oral conversations are, according to sociolinguists, akin to cross cultural conversations and hence the tendency toward same-gender conversations. Extrapolating to the realm of threaded discussions in online courses,

these gender differences, it is hypothesized, should translate into mild gender segregation in the threaded discussions as well as men showing a greater proclivity to dominate the discussion. Data from 233 students in 27 courses support these hypotheses and allow a significant identification of the gender of the student based on whom they reference in the threaded discussion and the way they reference others. Implications on managing threaded discussions are discussed.

INTRODUCTION

Conversation is more than an exchange of words and the meaning they convey. A central part of conversation is to carry a social message and the relating social segregation this creates. Unconsciously, both men and women insert into their conversations a rich social message. The trouble is that men and women communicate with very different social objectives. So different can these objectives be that men and women may totally misunderstand the underlying meaning an opposite gender member is making. Typically, men, more than women, communicate with an objective of establishing and maintaining their social status, while women, more than men, communicate to broadcast rapport. The result is often a cross-cultural misunderstanding (Tannen, 1994). Often a direct consequence of these differing social objectives and cross-cultural misunderstandings is gender-segregated discussions, both in underlying meaning and in who talks to whom. In gender-segregated discussions, men prefer to talk to other men and women prefer to talk to other women. This is the basic premise of sociolinguistics (Yates, 2001).

The applicability of this idea, originally conceived in the socially rich context of oral conversations, to the Internet with its more lean social context has received some verification in recent years (Gefen & Ridings, 2005). Virtual communities in which people freely interact online as though they were interacting face to face in a social club exhibit much of the same gender-related behavior predicted by sociolinguistics. Men join these communities to gather and share information, while women do so to give and share social support. Moreover, although many virtual communities are voluntarily mostly single-gender communities, when men seek social support in virtual communities, they go to mixed-gender communities, supporting the typically stereotyped tendency of women to center their communica-

tion on the social side of things. Likewise, when women seek information, they go to mixed-gender communities, supporting the typically stereotyped tendency of men to center their communication on information exchange (Gefen & Ridings, 2005). These cross-gender boundary preferences portray the characteristic gender behavior observed in oral communication (Hannah & Murachver, 1999). And, across cultures, business-related e-mail messages, although generally not there to serve a social purpose, are perceived differently by men than by women, with women significantly sensing more social presence in these e-mails and as a result perceiving them as a more useful medium in their work (Gefen & Straub, 1997).

But whether and how this applies to online class settings remain open questions. These are important questions to answer because threaded discussions are among the most valuable activities in online classes (Levy, 2006). On the face of it, in the controlled social environment of an online class, threaded discussion and the limited power play available in these settings should make these gender tendencies, especially the need for social dominance by men and the voluntary gender segregation, rather mute. On the other hand, if these are indeed ingrained gender-based characteristics, as opposed to being socially and context oriented, then these gender tendencies should come through even in these very lean social settings. Moreover, and relating to the second part of the research question, the very controlled online class environment, with its dictated rules of conduct, makes many of the typical gender-related behaviors inapplicable. Nonetheless, how these behaviors may come through is the other open-ended question. The objective of this study is to empirically examine this and, in doing so, to raise the need to consider these gender differences in threaded discussion in online courses.

These issues are important. Although online learning has gained considerable growth in recent years, there are many student dropouts making

student retention a major concern (Rovai, 2002). One facet of the online threaded discussions is to replace of face-to-face class discussions and enhance learning. The other facet is overcoming the “loneliness of the long-distance learner” (Eastmond, 1995). Online discussions are aimed at solving this problem and increasing retention (Guri-Rosenblit, 2005). Hence, it is crucial to conduct these discussions effectively by creating the appropriate social atmosphere to support the online learning process.

The data, which examines some prominent gender differences in communication style embedded in the online discussions, show that men and women do generally communicate differently, and there is some preference for same-gender communication within the shared class threaded discussion, even in the socially lean and rigid environment of online course discussions. While there was no support to the hypothesis that women would show more empathy than men would, there was support for the hypothesis that men would show more socially dominating behavior. These effects while weak in the entire data became strong when examining only students who took advantage of the online conversations to engage with other students.

The contributions of this study are twofold, practically and theoretically. Practically, the study highlights the different conversational behavior men and women have also in online courses, giving instructors some idea of what to expect, hence how to better manage online courses. Theoretically, the study introduces sociolinguistics to the hitherto unstudied context of conversations in online courses, with their relative lean and controlled social environment, showing that while the empathy of women may not have extended to this context, men’s tendency to control the conversation as a way of showing social standing does. The paper discusses the implications of these findings on online learning and suggests directions for further research.

THEORY AND HYPOTHESES

Gender Communication Style Differences

Although communication is about the exchange of information, there almost always is also a strong social aspect that permeates conversation and that carries meaning beyond the actual words spoken and the direct meaning they convey. The social meaning embedded in conversation and the way it is understood, according to sociolinguists, are both to a large extent gender dependent. Men and women may speak what on the surface may be the same language, but the underlying social message is often very different. So different, in fact, that some sociolinguistics claim that cross-gender conversations are almost bound to be misunderstood. For example, when a woman says she wants to buy something, there often is a social message of inclusion and rapport permeating this statement. This social message may actually be at the core of the message, being more important than the information conveyed itself. It is a message of come share this idea with me and talk to me about it. But, many men might understand this message either as a matter of informing them of this purchase intention or as requesting permission, although neither of which were initially intended. Tannen (1994) exasperatedly and famously caught this cross-gender misunderstanding in her best-selling book with the telling title *You Just Don’t Understand*.

According to sociolinguistic theory, the basic gender difference in communication is that men communicate with the social objective of attaining and maintaining social status, while women communicate more to create rapport. Consequently, men try to control the conversation and are more critical of others, while women try to be inclusive and supportive (Kilbourne & Weeks, 1997; Mulac, Erlandson, Farrar, & Hallett, 1998; Tannen, 1994, 1995). This holds true across

cultures (Costa, Terracciano, & McCrae, 2001; Hofstede, 1980). These differences originally observed in oral conversations apply also to the Internet, to listservs (Herring, 1996b; Stewart, Shields, & Sen, 2001), to electronic commerce (Gefen, 2000), to the reason people join virtual communities (Gefen & Ridings, 2005), to their assessment of e-mail (Gefen & Straub, 1997), to why people use the Internet (Fallows, 2005), and to how they take computer training (Venkatesh & Morris, 2000). Supporting these conclusions, women, more than men, utilize email and the Internet to maintain social ties (Boneva, Kraut, & Frohlich, 2001; Parks & Floyd, 1995).

A second consequence of these gender differences is the preference, in some cases, to have same-gender conversations. Men generally prefer to talk to other men and women to other women. Considering the cross-cultural communication aspects of cross-gender communications, this is no surprise (Tannen, 1994). This preference can easily be seen in cocktail parties, but it also applies to virtual communities. This applicability to virtual communities is important because people can hide or masquerade their gender in these communities; nonetheless, some expected gender differences and the preference for same-gender conversations come through. Perhaps even more telling is that when people prefer cross-gender communications, it is in accordance with the stereotypical gender behavior. Men go to mixed communities because they want social support, a known female communication attribute, while women go to mixed communities when they want to concentrate on obtaining information, a known male communication attribute (Gefen & Ridings, 2005).

Online Course Discussions

These social segregations and misunderstandings in communication may seem rather amusing, and, indeed, Tannen's book (1994) was a best seller, but their repercussions are far reaching. Tannen

(1995) demonstrates how differences in conversational style may undermine women in the workplace by making them seem less competent and confident. A similar phenomenon was observed in classroom discussions (Tannen, 1991). These gender-related discourse differences also affect some aspects of the way people learn online. Notably men use online resources more often to obtain information, while women do so more often to communicate personal issues (Herring, 1993, 1996a; Yates, 2001). Unknown to them and with no bad intentions, students may bring these gender-related social messages into their class conversations, as people generally do into many of their conversations. The result of all this may be misunderstandings, which may impair the learning process. That is why it is imperative for online instructors to recognize these differences and realize their cross-gender differences.

One place where these misunderstandings may come about and have unintended consequences are in online courses. Online courses are courses taught through the Internet, where students download course materials online, send in their assignments electronically, and even take quizzes and exams online. An integral part of many of these online courses is the threaded discussion section. In the threaded discussion, the professor posts a question or topic for discussion, and the students are then expected, and are often graded on, to take part in an asynchronous discussion of this topic. As an integral part of this discussion, the students are expected not only to bring up their own ideas but also to discuss the ideas brought up in the postings of the other students. In the university where the data were collected, these conversations were weekly units with a new topic started once a week. These weekly topics would evolve during the week, much as a guided discussion in a face-to-face setting would, with new questions being posted to the students as older ones were discussed in full. Typically, there were around 20 students participating in each online class. Participation was graded.

HYPOTHESES

If these gender differences and segregation tendencies in communication, so highlighted in oral discourse (Crawford, 1995; Gray, 1992), are a matter of gender differences, rather than dependent on the type of media involved (Gefen & Straub, 1997), then some of these differences should also be evident in online courses. Specifically, in the case of the type of online course discussions that goes on in a threaded discussion, we would expect, extrapolating from sociolinguistics, to find that women will be more supportive of other threaded discussion participants, while men will be more critical. This is in accordance with women's reputed tendency to be inclusive and men's tendency to be controlling in conversation. Moreover, men do tend to try and control the conversation more than women do (Edelsky, 1993) and are more prone to try to create their superior social standing through the conversation (Tannen, 1994, 1995). Women, on the other hand, tend to encourage more participation by all involved and are less forceful toward other participants (Weatherall, 1998), encourage cooperation (Coates, 1986), and are more complementary (Coates, 1986; Yates, 2001). Moreover, men tend to be more aggressive and competitive in their speech (Kilbourne & Weeks, 1997) and to interrupt others more (Anderson & Leaper, 1998; West & Zimmerman, 1983; Zimmerman & West, 1975) in an attempt to be dominant in the conversation (Herring, 1993; Holmes, 1992).

Taken together, this should translate to women being more supportive of others in the conversation as a way of being inclusive, paying complements, and being encouraging, while men should be more critical of others as a way of showing their domination, higher social standing, and generally being more competitive, especially as this could downplay the importance of others (Tannen, 1994).

H1: Women will be more supportive of others in the threaded discussions.

H2: Men will be more critical of others in the threaded discussions.

In the context of these gender-related communication characteristics, the reputed same-gender congregation tendency should also be evident in threaded discussions. In oral conversations cross-gender conversations are akin to cross-cultural conversations, hence, there is a tendency toward same-gender conversations (Tannen, 1994). If this applies also to online courses, then this tendency should carry over also to threaded discussions. Practically, this means that there should be more references by men to previous postings by men and more references by women to previous postings by women. Indeed, in virtual communities there is such a preference with many communities being almost all men or all women (Gefen & Ridings, 2005).

H3: There will be more references to previous postings by same-gender students in the threaded discussion, than to posting by members of the other gender.

If these tendencies are as pronounced in threaded discussions as they are in oral discourse, then just as in oral discourse where conversation styles could be a predictor of the person's gender (Hannah & Murachver, 1999), styles should be a predictor of gender in a threaded discussion too.

H4: Student gender can be identified by the supportiveness and criticism in the posting.

RESEARCH METHODOLOGY

Examining threaded discussion postings in online courses, this study answers these two questions.

A large number of courses and their online discussion components were examined. The content of the threaded discussion in these courses was copied and then classified. In all, 1,335 postings in 27 courses by 233 individuals were classified. Each posting was initially classified based on whether it referred to previous postings by other students. If the posting did refer to a previous posting, then it was recorded as to whether the posting agreed or disagreed with the postings to which it referred and whether it related to the person who posted the referred to posting by name. The data were classified by two raters with a 100% agreement between them during the training period on the actual data.

DATA ANALYSIS

Hypotheses H1, H2 and H3 were examined with T tests. These are shown in Table 1, together with general statistics. There is no significant difference in the percent of supportive, agreeing, or disagreeing messages. Neither H1 nor H2 are supported, although men did post more and longer messages, possibly related to an attempt attributed to men in the literature to try and dominate the conversation (Edelsky, 1993).

A more detailed analysis of Table 1, however, shows a more complex picture. Men refer back more often to men and women more often to other women. In doing so, the women agree more with other women, and the men are more supportive of other men. This supports H3. Practically then, while the anticipated typical gender behaviors were not evident in the data, what was evident was a gender-oriented group boundary of the kind one typically comes across at a cocktail party. Women communicate more with other women and men more with other men. Interestingly, Gefen and Ridings (2005) came to much the same conclusion when analyzing voluntary participation in virtual communities.

Hypothesis 4 was examined by verifying whether the gender of the poster could be significantly classified based on the nature of the reference to previous posters. Based on these 1,335 postings the logistic regression did significantly ($\chi^2_8=8.951$, $p=.346$)¹, albeit weakly (Nagelkerke $R^2=3.8\%$) identify 56% of the students' gender correctly. This weak result is not surprising. Many students in online courses do not refer back to postings by other students, so identifying the gender of the student by typical gender communication style with others should be mostly weak. Nonetheless, the data did show some characteristic communication behavior, even in these data. Men were significantly identified by having longer postings ($\beta=.002$, $p<.001$) and referring to women by name significantly less than women did ($\beta=-.372$, $p=.002$). Trying to control the conversations by speaking longer is a typical male trait (Herring, 1993, 1996b), and men do tend to interrupt others (Anderson & Leaper, 1998; Coates, 1986). In this case, since the conversation is asynchronous, the equivalent of interruption is downplaying the contribution of others.

The data was then reanalyzed but only including those postings where students referred back to postings by others. Since this type of posting corresponds more readily to the equivalent of a discussion, rather than a monologue, we expected the results to be much stronger in this case, as indeed they were. Based on the 401 postings of students who did refer back to other students at least once in their posting, the results of the logistic regression did significantly ($\chi^2_8=9.043$, $p=.339$), albeit still rather weakly (Nagelkerke $R^2=7.4\%$) identify 58% of the respondents' gender correctly. Again, the data showed some characteristic communication behavior but in a more pronounced manner. Men significantly referred more to postings by other men by name ($\beta=.550$, $p<.001$) and agreed less often with them ($\beta=-.362$, $p=.032$). This tendency to prefer to communicate with same-gender others resembles findings about virtual

Cross-Gender Conversations in Threaded Discussions

Table 1. Group statistics

| | | All the data (1,335 postings) | | | Those who referred back to others at least twice (162 postings) | | |
|--|-------|-------------------------------|--------|-------------|---|--------|-------------|
| | | Mean | Std. | T-statistic | Mean | Std. | T-statistic |
| Total length in words | Women | 292.90 | 175.05 | -4.36** | 400.71 | 184.01 | -2.48* |
| | Men | 343.54 | 205.07 | | 480.84 | 202.18 | |
| Number of postings | Women | 2.58 | 1.71 | -2.70** | 4.05 | 2.02 | -2.06* |
| | Men | 2.92 | 2.32 | | 4.82 | 2.41 | |
| Percent of supportive messages | Women | 9.1% | 0.29 | 0.463 | 0.37 | 0.49 | 1.68 |
| | Men | 8.4% | 0.28 | | 0.25 | 0.43 | |
| Percent of disagreeing messages | Women | 5.4% | 0.23 | 0.246 | 0.28 | 0.50 | 0.88 |
| | Men | 5.1% | 0.22 | | 0.22 | 0.49 | |
| Percent of agreeing messages | Women | 19% | 0.40 | 1.89 | 0.49 | 0.50 | 1.43 |
| | Men | 15% | 0.36 | | 0.38 | 0.49 | |
| How many of these postings referred explicitly to postings by others | Women | 0.54 | 0.96 | -0.16 | 2.58 | 0.98 | -1.74 |
| | Men | .55 | 1.07 | | 2.91 | 1.17 | |
| How many postings relate to postings by men by name | Women | 0.31 | 0.65 | -1.91 | 1.42 | 0.96 | -3.74** |
| | Men | 0.40 | 0.86 | | 2.12 | 1.24 | |
| How many postings relate to postings by women by name | Women | 0.21 | 0.58 | 2.08* | 1.02 | 1.11 | 1.78 |
| | Men | 0.15 | 0.47 | | 0.73 | 0.94 | |
| How many of these postings to men are supportive in tone | Women | 0.08 | 0.31 | -.198* | 0.42 | 0.65 | -2.33* |
| | Men | 0.13 | 0.47 | | 0.76 | 1.00 | |
| How many of these postings to women are supportive in tone | Women | 0.05 | 0.22 | 1.26 | 0.23 | 0.46 | 2.42* |
| | Men | 0.03 | 0.21 | | 0.08 | 0.33 | |
| How many of these postings to men agree with others | Women | 0.20 | 0.56 | 0.13 | 1.02 | 1.08 | 0.20 |
| | Men | 0.20 | 0.55 | | 0.98 | 1.08 | |

Table 1. continued

| | | | | | | | |
|---|-------|------|------|-------|------|------|-------|
| How many of these postings to women agree with others | Women | 0.13 | 0.40 | 1.97* | 0.51 | 0.76 | 0.27 |
| | Men | 0.09 | 0.37 | | 0.47 | 0.84 | |
| How many of these postings disagree with men | Women | 0.04 | 0.19 | -1.32 | 0.21 | 0.41 | -1.20 |
| | Men | 0.06 | 0.30 | | 0.33 | 0.71 | |
| How many of these postings disagree with women | Women | 0.02 | 0.14 | -0.99 | 0.11 | 0.31 | -1.24 |
| | Men | 0.03 | 0.21 | | 0.19 | 0.50 | |

communities where men and women tend mostly to congregate in same-gender communities (Gefen & Ridings, 2005), as in H3. This tendency of men to agree less with other men is also in agreement with theory about oral discourse, where men are supposed to be more motivated to compete with other men for social dominance (Tannen, 1994, 1995) and downplay the contribution of others in an attempt to bolster their own social standing (Kilbourne & Weeks, 1997).

This pattern is even stronger once the analysis was limited to only those who referred back to others at least twice. Here the results became much stronger. Limiting the analysis to these 162 postings, the logistic regression did significantly ($\chi^2_8=6.819, p=.556$) and rather strongly (Nagelkerke $R^2=25\%$) identify 66% of the respondents' gender correctly. As before, the data showed some characteristic communication behavior but in a more pronounced manner. Men significantly referred more to postings by other men by name ($\beta=.837, p<.001$) and agreed less often with them ($\beta=-.470, p=.022$). H4 was supported.

DISCUSSION

Summary of Results

Men and women also communicate differently in threaded discussions. Apparently, the dictated nature of the conversation in an online course does not support the typical gender behaviors, which are so evident in oral discourse and virtual communities. But, nonetheless, the conversational behavior of men and women is still sufficiently different, primarily in preferring same-gender references, that the gender of a student can be identified based on this behavior. Also, men tend to refer more to postings by other men and are more supportive of other men, while women refer more to postings by other women and are more supportive of other women. These tendencies are evident especially when the analysis focuses on those students who refer more to others. Although it would be an exaggeration to say there are two separate discussions going on, men-to-men and women-to-women, there are some signs of a slight tendency in this direction. This is interesting

because overall men and women are on average about as supportive, agreeing, and disagreeing with other students if the gender of the other student is not included in the analyses. In other words, even in the pedagogically controlled setting of online courses, there are gender effects.

Limitations

Online courses and the way they are taught are not cast in a mold. As courses generally do, online courses differ in the way they are taught and are influenced by the personality of the online instructors. Thus, the results and conclusions of this exploratory study with its convenience sample should be understood as such. The data raise the need to consider these interesting implications and warrant additional research. Whether the results can be generalized to other online course environments depends on additional research and many more samples.

Implications to Theory

The theoretical contribution of this study is in its initial validation of the need to consider the gender mix of classes, even when they are online, and by bringing in sociolinguistics theory, which explains this in online course threaded discussion settings. Much more research is needed to establish exactly how sociolinguistics applies to this setting, to better understand how the gender mix affects online classes, and exactly what online instructors and course designers need to do to make the online threaded discussion more successful. But this study does verify this need. Gender implications also apply in an online course environment.

The following discussion presents some questions that arise from our findings and suggests directions for further research. The first question is does the gender mix in an online class matter? More specifically, now that this study has shown that the gender mix does make a difference in

how students participate in online discussions, the question becomes how does this gender mix affect the quality of student learning and student satisfaction with online courses? This question then ties into the next crucial question: What impact does this have on student retention? Considering what the gender mix does in regular classroom settings (Felder, Felder, Mauney, Hamrin, & Dietz, 1995), it is quite possible that this gender mix effect might negatively affect students, therefore, it should be recognized at least. This study takes the first step in that direction by showing that there is such a gender effect and by suggesting a possible theory base which, in part, explains it.

The role of the course instructor in shaping the social atmosphere in online discussions and its influence on the conversational style of students is another important question that requires further research. As Salmon (2004, p.4) explains, students' experience is central to knowledge construction, and the electronic moderator (e-moderator) is essential in promoting constructive communication. She also encourages e-moderators to pay attention to cultural differences, regarding styles of address, hierarchy, and authority; attitudes towards gender, criticism; the proper ways of asking and answering questions; personal disclosure; and even the names that students use (Salmon, 2004, p.157-159). It is still an open question exactly how this can be done in an online course, but some ideas can be borrowed from other settings. As Tannen (1991) reports regarding nononline class settings, women respond differently to challenges during class discussions and are relatively silent, but they can be encouraged to participate with open-ended questions. Whether this applies to online discussions requires more research.

Implications to Practice

Men and women do communicate differently, therefore, in certain cases, they prefer gender-segregated communications (Tannen, 1994). The same applies with online virtual communities

(Gefen & Ridings, 2005). As this study shows, to some extent, this tendency also applies to online courses with threaded discussions. Being aware of this could help instructors facilitate better threaded discussions. While this preference by students to relate more to same gender students may not interfere with their or with others' learning experiences, it might spoil the online course social atmosphere, if a student feels relatively ignored or not supported enough by his or her cohorts. After all, communication is of paramount importance in learning.

Understanding this student proclivity to cluster in their threaded discussions in same-gender subgroups should be considered when managing these discussions, especially because one of the main advantages of online courses is in the way that they allow reticent students to actively participate in the course discussions. However, as this study findings show, even in the lean environment of threaded discussions, there are conversational-style gender differences that may imperil this advantage.

This actually is not so surprising, apparently, even the perceived gender of the computer itself, manifested by its sound being based on a male or a female narrator, is enough to elicit typical responses associated with this artificial gender manipulation (Nass, Moon, & Green, 1997). Likewise, associating a computer-generated message with a cartoon representation of a man or a woman elicited the same type of gender response. People are more inclined to accept the answer given by the computer when the gender of the computer-generated cartoon giving this answer matches gender stereotypes: people were more accepting of answers about sports when given by a male cartoon and more accepting of answers about fashion when given by a female cartoon (Lee, 2003).

Being aware of the student and his or her unique needs is a hallmark of good teaching. Although arguably this is much harder in an online course than in a regular classroom, nonetheless, at least

this gender aspect is something online instructors can and should consider. Controlling the online conversation and discreetly, but directly, focusing the positive discussion on a student who might otherwise have been relatively ignored because of these same gender preferences is one way of doing so. Creating smaller and mixed-gender teams is another method instructors in online courses can apply. Such a method directly utilizes one of the great advantages of online courses and may make the online environment more conducive to overcoming these same-gender preferences than other teaching environments.

CONCLUSION

Sociolinguists typify cross-gender communication as almost a cross-cultural experience. Our data do not quite support such a view but do show certain patterns of online communication in threaded discussion of which instructors should be aware. The expression birds of a feather flock together applies when it concerns the gender of online students. Students prefer to relate to other students of their own gender. Instructors should seek ways to use the flexibility and unique capabilities of online courses to better serve their students, recognizing these gender preferences.

REFERENCES

- Anderson, K. J., & Leaper, C. (1998). Meta-analyses of gender effects on conversational interruption: Who, what, when, where, and how. *Sex Roles, 39*(3/4), 225-252.
- Boneva, B., Kraut, R., & Frohlich, D. (2001). Using e-mail for personal relationships: The difference gender makes. *American Behavioral Scientist, 45*(3), 530-549.
- Coates, J. (1986). *Women, men and languages: Studies in language and linguistics*. London: Longman.

- Costa, P. T. J., Terracciano, A., & McCrae, R. R. (2001). Gender differences in personality traits across cultures: Robust and surprising findings. *Journal of Personality and Social Psychology*, 81(2), 322-331.
- Crawford, M. (1995). *Talking difference. On gender and language*. London.: Sage.
- Eastmond, D. V. (1995). *Alone but together: Adult distance study through computer conferencing*. Cresskill, NJ: Hampton Press.
- Edelsky, C. (1993). Who's got the floor? In D. Tannen (Ed.), *Gender and conversational interaction* (pp. 189-227). New York: Oxford University Press.
- Fallows, D. (2005). *How women and men use the Internet*. Retrieved December 28, 2005, from http://www.pewinternet.org/PPF/r/171/report_display.asp
- Felder, R. M., Felder, G. N., Mauney, M., Hamrin, C. E. J., & Dietz, E. J. (1995). A longitudinal study of engineering student performance and retention. III. Gender differences in student performance and attitudes. *Journal of Engineering Education*, 84(2), 151-174.
- Gefen, D. (2000). Gender differences in the perception and adoption of e-mail and computer-mediated communication media: A sociolinguistics approach. In A. Kent (Ed.), *The encyclopedia of library and information science* (Vol. 69) (pp. 139-153). New York: Marcel Dekker, Inc.
- Gefen, D., & Ridings, C. (2005). If you spoke as she does, sir, instead of the way you do: A sociolinguistics perspective of gender differences in virtual communities. *The DATA BASE for Advances in Information Systems*, 36(2), 78-92.
- Gefen, D., & Straub, D. W. (1997). Gender differences in perception and adoption of e-mail: An extension to the technology acceptance model. *MIS Quarterly*, 21(4), 389-400.
- Gray, J. (1992). *Men are from Mars, women are from Venus*. New York: HarperCollins.
- Guri-Rosenblit, S. (2005). Eight paradoxes in the implementation process of e-learning in higher education. *Higher Education Policy*, 18(1), 5-29.
- Hannah, A., & Murachver, T. (1999). Gender and conversational style as predictors of conversational behavior. *Journal of Language and Social Psychology*, 18(2), 153-174.
- Herring, S. C. (1993). Gender and democracy in computer mediated communication. *Electronic Journal of Communication*, 3(2) Retrieved July 29, 2006 from <http://www.cios.org/www/ejc/v3n293.htm>
- Herring, S. C. (1996a). Posting in a different voice: Gender and ethics in computer-mediated communication. In C. Ess (Ed.), *Philosophical perspectives on computer-mediated communication* (pp. 115-145). Albany: State University of New York Press.
- Herring, S. C. (1996b). Two variants of an electronic message schema. In S. C. Herring (Ed.), *Computer-mediated communication linguistic, social and cross-cultural perspectives* (pp. 81-106). Amsterdam/Philadelphia: John Benjamins Publishing Company: Philadelphia, PA.
- Hofstede, G. (1980). *Culture's consequences: International differences in work related values*. London: Sage.
- Holmes, J. (1992). Women's talk in public contexts. *Discourse and Society*, 3(2), 131-150.
- Kilbourne, W., & Weeks, S. (1997). A socio-economic perspective on gender bias in technology. *Journal of Socio-Economics*, 26(1), 243-260.
- Lee, E.-J. (2003). Effects of "gender" of the computer on informational social influence: The moderating role of task type. *International Journal of Human-Computer Studies*, 58, 347-362.

- Levy, Y. (2006). The top 10 most valuable online learning activities for graduate MIS students. *International Journal of Information and Communication Technology Education*, 2(3), 27-44.
- Mulac, A., Erlandson, K. T., Farrar, W. J., & Hallett, J. S. (1998). Uh-huh. What's that all about? Differing interpretations of conversational backchannels and questions as source of miscommunication across gender boundaries. *Communication Research*, 25(6), 641-668.
- Nass, C., Moon, Y., & Green, N. (1997). Are computers gender-neutral? Gender stereotypic responses to computers. *Journal of Applied Social Psychology*, 27, 864-876.
- Parks, M. R., & Floyd, K. (1995). Making friends in cyberspace. *Journal of Computer Mediated Communication* 1(4), Retrieved July 29, 2006 from <http://jcmc.huji.ac.il/vol1/issue4/vol1no4.html>. pp. 80-97.
- Rovai, A. P. (2002). Building sense of community at a distance. *International Review of Research in Open and Distance Learning*, 3(1), www.irrodl.org/index.php/irrodl/article/viewPDFInterstitial/79/153
- Salmon, G. (2004). *E-moderating: The key to teaching and learning online* (2nd ed.). London: RoutledgeFalmer, Taylor and Francis Group.
- SPSS. (2004). *SPSS 13.0 for Windows*. SPSS Inc., Chicago.
- Stewart, C. M., Shields, S. F., & Sen, N. (2001). Diversity in on-Line discussions: A study of cultural and gender differences in listervs. In C. Ess & F. Sudweeks (Eds.), *Culture, technology, communication: Towards an intercultural global village* (pp. 161-186). Albany: State University of New York Press.
- Tannen, D. (1991). Teachers' classroom strategies should recognize that men and women use language differently. *The Chronicle of Higher Education* 37, B1-B3.
- Tannen, D. (1994). *You just don't understand: women and men in conversation*. New York: Ballantine Books.
- Tannen, D. (1995). The Power of talk: Who gets heard and why. *Harvard Business Review*, 73(5), 138-148.
- Venkatesh, V., & Morris, M. G. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS Quarterly*, 24(1), 115-139.
- Weatherall, A. (1998). Re-visioning gender and language research. *Women and Language*, 21(1), 1-9.
- West, C., & Zimmerman, D. (1983). Small insults: A study of interruptions in cross-sex conversations between unacquainted persons. In B. Thorne, H. Kramarae, & N. Henley (Eds.), *Language, gender and society* (pp. 103-118). Rowley; Newbury House: Massachusetts.
- Yates, S. J. (2001). Gender, language an CMC for education. *Learning and Instruction*, 11(1), 21-34.
- Zimmerman, D., & West, C. (1975). Sex-roles, interruptions and silences in conversation. In B. Thorne, H. Kramarae, & N. Henley (Eds.), *Language and sex: Difference and dominance* (pp. 89-101). Rowley: Newbury House: Massachusetts.

ENDNOTE

- ¹ The Hosmer and Lemeshow Chi Square test shows good fit when the p-value is insignificant (SPSS, 2004).

This work was previously published in the International Journal of Information and Communication Technology Education, edited by L. Tomei, Volume 3, Issue 2, pp. 60-71, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 7.23

The Paleolithic Stone Age Effect?

Gender Differences Performing Specific Computer-Generated Spatial Tasks

Geoffrey S. Hubona

Georgia State University, USA

Gregory W. Shirah

National Aeronautics and Space Administration, USA

ABSTRACT

Most computer applications feature visual user interfaces that assume that all users have equivalent propensities to perceive, interpret, and understand the multidimensional spatial properties and relationships of the objects presented. However, the hunter-gatherer theory (Silverman & Eals, 1992) suggests that there are modern-day differences between the genders in spatial and cognitive abilities that stem from differentiated prehistoric sex roles. If true, there may be discrepancies in how males and females differentially utilize particular spatial visual cues and interface features. We report three experiments in which participants engage in visual spatial tasks using 2D and 3D virtual worlds: (1) matching object shapes; (2) positioning objects; and (3) resizing objects.

Female subjects under-perform male subjects in the matching and positioning experiments, but they outperform male subjects in the resizing experiment. Moreover, male subjects make more use of motion cues. Implications for the design of gender-effective user interfaces and virtual environments are considered.

INTRODUCTION

A perennial trend in the evolution of computer technology relates to the ever-increasing power of hardware and the resulting burgeoning possibilities to develop more complex software. These trends have enabled the proliferation of more specialized and powerful computer applications that support users in a wide variety of personal

The Paleolithic Stone Age Effect?

and professional tasks. Associated with these trends are multiple challenges: (1) to make the presentation of geometrically increasing amounts of data ever more concise; and (2) to condense, convey, and present larger and larger volumes of useful information using smaller and smaller spaces. To meet these challenges, new and creative approaches to the design of visual user interfaces have emerged, many that present complex, multidimensional data sets and relationships into condensed visual forms and spaces.

Unfortunately, an implicit assumption in the design of commonplace visual user interfaces is that preponderant portions of the existing user population have similar abilities to cognitively perceive, process, interpret, and ultimately understand the intended visual and spatial properties of the objects presented. Yet, it is known that certain measures of spatial cognition are correlated with performance in user interface tasks (Cockburn, 2004). As an example of how individual perceptual differences can affect user interface design, professional Web designers are aware of color blindness patterns¹ in the general population that affect the ability to correctly perceive color-encoded information. As a result, professional designers of high-traffic Internet Web sites avoid these color blindness traps in order to enhance the universal usability of the sites.

Clearly, the assumption of equivalent user capabilities runs the risk of impairing the usability of visual interfaces that ignore broad, existing population anomalies in spatial cognitive and task performance abilities. Through the process of evolutionary natural selection, the hunter-gatherer theory (Silverman & Eals, 1992) ties modern-day, gender-based differences in certain cognitive, spatial abilities back to sharply differentiated sex roles from prehistoric times. Also, it is recognized in behavioral research communities that there are innate differences between the male and female genders related to cognitive spatial abilities (Kimura, 2000; Linn & Petersen, 1985; Voyer, Voyer, & Bryden, 1995). These gender differences

may directly impact the ability to perceive, interpret, and cognitively process spatial properties and spatial relationships of multiple visual objects presented on a computer screen. Thus, there may be fundamental differences between the genders with respect to the ability to use certain visual user interface features, particularly when these features relate to the perception of depth and to the spatial relationships of objects and scenes presented at varying levels of intended depth.

In this article, we review theory and empirical studies relating to (1) gender and human computer interaction and (2) gender differences in innate spatial cognitive and task performance abilities. We then describe three experiments that examine gender-based performance differences in object matching, positioning, and size estimation tasks using two-dimensional (2D) and three-dimensional (3D) virtual worlds. The observed gender performance differences are discussed with respect to applicable theory and with respect to the design of gender-neutral user interfaces and virtual environments.

THEORY AND BACKGROUND

Gender and Human-Computer Interaction

Researchers long have acknowledged the relevance of gender as impacting human computer interaction. Gender has been noted as a broad issue affecting computer skills and computer design issues (Balka, 1996). Gender has been recognized as an important consideration for the design of user interfaces (Leventhal, Teasley, & Stone, 1994) and display techniques (Shneiderman, 1990) and as an issue relevant to achieving universal usability among diverse users of Web-based computer services (Shneiderman, 2000). Gender has been related to the process of decision making, to preferences for investment models, and consequently, as an important consideration

in the design of financial (Palma-dos-Reis & Zahedi, 1999) and organizational decision support systems (Powell & Johnson, 1995) for men and women. It has been shown that there are different perceptions and preferences between men and women with respect to the use and satisfaction with different features of electronic commerce Web sites (Simon, 2001).

Numerous researchers have noted differences between the genders while interacting with computers. For example, it has been shown that boys and girls think differently about computers (Hall & Cooper, 1991; Wilder, Mackie, & Cooper, 1985), and that boys and girls have different motivations for using computers (Inkpen et al., 1994; Uptis & Koch, 1996). Moreover, gender-specific preferences for computer interface features and usage styles also have been documented (Lockheed, 1985). Hinckley, Pausch, Proffitt, and Kassell (1998) reported that females were faster than males performing a two-handed, 3D neurosurgical visualization (manipulation) task, and it has been suggested that females outperform males at certain dexterity tasks (Halpern, 1986; Hinckley, Pausch, Proffitt, Patten, & Kassell, 1997).

However, some studies have found no gender differences while interacting with computers. For example, Inkpen (2001) found no boy-girl differences in children's interaction styles with point-and-click as compared to drag-and-drop interfaces. In addition, Rieman (1996) found no significant gender impact on the number of reported exploratory learning discoveries using new systems.

One area of HCI that has examined closely the gender performance differences is with respect to the exploration, use, and navigation of virtual reality (VR) and virtual environment (VE) applications. Investigating gestural input techniques for multimodal and virtual environment applications, Wexelblat (1995) reported that gender was not a reliable predictor of gesture frequency for subjects describing movie scenes. Basdogan, Ho, Srinivasan, and Slater (2000) found that female

subjects engaged in haptic communication in shared virtual environments (SVEs) reported higher levels of sense of togetherness in performing a collaborative task with an unseen partner than did male subjects. Kauppinen, Kivimaki, Era, and Robinson (1998) argued that gender differences in interacting with others in Collaborative Virtual Environments (CVEs) can be traced to broader, societal-driven, gender-specific, identity distinctions that are also witnessed in natural, non-computer-mediated interactions.

Waller, Hunt, and Knapp (1998) suggested that the transfer of spatial knowledge in virtual environment training is responsible for males outperforming females in computer-generated environments. Similarly, other studies have reported men outperforming women (Astur, Ortiz, & Sutherland, 1998) and making use of different cues than women (Sandstrom, Kaufman, & Huettel, 1998) in navigating virtual worlds. Tan, Robertson, and Czerwinski (2001) reported that men completed 3D virtual environment navigation tasks more quickly than women while using smaller, 15-inch displays, but that this male performance advantage disappeared when using larger, 39-inch displays. Subsequently, Czerwinski, Tan, and Robertson (2002) extended this work with two navigation studies. The first study replicated their findings that a wider field of view combined with a large display reduces gender performance biases. Their second study demonstrated that wider fields of view assist females' performances in navigating virtual worlds that are densely populated with objects.

Gender Differences in Spatial Abilities

Innate gender differences in mental spatial abilities generally are identified as the basis for gender disparities in performing spatial tasks (Kimura, 2000; Linn & Petersen, 1985; Voyer et al., 1995). Certain meta-analytic studies (Linn & Petersen, 1985; Voyer et al., 1995) do indicate a male ad-

vantage on particular cognitive spatial tests, but individual studies' results are inconsistent in this regard. Further, the different studies often use varying test instruments to measure spatial abilities. Linn and Petersen (1985) categorized the various instruments reported in the literature into three distinct groups: those that measure (1) spatial perception, (2) mental rotation, and (3) spatial visualization. Spatial perception is described as the ability to determine spatial relations despite distracting information. Mental rotation refers to the ability to rotate quickly and accurately two- or three-dimensional figures in imagination. Spatial visualization is the ability to manipulate complex spatial information when several stages are needed to produce the correct solution. These meta-analyses (Linn & Petersen, 1985; Voyer et al., 1995) conclude that men score higher than women on spatial perception and mental rotation cognitive tests, but that neither gender has higher scores on spatial visualization cognitive tests.

The hunter-gatherer theory of the origin of sex-specific spatial attributes (Silverman & Eals, 1992) is one prominent theory that offers an evolutionary perspective on gender differences in modern-day spatial abilities. This theory suggests that men and women have different present-day cognitive skill predispositions that relate to handling differentiated sex role aspects from prehistoric times. Prehistoric females, or gatherers, who could effectively forage for food, and who were successful at keeping track of relationships, activities, objects, locations, and landmarks near their habitats, were superior at acquiring resources for bearing and raising offspring. On the other hand, prehistoric males, or hunters, who could travel better in unfamiliar territory, estimate distance, and navigate with a bird's-eye view orientation, were, as a consequence, more successful at hunting, competing with other males, finding mates, and, thus, fathering offspring.

The hunter-gatherer theory suggests that these male-female cognitive predispositions persist today through the process of natural evolutionary

selection. As evidence supporting this theory, it has been shown that contemporary females outperform men on spatial tasks related to foraging-related activities, such as remembering the location of objects (e.g., landmarks) in their environment (Dabbs, Chang, Strong, & Milun, 1998). Moreover, it has been demonstrated that women outperform men at keeping track of objects and in finding objects that are lost (Eals & Silverman, 1994; Silverman & Eals, 1992). In addition, studies have shown that women remember the locations of previously viewed items better than men (McBurney, Gaulin, Devineni, & Adams, 1997), and that women outperform men remembering the locations of specific objects (James & Kimura, 1997). In contrast, men typically outperform women at spatial tasks manipulating objects in space (Collins & Kimura, 1997; Goldstein, Haldane, & Mitchell, 1990; Kimura, 1983; Kolb & Wishaw, 1990; Linn & Petersen, 1985; Lohman, 1986; Maccoby & Jacklin, 1974). Other studies have demonstrated that men have more adept mental rotation spatial abilities than women (Dabbs et al., 1998; Silverman, Choi, Mackewn, Fisher, Moro, & Olshansky, 2000), purportedly as an evolutionary artifact of the ability to pursue an animal through unfamiliar terrain and then expeditiously find their way home.

METHOD

Hypotheses and Experimental Tasks

We report three experiments performing spatial tasks using 2D and 3D virtual worlds: object matching, object-positioning, and object resizing. The object-matching experiment was designed largely to tap mental rotation abilities (Linn & Petersen, 1985). The object-positioning and resizing experiments were designed to tap spatial visualization abilities (Linn & Petersen, 1985). Commensurate with the spatial abilities literature, we expect men to outperform women

in the object-matching task, but there should be no male-female performance differences in the object-positioning/resizing tasks. Consequently, we propose the following two hypotheses:

- H1: Male subjects will outperform female subjects matching objects using a mental rotation paradigm.
- H2: Male and female subjects will exhibit equivalent performances positioning and resizing objects.

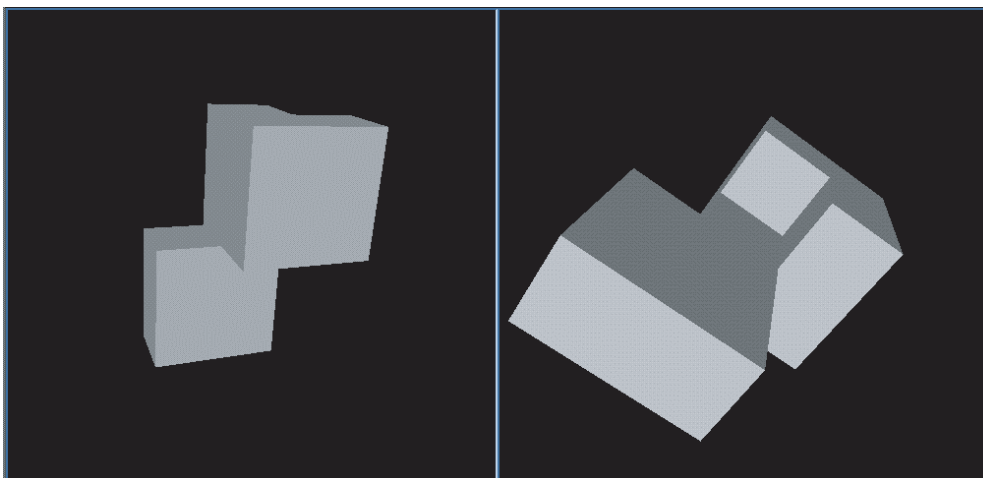
Object-Matching Experiment. The object-matching experiment was based on the mental rotation paradigm first developed by Shepard and Metzler (1971). Viewing successive pairs of object images presented from different angles, the task was to judge as accurately and as quickly as possible whether the two images represented identical or different objects. For example, Figure 1 shows a typical object-matching image pair. As quickly as the subject could judge whether the split-screen image pair represented the same or different objects, she or he clicked a corresponding same or different button on the interface, causing the next image pair trial to be presented. Exactly

one-half of the 208 randomly presented image pairs represented identical objects, and the other half showed non-identical objects in the pair.

One-half of all trials were viewed by the men and women subjects in stereo, using 3D Crystal-Eyes™ glasses. The remaining trials were viewed in 2D (monoscopically). The left object image in each trial was always stationary, while the right image was always capable of motion and, specifically, two kinds of motion: (1) in one-half of the trials, subjects could control the motion of the right object image by rotating it in any direction for 360 degrees around the center; and (2) in the remaining trials, the right object always rotated automatically in a fixed and random direction about the center point, rotating at a constant speed of approximately 18 degrees per second. The measured performance variables included error rate, the percentage of incorrect matching responses, and response time, measured in milliseconds.

Seventeen males and 14 female subjects volunteered to participate in the object-matching experiment. All subjects were employees or contractors of the Goddard Space Flight Center in Greenbelt, Maryland. Subjects with corrected vision wore

Figure 1. Object-matching image pair



The Paleolithic Stone Age Effect?

their eyeglasses underneath the stereoscopic viewing glasses. All subjects had professional occupations and included engineers, computer programmers, and computer scientists. The mean age of the subjects was 34.97 years with 4.48 mean years of education beyond high school, 17.03 mean years of computer experience, and 12.65 mean years of professional work experience.

Object-Positioning Experiment. The object-positioning task consisted of subjects viewing computer-generated virtual worlds containing three identically sized spherical objects suspended in 3D space (see Figures 2 and 3). As quickly and accurately as possible, subjects were asked to reposition a target object in order to complete a straight line vector configuration defined by three spheres positioned at equal distances from each other. For example, Figure 2 shows a typical initial scene presented at the beginning of a positioning trial. Subjects would fly the object to be repositioned within the virtual world using a (six-degrees-of-freedom) spaceball input device. When satisfied that they had correctly positioned the misplaced object, they pressed a button on the spaceball that recorded their performance data in an output file and caused the next world to appear

immediately. Figure 3 shows the correct (solution) placement of the spheres for the initial trial scene presented as Figure 2. Note that correctly performing the positioning task required subjects to locate the displaced object in three dimensions: x (left and right); y (up and down); and z (toward and away from the viewer). One hundred and forty-four unique worlds were presented to each subject in random order.

Thirty volunteer subjects, 14 female and 16 male, participated. All had professional occupations as computer programmers, analysts, and scientists at the Goddard Space Flight Center. The subjects' mean age was 35.03 years, with 5.53 mean years of education beyond high school, 17.07 mean years of computer experience, and 13.12 mean years of professional work experience.

One-half of all positioning trials was viewed stereoscopically using 3D CrystalEyes™ glasses, while the remaining trials were viewed in 2D (monoscopically) without wearing the glasses. Because subjects wore the glasses to view scenes in 3D, the stereo and mono trials were presented in cohesive blocks of 72 scenes each. The starting order for presenting the stereo and mono blocks was alternated between subjects.

Figure 2. Initial positioning scene trial

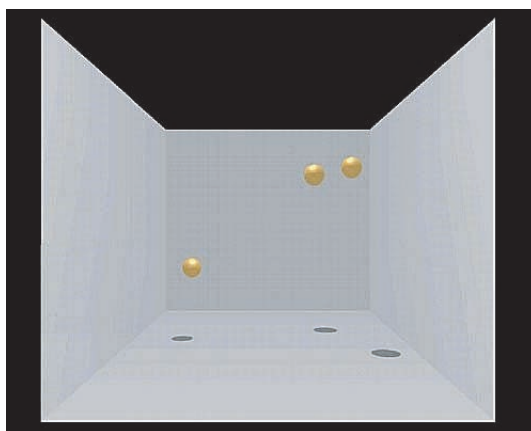
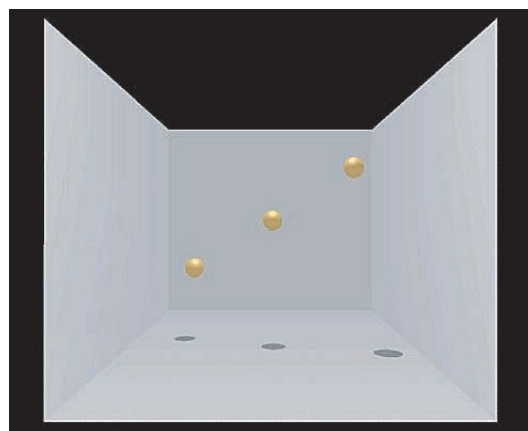


Figure 3. Completed positioning scene trial



The measured performance variables included distance error magnitude, response time, and rotational distance magnitude. Distance error magnitude was defined as the Euclidean summation of the three directional errors in the x, y, and z dimensions, or $((e^2x + e^2y + e^2z)^{1/2})$. Thus, this metric measured the exact absolute distance of the repositioned target object from its correct location in three-dimensional space. Response time again was measured in milliseconds. Also, subjects were able to voluntarily rotate the world left or right a total of 45 degrees from the center in either direction, using the left and right arrow keys on the keyboard. The total number of degrees in which the world was rotated in both the left and right directions was captured as a performance rotational distance metric. In addition to positioning distance accuracy and response latency, we were particularly interested in observing mean variances in rotational distance as a function of gender. We introduced the ability for the subjects to rotate the worlds for two predominant reasons: (1) to extract another dependent variable performance measure in addition to standard accuracy and response time measures; and (2) to provide an additional motion-related cue and to see if

the male and female subjects would use this cue differentially.

Object-Resizing Experiment. The object-resizing task consisted of subjects viewing virtual worlds containing two differently sized spherical objects suspended in 3D space and displaced at different depths from the viewer (see Figures 4 and 5). Unlike the positioning task, the resizing objects were fixed in position. The task was to adjust the size of a target object in order to correspond with the apparent size of a referent object. Figures 4 and 5 show a typical set of starting and correctly resized ending virtual worlds. One hundred forty-four unique worlds again were displayed in random order to each subject within alternating blocks, consisting of 72 2D (monoscopic) or 3D (stereoscopic) scenes. Each subject viewed the same 144 worlds (although in a random order); thus, the average target and referent ball sizes across all scenes were equivalent and, therefore, the same for all males and females.

The same 30 subjects from the object-positioning experiment participated in the object-resizing experiment. The measured performance variables included radius error percentage in addition to

Figure 4. Initial resizing scene trial

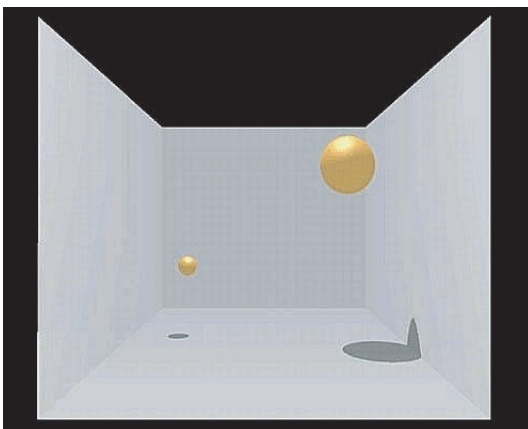
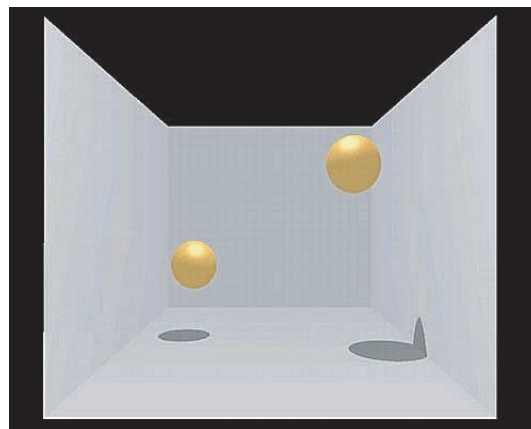


Figure 5. Completed resizing scene trial



The Paleolithic Stone Age Effect?

response time and rotational distance magnitude. Specifically, radius error percentage was defined as the absolute value of the difference between the correct (e.g., referent sphere) radius length and the final resized (e.g., target sphere) radius length divided by the radius length of the referent sphere, or $\frac{(|\text{correctRL} - \text{finalRL}|)}{\text{correctRL}}$. An accuracy measure relative to the size of the referent object was used, because the referent objects randomly varied in size from large to very small. The response time and rotational distance performance metrics were identical to those used in the positioning experiment.

Assessing Gender Differences in Cognitive Spatial Abilities

Gender-based differences in subjects' mental (cognitive) spatial abilities were assessed using the factor-referenced cognitive tests (Ekstrom, French, Harman, & Dermen, 1976) developed by the Office of Naval Research (ONR) and licensed for research use through the Educational Testing Service (ETS). In all three experiments, subjects were administered the cube comparisons and paper-folding cognitive tests. The ETS cube comparisons test assesses mental rotation cognitive ability. In this timed test, subjects were presented with image pairs of wooden cubes, or blocks. Each cube had a different letter, number, or symbol on each of the six faces (i.e., top, bottom, four sides) of the cube. However, in each pair of cubes presented, only three (of the six) sides of the cube were visible. The task was to determine whether the pair represented identical (e.g., the same) or different cubes.

Unlike cube comparisons, which assess mental rotation ability, the ETS paper-folding test assesses spatial visualization ability. In the timed paper-folding test, subjects had to imagine correctly the folding and unfolding of pieces of paper with holes punched through them. According to ETS, cube comparisons require only the mental rotation of the cube configurations, whereas paper

folding requires both rotation and visualization, defined as performing serial operations on the configuration. Since both cube comparisons and object-matching task performances are based on the mental rotation process, as described by Shepard and Metzler (1971), cube comparison ability should correspond with object-matching task performances. Similarly, paper-folding skill should correspond to task performances in the object-positioning and resizing experiments, since all are based on spatial visualization ability.

Results

Cognitive Abilities Test Scores. Tables 1 and 2 reflect the mean scores of the male and female subjects by experiment on the cube comparisons and paper-folding cognitive abilities tests. According to Dr. Ruth Ekstrom (by personal correspondence), the appropriate approach to assess these test results is to consider separately for each test the total number of items answered correctly, the number answered incorrectly, and the number omitted, or unanswered. As indicated in Table 1 (and after checking for equal variances in the male-female scores populations²), t-test comparisons of male-female scores on each test indicated that for the object-matching subjects, female subjects answered incorrectly significantly more cube comparison items than males. However, there were no male-female differences in the number of cube comparison items answered correctly or in the number omitted. Moreover, for the paper-folding test, there were no significant male-female differences in the number of items answered correctly, answered incorrectly, or omitted. By answering significantly fewer cube comparison items incorrectly, there is at least some evidence that the male subjects in the object-matching experiment had an advantage over the females in innate mental rotation cognitive ability. However, the paper-folding test scores indicate no significant male-female differences in innate spatial visualization cognitive abilities.

Table 1. Mean cube comparisons and paper folding test scores by gender for subjects in the object-matching experiment

| Object Matching Subjects | Cube Comparisons Test (Mental Rotation) | | Paper Folding Test (Spatial Visualization) | |
|--------------------------|---|--------------|--|--------------|
| | Males | Females | Males | Females |
| Number of Test Items: | | | | |
| Answered Correctly | 26.65 | 26.00 | 13.29 | 13.57 |
| Answered Incorrectly | 3.47* | 6.07* | 2.71 | 2.57 |
| Omitted (Unanswered) | 11.29 | 9.93 | 4.00 | 3.93 |

* *Bolded test scores indicate significantly different (at $p < 0.05$) male-female scores.*

Table 2. Mean cube comparisons and paper-folding test scores by gender for subjects in the object-positioning and resizing experiments

| Object Positioning/ Resizing Subjects | Cube Comparisons Test (Mental Rotation) | | Paper Folding Test (Spatial Visualization) | |
|---------------------------------------|---|---------------|--|---------|
| | Males | Females | Males | Females |
| Number of Test Items: | | | | |
| Answered Correctly | 28.25* | 21.43* | 13.06 | 10.36 |
| Answered Incorrectly | 2.38* | 5.79* | 2.31 | 4.00 |
| Omitted (Unanswered) | 11.38 | 14.64 | 4.63 | 5.64 |

* *Bolded test scores indicate significantly different (at $p < 0.05$) male-female scores.*

As indicated in Table 2, t-test comparisons of male-female cube comparison test scores for subjects in the object-positioning and resizing experiments indicate that male subjects answered (1) significantly more items correctly than females and (2) significantly fewer items incorrectly than females. However, there were no significant male-female differences in the number of items omitted in the cube comparisons test. Moreover, there were no significant male-female differences in the number of paper-folding test items answered correctly, answered incorrectly, or omitted. Thus, in the object-positioning and resizing experiments, there again is evidence that males compared to females had superior innate mental rotation cognitive abilities. However, similar to

the cognitive test data for subjects in the object-matching experiment, there again is no evidence of significant male-female differences in innate spatial visualization cognitive abilities.

Object-Matching Experiment Results. The object-matching data were fitted to a repeated measures multivariate analysis of variance model (MANOVA). There were significant differences in both error rate ($p < 0.0001$) and response time ($p < 0.0001$) as a function of gender. Males were more accurate at judging whether the objects were identical or different (see Figures 6 and 7). The overall mean male error rate was 9.39%, whereas the overall mean female error rate was 13.05%. Furthermore, the male subjects were faster at

The Paleolithic Stone Age Effect?

Table 3. Mean object-matching error rates and response times by gender* for the viewing and motion conditions

| Object Matching Conditions: | Error Rate (%) | | Response Time (seconds) | |
|-----------------------------|----------------|---------|-------------------------|---------|
| | Males | Females | Males | Females |
| Stereo Viewing | 6.79 | 10.10 | 11.75 | 12.88 |
| Mono Viewing | 11.99 | 16.00 | 13.32 | 14.28 |
| Controlled Motion | 7.07 | 11.95 | 12.87 | 13.98 |
| Uncontrolled Motion | 11.71 | 14.15 | 12.20 | 13.18 |

* The minimum significant performance differences (at $p < 0.05$) between the genders for the object-matching task are (1) mean error rate: 1.51%; (2) mean response time: 0.43 seconds.

making these object comparisons (see Figures 8 and 9). Males exhibited an overall mean response time of 12.53 seconds, whereas females responded in an overall mean time of 13.58 seconds.

To further investigate the gender-based impact of the viewing and motion conditions on object-matching performances, the sample then was split by gender and tested for the effects of viewing

mode and type of motion on the object-matching error rates and response times for each gender. The data are presented in tabular form in Table 3. Figures 6, 7, 8, and 9 present these data using line graphs that indicate the minimum significant differences (at $p < 0.05$) between the genders for object-matching error rate and response time (noted in Table 3).

Figure 6. Object-matching error rate by gender by viewing mode

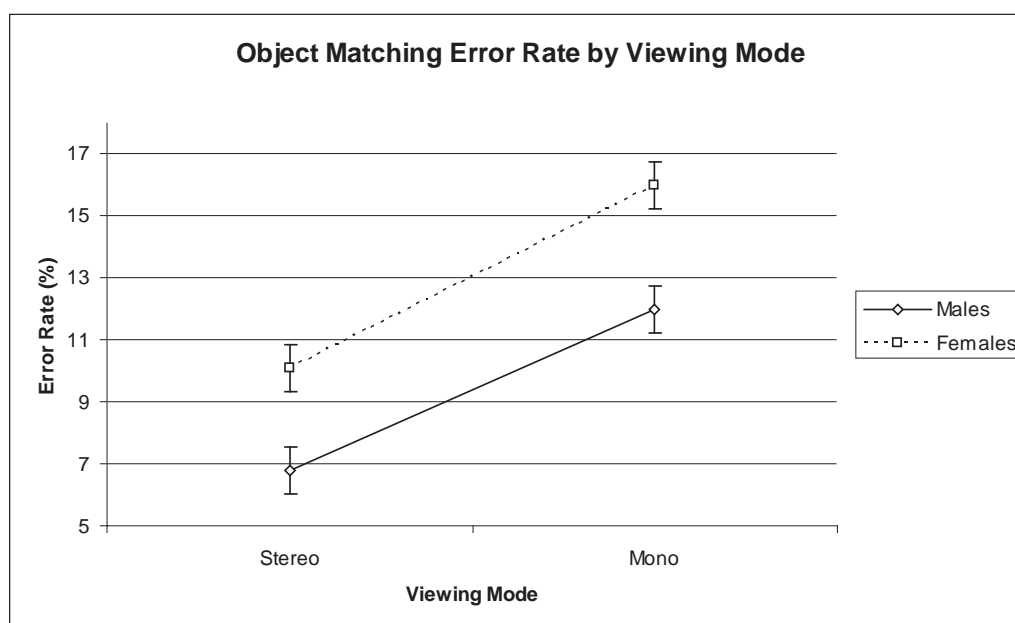


Figure 7. Object-matching error rate by gender by type of motion

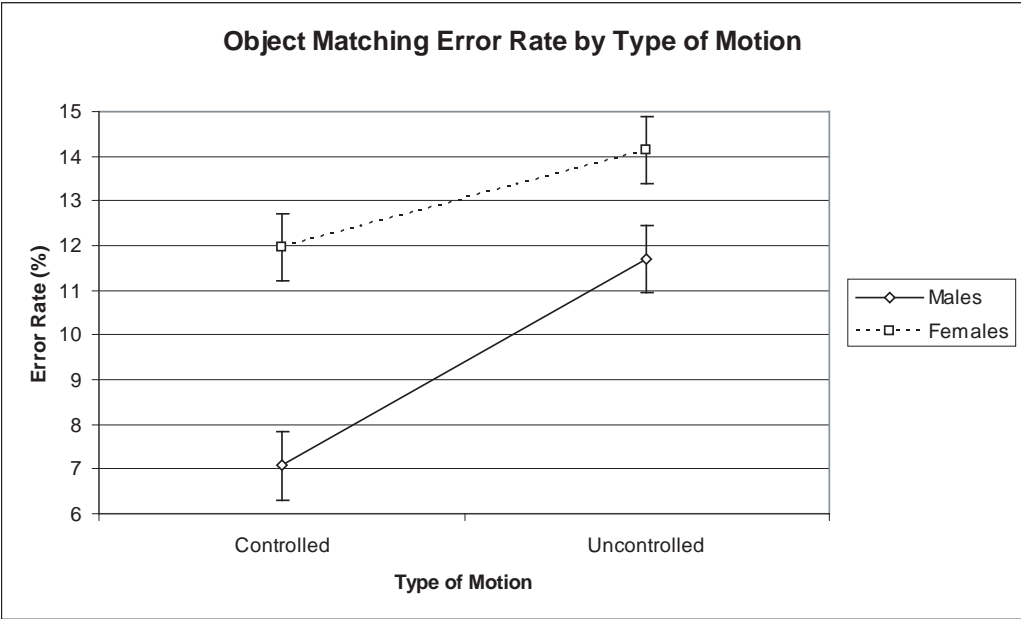


Figure 8. Object-matching response time by gender by viewing mode

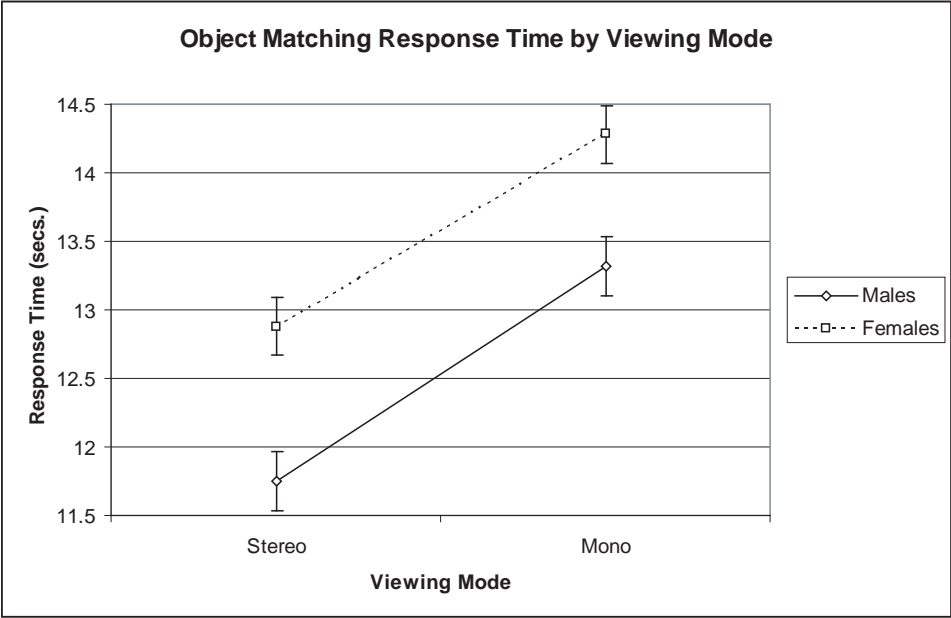
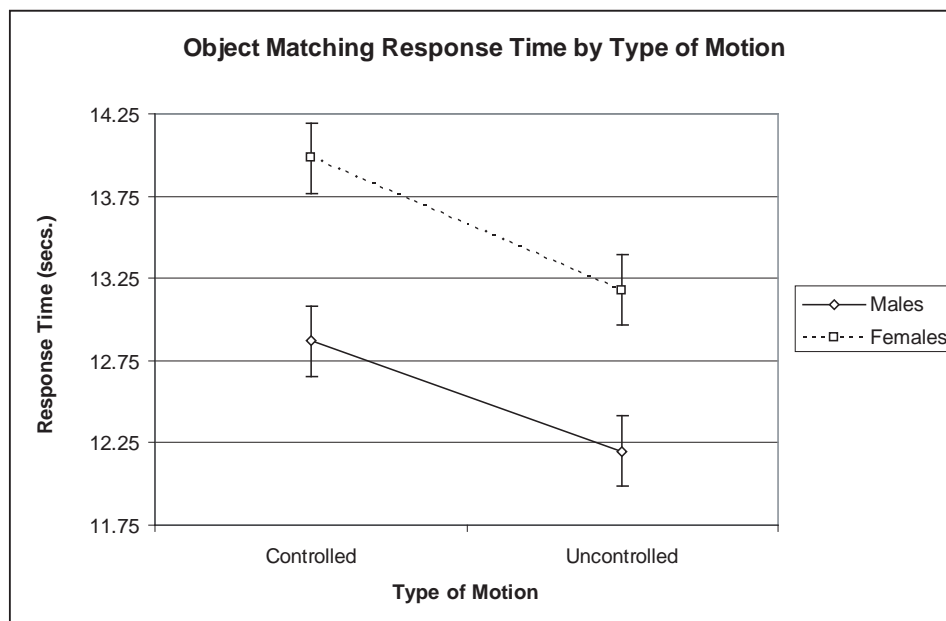


Figure 9. Object-matching response time by gender by type of motion



Both male and female subjects were more accurate and faster at matching objects when viewing the object pairs in stereo (see Figures 6 and 8). When the males controlled the motion of the right-hand object image, also called the comparison object (recall that the left image was always stationary), they were more accurate than when they did not control this motion (see Figure 7). For females, there was no significant difference in object-matching accuracy whether they controlled the motion of the comparison object or not (see Figure 7). However, both males and females took longer to judge whether the objects were identical or different when they were controlling this motion (see Figure 9).

Object-Positioning Experiment Results. The positioning data were also fitted to a MANOVA model. There were significant differences in distance error magnitude ($p < 0.0001$) and in

rotational distance magnitude ($p < 0.0001$) as a function of gender. The male subjects were more accurate in the positioning task (see Figure 10). The overall mean male distance error was 0.573 units, whereas the overall mean female distance error was 0.851 units. Furthermore, the male subjects rotated the positioning scenes to a greater extent than did the females (see Figure 12). The overall mean male rotational distance was 171.99 degrees, whereas the overall mean female rotational distance was 150.78 degrees. The difference in positioning response time as a function of gender was not significant ($p = 0.97$). Both males and females exhibited a mean positioning response time of 20.1 seconds (see Figure 11).

To further investigate the gender-based impact of the viewing conditions on object-positioning performances, the sample again was split by gender and tested for the effects of mono and stereo viewing on positioning accuracies, response

times, and rotational distances for each gender. The data are presented in tabular format in Table 4. Figures 10, 11, and 12 present these data using line graphs that indicate the minimum significant differences (at $p < 0.05$) between the genders for object-positioning radius error, response time,

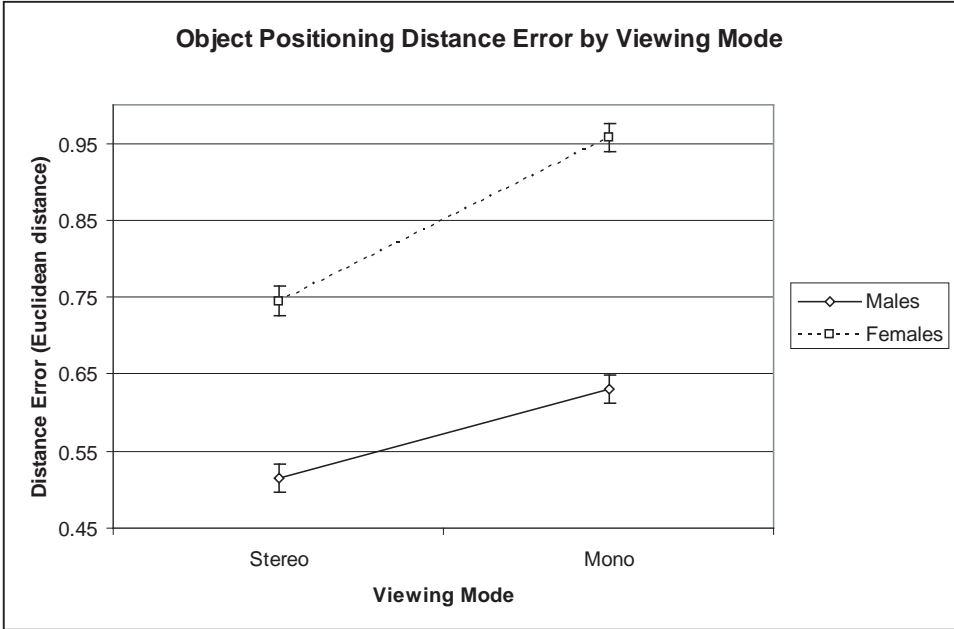
and rotational distance (noted in Table 4). Both males and females were more accurate and faster at positioning objects in stereo (see Figures 10 and 11). Stereo viewing particularly improved the positioning response time for males more than for females (see Figure 11). Furthermore, both

Table 4. Mean object-positioning distance errors, response times, and rotational distances by gender* for the viewing conditions

| Viewing Conditions: | Object Positioning Performance Measures | | | | | |
|---------------------|---|---------|-------------------------|---------|---|---------|
| | Distance Error (Euclidean distance) | | Response Time (seconds) | | Rotational Distance Magnitude (degrees) | |
| | Males | Females | Males | Females | Males | Females |
| Stereo Viewing | 0.515 | 0.745 | 17.71 | 19.44 | 140.63 | 142.43 |
| Mono Viewing | 0.631 | 0.957 | 22.49 | 20.80 | 203.36 | 159.13 |

* The minimum significant performance differences (at $p < 0.05$) between the genders for the object-positioning task are (1) mean Euclidean distance error: 0.0377 units; (2) mean response time: 0.78 seconds; and (3) mean rotational distance: 9.62 degrees.

Figure 10. Object-positioning distance error by gender by viewing mode



The Paleolithic Stone Age Effect?

Figure 11. Object-positioning response time by gender by viewing mode

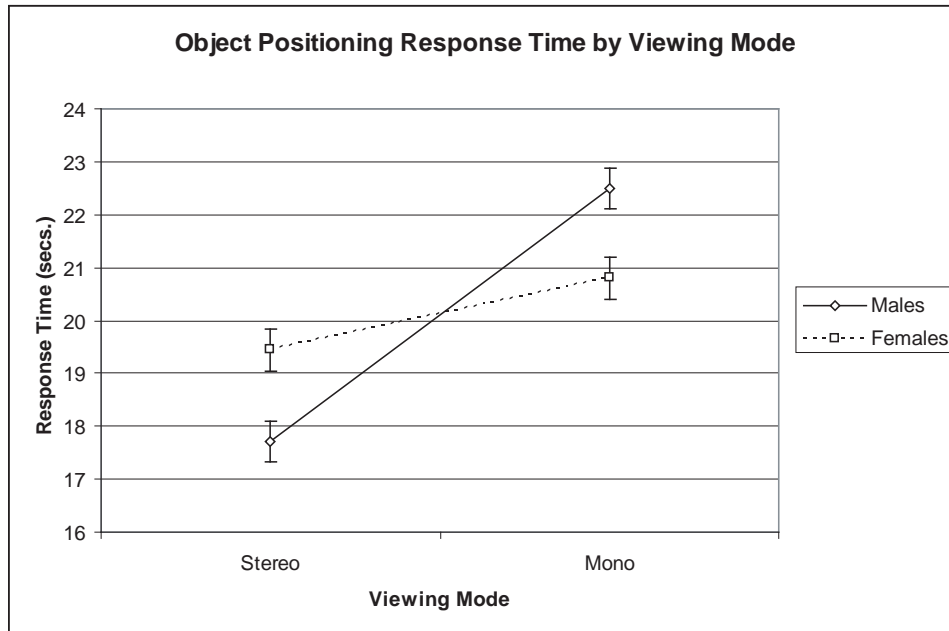
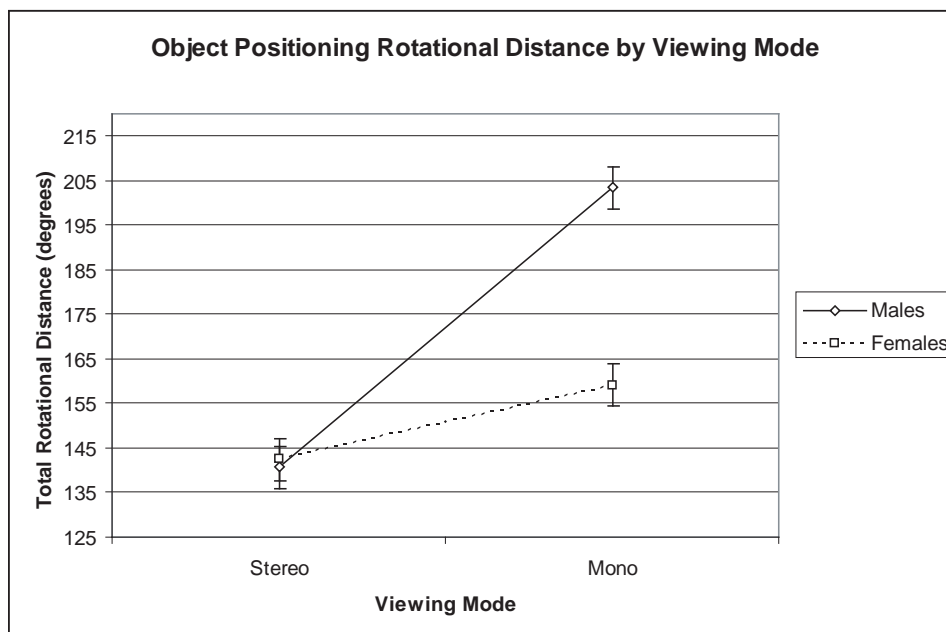


Figure 12. Object-positioning rotational distance by gender by viewing mode



males and females used less rotational distance positioning objects when viewing the objects in stereo, although males exhibited more of this effect than did the females (see Figure 12).

Object Resizing Experiment Results. In the resizing task, there were significant differ-

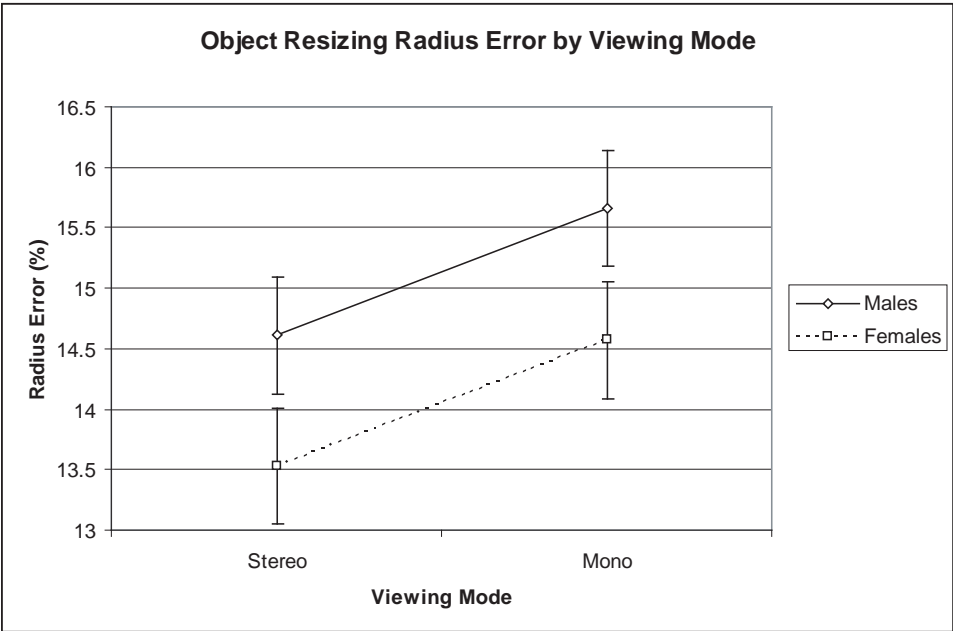
ences in radius error percentages ($p < 0.027$) and rotational distance magnitudes ($p < 0.006$) as a function of gender. The male subjects were less accurate resizing the objects than were the females (see Figure 13). The overall mean male radius error percentage was 15.14%, whereas the overall mean female radius error percentage was

Table 5. Mean object resizing radius error percentages, response times, and rotational distances by gender* for the viewing conditions

| | Object Resizing Performance Measures | | | | | |
|---------------------|--------------------------------------|---------|-------------------------|---------|---|---------|
| | Radius Error (%) | | Response Time (seconds) | | Rotational Distance Magnitude (degrees) | |
| Viewing Conditions: | Males | Females | Males | Females | Males | Females |
| Stereo Viewing | 14.61 | 13.53 | 9.87 | 10.05 | 100.05 | 98.46 |
| Mono Viewing | 15.66 | 14.57 | 11.49 | 11.90 | 125.32 | 112.39 |

* The minimum significant performance differences (at $p < 0.05$) between the genders for the object resizing task are (1) mean radius error percentage: 0.96%; (2) mean response time: 0.64 seconds; and (3) mean rotational distance: 5.20 degrees.

Figure 13. Object resizing radius error by gender by viewing mode



The Paleolithic Stone Age Effect?

Figure 14. Object resizing response time by gender by viewing mode

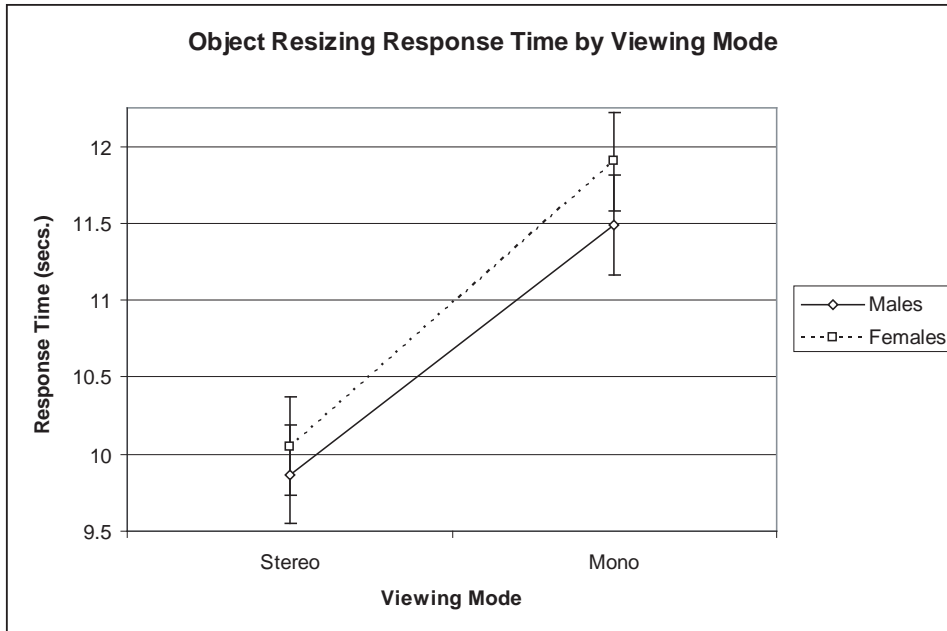
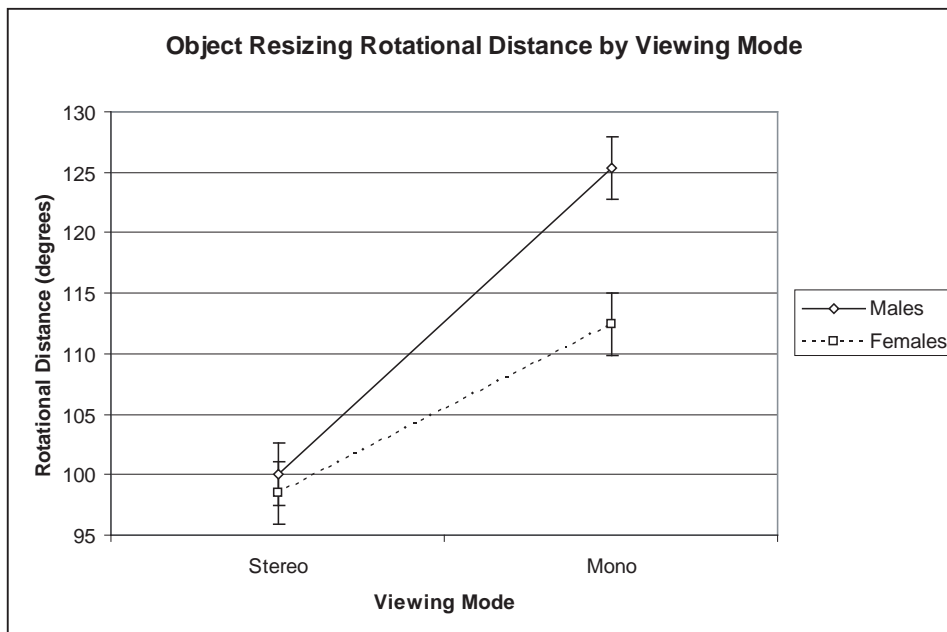


Figure 15. Object resizing rotational distance by gender by viewing mode



14.05%. However, the male subjects rotated the resizing scenes to a greater extent than did the females (see Figure 15). The overall mean male rotational distance was 112.68 degrees, whereas the overall mean female rotational distance was 105.43 degrees. Furthermore, males and females were equally fast at performing the resizing task (see Figure 14). The difference in resizing response time as a function of gender was not significant ($p = 0.37$). The mean male response time was 10.68 seconds, and the mean female response time was 10.98 seconds.

The resizing data sample also were split by gender and tested for the effects of mono and stereo viewing on resizing accuracies, response times, and rotational distances for each gender. The data are presented in tabular format in Table 5. Figures 13, 14, and 15 present these data using line graphs that indicate the minimum significant differences (at $p < 0.05$) between the genders for object resizing radius error, response time, and rotational distance (noted in Table 5). Viewing the worlds in stereo compared to mono had no significant effect on the mean resizing accuracy for either gender (see Figure 13), although it did reduce mean response times for both genders (see Figure 14). Similar to the results from the positioning task, both males and females rotated the scenes less while resizing objects viewed in stereo compared to mono viewing, although the males

reduced this stereo-viewed rotational distance more than the females (see Figure 15).

SUMMARY OF FINDINGS

Table 6 summarizes relative task performance differences by gender with each experiment. The spatial abilities literature indicates a robust male performance advantage in mental rotation tasks but no clear advantage for either gender in spatial visualization tasks. Indeed, the ETS factor-referenced cognitive tests administered to our subjects generally corroborate the existing literature. The male subjects answered significantly fewer cube comparisons (mental rotation) test items incorrectly than the females, but there were no differences in male-female paper folding (spatial visualization) test scores.

We hypothesized a male performance advantage in the (mental rotation) object-matching experiment (H1) but no advantage for either gender in the (spatial visualization) object-positioning and resizing experiments (H2). Consistent with the prediction of hypothesis H1, males did exhibit more accurate and faster performances than females in the object-matching experiment. As this task was based on a mental rotation paradigm (Shepard & Metzler, 1971) and coupled with spatial literature meta-analyses indicating male

Table 6. Summary of gender-based differences in accuracy, response time, and rotational distance performances for object matching, positioning, and resizing experiments

| Experiment: | Accuracy/Gender: | RT/Gender: | Rot. Dist./Gender |
|---------------------------|-----------------------|-------------------|-------------------|
| Object Matching | Males more accurate | Males faster | Not Applicable* |
| Object Positioning | Males more accurate | No M/F difference | Males use more |
| Object Resizing | Females more accurate | No M/F difference | Males use more |

* There was no formal rotational distance dependent variable performance measure in the object-matching experiment. However, when males controlled the motion of the comparison object, they were more accurate (unlike the females) in their object-matching performances.

The Paleolithic Stone Age Effect?

advantages in mental rotation tasks and cognitive tests, it is not surprising that the male subjects outperformed the female subjects in the accuracy and speed of matching objects. Moreover, controlling the motion of the right-hand comparison object image significantly improved (i.e., reduced) male object-matching error rates but had no effect on female error rates. Since controlling the motion facilitated the mental rotation task in general, and since males typically outperform females at mental rotation tasks (Dabbs et al., 1998; Silverman et al., 2000), this could explain why males made more effective use of this motion cue.

However, contrary to the prediction of hypothesis H2, in the object-positioning and resizing (spatial visualization) experiments, the relative gender performances were mixed; males were more accurate at positioning objects, whereas females were more accurate at resizing objects. Moreover, the male subjects made more use of the rotational distance feature in both the positioning and resizing tasks. Note that the rotational distance feature, by nature, is a type of motion cue. That is, by rotating the virtual world left or right, the viewer is able to adjust the locations and displacements of the objects in relation to the other objects and in relation to the viewer. The males evidently found this rotating feature to be more useful than females in attempting to position and resize objects in the virtual worlds.

To understand why males were more accurate at positioning objects and why females were more accurate at resizing objects, it is worthwhile to scrutinize the elements of each task. In this regard, object motion was a critical attribute for successfully positioning objects but not for resizing objects. Accurately positioning the target object in a straight line segment required flying the object around the visual space. This essential motion attribute may have contributed to a male performance advantage at positioning objects and is consistent with previous findings that men typically outperform women in tasks manipulating objects in space (Collins & Kimura, 1997;

Goldstein et al., 1990; Kimura, 1983; Kolb & Whishaw, 1990; Linn & Petersen, 1985; Lohman, 1986; Maccoby & Jacklin, 1974).

However, the females were more accurate than the males at resizing the target object to match the apparent size of the referent object. The females evidently had a better sense of the relative comparative sizes of the two objects that were displaced in distance but otherwise fixed in position. It has been demonstrated that females, compared to men, rely more on landmarks for way finding (McGuinness & Sparks, 1983; Miller & Santoni, 1986) and refer to landmarks when giving directions (Miller & Santoni, 1986). The literature also indicates that females outperform males in remembering the location of objects that are fixed in space (Dabbs et al., 1998; McBurney et al., 1997). Accurately resizing the target object required the cognitive calibration of the relative apparent sizes of two objects that were displaced in distance from the viewer but otherwise fixed in position. We speculate that the female resizing accuracy advantage could be related to a female propensity to recognize better the locations of landmark objects that are fixed in position (Eals & Silverman, 1994; Silverman & Eals, 1992).

CONCLUSION AND DISCUSSION

In general, the results of these experiments indicate the following:

1. Males outperform females at matching abstract, visual objects using mental rotation in computer-generated virtual worlds.
2. Males make more use of certain motion-related cues in performing visual tasks in computer-generated virtual worlds.
3. Males are more accurate at moving and positioning objects in computer-generated virtual worlds.
4. Females are more accurate at estimating the relative sizes of objects displaced in depth

but fixed in position in computer-generated virtual worlds.

How do these findings suggest approaches to developing gender-neutral visual interfaces? The ideal goal in this regard is to move toward the design of user interfaces that will improve usability for both genders and, particularly, to mitigate the postulated female handicap with mental rotation and motion cues. Simply adding a third dimension to an otherwise 2D display does not guarantee improved task performances (Cockburn & McKenzie, 2002). One suggestion is to add meaningful landmarks and to decrease user reliance on mental rotation ability. For example, visual interfaces that allow the stationary user to look right or look left (or up, down, backward, etc.) for familiar landmarks may prove to be an effective, gender-neutral alternative to the use of typical motion cues such as flying around virtual spaces. Our research suggests that the reliance on motion cues, in particular, to extract information can be especially problematic and can lead to a male performance advantage.

An evolving area of visual computing technology to which these findings are relevant is computer-generated virtual environments (VEs). The spatial structure of a VE and the objects that are visible sometimes are used to represent information. According to Vinson (1999), "a VE could contain objects whose spatial properties (e.g. shape, position, size) represent data values on different dimensions. Here, it is necessary for the navigator to quickly develop accurate representations of those spatial properties in order to understand the relationships in the data" (p. 279). These spatial properties (i.e., shape, position, and size) correspond with the three spatial task manipulations analyzed in our studies. To the extent that there are gender biases when cognitively processing and understanding these spatial properties, then these biases likely would extend to understanding the corresponding data relationships in VEs.

Although the tasks analyzed in our studies are not navigation tasks per se, the findings, nevertheless, have implications for the design of navigable VEs, since recognizing object shape and estimating the size and distance of objects are intrinsic activities of successful VE navigation (Vinson, 1999). Navigation is a process of tracking one's position in an environment in order to arrive at a desired destination. Doing so requires knowledge about positional, velocity, and acceleration attributes, which are derived from location, depth, and motion cues (Cutmore et al., 2000). Location information comes from landmarks and other fixed, distant features in the environment. The ability to recognize object shapes and to estimate their relative distances (or positions) is necessary in order to acquire basic location information that is a foundation of successful navigation. Moreover, correctly estimating the relative size of a landmark directly relates to understanding its distance and also promotes successful navigation.

Previous studies have indicated male performance advantages when navigating virtual worlds (Astur et al., 1998; Sandstrom et al., 1998; Waller et al., 1998). However, other researchers have noted that the apparent male navigation superiority is mitigated when the virtual worlds are presented to users with wider fields of view and larger display screens (Czerwinski et al., 2002; Tan et al., 2001). Indeed, both genders benefit under these conditions. Tan, Gergle, Scupelli, and Pausch (2003) reported that using larger displays improved both male and female performances in a static, 2D, mental rotation task³, but there was no corresponding performance benefit in a reading comprehension task. Subsequently, Tan, Gergle, Scupelli, and Pausch (2004) also demonstrated that users are more effective when performing 3D virtual navigation tasks on larger displays. They noted that when navigating, users continually update their mental sense of position and orientation within the environment (termed spatial updating) using two basic strategies: (1) piloting, or using external landmarks to position

themselves within the environment; and (2) path integration, or sensing self-velocity and acceleration to determine their position relative to some starting point. There is evidence that women rely more heavily on the piloting strategy (Czerwinski et al., 2002; Golledge, 1999).

Cockburn (2004) suggested that human spatial capabilities could be leveraged while interacting with computer-generated 3D scenes if the scenes were presented in ways “that better reflect the way we perceive our natural environment” (p. 25). We submit that user interface technology will best support all users to effectively navigate virtual worlds when those worlds are presented to user groups in ways that most closely mirror how users typically and best navigate in natural environments. Flying around over terrain that is visually presented on a limited 2D display screen is not a natural approach for ordinary human navigation. Extending the wider field of view and wider display arguments of Czerwinski et al. (2002), we suggest that the total immersion of users navigating a pedestrian and, apparently, terrestrial virtual world can better support individual human navigation in those worlds. Spatial navigation is improved with an increased sense of presence, or being in the virtual environment, which is a direct outcome of immersion (Tan et al., 2003). For women, these worlds perhaps would be designed best using highly visible and easily recognizable landmarks⁴ that are stationary in position and visible within a 360° field of view. That is, women users should be able to look around the virtual landscapes in all directions. Furthermore, the mode of navigating, or movement, should be along the surface of the virtual landscape, especially with alignment and orientation to and from those salient landmarks. For men, cues that further suggest Euclidean distance and direction also should be helpful. Virtual worlds that support both genders’ existing propensities to navigate would be most effective for the majority of users.

Limitations

The results of this study should not be interpreted as suggesting that either gender is superior in terms of spatial abilities. Rather, the study suggests (and the reported findings confirm) that there are differences in relative male and female performances on particular spatial processing tasks. Some of these differences are explored in this study. Many others are well-documented in the gender-specific mental abilities literature. In point of fact, both males and females have performance advantages in particular cognitive tasks.

The domain of this study is limited. It focuses on the gender-effective use of abstract visualizations and visual tasks that may relate to particular attributes of visual user interfaces. For example, visual user interface domains that involve the mental rotation of objects or the user-controlled motion, orientation, or resizing of objects, particularly in scenes representing three-dimensional space, are germane. However, domains relating to typical two-dimensional point-and-click activities or to the user interpretation of textual information are not addressed in this study.

In terms of methodology, a limitation of this study is that there was a separate set of subjects in the mental rotation experiment compared to the positioning and resizing experiments. As a result, there was a combination of within- and between-subject comparisons pertinent to the findings and related discussions. However, because these experiments were conducted over a period of time, the attrition of some subjects was unavoidable.

Further, in generalizing these findings, we note that these subjects likely have heightened spatial abilities relative to the general population. They were all working professionals in a premier scientific governmental organization, many holding advanced degrees. Therefore, whether these findings generalize to the population at large is debatable. However, one could argue that any

performance effects fostered by the spatial cues would be more pronounced within this group than within the general population. That is to say, if there were no observable effects with these select subjects, then there likely would be no effect within the general population.

Finally, we mention one additional limitation. Egocentric motion tasks, for example, physically walking through a 3D environment, and finding one's way along a route and/or to and from landmarks have additional perceptual dimensions than do the tasks in our study. However, some elements of egocentric way-finding are embedded in our tasks, such as recognizing the relative shapes, orientations, distances, and sizes of objects in the visual field. Additionally, we did incorporate aspects of egocentric motion skills by enabling the rotation of objects and the rotation of the scenes left and right. However, these tasks do not capture completely all of the perceptual cues and sensory elements inherent in egocentric motion tasks.

Considerations for Future Research

There are large segments of the general population that are characterized by differing opportunities, propensities, and abilities to access and make effective use of computer technologies. For example, the very young, the elderly, and the handicapped all have particular impediments to using computer technologies that most people take for granted. As computer applications become increasingly prevalent in everyday life, it is a worthwhile goal to try to mitigate intrinsic barriers and to equalize access and opportunities in order to make effective use of computer technologies.

In terms of gender differences in using visual interfaces, this research is an attempt to identify and highlight broad categories of disparities in male-female abilities to interpret and to manipulate visual abstractions. The intent is to work toward the development of gender-neutral guidelines for effective visual user interfaces and virtual

environments. Future research should explore the relative efficacies of different approaches of augmenting computer-generated visualizations so as to promote equal understanding and effective interfaces for different user groups. To this end, investigating approaches that do not rely strictly on abstract visualizations to convey information is warranted. Although it has been demonstrated that visual abstractions effectively can condense and convey large volumes of tabular, multi-dimensional (2D and 3D) data, the combination of visual with, in some cases, textual as well as multi-modal approaches likely will lead to more effective user interfaces across a larger number of user groups. Furthermore, investigating the design of virtual worlds that most closely mimic how men and women navigate real worlds likely would benefit the largest share of all users.

REFERENCES

- Astur, R. S., Ortiz, M. L., & Sutherland, R. J. (1998). A characterization of performance by men and women in a virtual Morris water task: A large and reliable sex difference. *Behavioural Brain Research, 93*(1-2), 185-190.
- Balka, E. (1996). Gender and skill in human-computer interaction. In *Proceedings of the CHI 1996* (p. 325). New York: ACM Press.
- Basdogan, C., Ho, C., Srinivasan, M., & Slater, M. (2000). An experimental study on the role of touch in shared virtual environments. *ACM Transactions on Computer-Human Interaction, 7*(4), 443-460.
- Cockburn, A. (2004). Revisiting 2D vs. 3D implications on spatial memory. In *Proceedings of the Fifth Conference on Australasian User Interface* (pp. 25-31), Darlinghurst, Australia: Australian Computer Society, Inc.

The Paleolithic Stone Age Effect?

- Cockburn, A., & McKenzie, B. (2002). Evaluating the effectiveness of spatial memory in 2D and 3D physical and virtual environments. In *Proceedings of the CHI 2002* (pp. 203-210). New York: ACM Press.
- Collins, D. W., & Kimura, D. (1997). A large sex difference on a two-dimensional mental rotation task. *Behavioral Neuroscience, 111*(4), 845-849.
- Cutmore, T. R. H., Hine, T. J., Maberly, K. J., Langford, N. M., & Hawgood, G. (2000). Cognitive and gender factors influencing navigation in a virtual environment. *International Journal of Human-Computer Studies, 53*(2), 223-249.
- Czerwinski, M., Tan, D. S., & Robertson, G. G. (2002). Women take a wider view. In *Proceedings of the CHI 2002* (pp. 195-202). New York: ACM Press.
- Dabbs, J. M., Chang, E.-L., Strong, R. A., & Milun, R. (1998). Spatial ability, navigation strategy, and geographic knowledge among men and women. *Evolution and Human Behavior, 19*(2), 89-98.
- Eals, M., & Silverman, I. (1994). The hunter-gatherer theory of spatial sex differences: Proximate factors mediating the female advantage in recall of object arrays. *Ethological Sociobiology, 15*, 95-105.
- Ekstrom, R. B., French, J. W., Harman, H. H., & Dermen, D. (1976). *Manual for kit of factor-referenced cognitive tests*. Princeton, NJ: Educational Testing Service.
- Goldstein, D., Haldane, D., & Mitchell, C. (1990). Sex differences in visual-spatial ability: The role of performance factors. *Memory & Cognition, 18*(5), 546-550.
- Golledge, R. G. (Ed.). (1999). *Wayfinding behavior: Cognitive mapping and other spatial processes*. Baltimore, MD: John Hopkins University Press.
- Hall, J., & Cooper, J. (1991). Gender, experience and attributions to the computer. *Journal of Educational Computer Research, 7*(1), 51-60.
- Halpern, D. F. (1986). *Sex differences in cognitive abilities*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Hinckley, K., Pausch, R., Proffitt, D., & Kassell, N. (1998). Two-handed virtual manipulation. *ACM Transactions on Computer-Human Interaction, 5*(3), 260-302.
- Hinckley, K., Pausch, R., Proffitt, D., Patten, J., & Kassell, N. (1997). Cooperative bimanual action. In *Proceedings of the CHI 1997* (pp. 27-34). New York: ACM Press.
- Hubona, G. S., & Shirah, G. W. (2004, January 5-8). The gender factor performing computer tasks on computer media. In *Proceedings of the 37th Hawaii International Conference on System Sciences* (CD-ROM). Computer Society Press.
- Inkpen, K. (2001). Drag-and-drop versus point-and-click mouse interaction styles for children. *ACM Transactions on Computer-Human Interaction, 8*(1), 1-33.
- Inkpen, K., Klawe, M., Lawry, J., Sedighian, K., Leroux, S., Hsu, D., et al. (1994). We have never-forgetful flowers in our garden: Girls' responses to electronic games. *Journal of Computers in Math and Science Teaching, 13*(4), 383-403.
- James, T. W., & Kimura, D. (1997). Sex differences in remembering the locations of objects in an array: Location-shift versus location-exchanges. *Evolution and Human Behavior, 18*(3), 155-163.
- Kauppinen, K., Kivimaki, A., Era, T., & Robinson, M. (1998). Producing identity in collaborative virtual environments. In *Proceedings of the ACM Symposium on Virtual Reality Software and Technology* (pp. 35-42). New York: ACM Press.

- Kimura, D. (1983). Sex differences in cerebral organization for speech and praxis functions. *Canadian Journal of Psychology, 37*, 19-35.
- Kimura, D. (2000). *Sex and cognition*. Cambridge, MA: MIT Press.
- Kolb, B., & Whishaw, I. (1990). *Human neuropsychology*. New York: Freeman.
- Leventhal, L., Teasley, B., & Stone, D. (1994). Designing for diverse users: Will just a better interface do? In *Proceedings of the CHI 1994* (pp. 191-192). New York: ACM Press.
- Linn, M. C., & Petersen, A. C. (1985). Emergence and characterization of sex differences in spatial ability: A meta-analysis. *Child Development, 56*, 1479-1498.
- Lockheed, M. (1985). Women, girls and computers: A first look at the evidence. *Sex Roles, 13*(3/4), 115-122.
- Lohman, D. F. (1986). The effect of speed-accuracy tradeoff on sex differences in mental rotation. *Perception and Psychophysics, 39*, 427-436.
- Maccoby, E. E., & Jacklin, C. N. (1974). *The psychology of sex differences*. Stanford, CA: Stanford University Press.
- McBurney, D. H., Gaulin, S. J. C., Devineni, T., & Adams, C. (1997). Superior spatial memory of women: Stronger evidence for the gathering hypothesis. *Evolution and Human Behavior, 18*(3), 165-174.
- McGuinness, D., & Sparks, J. (1983). Cognitive style and cognitive maps: Sex differences in representations of familiar terrain. *Journal of Mental Imagery, 7*(1), 91-100.
- Miller, L. K., & Santoni, J. (1986). Sex differences in spatial abilities: Strategic and experimental coordinates. *Acta Psychologica, 62*(3), 225-235.
- Palma-dos-Reis, A., & Zahedi, F. (1999). Designing personalized intelligent financial decision support systems. *Decision Support Systems, 26*(1), 31-47.
- Powell, P. L., & Johnson, J. E. V. (1995). Gender and DSS design: The research implications. *Decision Support Systems, 14*(1), 27-58.
- Rieman, J. (1996). A field study of exploratory learning strategies. *ACM Transactions on Computer-Human Interaction, 3*(3), 189-218.
- Sandstrom, N. J., Kaufman, J., & Huettel, S. A. (1998). Males and females use different distal cues in a virtual environment navigation task. *Cognitive Brain Research, 6*(4), 351-360.
- Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science, 171*(972), 701-703.
- Shneiderman, B. (1990). Human values and the future of technology: A declaration of empowerment. In *Proceedings of the Conference on Computers and the Quality of Life* (p. 16). New York: ACM Press.
- Shneiderman, B. (2000). Universal usability. *Communications of the ACM, 43*(6), 85-91.
- Silverman, I., & Eals, M. (1992). Sex differences in spatial abilities: Evolutionary theory and data. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 531-549). New York: Oxford Press.
- Silverman, I., Choi, J., Mackewn, A., Fisher, M., Moro, J., & Olshansky, E. (2000). Evolved mechanisms underlying wayfinding: Further studies on the hunter-gatherer theory of spatial sex differences. *Evolution and Human Behavior, 21*(3), 201-213.
- Simon, S. J. (2001). The impact of culture and gender on Web sites: An empirical study. *The DATA BASE for Advances in Information Systems, 32*(1), 18-37.

The Paleolithic Stone Age Effect?

- Tan, D. S., Czerwinski, M., & Robertson, G. (2003). Women go with the (optical) flow. In *Proceedings of the CHI 2003* (pp. 209-215). New York: ACM Press.
- Tan, D. S., Gergle, D., Scupelli, P. G., & Pausch, R. (2003). With similar visual angles, larger displays improve spatial performance. In *Proceedings of the CHI 2003* (pp. 217-224). New York: ACM Press.
- Tan, D. S., Gergle, D., Scupelli, P. G., & Pausch, R. (2004). Physically large displays improve path integration in 3D virtual navigation tasks. In *Proceedings of the CHI 2004* (pp. 439-446). New York: ACM Press.
- Tan, D. S., Robertson, G. G., & Czerwinski, M. (2001). Exploring 3D navigation: Combining speed-coupled flying with orbiting. In *Proceedings of the CHI 2001* (pp. 418-425). New York: ACM Press.
- Upitis, R., & Koch, C. (1996). Is equal computer time fair for girls? In *Proceedings of the 6th Conference of the Internet Society on INET '96*, Montreal, Quebec, Canada.
- Vinson, N. G. (1999). Design guidelines for landmarks to support navigation in virtual environments. In *Proceedings of the CHI 1999* (pp. 278-285). New York: ACM Press.
- Voyer, D., Voyer, S., & Bryden, M. P. (1995). Magnitude of sex differences in spatial abilities: A meta-analysis and consideration of critical variables. *Psychological Bulletin*, 117, 250-270.
- Waller, D., Hunt, E., & Knapp, D. (1998). The transfer of spatial knowledge in virtual environment training. *Presence: Teleoperators and Virtual Environments*, 7(2), 129-143.
- Wexelblat, A. (1995). An approach to natural gesture in virtual environments. *ACM Transactions on Computer-Human Interaction*, 2(3), 179-200.
- Wilder, G., Mackie, D., & Cooper, J. (1985). Gender and computers: Two surveys of computer-related attitudes. *Sex Roles*, 13(3/4), 215-228.

ENDNOTES

- ¹ <http://www.webaim.org> estimates that as many as 10% of all males and 0.5% of all females are characterized by patterns of color blindness that affect their ability to understand certain shades of color-encoded information.
- ² Pooled t-test method was utilized with equal population variances; satterthwaite t-test method was utilized with unequal population variances.
- ³ Specifically, they used the Guilford-Zimmerman spatial orientation task. Please see Tan et al. (2003) for more detailed information.
- ⁴ For a complete discussion of guidelines for designing landmarks to support navigation in VEs, please see Vinson (1999).

This work was previously published in the International Journal of Technology and Human Interaction, edited by B. C. Stahl, Volume 2, Issue 2, pp. 24-48, copyright 2006 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Section 8

Emerging Trends in Information Communication Technologies

This section highlights research potential within the field of ICT while exploring uncharted areas of study for the advancement of the discipline. Introducing this section are chapters that set the stage for future research directions and topical suggestions for continued debate. Discussions exploring RFID, virtual religion in the 21st century, and new ICTs for conflict management provide insight into forthcoming issues in ICT study. Authors within this section look past the digital divide to a time when ICT is ubiquitous and divisions no longer exist. These contributions, which conclude this exhaustive, multi-volume set provide emerging trends and suggestions for future research within this rapidly expanding discipline.

Chapter 8.1

Bringing the Next Billion Online: Cooperative Strategies to Create Internet Demand in Emerging Markets

Karen Coppock
Stanford University, USA

ABSTRACT

This chapter classifies the types of partnerships employed to increase Internet demand in emerging markets. This classification system, or taxonomy, is based on more than 60 in-depth interviews, about 32 partnerships, designed to create Internet demand in Mexico. The taxonomy first classifies the partnerships into three broad categories based on the number of barriers to Internet usage the partnership was designed to overcome: one, two, or three. The partnerships are then classified into six subcategories based on the specific barrier or combination of barriers to Internet usage the partnership sought to overcome. The six subcategories of the taxonomy are: (1) lack of funds; (2) lack of awareness; (3) lack of uses; (4) lack of funds and lack of uses; (5) lack of funds and lack of infrastructure; and (6) lack of funds, lack of uses, and lack of infrastructure. This taxonomy gives empirical meaning and enables further analysis of this unique and increasingly popular type of partnership.

INTRODUCTION

... it may sound altruistic and it may sound philanthropic, but let me tell you, it is very concrete ... if we do not invest, if we do not take the time ... we will never close the digital divide ... and we will never grow these markets ... and we can never do it alone ... not the government alone, not universities alone, not even businesses alone, we absolutely have to do it together. (Omar Villarreal, President, Latin America and the Caribbean, Motorola)¹

The focal point of the Internet is rapidly shifting toward emerging markets. The sale of personal computers (PCs) and Internet access is stabilizing in industrialized countries and profit margins are eroding (International Telecommunications Union [ITU], 2001; Smith, 2001). Market research firms predict that the growth rates of information and communications technologies (ICTs) such as the Internet will not return to their previous levels in industrialized markets, but that future revenue

opportunities lie in the developing world countries of China, India, Russia, Brazil, and Mexico (De Marcillac, 2003). The sheer size of the population of these five economies, coupled with their low Internet usage rates, make them extremely attractive markets for multinational corporations. The Internet is also seen as a powerful tool for socioeconomic development and therefore, governments, nongovernmental organizations (NGOs), and universities are also intent on increasing their usage in these emerging markets.

The opportunity is clear, yet elusive. In 2001, from 33-50% of the population of industrialized economies had Internet access, whereas a scant 1% or less of emerging market citizens were online (ITU, 2002). Billions of people, therefore, have never surfed the Web nor used e-mail. The reasons for the discrepancy in Internet proliferation have been widely studied. On the demand side, education and skill levels, Internet access costs, per capital gross domestic product, and a lack of access facilities (telephone lines) are all statistically significant determinants of Internet usage rates in emerging markets (Cukor & McKnight, 2001; Kiiski & Pohjola, 2002). On the supply side, the absence of an independent regulator and credible regulatory frameworks lead to under investment in ICT infrastructure, which hinders Internet access rates (Gutierrez & Berg, 2000).

A wide range of initiatives sponsored by a diverse set of organizations have been launched to increase Internet usage in emerging markets. The Digital Dividends Project Clearinghouse (<http://wriwsl.digitaldividend.org/wri/app/index.jsp>) created by the World Resources Institute lists nearly 1,000 initiatives designed to increase Internet usage. At least one half of these initiatives are being implemented through the cooperative effort of two or more organizations. These include both “traditional” partnerships, or those between two or more private sector firms, and cross sector partnerships, or those between firms (private sector) and organizations from the public (government) and/or nonprofit sectors (including universities).

The purpose of this chapter is to classify the types of partnerships being used to increase Internet demand in emerging markets. A classification system, or taxonomy, will enable further analysis of this unique type of partnership and is the first step in any new line of social science research.

The chapter is organized as follows. First, I define the concept of market creation and outline the discrepancy between the practice and theory of market creation partnerships. Secondly, I present and explain the Internet market creation partnership taxonomy and provide definitions for each of its six categories. In the third, fourth, and fifth sections of this chapter, each of the three main categories of the taxonomy are explained in detail and examples are provided for each of the partnership configurations. The sixth section provides a high level overview of the methodology used to develop the taxonomy. The chapter ends with a brief conclusion.

MARKET CREATION PARTNERSHIPS

This chapter focuses on partnerships formed to create new markets, not simply access existing markets. A partnership in this chapter is defined as two or more organizations (i.e., firms, government agencies, NGOs, and universities) that agree (implicit or explicit contract) to share risk, responsibility, resources, competencies, and benefits to achieve a specific objective—in this case, to increase Internet usage rates in Mexico (Nelson 2002).²

According to Kotler and Armstrong (2001), one way a firm can expand the size of its market is to develop new users: either by extending into new geographic segments (market access) or by converting nonusers of a good or service into users (market creation). Market access, therefore, refers to market-share expansion, or increasing a firm’s proportion of the total sales of a particular good or service on a global level. Conversely, market

creation, or converting nonusers to users, is defined as increasing the total sales of a particular good or service on a global level. Because the vast majority of emerging-market citizens do not currently use the Internet or Internet-related goods and services, the focus of this chapter is on market creation partnerships or those designed to convert Internet nonusers into users.

There is a discrepancy, however, between the practice and theory of market creation partnerships. In practice, firms are drawing upon a wide range of entities—firms, universities, government organizations, and nonprofit organizations—for their market creation partnerships. Scholars such as Kanter (1998) and Prahalad and Hart (2002) all agree that market creation efforts in emerging markets require partnerships of diverse configurations. In theory, however, the conceptual foundations for partnership are largely separated into two categories: traditional (between two or more private sector firms) and cross-sector (between public, private, and nonprofit organizations) partnerships (Gray, 2000; Huxham & Vangen, 2001). Not only is this scholarship compartmentalized, but Nelson (2002) also contends that there is a bias toward the study of traditional interfirm partnerships.

This research project contributes to academic theory by simultaneously analyzing both traditional and cross-sector partnerships. Specifically, the focus is on partnerships with a market creation objective. As a first step in this new line of inquiry, this chapter will classify the partnerships to give them empirical meaning.

INTERNET MARKET CREATION PARTNERSHIP TAXONOMY

Classification is arguably one of the most central and generic of all of our conceptual exercises ... Without classification, there could be no advanced conceptualization, reasoning, language,

data analysis or, for that matter, social science research. (Bailey, 1994, p. 1)

High-tech firms are partnering with a wide array of organizations to overcome the barriers to Internet usage in Mexico and stimulate its demand. These strategies can be categorized according to the barrier(s) to Internet usage they were designed to overcome. This classification system, or taxonomy, is based on a total of 32 Internet market creation partnerships in Mexico. The Internet market creation partnership taxonomy (taxonomy) is shown in Table 1.

The taxonomy classifies the market creation partnerships into three broad categories and six subcategories. The three broad categories are the number of barriers to Internet usage, in Mexico, the partnership was designed to overcome. The majority of partnerships in this study set out to tackle a single barrier to Internet usage. Slightly less than one third of the partners set out to simultaneously tackle two barriers to Internet usage. Very few partnerships set out to simultaneously tackle three barriers to Internet usage. None of the partnerships included in this study simultaneously tackled all four barriers to Internet usage. This is because two of the barriers (lack of awareness and lack of uses) are mutually exclusive.

The six subcategories of the taxonomy are the specific barrier, or combination of barriers, to Internet usage the partnership set out to overcome. These are as follows:

Single Barrier Partnerships

- Lack of funds: The potential user does not have the economic resources to afford Internet access or to acquire the technology or services required to facilitate this access.
- Lack of awareness: The potential user is unaware of the value of the technology.
- Lack of uses: The technology is not “accessible” to the potential user or does not have value for the potential user due to its current

Table 1. Internet market creation partnership taxonomy

| INTERNET MARKET CREATION PARTNERSHIP TAXONOMY | | | | | | |
|--|----------------|-------------------|--------------|--|------------------------------------|---|
| Number of Barriers Tackled by the Partners | SINGLE BARRIER | | | DUAL BARRIER | | TRIPLE BARRIER |
| Type of Barrier(s) to Internet Usage Tackled by the Partners | Lack of Funds | Lack of Awareness | Lack of Uses | Lack of Funds + Lack of Infrastructure | Lack of Funds + Lack of Uses | Lack of Funds + Lack of Uses + Lack of Infrastructure |

form or the user’s profile (education rates, etc.) (Gándara, 2003).³

have value for the potential user due to its current form or the user’s profile (education rates, etc.)

Dual Barrier Partnerships

- Lack of funds + lack of infrastructure: The potential user does not have the economic resources to afford Internet access or to acquire the technology or services required to facilitate this access; and the potential user does not have a telephone line to use to access the Internet.
- Lack of funds + Lack of uses: The potential user does not have the economic resources to afford Internet access or to acquire the technology or services required to facilitate this access; and the technology is not “accessible” to the potential user or does not

Triple Barrier Partnerships

- Lack of funds + lack of infrastructure + lack of uses: The potential user does not have the economic resources to afford Internet access or to acquire the technology or services required to facilitate this access; the potential user does not have a telephone line to use to access the Internet; and the technology is not “accessible” to the potential user or does not have value for the potential user due to its current form or the user’s profile (education rates, etc.)

The underlying assumption behind the lack of awareness, lack of funds, and lack of infrastructure barriers to Internet usage is that the technology, in its current form, does offer value, but the potential user is simply unaware of this value (lack of awareness) or unable to tap into this value due to economic (lack of funds) or telephone line (lack of infrastructure) constraints. The lack of infrastructure barrier always went hand-in-hand with the lack of funds barrier in the partnerships cited by the high-tech firms in the sample.

Examples of single-, dual-, and triple-barrier partnership strategies are presented in the next three sections of this chapter. This serves to clarify and further describe the taxonomy and categories.

SINGLE BARRIER PARTNERSHIPS

Approximately two thirds of the 32 partnerships analyzed to develop the taxonomy fall within one of the three single barrier categories of the taxonomy: lack of funds, lack of uses, and lack of awareness. More than half of the single barrier partnerships were between two or more firms, often high-tech multinational firms. The other half of the partnerships consisted of a diverse array of partner configurations (i.e., a private sector firm and a government agency; a private sector firm and a university; and a private sector firm and a nonprofit organization). In the balance of this section, each of the single barrier category types is explained and an actual example of a partnership in this subcategory is provided.

Lack of Awareness

After the double-digit growth of the ICT industry in the late 1990s, spending on ICT-related goods and services plummeted after the turn of the century. The dot com bubble burst, coupled with the overall downturn in the global economy, led ICT investment proposals to be scrutinized as never

before. This is particularly true of small- and medium-sized enterprises (SMEs), an extremely large and important market segment in Mexico, and late adopter of Internet-related technologies. Most high-tech executives interviewed for this study believe that the Internet has intrinsic value for both SMEs and larger organizations and many have formed partnerships to build the business case or educate the market on the value of this technology. These partnerships tended to be, but were not exclusively, between two high-tech firms.

Example: Making the Business Case

Partnership: Cisco Systems and the Mexican Ministry of Health

Cisco Systems (Cisco), a \$19 billion dollar company, is the “worldwide leader in networking for the Internet” (Cisco, n.d.). Until recently Cisco was the darling of the new economy. Within 10 years of its creation, Cisco had experienced growth rates of up to 50% and at one point had one of the highest market capitalizations in the world. After the turn of the century and with the burst of the dot com bubble, however, Cisco’s stock plummeted and for the first time ever it announced layoffs.

Cisco’s lackluster performance after the turn of the century, coupled with an overall downturn in the global economy, forced the firm to revisit its sales strategies. In this more austere environment, technology investment proposals were being scrutinized as never before and traditional financial measurements, such as return on investment, were now required to justify these purchases. Cisco equipment would no longer sell by itself, the firm now needed to proactively create new markets for its products.

Cisco relied heavily on the Internet to facilitate the exponential growth it experienced in the 1990s and has incorporated this technology into all facets of its business operations. Cisco has

been meticulous in documenting the cost and productivity advantages that resulted from its internal use of Internet technology. Cisco created the Internet Business Solutions Group (IBSG) to share these Internet “best practices” with its key customers.

IBSG provides pro bono consulting services to Cisco’s most strategic customers. These services revolve around demonstrating the business case for using Internet technology to solve tangible business problems. Cisco’s objective is to help potential customers justify Internet-related investments. Each solution generally involves products and services from multiple providers, including Cisco. Partnerships, therefore, are a large part of the equation and Cisco has a stable set of solid technology partners it knows it can depend on for high quality, integrated solutions.

In Mexico, the IBSG group proactively approached the leaders of e-Mexico, the national connectivity program, and offered them its trusted advisor services. E-Mexico is the Mexican government’s strategy to exploit the power of the Internet technology for the delivery of health, education, commercial, and government services across the country. Specifically, Cisco has worked with the Ministry of Health on a medical training project. As in most emerging markets, the public sector is a major technology consumer and therefore a key target for Cisco. By forming strong relations with the e-Mexico team, Cisco hoped to improve its overall positioning within Mexico’s federal government.

In a tribute to Cisco’s Mexican IBSG team, a representative from the e-Mexico Committee of the U.S. Chamber of Commerce commented that the Ministry of Health’s e-Mexico plan is one of the most realistic and feasible of all of the e-Mexico projects. The quality of the actual plan, however, is not Cisco’s primary objective. By becoming a trusted advisor to, and partner of, the Mexican government and providing them with Internet-

based solutions to concrete business problems, Cisco is attempting to expand the overall market for its Internet equipment.

Example: Educating the Market

Partnership: Alestra and Cisco’s Public Forum for Technological Diffusion

Alestra, which markets its services under the AT&T brand name, is a telecommunications provider and the fourth largest Internet service provider (ISP) in Mexico.⁴ Since competition was introduced into the Mexican marketplace in 1996, prices for Alestra’s core offering—long distance telephone service—decreased by over 60% (Alestra, 2002). Alestra believes that the Internet and data services are key to its survival, but fears that the low number of high-usage Internet customers in the country could hinder its success (Alestra, 2002).

Almost 80% of all of Mexican corporations have less than 15 employees (Osterroth, 2004). These firms are leading the growth of the Mexican economy and are expected to contribute to more than half of the new jobs created in 2004 (“SMEs generate 70% of new jobs”, 2004). Alestra’s Internet business development director noticed that SMEs were not aware of the capabilities or value of Internet technology. In late 2001 he decided to work on educating this market segment on the value of Internet technology in order to generate new demand in this fast growing and underserved market.

Alestra invited Cisco to partner with it on its SME education initiative. Alestra’s parent company, AT&T, has a close relationship with Cisco in the United States and Alestra itself uses Cisco equipment exclusively for its Internet network in Mexico. The relationship was mutually beneficial because as Alestra sells more Internet services, it will need additional networking equipment. Suc-

Bringing the Next Billion Online

cess in this initiative, therefore, would translate into increased demand for both firms. Furthermore, by partnering, the two firms would become solutions providers and not stand-alone hardware or communications service vendors.

The solution was the Public Forum for Technological Diffusion for SMEs. Alestra and Cisco sporadically hosted these sessions in the six principal cities in Mexico. The objective was to educate SMEs on the value of Internet technology, not sell products. No price lists or sales-oriented literature was shown. In the forum events, Alestra and Cisco presented economical alternatives for exploiting the Internet for business gain, and SMEs gave testimonials on their successes in implementing this powerful business tool.

Although these forum events are not sales seminars, Alestra measures success based on the number of leads generated at each session and how many of these led to new sales of virtual private networks. Based on these two indicators, the forum has had very good results. The relationship between the two firms is also very solid.

Lack of Funds

According to World Bank (2004) statistics, Mexico's per capita income was \$6,230 in 2003. The vast majority of potential Internet users in Mexico, therefore, do not have the economic resources to afford Internet access or to acquire the technology or services required to facilitate this access. High-tech firms have partnered amongst themselves to decrease the costs of Internet access to create new demand for this service. These partners have employed three main tactics: (1) decrease upfront costs (bundle and finance model), (2) decrease recurring costs (prepaid model), and (3) increase operational efficiency (efficiency model). One firm took an alternative approach and focused on increasing income levels rather than decreasing costs.

Example: Decreasing Upfront Costs (Bundle and Finance Model)

Partnership: Teléfonos de México's Prodigy Internet Plus

Teléfonos de México (Telmex) is the leading communications provider in Mexico and a part of the Carso Group, the largest conglomerate in Latin America ("Latin Trade 100", 2002; Telmex, 2002). Carlos Slim, Chairman of the Carso Group, believes because of the commoditization of long distance telecommunications services, Telmex's primary source of revenues, "we have to move into other areas...the key is the Internet" (Business-Week Online, 2001). Telmex launched Mexico's first commercial Internet access service, Direct Personal Internet (DPI), in 1997 and although the number of DPI subscribers increased 400% in a single year, this still represented less than 2% of Telmex's customer base (Telmex, 2000). Telmex estimated that it should easily have five times that number of subscribers and set out to accelerate Internet usage in Mexico.

Telmex's Vice President, Internet Platform realized that "to sell the Internet and use the Internet you need a device," or PC. This was an obstacle to Internet growth in Mexico as there were less than 4 million PCs in the entire country in 1998 (ITU, 2000). Many of Telmex's customers could not afford the upfront expense of a PC and consumer credit was severely limited due to the significant defaults associated with the 1994 Peso crisis. Telmex decided to "lower the barriers to entry" by bundling a PC with its Internet service and finance this bundle over a several year period. This is a model telecommunications carriers have used with their commercial customers for years: personal branch exchange (PBX) equipment was bundled with telecommunications services and the telecom company charged the corporate customer a fixed monthly fee. Telmex simply extended

this model to the consumer mass market and the Internet arena.

In mid-1999, Telmex introduced Prodigy Internet Plus (PIP) in Mexico. Telmex partnered with a wide array of firms to assemble and distribute this package. The PIP service included a PC loaded with Microsoft's Office suite of products, 2 years of unlimited Internet access, an e-mail account, and an individual Web page. Subscribers were charged a small down payment upon signing up for the service and the balance was paid via fixed monthly fees charged to their Telmex phone bill. At first, Telmex sold PIP services via a call center, but subsequently it extended this offering to the retailers in the Carso Group of companies (e.g., Sears and Sanborns) for wider distribution.

Telmex and its partners have had to adjust its PIP program various times to stimulate demand. When PIP sales began to level off in 2000, Telmex revised the PIP package and replaced Microsoft's Office for Microsoft's less expensive (and functional) Works suite of products. Telmex passed this cost savings on to its customers and decreased the PIP fixed monthly fee. PIP subscriptions surged as a result. In 2002, PIP sales once again stalled. As before, Telmex adjusted the package, this time replacing Intel processors with a less expensive processor and charging a per-minute fee for Internet access during peak hours. This new offering was called PIP-Home and was designed for students, which would likely use the Internet on nonpeak hours. PIP sales again spiked as a result.

Several of Telmex's competitors state that Telmex's PIP offering has been the most successful program in increasing Internet demand in Mexico and credit it with single handedly doubling Internet usage rates in the country. An anonymous senior executive at Telmex, however, acknowledges that the PIP program has limits, "today we finance computers ... in order to facilitate the purchase of PCs ... it is a method of attacking the lack of purchasing power ... but even this has a limit,

when you reach a point when even with this people can't use a computer..."

Example: Decrease Recurring Costs (Pre-Paid Model)

Partnership: Todito and Adatel's Pre-Paid Internet Card

Todito is an Internet portal, electronic commerce (e-commerce) site, and ISP in Mexico (Todito, n.d.). Todito is part of Salinas Group, a large Mexican conglomerate led by Ricardo Salinas, which focuses primarily on the mass market in Mexico. During the dot com boom of the late 1990s, the group's companies became interested in exploiting the Internet and e-commerce. Instead of creating a new Internet company, the Salinas Group acquired a 50% stake in Todito, which was owned by Salinas' brother's Dataflux Group.

Todito's chief executive officer (CEO) recognized that his Internet portal and e-commerce services would be worthless if people could not access the Internet. He believed that one significant barrier to Internet usage in Mexico was the lack of affordable ISP access. Adatel, a small high-tech firm, had approached Todito with a pre-paid Internet solution. Todito's CEO thought that this would be a particularly appropriate solution for Mexico. He notes that pre-paid programs proliferate in the country because the economic uncertainty makes the idea of having a long-term obligation unappealing to most Mexicans. Furthermore, he claims that the average Internet user in Mexico connects to the Internet only 8 hours a month, thus he believed the flat-fee Internet services made hourly rates cost prohibitive for the mass market. A pre-paid Internet card would allow consumers to both control their costs and only pay for the time they are actually online.

Todito and Adatel worked together to develop a "Todito card" prepaid Internet product, which was launched in the spring of 2001. At first, Todito

Bringing the Next Billion Online

marketed and distributed the Todito card and Adatel provided the actual service. Over time, Todito licensed the technology from Adatel and assumed the service delivery responsibilities. The partnership subsequently ended, but Todito continued with the Todito card product on its own.

The Todito card catapulted Todito from relative obscurity to being the third ranking ISP in the Mexican marketplace in less than 2 years. The profit margins on the card are generous and it is now a profitable business for Todito.

Example: Increasing Operational Efficiency (Operational Efficiency Model)

Partnership: IBM and Telecommunications Providers in Mexico

IBM is the “worlds largest” information technology (IT) solutions and services provider (IBM, 2004). When Gerstner joined the firm as CEO in the early 1990s, IBM was a decentralized, technology-centric firm that was losing billions of dollars a year (Gerstner, 1998). In less than a decade, IBM was once again a highly profitable IT powerhouse and Gerstner a widely acclaimed business guru (Teresko, 1999). Gerstner claims that this successful turnaround is due to IBM’s singular focus on developing integrated solutions that will provide its customers with a competitive advantage. The Internet is at the core of IBM’s solution-centric strategy, and early on IBM focused on the “transformative power” of the Internet and “ways individuals and institutions derive value” from the Net (Gerstner, 1998).

IBM was the sole firm in the sample that took an indirect approach to tackling the lack of funds barrier to Internet usage in Mexico. Specifically, IBM focused on increasing the operational efficiency of telecommunications providers in Mexico. It realizes that the productivity of telecommunications’ infrastructure investments greatly decreases

once outside of high-density urban areas. IBM believes that its technology can help increase the efficiency of telecommunications providers, enabling them to offer more services at more economical rates in lower density populations and subsequently lead to increased Internet demand in the country. IBM therefore collaborates with its customers—telecom providers—to assist them with systems integration, processes optimization, and creating and provisioning new services to this client base.

Specific information was not made available on the success of this approach, but it is an innovative way of tackling the supply side of the lack-of-funds barrier to Internet usage.

Example: Increase Income Levels

Partnership: Motorola=educ@Mexico

Motorola has a long tradition of supporting education and viewing investments in education as imperative to achieving its long-term, market creation objectives. Motorola’s executive team in Mexico believes that improved education levels lead to enhanced employment opportunities and thus, higher earning potential. As disposable incomes increase, so does the overall market for Motorola’s products and services. Additionally, they believe that education can be used to overcome people’s fear of technology, again leading to increased demand. Education-related activities, therefore, are a core component of Motorola’s long-term expansion strategy in emerging markets, such as Mexico.

In 1999, Motorola launched the Motorola=educ@Mexico initiative. Motorola had been actively engaged with educational institutions since its entry into the Mexican market over 40 years ago, and this program simply organized these efforts under a single umbrella initiative. Motorola has partnered with a diverse range of firms, NGOs, universities, and government agen-

cies to improve education under the auspices of the Motorola=educ@Mexico program.

One specific Motorola=educ@Mexico partnership was between Motorola and the Universidad del Valle de Mexico (UVM). UVM is a large, national, private university in Mexico with a predominantly middle-class student body. Motorola provided UVM with \$25,000 to assist it with equipping two computer laboratories on its Lomas Verdes campus, and high-ranking Motorola executives participated in educational-related events at UVM (Romano, 1997). UVM believes that its students must have access to state-of-the-art technology for their laboratory experiments and workshops. The Motorola partnership has enabled UVM to achieve this objective, and the laboratory on its Lomas Verdes campus is the most sophisticated of its 16 campuses.

Motorola's university partners interviewed in this study unanimously agreed that Motorola made great strides in enhancing educational activities in their institutions and they believe this is largely due to the firm's pro-education corporate culture and executive team in Mexico. In an industry where the very survival of a firm depends on its ability to effectively compete for a limited pool of highly trained personnel, Motorola's direct link to the source of this talent could also be a significant competitive advantage.

Lack of Uses

Many potential Internet customers in Mexico are unable to use the technology because of language, literacy, training, and cultural barriers. Lack of Uses could be the single most difficult barrier to overcome, as resolving it requires rethinking the value proposition of the technology and partnering with nontraditional players (educational institutions, government agencies, and/or NGOs). The most common approach to tackling this barrier to Internet usage was to develop new applications and uses for the technology.

Example: Developing New Uses for the Technology

Partnership: IBM's Reinventing Education

High-tech firms have a long history of partnering with educational institutions. These partnerships have traditionally revolved around product donations, which are seen as a method of building brand awareness and future consumers. IBM has taken a distinct approach—it has focused on providing educators and educational institutions with compelling reasons to use its technology. IBM's Director of the Public Sector in Mexico, Lorenzo Valle, states, "it isn't a question of simply implementing Internet services, it is a much more complex problem...the most important thing is that people know how to use it and have a reason to use it" (personal communication, 2004, emphasis added).

IBM believes that it is capable of developing technological solutions, but it needed experts in education to help identify and develop value-added uses for Internet technology in academic institutions. The result was IBM's Reinventing Education Program. IBM partnered with a small set of schools to identify systemic problems in education and educational institutions. It then worked hand-in-hand with these schools to develop technological solutions for these problems. These solutions were pilot tested in a school, refined and then, ideally, converted into commercial offerings for the educational marketplace.

One specific result of the Reinventing Education Program was the development of Learning Village software. This software connects schools, libraries, professors, students, teachers, and parents to encourage greater collaboration, communication, and learning. The software was initially developed and refined in conjunction with a school in the United States and in 2004 was introduced to Mexico and Brazil. In Mexico, the Learning Village software will be piloted in the Mexican

state of Hidalgo. IBM believes that Hidalgo is an ideal test bed for this software as there are just a handful of advanced firms and universities, a moderate-sized, middle-class population, and a large marginalized and poor community in this state. These characteristics—small upper and middle classes and a large lower class—are representative of Mexico as a whole.

It is too early to evaluate the success of IBM's Learning Village pilot project in Mexico. An evaluation conducted by the Center for Children and Technology, however, reports that IBM's overall Reinventing Education Program has had very positive results on education and educational administration in the United States (Spielvogel, 2001). This program has also helped IBM begin to make a profit in the K-12 education market—a market where IBM had traditionally recorded a loss (Kanter, 2001).

DUAL BARRIER PARTNERSHIPS

Slightly less than one third of the partnerships analyzed to develop the taxonomy fall within one of the two dual barrier categories of the taxonomy: lack of funds + lack of uses and lack of funds + lack of infrastructure. Approximately half of these partnerships were formed between a high-tech firm and a university, one quarter were between two high-tech firms, and one quarter involved the participation of high-tech firms and NGOs. In the balance of this section, each of the dual barrier category types is explained and an actual example of a partnership in this subcategory is provided.

Lack of Funds and Lack of Infrastructure

The vast majority of Mexico's Internet subscribers rely on the traditional wire-line telephone network for Internet access. According to the ITU (2002),

14 out of 100 Mexicans, or approximately 45% of households, have a phone line. The number of telephone lines is therefore an artificial ceiling for Internet usage rates in Mexico. This is particularly true for potential users in lower economic levels in Mexico, which tend to live in infrastructure-poor areas (no telephone lines). High-tech firms partnered with a diverse set of entities to simultaneously overcome both the financial (lack of funds) and infrastructure (lack of telephone lines) barriers to Internet usage in Mexico. Todito, for example, was particularly active with dual barrier partnerships and employed two main approaches: providing low-cost, shared-access sites (cybercafe model) and developing alternative, less expensive, access and payment technologies (wireless and prepaid model).

Example: Cybercafe Model

Partnership: Todito and Oxxo's Digicentro Todito

Todito's CEO believes that there are three barriers to Internet usage in Mexico: a phone line, a computer, and an affordable ISP. The Todito prepaid Internet card addressed the last issue—the affordable ISP. The remaining two barriers still prevented large segments of the Mexican population from using the Internet. Todito, therefore, decided to simultaneously leverage the success of its Todito card and tackle the income and infrastructure barriers to Internet usage in Mexico via a new initiative: Digicentro Todito.

Todito partnered with one of Mexico's largest chain of convenience stores, Oxxo, which was also one of the primary distributors of its Todito card. These two parties created cybercafes or Digicentros Todito. Customers would use their Todito prepaid Internet cards in the Digicentro Todito to access the Internet from one of the half dozen computers located in the Oxxo store. Oxxo provided the physical and communications

infrastructure (telephone lines and space in the Oxxo stores) and Todito provided an affordable method of accessing the Internet (Todito prepaid Internet cards and PCs).

It was envisioned that Todito would benefit by having an additional outlet for its Todito cards and by solidifying its relationship with a key distributor. Oxxo would benefit by selling additional units of a high-volume product (Todito card) and by upgrading its stores and image in line with its “Oxxo of the Future” campaign. To bias the likelihood of success, the first Digicentro Todito was launched in late 2003 in Cancun, a hot spot for foreign tourists. If this launch is a success, Digicentro Todito cybercafes will be rolled out in the major cities in Mexico and ideally, to all 2,000 Oxxo stores across the country.

Example: Wireless and Pre-Paid Model

Partnership: Todito and Biper’s Movilaccess

Todito executives believe that e-mail is the number one application on the Internet in Mexico. In the mid-1990s, Grupo Salinas established a company—Biper—to provide paging services in the Mexico market. The cost of acquiring a pager and Biper’s monthly fees were relatively expensive for the mass market for which the Grupo Salinas’ companies traditionally catered. Todito’s executives believed that if they could lower the price of the device and enable customers to send and receive e-mails paid for by Todito prepaid Internet cards, they could enable an entire new segment of the Mexican market access to the most popular application of the Internet and increase aggregate Internet demand. This solution would overcome both the income (low cost device and prepaid Internet access) and infrastructure (low levels of telephone lines) barriers to Internet usage.

Todito’s business plan was based on three elements: a device priced at less than \$50, affordable access fees, and wide-scale distribution.

The access fees could be made affordable by using Todito’s prepaid Internet access card, which would allow Mexicans Internet access without having to sign a long-term contract. Distribution channels had already been secured for the Todito card and could now be used for this new product. The critical factor was decreasing the device cost from approximately \$160 to less than \$50.

At the time, the usage of two-way paging technology was declining in industrialized countries. Todito hoped to exploit this mature technology for a few years in Mexico until the country was ready for more sophisticated technology. Todito sought a partnership with a two-way paging technology company. These companies, however, were diverting their resources and energies away from this declining technology and toward more cutting-edge solutions. Todito quickly found that as the technology fades in industrialized countries, the number of firms that offer it decreases, as do investments in the technology.

Todito and Biper were still negotiating with paging manufacturers at the end of this study and it was unclear as to if they could reach the targeted \$50 price for these devices. This case is interesting, however, as it demonstrates the limitations of firms and countries in repurposing existing technology for the needs of emerging markets. Leapfrogging, or bypassing mature technologies in favor of cutting-edge technologies, may be the only option in some cases.

Lack of Funds and Lack of Uses

Low income levels often go hand-in-hand with low educational attainment rates. If individuals do not learn computers, IT, and English language skills in school, they may not be able or interested in using the Internet. Firms have partnered with educational institutions and NGOs to simultaneously tackle the income and uses barriers to Internet demand in Mexico. These partnerships generally attempted to increase income levels and

to develop new uses for this technology (education and content development model).

Example: Education and Content Development Model

Partnership: Sun Microsystems and UNITEC's E-Business Technology Incubator

Sun Microsystems (Sun) is a “leading provider” of hardware, software, and services that power the Internet (Sun, n.d.). Sun strongly believes in ubiquitous connectivity and its mission is to link “every man, woman, and child on the planet” to the Internet (Sun, n.d.). Sun executives in Mexico perceive that there are at least two primary barriers impeding Sun from achieving this mission in their country: lack of funds and lack of uses. Sun's collaborations with universities are designed to overcome these obstacles and in the long run, create Internet demand in this market.

Since the turn of the century, Sun has executed a variety of strategies directed toward expanding its business around the world and in Mexico. Given Sun's long tradition of collaborating with universities, many of these market creation initiatives were implemented in conjunction with the educational sector. Specifically, these strategies focus on creating employment opportunities, improving education, and diffusing Sun's network-centric technology vision. In the long run, higher educational achievement and increased employment opportunities will lead to improved income levels and people's ability to afford the Internet and Sun's goods and services. Furthermore, Sun focuses many of its university collaborations on developing applications designed to make the Internet “simpler” and less expensive. Sun's Java technology can be used to connect less expensive devices—such as cell phones and personal digital assistants (PDAs)—to the network, decreasing the lack of funds and lack of uses barriers to Internet diffusion.

One specific partnership was the Sun—Universidad Tecnológica de México (UNITEC) electronic business technology incubator (Incubator). In September of 2001, Sun invited UNITEC to participate in its elite Campus Incubator Program. UNITEC is the second largest, private university in Mexico and has a predominantly middle-class student body (UNITEC, n.d.). These two organizations jointly established an Incubator on UNITEC's Atizapán campus outside of Mexico City.

The UNITEC Incubator is equipped with an extensive array of Sun products, so that the students can develop their Java-based business concepts on state-of-the-art technology. Students that enter the Incubator are required to take a significant number of courses on Sun's Java technology. In order to facilitate the technical training, Sun taught and certified three UNITEC professors on Java and has authorized UNITEC to impart Java courses to the students in the Incubator free of charge. The students also received business training and individualized assistance on their business plans.

In late 2003, UNITEC announced its sixth business plan competition for entry into the Incubator. Over 300 business plans have been submitted thus far and 20 have been selected for development in the Incubator. The first businesses were slated to exit the Incubator in early 2004. The Incubator Director's top priority in late 2004 was to find venture capital for these nascent companies, an extremely difficult task with the significant decreases in capital being invested in IT solutions and in Latin America after the dot com bubble burst.

TRIPLE BARRIER PARTNERSHIPS

Less than 10% of the partnerships analyzed to develop the taxonomy fall under the triple barrier category of the taxonomy: lack of funds + lack of

uses + lack of infrastructure. Very few high-tech firms had the financial capacity and reach to initiate these partnerships and the Mexican government took the lead on the primary initiative in this category—e-Mexico, a national connectivity program. The one exception was a multi-sector relationship between a high-tech firm, a university in the United States, local government agencies, and NGOs.

Lack of Funds, Lack of Uses, and Lack of Infrastructure

Many Mexican high-tech firms segment their market according to socioeconomic level (education, housing, and income levels). The scale ranges from A to E, with A being the highest socioeconomic level and E the lowest. A Mexican newspaper, reported that from 2000 through 2002 the number of Internet users in the highest (A and B+) and lowest (D- and E) socioeconomic levels in Mexico remained relatively constant (Reforma, 2004). This suggests that the majority of programs designed to increase Internet usage in Mexico have attracted new customers primarily from middle socioeconomic tiers. These customers may have faced one or two barriers to using the Internet. The lower on the socioeconomic pyramid an individual is, however, the more barriers to Internet usage he/she likely faces. In rural communities and marginalized sections of urban areas, Mexicans may lack the funds, required infrastructure (telephone lines), and ability to use the Internet. In Mexico, the government and private sector are collaborating to simultaneously tackle these three barriers to Internet usage. The programs extend telephone infrastructure (both wireline and wireless—satellite), developing relevant content, and subsidizing usage fees. In the balance of this section, the only triple barrier category type is explained and an actual example of a partnership in this subcategory is provided.

Example: Subsidized Internet Access, Infrastructure Deployment, and Content Development Model

Partnership: e-Mexico

In December of 2000, Mexico's newly elected President, Vicente Fox, announced a national Internet connectivity program, e-Mexico. By the end of Fox's 6-year presidency, the e-Mexico system would consist of 10,000 digital community centers, which provided free (or highly subsidized) access to computers, the Internet, and newly developed content in the areas of health, education, electronic government (e-government), and e-commerce-related content. These centers would be placed in public facilities (i.e., schools, government offices) and would connect over 95% of Mexico's population to the digital economy.

President Fox made it clear that he was counting on private sector support for this multi-billion dollar initiative because the federal government did not have the budget, nor technical expertise, to complete it on its own. Shortly after e-Mexico was announced executives from Telmex, Hewlett Packard, IBM, Intel, Microsoft, Sun Microsystems, and other firms all expressed an interest in partnering with the federal government on this ambitious program. Some partnerships simply extended existing global programs to Mexico (i.e., Intel committed to training Mexican teachers via its global Teach for the Future initiative). Other partnerships created new initiatives to contribute to the Mexican government's objectives for e-Mexico (Telmex created eTelmex, an initiative designed to connect 2,445 targeted e-Mexico villages to the Internet).

By mid-2003, President Fox announced that he had connected 3,200 digital community centers to the Internet and created the e-Mexico portal with content in the areas of education, health, e-commerce, and e-government (Fox, 2003). What was not reported, and is not being monitored by the

Mexican government, is the actual number of new Internet users on the e-Mexico platform. Access to the technology does not necessarily translate into its usage; particularly if training is not included with the newly deployed access. Furthermore, although the Mexican government pronounced an interest in “partnering” with the private sector to achieve the e-Mexico objectives, it has worked in a more traditional vendor-customer fashion and has submitted requests for proposals and selected its “partners” largely based on price.

METHODOLOGY

Four main steps were taken to develop the taxonomy. The first step was to select the partnership population: 25 leading high-tech firms in Mexico. The second step was data collection: data were gathered via more than 60 personal interviews with executives and managers of leading high-tech firms, nonprofit leaders, academic, government representatives, and external experts in Mexico. The third step was data analysis: an iterative process of data reduction, categorization, and testing. The fourth, and last step, was testing: the integrity and exhaustiveness of the taxonomy was tested through a second round of data collection and analysis, and external validation.

Step 1: Select the Partnership Population

A relatively broad population was drawn upon to develop the taxonomy. This population consisted of 25 leading high-tech firms in Mexico and was selected based on three dimensions: (1) market characteristics (industry growth potential, income and population levels, and regulatory framework), (2) industry characteristics (high-tech firms in Mexico), and (3) firm characteristics (firm’s market position and physical presence in Mexico). Mexico was selected for analysis because it represents upper-middle income, densely populated countries

with substantial competition in the Internet arena. The 25 firms included in the taxonomy population are: Alestra, AMD, AOL, Apache, Avantel, Cisco, Dell, EsMas, Hewlett Packard, IBM, Intel, Juniper, Maxcom, Microsoft, MSN, PanAmSat, Prodigy, RedUno/Uninet, Satmex, Sun, TIMSN, Telmex, Terra Lycos, Todito, and Yahoo.

Step 2: Data Collection

After the population was selected, data were gathered. Two pieces of information were required from the firms to construct the taxonomy: (1) high-tech executives’ and managers’ perceptions of the barriers to Internet diffusion in Mexico; and (2) the partnerships these firms have created, or participated in, to overcome these barriers and grow the market. Interviews were also conducted with the firms’ partners and external experts to determine the effectiveness and nature of the partnerships included in the taxonomy.

Before interviews were conducted, both primary and secondary archival records were consulted. These were used to construct a preliminary sketch of the high-tech firms market in Mexico and to develop a list of potential interview candidates.

A total of 13 of the targeted 25 firms agreed to be included in this study. Personal interviews were conducted with a total of 63 individuals: 38 representatives of high-tech firms, 14 of the high-tech firms’ partners, and 10 external experts in Mexico. Most of these interviews were conducted during four field research trips to Mexico City: February 2003, May 2003, October 2003, and January 2004. The interviews were semi-structured, face-to-face sessions that ranged from 20-240 minutes.

Step 3: Data Analysis

Vast amounts of data were generated from the interviews. Miles and Huberman’s (1994) process of data reduction, data display, conclusion drawing,

and verification were used to analyze these data. The first step in the data analysis process was to reduce the data, or to identify and select specific portions of data for analysis. The data in this case were the interview transcript sheets. A coding scheme was developed to enable data reduction. Once the data were reduced, they were displayed in Excel spreadsheets. The data in these spreadsheets were reviewed and labels given to the individual barriers to diffusion. Subsequently, these labels were analyzed to see if there was consistency, or a pattern, in the barriers cited. A great deal of consistency was found and 10 major themes emerged. These themes were further examined and grouped into more concise and overarching categories. The final result of this process was the creation of four categories of the perceived barriers to Internet diffusion in Mexico (lack of awareness, lack of funds, lack of infrastructure, and lack of uses).

Once the perceived barriers to Internet diffusion had been identified and classified, they needed to be associated with the partnerships. Specifically, each of the 32 partnerships was categorized by the specific barrier(s) to Internet diffusion it was designed to overcome. The draft taxonomy was then completed.

Step 4: Validity Assessment

Two primary verification mechanisms were used to increase the validity of the taxonomy: external validation and a second round of data collection and analysis. After the first round of interviews and data analysis, an external expert in the field cross validated the coding of the interview transcripts. This individual coded a representative sample of approximately 20% of the senior executive, interview transcript sheets. The coding results were compared against those of the author of this study and any inconsistencies were reviewed and discussed until agreement was reached. The coding definitions were also rewritten to make them more concise and clear.

Secondly, after completing the first draft of taxonomy, an additional 19 interviews were conducted. The data from these interviews were used to further test the validity of the taxonomy. This additional data suggested that these conclusions are valid and the taxonomy was exhaustive.

CONCLUSION

This chapter shed light on innovative market creation strategies being implemented by leading high-tech firms in Mexico. The objective was to develop a taxonomy of Internet market creation partnerships. This taxonomy classified the types of partnerships high-tech firms were using to create Internet demand in Mexico. The classification was based on the number and type of barrier(s) to Internet usage the partnership was designed to overcome.

As markets become more saturated in industrialized countries and multinational firms seek additional growth opportunities, market creation partnerships will increase in number and importance. This chapter advances scholarship by developing a classification system for market-creation partnerships. Practitioners can use this tool to identify and understand the diverse models being employed to increase Internet usage and emerging markets. Academics can use this tool as the basis for further empirical analysis of partnerships of this nature. Both society and business will benefit from a greater understanding of market creation partnerships as the barriers to Internet usage have both social and commercial underpinnings.

REFERENCES

Accenden a Internet Nuevos Grupos. (New Groups Join the Internet.) (2004, June 21). Reforma. Business Section.

Alestra. (2002). Form 20-F: Annual Report for the Fiscal Year Ending December 31, 2001. San Pedro Garza Garcia, Nuevo Leon, Mexico: Alestra.

Alestra. (n.d.). *Quienes somos*. (Who we are.) Mexico City, Mexico: Alestra. Retrieved February 5, 2004, from <http://www.alestra.com.mx/empresa/quienes.shtml>.

Baez, G. (2003, February 27). *Pyramid research: Communications markets in Mexico: Overview*. Presentation delivered to the Institute of the Americas Telecom/IT Mexico Roundtable. Mexico City.

Bailey, K. D. (1994). *Typologies and taxonomies: An introduction to classification techniques, Quantitative Publications in the Social Sciences Series, no. 07-102*. Thousand Oaks; London; New Dehli: Sage University Papers.

Cisco. (n.d.). *Corporate overview*. Retrieved February 13, 2004, from http://newsroom.cisco.com/dlls/company_overview.html

Cukor, P., & McKnight, L. (2001, Winter). Knowledge networks, the Internet and development. *The Fletcher Forum of World Affairs*, 25(1), 43-58.

De Marcillac, P. (2003, March). International markets: A renewed opportunity. Presentation delivered to the IDC Analyze the Future Conference, Boston.

Fox, V. (2003, June 5). Lanzamiento e Inauguración de la Primera Red Satelital e-México. (Launch and Inauguration of the First e-Mexico satellite network.) Speech delivered by Vicente Fox at the Launch and Inauguration of the First Satellite Network of e-Mexico, Gómez Portugal, Aguascalientes.

Gándara, M. (2003, Summer). Lessons from the field: The less-known dimensions of the digital divide. *STS Nexus*, 3(2), 17-22.

Generan Pymes 70% de los Nuevos Empleos. (2004, May 10). El Financiero.

Gerstner, L. (1998, April 27). 1999 IBM Annual Meeting of Stockholders. Excerpted remarks as delivered, Miami, FL.

Gray, B. (2000). Assessing inter-organizational collaboration: Multiple conceptions and multiple methods. In D. Faulkner & M. de Rond (Eds.), *Cooperative strategy: Economic, business and operational issues* (pp. 242-261). Oxford University Press.

Gutierrez, L. H., & Berg, S. (2000, November/December). Telecommunications liberalization and regulatory governance: Lessons from Latin America. *Telecommunications Policy*, 24(10-11).

Huxham, C., & Vangen, S. (2001). What makes practitioners tick? Understanding collaboration practice and practising collaboration understanding. In J. Genefke & F. McDonald (Eds.), *Effective collaboration: Managing the obstacles to success* (pp. 1-16). New York: Palgrave.

IBM. (2004, February 19). IBM offers solution for regulatory compliance. Retrieved February 25, 2004, from <http://www-1.ibm.com/press/PressServletForm.wss?MenuChoice=pressreleases&TemplateName=ShowPressReleaseTemplate&SelectString-t1.docunid=6708&TableName=DataheadApplicationClass&SESSIONKEY=any&WindowTitle=Press+Release&STATUS=publish>>

International Telecommunications Union (ITU). (2000). World telecommunications development report. Geneva, Switzerland: ITU.

International Telecommunications Union (ITU). (2001, January/February/ March). Numbering cyberspace: Recent trends in the Internet world. International telecommunications indicator update.

International Telecommunications Union (ITU). (2002). World telecommunications development report. Geneva, Switzerland: ITU.

- Kanter, R. M. (1998, January/February). *Six strategic challenges*. World Link.
- Kanter, R. M. (2001, September 10). IBM's reinventing education (A). (Case Study 9-399-008). Cambridge, MA: Harvard Business School.
- Kiiski, S., & Pohjola, M. (2002, June). Cross-country diffusion of the Internet. *Information Economics and Policy*, 14(2), 297-310.
- Kotler, P., & Armstrong, G. (2001). *Principles of marketing* (9th ed.). Upper Saddle River, NJ: Prentice Hall.
- Latin Trade 100. (2002, July). Latin Trade.
- Malkin, E. (2001, June 18). Telmex: Mexico's 800-pound gorilla. *Businessweek Online*. Retrieved December 5, 2003, from http://www.businessweek.com/magazine/content/01_25/b3737725.htm
- Miles, M. B., & Huberman, M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage Publications.
- Nelson, J. (2002). *Building partnerships: Cooperation between the United Nations system and the private sector*. New York: The United Nations' Department of Public Information.
- Osterroth, M. (2004, May 5). *Bajan Telefónicas Tarifas a Pymes*. (Telephone companies lower rates for SMEs.) Reforma.
- Prahalad, C. K., & Hart, S. L. (2002, First Quarter). The fortune at the bottom of the pyramid. *Strategy + Business*, (34).
- Romano, L. (1997, April 11). Promueve la Empresa el Desarrollo de Tecnología de Punta en Instituciones como la UVM-Edomex. (Firms are promoting the development of state-of-the-art technology in institutions like UVM-Edomex.) La Reforma, Business section.
- Smith, J. (2001, July 30). PC: Pretty cheap; Market saturation has made it a computer buyer's paradise. Rocky Mountain News, Business (p. 1B). Denver, CO: Rocky Mountain News.
- Spielvogel, B. (2001, June). *IBM reinventing education: Research summary and perspective*. New York: Center for Children and Technology.
- Sun Microsystems. (2004, January). Company info. Retrieved from <http://www.sun.com/company/>
- Telmex. (2000). Annual report for the fiscal year ending December 31, 1999. Mexico City: Telmex.
- Telmex. (2002). Annual report for the fiscal year ending December 31, 2001. Mexico City: Telmex.
- Telmex: Mexico's 800-Pound Gorilla. (June 18, 2001). *BusinessWeek Online*.
- Teresko, J. (1999, December 6). Driving success at New Blue. *Industry Week*, 56.
- Todito. (2002, October 14). Todito.com announces the launch of Todito ePAID. Todito press release. Retrieved January 9, 2003, from <http://www.todito.com/paginas/contenido/fc10142002/nt10778.html>
- UNITEC. (n.d.). *Conócenos*. Retrieved October 10, 2003, from <http://www.unitec.edu.mx/Acerca/index.html>
- World Bank. (2004). Mexico at a glance. Retrieved February 13, 2004, from http://www.worldbank.org/data/countrydata/aag/mex_aag.pdf
- World Resources Institute. (2003). Project Clearinghouse. Washington, DC: WRI. Retrieved December 5, 2003, from <http://wriwsl.digitaldividend.org/wri/app/navigate>

APPENDIX A: INTERVIEWS USED TO DEVELOP THIS CHAPTER

Personal interviews were conducted with a total of 63 individuals: 38 representatives of high-tech firms, 14 of the high-tech firms' partners, and 10 external experts in Mexico. Most of these interviews were conducted during four field research trips to Mexico City: February 2003, May 2003, October 2003, and January 2004. These interviews were used to develop this chapter and taxonomy. Almost half of those interviewed requested anonymity. Those that agreed to be identified are listed here by name and/or title and organization.

Representatives from High-Tech Firms

- Carlos Baradello, Vice President and General Manager of Latin America and the Caribbean, 1996-2002 (retired), Motorola of Mexico
- Gerardo Barragan, Director of Business Development, Alestra
- Rosendo Canizo, Director of Commercial Sector Services, Sun Microsystems of Mexico
- Eduardo Diaz Corona, VP of Internet Platform, Teléfonos de México (Telmex)
- Jesus Domene, Director of Internal Relations, Motorola of Mexico
- Javier Elguea Solís, Corporate Committee for Human Resources, Grupo Carso (Telmex) and President, Inttelmex
- Adrian Gonzalez, Chief Operating Officer, Todito
- Mauricio Martens, Cluster Unit Executive, Communications Sector, IBM of Mexico
- Mario O'Campo, Director of External Relations, Motorola of Mexico
- Tim Parsa, CEO, Todito
- Henry Peluffo, Director of Marketing, SBCI International, (Telmex)
- Rene Sagastuy, CEO and GM, Maxcom

- Juan Saldivar, CEO, EsMas
- Ricardo Saucedo, CEO, Aranea
- Lorenzo Valle, Director, Public Sector, IBM of Mexico
- Jaime Valles, Sun Microsystems of Mexico
- Omar Villarreal, Corporate Vice President and President, Latin America North, Motorola of Mexico
- Julio Dozal, Researcher and Coordinator of the Center for Digital Culture, Inttelmex
- Manuel Gándara, Researcher and Coordinator of the Center for Digital Culture, Inttelmex
- Maria de Jesús Ugalde, Solutions Manager, Telmex
- Ricardo Medina, Sales Manager, Education Sector, Sun Microsystems of Mexico
- Isidro Quintana, Senior Manager, Internet Business Solutions Group, Cisco of Mexico

High-Tech Firms' Partners

- Walter Bender, Executive Director, MIT Media Lab
- Eduardo Garcia, Director, Technology innovation, University del Valle de Mexico (UVM)
- Bakhtiar Mikhak, Research Scientist, Massachusetts Institute of Technology (MIT) Media Lab
- Edgar Ortiz, Director, Electric Engineering Program, Iberoamerican University (Ibero)
- Alejandro Pisanty, GM, Academic Computing Services, Universidad Nacional Autónoma de México (UNAM)
- Eduardo Rubio, Sub-Director, Internal Information Technology Market, Ministry of the Economy, Mexico
- Patricia Sierra, Director, Cooperation and Exchange Programs, Universidad del Valle de Mexico (UVM)

- Guillermo Vega, Director, Electronic Business Technology Incubator, Universidad Tecnológica de México (UNITEC)

External Experts

- Javier Flores, Commercial Specialist, U.S. Embassy, Mexico
- Investigator, INFOTEC
- Director, Government Relations Group, Mexican Internet Association (AMIPIC)
- Member, eMexico Task Group, American Chamber of Commerce
- Professor, Universidad Autónoma Metropolitana (UAM), Mexico
- Staff member, Universidad Tecnológica de Monterrey, Mexico

ENDNOTES

- ¹ Omar Villarreal, Corporate Vice President, Motorola Inc, and President, Motorola Latin America North, Motorola, interview by author, tape recording, Mexico City, Mexico, February 26, 2003.

- ² This definition is adapted from the one used in Nelson (2002, p. 46), *Building Partnerships: Cooperation Between the United Nations System and the Private Sector*.

- ³ There are six elements of accessibility: operability (amount of training required to effectively use the technology); intelligibility (degree to which the technology is offered in one's native languages and literacy rate); cultural compatibility (ability of the technology to build upon current communication patterns in a nondisruptive way); relevance (degree to which the technology offers socially useful and relevant content); usability (the simplicity of the technology from a user's perspective); and security (degree to which the technology is secure and respects the privacy of the users). These elements are taken from Gándara (2003).

- ⁴ For market share information please see, Baez (2003) and for information on Alestra and its relationship with AT&T, please see Alestra (n.d.) in the reference list.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 209-237, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 8.2

ICT and the Efficient Markets Hypothesis

Andrea J. A. Roofe

Florida International University, USA

INTRODUCTION

This article represents a preliminary attempt to identify the variables influencing the relationship between technological development and efficiency in the financial markets of a Caribbean economy. The analysis uses qualitative methods only. From the late 1980s, Kitchen (1988) observed, "... the major inefficiency in the capital market is the lack of information..." (p. 48). Two characteristics that differentiate the financial markets of developing countries from those of developed economies, and have an impact on their efficiency are:

1. A small number of investors;
2. Few types of investors;
3. The limited range of financial instruments.

The above render the financial markets inefficient, from the perspective of the Efficient Markets Hypothesis, compared with those of developing countries. As the ICT infrastructure among developing countries varies, the article is

limited to one country—Jamaica. The Jamaican financial market was considered a top performer among emerging markets in 1992, based on movements in its stock prices. Following the collapse of the island's financial sector in 1993, the market remained in the doldrums for several years..

The government and the key players in the financial services sector recognized the need to upgrade the technological infrastructure of the financial markets to attract international players and render its operations more efficient and transparent. The technology permits trading in real time, across borders among the three major exchanges in the Caribbean-Trinidad, Jamaica and Barbados.

In the last 12-15 years, in addition to attracting international institutional investors, the Jamaican financial services industry has been actively educating the local individual investor to attract his participation in the financial markets as an individual investor – whether as a holder of a Unit Trust/Mutual Fund, Treasury Bills, Local Registered Stock or as a minority stockholder in a listed company. The Jamaican market, therefore,

provides an example of an institution that recognized the importance of the role of ICT (especially Internet-based technologies) in its re-emergence from relative obscurity and as it attempts to facilitate economic development.

The outline of the article is as follows:

1. The role of the financial sector in the development process in an economy and in wealth-creation.
2. The structure of the Jamaican financial market.
3. The underlying theoretical framework—the efficient markets hypothesis and the contribution of 21st century technology to the improved efficiency in the Jamaican financial markets. It assesses measures of the technological development of the country—tele-density and infrastructure development and legal considerations. These are considered important issues for local development as, in addition to international institutional investors, the key players have been actively trying, in recent years, to attract the participation of local individual investors into the market to facilitate a more diverse basis of local wealth creation. In addition, international investors can serve as an invaluable source of capital during a public offer of shares.
4. Issues in customer relationship (client account management) and operations management (back office operations) in the financial services sector that have been, or can be addressed by enhanced technology. These are the key areas of management of financial services that impact directly on market efficiency.
5. Opportunities for new technology product development, training and marketing that may reasonably be considered by software developers, infrastructure providers, and providers of technology training services, with the intention of attracting skilled

persons into the field of technology and/or improving the technological infrastructure and applied knowledge of the key players in the financial markets.

BACKGROUND

Martin Sewell, owner of the Web site, <http://www.e-m-h.org>, states that “...The origins of the Efficient Markets Hypothesis (EMH) can be traced back at least as far as the pioneering theoretical contribution of Bachelier (1900) and the empirical research of Cowles (1933). The modern literature in economics begins with Samuelson (1965), whose contribution is neatly summarized by the title of his article: ‘Proof that Properly Anticipated Prices Fluctuate Randomly’...” Solnik and McLeavy (2004) argue that “the notion of an efficient market is central to finance theory. In an efficient market, any new information would be immediately and fully reflected in prices. Because all current information is already impounded in the asset price, only news—that is, unanticipated information—could cause a change in price in the future” (p. 24).

The central concept of this article is that technology facilitates efficient financial markets by making information available to existing and prospective investors on a timely basis. It assumes greater relevance in light of the global nature of financial transactions. An efficient financial market is required to attract global institutional investors to an emerging economy. In addition, it facilitates the wealth creation process among the local populace. The author is unaware of any recent scholarly work that considers the Jamaican financial markets, from the perspective of the Efficient Markets Hypothesis. In the last five years, several governments and international bodies have sponsored conferences and working groups to help developing nations consider the impact of technology on key sectors of the economy. It was argued that technological infrastructure and legal

and audit concerns ranked highest in their priorities to develop the national economies. Bridges.org (2001), Digital Opportunity Initiative (2001), Grant (2001), COMNET-IT (2002) and UNCTAD Secretariat (2002) offer similar opinions.

Grant (2001) refers to the work of the E-Commerce working group, a sub-committee of the E-Commerce Committee of Jamaica that identified a number of requirements for the successful implementation of e-commerce in the island. He cites the following:

- i. Human resources skills:
 - “Education across all parts of the society in ICT is needed. This is in fact a cross-cutting issue and should be given the highest priority and resources allocated. Some important areas of development for the private and public sector are:
 - The establishment of Life Long Learning facilities to facilitate technology training by older users who may be intimidated by technology.
 - To inculcate a vision of ICT usefulness through training of senior management in IT skills rather than creating an environment where they are forced to use technology” (p. 24).
- ii. Improved ICT infrastructure:
 - “Electricity-should be available to all persons in reliable supply.
 - Telecommunications to every home and business place and at low cost (VSAT, Fibre, Wireless, dial-up).
 - Database Security, Dependable backup, redundancy, disaster mitigation, and when all else fails, adequate consequential loss insurance” (p. 24).

The financial sector was not mentioned in this discussion, possibly because the financial markets were well underway, with the process of upgrading

their technological base. In Jamaica, the thrust toward improved technological infrastructure was largely driven by the private sector (viz. the Stock Exchange, stockbrokers and investment bankers), which felt the need to meet international standards to attract the international investment community. The Caribbean and international academic communities appear not to have carried out significant research on this topic. Hopefully, this article will stimulate further discussion and writings on this issue within the development, academic and professional communities.

FINANCIAL MARKETS AND ECONOMIC DEVELOPMENT: THE EFFICIENT MARKETS HYPOTHESIS

The Efficient Markets Hypothesis

Reilly and Brown (2000) state that the most basic form of the efficient markets hypothesis—the weak form—“...assumes that current stock prices reflect all security-market information, including the historical sequence of prices, rates of return, trading volume data, and other market-generated information such as odd-lot transactions, block trades, and transactions by exchange specialists or other unique groups” (p. 215). An efficient market, therefore, has few opportunities for arbitrage, as imbalances are immediately corrected by the immediate dissemination of information using ICT.

The Role of Financial Markets in the Development Process

Finance is considered the “lubricant” of the wheels of the productive sector. ICT have dramatically transformed the manner in which the financial services sector of developing economies operates. As with other industries, ICT help financial markets become more effective, customer-oriented and

transparent in their operations. ICT facilitate the investment decision-making process as follows:

1. The delivery of investment information on a timely basis, using computerized investment information systems and investment research tools.
2. Verification and delivery of client transaction information for prompt settlement of transactions, and authentication, using automated trading, settlement and depository systems.

Efficiency and transparency are necessary to attract foreign investors to participate in an emerging financial market. They ensure the survival of such markets, as the local investors lack the resources to support the market, especially during times of economic downturn. Sometimes, the size of a public offer may be reduced, because of the limited capacity of the local market. The economy benefits from the positive impact on individual and corporate wealth enhancement.

How the Jamaican Financial Services Sector Works

Generally, the financial services sector facilitates the purchase and sale of securities on the primary (new issues and IPOs) and secondary markets through the process of financial intermediation. Owners of surplus funds offer their savings to businesses with the expectation of an adequate return. Financial institutions play an intermediary role, allocating funds based on the relative rank of projects and companies, according to their expected returns and risk profile of the project and/or company. Figure 1 depicts the flow of funds within a typical developing economy, such as Jamaica.

Table 1 summarizes the typical types of investors and institutions found in Jamaica, a typical economy with a developing financial structure.

In 2002, Jamaica’s literacy rates (and hence, potential for human resource development) compare favorably with the rest of Latin America/ the Caribbean and other lower middle-income

Figure 1. Flow of funds within a typical developing economy (Compiled from information contained in Santomero & Babbel, 2001)

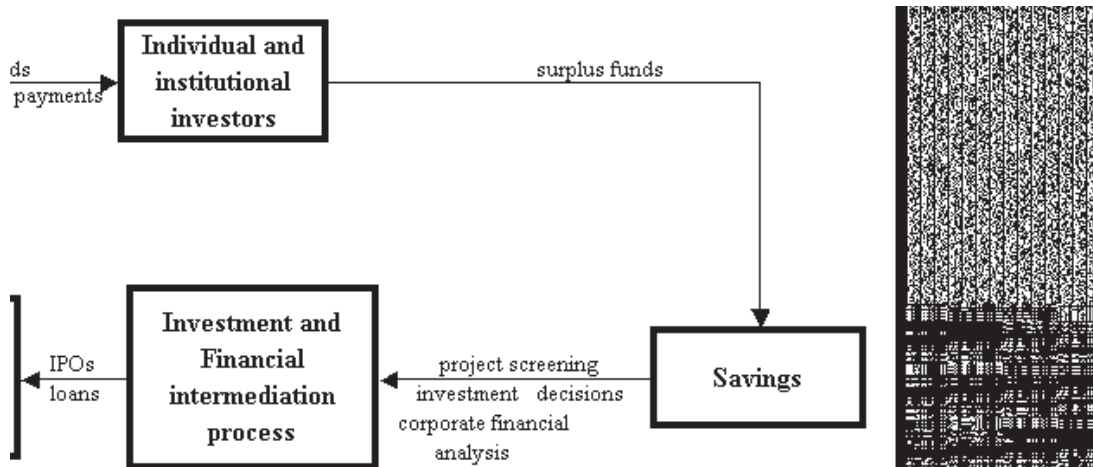


Table 1. Structure of the financial services industry in Jamaica (Source: ICT at a Glance-Jamaica, The World Bank October 3, 2003)

| Investment Services Providers | Investors |
|--|--|
| Life Insurance Companies | Pension funds |
| Stock/Money market brokers | Life and General Insurance companies |
| Merchant/Investment Banks | Commercial banks (Usually investments are made only on a short-term basis, due to legal restrictions.) |
| Trust companies and portfolio managers | Other institutional investors, and individuals |

Table 2. Economic and social metrics—Jamaica and Latin America (Source: ICT at a Glance Jamaica, The World Bank October 3, 2003) (Source: Compiled by the author, November 2003)

| | Jamaica | LATAM & Carib. | Avg. lower middle |
|--|----------------|---------------------------|----------------------------|
| | 2002 | 2002 | income nations 2002 |
| Adult literacy rate (% ages 15+) | 87.6 | 89.5 | 86.6 |
| Urban population (% of total population) | 57.1 | 76.2 | 49.4 |

countries. With a larger rural-based population than most Latin American/Caribbean countries, it becomes important to improve the technology infrastructure of Jamaican rural communities.

Training and Infrastructure Considerations

Without adequate training and infrastructure, the securities market will not be able to conduct its activities to international standards. Tables 3, 4 and 5 highlight comparative indicators of the level of development of the ICT sector in Jamaica as compared with other Latin American and Carib-

bean countries and other lower middle-income nations in 2001 and 2002.

In 2002, Jamaica compared favorably with the rest of Latin American/Caribbean and other lower middle income nations with respect to ICT infrastructure and access, computers and Internet usage and the ICT business and regulatory environment. The sole exception was the number of secure servers located in the island, a key requirement for the transmission of confidential information across the Internet. Telecommunications costs remain prohibitively high—the result of the small scale of operations over which the companies recover their overhead costs. At the time of final edit, the

Table 3. ICT metrics for Jamaica compared with LATAM and lower middle-income countries: ICT infrastructure and access (n.a. Not Available: Sources: ICT at a Glance-Jamaica, The World Bank September 9, 2002 and October 3, 2003)

| | Jamaica 2001 | LATAM & Carib. 2001 | Avg. lower middle income nations 2001 |
|---|-------------------------|------------------------------------|--|
| Telephone mainlines/ 1,000 people | 197 | 163 | 146 |
| Telephone mainlines in largest city/1,000 people | n.a. | 175 | 524 |
| Waiting list (thousands) | 209 | 4,403 | 27,675 |
| Waiting time (years) | n.a. | n.a. | n.a. |
| Revenue per line (US\$) | 949 | 827 | 283 |
| Cost local call (US\$/3 min) | 0.06 | 0.09 | 0.04 |
| Mobile phones/1,000 people | 269 | 160 | 110 |
| Outgoing traffic (min/ subscriber) | 144 | 87 | 58 |
| Cost of call to U.S. (\$/3 min) | 5.20 | 3.20 | 4.50 |
| Daily newspapers/1,000 people | 62 | 70 | n.a. |
| Radios/1,000 people | 796 | 410 | 346 |
| Television sets/1,000 people | 194 | 274 | 292 |

Table 4. ICT metrics for Jamaica compared with LATAM and lower middle-income countries: Computers and Internet usage (n.a. Not Available: Sources: ICT at a Glance-Jamaica, The World Bank September 9, 2002 and October 3, 2003)

| | Jamaica 2001 | LATAM & Carib. 2001 | Avg. lower middle income nations 2001 |
|---|---------------------|------------------------------------|--|
| Internet Users ('000) | 100.0 | 25,666.9 | 68,936.9 |
| Monthly off-peak access charges: service provider charge (US\$) | 49.3 | n.a. | 16.7 |

ICT and the Efficient Markets Hypothesis

Table 5. ICT metrics for Jamaica compared with LATAM and lower middle-income countries-ICT business and government environment (n.a. Not Available or Not Applicable [ratings from 1 to 7. 7 is highest/best]: Sources: ICT at a Glance-Jamaica, The World Bank September 9, 2002 and October 3, 2003)

| | Jamaica 2002 | LATAM & Carib. 2002 | Avg. lower middle income nations 2002 |
|---|-----------------|------------------------|---|
| Broadband internet access availability | 2.5 | 4.0 | 3.6 |
| Local specialized IT services availability | 4.2 | 4.5 | 4.3 |
| Competition in ISPs | 4.7 | 4.0 | 4.2 |
| Government online services availability | 3.3 | 3.3 | 3.1 |
| Laws relating to ICT use | 3.3 | 3.3 | 3.3 |
| Secure servers | 5 | 2,103 | 2,769 |

author was unable to locate updated information on the metrics for the ICT industry for the year 2003. However, it is unlikely that the island's standing has been lowered as the government and private sector have made significant improvements to the telephony/ICT infrastructure since the start of the 21st century so as to attract international investments and facilitate increased productivity among local businesses.

HOW ICT HELPS IMPROVE MARKET EFFECTIVENESS AND EFFICIENCY

Investment Information

The two critical issues in customer relationship management (CRM) are as follows:

- The availability of accurate information to all existing and prospective investors.

- The timely delivery of information (in or near to real time) to all parties to facilitate prompt decisions.

In 2003, the consulting firm CaribbeanPortfolio.com (2003) conducted a survey among Jamaican institutional investors. The participants comprised 20 of the largest institutional investors in Jamaica. The findings revealed that investors ranked the timely delivery of transaction information and a prompt response to client inquiries as critical to the success of the investment decision-making process. The Jamaican financial services sector has largely addressed these concerns through the delivery of trading information at the end of the trading day to the major investors. One firm, JMMB Securities Limited provides text messaging and daily email notification of transactions to its individual investors. Unfortunately, this information is not available in real time.

Operations Management

Operations management is concerned with:

- Trading systems (inter-broker and broker-client systems);
- Settlements (broker-client/broker-broker) Security registration, transfer and custody; and
- Dividend accounting and payments.

The above sub-systems are established using intranet or extranet-based modules. As part of the final phase of its modernization program, the Jamaican financial markets have implemented a Central Security Depository. The Jamaica Central Security Depository (JCSD), "... a wholly-owned subsidiary of the Jamaica Stock Exchange, is a facility for holding securities which enables share transactions to be processed by book entry. A book entry system is an accounting system that facilitates the change of ownership of securities electronically between parties, without the need for the movement of physical documents. In short, the JCSD is a means of recording the ownership of shares" (JCSD Web site).

Legal Considerations

Grant (2001) argues that any ICT or e-commerce model adopted by the business community will require updated legislature and supporting infrastructure (especially security arrangements) for its successful implementation. Two fundamental changes to the law are proposed:

1. E-Signature or E-Transaction legislation;
2. Laws Protecting Parties, Transactions, Systems and Data.

Such legislation would render signatures as legally binding as those done in print or handwritten form. The supporting infrastructure would

protect the privacy of the participants, transaction data, and confidentiality of sensitive information, which are critical requirements for the transmission of financial data in cyberspace.

To date, the major regional stock exchanges have been able to conduct cross-border trading operations with a high degree of success, primarily because transactions have been limited to a small number of players and a single network connecting the three major Caribbean financial markets. Grant (2001) notes the difficulty in implementing secure databases. The author also found it an extremely laborious and time-consuming process to become a trusted member of an international network to be able to sign documents electronically and transmit email with a verifiable identity, as there was no trusted member of that network residing in the island of Jamaica. Updates to existing intellectual property laws and revisions to existing consumer protection laws are also necessary to support the new business environment.

Audit Considerations

This concerns the nature of transaction documentation and audit confirmation available to the accounting and audit community. The Caribbean-Portfolio.com (2003) report noted that, "... 65% of interviewees preferred that their transactions be confirmed by letter or contract note. For 30% of respondents, email or online verification of transaction was preferred, primarily because the information was accessible at the client's convenience and be available for immediate delivery to its auditors. Almost 68% of respondents preferred settlement by same day cheque, while just over 30% preferred to settle a transaction by direct transfer of funds transferred to/from a bank account..." (CaribbeanPortfolio.com, 2003). There was some concern that the securities regulatory bodies and the local accounting fraternity had not yet updated their practices to recognize the validity of online or electronic transactions and

documentation. It is hoped that the enactment of relevant legislation will force these entities to update their rules.

FUTURE TRENDS AND OPPORTUNITIES FOR ICT IN THE FINANCIAL SERVICES SECTOR

Hardware

Opportunities exist for hardware manufacturers and distributors in the provision of affordable mobile and wireless/satellite technology solutions, as more than half of the population of Jamaica is based in rural communities. The rural parts of Jamaica consist of rugged mountainous terrain with isolated districts scattered throughout the hilly interior. Satellite and wireless technology are considered more appropriate due to the high cost of installing wired telephone service in a hilly terrain.

There will be a demand for hardware used to provide faster wired Internet access services, as existing users upgrade their Internet access from dial-up services to services offering dedicated access and faster connectivity such as T-1 and ADSL, to access information as soon as it becomes public. Broadband connectivity must improve to speeds available in the major financial centres. High speed Internet access should be made more affordable and its implementation in a home/small business network rendered user-friendlier.

Software

Much of the software requirements of the financial services industry are available from the major financial centres, and may be customized for use under local legal, tax and accounting practices. Others are proprietary systems developed by local programmers.

Training and Human Resources

There will be an increased demand for affordable training services in basic computer use, as computers will become an important part of daily life. The demand for training in the use of wireless/mobile technology will increase as providers develop solutions to meet the needs of the rural population inhabiting the interior hilly regions of the island. Online training is an excellent means of reaching the rural populace. Institutions and service providers will demand for trained and certified system administrators and technicians to implement and support wireless and mobile systems, and to support a growing user base.

There will be a demand at least initially for trained and certified software engineers and project managers to customize and implement trading and security accounting software, as some security registrars still maintain their databases in manual form.

CONCLUSION

ICT have transformed the manner in which the Jamaican financial markets operate. However there is scope for improvement especially in the delivery of Internet access to a larger number of the rural populace. It may be argued that persons living in isolated rural communities, who have sufficient excess cash, already have access to technology. Those who lack this knowledge and technology are likely to improve their lot if afforded the opportunity to gain access to education to improve their earning power.

Once the requirements in the previous sections are satisfied, in the form of a fully-integrated system, that is available to a majority, if not all of the population, then a necessary condition for the existence of an efficient market would have been satisfied, as information would be available to all

parties at the same time, on a timely basis, and subsequent payments would have been accounted for accurately and promptly, with minimum loss of interest on outstanding balances.

REFERENCES

Bridges.org. (2001). *Spanning the digital divide: Understanding and tackling the issues*. Retrieved October 20, 2002, from <http://www.bridges.org/spanning/download.html>

CaribbeanPortfolio.com. (2003). *Survey among prospective investors in a mutual fund*. Kingston, Jamaica.

Commonwealth Network of IT for Development (COMNET-IT), Commonwealth Secretariat. (2002, March 17-19). Workshop on ICT strategies for islands and small states, Malta.

Digital Opportunity Initiative. (2001, July). *Creating a development dynamic: Final report of the digital opportunity initiative*. Retrieved October 20, 2002, from <http://www.opt-init.org/framework/DOI-Final-Report.pdf>

Grant, G. (Ed.) (2001, April 3-5). *Final report on a regional initiative for informatics strategies*, Kingston, Jamaica (Comnet-IT).

International Telecommunications Union. (2002). Basic telecommunications statistics for all countries.

Jamaica Central Securities Depository Web site. Retrieved October 20, 2002, from <http://www.jamstockex.com/jcsd.htm>

JMMB Securities Web site. Retrieved October 20, 2002, from <http://www.jmmbsecurities.com/infoform.php>

Kitchen, R. (1988). *Finance for the developing countries*. UK: John Wiley & Sons.

Reilly, F., & Brown, K. C. (2000). *Investment analysis and portfolio management*. USA: Dryden Press.

Santomero, A., & Babbel, D. F. (2001). *Financial markets, instruments, and institutions*. USA: Irwin Publishers.

Sewell, M. (2004). Retrieved October 20, 2002, from <http://www.e-m-h.org/introduction.html>

Solnik, B., & McLeavy, D. (2004). *International investments*. USA: Pearson Education, Inc.

UNCTAD Secretariat. (2002). *E-Commerce and development report* (Chapters 4 & 6). Retrieved October 20, 2002, from http://r0.unctad.org/ecommerce/docs/edr02_en/ecdr02ch4.pdf and http://r0.unctad.org/ecommerce/docs/edr02_en/ecdr02ch6.pdf

The World Bank. (2002). *ICT at a glance-Jamaica*. Retrieved October 20, 2002, from <http://www.worldbank.org/data/countrydata/ictglance.htm>

The World Bank. (2003). *ICT at a Glance-Jamaica*. Retrieved October 20, 2002, from <http://www.worldbank.org/data/countrydata/ictglance.htm>

KEY TERMS

Arbitrage: The simultaneous purchase of an undervalued security and sale of an overvalued but equivalent security to obtain a risk less profit on the price differential. Taking advantage of a market efficiency in a risk less manner.

Back Office: Settlement and related processes, including the process of paying for transactions conducted on the financial markets.

Customer Relationship Management: The set of automated processes designed to improve customer service.

ICT and the Efficient Markets Hypothesis

Efficient Market: A market in which any relevant information is immediately impounded in asset or security prices.

Financial Intermediary: A bank, securities firm, or other financial institution that collects deposits and makes loans, manages the risk associated with the loan process, and/or facilitates the flow of capital between operating units and the economy.

Financial Structure: The set of institutions and processes that comprise the financial system.

Primary Market: The market for new securities issues. In the primary market, the security is purchased directly from the issuer. Includes IPOs (Initial Public Offerings of shares to the public).

Secondary Market: A market in which an investor purchases a security from another investor rather than the issuer, subsequent to the original issuance in the primary market, also called the aftermarket.

Teledensity: The number of telephones per 100 people in a region.

*This work was previously published in *Encyclopedia of Developing Regional Communities with Information and Communication Technology*, edited by S. Marshall, W. Taylor, & X. Yu, pp. 353-359, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).*

Chapter 8.3

Creating Competitive Advantage:

The Emergence of a New Business through Collaborative Networks—An Empirical Case Study in the ICT Sector

Arla Juntunen

Helsinki School of Economics, Finland

ABSTRACT

This chapter addresses collaborative business networks at the level of industry/cluster networks, which is important and relevant from the strategic management perspective in several industries. This chapter examines two current “hot topics”: the emergence of a new Internet driven business group, and its construction through a series of intentionally developed collaborative networks. Networks are seen to offer firms collective benefits beyond those of a single firm or market transaction. The author of this chapter aims to contribute to the development of the emerging theory of network management by integrating notions from the industrial network approach and the resource-based view of the firm, in particular its extensions into dynamic capabilities and learning. The starting premise is that the characteristics

of the task that organizations try to accomplish through forming a specific collaborative network influence, the management of that network, and thus, the capabilities developed and required. This chapter is based on a longitudinal case study in the ICT-sector.

INTRODUCTION

This study examines two current “hot topics”: the emergence of a new Internet driven business group, and its construction through a series of intentionally developed *collaborative networks*. This is a highly relevant topic from a number of perspectives. First, relatively little academic research into so-called *e-business* has been published, in spite of its huge impact on economy (Amit & Schott, 2001). Many Scholars argue

that network organizations are expected to take the leading role in economic and social innovations in the world of increasing globalization, connectivity, and knowledge intensity (Castells, 1996; Grabher, 1993; Jarillo, 1993; Parolini, 1999; Thompson et al., 1994). Second, in spite of the few seminal studies (Alajoutsijärvi et al., 1999; Lundgren, 1991; Håkansson & Lundgren, 1995; Håkansson & Waluszewski, 2002) we have no more than a rather scant understanding of the dynamics of the emergence of business networks, and especially about the role of individual actors in this process.

Furthermore, the companies operating in a network context need to learn to master both the social and business networks in order to succeed in their business networks (e.g., Lechner & Dowling 2003; Uzzi, 1997) and use the knowledge and information shared in these networks to create competitive advantage. The partners and relationships in networks have also been studied in social networks studies (e.g., Griffith & Harvey, 2004). Relationships in collaborative networks can be divided as follows: Firstly, the relationships involved in research and development activities in software and hardware (platform) technology development and their production, including R&D organizations, universities, and research laboratories (Lee et al., 2001; Anderson & Jack, 2002), or as Lechner and Dowling (2003) stated, knowledge, innovation, and technology (KIT) relationships and networks. Secondly, relationships involved in marketing and distribution, including in after-sales services and maintenance, distribution and marketing networks, such as advertising agencies, marketing consultancies, and various distribution channel partners that enable access to new or current markets, and provide new market information and expertise in commercializing a product-service offering (Larson, 1991; Lechner & Dowling, 2003; Rocks et al., 2005). Thirdly, network actors facilitating or supporting business processes include business

associations (Vanhaverbeke, 2001) and financial partners (Birley, 1985).

This chapter aims to show how an intentional networking among different actors can benefit a focal actor in developing a new business group based on emerging technologies, and thus, create competitive advantage. This study is based on a longitudinal case study in the ICT sector (Juntunen, 2005), and it takes the viewpoint of a focal actor. The author looks at how new breakthrough technologies (i.e., xDSL, multimedia, mobile technology, Internet) and the combination of formerly separate technologies and businesses are transformed into a viable business—the so-called *home commerce* business group—during the time period of 1990-2003. *Home commerce* refers to a set of Internet-based services targeted for consumers and accessible at home via different terminals. This study also examines how the focal actor tries intentionally to construct this new business group by developing of a series of interlinked strategic alliances and networks of organizations. Using the insights gained during this process the author tries to identify the capabilities that the focal actor develops, giving particular attention to network capabilities. The study of network *capabilities* is a rapidly growing area of research, which combines aspects of industrial network theory and the dynamic capability view of the firm. The basic idea is that companies must develop specific organizational capabilities, which the author calls network capabilities, in order to operate and survive in a network context (Möller et al., 2003; Möller & Svahn, 2003, 2006) and to create competitive advantage (Ulaga & Eggert, 2005). This view is supported by the work of Gemunden and Ritter, who speak of network competence (Gemunden & Ritter, 1997; Ritter, 1999).

Academic interest in different forms of inter-organizational collaboration has increased considerably during the last decade. The author has adopted the following theoretical approaches

in the empirical study: industrial network theory, and the resource-based view of the firm, in particular its extensions into dynamic capabilities and learning. As the emphasis in this study is on the empirical analysis, only a brief discussion of these approaches is provided.

The chapter is organized as follows. The author starts by discussing the conceptual background for the study. The methodological solutions are then described and arguments for them are presented. The fourth section of the paper is the case analysis, where periodic description of the emergence of the home commerce business group (HCB) is covered. The types of collaborative networks that are considered to be critical in this emergence are also discussed, with special attention being paid to identifying the network capabilities, through which the focal actor was created. The role played by these network capabilities is analyzed. A discussion of the theoretical and managerial conclusions and suggestions for future research conclude the chapter.

BACKGROUND

Academic interest in different forms of inter-organizational collaboration has increased considerably during the last decade. The author has adopted two theoretical approaches in the empirical study: industrial network theory and the resource-based view of the firm (RVB), in terms of dynamic capabilities and learning. The study emphasizes on the empirical analysis, and a brief discussion of these approaches has been provided.

Industrial Network Theory

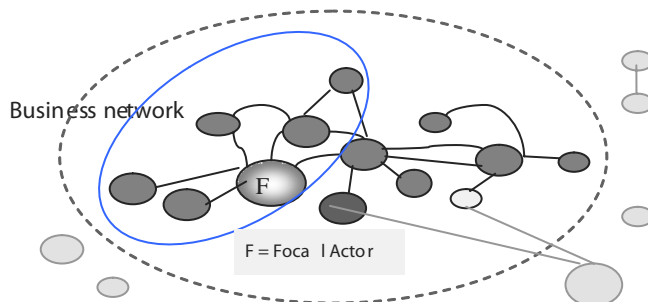
The industrial network or “markets-as-networks”-approach (INT) pursued by the industrial marketing and purchasing group (IMP) view industrial markets as networks of inter-firm relationships.

Industrial network theory (INT) provides the basic conceptual tools, the actors who carry out value-activities through the resources, and capabilities they command (Håkansson & Snehota, 1995). It stresses the importance of business relationships as a coordination mechanism on a balance with markets and hierarchies, and their role in supporting learning and innovation in industrial systems (e.g., Håkansson, 1982, 1987, 1989; Lundgren, 1991). Networks represent a complex system in which different interdependencies between actors are characterized by both competition and cooperation, continuously constituting and reconstituting business fields (Alajoutsijärvi et al., 1999; Halinen et al., 1999; Halinen & Törnroos, 1998; Håkansson & Waluszewski, 2002; Mattsson, 1985). A development of new technical innovations and solutions (e.g., Håkansson, 1989; Waluszewski 1990; Lundgren, 1991) require continuity in relationships (i.e., long-term relationships). Also, they claimed that interdependence between actors and technologies is apparent (e.g., Håkansson, 1989; Lundgren, 1991; Waluszewski, 1990). Moreover, any single firm has only limited control over its relationship portfolio and network position (Håkansson & Ford, 2002). The position describes how the firm is connected to the other actor that is to what external resources it has access, with which actors it competes and includes the actor’s internal resources (Mattsson, 2003). In an intentionally created business network, a focal actor is presumed to have some kind of power to control and mobilize other participants in the business network (Juntunen, 2005).

The firm negotiates through a network of relationships within networks of organizations. First, it is important to make a distinction between a network of organizations and a network organization. Network of organizations refers to any group of organizations or actors that are interconnected by relationships (Möller & Svahn, 2003, 2004). According to Axelsson and Easton (1992) and Håkansson and Snehota (1995) any market can

Creating Competitive Advantage

Vignette 1. The industrial network approach offers some useful concepts that are important in this study.



A business network refers to the overall configuration of interconnected actors around a focal actor. A network environment, a macro network, refers to the overall configuration of interconnected organizations around a focal actor. The surrounding macro network includes such entities as a market area, economy and society that the focal actor cannot openly influence. The network environment in this study incorporates many other companies which are not visible to the focal actor and to a particular net, and which cannot be directly influenced by the focal actor.

be described as a kind of a macro network. This markets as networks view also compares to that held by scholars of economic sociology (Granovetter, 1973, 1985; Knoke, 2001; Uzzi, 1996), and prevailing in the network externalities discussion in economics (Katz & Shapiro, 1985) as well as in the recent marketing studies of “network markets” (Frels et al., 2003; Srivastava et al., 1998).

Another relevant aspect is provided by the concept of embeddedness, which refers to an organization’s relations with and dependence on the different types of networks (institutional and political networks, technological systems, and institutions), which form an organization’s “environment.” All these simultaneously improve the organization’s actions, its potential relationships, and the outcomes it may achieve (Halinen & Törnroos, 1998; Lundgren, 1991). In other words, actors in a network should be viewed as important change agents and not only as passive adaptors to a faceless, changing environment.

When industrial network theory primarily focuses on the general characteristics of organically-evolved networks, for example, on their

structure and development processes (Möller & Halinen, 1999), the emerging strategic network approach is primarily interested in the creation and management of intentionally-formed network organizations featuring a specific set of actors (Jarillo, 1993; Normann & Ramirez, 1993; Parolini, 1999).

Resource-Based View, Dynamic Capabilities and Organizational Learning

Many practitioners have opined that strategy depends on learning, and that learning depends on capabilities (e.g., Prahalad & Hamel, 1990; Mintzberg et al., 1998, p. 213). Unique company resources and capabilities are, therefore, seen as a primary basis of profitability and the basis for formulating its longer-term competitive advantage. This organizational emphasis on restructuring, reengineering, outsourcing, and forming alliances to build unique capabilities became known as the resource-based view (RBV) (Barney, 1991; Penrose, 1959; Rumelt, 1974; Zollo & Winter, 2002).

RBV perspective suggests that a firm is a collection of heterogeneous resources (Wernerfelt, 1984) and also, that a company's performance is related to differences in its resources. Resources are not easy to imitate and they form the basis for competitive advantages (Amit & Schoemaker, 1993; Barney, 1991).

The RBV-approach and its knowledge-based extension of inter-organizational collaborations conceptualize the firm as a collection of resources, of which knowledge and core capabilities are critical elements in achieving, maintaining, and renewing competitive advantage. Companies differ in how they can control resources that are necessary for implementing strategies. The core behavioral assumption is that companies are able to learn by acquiring, assimilating, sharing, and dissimilating knowledge within the organization and between organizations. RBV sees the knowledge, capabilities, organizational culture, and management as sources of competitiveness. The resource-based argument of alliance formation suggests that firms use alliances to establish the optimal resource configuration that maximizes the value of their resources. Companies use alliances and other types of cooperative forms to develop a value creating resource base that a single company could not have formed (e.g., Das & Teng, 1998; Möller & Rajala, 1999; Blomqvist, 2002).

The concept of dynamic capabilities became an addition to the RBV approach in the middle to late 1990's. The main thrust in the discussion of dynamic capabilities has been how firms integrate, reconfigure, renew, and transfer their own resources and the resources they control. Although in relevance of exploiting external resources (Teece et al., 1997), the importance of "alliance and acquisition routines that bring new resources into the firm from external sources" (Eisenhardt & Martin, 2000, p. 1108) and the "ability to integrate efforts of different actors" (Grant, 1996) have been mentioned, the challenges involved in operating in a complex network remain fairly unarticulated (Kenis & Knoke, 2002; Park, 1996)

The RBV and IMP approaches both view a company as an actor in a web of relationships which influence the firm's conduct, survival and success. While the RBV approach focuses on the constraints that a dependence on exchange partners poses and emphasizes the firms' pursuit for independency by increasing the firm's resource base, and thus, productivity (e.g., Rumelt, 1984; Wernerfelt, 1984), IMP theory focuses on accumulating benefits and effectiveness via a web of relationships (e.g., Ford et al., 2003; Håkansson 1987,1989). The dynamic capability -view adds the dimension of seizing business opportunity via the creation of new capabilities dynamically suitable for the changing situation within both a network and a business context.

In the construction of a new business group—which is often based on the ability to combine several technologies and coordinate the resources and capabilities of various actors coming from different fields—both knowledge and learning can be expected to play core roles. The author draws on studies of "knowledge management" (Larsson, Bengtsson, Henriksson, & Sparks, 1998; Nonaka, Toyama, & Konno, 2001) which suggest that inter-organizational relationships allow possibilities for collaboration, knowledge transfer, knowledge combination, and knowledge exploitation. For a more in depth discussion of inter-organizational learning, see Holmqvist (2003); and for a discussion of the role of knowledge and learning in different types of strategic networks, see Möller and Svahn (2003).

As a summary, a potential criticism of this study may concern the way these multiple research traditions were utilized for providing concept for analyzing the empirical material. The purpose of this was to have a selection of different, but interrelated, conceptual perspectives, to match the complexity and multi-layered characteristics of the phenomena under study. While it can be argued that using a single research tradition may have provided a more focused analysis, such a study would have been able to only partially cover the

multidimensional and comprehensive findings achieved with the multi-theory approach. Another important aspect is the layered character of the new business emergence. In order to achieve a holistic view of the complex causal relationships between technological evolutions, strategic intentions of major actors, and strategic networks, study designs with multiple level of analysis is recommended.

RESEARCH SETTING AND METHODOLOGY

This study also argues that a better theoretical and empirical understanding of the mechanisms by which a focal actor constructs its business and networks is needed. Currently, it is not clear which specific factors in the various collaborative forms determine the positive outcomes and competitive advantage for a focal actor.

This study argues that an inter-organizational collaboration is needed to construct a new business. The goals of this study, for example, to identify, describe, and analyze how a new business group is constructed in an environment of dynamic change, exert a strong influence on the choices of methodology. In order to capture the construction dynamics, a longitudinal study is required in a field that is characterized by technological and commercial change and uncertainty (Huber & Van de Ven, 1995). The explicit focus of this study is the potential implication for the formulation of theoretical propositions regarding the emergence of a new business, and what capabilities and managerial processes are required in the development of business networks.

Furthermore, as the author wishes to examine the interaction between a focal actor and the networks in which it is embedded, an approach was needed to capture how events unfold in a specific context: this requirement is matched by the strong aspects of a longitudinal case study (Pettigrew, 1997; Van de Ven & Poole, 1990).

As examining change in a longitudinal study is very intensive, It was decided that the focal actor in this study should be a single organization, *Elisa* (the 2nd largest tele-operator in Finland, see www.elisa.com), and more specifically one of its business groups *the home commerce business group* (HCB).

Development of the home commerce business (HCB) in Elisa in Finland based on several emerging technologies and its commercial development has been influenced both by the “e-hype” period of the late 1990’s and the bursting of this “bubble” in the early 2000. The study was temporally limited to the time period from 1990 to 2003. The time period was long enough to capture the developmental process of a new business, home commerce business (HCB). The selection of a single corporation from which the multiple cases were chosen naturally brings limitations concerning the generalization of the results of the study. On the other hand, a multiple-case study within a single corporation with excellent data access made it possible to understand the phenomenon under study more profoundly. This decision was also guided by Elisa’s cooperative attitude shown towards the study.

Elisa Corporation is a nationwide telecommunications group whose core business areas are ElisaCom, Elisa Mobile, Elisa Networks in Finland, and Elisa Kommunikation in Germany. HCB was part of ElisaCom. The business services HCB provided, as well as the technologies used, differed from those used earlier in the Elisa, and the processes, functions, activities, business requirements, and marketing and business strategies were seen to be different to those of traditional telecommunication business (i.e., fixed line telephone business). HCB integrated several technologies, capabilities, and resources from a number of actors in different industries to create services for consumers and communities, (e.g., KotiporttiTM which consists of various subscriber connections and community services; e.g., Kaasinen, 2001, p. 51); household monitoring

and security systems; Efodi -learning space: IS-services for publishers, schools, groups, students and teachers. The development process during the years 1990-2003 was explored and evaluated, and an attempt was made to understand the factors and events affecting the development of business networks and the capabilities required.

The present study concentrates on the focal actor and presents the business and network development from the focal actor's point of view. In view of the richness of the material from the case corporation, it was decided to limit the perspective to the focal actor. The focal actor was one of Elisa's business groups; the home commerce business group (HCB) integrated several technologies and resources from a number of actors to create services for consumers and communities. Home commerce, in this instance, refers to a set of Internet-based services targeted toward consumers and accessible from home using various terminals. Internationally, the concepts of "*future home*," "*smart home*," "*intelligent home*," "*digital home*," "*networking home*," "*smart environments*," "*internet home*," "*automated home*," and "*smart housing*" are used for platforms and services in this business (Masala, December 16, 2003). The focal actor, HCB, uses the terms "Future Home" and "Smart Home" in the same context (Masala, December 16, 2003).

Research documentation in this case study consists of both information about the telecommunication industry and the case corporation, Elisa, and HCB's development during the period under study. About 20 persons representing various business units and subsidiaries of Elisa and cooperating partners were interviewed during the period of 1999-2003 (see reference list). Data gathered consists of articles, project documents, e-mails between members of the projects, memorandums concerning strategy and business plans, and annual reports from the years 1990-2001. As the development of the home commerce business (HCB) primarily took place through inter-organizational projects the documents used in the case

were arranged in chronological order by project. Even if majority of the material came from HCB-based sources, this does not diminish the value of the conceptualized findings, however. It can be claimed that the conceptualized findings have more general relevance, particularly for firms operating in dynamic, rapidly changing fields characterized by several interlinked technologies. It is also claimed that this relevance reaches beyond the limited historical period.

The research design is a logical sequence that connects the empirical data to the initial research questions (Miles & Huberman, 1994; Yin, 1994). Since there are only a few seminal studies in e-business and on the emergence of business networks and the focal actor's role in the development process this study could be labeled as explorative but it also has some explanatory characteristics (Yin, 1994). The qualitative methods make it possible to develop a thorough understanding of a complex and a multi-dimensional phenomenon in a specific context. The case design here is a multiple-case study but conducted within one corporation.

The reason for choosing a case study approach lies in the in-depth knowledge needed regarding the evolution of different collaborative forms and their managerial processes. Information about these phenomena requires good access to an organization in order to be able to identify them (Heide & John, 1995; Yin, 1994). While a case study is claimed to increase understanding of the complexity of process and change (Cassel et al., 1994; Pettigrew, 1990; Van de Ven & Poole, 1990). Hartley (1994) emphasized the tailor-made nature of a case study because it allows observation within the context of a real-life situation. Furthermore, the longitudinal case study approach was selected so this case study can be described as cases of on-gong processes to increase the general understanding of the phenomena studied (see Carson et al., 2001, pp. 94-95).

Emerging Home Commerce Business Networks: Development Process During 1990-2003

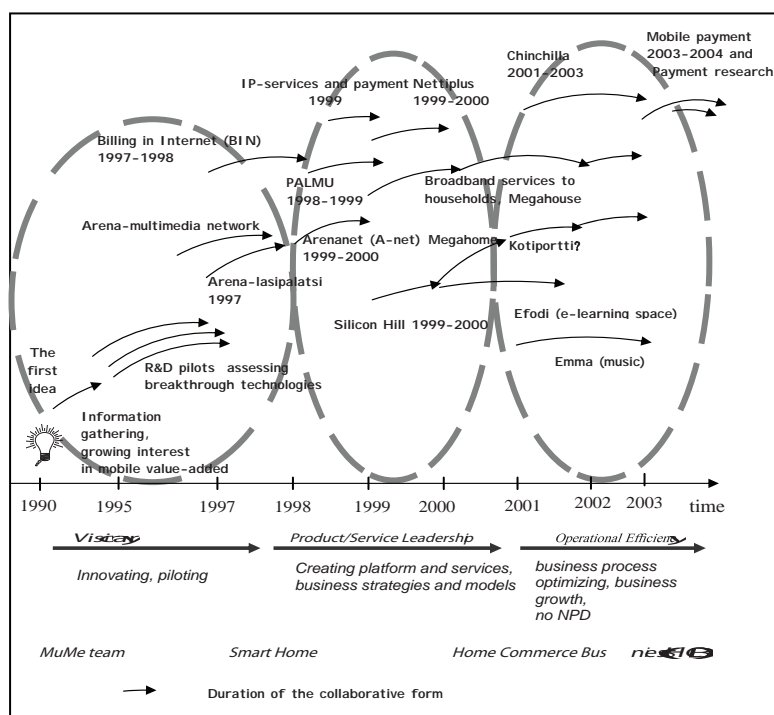
First, this chapter provides an overall view of the development process of Elisa's *home commerce* business group (HCB) through the period 1990-2003. The types of networks through which HCB mobilized this development are then examined together with a discussion of the capabilities required and created during this emergence process. The networks start as technology project networks and develop towards strategic networks with strategic intentions and collective network strategies.

The Period of Innovating 1990–1998

European telecommunication networks of the 1980s and early 1990s were constructed under

monopoly conditions (Beardsley, Bray, & van Rooijen, 1995, p. 157). During the first years of this study period, the main drivers of change were technology (e.g., broadband, multimedia), the deregulation in 1995 in Europe, and globalization of the telecommunication markets. Once the economic recession of the early 1990s in Finland was over, Elisa began investing in new R&D projects which led eventually to organization of the MuMe-team (this was the Multimedia team which later became HCB). This team participated in R&D, technology assessments and multimedia, Internet, mobile, and xDSL-based pilot projects. Figure 1 is a broad view of the whole process and the main projects. During this phase, development was strongly guided by the early vision of a single core individual in HCB (located in HTC, Helsinki Telephone Company, later Elisa). The capabilities acquired during this phase were technology-and

Figure 1. An overview of HCB's different collaborative forms from 1990 to 2003



project-related (For more thorough description of projects see Juntunen, 2005).

The central MuMe-team worked closely with Comptel, a company owned by the case corporation, which was its former IT-department. Cooperation with Comptel was essential when learning to integrate new services and products into existing architecture and platforms and also in product maintenance (i.e., on-going rationalizations of products, services, and IS/IT solutions). Benefits of this strategic dyad relationship were that both parties learnt and acquired new information and knowledge about the daily changes taking place and innovations being made inside the case company. Comptel was also able to use the knowledge gathered from this relationship in its other projects, including international ones, and this benefited the whole organization. When other resources or capabilities were required to develop new services and products, external partners were engaged solely on temporary, project-based contracts. Towards the end of this period, in addition to its close cooperation with Comptel and related partners, HCB also became an active member of national and global cooperative forums in which the competing and collaborating companies from ICT-sector participated, developing new standards and assessing the possibilities offered by new technologies.

In the “e-hype” years of 1997-1998, the general assumption was that a large part of the fixed-line network would be replaced by broadband access technology in the following 5 years. The Internet had also shown its potential as a platform for telecommunication, telephone, and other Web-based services. One important development step was PALMU (see Figure 2, Picture 1), a technology project funded by TEKES (The Finnish Technology Agency) which focused on creating secure billing via the Internet (Höltkä, 1998a, 1998b, Palmu-projektisuunnitelma, Palmu-kokousmuistio). A user-friendly and secure method of e-payment was a prerequisite for new ways of selling goods in Web-based markets. It was expected that

flexible payment methods and well-functioning customer interfaces would encourage rapid adoption of e-services by customers. The possibility of differentiating and integrating services in new ways would open opportunities to introduce self-service and the provision of services on demand (HPY Research, 1998). In this network, the case company was an equal partner with the other participants. The primary goal was to find a way of creating efficient web-based services and payment methods in the new network environment (Isomäki & Jäntere, 1998; Palmu, 1999). Both technological and business visions drove this kind of R&D technology-cooperation and technology piloting.

The results of this wider research into enabling technologies were transferred into the more business-oriented strategic dyad with Comptel and its surrounding network, for further development. HCB’s relationship with Comptel was very useful as each actor was a specialist and had its own support network, while there was sufficient common ground and mutual experience to co-create new solutions. As an IS/IT provider, Comptel maintained a portfolio of relationships from its business point of view while HCB initiated relationships from its perspective of starting to develop the first ADSL-based services while maintaining the vision of new home commerce business. Both actors could, at the same time, have the roles of a product developer and an IS/IT provider. During this period, Comptel, having gained significant knowledge in providing mediator-software services, embarked on rapid global growth.

The Period of Product/Service Development 1998-2000

Developments in 1990-1998 resulted in the creation of a technological platform of enabling Internet and broadband technologies, which could be used in a more business-oriented development of the home-commerce area. In Finland, this coincided with the deregulation of the telecommunication

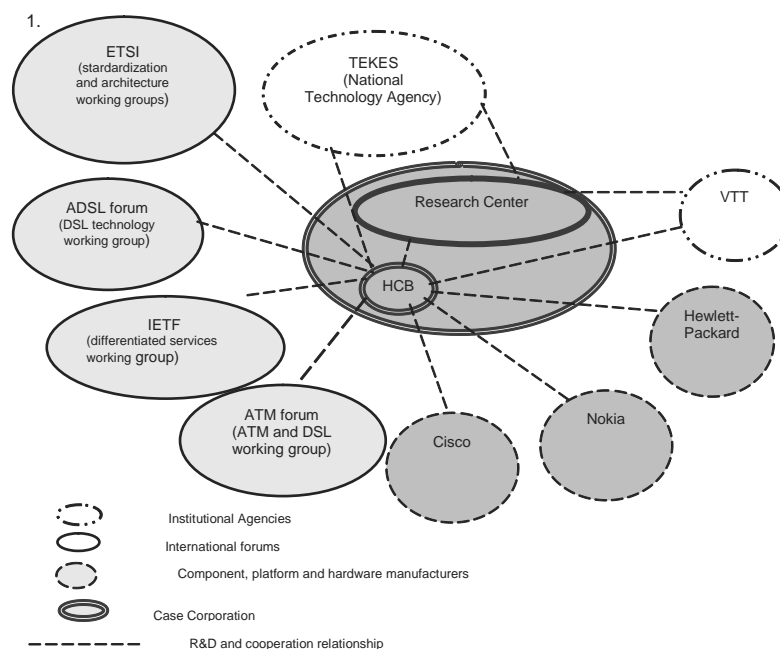
Creating Competitive Advantage

sector in 1998. During the period 1998-2000, the IT boom and rapid changes in competitive environment caused organizational changes, while new business and related projects received a higher proportion of resources and investments than they had before. R&D projects completed in 1990-2000 provided insight and direction suggesting the types of new knowledge, resources, and capabilities required when constructing architecture based on the new enabling solutions.

In Elisa, it was clearly understood that gaining competitive advantage in the new Internet and multimedia-driven business required additional technology, business, and managerial capabilities. This capability gap was perceived to be growing wider until Elisa's top management decided in 1998 to start building capabilities by establishing a product/service-oriented business unit called Smart Home (which later became HCB) and provided funding for further network projects.

The first 'real' business network aimed at new multimedia-technology-based business was Arenanet (A-net) (see Figure 2, Picture 2). The driving vision behind Arenanet, a coalition of culture and technology triggered by the City of Helsinki, European Cultural City of 2000 project, was to offer broadband-based services to every single home in Finland (Lehmus, 1999). The ambitious objectives of "Helsinki Arena 2000" were: to create a virtual Helsinki, a next generation multimedia network environment for Finland's capital city, to provide a forum for citizens, and a place where culture and business could meet (Salmi, 1999; Tenhovuori, 1996). By joining this network, smart home group (HCB) was aiming to create competitive advantage in this area of e-business, to strengthen both its role and its image, and to expand its customer base. It was a deliberate strategic move to combine Smart

Figure 2a. Picture 1: Equal partners in a network, (PALMU): Technology project-network with cooperation with competitors and institutions and international forums



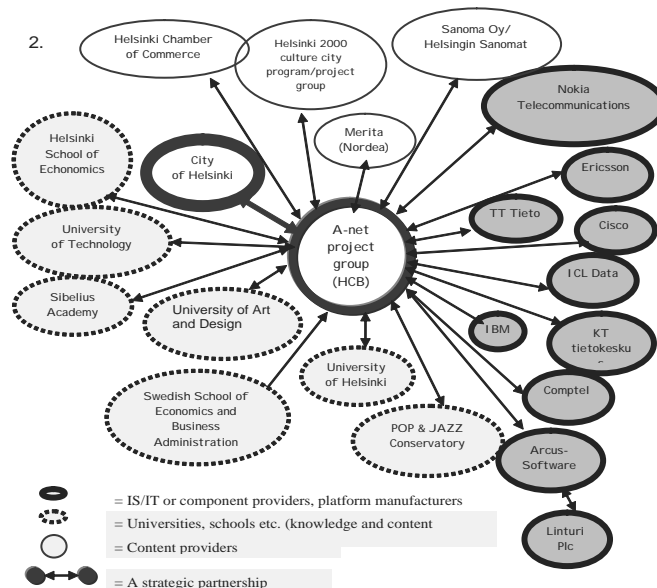
Home's (HCB's) technological knowledge with new business development.

Actors in Arenanet (A-net) were chosen primarily for the purposes of creating a broad-ranging service and information base for an "information age city." The actors in this network were both global players like Nokia, Cisco, and Hewlett Packard as well as national players like Elisa, Linturi, and the city of Helsinki. Relationships in this network were controlled and coordinated by the A-net project group in the case company and this group later became part of HCB. A-net also initiated a change from the strong emphasis on the relationship with Comptel towards increased networking with other businesses. A-net was a complex, temporary business network attempting to combine the knowledge and capabilities of several actors, but there was no clear view on how to manage network relationships or how to maintain the actors' interest in the cooperation. Smart home (HCB) and A-net project group it-

self lacked a clear vision of where this business development might lead, and especially whether and how it could be made profitable.

The exploration shows that rather than being a real business network, A-net was still more akin to R&D, a project for gaining experience of how to be in the multimedia and Internet-based business. On the other hand, A-net proved invaluable as a means of learning and establishing relationships. The hub company gained important knowledge of this type of networking and cooperation, which involves issues such as the types of resource and capability required, how to continue in the multimedia and Internet-based business, and determining the types of service that would interest consumers. The A-net experience helped the key members of the smart home (HCB) realize that a network is an entity to be taken care of and that in business networks, there are different actors and different roles.

Picture 2b. Arenanet (A-net): A coalition of technology and culture



Creating Competitive Advantage

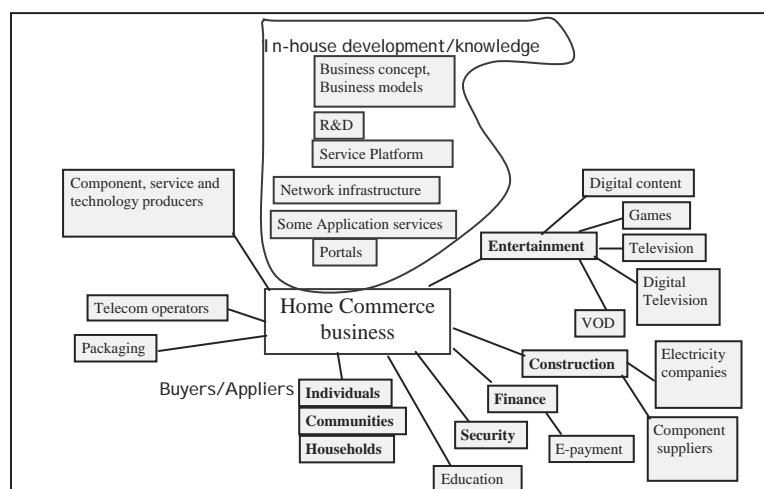
One important realization was that the primary reason for some actors' participation in the network was to gain knowledge and experience, which they could use in their own projects and in creating competitive services. Although a management board to control and coordinate the development of A-net existed, it did not effectively manage the roles of actors involved and the network's future development. A-net was also the first project in which actors from several different industries were involved and doing business together with HCB. The network was closed down in the end of 2000.

Even if the A-net was not a success from the business point of view, there was a consensus that networking is essential when dealing with multiple technologies and platforms within several industries. The experience confirmed that, in a context where knowledge is sophisticated, expanding and widely dispersed, the innovation and commercialization must be carried out through collaborative networks. Based on experience resulting from A-net, the case company initiated the *megahouse* and *megahome* project networks targeted at further development of the technology architecture and

basic services, as well as new home commerce services. They became so called mega concept. What differentiated the mega-concept from previous collaborative networks were the advantages resulting from being the first actor in this area and its foundation on risky and bold resource commitments. However, the successful integration of technologies, marketing, and innovative business models did not automatically translate into a sustainable strategy and advantage, the construction of organizational-specific dynamic capabilities was required.

In the mega-concept's value net, HCB's roles were as the hub, for example, the intermediary and the value chain integrator. HCB integrated the value chains of several industries. It also developed and provided the collaborative platform. HCB designed the net's architectural structure. It created a virtual community solution for households (Kotiportti™) and for teachers and students (Efodi—the e-learning space). In accordance with this, HCB provided the security solutions and services because Datatie, a subsidiary of Elisa, had provided those services previously. Those services were now integrated to the same interface

Figure 3. Overview of the home commerce business (HCB) and industries involved in mega-concept



and platform by HCB. The roles of the other actors were as software, component, device, application, content and service, access and network providers (i.e., Internet, broadband, fixed, or wireless network), as well as infrastructure and platform manufacturers. When comparing mega-concept to A-net, the main difference was that in A-net, HCB was not capable of preventing opportunistic behavior. Figure 3 shows the different industries involved in mega-concept.

The number of competitors in the future home market was few during the early phase but there was a proliferation of competitors by the beginning of the 21st century. The basis of competition became more defined. Initially, it was a question of attracting customers and building customer base. The vision for the future home and home commerce business was to maintain its position as the pre-eminent provider of home commerce services and information. To achieve that goal, HCB had to continue to enhance both content and site services and further diversify revenues, achieving cost savings through process redesign in order to remain dynamically efficient in the future.

Learning new technologies, integrating and implementing them into a business context underlay the main learning race within the ICT-sector during the 1990s. The capabilities developed around these new technologies and the businesses based on them were the source for HCB's competitive advantage. Moreover, the results show that an innovative actor has to be able to develop capabilities in network management. Without these managerial capabilities the actor is not capable of influencing, orchestrating, and mobilizing the other net members.

In addition to the strong competence learning, as well as service technology and concept development, the 1998-2000 period can also be characterized as the top management team of the HCB 'giving promises' to the corporate management and other constituencies. This relates to the question of communicating the potential growth

and profitability of multimedia and Internet-based business. This intra-organizational agenda "selling" resulted in HCB being given the resources it required to participate and mobilize all the development networks, and resulted in HCB achieving leadership in ADSL connections and the leading position in smart-home/future-home solutions (e.g., KotiportiTM, household monitoring and home security systems, digital television services) in Finland.

The Stabilization Phase 2001-2003

The years 1998-2000 were time of the 'IT-boom' and "e-hype" in Finland as well as in Europe. During that time, Elisa's R&D was allowed to test and fine-tune their products to be perfect in every way possible.

However, the years 2000-2003 showed unpredictable economic situation in the ICT-sector, and R&D investments were expected to have a short pay-back time and there was no extra time to spend in perfectionism in product designs. The years 2001-2003 showed the impact of exogenous factors, such as the burst of the "IT-bubble" and associated declining profits in the ICT-sector, in Elisa in many ways. The impacts seen included:

- **At a business level:** termination of unpredictable business, concentration on core and profitable products and services, the pruning of non-core business, the analysis of future business possibilities, and the investment in promising technological and business areas
- **At the organizational level:** the retrenchment of employees, the restructuring of the organization
- Customer service was considered to be more important than in the years of rapid growth and expansion seen during 1998 to 2000.

The reduction of investment in R&D affected HCB to the extent that the new product develop-

Creating Competitive Advantage

ment was terminated and HCB instructed to concentrate on their core business and key products like ADSL and Kotiportti™. Processes and interfaces of services underwent tuning to increase efficiency. Senior management's key motivation in investing in the new home commerce related business projects was because they saw these as a way to enhance current businesses and create new business opportunities. Organizational restructuring affected so that a couple of new emerging businesses were merged to HCB.

The formation of internal networks to focus on certain R&D areas of the business had changed within the case corporation. Whereas, in the 1990s, R&D was focusing on single technology pilots, in 2001-2003, the focus was on business issues and technologies related to that business.

In addition to networking within the case corporation, external partners were more precisely assessed, chosen, and classified not only for today's business needs but also with regard to future business needs. HCB's management needed to focus its attention to dynamic resource flows between actors in a business network. The managerial capabilities were needed to steer external resources toward supporting network's objectives. HCB retained only those activities to itself in which they excel over any other players in the markets. The management in Elisa was also required to have collaborative process design and management tools such as Elisa tried to develop in its knowledge management (KM) platform in late 1990s. The competition was not only between companies but also a competition of resources capable of adding the most value to the network.

Technological knowledge, the fast pace of technological developments and the business possibilities offered by the integration of technologies and businesses required more resources than HCB had originally envisaged. The concentration of business activity in an area, in which they performed optimally, including broadband,

home automation and future home solutions, was sufficient for HCB.

HCB had realized that the formulation of a business plan and the collective strategy of a network involved understanding the structure of each industry engaged in the network, finding the competitive advantage and determining how a business house will compete in the markets. HCB had learnt that growing a new business involved the establishment of partnerships with prominent companies, seeding the market and encouraging partners to participate in the creation process of a new business.

In HCB's internal service development, its role initially changed from product and service developer to platform developer and provider, eventually moving towards a role as service environment-provider in which the service environment included homes, buildings in general, and communities.

Role of Networks in Creating a Business and Management Capabilities

The descriptive analysis of the construction of a radically new business group highlights the relevance of networks in this process. It also provides insights into the building of dynamic network capabilities through collaborative networks. The nature and goals of networks and networks changed in a systematic manner as HCB developed during 1999-2003.

In an entirely logical manner, the early years (1990-1997) were characterized by participating in and mobilizing networks for the development of technological knowledge. The strategic alliance with Comptel, the multimedia projects and R&D networks, and participation in the Finnish Technology Agency (TEKES) financed e-payment project network, and all were crucially import in helping HCB to create the technological platform it needed to start offering Internet and broadband-

based services to businesses and consumers. Through this collaborative networking, HCB's core team learned that, in addition to the specific technological capabilities, it is essential to have networking capabilities, such as partner evaluation and selection, multiparty-project participation, and management. Because of the number and continuity of these primarily project-based networks (see Figure 1), HCB was able to build routines and a managerial infrastructure that turned primarily into people-embodied competencies with dynamic organizational capabilities. In conceptual terms, this process is termed as the experience accumulation and knowledge articulation learning mechanisms as suggested by Zollo and Winter (2002)

Furthermore, participation and the coordination of the A-net (the network coalition aimed at turning Helsinki into an e-city) was a turning point where the emphasis in HCB's network mobilization shifts from technology cooperation to business development. The A-net experience sensitized the HCB management team to the necessity of developing a network management capability; the careful selection of network members, and the provision of comprehensible roles with specific responsibilities, direction, and coordination. Development of these capabilities was carried out in the large, multi-firm and multi-industry networks (*megahouse* and *megahome*), which further emphasized aspects of network mobilization and management capability such as negotiating skills and the creation of new forms of contracts.

Another major learning experience that was already perceived during late R&D project networks, but really accentuated by the disappointment of not achieving any direct business objectives with the A-net, was the realization of the crucial role played by new business models in home-centered, Internet and broadband-enabled e-business. Without a clear and jointly agreed view about the earning modes and shares of each

network member (e.g., operator, software provider, content providers, portal owner) the network management functions faced continuous conflicts and inefficiency. In brief, a good network mobilization and management capability was highly dependent on the focal actor's competence in designing effective and attractive business models.

What enables a management team to design a good business model in a fast developing business sector? Accumulated experience gained from several networks and from participation in industry-wide forums provided the HCB team with a visioning capability for the unfolding business sector. This allowed them to assess the business opportunities from the perspectives of potential network members and led to viable and mutually attractive business models. This "framing capability", which makes it possible to create an overarching view of the architecture of a business group in which the value-systems of different business sectors merge, is very hard to achieve. On the basis of the case evidence, it appears that the HCB team was able to accomplish this.

As a team, HCB was considered more of a profit and innovation center than a cost center and they were encouraged to develop through internal training programs and through different technology networks. Also, they did their own market research.

This case of HCB could also be seen as a case of intrapreneurship—fostering entrepreneurship within an established organization. HCB's management team put together team of enthusiastic volunteers, sponsored by Elisa's senior management. It was a way for an established organization to find new markets and new top products. HCB's team could be considered as inventors as they stepped out of their traditional roles within the established business, they were creative and took risks. Moreover, they worked towards minimizing the risks using the collaborative networks to more efficient and effective product production and sales. The success of HCB also showed a

way to increase the speed and cost-effectiveness of technology transfer from research and development to the marketplace. It also seemed that success was based on the organizations ability to take on concurrently multiple and contradictory business elements through an organizational managerial structure that combined a mix of self and centralized government.

CONCLUSION

This study makes several contributions to the evolving theory of network management. It provides empirical evidence for the crucial roles played by different types of networks and networks in both the emergence of a radically new business group and in learning the managerial capabilities required to not only survive in this context but also to create it.

Different alliances, project networks, R&D forums, and large-scale project networks provided different types of learning experiences. In brief, they provided the case company with different resources and knowledge; in other words, they fulfilled the different functional needs that evolved during the evolutionary process. The author contends that a core management capability in this type of environment is the ability to utilize the available networks and mobilize one's own networks to meet the resource and learning needs that exist. This is not, however, an organizational capability which is inherent. It presumes two aspects—visioning and networking resources and capabilities. Firstly, a comprehensive or “architectural” view of the field, which enables a company to envision its development, at least a few steps ahead. Through visioning, an actor can anticipate the technologies and other capabilities it must develop. Visioning alone is not enough; the resources to carry out networking must also exist. In the phase where an actor wishes to mobilize its own strategic network, it must also be able to offer an attractive development agenda or business

model if it is to engage partners with cutting-edge knowledge in their own areas of operation.

This “functionality” perspective on the role of networks suggests that firms with an “architectural” vision and adequate resources can, through network relationships, purposefully attempt to create an extended pool of resources and capabilities that matches their current and foreseeable needs. If this attempt is successful, a success circle may result.

In addition to this functionality aspect of network collaboration and network management, the case analysis highlights the relevance of understanding the process-like nature of capability development. Only after exposure to a variety of continuing networking experiences, the management team of the case firm was able to identify and systematically start developing network-management capabilities. This provides additional support to the experimental learning view of dynamic capabilities (Zollo & Winter, 2002). As seen in this case, the intelligence in a network structure is its ability to share, modify, create, and distribute information, knowledge, and resources among the different parties, and thus develops and creates network capabilities that can change and dynamically develop over time (see also Möller et al., 2003; Möller & Svahn, 2006). Creating competitive advantage with the capabilities developed and acquired, the case company succeeded in gaining the leading position in ADSL-services at the end of the 1990s which supports the earlier studies of creating competitive advantage (e.g., Penrose, 1959; Rumelt, 1974; Wernerfelt, 1984; Barney, 1991). On the other hand, since network participation also has the character of an investment, as emphasized by the industrial network theory (Håkansson & Snehota, 1995), creating a variety of resources and gaining the knowledge cannot be achieved without an associated cost. Taken together, these findings provide support for and expand the extent of discussion on network capabilities.

These findings have important theoretical and methodological implications. First, they support the industrial network approach (Håkansson et al., 2004) and the Resource Based View in emphasizing the key role of combining the heterogeneous resources controlled by various actors in order to be able to create new technological and business solutions.

Moreover, knowledge of processes, particularly in relation to tuning R&D processes, in late 1990s made it easier for HCB to create a competitive advantage. The corporate vision provided a continuity of direction, which allowed HCB to create unique skills and capabilities and to build a strong reputation of superior technical knowledge in certain new technology areas (cf. Porter, 2001, p. 71).

Cognitive aspects of social capital can be seen as human-related aspects and motivation for collaboration (e.g., Nahapiet & Ghoshal, 1998; Anderson & Jack, 2002). From the focal actor's perspective, this study shows that in the relationships involving actors and networks related to the supply-side; for example, research and development activities, as well as in/out-sourcing of components and platforms required in software and platform development and production, the cognitive aspects of social capital providing value to software vendors include capabilities in both current technology, as well as in emerging future technology. In addition, innovativeness, flexibility, and adaptability seem to be linked to cognitive capabilities of the network actors. These relationships involve actors and networks facilitating and supporting business; for example, those partners who do not directly contribute to the value-creation process, cognitive capabilities are related to business strategy, marketing, and management.

As a conclusion, the emergence of a new business is clearly a combination of the evolution of technological and market factors which are not controllable by any one actor, rather it is accu-

mulation of the intentional strategy of developing collaborative forms—alliances, partnerships, and strategic networks—by the focal actor. First, this study shows that a focal actor can clearly promote its business by developing its business and social networks as seen in this case study. Without this strong intention or strategy, the focal actor would not have been able to develop its position in the emerging new Internet and mobility related services. Second, the results show that an innovative actor has to be able to develop capabilities in network management. Without these it cannot influence and orchestrate the other actors whose resources and competences are required in creating the technological platforms underlying new business services nor the services themselves. Network management was seen to be composed of such strategic level competencies as being able to design differentiated strategies for different types of networks, perceiving the networks and partnerships as an interrelated portfolio of collaborative forms, and being able to develop different contractual forms for different type of collaborative forms.

Finally, the global ICT-policy making addresses primarily the removal of all obstacles that might stand in the way of the unconstrained operation of the various international ICT actors on markets. Scope and direction of national ICT-strategies are influenced by the emerging global systems of the ICT-sector's governance. A successful national ICT-strategy as a part of a global ICT development can assist in the development of flexible and decentralized industrial production and R&D business networks, and thus, improve the competitive position of local ICT-suppliers in national markets against the global competitors. Through business networks, new global communities are being established. Increasingly, organizations in various countries are integrated into these webs of horizontal and vertical information and knowledge exchange. However, the biggest challenge for both the

national and global ICT-strategies are to ensure the sustainable growth and the development of the ICT-sector and ICT-related capabilities and skills. This sustainable development will not be possible only through technology development but by development of national and international policies. Business networks can offer new sources of innovations and knowledge, and thus, assist in developing the skills and capabilities needed in national ICT-development and assuring the competitive advantage locally or internationally.

Future Research Directions

ICT has been recognized as a major catalyst for socioeconomic development, therefore, the experiences and information of the usage of ICT are of key importance. ICT can be used in service of broader strategic objectives in a number of development sectors, for example: health, military, education, e-commerce, and e-government. Many innovative partnerships between governments, businesses, and private companies have been formed to build collaborative networks and deploy advanced ICT applications both nationally and internationally. However, we still lack the analytical and political tools to better conceptualize the business-university-government networking, and the role of each partner in the strategic ICT-development. Due to this networking, we also need tools to evaluate the processes and working methods cross different industry and organizational boundaries. Interaction in ICT-developmental projects between organizations is undertaken with intention to achieve an economic goal, with strategic objectives being implemented to obtain final economic rewards. Further, economic goals involve some overlapping of self and collective network-level interest. And probably, there is some disparity between interacting organizations on their combinations of expected self and collective network-level interest in the collaborative networking.

In addition, we need new frameworks to monitor and evaluate ICT-enabled projects and their role in national, economic, and/or business development. Measuring the benefits and failures of ICT development is particularly interesting because available data is limited. Collaborative networking in ICT-projects is difficult to track and there is a lack of exact data to serve as the basis for wide-scale policy decisions.

REFERENCES

- Alajoutsijärvi, K., Möller, K., & Rosenbröijer, C.J. (1999). Relevance of focal nets in understanding the dynamics of business relationships. *Journal of Business-to-Business Marketing*, 6(3), 3-35.
- Amit, R., & Zott, Ch. (2001). Value creation in e-business. *Strategic Management Journal*, 22, 493-520.
- Anderson, A.R., & Jack, S.L. (2002). The articulation of social capital in entrepreneurial networks: A glue or lubricant? *Entrepreneurship and Regional Development*, 14, 193-210.
- Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17, 99-120.
- Beardsley, S.C., Bray, W.D., & van Rooijen, M.C.W. (1995). The great European multimedia gamble. *McKinsley Quarterly*, 3.
- Birley, S. (1985). The role of networks in the entrepreneurial process. *Journal of Business Venturing*, 1, 107-117.
- Castells, M. (1996). *The rise of network society*. MA: Blackwell, Cambridge.
- Gemunden, H. G., & Ritter, T. (1997). Managing technological networks: The concept of network competence. In H. G. Gemunden, T. Ritter, & A. Walter (Eds.), *Relationships and networks*

- in international markets (pp. 294-304). Oxford: Elsevier Science.
- Grabher, G. (Ed.). (1993). *The embedded firm. On the socio-economics of industrial networks*. London: Routledge.
- Griffith, D.A., & Harvey, M. G. (2004). The influence of individual and firm level social capital of marketing managers in a firm's global network. *Journal of World Business*, 39, 244-254.
- Halinen, A., Salmi, A., & Havila, V. (1999). From dyadic change to changing business networks: An analytical framework. *Journal of Management Studies*, 36(6), 779-94.
- Halinen, A., & Törnroos, J.Å. (1998). The role of embeddedness in the evolution of business networks. *Scandinavian Journal of Management*, 14(3), 187-205.
- Heide, J.B., & John, G. (1995). Measurement issues in research on interfirm relations. In K. Möller & D. Wilson (Eds.), *Business marketing: An interaction and network perspective* (pp. 531-554). Boston: Kluwer Academic Publishing.
- Holmqvist, M. (2003). A dynamic model of intra- and interorganizational learning. *Organization Studies*, 24(1), 93-121.
- Huber, G.P., & Van de Ven, A. H. (Eds.). (1995). *Longitudinal field research methods. Studying processes of organizational change*. USA: SAGE Publications Inc.
- Håkansson, H., & I. Snehota (Eds.). (1995). *Developing relationships in business networks*. London: Routledge.
- Håkansson, H., & Waluszewski, A. (2002). *Managing technological development. IKEA, the environment and technology*. Routledge Advances in Management and Business Studies. London: Routledge.
- Jarillo, J. C. (1993). *Strategic networks: Creating the borderless organization*. Bodmin, Cornwall: MPG Books Ltd.
- Juntunen, A. (2005). *The emergence of a new business through collaborative networks: a longitudinal study in the ICT sector*. Acta Universitatis oeconomicae Helsingiensis. Printed in HSEPrint. A-series, no 256, ISSN 1237-556X. ISBN: 951-791-957-3/1.
- Kaasinen, K. (2001). *Describing business concept based on partnership network*. Thesis. Lappeenranta University of Technology.
- Kenis, P., & Knoke, D. (2002). How organizational field networks shape interorganizational tie-formation rates. *Academy of Management Review*, 27(2), 275-293.
- Larson, A. (1991). Partner networks: Leveraging external ties to improve entrepreneurial performance. *Journal of Business Venturing*, 6, 173-188.
- Larsson, R., Bengtsson, L., Henriksson, K., & Sparks, J. (1998). The interorganizational learning dilemma: Collective knowledge development in strategic alliances. *Organization Science*, 9(3), 285-305.
- Lechner, C., & Dowling, M. (2003). Firm networks: External relationships as sources for the growth and competitiveness of entrepreneurial firms. *Entrepreneurship & Regional Development*, 15, 1-26.
- Lee, C., Lee, K., & Pennigs, J.M. (2001). Internal capabilities, external networks and performance: A study on technology-based ventures. *Strategic Management Journal*, 22, 615-640.
- Lundgren, A. (1991). *Technological innovation and network evolution. The emergence of industrial networks*. EFI, Stockholm School of Economics, Stockholm.

Creating Competitive Advantage

- Möller, K., & Halinen, A. (1999). Business relationships and networks: Managerial challenge of network era. *Industrial Marketing Management*, 28, 413-427.
- Möller, K., Rajala, A., & Svahn, S. (2005). Strategic business nets—Their types and management. *Journal of Business Research*, 1274-1284.
- Möller, K., & Svahn, S. (2003). Managing strategic nets: A capability perspective. *Marketing Theory*, 3(2), 201-226.
- Möller, K., & Svahn, S. (2006). Role of knowledge in value creation in business nets. *Journal of Management Studies*, 43(5), 985-1007.
- Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23, 242-266.
- Nonaka, I., Toyama, R., & Konno, N. (2001). SECI, Ba and leadership: A unified model of dynamic knowledge creation. In Nonaka & Teece (Eds.), *Managing industrial knowledge. Creation, transfer and utilization* (pp. 13-43). London: Sage.
- Normann, R., & Ramírez, R. (1993). From value chain to value constellation. Designing interactive strategy. *Harvard Business Review*, 71(4), 65-77.
- Park, S. H. (1996). Managing an interorganizational network: A framework of the institutional mechanism for network control. *Organization Studies*, 17(5), 795-824.
- Parolini, C. (1999). *The value net: A tool for competitive strategy*. UK: John Wiley & Sons
- Porter, M. E. (2001, March). *Strategy and the Internet*. Harvard Business Review.
- Penrose, E. (1959). *The theory of growth of the firm*. London: Basil Blackwell.
- Pettigrew, A.M. (1997). What is a processual Analysis? *Scandinavian Journal of Management*, 13, 337-348.
- Ritter, T. (1999). The networking company. *Industrial Marketing Management*, 28(5), 497-506.
- Rocks, S., Gilmore, Audrey & Carson, David (2005). Developing strategic marketing through the use of marketing networks. *Journal of Strategic Marketing*, 13, 81-92.
- Rumelt, R. F. (1974). *Strategy, structure, and economic performance in large industrial corporations*. Boston: Harvard University Press.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.
- Thompson, G., Frances, J., & Levačič, R., & Mitchell, J. (Eds.). (1994). *Markets, hierarchies & networks: The coordination of social life*. Thousand Oaks, CA: SAGE Publications.
- Ulaga, W., & Eggert A. (2005). Relationship value in business markets: The construct and its dimensions. *Journal of Business-to-Business Marketing*, 12(1), 73-99.
- Uzzi, B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly*, 42, 35-67.
- Van de Ven, A.H., & Poole, M. S. (1990). Methods for studying innovation development in the Minnesota Innovation Research Program. *Organization Science*, 1(3) 313-335.
- Vanhaverbeke, V. (2001). Realizing new regional core competencies: Establishing a customer-oriented SME network. *Entrepreneurship & Regional Development*, 13, 97-116.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5, 171-180.

Zollo, M., & Winter, S.G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, 13(3), 339-351.

UNPUBLISHED REFERENCES

HPY Research (1998). *Palmu-project. 5.2.1998. Palmu-projektin kick-off tilaisuus*. Helsingin Puhelin Oyj. Helsinki, Finland.

Hölttä, P. (1998a). *Lisäselvitys Palmu-projektin tuotekehityshakemukseen*. 30.4.1998. Helsingin Puhelin Oyj. Helsinki, Finland.

Hölttä, P. (1998b). *Palmu-projektin väliraportti ajalta 1.1.1998–30.9.1998*. Helsingin Puhelin Oyj. Helsinki, Finland.

Isomäki, M. & Jäntere, K. *PALMU working draft. Laajakaistainen DSL Liittymä–Business-mallien ja niihin liittyvien teknisten toteutustapojen vertailu*. Helsinki, Finland.

Lehmus, P. (1999). *Strategiasuunnitelma 2000-2003. Arena*. Helsingin Puhelin Oyj, Liiketoimintaprojektit. 14.4. (1999). Helsinki, Finland.

Palmu-kokousmuistio. 13.1. (1999). Helsingin Puhelin Oyj. Helsinki, Finland.

Palmu-projektisuunnitelma HPY. (1999). Helsingin Puhelin Oyj. Helsinki, Finland.

Palmu (1999). Palvelujen Hallinta Mobiilissa Internetissä. Helsingin Puhelin Oyj. 13.1.1998. Helsinki, Finland.

Salmi, P. (1999). *Helsinki Arena 2000-esittelymateriaali*. Helsingin Puhelin Oyj. Helsinki, Finland.

Tenhovuori, T. (1996). *Helsinki Arena 2000–palveluverkko. Tavoitesuunnitelma Helsinki Arena 2000*. Helsingin Puhelin Oyj. 2.12.1996. Helsinki, Finland.

ADDITIONAL READING

The following list contains some useful and interesting books, reports, statistics, and articles of the ICT development, business networks, and value creation in networks:

Global Information and Communication Technologies (2006). Information and Communications for Development 2006. GlobalTrends and Policies (IC4D 2006), available at <http://www.worldbank.org/ict/>

Global Information and Communication Technologies (2006). The Evolution of Telecoms in Emerging Markets, available at <http://www.worldbank.org/ict/>

Global Information and Communication Technologies (2005). E-Development: From Excitement to Effectiveness. Available at <http://www.worldbank.org/ict/>

Helander, Nina (2004). *Value-creating networks: An analysis of the software component business*. Acta Universitatis Ouluensis, G 16. Doctoral dissertation.

Forsström, B. (2005). *Value co-creation in Industrial buyer-seller partnerships–Creating and exploiting interdependencies*, Åbo Akademi University Press: Åbo. Doctoral dissertation.

Gabrielsson, P., & Gabrielsson, M. (2004). Globalising internationals: Business portfolio and marketing strategies in the ICT field. *International Business Review*, 13(6), 661-684.

Gabrielsson, M., & Gabrielsson, P. (2003) Global marketing strategies of born globals and globalising internationals in the ICT field. *Journal of Euromarketing*, 12(3/4), 123-145.

Gabrielsson, M., & Kirpalani, V.H.M. (2004) Born globals: How to reach new business space rapidly. *International Business Review*, 13(5), 555-571.

- Gemunden, H.G., Ritter, T., & Heydebreck, P. (1996). Network configuration and innovation success: An empirical analysis in German high-tech industries. *International Journal of Research in Marketing*, 13(5), 449-462.
- International Telecommunication Union (2007). *Measuring the Information Society 2007/ICT Opportunity Index and World Telecommunication/ICT Indicators*. Available at www.itu.int
- International Telecommunication Union (2007). *Core ICT indicators*. Available at <http://www.itu.int/ITU-D/ict/partnership/material/CoreICTIndicators.pdf>
- Kirpalani, V.H. M., & Gabrielsson, M. (2004). Worldwide Evolution of Channels Policy: Impact of Globalization, Societal Problems and Research Needs. *Journal of Marketing Channels*, 11(2/3), 123-134.
- Lindgreen, A., & Wynstra, F. (2005). Value in business markets: What do we know? Where are we going? *Industrial Marketing Management*, 34(7), 732-748.
- Möller, K., & Svahn, S. (2004). Crossing East-West boundaries: Knowledge sharing in intercultural business networks. *Industrial Marketing Management*, 33, 219-28.
- Möller, K., & Svahn, S. (2005). Managing in emergence: Capabilities for influencing the birth of new business fields. In Sanchez & Freiling (Eds.), *Research in competence-based management, Issue 1: The Marketing Process in Organizational Competence*. Elsevier Science.
- Ritter, T., Wilkinson, I. F., & Johnston, W. J. (2002). Measuring network competence: Some international evidence. *Journal of Business and Industrial Marketing*, 119-138.
- Rusten, G., & Skerratt, S. (Eds.). (2007). *Information and communication technologies in rural society*. Routledge Studies in Technology, Work and Organizations. Routledge, UK.
- Steinbock, D. (2001). The Nokia Revolution. *The story of an extraordinary company that transformed an industry*. AMACOM.
- Steinbock, D. (2006). *The Mobile Revolution: The making of worldwide mobile markets*. UK: Kogan-Page.
- Taisch, M., Thoben, K-D., & Montorio, Marco (Eds.). (2007). *Advanced Manufacturing. An ICT and Systems Perspective*. UK: Routledge.
- Tuominen, M., Rajala, A., & Möller, K. (2004). Market-driving versus market-driven: Divergent roles of market orientation in business relationships. *Industrial Marketing Management*, 33(3), 207-217.
- Törnroos, J.Å., & Halinen, A. (1998). The role of embeddedness in the evolution of business networks. *Scandinavian Journal of Management*, 14(3), 187-205.

INTERVIEWS

| Name (Interviewee) | Position | Organization | Interview | Time |
|---------------------|------------------------------|---|---------------------------------|---|
| Ahlstrand, Klaus | Business Development Manager | Datatie | in person e-mails | March 29 th 2000, February 11 th 2001, October 31 st 2001, November 1 st 2001, November 12 th 2001, December 5 th 2001 |
| Arhi, Mika | BI, Analyst | Elisa Corporation | in person e-mail | May 2001, July 2002 |
| Buuri, Marko | Product Development | Elisa, HCB | in person, cooperation meeting | September 2001 |
| Hakanen, Seppo | Marketing Manager | Elisa, PCS | in person, cooperation meeting | March 30 th 2000, April 17 th 2000 |
| Hedberg, Nina | Voice Services, Manager | Elisa, Traffic and Subscriber connections, Elisa, PCS | in person, cooperation meeting | June 1999, March 30 th 2000, April 17 th 2000 |
| Hietanen, Petri | Development Manager | Elisa, HCB | in person, cooperation meeting | September 2001 |
| Hölttä, Pertti | Research Center | Elisa, Research Center | in person, cooperation meetings | January 31 st 2000, January 25 st 2001 |
| Jäntere, Kirsi | Development Manager | Elisa, PCS | in person, cooperation meetings | March 2000, April 2000 |
| Kaasinen, Katariina | Student, R&D developer | Elisa, HCB Nokia, R&D | in person ,e-mails | November 30 th 2001, August 4 th 2003 |
| Lehmus, Pasi | Director | Elisa, PC | in person, cooperation meeting | January 15 th 2002 |
| Malmberg, Juha | Director | Elisa, Traffic and Subscriber connections Elisa, PCS | in person | May 1999, March 30 th 2000, April 17 th 2000, November 20 th 2001 |
| Masala, Sami | Business Development Manager | Elisa, HCB | in person ,e-mails | April 17 th 2000, ,March 30 th 2000, April 17 th 2000, November 26 th 2002, December 12 th 2002, January 23 rd 2003, February 27 th 2003, November 13 th 2003, December 16 th 2003 |
| Peltola, Hannu | Product Development | Elisa, Traffic and Subscriber connections | in person, cooperation meeting | May 20 th 1999 |

Creating Competitive Advantage

continued

| | | | | |
|--------------------|--|-------------------|--|---|
| Rasia, Olli | Department Manager | Elisa, PCS | in person, cooperation meetings | May 1999, March 30 th 2000, April 2001, August 2001 |
| Simula, Timo | Head of Development, HCB's Manager | Elisa, HCB | in person, cooperation meetings, e-mails | March 30 th 2000, April 17 th 2000, November 7 th 2001, November 26 th 2002, December 12 th 2002, January 30 th 2003, March 14 th 2003, September 9 th 2003, October 13 th 2003, November 3 rd 2003 |
| Tirkkonen, Piia | Student, R&D | Elisa, HCB, Nokia | in person, e-mail | November 22 nd 2002, July 22 nd 2003 |
| Vainionpää, Sami | Multimedia Access, Development Manager | Elisa, PCS | in person, cooperation meeting | January 15 th 2001 |
| Viitala, Erkki | Customer Service Manager | Comptel | in person | December 2001, July 7 th 2003 |
| Vuolteenaho, Petri | Product Development, Manager | Elisa, PCS | in person, cooperation meeting | March 30 th 2000 April 17 th 2000 |

This work was previously published in Developing Successful ICT Strategies: Competitive Advantages in a Global Knowledge-Driven Society, edited by H. Rahman, pp. 202-225, copyright 2008 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 8.4

Enabling the Expansion of Microfinance Using Information and Communication Technologies

Narima Amin

Independent Consultant, USA

ABSTRACT

This chapter looks at the origins and evolution of microfinance and explores some of the challenges faced by microfinance institutions (MFIs). It examines the costs and benefits of using ICTs as a means of increasing the effectiveness and efficiency of MFIs enabling expansion and outreach to remote populations. Specific technologies such as smart cards, PDAs, and MISs are explored in detail and case studies are provided. MFIs can also use ICTs to facilitate income-generating opportunities for borrowers, and the case of Village Phone will highlight this potential. It is hoped that this chapter will advance the case for the continued use and research into the synergistic combining of microfinance and ICTs.

INTRODUCTION

In the international development community, there have been numerous discussions on methods for reaching the millennium development goals (MDGs)¹ by 2015. Stakeholders from all walks of life have many suggestions for eradicating poverty from this world where 1.2 billion people still live on less than \$1 a day.

Poverty-intervention tools will be of vital importance if we are to achieve the MDGs, especially the goal of reducing the number of people living in poverty by half by the year 2015. It is acknowledged that:

access to financial services provides the poor with the means to make improvements in their lives—in other words, to achieve most of the MDGs—on

their own terms, in a sustainable way. Access to credit, savings, or other financial services is only one of a series of strategies needed to reduce poverty and achieve the MDGs.²

Microcredit and microfinance, which involve providing financial and other services to the poorest³ people in developing countries, has proven to be a practical way to assist them in working their way out of poverty. Microcredit refers to small collateral-free loans targeted to the poor, provided by a bank or other institution. Microfinance involves not only loans, but also other financial products such as savings, insurance, and transfer services to the poor.

Microcredit and microfinance are recognized as effective tools for the reduction of extreme poverty and the creation of sustainable economic development. It is in the best interests of those living in poverty that the most effective strategies for reducing and even eradicating poverty be identified and implemented. Whether poverty is created because of the death of the head of a family, changes in economic policies, wars, or natural disasters such as a tsunami, poverty alleviation requires that the best alternatives be found to help poor people build their lives. As poverty-reduction tools, the strengths of microcredit and microfinance are that they are sustainable over the long term and also encourage the independence and self-sufficiency of their recipients.

The concept of microcredit originated in 1976 in Bangladesh when Professor Muhammad Yunus lent money out of his own pocket to prove poor people were bankable and creditworthy. Over the last 30 years, microcredit has evolved to the point where the United Nations declared 2005 as the International Year of Microcredit. According to a United Nations Development Programme (UNDP) administrator Mark Malloch Brown:

microfinance is much more than simply an income generation tool. By directly empowering poor

people, particularly women, it has become one of the key driving mechanisms towards meeting the Millennium Development Goals, specifically the overreaching target of halving extreme poverty and hunger by 2015.⁴

Information and communication technologies are considered tools for poverty reduction. Hans d'Orville (2001, p. 1) states that "in the developing world, information and communication technologies (ICTs) are proving formidable and cost-effective development tools. Properly used they can reduce poverty; empower people; build capacities, skills and networks." ICTs⁵ have been identified as mechanisms to help microfinance institutions (MFIs) overcome their operational challenges when expanding in remote and rural areas. Brown (2001, p. 1) said "he is convinced that ICTs can help us reach the targets established by world leaders at September's Millennium Summit, including the goal of halving poverty by 2015."

The challenge for microcredit and microfinance institutions is to fulfill the large unmet demand for financial services. The expansion of financial services to reach large numbers of the poorest of the poor is an obstacle confronting many MFIs. MFIs are faced with high transaction costs and institutional inefficiencies that inhibit their ability to reach the underserved segment of the population in remote rural areas. ICTs working in synergy with MFIs can assist in the efficient delivery of credit to the poor, in creating income-generating opportunities for the poor, and in further enhancing the outreach of MFIs to the marginalized poor in remote rural areas. ICTs can reduce poverty by improving the ability of the poorest people to access financial services. In fact, Attali (2004, p. 1) states that "new information and communications technologies constitute essential factors in the growth and ability of a microfinance institution to build capacity and are consequently vital tools in the fight against poverty."

The need for MFIs to lower transaction costs and to expand the scale of the delivery of their financial services to the remote rural poor in regions such as Latin America, Asia, and Africa make experimentation with innovative technologies by microfinance organizations attractive. The current utilization of ICTs such as the standard management information system (MIS), smart cards, personal digital assistants (PDAs), cell phones, and other technologies allow MFIs to service their clients more efficiently through “the reduced amount of paper work, access to information and ability to compute complex analyses” (Siu, 2001, p. 1). The integration of ICTs into MFIs is a relatively recent development, and there are many unknowns associated with its execution. This chapter explores the implementation of some of these new technologies by MFIs and the associated benefits and pitfalls. One publication⁶ concluded that “ICTs will continue to impact microfinance operations worldwide. As prices of relevant technology like ATMs [automated teller machines], biometrics, voice recognition, smart-cards, and PDAs continue to fall, more MFIs will be able to take advantage of the benefits they offer” (p. 4). ICTs show great promise for microfinance institutions with respect to efficiency, scale, and outreach.

There are concerns that providing access to ICTs could exacerbate the existing digital divide. However, it is shown that ICTs integrated through poverty-focused programs has been instrumental in narrowing the digital divide. Broadly, the digital divide is the wide technological disparity between countries (North and South) and between groups (rich and poor, men and women, rural and urban) within developing countries. It is a major challenge for our information- and knowledge-based world to overcome this digital divide; however, there is no question that ICTs can be used to facilitate groundbreaking initiatives for poverty reduction in the developing world. Gilhooly (2001, p. 1) says that “the sooner the world accepts it, the sooner

ICTs will play a possible crucial role in the global effort to reduce poverty and create a better life for all.” The divide will persist if left alone. Commitment from various stakeholders and sectors can aid in diminishing the divide. As with other stakeholders such as the United Nations, Canada recognizes the growing divide and has a “commitment to closing the digital divide through domestic innovations, an ICT agenda, involvement in the G8 Digital Opportunity Task Force (DOT Force) and investments in developing countries” (*CIDA's Strategy on Knowledge*, n.d., p. 4).⁷

In short, it is widely acknowledged that the business of fighting poverty is not an easy task, and it is equally accepted that neither microcredit and microfinance nor ICTs are answers in themselves for solving all development problems, but they can be used in combination as tools for poverty reduction. Brown (2001, p. 1) says, “as with all tools, the usefulness of ICTs depends on how they are employed.” The convergence of the ICT and microfinance sectors strengthens the possibility of reducing the inequities of poverty. Attali (2004, p. 1) further states, “*ICT can play a major role in the fight against poverty and at the same time, it is precisely in the context of the fight against poverty that these new technologies can help to reduce the digital gap most effectively.*” The synergy and partnership of stakeholders in and across both the ICT and microfinance sectors provide huge promise in the attainment of the MDGs, especially the goal of halving poverty by 2015.

THE EVOLUTION OF MICROCREDIT

The Origin of Microcredit

Professor Muhammad Yunus, an economist and former professor with the University of Vanderbilt in the USA, is credited with originating the concept of microcredit in 1976. At that time,

Yunus had returned to Bangladesh where he was teaching at the University of Chittagong. He realized the economic theories he was teaching were not solving the problems of the poverty-stricken people outside his own classroom. As part of a research project, and out of his own pocket, he loaned \$27 to about 42 villagers to finance their tiny businesses or income-generating activities. They all repaid their loans and made a profit. He then used his own savings as collateral with conventional banks, cosigning for more loans to lend to the poor. Despite numerous successful projects in several villages and regions of Bangladesh that demonstrated the poor do repay their loans, Dr. Yunus was unable to convince traditional banks that poor people are creditworthy. To address this situation, he founded the Grameen Bank in 1983, thus starting the revolutionary innovation that came to be known as microcredit. Until this time, poor people were at the mercy of money lenders who charged exorbitant interest rates that often forced the borrower into deeper poverty.

The Grameen Bank is owned by the poor. They are stockholders and hold positions as board members. Grameen Bank has now reached over 6.1 million borrowers in Bangladesh, 96% of whom are women, and has proven itself as an innovative leader in bringing credit without the requirement of collateral to the doorsteps of the poorest of the poor. It has loaned over US\$5 billion with loan amounts averaging less than \$200, and can claim an exemplary repayment rate of 99%. Fifty-five percent of Grameen borrowers and their families have raised themselves above the poverty line, and the remaining borrowers are moving in the same direction.⁸

The word microcredit means the provision of small collateral-free loans to the poor, most of whom are women, for the purposes of self-employment. Grameen-style credit is based on the philosophy that credit is a fundamental human right, that poor people are creditworthy, and that they have inherent skills and abilities that are unde-

rutilized or not utilized at all. Loans are provided for income-generating activities and housing for the poor, but not for the purposes of buying food (consumption). Grameen delivers credit to the poor; the poor do not have to travel to the bank. Other Grameen loan products include savings deposits and insurance. The bank also encourages social empowerment through the formation of groups and centers where women are given the opportunity to take on elected leadership roles, and this leads to borrowers participating in the local government electoral process. The 16 decisions followed by all Grameen borrowers include the promotion of health, the growing of vegetables for consumption, the selling of any surplus vegetables, and the education of their children.

In 1989, Grameen Trust of Bangladesh was created to support Grameen replication programs worldwide. It provides training, financial, technical, and other support to microcredit practitioners and replicators of Grameen-type credit and savings programs. One hundred and thirty-eight Grameen programs have now been replicated in 37 countries. Some include adaptations suited to a country's unique environment, but each maintains the Grameen Bank's philosophy. In 2004, the Grameen Trust introduced a new program called the Grameen Build, Operate, and Transfer (Grameen BOT) program. Where Grameen Trust normally relies on partnership organizations to implement a microcredit program, it has moved to into directly implementing programs especially in countries in difficult situations. It identifies a country and recruit staff to implement a program with the focus of targeting and reaching the poor and to achieve institutional and financial sustainability. This project has so far reached 7 countries including Costa Rica, Kosovo, Turkey, Zambia, and most recently Indonesia, serving the Tsunami affected individuals of the province of Aceh (Grameen BOT program, n.d.).

Microcredit Evolved into the Future

Microcredit, a concept involving lending or the provision of credit, has become a global initiative and has been adapted by numerous institutions in various regions of the world to include additional financial services or products such as transfers, deposits, insurance, and so forth. Credit with these additional services is often referred to as microfinance. Littlefield (2005, p. 1) further describes microfinance as:

driven by the simple idea that people in developing economies need access to affordable financial services that allow them to make deposits, transfer funds between urban and rural areas, and protect themselves through crop and life insurance. These services help individuals better manage risk and plan for the future, and provide an important buffer for sudden emergencies, business risks, and seasonal slumps.

Microcredit and microfinance institutions involved in the delivery of credit and other services include nongovernmental organizations (NGOs), cooperatives, credit unions, nonbank financial institutions, and some formal banks.

In the 30 years since the origin of microcredit, it has evolved from providing small loans to the poorest women to fund their income-generating activities into an international movement in which microfinance institutions are encouraged to become sustainable financial entities that serve regions where financial services did not previously exist.

In February 1997, over 2,900 participants gathered in Washington, DC, to launch the Microcredit Summit goal of “working to ensure that 100 million of the world’s poorest families, especially the women of those families, are receiving credit for self-employment and other financial and business services by the year 2005.”⁹ The Microcredit Summit campaign was instrumental

in the recognition of microcredit and microfinance as contributing factors for achieving the MDGs and in having 2005 declared as the International Year of Microcredit by the United Nations. In November 2006, the Global Microcredit Summit will be held in Halifax, Nova Scotia, Canada. At this meeting, a report on the progress of the 2005 goal will be presented, and the expansion stage of the campaign in support of the MDGs will be launched.

Many other independent initiatives are under way that emphasize the significance of microfinance as a tool to fight poverty. The World Bank and the Consultative Group to Assist the Poor (CGAP) are collaborating with national committees worldwide. Their goal is “to raise awareness of microfinance as a tool to empower and improve lives, in addition to developing strategies to face the challenge of scaling up resources to reach the estimated three billion people who still lack access to formal financial services” (Littlefield, 2005, p. 1).

Microcredit and Microfinance as Poverty-Reduction Tools

Who are the poorest people? The face of extreme poverty can be seen in Nibha Rani Sharkar, a borrower of the Grameen Bank. In a 1995 interview, she described how the Grameen loan program transformed her life and the lives of her children. Her husband died and she was left to raise their three boys, ages 3, 8, and 12. Before receiving a loan from Grameen, she could not afford to feed her children. She and her oldest son worked at another villager’s home as domestic servants, and in return they received a daily kilogram of rice. The children were fed mostly on rice mar, the drained liquid from the boiled rice. With her first loan of \$50 from the Grameen Bank, she bought a cow and sold the milk to earn an income. Two years later, she sold that cow, made a profit, and bought two others. Within 5 years, Nibha owned

several cows, chickens, and three fourths of an acre of land. Her children are now all in school and eat three healthy meals each day. All microcredit and microfinance programs worldwide—in Asia, Africa, the Middle East, Latin America, and the Caribbean—have similar stories to tell of their programs' impact on the lives of their clients as they lift themselves out of poverty. Microcredit and microfinance work to empower these individuals to lift themselves out of poverty and become self-sufficient.

Microfinance is by no means a panacea, but it is a powerful poverty-reduction tool, and its impact on the MDGs is far reaching. Morduch, Hashemi, and Littlefield (2003) conclude that access to financial services reduces poverty, and its effects are demonstrated in multiple ways. Access to microfinance services therefore become the basis for which other essential interventions depend. This is further explained when they state that:

evidence from the millions of microfinance clients around the world demonstrates that access to financial services enables poor people to increase their household incomes, build assets, and reduce their vulnerability to the crises that are so much a part of their daily lives (and this) also translates into better nutrition and improved health outcomes, such as higher immunization rates. It allows poor people to plan for their future and send more of their children to school for longer. It has made women clients more confident and assertive and thus better able to confront gender inequities. (p. 1)

In terms of sustainability and the impact on the lives of the poorest people on a large scale, they further say, "Microfinance thus offers the potential for a self-propelling cycle of sustainability and massive growth, while providing a powerful impact on the lives of the poor, even the extremely poor" (p. 1).

The Challenges of Microcredit and Microfinance Institutions

Many of the poorest people worldwide still lack access to formal financial services and still have to rely on informal financing methods such as family members, savings groups, and money lenders. The central challenge is how to address the large unmet demand for microcredit and microfinance services for the poorest people. Magnette and Lock (2005) estimate that in 2004, the demand for microfinance services globally was 500 million clients, of whom only 80 million were served by the estimated 7,000 to 10,000 microfinance institutions that exist. Financial services to these 80 million clients reach mostly the urban and peri-urban areas. MFIs have difficulty reaching the rural, remote, and low population-density areas. They are faced with the challenge of finding ways to overcome these obstacles and increase the scale and depth of their outreach while still operating efficiently.

While the focus is on MFIs to achieve scale and efficiency to enable them to reach large numbers, they equally have to ensure that they are in fact not excluding the target population of the 1.2 billion people that live on less than \$1 a day. Reaching and having an impact on the poorest people is not an automatic process. Simanowitz and Walter (2002, p. 60) indicated that "conventional microfinance acts through both deliberate and unintentional mechanisms which exclude the poorest. Programs therefore need to be designed to include the poorest, and to facilitate mechanisms that will lead to poverty impacts." Furthermore, "achieving good poverty outreach is about providing the right products as far down the poverty scale as is possible" (p. 64). Two important measurements of poverty outreach are "working in the poorest areas of the country and working with the poorest relative to the population in an MFI's operational area" (p. 64).

For MFI practitioners who are committed to ensuring both targeting and outreach to the

poorest segment of the underserved, there are poverty-measurement tools¹⁰ that exist to help MFIs monitor the depth of poverty reached.

THE IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGIES ON MICROFINANCE INSTITUTIONS

What are ICTs?

ICTs are defined as the transfer of information and data and include both old and new converging technologies. *CIDA's Strategy on Knowledge* (n.d., p. 7) states that "ICTs such as radio, television, telephones, computers, and the Internet can provide access to knowledge in sectors such as agriculture, microenterprise, education, and human rights, offering a new realm of choices that enable the poor to improve their quality of life." This section will focus on the new and advanced ICTs as enabling tools for transferring data and information to aid the effectiveness and efficiencies of MFIs in order to extend services to the poorest people in rural and remote areas.

Below are descriptions for a number of enabling technologies that are of potential use to MFIs. An MIS is a core information system that includes such functions as portfolio tracking, internal control, accounting, data analysis, and internal and external reporting functions to help MFIs make appropriate policy decisions and manage information more effectively and efficiently. Credit scoring allows an MFI to analyze a client's historical data, while providing links between a client's characteristics and behavior with the assumption that those links will predict how clients might act in the future. Scoring technology can assist MFIs to analyze past behaviors of clients to better assess loan applications, develop more effective loan-collection methods, create more effective target marketing strategies, and increase client retention.

PDA's are small handheld devices that field officers can use to do financial calculations and manage both client and MFI information. With data electronically stored, loan officers can readily gain access to client information, which assists them in activities such as loan processing, reviewing clients' historical data, and monitoring loan portfolios.

Smart cards are small plastic cards that can easily fit into a wallet. They have an embedded microchip that processes information or stores data and works like an electronic passbook to facilitate savings, deposits, and money transfers.

Point of sale (POS) is a device or system that is located at a physical location often remote from a main branch such as in a retail outlet. It is able to perform some of the financial transactions normally associated with branch banking such as the transfer of funds from one account to another or from a customer to a retailer.

Mobile phones allow clients to use a cell phone to call into an automated system to conduct business transactions and to access and request information. They also allow clients to charge others for use of their mobiles, especially in regions without a regular telecommunications infrastructure.

An ATM is a machine that facilitates banking transactions that would otherwise be serviced by staff. It provides account information, accepts deposits, and aids cash disbursement and balance transfers.

Biometrics technology measures an individual's unique physical or behavioral characteristics such as fingerprints and voice patterns to recognize and confirm identity. This technology is used in association with ATMs and POS.

Interactive voice response (IVR) technology allows clients to access an automated system through standard or mobile telephones to do banking transactions and get other information such as office hours and branch locations.

Internet banking allows clients to perform transactions similar to telephone banking, which

include verifying account information, making bill payments and money transfers, and accessing new product information.

Appropriate and Enabling ICTs for Microcredit and Microfinance Institutions

In light of the challenges MFIs are facing in terms of high transaction costs and the lack of outreach to isolated and sparsely populated rural areas in regions such as Africa and Latin America, several microfinance institutions worldwide are experimenting with various new technologies to lower operational and transaction costs, improve efficiency, aid in accurately tracking operations, and expand scale and outreach. Frankiewicz (2003) indicated that in terms of institutional technology usage, CGAP's survey of 150 MFIs worldwide:

found that only about one-third of the MFIs in Southeast Asia and Africa are computerized, compared to more than three-quarters of the MFIs in Latin America, Eastern Europe and Central Asia. Worldwide, 46% of MFIs still have very low-tech systems, either manual or spreadsheet-based MIS. The remaining 56% have more advanced systems, either custom outsourced systems (24% of the institutions surveyed), systems built in-house (20%), or applications purchased off the shelf (10%). (p.p 14-15)

There are MFIs of varying sizes and ranges of experience. Smaller MFIs still utilize manual ledgers and spreadsheets for record keeping. However, the majority of MFIs require information system (IS) technology to help them track, report, and analyze information for internal and external use. ICTs or delivery technologies appropriate for MFIs usually start with the core MIS. Other IS technology includes a handheld device such as a PDA that records client information, smart cards, a client-held device that stores customer information, scoring technology, a means

of analyzing and forecasting client behavior, and connectivity technologies (broadband or VSAT, a wireless data connection through satellite) that transfer data to staff and branches.

The more advanced delivery technologies that larger MFIs and some banks use include low-cost and standard ATMs and cell- or mobile-phone banking. POS systems are often placed in public retail outlets for use with credit and debit cards, and allow clients to do electronic payments and other transactions. All of these technologies facilitate customer financial transactions such as deposits and payments, and cash withdrawals and transfers. Biometrics, the fingerprint technology associated with smart cards that assists with verification and security of a client's identification, is also used by MFIs.

Frankiewicz's (2003) seminar report made reference to Elizabeth Littlefield's statement:

Technology certainly has the potential to help us do the one thing that microfinance has not been able to do except in very few places thus far and that is scale up exponentially. It can do this by enabling a rapid expansion in access points through improving operations, profits, customer service and, importantly, outreach to underserved populations, especially in rural areas. (p.73)

The report further recounts the seminar discussions on enabling technologies appropriate for MFIs and access points or contact points where clients can gain access to financial products and services that provide them with greater flexibility and convenience. These enabling ICTs and access points are thus seen as an added bonus for MFIs in terms of customer service. The tables below describe the various technologies, state the requirements for implementation, list any associated advantages or disadvantages associated with use, and therefore suggest the applicability of these technologies for MFIs globally.

In addition, case studies are provided below to further illustrate the scope of available tech-

Enabling the Expansion of Microfinance Using Information and Communication Technologies

Table 1. Summary of access points and their enabling technologies¹¹ (Source: AfriCap Seminar: Information Technology as Strategic Tool for Microfinance in Africa; used with permission from AfriCap Fund)

| Technology | Description | Requirements | Pros | Cons |
|--------------------------------|--|--|---|---|
| Automated Teller Machine (ATM) | A machine that can furnish account information, accept deposits, effect balance transfers, and disburse cash | <ul style="list-style-type: none"> Reliable and affordable communications and power infrastructure Central database Ability to securely transfer currency to machines | <p>For clients:</p> <ul style="list-style-type: none"> Convenient service Flexible account access Increased hours of operation <p>For MFIs:</p> <ul style="list-style-type: none"> Reduced transaction volumes and costs No staff needed to complete transaction Can attract savings deposits | <ul style="list-style-type: none"> Expensive to own and operate Need for integrated systems Maintenance and cash refilling is costly Security issues (including transport of cash) |
| Mobile Branches | An ATM on a truck or a branch in a bus that goes from one village to another in rural areas that can be served infrequently (e.g., once a week). Combines ATM functionality with operational staff | <ul style="list-style-type: none"> Should be combined with smart cards and POS devices MFI staff capable of providing a range of services | <ul style="list-style-type: none"> Full range of financial services Expands branch network to low-density rural areas Much lower cost than setting up a branch More secure than a permanent ATM Not dependent on telecommunication infrastructure | <ul style="list-style-type: none"> Clients can only transact when the mobile branch is in the village Higher per-unit cost than ATMs Need a staff of two to three to drive and service the mobile branch Higher operating costs (travel distances, maintenance) |
| Point of Sale (POS) Device | Small machine located at a point of sale that can be used to authenticate the transfer of funds from customer to the retailer | <ul style="list-style-type: none"> Retailer buy in and support Solid communications infrastructure Centralized database Coordination between institutions | <ul style="list-style-type: none"> Significant reduction of paperwork No need for data-entry personnel Immediate reconciliation of transactions | <ul style="list-style-type: none"> Expensive to implement and operate Need for interinstitutional coordination and shared infrastructure |

Enabling the Expansion of Microfinance Using Information and Communication Technologies

Table 1. continued

| Technology | Description | Requirements | Pros | Cons |
|---|--|--|--|---|
| Smart Cards | Wallet-sized plastic cards with embedded computer chips that can process information or simply store data | <ul style="list-style-type: none"> Reliable electrical and communications networks Dial-up facility for updates Software integration between cards, readers, and central MIS Presence of associated technologies | <ul style="list-style-type: none"> Store information No need for real-time connection Automated transactions More secure Quicker administrative functions Increased transaction accuracy | <ul style="list-style-type: none"> Need to purchase associated technologies High up-front development costs Security issues with stored information |
| Mobile Phones | Permit client to request information from, or conduct business with, an automated system through a mobile phone | <ul style="list-style-type: none"> Solid MIS Centrally stored, real-time data Network availability at affordable rates | <ul style="list-style-type: none"> Not reliant on poor landline phone infrastructure Permits access to rural clients Frees staff time 24/7 accessibility | <ul style="list-style-type: none"> Lack of mobile network in rural areas High cost of operation Expensive to install and maintain Need for centralized database |
| Interactive Voice Response (IVR) Technology | Allows callers to request information from, or conduct business with, an automated system by speaking into a telephone or inputting information through its keypad | <ul style="list-style-type: none"> Easy and affordable telephone access for clients Centrally stored, up-to-date data Secure databases | <ul style="list-style-type: none"> Can serve many clients at once 24/7 service Frees staff time for more personalized tasks (business counseling, collection calls) | <ul style="list-style-type: none"> Need access to telephone services Initial costs between \$10,000 and \$50,000 for in-house system Need for central system to control personal identification numbers (PINs) |

Table 1. continued

| Technology | Description | Requirements | Pros | Cons |
|------------------------------------|---|---|---|---|
| Personal Digital Assistants (PDAs) | Small, handheld digital computers that can run specialized programs to manage MFI and client data and perform financial calculations | <ul style="list-style-type: none"> Well-functioning MIS High-speed access to MIS data from branch offices Capable technical support Solid institution and good products | <ul style="list-style-type: none"> Increased productivity of field staff Applicable to wide range of tasks Can run various software programs Can standardize procedures Reduced volume of paper records Reduced labor costs | <ul style="list-style-type: none"> High initial and maintenance costs Long development process (9 months to 2 years) Need for custom-designed database applications |
| Internet Banking | Internet technology enables users to perform a variety of banking activities, including fund transfers, bill payments, and securities trading | <ul style="list-style-type: none"> Solid MIS infrastructure Centralized database Reliable and affordable communications and power infrastructure | <ul style="list-style-type: none"> Flexible account access No staff needed to complete transaction Increased hours of operation Eliminates need for data-entry personnel | <ul style="list-style-type: none"> Need Internet access and connectivity Need for integrated systems High initial costs Typically requires higher income and higher literacy rate |
| Biometrics Technology | Measures an individual's unique physical or behavioral characteristics to recognize and confirm identity | <ul style="list-style-type: none"> Reliable electrical power for card or biometric readers Solid processes and adequate staff Software integration between cards, readers, and central MIS | <ul style="list-style-type: none"> Greater security Convenience for clients Local verification Speedy verification that does not require staff User identity is stored safely and is tamper free | <ul style="list-style-type: none"> Time, money, and energy required for setup and maintenance Need to train users Slow user acceptance or user refusal System integration may require changes in other pieces of hardware |

nologies for the delivery of financial services, including the basic MIS system, PDAs, smart cards, POS, low-cost ATMs, biometrics, and mobile phones.

Management Information System

Gibbons and Meehan (2000) claim that the use of MIS will improve efficiency and increase the outreach of microfinance institutions, which suggests it to be a necessary technology for MFIs. Therefore, as MFIs scale up activities to reach more clientele, a well-defined and well-functioning computerized MIS is required. A full and complete MIS would include all the systems an MFI would need to help generate, track, and analyze information efficiently on staff and clients, as well as provide management systems for effective decision making. Most MFIs have an MIS consisting of an accounting system and a portfolio-tracking system (financial products such as loans and savings), and other systems on client impact and human-resource management. The MIS provides management with an overview of the organizational performance to guide them toward their goals of poverty reduction and building a sustainable and efficient organization. It helps them review performance on products, staff, and clients. The MIS also aids in external communication.

Although it is not a replacement for good and effective management, MISs provide information that is useful in addressing management inefficiencies relating to staff morale, operational, and procedural problems. A well-functioning MIS can be the basis on which other advanced technologies are built to enhance MFI client outreach. In the case of the Grameen Bank, almost all of their branches (1,315, out of 1,609)¹² have access to a computerized MIS. At weekly meetings, branch field officers have readily available computer-printed information on borrowers' repayment schedules. If clients repay their loans

according to the schedule, nothing is written but their signatures; therefore, the field staff spends less time on paperwork and are able to give more time to the clients.

Personal Digital Assistants

PDAs are small handheld computers that run specific programs to manage the MFI, client information, and aid in financial calculations. PDAs are custom-designed to be compatible with the institution's MIS. For PDAs to provide maximum benefit, they need to have high-speed access to data from the MIS at the branch offices. PDAs are not a substitute for an MIS, but a supplementary tool. They allow loan officers to access information from their MFI while in the field. From the field, they can access an electronic list of clients with loans in arrears and arrange for loan collection, see clients who are ready to apply for their next loan, and easily obtain background information including client data and records. From certain locations they can update their client records to the head-office MIS immediately or daily, thus reducing the need for data-entry clerks.

MFIs are exploring the use of PDAs to improve performance on a number of levels such as standardizing the institutional methodology and operating policies, aiding in the effectiveness and efficiency of loan officers, improving accuracy in data collection and reporting, and obtaining access to information while in the field.

As a result of the growing competition in the microfinance sector, particularly in Latin America, many MFIs are forced to lower operational costs and improve services and are therefore looking to PDAs to reduce the relatively high cost of labor. PDAs have been used as a microfinance tool since 1999 when they were first introduced by two Mexican MFIs, Compartamos and FinComun.

ACGAP IT Innovation Series paper evaluated the use of PDAs in 10 Latin American institu-

The findings reported by Waterfield (2004) for the Latin American case studies

| MFI | Results |
|--|---|
| Adopem - Dominican Republic | <ul style="list-style-type: none">• Improved client retention• Time frame for loan delivery reduced from 5 to 2 days• 60% reduction in paperwork• 50% reduction in data-entry cost• 35% increase in productivity of loan officers |
| BanGente - Venezuela Banco Solidario -Ecuador | <ul style="list-style-type: none">• Improved efficiency of work flow• Decreased operational cost (both of these results were not quantified) |
| Microfin - Mexico | <ul style="list-style-type: none">• Time saving noted by field staff• Improved consistency of work |
| Compartamos - Mexico | <ul style="list-style-type: none">• Suspended use due to different priorities• Management believed PDAs were implemented too early• Difficulties and interface problems between MIS and PDAs |

tions, as well as one MFI in the Philippines and one in India. The findings reported by Waterfield (2004) for the Latin American case studies are as follows.

The Waterfield (2004) survey indicated the following benefits of PDAs:

- Assisted in the standardization of the work process
- Increased the accuracy, productivity, and efficiency of field workers
- Improved loan delinquencies
- Improved management of time by field staff
- Increased accuracy and faster credit-approval process
- Decreased paper records

Smart Cards

Smart cards are similar to debit or credit cards in that they are made of plastic and are sized to fit into a wallet. Microchips (microprocessor and memory chip) are imbedded into the smart cards, and these allow for the storage and processing of data.

Smart cards can be used by MFIs to automate client transactions. They store all client savings, loan, and other product information. They operate like a debit card, an electronic passbook, or a credit card in that transactions are recorded once electronically, and this speeds up the transaction process and increases accuracy. For security purposes, smart cards also store clients' fingerprint images, and these are compared to images taken by biometric scanners during transactions.

Smart cards assist MFIs to reduce the volume of paperwork, decrease transaction times, and reach more clients.

The following are the experiences of three MFIs that used smart cards and combined them with other technologies.

SKS (India)

In 2001 and 2002, Swayam Krishi Sangam (SKS) of southern India implemented a 1-year pilot project with smart cards combined with PDAs. The objective was to increase the productivity of loan officers by saving time during client-centered meetings, decrease the number of errors produced by a manual recording system, and provide quick access to data for reporting and monitoring by management. SKS also intended to create a technology infrastructure through which other services could be facilitated—including emergency loans, credit scoring, automated cash access, and real-time application processing. The smart cards cost SKS \$3.40 each.

After 1 year's use of the combined technology (PDA and smart cards), SKS reported an increased accuracy in the recording of transactions and increased efficiency in the delivery of information to the central MIS. However, a significant increase to the productivity of loan officers was not realized as field officers increased their efficiency in manually recording transactions.

SKS suspended its use of smart cards because of the high up-front costs (over \$125,000) to develop the technologies. Even though SKS did not continue using this technology because of scarce resources and the high implementation costs, the pilot project proved that poor and illiterate people are able to use and understand technological devices, thus “making technology a viable infrastructure for providing additional services in the future” (Whelan, 2004, p. 3).

Prodem FFP (Bolivia)

In 2000, Prodem FFP, an MFI in Bolivia, partnered with Innova (a local software firm) to introduce smart cards. The goals were to reduce operating costs for services to rural areas and to eventually create a low-cost ATM referred to as Smart ATM (SATM). Innova developed the software to have the smart card furnished with client identification data that included fingerprint templates, and also with client financial data from the Prodem Financial processing system. The smart card facilitated withdrawals, currency exchanges, deposits, money orders, and other services.

A number of benefits were derived from the implementation of smart cards. The smart cards significantly reduced the wait time for clients; for instance, clients no longer had to line up to check their balances. Also, transactions were automated, which increased accuracy and security and helped protect user identity. The smart card served as an electronic passbook, and this eliminated paper transactions and allowed clients to perform a wide range of financial activities such as buying money orders, making currency exchanges, and making deposits and withdrawals. The integrated technologies of smart cards, ATMs, and fingerprint identification (biometrics) provided a competitive edge for Prodem PPF, and it attracted more depositors because of its quick and convenient service. Smart cards hold the flexibility to add other products that may be implemented in the future by Prodem FFP.

Microfinance Networks (Uganda): The Remote Transaction System

In 2002, Hewlett Packard joined with seven organizations (Foundation for International Community Assistance [FINCA] International, ACCION International, Freedom from Hunger, BizCredit, Echange, PRIDE Africa, and Gra-

meen Foundation, USA [GFUSA]) and formed the Microdevelopment Finance Team (MFT) to examine how technology can assist in increasing the scale of microfinance given the challenges that the industry is experiencing, “including the lack of industry-wide standardization, high transaction costs, and the inability to reach out to rural areas” (Magnetite & Lock, 2005, p. 1). The MFT created the remote transaction system (RTS), “a combined technology and business process which supports both group and individual lending, on-line and batch offline processing, and back office synchronization” (Magnetite & Lock, p. 1). The goal was to create an industry standard, assist the MFIs in cost-effective outreach to remote clients, and advance microfinance to a new stage of development.

The project was piloted for a 1-year period; however, this did not prove to be a sufficient length of time, even with an advance 3-month preparation period. A local team was hired to manage and implement the project. The RTS was piloted in Uganda with the partnership of three MFIs operating in Uganda: the Uganda Microfinance Union (UMU), a partner of ACCION; FINCA; and the Foundation for Credit Community Assistance (FOCCAS), a partner of Freedom from Hunger.

The RTS involved the use of sturdy handheld devices that communicate through GSM¹³ cellular networks, and these were combined with the use of smart cards. The smart cards hold account information and are given to clients and field officers to use with the POS device. Clients insert their cards to do their banking transactions, including making a loan payments, and the POS device provides a receipt. The POS system works off line in the field, but when the device is connected online, financial data is transferred via a server to the MFI’s MIS. The server could be something as simple as a basic computer with a straightforward software program that could be easily maintained by branch staff members.

The Remote Transaction System eliminated time spent on manual reporting, thereby reducing rural operating costs. The electronic data collection increased client confidence in the MFIs, as well as aiding in fraud reduction. Additionally, “the system, if used by the industry as a whole, might allow MFIs to take full advantage of latent synergies that exist among geographically and financially diverse institutions” (Magnetite & Lock, 2005, p. 1).

The value of RTS was assessed against the practices currently in use in the microfinance industry with group, branch, and individual clients. The results demonstrated that the most commercially-oriented of the three MFIs derived the most benefit from the technology largely because they were ready to adjust their business model to take full advantage of the RTS: “The advantages of the system as implemented included automation of transactions, reduced client time and travel, more frequent payments, reduced cash management risk, and avoidance of costs for ‘brick and mortar’ branches” (Magnetite & Lock, 2005, p. 1).

The RTS Uganda pilot-project implementation was short and only involved hundreds of clients, so the impact in terms of the scale of the technology was not clear. There were benefits to clients in rural areas who would otherwise have been excluded. The Microdevelopment Finance Team confirmed that there were advantages to the formation of nontraditional partnerships among nonprofit organizations, for-profit groups, and development agencies. Furthermore, “If the potential for enabling remote transactions, expanding services into rural areas, and altering business practices can be achieved, then the RTS could potentially have very significant developmental impact” (Magnetite & Lock, 2005, p. 1).

Summary of Benefits of ICTs to Microfinance Institutions

The above case studies suggest a number of benefits that technology can bring to MFIs. Ivatury

and Pasricha (2005) also mentioned several benefits from a wide range of technologies employed by various MFIs. These include more informed decision making and better reporting through the use of well-developed and well-managed MIS systems. Lower operating costs are another benefit through the use of a scorecard to predict customer payment patterns. Increased deposits and customer convenience are other benefits that were also demonstrated in Prodem's program. Other benefits include increased flexibility for clients, improved customer convenience, and increased number of rural customers.

The Challenges of Integrating Information and Communication Technologies by MFIs

While ICTs hold the promise to increase the efficiency of microfinance institutions and expand outreach to the rural poor by lowering transaction costs, there are obstacles for MFIs to overcome in the integration of ICTs. Hishigsuren (2006) indicated that many of the current ICT applications in the field are employed by the mainstream financial institutions who may not be serving the poor. For MFIs, whose primary mission is to reach the poor and reduce poverty, many of their ICT applications are still in the pilot stage. Also, those MFIs that have gone beyond the pilot stage of integrating ICTs are limited. It is further suggested that it will be sometime before MFIs will be able to fully utilize all the potential of ICTs, and that they should consider taking small steps and seriously consider the cost-benefit analysis when integrating ICTs in some functions of their operations.

The major challenges for MFIs in incorporating ICTs within their operations is not the availability of ICTs, but rather the costs associated with the implementation of ICTs, and the issues involved in choosing the appropriate technology that would give the maximum return on investment. The benefits associated with ICTs come at a price.

Software creation and implementation, including application software and the interface between the handheld or branch systems and the MIS, and hardware costs, as well as the time involved for software and hardware development all must be evaluated by the MFIs. Additionally, MFIs would normally need to hire an external firm to manage the development of the software and user interface: "Delivery technologies have the potential to reduce the costs of serving the poor. But in many countries these technologies have yet to prove themselves more cost-effective than manual operations."¹⁴ Technology systems for long-term support of MFIs are costly, especially when taking into account the need for MFIs to adjust to changes in customer needs and the economic and regulatory situations in which they operate. The price of software and hardware is about 15% of the total implementation cost, but the bulk of the expense involves staff time for training and adjusting to the new system.

Further, Ketley and Duminy (2003) stressed that technology is changing the banking arena and that the poor are increasingly becoming an attractive market for conventional banks. Therefore MFIs must be aware of this "challenge or risk becoming irrelevant." However, even with the cost factors, "MFIs cannot afford not to develop an appropriate technology integration strategy" (p. 2).

BRIDGING THE DIGITAL DIVIDE: GRAMEEN VILLAGE PHONE MODEL AS A CASE STUDY

This chapter has focused on ways in which MFIs are using ICTs to expand and strengthen their services. However, MFIs have developed a second method of using ICTs. ICTs are also being used as income generators for borrowers. Grameen Village Phone provides a good example of this type of use whereby borrowers or microentrepreneurs use the loans of the MFI to purchase ICTs, in this

case cell phones, which they then use to generate an income by providing services to villagers. In addition, there is future potential for the MFI to be greatly impacted; Frankiewicz (2003) suggests that “such microentrepreneurs can become agent access points for an MFI, facilitating access to certain services at a much lower cost than a traditional delivery channel (i.e., physical branch or permanent field staff) ever could” (p. 53).

The digital divide has become a concern for many in various sectors of international development. The CIDA strategy report states that as “of 2000, 70 percent of the world’s poor live in rural and remote areas, where access to information and communication technologies, even to a telephone, is often scarce—over one-third of the world population has never made a telephone call” (p. 8).

The Grameen Bank has developed trust and credibility, and established strong ties with thousands of rural villages and millions of the rural poor served by its microcredit programs. With this established network of clients, Grameen Bank was able to leapfrog into a position of using telecommunication technology to create the Village Phone concept. The Village Phone offers a solution for many remote and rural villages where telecommunications service is nonexistent because of the high cost involved in building and administering services where no fixed telephone lines exist.

The Village Phone methodology was pioneered in Bangladesh in 1997 by the Grameen Telecom of Bangladesh (GTC), a nonprofit organization under the Grameen family of companies. GTC partnered with the Grameen Bank program that provides small collateral-free loans to the poorest people in Bangladesh, and with GrameenPhone Ltd (GP), a for-profit company that is licensed to manage a mobile cellular network in all of Bangladesh. GTC buys bulk airtime from GrameenPhone Ltd. Buying airtime in bulk allows GTC to negotiate better rates, and it is then able to pass on savings to the Village Phone operators who get their loans

from Grameen Bank to purchase the phones and use them to generate income by providing a service to customers in the village.

The objectives of the Grameen Telecom Village Phone program¹⁵ are as follows:

1. To provide all of rural Bangladesh with easy access to telephone services
2. To offer a new income-generating activity for the villagers
3. To utilize the maximum potential of information technology, and bring it to the doorsteps of villagers
4. To use telephones to connect the rural population and bring new opportunities to them, as a new tool or weapon in the fight against poverty

Several social and economic benefits are derived from the Grameen Village Phone program. Richardson, Ramirez, and Haq (2000), in a study commissioned by CIDA, concluded that the Grameen Village program yields “significant positive social and economic impacts, including relatively large consumer surplus and immeasurable quality of life benefits.” (pg. 48) The study further indicated that the:

consumer surplus for a single phone call ranges from 2.64% to 9.8% of mean monthly household income. The cost of a trip to the city ranges from 1.93 to 8.44 times the cost of a phone call, meaning that the real savings for poor rural people is between 132 to 480 taka (\$2.70 and \$10.00) for calls that substitute for travel between the village and Dhaka. (p. 49)

The social and economic benefits can be summarized as follows:

1. Bangladesh is a labor-exporting country, and 42% of Village Phone users’ calls are made regarding remittances from family members working overseas. Through the

use of the phones, villagers have knowledge of the market rates and are able to negotiate better exchange rates on money sent from abroad.

2. Without the use of a phone, villagers have to travel long distances to provide or receive information. By spending the money to make a phone call, the family saves by not having to send a productive member on a journey that might involve hours of traveling time merely to deliver or receive information. The study shows that the cost to travel for information is up to 8 times more expensive than making a phone call.
3. Farmers are able to get better prices for their products by directly calling the markets themselves rather than using a middle-man.
4. Village Phone offers microentrepreneurs the ability to link with clients from various regions, providing opportunities to expand their microbusinesses.
5. Village Phone users generate their own business by reselling the information they gather to other villagers.
6. Phones have proven to be valuable in emergencies, such as arranging for medical help during natural disasters.
7. There is clear evidence that Village Phone operators have increased their social status in the village. Cell phones are a status symbol of the rich, and the Village Phone in a poor woman's hand elevates her status significantly. This increased social status is noted when a wealthier villager comes to the poorer woman's house to use the phone. The poorer woman's house becomes the center of activity, with villagers waiting to make or receive calls. The operator also has knowledge of the business of other village members. The additional income made further increases her economic status.

Since the Grameen Telecom Village Phone program's inception in 1997, 150,000 Village Phones have been distributed, and the program has spread to more than 35,000 villages in 61 out of 64 districts of the country. GrameenPhone reaches 3 million subscribers.

Yunus (2000) stated that:

Bangladesh is the only country in the world which could take mobile telephones to the poor women in the villages in a very successful commercial way because of micro-credit. That has laid the foundation for future inroads of IT services like e-commerce, e-healthcare, e-literacy, e-education, e-jobs etc. to the villages in general, and to the poor women in particular. With IT we can put the whole world in the hands of the poor. (p. 1)

Replicating the Grameen Village Phone Model

The Grameen Telecom Village Phone program in Bangladesh has proven to be a successful initiative demonstrating that technology can positively affect the lives of many rural villages. The Grameen Technology Center, a project under the Grameen Foundation USA (GFUSA),¹⁶ has started replicating the Village Phone model to prove this model could work outside of Bangladesh. It piloted a Village Phone project in Uganda with four objectives:

1. To provide the rural communities of Uganda with valuable communications services to enable them to break the cycle of poverty
2. To validate, measure, and document the Village Phone model in a single country outside of Bangladesh
3. To establish a generalized replication model for the Village Phone program
4. To disseminate this learning to the commercial telecommunications sector and the worldwide development communities so as

to catalyze and establish a global Village Phone movement (Keogh & Wood, 2005)

About Village Phone Uganda

GFUSA collaborated with the local telecommunications provider MTN Uganda. In addition to MTN Uganda, Grameen Technology Center established partnerships with eight microfinance institutions. These MFIs were FINCA, FOCCAS, UMU, Uganda Finance Trust (UFT), Feed the Children, MedNet, Hofokam, and Post Bank. GFUSA's extensive partnerships with the various MFIs permitted MTN Village Phone to reach a scale that would allow for "financial and social sustainability" (Grameen Foundation, n.d.).

The Village Phone operators first began their business in Uganda in March 2003 with the official launch of MTN Village Phone as an independent company in November of that same year. Keogh and Wood (2005) said, "Twelve months into formal operations, Village Phone operators in Uganda were selling an average of six times more airtime than is consumed by a typical MTN Uganda subscriber" (p. 13). FINCA Uganda, one of the partners, claims that "village bankers now have access to a powerful tool that can greatly improve their existing businesses' productivity—or be a new business itself." Below is a success story from one of FINCA's clients.

Sarah Sempa, a married mother of four, operates a small retail shop in the village of Namulesa in the Jinja district. She took her first FINCA loan in 2003 for 100,000 Ugandan shillings (\$57) and invested it into her business. When she learned of the Village Phone program, she reasoned that her busy trading center was the ideal venue and decided to diversify. Now she earns an additional \$25 to \$30 weekly, and estimates that people travel from as far as 2 miles on foot to buy minutes of airtime on her Village Phone.¹⁷

The replication of the Grameen Village Phone program in Uganda proved successful. The Vil-

lage Phone model has now been documented, and a manual¹⁸ for replication is available. Another Village Phone replication project is now being piloted in Rwanda.

Microfinance institutions worldwide with knowledge of and existing ties to the rural poor through the provision of financial services can position themselves to become the vehicle through which the Village Phone can be introduced as a new service. The replicable business model for this program starts when a client from an MFI is given a loan to purchase a Village Phone starter kit. The cost of the starter kit ranges from \$200 to \$250 and includes "a mobile phone, prepaid airtime card, external Yagi antenna, signage, as well as marketing and other materials necessary to get started" (Keogh & Wood, 2005, p. 3). This starter kit is provided by the Village Phone company that has developed a relationship with the MFI to offer products to their clients. The Village Phone company negotiates wholesale rates for airtime with the telecommunication provider, who in turn provides Village Phone operators with access to existing telecommunications infrastructures. The Village Phone operators can offer telephone calls at affordable rates to the individuals in the community. In the business model, there are no subsidies and a win-win situation for all parties involved in the partnership is created. With proceeds from the business, the Village Phone operator repays the MFI loan and also purchases additional prepaid airtime cards. The MFI earns money from the loan and also a percentage of the revenue from airtime sales. The telecommunications provider earns money through volume sales of airtime, and the Village Phone company earns enough money to continue to promote and expand the program.

Keys for Success

Keogh and Wood (2005, pp. 12-14) explain the keys for success:

There are four vital elements to ensure the long-term success of a Village Phone program:

1. The program should be structured so that all parties benefit.
2. The microfinance sector should be used as a “channel to market.” The social structures encouraged by microfinance institutions through groups, centers, and solidarity guarantees create a ready-made market for end-user consumers.
3. The telecommunications provider should provide wholesale airtime rates to Village Phone Operators to allow them to provide affordable services while simultaneously earning enough margin to repay their loan.
4. In-country staff should manage the business.

The Village Phone model has provided a way to bridge the digital divide. Through the use of the microfinance sector, the telecommunications sector is able to gain access to the large untapped rural markets they could not reach before because of the high cost of infrastructure development and maintenance. The Village Phone program potentially targets and reaches the poorest of the poor, women, and the illiterate within developing countries while holding the promise of helping to narrow digital disparities.

CONCLUSION

Like microcredit and microfinance, ICTs are not a panacea, but a powerful tool to aid microfinance institutions to become sustainable by reducing transaction costs, increasing scale, and expanding outreach to the remote areas, thus closing the gap in the demand for microcredit. The implementation of ICTs by microfinance institutions is still in its infancy, and it is not an easy or inexpensive process. Stakeholder collaboration within and

across both the ICT and microfinance sectors and proper business planning by MFIs is necessary for cost effectiveness and to derive maximum benefits in implementation. As the cost for appropriate MFI technologies continues to decline, and the innovation and development of new technologies leads to further reductions in cost, MFIs will be able to reach larger numbers of the poor and more isolated and underserved rural poor. While the synergy of the microfinance and ICT sectors shows great promise for the achievement of the MDG of halving poverty by the year 2015, reaching the 1.2 billion people living on less than \$1 a day will also depend on individual MFIs’ commitment, mission, and program design to target the poorest.

REFERENCES

- Attali, J. (2004). *Microfinance and new technologies*. Information for Development (I4D). Retrieved February 2005 from http://www.i4donline.net/issue/jan04/microfinance_full.htm
- Brown, M. M. (2001). Can ICTs address the needs of the poor? *UNDP Choices Magazine*. Retrieved August 20, 2005, from <http://www.undp.org/dpa/choices/2001/june/j4e.pdf>
- CIDA’s strategy on knowledge for development through information and communication technologies (ICTs)*. (n.d.). Retrieved July 2005 from <http://www.acdi-cida.gc.ca/publications-e.htm#Strategies>
- Cracknell, D. (2004). *Electronic banking for the poor: Panacea, potential and pitfalls*. Retrieved August 20, 2005, from <http://www.microsave.org>
- Daley-Harris, S. (2004). State of the Microcredit Summit Campaign report 2004. *Microcredit Summit E-News*, 2(4). Retrieved August 20, 2005, from <http://www.microcreditsummit.org>

- D'Orville, H. (2000). Knowledge and information: New levers for development and prosperity. *UNDP Choices Magazine*. Retrieved May 20, 2005, from <http://www.undp.org/dpa/choices/2000/june/p8-9.htm>
- FINCA helping bridge the digital divide. (n.d.). *FINCA News*. Retrieved August 20, 2005, from <http://www.villagebanking.org/fincanews-uganda.htm>
- Frankiewicz, C. (2003). *Information technology as a strategic tool for microfinance in Africa: A seminar report*. Calmeadow. Retrieved January 2006 from http://www.africapfund.com/site/IMG/pdf/2004_IT_Seminar_Report-2.pdf
- Gibson, D., & Meehan, J. (2000). *The Microcredit Summit's challenge: Working towards institutional financial self-sufficiency while maintaining a commitment to serving the poorest families* (Microcredit Summit Discussion Paper).
- Gilhooly, D. (2001). Deconstructing the digital divide. *UNDP Choices Magazine*. Retrieved May 20, 2005, from <http://www.undp.org/dpa/choices/2001/june/j8e.pdf>
- Grameen BOT project. (n.d.). *Build, operate and transfer (BOT) projects*. Retrieved October 5, 2006, from <http://www.grameen-info.org/grameen/gtrust/bot.html>
- Grameen Foundation. (n.d.). *Village phone Uganda partners*. Retrieved October 9, 2006, from http://www.grameenfoundation.org/who_we_are/partnerships/technology_partnerships/village_phone_uganda/
- Hishigsuren, G. (2006). *Information and communication technology and microfinance: Options for Mongolia* (Discussion Paper No. 42). ADB Institute. Retrieved March 2006 from <http://www.adbi.org/files/2006.02.dp42.ict.microfinance.mongolia.pdf>
- Ivatury, G., & Pasricha, N. (2005). *Funding microfinance technology* (Donor Brief No. 23). Consultative Group to Assist the Poor (CGAP). Retrieved December 2, 2005, from http://www.cgap.org/docs/DonorBrief_23.pdf
- Keogh, D., & Wood, T. (2005). *Village phone replication manual: Creating sustainable access to affordable telecommunications for the rural poor*. Grameen Technology Center, Grameen Foundation USA. Retrieved August 10, 2005, from http://www.gfusa.org/technology_center/
- Ketley, R., & Duminy, B. (2003). *Meeting the challenge: The impact of changing technology on microfinance institutions (MFI)* (Microsave Briefing Note 21). Retrieved August 25, 2005, from http://www.microfinancegateway.org/files/3771_03771.pdf
- Littlefield, E. (2005). *Celebrating the year of microcredit* [Press Release]. Consultative Group to Assist the Poor (CGAP) & World Bank Group. Retrieved September 5, 2005, from http://www.cgap.org/press/YOM_083105.html
- Magnette, N., & Lock, D. (2005). *What works: Scaling microfinance with the remote transaction system: Increasing productivity and scale in rural microfinance*. World Resources Institute. Retrieved August 15, 2005, from http://www.digitaldividend.org/case/case_rts.htm
- Morduch, J., Hashemi, S., & Littlefield, E. (2003). *Is microfinance an effective strategy to reach the millennium development goals* (Focus Note No. 24)? Consultative Group to Assist the Poor (CGAP). Retrieved August 14, 2005, from http://www.cgap.org/docs/FocusNote_24.html
- Rao, M. (2004). *Micro-finance and ICTs: Exploring mutual benefits and synergy*. Retrieved April 25, 2005, from http://www.orbicom.uqam.ca/in_focus/columns/en/archives/2004_avril.html
- Richardson, D., Ramirez, R., & Haq, M. (2000). *Grameen Telecom's village phone programme in rural Bangladesh: A multi-media case study*. Ottawa, Canada: Government of Canada.

Salazar, D. (2004). *CGAP IT innovation series: Credit scoring*. Retrieved April 25, 2005, from <http://www.microfinancegateway.org/content/article/detail/18047>

Silva, S. (2002). Quantum Leap microcredit boosted by technology. *Microenterprise Americas Magazine*. (pp. 32-35). Retrieved September 20, 2006 from www.iadb.org/sds/mic/micamericas/eng/2/autumn2002wb.htm

Simanowitz, A., & Walter, A. (2002). Ensuring impact: Reaching the poorest while building financially self-sufficient institutions, and showing improvement in the lives of the poorest women and their families. In S. Daley-Harris (Ed.), *Pathways out of poverty: Innovations in microfinance for the poorest families* (pp. 1-73). Bloomfield, CT: Kumarian Press Inc.

Siu, P. (2001). Increasing access to microfinance using information and communications technologies. PlaNet Finance 2005. Retrieved September 20, 2006 from developmentgateway.org/microfinance/rc/filedownload

Talking about the future of microfinance. (2005). *Microfinance Matters Newsletter*, 13. Retrieved March 20, 2005, from <http://www.uncdf.org/mf-matters>

Waterfield, C. (2004). *CGAP IT innovation series personal digital assistants (PDA)*. Retrieved April 25, 2005, from <http://www.microfinancegateway.org/files/18045>

Whelan, S. (2004). *CGAP IT innovation series: Smart cards*. Retrieved April 25, 2005, from http://www.microfinancegateway.org/files/18049_CGAP_Smart_Cards.pdf

Yunus, M. (2000). *IT can be Bangladesh's super highway to prosperity* (Speech at the North America Conference in Atlantic City). PlaNet Finance. Retrieved October 2005 from <http://www.developmentgateway.org>

Yunus, M. (2005). *Grameen Bank at a glance*. Retrieved August 2005, from <http://www.grameen-info.org/bank/GBGlance.htm>

WEB SITE REFERENCES

Development Gateway: <http://www.developmentgateway.org>

Digital Dividend Project: <http://www.digitaldividend.org>

Grameen Bank: <http://www.grameen-info.org>

Grameen Technology Center: http://www.gfusa.org/technology_center/

Grameen Telecom: <http://www.grameen-info.org/grameen/gtelecom/index.html>

Grameen Trust: <http://www.grameen-info.org/grameen/gtrust/replication.html>

Inter-American Development Bank: <http://www.iadb.org>

Microcredit Summit: <http://www.microcredit-summit.org>

Microfinance Gateway: <http://www.microfinance-gateway.org>

Microsave: <http://www.microsave.org>

Technology Resource Center, Consultative Group to Assist the Poorest: <http://www.cgap.org/technology>

The Canadian Development Agency: <http://www.acdi-cida.gc.ca>

United Nations: <http://www.un.org>

United Nations Capital Development Fund: <http://www.uncdf.org/english/microfinance/>

Year of Microcredit: <http://www.yearofmicrocredit.org>

ENDNOTES

¹ <http://www.un.org/millenniumgoals/index.asp>

² <http://www.cgap.org/about/faq04.html>

³ The poorest people, rural poor, unserved, underserved, and other like terms refer to those living on less than \$1 a day.

⁴ Quote from Mark Malloch Brown found at <http://www.unCDF.org/english/microfinance/>

⁵ ICTs often refer to both the old and new technologies including radio, television, Internet, and so forth for transferring and storing information. This chapter focuses on the new and advanced technologies appropriate for microfinance institutions.

⁶ Quote taken from *Lessons from the Field: ICTs in Microfinance* (<http://www.digitaldividend.org>)

⁷ CIDA refers to the Canadian International Development Agency.

⁸ Data taken from <http://www.grameen-info.org/bank/GBGlance.htm>

⁹ Quote taken from <http://www.microcredit-summit.org>

¹⁰ For poverty-assessment tools see <http://www.povertytools.org>

¹¹ Tables are taken from the AfriCap seminar report *Information Technology as a Strategic Tool for Microfinance in Africa* (pp. 47-48). Permission was provided by AfriCap Fund for its use.

¹² Information taken from <http://www.grameen-info.org/bank/GBGlance.htm>

¹³ GSM is the acronym for Global System for Mobile Communication.

¹⁴ http://www.microfinancegateway.org/resource_centers/technology/iss_software/other_technologies/ for the quote and for more information on the various technologies.

¹⁵ See <http://www.grameentelecom.net> for more details.

¹⁶ For further details, see http://www.gfusa.org/technology_center/.

¹⁷ See <http://www.villagebanking.org/fin-canews-uganda.htm> for full story from the news article “FINCA Helping Bridge the Digital Divide.”

¹⁸ See http://www.gfusa.org/technology_center/ for the replication manual.

This work was previously published in Information Communication Technologies and Human Development: Opportunities and Challenges, edited by M. Gascó-Hernández, F. Equiza-López, & M. Acevedo-Ruiz, pp. 157-181, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 8.5

Management of New Genetic Knowledge for Economic and Regional Development of Ethnic Minorities in China

Jan-Eerik Leppanen

International Institute for Asian Studies (IIAS), The Netherlands

ABSTRACT

The banking of genetic appliances and DNA represents an attempt to understand sustainable use and preservation for the benefit of current and future generations. The goal of this chapter is to highlight BioBanking as a tool for accelerating knowledge, understanding, conservation, and sustainable use of biodiversity. Genetic biobanks, collected from indigenous peoples, may pose some ethical risks for the ethnic populations. The new information in the hands of insurance companies, employees or governmental agencies could mean insecurity for ethnic minorities if the use of information violates the fundamental human rights of ethnic people. The new genetic knowledge may alter the relations between the individual (the self) and the community; the individual and the state; and the community and the state. This chapter will explore the technical issues, difficulties and benefits this

tool provides when dealing with marginalized ethnic populations in Southwest China.

INTRODUCTION

In this chapter, the author has tried to give an overview on genetic sampling¹ of ethnic minorities (*minzu*)² in China and to the different claims companies and research ventures have on this industry. It will look at the following question: how the new genetic knowledge—acquired by biobanking activities—could be turned into ethically sustainable, economic, and regional development of ethnic minorities in China.

The banking of genetic appliances and DNA represents an attempt to understand sustainable use and preservation for the benefit of current and future generations. The goal of this chapter is to highlight BioBanking as a tool for acceler-

ating knowledge, understanding, conservation and sustainable use of biodiversity. This chapter will explore the technical issues, difficulties, and benefits this tool provides when dealing with marginalized ethnic populations in Southwest China. This theoretical framework can be applied to the lives and conditions of ethnic people in other parts of East Asia (southwest), Southeast Asia (north, mainland) and in South Asia (far west).

Indigenous people groups in Southwest China and in other parts of northern Southeast Asia (mainland)³ go through development challenges that are, most of the time, transboundary. Some of the issues concern migration, effects of reforms (P.R.C), and technological knowledge. Genetic biobanks, collected from indigenous peoples, may pose some ethical risks for the ethnic populations. The new information in the hands of insurance companies, employees or governmental agencies could mean insecurity for ethnic minorities if the use of information violates the fundamental human rights of ethnic people. The new genetic knowledge may alter the relations between the individual (the self) and the community; the individual and the state; and the community and the state. This chapter focuses on genetic sampling holistically. This implies that the processes of change alter the social constructions in which minority people live.

However, the banks are also a new potential source of material wealth and health knowledge resources if the new information is applied according to local needs. The issue of information management with genetic knowledge is an ethical one, since businesses are primarily looking for profits, not for the rights of vulnerable people. It is probably impossible to find a perfect solution for biobanking enterprises. However, to avoid the mentioned problems, a model named “Charitable Trust” could be a resourceful framework to apply for the ethnic communities in the Southeast Asian region. This bank, originally proposed by D. and R. Winickoff, is a model for genomic biobanks, which is seen as superior to commercial

biobanking. A biobank organized as a charitable trust is created by a trust agreement between the research subject and the owner of the bank. Since the relationship with the “bank” manager and the research subject is mutual, it will be less easy to mishandle the rights of the sampled population. It would be even more advantageous if the “trust” being community based and owned biobank and resource rights regimes that seek to recognise the essentially community-based nature of much of the knowledge related to biodiversity.

The transformations brought about by the “knowledge economy” or “Information Society” are conventionally thought of in global or national terms. But as globalisation and the outcomes of new information and communications technology (ICT) have influenced people around the globe, they are also reformulating and restructuring the regions, though in multiple routes and often with highly differentiated results. The resources accessed from this article focus on the use by Asian regions and localities of ICT to support and promote the wealth and welfare of their citizens, businesses, and environments.

BACKGROUND

Economic and regional development in the context of Chinese minorities is interlinked. Minority dwellers in mountainous regions are, in general terms, worse-off compared to their fellow countrymen. This is because steppe regions means of livelihood are more limited and means of communication and transportation are restricted due to the great financial costs resulting from the demanding geography. In China, the minorities’ migration from the plains to the mountains have taken several routes and included a multiple number of historical events. A dominant theory claims,⁴ that minorities were pushed, step-by-step, ever higher to the mountains by the majority (Han) people, when the competition of the cultivable land area became more intense. Although this

is not the *de facto* situation in the case of many minorities, moving up to the mountains is not all natural phenomenon and the regional development efforts involves both parties, majority people and minorities alike.

Economic-regional development of ethnic minorities suggests that in order to advance the business and profit-making changes of indigenous peoples, the regional and geographic conditions need to be taken into account. The goal of any development plan must be to ensure that communities are strengthened, and rural people are not pressured to abandon their native lands and move to bigger cities and suburbs in the hope of better financial prospects and economic stability.

ECONOMIC DEVELOPMENT OF ETHNIC MINORITIES IN CHINA AND ASIA

Most of China's rural poor live in its hilly and mountainous regions, and in recent years the government has concentrated its "war on poverty" in these areas. Among the poorest of the poor are China's minority peoples, not least because they are outside the dominant culture and language. Unemployment is a huge problem in China, and the Yunnan province is among the country's poorest. Half of the population earns less than \$80 a year. Bureaucrats and population planners often see few options for the employment of ethnic minorities. The options are limited to tourism industry, service industry, or to tertiary industry (Yardley, 2004).

The economic importance of migration, and its effect on social change, is also a key factor among the minority peoples in the Southeast Asia region. Ethnic men seek casual unskilled work, often over the border, in Myanmar or Laos. But these laborers seem to be even more vulnerable to exploitation by employers, as their own languages are not spoken on the plains and in the cities. Indeed, each minority group has its own

distinct customs, practices and language, which remain a source of pride and definition. Low levels of literacy and limited access to news and information, plus some residual prejudice against minority peoples, make life even harder.

The ethnic informants talk of enlarged opportunities to earn money since China's economic reforms took hold, and express a preference for the new system of working for oneself rather than communally. Family networks remain a crucial source of support, financial and practical. Health facilities are both limited and too costly for some, especially for reproductive health, and this, combined with women's heavy workload meant many narrators suffered constant ill-health.

There is a strong belief among most narrators that they could raise their living standards significantly if they could get a little more training and investment. Being minority people with different languages, some feel they have not benefited from the same educational opportunities as the majority Han. But poor roads still limit people's ability to market their produce, and several ethnic subjects say lack of electricity is another hindrance: "Our lives will be better after the road is built and the electricity connected. You see, everything has to be done manually. I want to learn more skills. My thoughts cannot catch up with the Han—my literacy level is low, and I have poor technological knowledge."⁵ Another informant stated that: "We Miao people live in remote and backward mountain areas. Although we have had some development in these years, there is still a big gap between us and other peoples."⁶

China's economic reforms have shifted an almost uniformly poor nation into an increasingly prosperous one in the space of a mere generation. But the downfall of socialized medicine and astounding cost increases have opened a vast gap between health care in the cities and the rural areas, where the previous system of free clinics has disintegrated. The government, which under President Hu Jintao has made prioritised rural living standards in its reform agenda, has

recently announced an expansion of this experiment, with increased fees and increased coverage, but the impacts on the health crisis is still to be seen. As a result, in less than a generation a rural population that once enjoyed universal, if basic coverage, is now 79% uninsured. One of the great policy changes of modern times, China has disorganized its rural communes, privatised enormous segments of the economy, and moved public health resources away from rural areas and toward the cities. Public hospitals were pushed for charging commercial rates for newly designed drugs and most procedures, and today the wages of health care workers are normally linked to the amount of money they generate for their hospitals (French, 2006).

COMMERCIALIZATION OF HIGH-TECH SECTOR

Clearly, one of the biggest changes and challenges in the professional life of Chinese scientists is the commercialization of research (Baark, 2001). The big picture of commercialization becomes more evident if one looks at the growth of contract research in universities and research institutes. This is happening even when they are not starting their own companies. As soon as Chinese firms have begun to face the challenges of market competition, they have found that productive relationships with centres of research are lucrative. This applies to all types of Chinese companies, including state-owned enterprises, TVE's, and the startup of "new technology enterprises," all of which have sought to contract universities and research institutes for research and technical services (Baark, p. 142).

The commercial considerations in Chinese science are also seen in the actions and strategies of foreign multinational companies (MNCs) in China. The two principal modes of MNC penetration of the system are the establishment of

research centers in China and the uses of Chinese universities and research institutes as contractors for outsourcing research, development, and technical service activities. Working with MNC's is both attractive and professionally rewarding for many Chinese engineers and scientists. For these reasons, foreign firms have been able to employ some of the best and most talented from the research community. These newly discovered activities of MNCs in China have caused concerns over a new type of "internal brain drain."

In addition, the state remains the important source of funding for the nation's research activities that ensures that the influence of the bureaucratic policy culture remains strong. Chinese policymakers still have a long way in redefining the role of the state in the support of science (Baark, 2001). In terms of academics, the present age where China is and where it is further entering is an age of experts in which the relative importance of critical intellectuals to the public is declining while knowledge-based and profit-oriented professionals are becoming increasingly important (Gu & Holman, 2004). Marketization has generated fraudulent, get-rich-quick schemes among scientists. An interesting example of commercially inspired product fraud, and constructive responses to it from within the technical community, is seen in a dispute over the nutritional value of nucleic acid.⁷

Commercial involvement in genetics induces a moral environment in which blood is cherished *both* as the object of dignity *and* as the object of commercial interest. In this landscape blood has to be exchanged in nonmarket terms, with the ambition of fulfilling *both* moral hopes of better health *and* financial expectations (Hoyer, 2005). But the problem is that those material expectations may not be filled and the companies doing the research are collecting the rewards nevertheless. Specialized, for-profit firms may collect huge earnings through their access to human commodities. Access to sophisticated technologies also proves

highly effective in the expansion of procurement activities, with the result that various agencies may essentially buy their way into understaffed and poorly funded labs. In short, access to advanced technologies can improve authoritative power and, eventually, generate the necessary capital to facilitate boundary expansion (Sharp, 2002). It must be stated, however, that technologies are only one of several tools that may serve capitalist interests. There is a tendency to the bureaucratization of medico-scientific knowledge and its progress to a sophisticated form of mystification. Different knowledge (be it the values assigned to fetuses or cancer medications) is thus encoded with new layers of meaning, which, ultimately, obscure their origins and transform their usefulness within medico-corporate structures (Sharp, 2002).

CHINA AND INFORMATION SYSTEMS: A CASE STUDY OF GENETIC DATABASES

In the Chinese context, personal information systems of ethnic minorities and other genetic databases is most often nationally coordinated and governmentally monitored. Regional research divisions function as a coordinative body in a larger information system. A case example of the Chinese interlinked (bio)information system is the Chinese Biodiversity Information System (CBIS), which is constructed to a National Biodiversity Information Center (NBIC). It consists of one central information system and five disciplinary division information systems, and more than 30 data source information systems. Some of the regional divisions are handling genetic information of ethnic people. The data sources include specimen collections, botanical gardens, natural reserves, field ecosystem research stations, seed banks, geneplasm banks, and research groups. The CBIS aims to.⁸

Genetic Databases and Current Issues

The concept of genetic databases is not new. For the last 30 years it has been common practice to establish registers of patients with hereditary illnesses, aimed at providing genetic services to families with these conditions. But the new generation of genetic databases are quite disparate, both in size and format. In many cases, they involve exceptionally large populations. For example, the Icelandic Health Sector Database aims to link health records with genealogical information and information about genotype. DNA samples will be collected with informed consent, whereas entry into the health records database is by presumed consent. Genomic databases are often described as population biobanks. In these biobank databases, a range of further information relating to the individuals whose genetic data are stored complements that genomic data.

There is still substantial controversy about the desirability of establishing databases and the many ambiguities regarding access and control. Concerns are engaged with individual risks which revolve around those arising from access to genetic information, both by individuals themselves and by third parties. In the latter case, these might include health insurance companies, government bodies, or the legal profession and police. The questions of confidentiality and access to these databases play an important role here. Although much effort is being put into protecting individuals, there are still possibilities for the misuse of the databases.

What has also been suggested is that genetic research based on stored (human) biosamples may have the effect of stigmatizing entire countries or particular groups of individuals, and there are concerns about commercial exploitation without adequate compensation. Also, because scientific research depends on freedom of access to samples

and information, the commercial ownership of these databases may have a damaging effect on genetic research. As well as these concerns, there are a variety of socioeconomic and ethical issues advanced by this new trend in genetic science.

It is not definite whether individuals who donate DNA samples for these databases are entirely aware of the potential risks involved, and it is even less clear whether some of the arrangements that have been made with the private sector, which is becoming increasingly involved in these enterprises, are appropriately controlled. It is also not apparent how information, particularly unexpected findings, will be handled in these large population studies and how these DNA samples will be used above and beyond the stated aims of those who are establishing the databases.

One of the reasons genetic databases are being built is when health information is needed to be stored in one central location. Some developing countries, or geographical areas within developing countries, represent attractive opportunities for the development of such databases when the population is comparably genetically homogenous due to limited migration in or out of the area. These databases vary and individual data are typically made nonidentifiable to users of the database. The databases are in some cases developed by public health authorities in the country, sometimes in cooperation with private corporations as in the deCODE database in Iceland, and in other cases chiefly by private corporations. These databases raise a number of ethical issues, which includes profit sharing with the community from which the data are gathered.

A second crucial informed consent issue, both for databases and for other genetic research is whether health information or genetic material can be used for other purposes beyond those for which consent was originally given without obtaining additional consent for the new uses. It has been suggested that material or information should not extend beyond those for which consent

had been given. Genetic information about a specific health risk of a particular individual may imply a similar risk for other family members. In cases of comparatively isolated groups, which are unusually genetically homogenous, information about individuals may have implications not only to immediate family members, but also to the wider group.

Many of the risks in biobanking can be expected to increase in developing (and many developed) countries in the future. Responsibilities to provide proper biobanks/genetic information systems are being shifted from the public sector to the private sector in many countries, where private insurers make use of risk rating for health insurance. As a wider range of genetic tests become available and their cost continues to decline, the incentives and abilities of insurers to use this information to discriminate against individuals with risks of developing serious disease is about to increase.

Being labelled as having “bad” genes can have variety of serious social and psychological consequences for individuals, and this stigmatization may be stronger and more common where the levels of education and understanding is low. This is the case in many parts of Eastern and Southern parts of Asia.

Ethical, Legal and Social Issues (ELSI) in Genetic Research

Due to expensive medical and genetic services individuals’ needs sometimes become highly variable and unpredictable, and typically if they are provided through some form of insurance. This may happen within a national health system, but increasingly in many Asian countries, at least in part, and especially in China, through private health insurance. If increasing amounts of information become available to insurers about genetic risks, many people will face large differences in their health insurance costs from genetic risks. In this way, they will be denied of health

insurance, or be unable to afford it at all. Similar ethical concerns apply to the use of genetic testing by employers or potential employers.

The populations of very poor developing countries are especially vulnerable to economic exploitation by much richer developed countries or multinational corporations in genetic research or the development and use of genetic databases. Also, low education levels in some developing countries and limited familiarity with genetic medicine or research present special obstacles to obtaining truly informed consent from the population. A general feature of many developing countries is a lack of any well-developed regulatory apparatus to deal with either the scientific issues in genetic research and technology, or with the ethical, legal and social issues. As genomics becomes more prominent in many developing countries, it becomes an important priority to develop necessary regulatory structures for addressing both the scientific and ethical issues. These regulatory bodies may formulate policies and action plans incorporating better utilization of electronic databases.

Electronic Data and Population Profiles

Electronic records can be accessed in combination with other databases in diverse geographic locations. This linking capacity makes it possible to compare the data to get a profile of an identifiable person or population with neither personal identifiers nor other confidential information. What are seen problematic with people related to electronic data are the privacy problems. These side effects are always difficult to deal with. Firstly, are the ownership issues. Technological advances allowing easy access to such data make it difficult to determine who is the “owner” of the computer record. Many people take it for granted that the patient owns his or her genetic record and should

continue to be named as owner. But then again, one argument speaks for privacy protection when data is compiled anonymously. One important point to remember for the potential misuse of information is that the risks of fraud and abuse of individual medical information may not come from outside hackers, but mainly from those described as “authorized” users (Floya, 2001).

One practical example of a type of health record where potential misuse may take place is a record which combines lot of different kind of information and where medical and genetic information is linked through technological networks to other databases, like employment data, tax and credit records, insurance, welfare, and custody files. This could also be called as “centralization of sensitive information.” The problem with the centralization is that it places too much power in a single public agency. But the decisive question is not the access to information but it is the control over the information. It would then be necessary to think of certain guidelines of restricting access to medical and research data only to those with proper authorization for providing adequate safeguards. Furthermore, even with the addition of guidelines for protecting privacy, other questions remain unanswered. It is important to know: (1) which groups should oversee enforcement of the guidelines and, (2) how effective such enforcement could be (Floya, 2001).

However, there is a growing interdependence between information communication technology (ICT) and genetic and genomic research. Some ethical issues that have traditionally been associated with ICT are now also at the center of recent ethical concerns involving genetic and genomic research. The dependence on ICT may give some insight into why many issues in the fields of ICT ethics and genetic/genomic ethics now intersect at some points and converge at others (DeCew, 2004).

SOLUTIONS TO GENETIC INFORMATION MANAGEMENT

It has been suggested that the potential harm of the genetic revolution may rather lie in the ability of technology to distribute the available resources even more unequally than is currently the case, and in that way enforce and strengthen the existing disparities and inequity. On the other hand it is suggested that genetics might have enormous potential in leveling the existing inequalities and providing a more just and equitable existence. There are also views that dispute the application of a benefit-sharing framework within genetics. These are mostly related to a perception that benefit-sharing actually legitimizes the attempts to commercialize and profit from (human) genome (Simm, 2005). Habitually, these lead to biopiracies.

Biopatents and Biopiracy

The appropriation of indigenous knowledge on medicinal plants or human genetic information by multinational companies or other international, national, or local agencies is known as “biopiracy,” and it happens often without prior consent or compensation. Indigenous ethnic peoples rarely benefit from the financial gains of this new genetic knowledge. Pharmaceutical companies are quick to impose patents and exploit traditional knowledge, which has existed in indigenous communities for generations. The so called “TRIPS-plus” (Trade Related Intellectual Property Rights) treaties allow western countries to bypass current WTO limits on patents related to indigenous biodiversity.

The Coordinator at GRAIN, H. Hobbelink (YEAR), said in an interview: “in country after country TRIPS-plus agreements undermine national decision making processes and hijack policy options for the South, having serious consequences for farmers, research and the public interest” (p. 3). They are “manipulative” and “undemocratic”

and make the debate on patenting irrelevant and outdated (BMA, 2001). In the meantime, the government of the United Kingdom has established a new commission to study how gene patenting rules can be enhanced to take account of the world’s poor. The Commission on Intellectual Property Rights [CIPR] investigates the exploitation of traditional knowledge, the effects of TRIPS, human gene patenting, benefit sharing, and issues of consent (Grain, 2001).

Some of the most well known examples of the collision between traditional knowledge and genetic research are the “RiceTec” and “bintangor tree HIV/AIDS drug.” The U.S. Patent and Trademark Office (USPTO) has endorsed three patents for hybrid strains of basmati rice and awarded them to a U.S. company, RiceTec, regardless of attempts by the Indian government to have all the patents that were originally granted in 1997. USPTO commanded to disclaim RiceTec from calling the rice “basmati,” but allows them to label it “a superior basmati rice.” This has caused some major discontent in India. The Indian Government postponed in recognizing India’s claim to have basmati protected under geographical indication provisions at the WTO. India had been victorious, since RiceTec has been forbidden the use of the word “basmati” as a trade name (Devraj, 2001).

U.S. based pharmaceutical companies plans to develop a new anti-HIV/AIDS drug from Sarawak’s native bintangor tree, which has evoked NGO’s to criticize these schemes. M. Bujang of the Borneo Resources Institute says the East Malaysian state’s natives are in danger of having their traditional knowledge of medicinal plants stolen by biopirates. He indicates that the concept of property rights is unfamiliar to them. The locals openly share benefits from traditional knowledge that have been passed down through generations. Borneo Resources Institute tries to make sure a share of any profit arising from native wisdom goes to the people of Sarawak. In the meantime, the state-led Sarawak Biodiversity Center (SBC) has started a project to record, in writing, the

orally transmitted knowledge of the locals. The reason for the project is found from the research finding that recognition skills are fast disappearing. Today's young people can often name only 10-20 medicinal plants and animals whereas the previous generation knew hundreds of different species. Local populations would be able to keep any written records to themselves and, therefore, guaranteeing a share in any financial benefits arising from that knowledge. The records will also help Malaysia's attempts to implement the International Convention of Biological Diversity, requiring countries to ensure benefits derived from research of native genetic resources that are shared with indigenous peoples (Chalmers, 2001). The author prefers formation of charitable trusts that may take care of these issues and evolve as a catalytic agent for economic empowerment of the indigenous communities.

The Charitable Trust

In a 2003 article, D. and R. Winickoff (2003) proposed the charitable trust as a model for genomic biobanks which is superior to commercial biobanking. A biobank organized as a charitable trust would be created by a trust agreement under which the participant in the research (or settler), "formally expresses a wish to transfer his or her property interest in the tissue to the trust" (p. 1182). By donating the tissue samples to the biobank, the donor contextually appoints the recipient as trustee of the property, who has legal fiduciary duties to keep or use the property for the benefit of the beneficiary.

Winickoff & Winickoff (2003) argue that the charitable trust presents three clear advantages, namely (1) the protection of the participants' rights, (2) the propensity to build participants' trust, and (3) the protection and maximization of the scientific value of the biological collection. Furthermore, the charitable trust model presents at least three more advantages if compared to a model based purely on contractual relationships. First,

the charitable trust model favors the *separation between control and use of the collected samples*. Large collections of human tissue are often being developed as resources that enable future research projects rather than as tools to enhance pre-existing genetic investigations. Therefore, a person who stores samples and data is often not the user of the same data because that person is not carrying out genetic research directly. However, in the real world, *storage of material and of the owner are often separate*, and having an *institutional framework*—such as the charitable trust model—that builds upon this distinction shows a clear advantage (Boggio, 2005).

In practice, transparency and opportunity for ethics review are enhanced if storage and use are separate. In this scenario, third-party researchers interested in accessing the samples would always be required to file a request to access the samples—or the genetic data that are derived from the samples. By filing such requests, external researchers would make explicit the circumstances and the intended purpose of their access. This practice would certainly favor a transparent access to databases and accountability of both the third parties towards the trustees and of the trustees towards the "general public."

Second, the charitable trust model provides a governance framework that facilitates the participation of donor groups in the management of the database. Third, the charitable trust model facilitates balancing the different interests that are affected in large-scale DNA collections. The trusted biological samples can only be used to serve the interests of the beneficiary. Thus, each request for access shall be balanced against the interest of the "general public" (Boggio, pp. 44-45). Now, the author would like to focus on the Chinese genetic information management system.

In China, the state still has a lot of control over the private life of individuals in the field of health and sickness. People are inclined to follow the advice of physicians because people's lives depend on them. To give blood samples for the

common good is not perceived as an additional burden if the results of ignoring the genetic tests would carry some disagreeable consequences on their lives. But the decision to join genetic sampling is being done under the pressure, not free willingly by the research subjects. If there is no necessary institutional framework (as is suggested in Winickoff's model) to support subjects' rights, it becomes difficult for them to claim their share of the new genetic knowledge. Another determinant of sound research ethics in genetic sampling is the level of awareness/knowledge that research subjects have about their rights. When the population being sampled consists of ethnic minorities, communication is then, naturally, cross-cultural. Language and cultural differences should be taken into consideration when research is planned and conducted so that research participants have a full understanding of the research project.

Sometimes in Chinese academia, what is researched, to what purpose the information is used, where it is used, and who is drawing the conclusions from the research data is not agreed upon mutually. These setbacks could be avoided if the storage of material and of the owner would be separate and there would exist a separation between control and use of the collected samples as suggested in Winickoff's model. This would lead to a conclusion that the Chinese *minorities* as a research populace would be in an especially vulnerable position since they are less significant in size and power than the majority, *Han*, people. However, in the Chinese context, ethnic minorities are in many ways "strong" and dynamic agents. It is a simplified truth to claim that minorities face a vulnerable position because of restrictive obligations enforced by the government. Yet, minority privileges surpass those of the Han Chinese in the number of children permitted to a couple (generally more than one) and the special position in minority language schooling, although this has regional variation.

Minorities are not automatically voiceless, but further effort is surely needed to make their

claims heard on minority matters, since minority administration is de facto in the hands of the *Han* people who make up approximately 92% of the whole population. This is true in the area of human genomics projects, for example, solely about research conducted on ethnic subjects. The existence of a "colorful" cultural variety of 54 Chinese minority people groups is one of the founding reasons for Chinese human genetic programs. But, it has to be said, the whole idea of Chinese ethnic (*minzu*) groups with clearly defined borders is a fleeting, contingent, and rather modern invention. With a history of only 50 years, the Chinese *minzu* map and theory live new renaissance. Chinese officials have adopted new DNA analysis based techniques in archeology and forensic research to prove their theory correct: that in China there exist only 55 nationalities altogether, and that regional linguistic and cultural variation is non-existent within these groups.

FUTURE ISSUES

A medium and long-term scientific and technological development program, which was first put forward in the proposed 11th Five-Year Plan (2006-2010), will set the pace for all Chinese technological policies from 2006 to 2020. The program, on which over 2,000 experts and scholars spent more than two years, rolled out the blueprint for an innovation-oriented China. China is seen as a country in which science and technology play an enhanced role in promoting economic and social development and safeguarding national security, in which research in basic science and cutting-edge technology are strongly emphasized (Zhang, 2006, p. 24). The newly adopted scientific development program has made it clear that by 2020, scientific and technological progress should contribute about 60% to the country's economic growth with 2.5% of its GDP devoted to scientific research and development, including genetics and information systems (Zhang, 2006, pp. 24-25).

In the private industry sector, Big Pharma and Western biotech companies appear to have gotten over their concerns about intellectual property protection in China, traditionally a barrier to outsourcing this type of work. They have found that the “grass is greener” for biotech development in China, where costs are much lower (Young, 2006, p. 36).

The most recent Chinese Government’s White Paper⁹ concerns regional autonomy of ethnic people. It says that the country’s regional autonomy system for ethnic minorities adopted half a century ago has been in conformity with the country’s development goals and proven to be in the common interests of all ethnic groups. After New China was established in 1949, the white paper says that the Chinese government began to introduce the system of regional autonomy for ethnic minorities to all regions where ethnic minorities lived in compact communities. By the end of 2003, China had established 155 ethnic autonomous areas. Of these, five are autonomous regions, 30 autonomous prefectures, and 120 autonomous counties (banners). According to a national census in 2000, of the 55 ethnic minorities, 44 have their own ethnic autonomous areas. The area where such regional autonomy is practiced accounts for 64% of the entire territory of China. However, not all the policies during the socialist governance have been beneficial for the minorities, and even the Chinese government acknowledges this reality. The white paper states that the economic and social development level of western China’s minorities is still low compared with the more developed eastern areas. It further urges development work in remote and backward areas in Southwest China (PDO, 2005). The challenging task of implementing the technology investment and development plans for the following years is in the hands of government cadres and party leaders. It is decidedly important that the needs of the ethnic people are prioritised and their economic-regional prospects are given necessary importance.

CONCLUSION

In this chapter the author has tried to argue that there are a number of development needs among the ethnic people groups in East Asia, Southeast Asia, and in South Asia. However, the nature of most of the regional and economic development conditions of these ethnic minorities is trans-boundary. The indigenous people groups that are situated in the mountainous border provinces in the states of East Asia, Southeast Asia, and South Asia, face similar difficulties due to their linguistic and cultural dissimilarity from the dominant majority populations.

It has been observed that economic reforms in China work towards finding increased access to money. However, there are a great number of hindrances that are making it more difficult for ethnic people to meet their necessities: employment (they are outside the dominant culture and language), schooling (illiteracy and limited access to information), and technological skills. In this context, genetic biobanks may pose some ethical risks for the ethnic populations, but at the same time can also be treated as a new potential source of material and health knowledge resources. They can be:

- Disease gene mapping in which profits arising from the biobanking go to the people and this may boost the local economy.
- Other plant and nature related to new genetic products based on traditional knowledge of ethnic people; any profit arising from native wisdom goes to the ethnic people.
- IPR should be part of technological training of ethnic people; this would improve the know how of genetic information system management.
- A community owned biobank (charitable trust) which could provide a financially sound solution that stands by the side of marginalized ethnic people.

There is much to be discussed on the choices that scientists and medical doctors are making while handling the data of ethnic minorities. The new information extracted from minority people is handled by bio-technicians, bio-genetic engineers and genetic laboratory personnel. But, there is no self-evident way to interpret the data of ethnic people in China. Since the beginning of the *minzu* classification system, there has been ongoing negotiation over the truth-value and existence of these groups, and questions such as what the forms of ethnic minority representation are today and what it was in the 1950s, 60s, 70s, 80s and in the 90s. Any argument over or notion of the “nationalities” characteristics’ is, and must be, politically charged, since the whole existence of the *minzu* system is a calculated and systematically constructed socio-political invention.

In general, to pass on someone’s genetic information to the wrong hands does not necessarily carry potential hazardous immediate consequences. But, the information becomes fundamentally sensitive if it affects the ability of minority peoples to choose where to work, what kind of position they maintain in their local community, what types of insurances are available, and so forth. Genetic databanks can open up some doors but they can also restrict available lifestyle choices. The point that the author is trying to make here is that, by considering the small numerical representation of minorities in governing bioethical bodies and their disrespected position in the nationality hierarchy, it is more difficult for them to make claims for injustices done to them. This also relates to the question that goes into the very essence of the minority debate: what, actually, is a minority to the majority; does the relationship signify weakness or strength? If and when this relation is grounded on differences, asymmetry and subject-object relations, the outcomes of human genome studies on minorities can never be purely value-free. The Han majority is the arbiter of the campaign; they thus control the conclusion drawn from the result as well.

REFERENCES

- Baark, E. (2001). The making of science and technology policy in China. *International Journal of Technology Management*, 21, 1-21.
- BMA. (2001). BMA calls for debate on gene patenting. Retrieved June 28, 2006, from <http://www.ngin.org.uk/>
- Boggio, A. (2005). Charitable trusts and human research genetic databases: The way forward? *Genomics, Society and Policy*, 1 (2).
- Brown, M. (Ed.). (1996). *Negotiating ethnicities in China and Taiwan* (China Research Monograph). Berkeley, CA: Institute of East Asian Studies, University of California.
- Cavalli-Sforza et al. (1991). Call for a worldwide survey of human genetic diversity: A vanishing opportunity for the human genome project. *Genomics*, 11, 490-91.
- Cavanaugh, T.A. (2000). Genetics and fair use codes for electronic information. *Ethics and Information Technology*, 2, 121-123.
- Chalmers, P. (2001). Bio-pirates stalk Borneo tribe’s treasure trove. Retrieved June 28, 2006, from <http://www.ngin.org.uk/>
- Coleman, J.S. (1990). *Foundations of social theory*. Cambridge, MA: Harvard University Press
- DeCew, J.W. (2004). Privacy and policy for genetic research. *Ethics and Information Technology*, 6, 5-14.
- Devraj, R. (2001). *India still sifting grain from “Basmati” Chaff*. Norfolk Genetic Information Network (NGIN). Retrieved June 28, 2006, from <http://www.ngin.org.uk/>
- Ettorre, E. (2000). Reproductive genetics, gender and the body: “Please doctor, may I have a normal baby?” *Sociology*, 34(3), 403-420.

- Everett, M. (2003). The social life of genes: Privacy, property and the New Genetics. *Social Science & Medicine*, 56, 53-65.
- Finkler, K. (2005). Family, kinship, memory and temporality in the age of the New Genetics. *Social Science & Medicine*, 61, 1059-1071.
- Floya, A. (2001). The concept of "social division" and theorising social stratification: Looking at ethnicity and class. *Sociology*, 35(4), 835-854.
- French, H. (2006, January 14). Wealth grows, but health care withers in China. *The New York Times*.
- Goodman, A.H., Heath, D., & Lindee, S.M. (2003). *Genetic nature/culture—Anthropology and science beyond the two-culture divide*. Berkeley, CA.: University of California Press.
- Grain. (2001). *TRIPS-plus treaties leave WTO in the dust*. Retrieved June 28, 2006, from <http://www.ngin.org.uk/>
- Gu, E., & Goldman, M. (2004). *Chinese intellectuals between state and market*. London: Routledge-Gurzon Studies on China in Transition.
- Hoeyer, K. (2005). The role of ethics in commercial genetic research: Notes on the notion of commodification. *Medical Anthropology*, 24, 45-70.
- Marturano, A., & Chadwick, R. (2004). How the role of computing is driving new genetics' public policy. *Ethics and Information Technology*, 6, 43-53.
- People's Daily Online (PDO). (2005, January 3). *Regional autonomy system benefits all ethnic groups in China—a white paper*. Information Office of the State Council.
- Regidor, E. (2004). The use of personal data from medical records and biological materials: Ethical perspectives and the basis for legal restrictions in health research. *Social Science & Medicine*, 59, 1975-1984.
- Sharp, L. (2000). The commodification of the body and its parts. *Annual Review of Anthropology*, 29, 287-328.
- Sharp, L.A. (2002). Bodies, boundaries, and territorial disputes: Investigating the murky realm of scientific authority. *Medical Anthropology*, 21, 369-379.
- Simm, K. (2005). Benefit-sharing: An inquiry regarding the meaning and limits of the concept in human genetic research. *Genomics, Society and Policy*, 1(2), 29-40.
- Spinello, R.A. (2004). Property rights in genetic information. *Ethics and Information Technology*, 6, 29-42.
- Tavani, H.T. (2004). Genomic research and data-mining technology: Implications for personal privacy and informed consent. *Ethics and Information Technology*, 6, 15-28.
- Waldby, C., Rosengarten, M., Treloar, C., & Fraser, S. (2004). Blood and bioidentity: Ideas about self, boundaries and risk among blood donors and people living with hepatitis C. *Social Science & Medicine*, 59, 1461-1471.
- Williams, G. (2005). Bioethics and large-scale biobanking: Individualistic ethics and collective projects. *Genomics, Society and Polity*, 1(2).
- Winickoff, D.E., & Winickoff, R.N. (2003). The charitable trust as a model for genomic biobanks. *New England Journal of Medicine*, 349(12), 1182-1183.
- World Health Organization. (2002). *Genomics and world health—Report of the Advisory Committee on Health Research*. Geneva: World Health Organization.
- Yardley, J. (2004, March 10). Dam building threatens China's "Grand Canyon." *The New York Times*.
- Young, M. (2006). Getting testy. *Beijing Review*, 49(3), 36.

Zhang, Z. (2006). Innovation renaissance. *Beijing Review*, 49(4), 24.

ENDNOTES

¹ Genetic sampling of ethnic minorities primarily conducted in the Southwestern province of Yunnan, bordering Vietnam, Laos, and Myanmar. Yunnan comprehends 25 out of 55 Chinese official minorities in total. The main sampling projects are Chinese Human Genome Diversity Project (CHGDP) and International HapMap project.

² The original idea in the nationalities' mapping endeavor was to understand the diversity of the newly founded Peoples' Republic of China. Through the decades, it has turned into a "[slapping] endeavour" where the minority label should tell it all, but in truth it does not say always as much. During the past 50 plus years, people have been using not just the official label for the nominal group, but also other ethnic signifiers—some that are altogether more important than the *minzu* name. People in rural China have found it important to define themselves according to their place of origin, to their kin, tribe, or according to blood relations. Ethnicity consists of different, varying, and multilayered factors. Put together, they make up an interlinked web of something evolving and changing and sometimes unutterable. Unutterable because the words used to describe ethnicity are in the process of change; a common vocabulary is sometimes unattainable because the linguistic differences are too great. Group names are one example of the described problem: it has usually both *emic* and *etic* versions of the same subject, consisting of the insiders' view of its world and then the

versions that outsiders tend to use when referring to the group. This is still a very rough divide because ethnic groups have dozens of specific group names for those speaking different languages and following varied cultural traditions.

³ This article is based on a field research in Yunnan province (P.R.C). The geographical locations that the author is referring to are in the border regions of P.R.C, Laos, Vietnam, Thailand, and Myanmar.

⁴ See Brown (1996) for more information on ethnicity theories.

⁵ (Ah, 22 years/female, agricultural extension worker, Lahu minority, Lancang county, Yunnan. www.mountainvoices.org)

⁶ (Mingchun, 27 years/male, Oxfam extension worker, Miao, Weining County, Guizhou. www.mountainvoices.org)

⁷ Early in 2000, in advertisements and on the Internet, several Chinese companies claimed that nucleic acid is a nutrient that could resist ageing and prolong life. Ordinary Chinese citizens, lacking the technical knowledge to judge such claims, were attracted to the products in a kind of nucleic acid minicraze. Biochemist Fang Shimin, who has been living in the U.S. since getting his Ph.D. there, was appalled by the widespread "nucleic acid nutrient hype" and wanted to expose the "fraud in Chinese science." The matter eventually received international attention when articles on the issue and Fang's efforts appeared in both *Nature* (2001) and *Science* (2001) (Williams, 2005, p. 151).

⁸ See more information from the "Development Gateway," *The Chinagate* (www.chinagate.com.cn).

⁹ The 12,000-word document, titled "Regional Autonomy for Ethnic Minorities in China," was issued by the Information Office of the State Council on January 3, 2005.

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 320-335, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 8.6

Visualizing ICT Change in the Academy

Gale Parchoma

University of Saskatchewan, Canada

ABSTRACT

This chapter introduces complexity theory as a theoretical framework for analyzing the influences of information and computer technologies (ICTs) on the structures, cultures, economies (reward systems), and pedagogical praxes within the Academy. An argument is made that the strategic adaptation of the academy's structures, cultures, economies, and pedagogical praxes to the knowledge economy can help build a future where Academy-based distributed learning networks will transmit ICT-mediated learning opportunities around the world, thus providing flexible access for a wide range of learners to fully participate in the global learning society. The author posits attunements to policies and practices to support institution-wide involvement in ICT initiatives.

OVERVIEW

This chapter addresses the technology management and change theme through the application

of complexity theory to information and communications technologies (ICT) change initiatives directed toward enhancing learners' access to higher education, opportunities to succeed, and experiences with human computer interaction (HCI). Academic organizational structures, cultures, economies, and pedagogies are analyzed for their alignment with successful integration of human computer interaction into learning experiences as a core activity within higher education. A variety of challenges to achieving institution-wide involvement in HCI are addressed. A series of adjustments to policy and practice is posited.

INTRODUCTION

The contemporary global learning society's demands upon individuals for life-long learning are now transforming and will continue to transform the traditional Academy. The adoption of information and computer technologies (ICT) to provide flexible access to distributed learning opportunities for working adults underpins this

transformation. The external economic forces of the new economy and its information technology paradigm may be the most powerful influence for this change. Simultaneously, the social forces of postmodernism, the interpretive turn, identity politics, and globalization are affecting change in the organizational culture of higher education and increasing demands for collaborative and distributed learning opportunities. At this juncture, traditional research universities may need to re-examine their policies and practices to effectively adapt to a complex, ambiguous, and dynamic, and technologically driven external environment. University leadership may need to strategically respond to these external pressing demands for change.

Internal organizational structures, cultures, economies (reward systems), and pedagogical praxes may need to be attuned to changing academic times. At the heart of this need for adjustment of university policies, procedures, and customs is the groundswell of demands for lifelong, personalized, customized, and distributed learning opportunities (Daniel & Mohan, 2004; McCalla, 2004; Tjeldvoll, 1998). Strategic responses to these demands are required to ensure that ICT-mediated solutions provide flexible access to high quality higher education and forestall the potential of models rapidly being developed by new for-profit higher education competitors (DiPaolo, 2003) from becoming disruptive technologies and eclipsing the role of traditional universities in the higher education sector (Archer, Garrison, & Anderson, 1999; Christensen, 1997). The Academy needs to embrace ICT solutions and their associated service orientation to ensure its ongoing position as the best option for higher education.

In order to achieve this transformation, leaders in traditional research universities may need to increase their capacity to effectively manage complexity. Control and direction need to be abandoned in favor of influence. Contextualized solutions to complex problems need to be deter-

mined via inclusionary, polycultural approaches to change (Sackney & Mitchell, 2002; Suter, 2001). Faculty members need to be engaged and willing to take innovative risks (Bates, 2000; Brown & Jackson, 2001; Olcott & Schmidt, 2000). Cost-effective, scalable innovations need to be researched and developed (Daniel & Mohan, 2004). To make this transformation possible, individual institutions need to more thoroughly understand their current situations and collegially create effective visions for the future—a future where Academy-based distributed learning networks will transmit ICT-mediated learning opportunities around the world, thus providing flexible access for a wide range of learners to fully participate in the global learning society.

THEORETICAL FRAMEWORK

Structural, cultural, economic, and pedagogical value positions within the Academy may not be closely allied to the potential for successfully increasing access to higher education via ICT-mediated learning opportunities (Brown & Jackson, 2001; Graves, 2001; Hanna, 2000a). Dealing with the complexity of issues in this range of value positions “does not mean controlling or eliminating them. It means tapping the power of complexity by accepting it, understanding its principles, and working with it as academic institutions work with faculty to transform teaching and learning” (Suter, 2001, p. 25).

Suter (2001) applies complexity theory in her development of five principles for transforming the Academy into a postmodern, technologically advanced organization. She argues, “When the speed of change (in demographics, demand, workforce, technology, economics) leads us to the edge of chaos, the command-and-control model” of organizational structures and functions “is not only counterproductive, it is simply not possible” (p. 25). Suter’s first principle advises academic leaders to “give up control and aim for

influence” through systematic sharing of “information,” “authority, responsibility, and the power to oppose” (p. 26). She argues that accelerating change requires institution-wide involvement and distributed leadership.

Secondly, adopting a stance of studying the Academy as if it were an artwork, is posited as an avenue to the creation of an “institutional vision” for a future where shared “goals worth working toward” can be achieved through “tracking important patterns” (pp. 28-29). Using an analogy to nature, Suter prescribes a reduce and reuse approach to creating streamlined, useful structures that fulfill multiple purposes, as well an over-arching common structure for institutional coherence. Paradoxically, she suggests investing in “polyculture and prototyping,” experimenting with diverse approaches, and accepting that “failure is necessary to create the conditions for successful change” (p. 31).

Finally, Suter promotes tapping “the power of limits,” through setting and communicating clear “boundary conditions” (p. 32). Boundary conditions are defined as limits within which the organization must manage its resources. An example of “the power of limits” is the extended use of research funding through application of findings to teaching and learning settings. Using Suter’s (2001) managing complexity framework, an examination of five aspects of each of structural, cultural, economic, and pedagogical value positions follows.

Organizational Structure

Five aspects of organizational structure, which have an impact on the successful adoption of ICT-mediated learning, include: tensions between hierarchical and decentralized organizational forms; bureaucratic and autonomous functions; individual and distributed leadership models; the relative comfort of gradual change and need for more rapid change; pressures for sustaining independent faculty roles; and pressures to

include emergent professions in collaborative, interdependent activities. Strategically mediating these tensions contributes to the “health” of the Academy:

‘Healthy’ institutions are ‘fit for purpose’; in other words, they are organized to ensure their goals and purposes are achieved in the most effective and efficient manner. The current structure and organization of most universities and colleges is largely historical and ... unsuited to new forms of technological delivery. (Bates, 2000, p. 36)

Despite this criticism, Bates (2000) acknowledges an important way in which traditional universities are well prepared to become highly functional, postmodern organizations. He notes a form and function paradox, which serves two basic needs of a postmodern organization: the need for a clear vision of organizational goals and purposes, and the need for flexibility and adaptability to effectively and efficiently meet those goals and purposes. “Despite its hierarchical organizational structure, a [traditional research] university is in practice an extremely decentralized organization” (p. 41). The existing hierarchical form provides opportunities for “strong leadership, characterized by clear but broad vision and objectives,” and an “integrating, coordinating and facilitating role” for senior management (p. 40). The functionally distributed decision-making ability allows a “large and creative ‘core’ of staff—faculty—who are able and willing to operate relatively autonomously, are concerned with the creation and transmission of knowledge, and have the power to develop and implement new ways of doing things” (p. 41), thus allowing the organization to be flexible and adaptable. This paradox of form and function has the potential to balance tension between centralized and decentralized control. It allows leaders to, at once, “give up control while ensuring that there are commonly shared principles for decision making aligned with the institution’s goals” (Suter, 2001, p. 27). In theory, strategic planning and faculty

autonomy can co-exist within the distributed leadership environment of the Academy.

However, faculty autonomy is a factor that affects the pace of organizational change. Few organizations allow the scope of latitude afforded to university and college faculty (Cahn, 1986). “The tradition-bound nature of the Academy has accommodated this latitude, and the slow pace of change in almost every aspect of campus life has made it a tolerable part of the academic landscape” (Hagner & Schneebeck, 2001, p. 2). Conversely, rapid technological development and change, especially rapidly accelerating “dependence on information technology,” “networking” (Bates, 2000, p. 40), and “prototyping” (Suter, 2001, p. 31) are hallmarks of postmodern organizations. The mismatch of the respective paces of traditional academic culture and postmodern organizational culture is a potentially powerful source of resistance to change (Hagner & Schneebeck, 2001; Hanna, 2000a). If the Academy is going to become flexible, adaptable organization, capable of providing learners with the necessary experiences “to develop knowledge and skills appropriate for living and working in a rapidly changing, technology-based society” (Hanna, 2000a, p. 46), the challenge of accelerating the pace of change within the Academy must be met. Engaging faculty in the process of change through clear and open communication and decision-making channels may provide leaders with sufficient influence to do so (Suter, 2001).

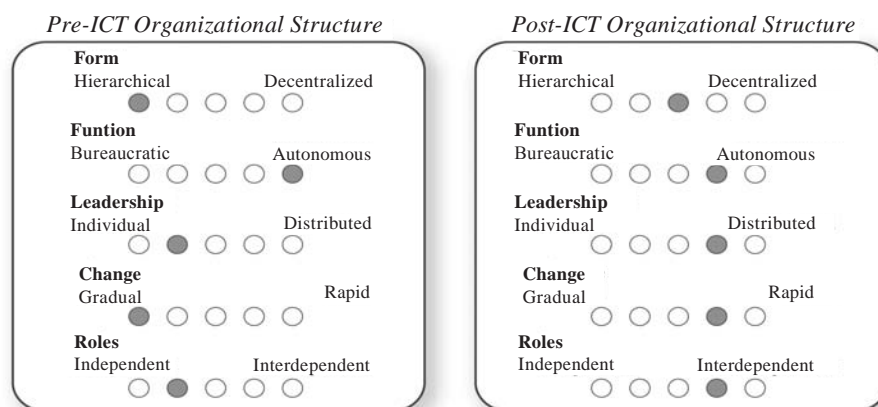
A further structural concern, one that impacts faculty autonomy, is a shift from independence to interdependence in scholarly work. In particular, emergent professions are beginning to be involved in the scholarly work of teaching. Traditionally, “university and college staffs have been highly skilled and ... well-trained for *research*” (Bates, 2000, p. 41). However, “*teaching* has not been not professionalized in the sense of being based on skills resulting from research into and analysis of teaching and learning processes” (p. 41). Rather, teaching has most often been an independent, role

model-based *art* or *craft*, which in comparison to research has “not [been] well rewarded” (Boyer, 1990, p. xii). However, in the development and implementation of ICT-mediated learning opportunities, the professionalization of teaching through study of such areas of knowledge as, “psychology of learning, organizational management research, communications theories, [and] human-machine interaction” (Bates, 2000, p. 41) is critical.

Yet, acquiring and maintaining current, in-depth understanding of these disparate fields, in addition to a specialty area of knowledge, is not always possible. Therefore, many, if not most, faculty members need to work collaboratively with teams of specialists occupying emergent roles (Bates, 2000; Hanley, 2001; Hanna, 2000a; Hutchins, 2000; Luker, 2000). Teaching with technology requires a shift from perceiving teaching as fulfilling a traditional, independent role to “one where teaching and learning are the products of an integrated group of individuals” (Hanley, 2001, p. 59). Emerging roles within the realm of academic teaching and scholarship include instructional designers, educational technologists, Web programmers, multimedia experts, computer scientists, and system engineers. In order to support a team-based approach to instructional development, academic leaders need to promote a culture of collaboration and change tenure and promotion standards that sufficiently reward faculty for time spent on collaborative instructional development activities.

Figure 1 illustrates five continua of organizational structure within the Academy: hierarchical to decentralized organizational forms, bureaucratic to autonomous functions, individual to distributed leadership models, gradual to rapid responses to change, independent to interdependent roles. In addition, in Figure 1 current and required conditions for successful adoption of ICT-mediated learning are hypothesized through the use of a stereo analogy. The premise of this analogy is that just as tone, balance, bass, and

Figure 1. Organizational cultures “in tune” with ICT initiatives



treble need to be adjusted to suit an audio recording, organizational structures need to be “in tune” with ICT initiatives.

Organizational Culture

Shafritz and Ott (2001) define organizational culture as a collage of ephemeral phenomena, including “values, beliefs, assumptions, perceptions, behavioral norms, artifacts, and patterns of behavior,” each of which contribute to “meaning, direction, and mobilization” (p. 361). Schein (1993) argues that a useful way to perceive organizational culture is “as the accumulated shared learning of a given group, covering behavioral, emotional, and cognitive elements or the group members’ total psychological functioning” (p. 372). An organizational culture requires a “common language” and “a common system of communication” as the basis for “group learning”—the ability to acquire and dispel “shared basic assumptions” (p. 373).

When elements of an organizational culture “have become maladapted” to the external environment, “it is ultimately the function of leadership to recognize and do something about the situation” (Schein, 1993, p. 370). Trice and

Beyer (1993) argue that *doing something about the situation*, changing an organizational culture, “is a relatively drawn out and slow process,” which “usually takes several years to accomplish” (p. 415). They recommend initiating change at “propitious moments, when some obvious problem, opportunity, or change in circumstances makes change desirable” (p. 417). The accumulative problems of decreasing public funding (Archer, Garrison, & Anderson, 1999; Bates, 2000; Hanna, 2000a; Mackay, 1996; Nesbit, 2004), opportunities to extend the Academy to better serve the needs of a global learning society (Alclay, 2003; Archer & Wright, 1999; Maduro, 1998; McLuhan, 1964; Norton, 2000; O’Driscoll, 2003), and changes in circumstances, such as the entrance of for-profit competition (Bates, 2000; Hanna, 2000a; Maduro, 1998), as well as the impacts of advanced information and learning technologies (Archer, Garrison, & Anderson, 1999; Bates, 2000; Hanna, 2000a; Nesbit, 2004) currently facing higher education, suggest that a *propitious moment* for cultural change is at hand:

The most important and immediate task for universities facing an uncertain future is to build a

culture that is friendly to and supportive of innovation and change at all levels of the organization. (Hanna, 2000a, p. 348)

Again employing Suter's (2001) managing complexity approach, an examination of five elements of academic organizational culture that affect successful adoption of ICT-mediated learning follows. Beliefs about institutional operations are examined along an independence/interdependence continuum. Values are traced from the tradition of emphasis on open discourse to inclusion of teaching marketable skills. Assumptions about the appropriate role of continuing education units within the Academy scan a range from public service to entrepreneurial venture. Perceptions of technology—from skepticism to enthusiasm—are explored. Artifacts, from lecture notes, assignments, and exams to ICT-mediated learning opportunities, are described in terms of the cultural changes associated with their use. Each of these elements is examined for alignment with the external forces driving and restraining change.

“The curtailment of public funding has become a year-to-year fact of planning life on the campuses” (MacKay, 1996, p. 10). As public funding is withdrawn “and as the ability of the universities, for reasons of equity and practicality, to replace these funds with other sources of revenue, such as tuition, becomes more restricted or disappears, the universities again face the fundamental question of how to rebalance themselves” (p. 10). Increasingly, public pressure is mounting “to ensure that, where possible, the universities act in a cooperative and complementary fashion as they conduct their institutional missions” (p. 10). As a result, “memoranda of understanding” between/among universities are being developed. At a basic level, these memoranda may outline credit transfer policies and joint course development and delivery initiatives among universities. More recent types of memoranda, made possible by ICT-mediated learning, include franchise arrangements, which

allow for use, revision, and reuse of electronic learning resources. This cooperative “reduce and reuse” (Suter, 2001, p. 28) approach to creating and managing resources is a well-suited response to an environment of fiscal restraint.

Fiscal pressure is also fostering a need “to forge many linkages and partnerships with external associations” (Hanna, 2000a, p. 339). Traditional research universities are under significant pressure to abandon the posture of “quiet enclaves for the pursuit of truth far removed from the busy world of commerce and industry” and to assume close linkages “with national economic and scientific objectives” (Nesbit, 2004, p. 104). A pervasive debate within the Academy involves increasing tensions between the academic value attached to “the traditional academic mandate of [fostering] a ‘lively exchange of ideas’” through open discourse and the economic value of “the teaching of [marketable] skills that can lead to required and satisfying careers” (Maduro, 1998, p. 42). Arguments against shifting the mandate further toward marketable skills include: such a change would amount to “prostitution of education”; and the Academy would end up “being in the pockets of industry” (p. 42). Given the “rapid growth in opportunities to profit from the production of knowledge,” the risk of “conflicts of interest” merits recognition (Nesbit, 2004, p. 106). However, counter-arguments, such as “the ‘job-readiness’ gap is growing,” and that “skill deficits” are contributing to Canadian “non-competitiveness,” (Maduro, 1998, p. 40) are equally worthy of note. While the clash between “commercial and academic values” (Nesbit, 2004, p. 106) requires significant deliberation, resolution may be found. Acknowledging the “polyculture” of the Academy (Suter, 2001)—in particular, the role that Continuing Education (CE) units can play in skills training (Hanna, 2000a; Maduro, 1998)—may provide an acceptable balance, attuned to both academic values and knowledge economy pressures.

The appropriate role of CE units is another source of debate. Many North American CE units' mandates originally referenced "the Wisconsin Idea": [that] the purpose of a university was not to educate a small, elite class, but rather to serve the educational needs of the community" (Archer & Wright, 1999, Three eras in university extension, para. 2). Subsequently, CE units have commonly been tasked with dual responsibilities of providing high quality educational services as a public service function and increasing accessibility to programming to non-traditional learners. Conversely, "especially in research universities, many faculty members question whether providing lifelong learning, especially for those in the workforce, is an appropriate mandate" (Bates, 2000, p. 15). As a result, "departments of continuing education (CE) usually have both fewer resources and a lower status than other university units" (Nesbit, 2004). Long-term erosion of institutional support for public service programming through declining financial support from university administrations (Bates, 2000; Maduro, 1998) has created significant fiscal challenges for CE units. Increasingly, CE units are expected to operate on a cost-recovery basis (Nesbit, 2004). However, undertaking entrepreneurial ventures tends to garner criticism from students and faculty, resulting in further erosion of academic status across the Academy (Maduro, 1998; Nesbit, 2004). This stalemate has contributed to North American universities losing an estimated "70 billion dollars a year" to "corporate universities" and "training centers," where in-house programs address CE gaps (Maduro, 1998, pp. 43-44).

Given the significance of the need for lifelong learning, driven by the knowledge and skill demands of the economy combined with the public perception that publicly funded universities have a major obligation to share new knowledge via new information technologies and support for lifelong learning, reconsideration of institutional support for CE units, and their use of ICT is warranted

(Hanna, 2000a). An institutional vision for a future where public learning needs are addressed through a reduction of the "rigidity of boundaries between [universities] and their external publics" through "interaction made possible by increasingly powerful technologies" (p. 343) has the potential to revitalize the relationship between the Academy and society.

If ICT-mediated knowledge sharing is to become a basic tenet of the future Academy, the challenge of developing technically competent faculties must be addressed by university leaders. Rogers' (1995) theory of *diffusion of innovations* "has quite deservedly been recognized as the baseline work" (Hagner & Schneebeck, 2001, p. 1) on perceptions of technological innovations. Findings based upon "intensive interviews with 240 faculty at the University of Hartford" strongly suggest that faculty tend to "demonstrate predominant characteristics" of Rodgers' four technological adoption groupings (p. 2).

The "first wave" or early adopters are "professors who represent the vanguard of innovation in teaching and learning" with technology (Hagner & Schneebeck, 2001, p. 3). However, "their work tends to be idiosyncratic" and is not scalable for broader use (p. 3). Engaging early adopters in scalable solutions requires clearly articulated processes and procedures, which are evidently more effective and efficient than individual efforts.

The "second wave" or "risk averse" are committed to quality teaching and learning opportunities, and they are attracted to the potential of "new technologies" for improving "what they do"; however, they often lack "technological expertise," and require "significant levels of instructional support" (Hagner & Schneebeck, 2001, pp. 2-3). Risk averse are often afraid that "their current success in teaching will not translate into the new teaching environments" (p. 2). Some "are hesitant to become engaged in the process of self-examination" (p. 2). Technological and peer support are critical for this group.

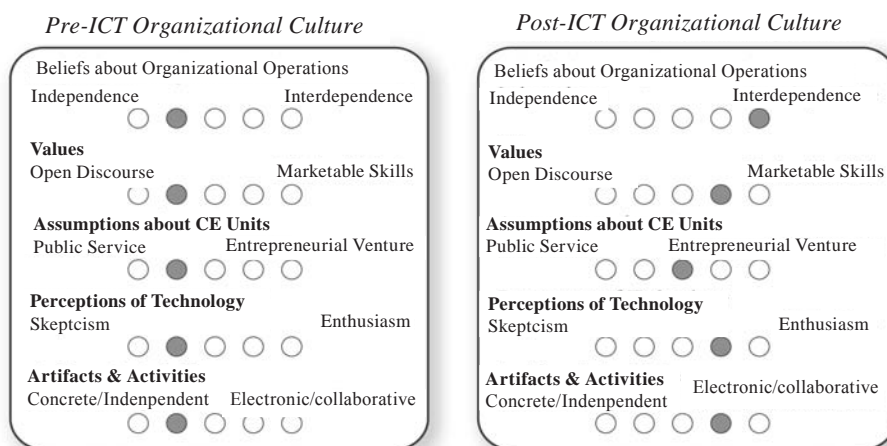
The “third wave” or “reward seekers” tend to focus on use of technology “to advance their professional careers”; therefore, their motivation “is closely tied to the university’s reward structure” (Hagner & Schneebeck, 2001, p. 4). “When they view adoption of new teaching and learning techniques as having a positive impact on tenure, promotion, and salary decisions, they will be more willing to transform” (p. 4).

The “fourth group” or “reluctants” are “those who are computer illiterate or firmly believe that traditional models of learning are superior” (Hagner & Schneebeck, 2001, p. 4). In some academic institutions, “there is a pervasive belief that faculty jobs are going to be replaced by the adoption of technology” (Olcott & Schmidt, 2000, p. 262). Fearful and “philosophically resistant faculty” increasingly risk being perceived as “anachronistic” and the professional consequences of that perception, including “an adverse impact on the evaluation of their teaching” (Hagner & Schneebeck, 2001, p. 5). One effective leadership method with this group is to communicate these risks through “faculty bodies, such as faculty senates” (Hagner & Schneebeck, 2001, p. 6).

Variant perceptions of technology—from the skepticism of reluctants to the enthusiasm of early adopters—warrant consideration in the design of engagement strategies. To circumvent cultural resistance to technological innovation, institutions need to determine their [particular] faculty mix and strategically plan appropriate support mechanisms and communication channels for each adoption group.

Organizational culture is often expressed through the use of artifacts for cultural activities. Whereas lecture notes, assignments, books, and exams are predominant artifacts in traditional educational settings, ICT-mediated learning artifacts include electronic learning resources and environments, and electronically mediated personal and professional experiences. The use of traditional educational artifacts emphasized concerted individual, isolated effort directed toward “abstract and relatively unconnected assessment processes such as . . . content examinations” (Hanna, 2000a, p. 345). ICT artifacts increasingly focus on “the ability to work in teams, to develop creative approaches to problem solving, and to learn continuously” (p. 344). Networked univer-

Figure 2. Organizational cultures “in tune” with ICT initiatives



sities are becoming “more and more concerned with ensuring that students know how to learn and to apply what they learn to real situations” (p. 344). This activity-centered approach to demonstrating learning represents a cultural shift from valuing abstract knowledge to valuing applied knowledge and skills—the same skills that are “necessary to live and work in a rapidly changing economy” (p. 64).

Figure 2 illustrates two hypotheses: one suggests a current state of academic culture, and one recommends cultural attunement for successful adoption of ICT-mediated learning opportunities.

Organizational Economies (Institutional Reward Systems)

Five aspects of organizational economies (institutional reward systems) that have an impact on the successful adoption of ICT-mediated learning opportunities include: tensions created by an emphasis on rewarding research activities more substantially than teaching activities; restricting the involvement of junior faculty in ICT development through out-date tenure and promotion criteria; emergent tensions between institutional rewards for commercialization of research discoveries and innovations and commercialization of ICT development activities; emergent issues about ICT intellectual property rights; and valuing work with graduate and traditional (full-time, on-campus) learners more than undergraduate and non-traditional (part-time, distance) learners.

Extending Suter’s (2001) approach to managing complexity, an analysis of these five elements of institutional reward systems that affect successful adoption of ICT-mediated learning follows:

Today... there is a recognition that the faculty reward system does not match the full range of academic functions and that professors are often caught between completing obligations... According to the dominant view, to be a scholar

is to be a researcher—and publication is the primary yardstick by which scholarly activity is measured... Given these tensions, what is the balance to be struck between research and teaching? (Boyer, 1990)

More than a decade after Boyer (1990) posed his question, the advent of ICT development as a teaching activity for faculty adds salience to it. ICT design, development, and delivery involve significant time investments from faculty (Bates, 2000; Hanley, 2001). Conversely, the same time investment could be made in research activities. If the Academy is serious about technological innovation in teaching praxis and does not adjust this mismatch of rewards, it will be difficult to engage faculty in ICT development initiatives (Archer, Garrison, & Anderson, 1999; Olcott & Schmidt, 2000).

Junior faculty members—the group that initially may seem most likely to adopt innovations—are, in fact, systematically discouraged by existing reward systems:

Interestingly, senior tenured faculty can venture out and be innovative, while junior non-tenured faculty must adhere to traditional norms. Translated, this means strict adherence to promotion and tenure criteria. In sum, for many junior faculty members there are not only few incentives but, in fact, underlying disincentives operating in this subculture. (Olcott & Schmidt, 2000, p. 264)

If technological innovation is to take hold in the Academy, the criteria for tenure and promotion must become more inclusive in determining legitimate scholarly activities, and this change needs to be perceived as an immediate, rather than a future, concern:

The currency of the Knowledge Age is information. More precisely, it is the creation, analysis, preservation, and distribution of information in efficient, easily accessible venues that give users

the immediate capacity to apply information and knowledge. (Olcott & Schmidt, 2000, p. 259)

In the New Economy, the academic tradition of autonomous pursuit of knowledge, for its own sake, is coming under increasingly powerful political-economic pressures. Fiscal challenges, combined with expanded opportunities to commercialize discoveries and innovations, are driving academic leaders to reward faculty for commercialization of research (Boyer, 1990; Nesbit, 2004). To date, few examples of commercialization of ICT-mediated learning can be found, but that may change. Increasingly, faculties who are skilled and experienced in ICT development are being “courted by private-sector companies, publishing firms, and government to develop technology-based content and instructional packages” (Olcott & Schmidt, p. 266). A logical next step would be to reward faculty for commercialization of teaching activities in comparable terms to those that currently exist for commercialization of research activities.

One element of commercialization of electronic learning resources that deserves particular attention is the question of who owns the intellectual property (IP) rights to ICT products that have been funded by academic institutions, and developed by faculty members in collaboration with instructional designers, multimedia, and information technology specialists. This question is complex, and to date, unanswered. Given that “cases have held ... that a professor who creates his or her own lectures (assuming they meet the test of originality and fixation, that is, recorded in a fixed format, such as print) owns the copyright in his or her own works” (Tallman, 2000, p. 194), it seems arguable that similar criteria would be applied to ICT-mediated learning artifacts. However, given the “vast resources the university invests in the creation” of ICT-mediated learning, “it is understandable that a university will claim ... ownership” (p. 194).

A further complicating factor is the status of the collaborators in the IP picture. Whereas multimedia and information technology specialists routinely belong to professional associations whose contractual relationship with the university includes relinquishing IP ownership of “work-made-for-hire” (Tallman, 2000, p. 194), instructional designers often hold faculty positions. The latter consideration brings to the fore questions concerning the respective values of content and design in ICT-mediated learning. As muddy as the IP waters appear to be, “there is a middle ground: copyright can be owned jointly” (p. 195). In sum, legal guidelines for sharing profits derived from the commercial exploitation of ICT-mediated learning artifacts may soon be a matter of significant contention between academic faculties and leaders. The manner in which this matter is managed could become a critical element in either driving or inhibiting faculty engagement in technological innovation.

A fifth consideration of existing reward systems are the variant returns on investment faculty receive for teaching and advising different types of students. The least profitable learners in the educational sector are individuals, who for geographic, economic, or academic reasons, cannot access a conventional university program. Typically, these non-traditional learners have registered in unclassified or non-degree programs offered via distance learning options. Distance education within traditional universities has typically been marginalized in Continuing Education and Extension Divisions, and is of little interest to the Academy at large (because neither status nor rewards were offered for this work); therefore, the tasks of teaching and advising non-traditional, part-time learners has often been contracted to sessional lecturers.

“In the environment of public universities in Canada, it is easy to identify [traditional, on-campus] undergraduates as being ... the university’s [second] ‘least profitable customers’” because

Visualizing ICT Change in the Academy

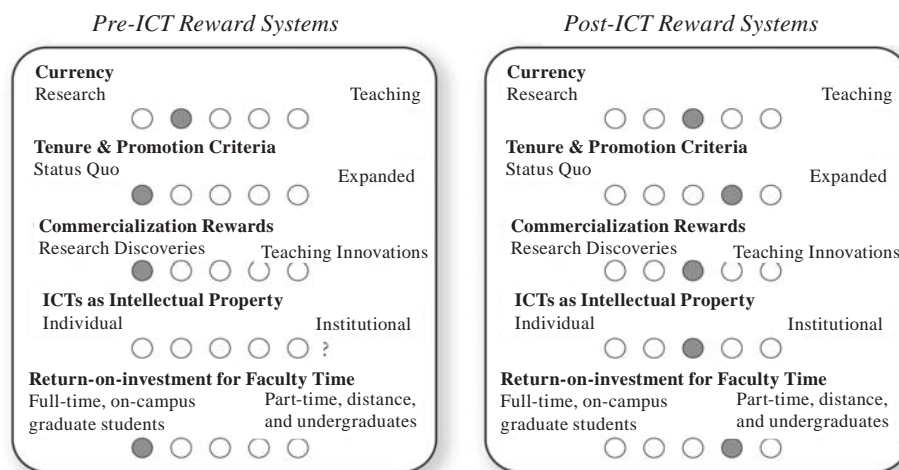
they do not contribute to the most “lucrative part of the ‘market’ addressed by research universities” (Archer, Garrison, & Anderson, 1999, p. 18). As research is the currency of traditional universities—the predominant source of tenure and promotion for faculty—and as undergraduate students rarely contribute to this currency, emphasis on undergraduate teaching may be less valued.

Recently, for-profit corporate universities have entered the post-secondary educational *market*, and have with variant levels of success, established themselves as players in the graduate “sector” (Bates, 2000; DiPaolo, 2003). In response to this emerging competition, traditional universities, to variant degrees, have implemented changes to graduate studies admission and residency requirements, and as a result, have created a third class of academic clients: professional or executive graduate students. The Universities of Toronto, Saint Mary’s, Western Ontario, McGill, Brock, and Concordia, for example, have launched Executive Masters of Business Administration programs, all of which involve flexible access,

such as weekend and evening classes, and many of which include part-time and e-learning options. While learners in programs such as these are involved in research, as part-time and/or remote program participants they are unlikely to contribute significantly to campus-based research programs. However, with annual tuition fees as high as \$20,000 (McGill, 2006) and \$16,500 (Brock, 2006) per year for e-learning options, tuition revenues can significantly contribute to funding on-campus research.

The fourth, and arguably still most-valued class of learners in traditional research universities, remains full-time, on-campus graduate students. These learners make significant contributions to the Academy through research and teaching assistant positions, thus freeing faculty to focus their time and energy on research and publication (Archer, Garrison, and Anderson, 1999; Olcott & Schmidt, 2000). As a result, the activities of full-time, on-campus graduate students currently are most closely aligned to existing faculty reward systems, thus providing the most return on investment for faculty time.

Figure 3. Organizational economy/reward systems “in tune” with ICT initiatives



However, the influence of the New Economy, combined with rapidly increasing educational costs (Bates, 2000), and the available option of e-learning may make full-time, on-campus graduate study less attractive. Further, “the public, the legislature, and consumers care about quality,” but they also increasingly focus attention on “cost-effectiveness” (Olcott & Schmidt, 2000, p. 269). Scalable e-learning systems are gradually becoming more cost-effective than campus-based programs (Bates, 2000), and if one takes a broader view, productivity and wage losses due to long-term study-related career interruptions are arguably also measures of cost-effectiveness. The “new generation of students who are more demanding, selective, and vocal about their educational” and financial needs may less often choose the full-time, on-campus route through graduate studies (Olcott & Schmidt, 2000, p. 268). Therefore, traditional research universities may be well advised to consider re-evaluating existing reward systems to provide incentives for increased faculty involvement with a broader variety of learners.

Figure 3 illustrates two hypotheses: one suggests a current “economic” state of the Academy, and one recommends reward-system attunement for successful adoption of ICT-mediated learning opportunities.

Pedagogical Praxis

With the advent of ICT-mediated learning opportunities, “faculty must begin to *design* instruction and not just *deliver* instruction (Olcott & Schmidt, 2000, p. 274). The professionalization of teaching, as a critical component of successful adoption of ICT-mediated learning, requires that faculty re-evaluate their pedagogical practices. “Habit, tradition, and culture have so far kept [many] faculty from addressing pedagogical practice and technological innovation” (Olcott & Schmidt, 2000, p. 274). An increasingly common institutional approach to address pedagogical practices

in the development of ICT-mediated learning is to involve instructional designers.

Instructional design—a combined art and science of teaching—is based upon principles of learning psychology, “cognitive science research and instructional models” (Olcott & Schmidt, 2000, p. 274). Research conducted through EDUCAUSE, a non-profit organization, whose membership includes “more than 1,800 campuses, organizations, and corporations” (Barone & Hagner, 2001, p. viii), strongly suggests the involvement of instructional designers, or at a minimum, provision of instructional design resources for ICT development initiatives “serves to increase quality and reduce risk” (Hartman & Truman-Davis, 2001, p. 51). Increasing quality and reducing risk are two of the most important concerns in ICT initiatives. Thus, a series of pedagogical considerations is warranted.

Five pedagogical considerations that have an impact on the successful adoption of ICT-mediated learning include: the changing nature of student enrollment patterns; customization and personalization of learning environments and experiences; transitioning from content-focused to learner-centered and service-oriented instruction; transforming classroom-based and distance education models into distributed learning opportunities; and designing ICT-mediated learning for reuse. Thoughtful, strategic responses of these five pedagogical issues can contribute to successfully managing the complexities of ICT initiatives.

One of the major challenges that traditional research universities face in the digital era—perhaps the most salient one—is determining who their prospective learners are and who future learners will be. Whereas geographical area, institutional reputation and mandate, as well as fee structures, may have been the criteria via which defined institutional “clienteles” in the past, increasing job market demands, e-learning options, and lifelong learning needs are influencing the “student mix and competitive position” of universities (Hanna, 2000a, p. 337). Diversity in the range of job-re-

lated skills in demand and diversity in the range of learners *shopping* for courses and programs are contributing to demand for customized or personalized learning experiences:

Personalizing learning will require the development of new administrative and pedagogical processes, and learning technologies will play an important role in being able to accomplish this personalization effectively. (Hanna, 2000a, p. 337)

Personalizing learning also requires knowing who the learners will be and the range of individual needs that must be met. Failure to address the personalization issue has already caused a significant number of institutions to experience significant difficulty in implementing e-learning initiatives.

Rapidly increasing enrollments in higher education e-learning programs may not result in the equally high successful completion rates. Carr (2000, para. 13) reports a range of 20% to 50% attrition rates in distance education programs in American colleges. While these rates vary significantly among institutions, administrators generally concur that “course-completion rates are often 10 to 20 percentage points higher in traditional courses than in distance offerings” (para. 13). A metastudy of a broad range of correspondence-based distance education results, undertaken by the World Bank, reported “dropout rates ranging from 19% to 90% and an overall rate of 40%” (Potashnik & Capper, 1998, p. 43). Potashnik and Capper suggest that “while similar studies have yet to be conducted for technology-based distance learning, both intuition and the limited research already done suggest that the interactivity and novelty provided by most technology-based approaches may contribute to higher completion rates” (p. 43).

However, recent studies of attrition rates in online learning programs provide little supportive evidence that ICT-based approaches can

ensure higher completion rates. Jameson (2002) argues, “It is common in Web-based instruction to have high attrition rates” (p. 2). Neil (2002) reports, “Enrollment and attrition rates are both statistically greater in the online format” (p. 66). Lorenzetti (2002) concurs that while it is relatively easy to attract learners to online distance education courses, dropout rates can “range as high as 50%” (p. 1). MacGregor (2001) argues that not all learners are willing to try online approaches to distance learning, and “those who do sign up drop out in higher numbers than in a traditional face-to-face course” (p. 143). “Retention has been indicated as one of the greatest weaknesses in online instruction” (O’Brien, 2002, para. 1). Given these preliminary findings, the success of electronically delivered distance education products and services may not be as secure as projected demand statistics predict. Whether or not e-learning will be successful is a question that the learners, not the technologists, will ultimately answer. In short, the predominant question about e-learning has been, “If we build it, will they come?” Currently, the question is, “How do we design it to ensure they stay?”

One strategy for increasing retention rates is to place stronger emphasis on the needs of learners during the development and delivery phases of e-learning projects. This strategy involves moving away from traditional domain-centered pedagogy and toward a learner-centered perspective. The shift from domain-centered to learner-centered design is being undertaken in order to increase the effectiveness and relevance of teaching practice.

To date, comparative research on the effectiveness of online learning has tended to focus on classroom-based learning. As a result of this context, many early versions of online instruction extended classroom-based pedagogical practice into online learning environments (Gifford & Enyedy, 1999). Traditional classroom-based pedagogical practice has been highly dependent upon “the transmission model of knowledge transfer...[in which] knowl-

edge is an identifiable object that is possessed by a person, detached from any social context, that can be conveyed from the mind of the instructor to the mind of the student” (Gifford & Enyedy, 1999, p. 2). Given the epistemological perspective that knowledge-to-be-learned is an object that may be possessed and transferred, Domain Centered Design (DCD) tends to focus on design and development activities that lead to well-organized and well-presented knowledge objects (Sims, 2001). Rather than taking into account the needs, wants, and desires of the learner, “the focus of pedagogy from this perspective is to make transmission more efficient” (Gifford & Enyedy, 1999, p. 2). As a result, learners who use online products and services created from a DCD perspective tend to struggle with difficulties similar to those that have long challenged traditional distance learners who have used print-based materials (Beffa-Negrini, Miller, & Cohen, 2002).

In contrast to DCD models of knowledge acquisition, learner-centered, activity-centered, situated, and participatory models of instructional design and development focus on demographic and cognitive profiles of learners, prior knowledge, perceptions, preferences, needs, goals, characteristics, and experiences of learners. While individual theorists draw distinctions among learner-centered, activity-centered, situated, and participatory models (Gifford & Enyedy, 1999; Reeves, 1999; Vinicini, 2001; Wilson, 1995), for the purposes of this chapter, the commonalities among these models will be considered and will be referred to as learner-centered design (LCD).

The underpinning tenet of each of these models is a shift of *focus* from what is known about and what is valued within a content domain (DCD) to what is known about and what is valued by learners (LCD). This shift is away from primary concern for what will be taught to a careful examination of learner characteristics and to ensuring that learners will perceive content as worth knowing (Sims, 2001). Subsequent development activities are focused on ensuring that essential

content is contextualized in learner experiences and/or goals, so that learners will be motivated to value it.

A Boise State University (BSU) case study exemplifies the difference that may be made by a shift from DCD to LCD. In 1989 Boise State launched a distance learning online/off-Web, Masters’ degree program in Instructional Performance and Technology (IPT). A variety of undergraduate degrees were accepted for entrance into the program; however, much of the curriculum assumed prior knowledge in the fields of psychology, educational psychology, and instructional design. Most students were full-time working professionals in fields other than education or instructional design. A common motivation for entering the program was to make a career change or to specialize in training within an existing profession. All students were required to make substantial commitments of weekly time and long-term planning. The program was, for its time, rather expensive, and its service level to students did not match either its fee level or learner needs. Students were required to have access 15 hours per week to a computer system valued at approximately \$3,000 U.S. in order to interact with the *FirstReader* courseware system that delivered the program. Tuition fees per 3-credit course, by 1995, had reached \$999 U.S. Despite their considerable initial commitments, “between fall 1989 and fall 1996, 44% of the students had dropped out” (School’s Founder, 2002, p. 4). In a series of exit interviews conducted by Chyung (2001), the most often cited reason for attrition was “discrepancies between... professional or personal interests and the curriculum or the course structure” (Cause analysis, para. 1). Course developers at Boise State took this feedback seriously. A series of changes were made to the *IPT* curriculum and course structure. By the end of the 2000 term:

BSU’s department of Instructional Performance and Technology had decreased online attrition to

Visualizing ICT Change in the Academy

15% by focusing on its first-time Internet learners... The department also devised interventions to address students' unfamiliarity with the subject matter; varying interests, goals, and learning styles; and desires for personal contact and social interaction. (School's Founder, 2002, p. 4)

Aligning the *IPT* program more closely with learners' needs, wants, and goals, as well as providing additional student support mechanisms, resulted in significantly improved retention rates and student satisfaction ratings, which in turn, resulted in the continuance of the *IPT* program. A lesson learned in the *IPT* case is that for-profit e-learning ventures where discrepancies between fee and service levels persist, and where learner needs and aspirations are ignored, are unlikely to be sustainable over the long term.

Transforming classroom-based and distance education models into distributed learning opportunities has the potential to better serve traditional, on-campus learners and non-traditional, distance learners. Distributed learning adopts a learner-centered approach to pedagogy and "integrates a number of technologies to enable opportunities for activities and interaction in both asynchronous and real-time modes... This approach gives instructors the flexibility to meet the needs of diverse student populations, while providing both high quality and cost-effective learning" (Bates, 2000, p. 27). Distributed learning models provide faculty with more flexible working conditions, which in turn allow faculty the opportunity to more easily balance teaching and research responsibilities.

An element that distinguishes distributed learning from other modes of instruction is its use of ICT-mediated learning opportunities to facilitate peer-to-peer learning: "Students do not so much interact *with* the technology as *through* the technology with teachers and other learners" (Bates, 2000, p. 27). Interacting with peers via online communication promotes "collaborative learning," and builds teamwork capacities (p.

27). Interacting with teachers, and in some cases external experts in the field of study, extends learning for both traditional and non-traditional learners well beyond the campus of the university, potentially into previously inaccessible work- and research-related arenas. Thus, the benefits of distributed learning opportunities are well suited to the demands of the global learning society and strategically suited to university goals, such as the provision of high quality and cost-effective learning.

Finally, designing ICT-mediated learning opportunities for reuse is a topic of increasing interest. The escalating costs of designing and developing high quality ICT-mediated learning opportunities is driving this interest and creating a new area of educational research: reusable learning objects (RLOs). RLOs and RLO repositories are currently hot topics of debate across the educational sector (Wiley, 2002).

Even the definitions for these terms are controversial. The Institute of Electrical and Electronics Engineers' Learning Objects Metadata (LOM) Working Group (2002) defines learning objects as "any entity, digital or non-digital, that may be used for learning, education or training" (Institute of Electrical and Electronics Engineers, 2004, para. 1). This definition has been broadly applied in commercial venues, but has received significant criticism from the educational community because its breadth is perceived as meaningless. Wiley (2002) alternatively defines learning objects as "any digital resource that can be reused to support learning" (p. 6). Merrill (2001) offers a distinction between learning objects and knowledge objects: knowledge objects include "only the content to be learned but not an objective, presentation, or assessment; learning objects are distinct from knowledge objects in that they also include an objective, some instructional information, and assessment" (Wiley, 2002, p. 11).

Similar controversy surrounds the definition of learning objects repositories. Definitions range from an alternative term for a database to a special-

ized computer server that houses information in a structured environment, which is organized and accessed via metadata. “Metadata, literally ‘data about data’ is the descriptive information” about both knowledge and learning objects that allows them to be retrieved from an electronic repository via a search mechanism (Wiley, 2002, p. 8).

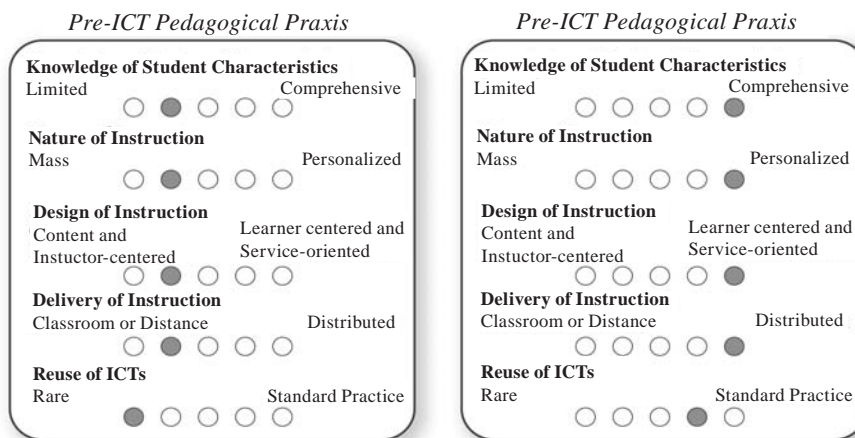
Definitional debates aside, reusable electronic learning objects and the repositories that house them promise sufficient cost-effectiveness to warrant attention (Barritt & Alderman, 2004; Daniel & Mohan, 2004). CANARIE, Canada’s advanced Internet development organization, has contributed \$10 million over the past five years to the research and development of reusable electronic learning objects and learning objects repositories (Wosk, 2003). This investment has been aimed at “attaining critical mass [of RLO users] to demonstrate value” and “addressing [the] major problem” of developing cost-effective approaches to managing ICT-mediated learning opportunities (p. 2).

In more advanced e-learning environments, learning agents can broker relationships among learners, experts, and objects by matching learner

profile information for the purposes of recommending specific resources and peer-to-peer, as well as expert-to-novice, support (McCalla, 2004; Mohan & Greer, 2003). In combination with learning objects and agents, user-tracing software can detect user-behavior, analyze behavior patterns, and assist the agents in making increasingly accurate recommendations (Zaiane, 2002). Thus, the system can *learn* to effectively link individuals to others who share their interests and who can provide peer or professional assistance. The system can also *learn* to recognize resources that match individuals’ learning styles and learner goals, thus enabling individualization of user experiences (McCalla, 2004). While data-mining and expertise-location tools are still in the research and development phase, in combination with learning objects technologies, their development holds significant promise for future community-building functionalities within e-learning systems.

Finding or creating cost-effective avenues to create, customize, use, and reuse ICT-mediated learning artifacts, and to create the conditions for communities of users to support each other in their

Figure 4. Pedagogical praxis “in tune” with ICT initiatives



learning goals, are emerging fields of research and development, which will be of significant interest to university leaders, who face concerns about “how and where to invest scarce resources” (Suter, 2001, p. 29) in technological innovations for teaching and learning. As accumulating existing ICT resources reach a management and maintenance crisis-point, these issues will come to the fore of the list leadership challenges in higher education.

Figure 4 illustrates two hypotheses: one suggests a current state of the pedagogical praxis within the Academy, and one recommends pedagogical attunement for successful adoption of ICT-mediated learning.

CONCLUSIONS AND RECOMMENDATIONS

The global learning society, and its demands upon members of society to learn their living, are now and will continue to transform the Academy. At this juncture, traditional research universities may need to examine their e-learning policies and practices to effectively adapt to a complex, ambiguous, and dynamic external environment. University leadership needs to strategically respond to the pressing demands of external forces for change. By attuning internal organizational structures, cultures, economies (reward systems), and pedagogical praxes to changing academic times, the Academy can embrace ICT solutions and their associated service orientation to ensure its ongoing position as *the best option* for higher education.

ACKNOWLEDGMENT

The graphics in this chapter were created by Carmen Perret-Smith at the University of Saskatchewan.

REFERENCES

- Alcay, R. E. (2003). *The new economy: What it is, how it happened, and why it is likely to last*. New York: Farrar, Stratus, & Giroux.
- Archer, W., Garrison, D. R., & Anderson, T. D. (1999). Adopting disruptive technologies in traditional universities: Continuing education as an incubator for innovation. *Canadian Journal of University Continuing Education*, 25(1), 13-44.
- Archer, W., & Wright, K. (1999). Back to the future: Adjusting university continuing education research to an emerging trend. *Canadian Journal of University Continuing Education*, 25(22), 61-84.
- Barone, C. A., & Hagner, P. R. (2001). Preface. In C. Barone & P. Hagner (Vol. Eds.), *Educause leadership strategies: Vol.5. Technology-enhanced teaching and learning: Leading and supporting transformation on your campus* (pp. 35-54). San Francisco, CA: Jossey Bass.
- Barritt, C., & Alderman, F. L. (2004). *Creating a reusable learning objects strategy: Levering information and learning in a knowledge economy*. San Francisco, CA: Pfeiffer.
- Bates, A. W. (2000). *Managing technological change: Strategies for college and university leaders*. San Francisco, CA: Jossey-Bass.
- Beffa-Negrini, P. A., Miller, B., & Cohen, N. L. (2002). Factors related to success and satisfaction in online learning. *Academic Exchange Quarterly*, 6(3), 105-114.
- Bok, D. (2003). *Universities in the marketplace: The commercialization of higher education*. Princeton, NJ: Princeton University Press.
- Boyer, E. L. (1990). *Scholarship reconsidered: Priorities of the professoriate*. Princeton, NJ: The Carnegie Foundation for the Advancement of Teaching.

- Brown, D. G., & Jackson, S. (2001). Creating a context for consensus. In C. Barone & P. Hagner (Vol. Eds.), *Educause leadership strategies: Vol.5. Technology-enhanced teaching and learning: Leading and supporting transformation on your campus* (pp. 35-54). San Francisco, CA: Jossey Bass.
- Cahn, S. M. (1986). *Saints and scamps: Ethics in Academia*. Lanham, MD: Rowman & Littlefield.
- Carr, S. (2000). As distance education comes of age, the challenge is keeping the students [Electronic version]. *Chronicle of Higher Education*. Retrieved April 20, 2006, from <http://chronicle.com/free/v46/i23/23a00101.htm>
- Christensen, C. M. (1997). *The innovator's dilemma: When new technologies cause great firms to fail*. Boston: Harvard Business School Press.
- Chyung, Y. (2001). Improve the motivational appeal of online instruction for adult learners: What's in it for me? Retrieved April 20, 2006, from <http://coen.boisestate.edu/ychyung/researchpaper.htm>
- Collins, M., & Berge, Z. (1996, June). *Facilitating interaction in computer mediated online courses*. Paper presented at the FSU/AECT Distance Education Conference, Tallahassee, FL.
- Daniel, B. K., & Mohan, P. (2004, July). *Re-engineering the public university with reusable learning objects approach*. Paper presented at the International Conference on Education and Information Systems: Technologies and Applications, Orlando, FL.
- DiPaolo, A. (2003, December). *Choices and challenges: Lessons learned in the evolution of online education*. Paper presented at the Association of Pacific Rim Universities' 2003 Distance Learning and the Internet conference. Retrieved April 20, 2006, from http://www.cit.nus.edu.sg/dli2003/Presentation/Andy_DiPaolo.pdf
- Fees. (2006). Retrieved April 20, 2006, from the Brock University Web site: http://www.bus.brocku.ca/mba/mba_fees.html
- Gifford, B., & Enyedy, N. (1999, December). *Activity centered design: Towards a theoretical framework for CSCL*. Paper presented at the Third International Conference on Computer Support for Collaborative Learning, Stanford, CA. Retrieved April 20, 2006, from http://www.ee.upatras.gr/hci/courses/colaborative_technology/Gifford_Enyedy_CSCL_1999.pdf
- Graves, W. H. (2001). Transforming traditional faculty roles. In C. Barone & P. Hagner (Vol. Eds.), *Educause leadership strategies: Vol.5. Technology-enhanced teaching and learning: Leading and supporting transformation on your campus* (pp. 35-43). San Francisco, CA: Jossey Bass.
- Hagner, P. R., & Schneebeck, C. A. (2001). Engaging the faculty. In C. Barone & P. Hagner (Vol. Eds.), *Educause leadership strategies: Vol.5. Technology-enhanced teaching and learning: Leading and supporting transformation on your campus* (pp. 1-12). San Francisco, CA: Jossey Bass.
- Hanley, G. L. (2001). Designing and delivering instructional technology: A team approach. In C. Barone & P. Hagner (Vol. Eds.), *Educause leadership strategies: Vol.5. Technology-enhanced teaching and learning: Leading and supporting transformation on your campus* (pp. 57-64). San Francisco, CA: Jossey Bass.
- Hanna, D. E. (2000a). Emerging organizational models: The extended traditional university. In D. Hanna & Associates (Eds.), *Higher education in an era of digital competition: Choices and challenges* (pp. 93-116). Madison, WI: Atwood.
- Hanna, D. E. (2000b). Emerging approaches to learning in collegiate classrooms. In D. Hanna & Associates (Eds.), *Higher education in an era of digital competition: Choices and challenges* (pp. 45-65). Madison, WI: Atwood.

- Hartman, J. L., & Truman-Davis, B. (2001). The holy grail: Developing scalable and sustainable support solutions. In C. Barone & P. Hagner (Vol. Eds.), *Educause leadership strategies: Vol.5. Technology-enhanced teaching and learning: Leading and supporting transformation on your campus* (pp. 45-56). San Francisco, CA: Jossey Bass.
- Hutchins, R. (2000). Working with your neighbors. In M. Luker (Vol. Ed.), *Educause leadership strategies: Vol.1. Preparing your campus for a networked future* (pp. 59-70). San Francisco: Jossey Bass.
- Institute of Electrical and Electronics Engineers. (2004). WG12: Learning object metadata. Retrieved April 20, 2006, from <http://ltsc.ieee.org/wg12/index.html>
- Jameson, T. (2002). Theory-driven motivational study aims to assist retention. *Distance Education Report*, 6(22), 5-6.
- Lincoln, Y. S. (2001, April). *The fourth generation view of evaluation: The future for evaluation in a new millennium*. Paper presented at the 2001 Arizona Evaluation Network's Spring Conference.
- Lorenzetti, J. P. (2002). Before they drift away: Two experts pool retention insights. *Distance Education Report*, 6(8), 1-2.
- Luker, M. A. (2000). What campus leaders can do today. In M. Luker (Vol. Ed.), *Educause leadership strategies: Vol. 1: Preparing your campus for a networked future* (pp. 93-100). San Francisco, CA: Jossey-Bass.
- MacGregor, C. J. (2001). A comparison of student perceptions in traditional and online classes. *Academic Exchange Quarterly*, 5(4), 143-146.
- Mackay, H. H. (1996). The MacKay report on universities. Retrieved April 20, 2006, from http://www.sasked.gov.sk.ca/branches/university_services/mackay/mackaytc.html
- Maduro, M. (1998). The issue of competitiveness and skills training in continuing education today. *Canadian Journal of University Continuing Education*, 24(2), 37-46.
- McCalla, G. (2004). The ecological approach to the design of e-learning environments: Purpose-based capture and use of information about learners [Electronic version]. *Journal of Interactive Media in Education*, (7). Retrieved April 20, 2006, from www-jime.open.ac.uk/2004/7
- McLuhan, M. (1964). *Understanding media: The extensions of man* (2nd ed.). Toronto: The New American Library of Canada.
- Merrill, M. D. (2001). Knowledge objects and mental-models. Retrieved April 20, 2006, from <http://cito.byuh.edu/merrill/text/papers/KOMM.PDF>
- Mohan, P., & Greer, J. (2003, August). *Using learning object technology to tackle the educational challenges of the Caribbean*. Paper presented at IEEE 1st International Workshop on Technology for Education in Developing Countries, Newark, NJ.
- Nesbit, T. (2004). [Review of the book Universities in the marketplace: The commercialization of higher education]. *Canadian Journal of University Continuing Education*, 30(1), 104-106.
- Norton, R. D. (2000). *Creating the new economy: The entrepreneur and the U.S. resurgence*. Northampton, MA: Edward Elgar.
- O'Brien, B. (2002). Online student retention: Can it be done? *World Conference on Educational Multimedia, Hypermedia and Telecommunications 2002* (1), 1479-1483. [Online]. Retrieved January 4, 2005, from <http://dl.aace.org/10372>
- O'Driscoll, T. (2003). Proposing an optimal learning architecture for the digital enterprise. *Educational Technology*, 43(1), 12-18.

- Olcott, D., & Schmidt, K. (2000). Redefining faculty policies and practices for the knowledge age. In D. Hanna & Associates (Eds.), *Higher education in an era of digital competition* (pp. 258-286). Madison, WI: Atwood.
- Palloff, R. M., & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom* (1st ed.). San Francisco, CA: Jossey-Bass.
- Potashnik, M., & Capper, J. (1998). Distance education: Growth and diversity. *International Monetary Fund and the International Bank for Reconstruction and Development/The World Bank*. Retrieved April 20, 2006, from <http://www.worldbank.org/fandd/english/0398/articles/0110398.htm>
- Reeves, W. (1999). *Learner-centered design: A cognitive view of managing complexity in product, information, and environmental design*. Thousand Oaks, CA: Sage.
- Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: The Free Press.
- Ruttenbar, B. W., Spickler, G. C., & Lurie, S. (2000). *E-learning: The engine of the knowledge economy*. Retrieved April 20, 2006, from <http://www.internetttime.com/itimegroup/morgankeegan.pdf>
- Sackney, L., & Mitchell, C. (2002). Postmodern expressions of educational leadership. In K. Leithwood & P. Hallinger (Eds.), *Second international handbook of educational leadership and administration* (Vol. 2) (pp. 881-913). Boston: Kluwer Academic Publishers.
- Schein, E. H. (1993). Organizational culture and sense making. In J. M. Shafritz & J. S. Ott (Eds.), *Classics of organization theory* (5th ed.) (pp. 369-376). Belmont, CA: Wadsworth.
- School's founder says dumping the traditional is secret to retention success online. (2002). *Recruitment and Retention in Higher Education*, 16(3), 4-5.
- Shafritz, J. M., & Ott, J. S. (2001). Organizational culture and sense making. In J. M. Shafritz & J. S. Ott (Eds.), *Classics of organization theory* (5th ed.) (pp. 361-368). Belmont, CA: Wadsworth.
- Sims, R. C. (2001). *From art to alchemy: Achieving success with online learning*. Retrieved April 20, 2006, from <http://it.coe.uga.edu/itforum/paper55/paper55.htm>
- Suter, V. N. (2001). Managing complexity in a transforming environment. In C. Barone & P. Hagner (Vol. Eds.), *Educause leadership strategies: Vol.5. Technology-enhanced teaching and learning: Leading and supporting transformation on your campus* (pp. 25-34). San Francisco, CA: Jossey Bass.
- Tallman, J. (2000). Who owns knowledge in a networked world? In D. Hanna & Associates (Eds.), *Higher education in an era of digital competition: Choices and challenges* (pp. 185-218). Madison, WI: Atwood.
- Tjeldvoll, A. (1998, Fall). The idea of the service university [Electronic version]. *International Higher Education*. Retrieved April 20, 2006, from http://www.bc.edu/bc_org/avp/soe/cihe/newsletter/News13/text4.html
- Trice, H. M., & Beyer, M. (1993). Changing organizational cultures. In J. M. Shafritz & J. S. Ott (Eds.), *Classics of organization theory* (5th ed.) (pp. 361-368). Belmont, CA: Wadsworth.
- Tuition fees and expenses*. (2006). Retrieved April 20, 2006, from <http://www.mcgill.ca/mba/financing/tuition/>
- Vinicini, P. (2001). The use of participatory design methods in a learner-centered design process. *ITFORUM 54*. Retrieved April 20, 2006, from <http://it.coe.uga.edu/itforum/paper54/paper54.html>

Visualizing ICT Change in the Academy

Wiley, D. A. (2002). Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy. In D. Wiley (Ed.), *The instructional use of learning objects*. Bloomington, ID: Agency for Instructional Technology and Association for Communications & Technology.

Wilson, B. G. (1995). Situated instructional design: Blurring the distinctions between theory and practice, design and implementation, curriculum and instruction. In M. Simonson (Ed.), *Proceedings of selected research and development presentations*. Washington D. C.: Association for

Educational Communications and Technology [Electronic version]. Retrieved April 20, 2006, from <http://carbon.cudenver.edu/~bwilson/sitid.html>

Wosk, M. J. (2003, November). CANARIE: Mini-summit on learning object repository implementation. Canarie, Inc.: Vancouver.

Zaïane, O. R. (2002). Building a recommender agent for e-learning systems. Retrieved April 20, 2006, from <http://www.cs.ualberta.ca/~zaiane/postscript/icce02.pdf>

This work was previously published in Enhancing Learning Through Human Computer Interaction, edited by E. McKay, pp. 1-20, copyright 2007 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).

Chapter 8.7

Perspectives on 21st Century E–Learning in Higher Education

Lalita Rajasingham

Victoria University of Wellington, New Zealand

ABSTRACT

This chapter explores a new higher education paradigm given the changing environment that will come with the advance of globalization and the rapid development of the Internet. As economies evolve around a global network and the value of knowledge, societies rely on universities to help shape future education in an emerging knowledge society. As teachers and learners already find that they need to adapt to the presence of the Internet, university managers and administrators will need to adapt their structures, strategies, procedures and programs to deal with the processes of globalization. Based on international research, this chapter presents a vision, and a paradigm from which higher education might be constructed. The Sloan-C Five Pillars of Quality Online Education and new applications, HyperReality and Croquet, are examined as potential platforms to reframe future developments.

INTRODUCTION

In describing the concept of paradigms, Thomas Kuhn (1962), in his text, *The Structure of Scientific Revolutions*, meant “what members of a scientific community, and they alone, share” (Kuhn, 1977, p. 294) and went on further to suggest that “when paradigms change, the world itself changes with them” (1962, p.110).

Another equally important related concept as we examine changes in society is world-view—*zeitgeist*—which Michel Foucault calls an episteme, by which he means an all-encompassing body of unconscious knowledge peculiar to a particular time and place, and concludes that it is not possible for people in one episteme to comprehend the way people in another episteme think (Foucault, 1970).

Historically, higher education has seen many global paradigm shifts, with varying degrees of turmoil. The medieval university taught the word of God and began in monasteries in Europe and

in temples, madrassas and churches in other parts of the world. Essentially elitist and male, it served princes and priests.

The emergence of communications technologies, especially the printing press and the railways, gave birth to industrialization and nation states. Universities moved from explaining the world in terms of God's word to become part of the structure of the industrial age, explaining reality in terms of scientific rationalism, catering for a nation's managerial and professional elite, gradually including women. This is the paradigm of national higher education that we know today. However, with the developments of the Internet, the World Wide Web, broadband, digitalization, wireless, satellite, mobile phones and new applications of virtual reality, HyperReality and artificial intelligence to build collaborative, immersive simulated environments, our children and grandchildren will face very different educational environments. Higher education is once again undergoing a paradigm shift, as technologies add new global perspectives, and universities worldwide face new challenges at a time of unprecedented demand for higher education.

Current Scan

John Daniel (1996) suggests that given the demand for higher education and the inability of conventional universities as we know them to cope, even sustaining the current level of participation in higher education and particularly the growing demand in India and China, one new major institution would need to be created somewhere in the world each week for the next 30 years. Clearly, a solution is needed that moves universities from being based on building and transport technologies, which are becoming increasingly costly, to also operate with computers and telecommunications. Students, particularly adults, seek life-long learning opportunities anytime and anywhere more convenient for their dual roles of juggling personal and professional needs.

Donald Hanna (2002) argues the need to develop greater understanding of how teaching and learning, knowledge generation and preservation, organizational design and evaluation, and leadership can all function together within a changing and increasingly competitive external environment and create new ways to respond to diversity within higher education. He approaches the challenge of access and suggests that traditional campus-based universities are opening access points through technology enhanced e-learning, and the large 'mega-universities' described by Daniel (1996) are beginning to build more robust mechanisms, including interactions among students and faculty that are both face to face and supported by advanced information and communications technologies (ICT), such as the Internet. Providing access to higher education for increasing demand, both in the developed and developing societies, remains one of the main challenges facing governments. In his paper, Poley examines this issue from the perspective of gender, poverty and race (2000).

In the United States (U.S.), for-profit universities are being established to serve working adults, and new online, virtual universities and strategic consortia are also emerging; Hanna (2002) and Poley (2000) stress the importance of leadership with vision as universities become competitive and commercialized in the age of knowledge (Poley, 2000). According to Potashnik and Capper (1998), there are 11 mega-universities, each of which enrolls more than 100,000 students per year, with a combined enrollment of some 2.8 million.

E-learning and increasing fiscal constraints faced by modern universities are introducing some new pedagogical frameworks, learning environments and stakeholder demographics. University fees turn students into customers that demand life-long education. Rectors and vice chancellors are employed as chief executives rather than distinguished scholars. Research becomes that which is funded and formulaic instead of a search for knowledge and truth. These are the

Table 1. Mega-universities: Basic data (Potashnik & Capper, 1998)

| | Name of institution | Established | Students in degree programs ¹ | Graduates per year | Budget (million dollars) | Percentage of budget from | | Unit cost ² |
|----------------|---|-------------|--|--------------------|--------------------------|---------------------------|-------------------|------------------------|
| | | | | | | Student fees | Government grants | |
| China | China TV University System | 1979 | 530,000 | 101,000 | 1.2 ³ | 0 | 75 | 40 |
| France | Centre national d'enseignement à distance | 1939 | 184,614 | 28,000 | 56 | 60 | 30 | 50 |
| India | Indira Gandhi National Open University | 1985 | 242,000 | 9,250 | 10 | 42 | 58 | 35 |
| Indonesia | Universitas Terbuka | 1984 | 353,000 | 28,000 | 21 | 70 | 30 | 15 |
| Iran | Payame Noor University | 1987 | 117,000 | 7,563 | 13.3 | 87 | 13 | 25 |
| Korea | Korea National Open University | 1982 | 210,578 | 11,000 | 79 | 64 | 36 | 5 |
| South Africa | University of South Africa | 1873 | 130,000 | 10,000 | 128 | 39 | 60 | 50 |
| Spain | Universidad Nacional de Educación a Distancia | 1972 | 110,000 | 2,753 | 129 | 60 | 40 | 40 |
| Thailand | Sukhothai Thammathirat Open University | 1978 | 216,800 | 12,583 | 46 | 73.5 | 26.5 | 30 |
| Turkey | Anadolu University | 1982 | 577,804 | 26,321 | 30 ⁴ | 76 | 6 | 10 |
| United Kingdom | Open University | 1969 | 157,450 | 18,359 | 300 | 31 | 60 | 50 |

¹ Enrollment figures vary by year between 1994 and 1996

² Unit cost per student as an approximate percentage of avg. cost per student for other universities in the country

³ Central unit only

⁴ Open Education Faculty only

early symptoms of the coming paradigm shift. A play on Harold Lasswell's Communications dictum, the question is who will teach what to whom in what channel, with what effect in the knowledge society?

It is possible that the new paradigm of higher education will be located in cyberspace, as the changes we are likely to see over the next 20 to 30 years assumes that computing technology will continue to converge with telecommunications, that cellular and digital environments will become ubiquitous, that the trend to wear information technology will continue, that we will access distributed virtual realities as we do mobile phones now and that artificial intelligence will have a growing role (Tiffin, 2004). Such developments make it possible to rethink every aspect of higher education, from curricula assessment, instructional methodology, student entry, satisfactory academic status, fees, terms and timetables

within the framework of the Sloan-C Five Pillars of Quality Online Education.

Sloan-C Five Pillars of Quality Online Education

The Sloan Consortium Report to the Nation (2002), by George Lorenzo and Janet Moore, established the Five Pillars of Quality Online Education-- learning effectiveness, student satisfaction, faculty satisfaction, cost effectiveness and access-- as the values, principles and goals of asynchronous learning networks. Asynchronous learning networks (ALN) today commonly refer to 'online learning,' 'flexible learning,' 'e-learning,' 'virtual classes' and 'virtual universities,' reflecting the use of computer and Internet technologies to facilitate interactive communications between teachers and learners in an online learning environment. The Five Pillars are interrelated, and

conventional universities have a long and successful history of established procedures and structures for the interaction between the Pillars (Lorenzo & Moore, 2002). However, the rapid advances in speed and power of new clusters of digital technology enable fully immersive learning environments to replicate in different locations the communications functions of the multimediated, conventional face-to-face classroom. This will impact on the interrelation between Sloan-C Five Pillars, changing how teaching, learning, and knowledge creation and dissemination—the universals of universities—will be conducted in the future.

A Universal of Higher Education: The Teaching/Learning Function

There are some critical factors that constitute higher education, the universals of a university that will not change whatever the episteme, the place, the language, the culture or the medium used. From a neo-Vygotskyian (Vygotsky, 1978) perspective, higher education is interactive communication where teachers who have graduated help learners who have not yet graduated to apply knowledge to solve real-life problems. The main difference that distinguishes e-learning from on-campus learning is that instead of bringing students and teachers together physically by means of local transport systems and buildings for face-to-face interaction, it uses computers and telecommunications to bring them together as tele-presences on the global Internet.

The Internet is still evolving and will continue to do so. Curricula designed for use in a particular institution within a particular nation and context and posted on the Internet are now open to scrutiny from a global perspective, as the professional application of knowledge increasingly takes place in a global and a local context. The conventional university system is designed and localized for the nation in which it operates, teaching people how to be doctors, lawyers, teachers and pilots

in the paradigm of one particular country, and operate according to the rules, regulations, laws and language of that country.

However, with advances in the Internet, professionals need to know about international practice as they compete in the global economy. Pilots fly internationally as well as nationally. AIDS, SARS and Avian Flu know no frontiers, and doctors need to be able to collaborate internationally to deal with these pandemics. Students now compare and evaluate what is taught in other countries by using the World Wide Web, and linking in chat rooms with students from around the world. The inevitable march of higher education into a global tempo will only increase and will need curricula to match.

Globalizing Curricula

In his 1902 collection of essays on the Idea of a University, John Newman said:

A university, I should lay down, by its very name professes to teach universal knowledge. (Newman, 1996, p. 25)

Georgette Wang (personal communication with J. Tiffin & L. Rajasingham on “The Purpose of a University”, November 23, 1999) suggests that the purpose of a university is to address the great issues of its time. Today, in any media in any country we are informed about tsunamis (2004), hurricanes (2005), new viruses and pandemics, genetic engineering, free trade, terrorism and the impact of technology in all human communications. These issues echo the way world problems are listed and taxonomically mapped in the Encyclopedia Plus of World Problems and Human Potential (1996). These are the great issues of our time, and they are problems of global dimensions. Global problems need cadres of professionals equipped with skills to offer global solutions.

It follows that to be effective in e-learning, higher education needs to globalize its curricula.

The World Trade Organization's (WTO) General Agreement on Trade and Services (GATS) regards higher education as an information service that can be traded globally. A global trade in teaching has begun, as evidenced by the increasing number of online, virtual and e-learning courses on the Internet. However, as companies and institutions that market globally have discovered, there is more to globalizing a product than putting what works well in one country, in one paradigm and one episteme up for sale in another on the Internet.

The timely and useful book, *Partnering in the Learning Marketplace* (2001), foreshadows issues as education becomes global and competitive using innovative technologies. There is a growing smorgasbord of educational courses and degrees on the Internet, giving birth to a new marketplace where all our transactions—learning, business, shopping and working—are moving from place to cyberspace. "Marketplace" is a term coined by Rayport and Sviokla (1994) to distinguish the new virtual world of bits of information from the atomic physical world, and Kevin Kelly (1998) notes, "people will inhabit places, but increasingly, the economy inhabits space" (p. 94).

While the idea of a market where teachers and learners can trade is not new, the medium in which it takes place is new. As the Internet grows in power and robustness, a global trade in teaching is enabled as learners become customers and buyers, and teachers and universities become sellers of products and services in competition in the global marketplace (Tiffin & Rajasingham, 2001).

To respond to an increasingly sophisticated and market-driven learner satisfaction, academic departments in universities need to rethink, reformat and redesign their programs and structures as e-learning moves from being teacher-controlled to learner-centered, and becomes more connected with personal and professional experiences. Furthermore, learning and teaching will need to become increasingly interdisciplinary to mirror and respond to real-life problems and issues from

multicultural perspectives. According to Drucker (1999, 2000) the trend is amplified by learners' desire for a 'holistic' constructivist approach to knowledge, not just from their own specialized discipline.

The tendency today is to take an existing course designed for one country and adapt it to another, with serious consequences, especially for developing countries. Often, issues of cultural relevance, language, learning styles and protocols seem intractable because of copyright and institutional intellectual ownership issues, resulting in programs and courses being mothballed, wasting scarce financial resources. What is needed is curricula design for the global market to allow societies to act global and then localize in consonance with local thinking. This has the potential to upgrade relevance of what is taught. According to Tiffin and Rajasingham (2003), with instructional design principles for Internet-based learning, basic courses that are the currency of higher education-- whatever the country-- can be readdressed from the multiple perspectives of different countries, cultures and languages to develop new curricula to match global concerns.

The process of designing, accrediting, validating and assessing global curricula is critical in the higher education paradigm. The *Chronicle of Higher Education* and the *Times Higher Education* increasingly report academics worldwide deploring declining standards as universities become businesses for profit, reducing staffing, increasing on-seat student numbers and cutting staff and student support systems. The Oxford and Cambridge one-to-one tutorials as well as the five-to-eight student tutorials that existed in many universities in the Western world have now succumbed to planned obsolescence. As staff/student ratios rise, inevitably, standards fall.

Universities historically are places where students learn how to learn and develop critical thinking skills to apply what they learn to real-life problems. If universities continue their traditional ways of measuring learning via lecture mode

and in abstract, passive, relatively unconnected assessment processes such as class examinations, multiple-choice tests and other forms of memorization and recall, they will increasingly be at a competitive disadvantage (Hanna, 2002). In the knowledge society, collaboration and new construction of knowledge in culturally diverse learning environments will be the valued skills for competitive advantage.

Traditionally, it was the teacher who decided what goes into a conventional curriculum and how it will be assessed by setting and grading exams and summative measures if learning has taken place. This process has inherent flaws, because we still do not know what learning is and as yet there are no global standards by which to measure a degree, a diploma or a credit. There is no way of knowing if a degree from Peking is better or worse than one from Harvard, Heidelberg or Madras. Many countries have some kind of ranking for institutions of higher education that indicate a pecking order of prestige. Also, there are global listings that rank universities, but they do so on the basis of research, not teaching and effective learning outcomes. The report *Academic Ranking of World Universities – 2005* outlines the complex issues involved in ranking universities (Liu & Cheng, 2005). In a situation where there are no standards, how can universities compete in the new business world while maintaining their universals: the creation and dissemination of knowledge for the public good?

Adam Smith wrote, “When a man has learned his lesson very well, it surely can be of little importance where or from whom he learned it” (Peacock, 2001, p. 6). The proliferation of click for a ‘degree.com’ tends to devalue well-designed virtual courses, such as the digital content of the Massachusetts Institute of Technology (MIT) now available on the Web.

To be successful in the new technological environment, e-learning in higher education will need to adopt a rigor in course design, accreditation and assessment, and introduce new processes

and strategies beyond that which now operate in conventional institutions. This includes separating summative assessment from teaching and developing curricula in conjunction with national and international associations in the subject field, and so setting new global standards (Tiffin, 2004).

Access, Quality, and Costs: Non-Zero Sum Variables

In his thought-provoking paper, Daniel (2004) argues that sustainability as a route to development is a critical factor if open-distance education is to build on the respectability it has earned. Open and distance learning allows education to break out of the iron triangle that has constrained its impact throughout history, which Daniel describes as the vectors of access, quality and cost, where the assumption by educators and the public is that education is a zero-sum game between these variables. On this assumption, increasing access to education will lower quality and raise overall cost. Similarly, raising quality will increase costs and therefore reduce access. Daniel challenges universities to break this iron triangle and the link between quality and exclusivity in education.

While to change or not to change is no longer an option for institutions of higher learning, there are a variety of routes to making those changes, some producing greater success than others. Many of the strategies for change referenced in the current higher education literature that involve restructuring and quality management are framed around barriers to change and re-engineering processes that are not working, and begin from the perspective of cost deficit. Cost factors associated with going online are increasingly open to critical analysis, and there is a growing body of literature that addresses the issue of costing e-learning. Theoretically, cost is related to volume, and the more units produced, the lower the unit costs, thus introducing competitive trade in teaching.

Rumble (1997, 1999, 2001) suggests that any attempt to do comparative cost analysis between

online education and conventional face-to face or traditional print-based distance education is fraught with complexity because it is difficult to agree on the critical variables in each educational approach, and the different interpretations of what is meant by online education. Some take it to mean asynchronous Web-based learning, and others include synchronous interactivity, and what should be included in the costs (Rumble, 2001)? In costing e-learning, Rumble includes the costs of:

1. Developing e-materials
2. Teaching students online
3. Administering students online
4. Providing the infrastructure and support within which e-education can operate
5. Planning and managing e-education.

Rumble notes that cost studies in these areas are few; in the area of e-administration within education, he found none. Furthermore, he notes that none of the studies comprehensively identify overhead costs (Rumble, 1997).

Ling, Inglis and Webster (1999) discuss costing flexible learning, providing useful comparative costing analysis between on-campus and off-campus learning and teaching environments. Further studies on the subject of costing online learning and considering the cost benefits by Daniel (1996, 2003), Mason (1998), Bacsich (1999), Jewett, Finkelstein, Frances, and Scholz (2000), and Bates (1995) posit a major economic argument in favor of distance learning that produces graduates cheaper than from a conventional institution.

E-learning based on advances in innovative technologies has the inherent capability to cope with the future escalation of global higher education, and implies the adoption of a new educational paradigm where students are empowered with teachers as advisors. There is no longer one answer, but the construction of collaborative and culturally appropriate understanding of meanings and knowledge. Universities in transition

to a new paradigm need to think beyond their current norms, structures and processes, and cannot afford to withstand too many stories of institutional failures.

Changing Teacher Roles

It is the teaching profession that faces some of the greatest challenges in future higher education as teacher roles change. In 1982, Dede made a prognosis for education, suggesting a new model of teaching and learning with new teacher roles, new teacher skills, new pay scales that will be fundamentally different from the last 100 years, and it will almost be a completely new profession. He has proved to be significantly prophetic.

In a world where communications and information technologies impact on all our endeavors, universities intent on meeting the challenges of innovative technology will need to invest in staff who have the skills of designing student-centered learning in new technological environments. Many of these technologies are already emerging, providing alternate loci of learning, not to replace the conventional classroom, but as its complement.

Emerging Applications on the Wings

Virtual classes use mobile phones and laptops to link with students from anywhere at anytime and in different time zones, everyone viewing the same power points and audio and video clips during the synchronous interaction, making it possible for communication between teachers and students independent of place. Eliminating building maintenance, transportation systems and the support infrastructures that bring people to them can mean that costs go down.

3G mobiles are used as accessories in handbags, around the neck, waist or wrist watches, where students send each other pictures of where they are and what they are doing, often with far greater familiarity and sophistication than their

teachers in the new cellular, digital environment. In the real world, learners are going to have to use this technology as they apply the knowledge gained from teachers to the problems they will encounter in the real world.

Information technology continues to shrink and become part of the environment. The race is on to develop the first nanofactories to introduce nanodevices in diagnostic and clinical medicine in the next 10 years. MIT has a research institute for applying nanotechnology to military purposes. It is argued that nanotechnology in higher education could introduce a future where students and teachers wear the kind of nanodatasuits that Drexler (1990) describes, where billions of interlinked nanocomputers and nanotransceivers are embedded in the fabric of people's clothes. Dressed in such smart clothing, students could step into a virtual class as they would a conventional class, only it would be a fully immersive and sensually realistic experience that improves on the conventional classrooms that students have known for the last 4,000 years. Rather than the classroom being a staid four-walled room, it could be the subject of the class--a volcano, the eye of a hurricane, a diseased heart, a Parisian catwalk or a performance of Hamlet in the Globe Theatre.

HyperReality

Some technological applications are emerging that would allow wraparound, immersive, collaborative and distributed learning, replicating the communications functions of a conventional classroom where teachers help learners to apply knowledge to problems in culturally appropriate ways.

Smart suits would give entry to HyperReality. HyperReality is the brainchild of Nobuyoshi Terashima, at Waseda University Japan. Between 1986 and 1996, Terashima led a team that developed a form of distributed virtual reality for teleconferencing he called Telesensation (Terashima, 1993). The technology allowed people who were

physically present in different places to meet as telepresences to work together on a common task. Something similar was developed in the U.S. by Jaron Lanier, who calls it Tele-immersion (Lanier, 2001). Revising the concept in 1996, Terashima began working on the idea of a spatio-temporal field of communication that makes connection not only between the real and the virtual, but also between artificial intelligence and human intelligence. He called this HyperReality (HR) (Terashima, 2001).

HR is the technological capability to intermix virtual reality (VR) with physical reality (PR) and artificial intelligence (AI) with human intelligence (HI) in a way that appears seamless and allows interactive communication. Two-dimensional (2D) images from one place can be reproduced in three-dimensional (3D) VR at another place. The 3D images can then be part of a physically real setting in such a way that physically real things can interact synchronously with virtually real things. It allows people not present at an actual activity to observe and engage in the activity as though they were present. The technology will offer the experience of being in a place without having to physically go there. Real and unreal objects will be placed in the same 'space' to create an environment called a HyperWorld (HW). Here, imaginary, real and artificial life forms and imaginary, real and artificial objects and settings can come together from different locations via information superhighways, in a common plane of activity called a coaction field (CF), where real and virtual life forms can work and interact together ... What holds a CF together is the domain knowledge (DK) that is available to participants to carry out a common task in the field (Terashima, 2001).

The HyperClass

The domain of knowledge in a CF could be the curriculum of a course in higher education that could be conducted in a HyperClass. A Hyper-

Class is a space where a conventional class is intertwined with a virtual class in such a way that virtual components can interact with physically real components. The components are people, objects and settings and the mode of interaction face to face (Tiffin & Rajasingham, 2003). The first experiments took place between Victoria University of Wellington in New Zealand and Waseda University in Japan in 1998. To the Japanese, the New Zealanders (as avatars) were virtual and to the New Zealanders, the Japanese (as avatars) were virtual. In other words, whether the participants were virtual or real depended on where they were in relation to each other. It was a form of teleconferencing where the avatars, the setting and the objects of study were 3D and virtual objects could be handled by, modified collaboratively and passed between the virtual and real people, allowing learning to take place in consonance with the learners' own cultural milieu. Although HR has still some way to go, the rate of development, particularly the increasing computer processing power and speed, suggests that in the future there will be no technological limitations to the number of centers and countries that can be linked together in a HyperClass.

Terashima's concept of HR, unlike Lanier's concept of Tele-immersion, has a further dimension. It is also a place where AI can interact with HI and enables artificial life developed in VR to cross into the physical world. So far, AI has developed logical-numerical intelligence that can be applied in clearly defined domains. This is why it is so readily adaptable to the HR device of a CF and to the paradigmatic nature of university subjects. Wherever knowledge can be expressed as a closed system with clearly defined rules and procedures, AI can be applied.

Just-in-Time Artificially Intelligent Teachers (JITAITs)

Vygotsky (1978) postulates that when a learner finds he or she cannot solve a problem by them-

selves, a Zone of Proximal Development (ZPD) opens. It is the role of the teacher to close that ZPD as quickly and effectively as possible, and hence the critical need to have interactive communication between student and teacher. However, today human teachers can only respond immediately to a learner during working hours and if there is only one student seeking help. In large classes, student questions have to wait until a teacher is available. In higher education, much learning is done asynchronously and students get feedback on an assignment a week or more after doing it. This is hardly an efficient way to close a ZPD. Most students have forgotten the things they found difficult. It is time for the JITAIT. As the name implies, this is an AI teacher that can be available whenever and wherever a student needs help (Tiffin & Rajasingham, 2003).

JITAITs are expert systems, effective where the domain of knowledge they address is restricted, paradigmatic and orientated toward problem solving. A JITAIT can, therefore, be an expert teacher on a subject that formed the domain knowledge of a CF in HR. JITAITs would always be ready to help any learner in the CF and would improve from each encounter with a learner, provided it received feedback from a human teacher. JITAITs could take over low-level repetitive student-teacher interactions, such as spelling and grammar checks that today are a standard component of computers, and frequently asked questions (FAQs).

JITAITs could also act as personal teachers to individual students. They could search for information, keep track of a student's individual program of study and help organize learning activities. Interlinked intelligent agents that manage schedules, meetings, e-mail and workflow are already used in office systems. The Web-based organization of programs of study taking place in universities around the world provides a framework for such a development. JITAITs could have avatar form and a personality and act as a guide and mentor in the manner of the servant-tutor pedagogues of ancient Greece, or the paper clip

wizard that today pops up when not needed (or when it is needed, it is less than useful and more of an irritating distracter). But it does not mean that in the future, these agents will not become more intuitive and intelligent.

JITAITS in the Levels of Teaching

Teaching has three hierarchical levels. Lower-level activities consist of marking those parts of tests, exams and assignments that have set answers, collating marks, registering attendance and managing class schedules. Such automatic activities could be computerized to leave teachers to teach.

The middle level is that of tutoring. It is where teachers interact with students to guide their learning. It involves listening to students, comprehending the difficulties they have in mastering a subject and its application, eliciting performance, explaining and demonstrating, monitoring student practice, marking assignments, tests and exams where answers are open ended, providing detailed feedback and answering student questions. This takes up teaching time and keeps student-teacher ratios down, because it involves one-on-one or small group communications, as much of the work at this level needs human understanding, although much is very repetitive. Each intake of students asks the same questions and has the same problems, and wherever this is the case, a JITAITS can be used. So the second level could be shared between human and AI tutors. As time went by and JITAITS handled more and more FAQs, their role would increase and the student-teacher ratio could be progressively increased without lowering standards.

The upper level of the hierarchy is that of the subject specialist, the professors and professionals who have achieved academic stature through research, publications and experience and can arbitrate on content. Their primary purpose is to communicate a synthesis of the subject matter in a way that brings it up to date, places it

in context and encourages students to question. They do this by lecturing. In the U.S., it is common in large universities to have such a person supported by a team of teaching assistants who do the tutoring, leaving the professor to lecture to very large classes. With e-learning, the professors could stream their lectures to the whole world, and there need be no limits to the numbers who could attend. Instead of being salaried employees, professors who could attract such numbers would be valuable property. They could relate to their universities in the way authors relate to their publishers (Katz, 1999), receiving royalties for each student taking their program.

Croquet

This is another potentially useful application. The need for designing a more responsive, collaborative, online, global, virtual university environment led Julian Lombardi and his team in the division of information technology, University of Wisconsin – Madison to develop Croquet. A multi-user 3D environment, it is a multi-institutional initiative under development at the Universities of Wisconsin – Madison, Minnesota, Kyoto and the Hewlett Packard Research Labs. Croquet is an ‘overlapping windows’ computer interface and represents the next step beyond today’s desktop computer interface; and unlike HR, which today is dependent on proprietary software, Croquet capitalizes on open-source programming language and advanced networking capabilities available in university campuses.

According to Lombardi, the aim is a learning environment for spontaneous interaction between cross-disciplinary and cross-institutional communities of practice. Within the Croquet environment, faculty, staff and students of the participating institutions will be visible to one another (as digital avatars) and able to move quickly and seamlessly among multimedia learning resources, including 3D models, whiteboards, Web pages, video

footage, flash animation, simulations, streaming video, television broadcasts and PowerPoint presentations. As in a traditional face-to-face classroom, learners will see one another 'handling' learning objects and resources, and support each other with real-time feedback. Croquet is scheduled to be commercially available in 2007 (Lombardi, 2004).

The Research Function

Another universal of higher education—the creation, dissemination and application of knowledge—is its research function that defines the nature of higher education, whatever the medium used. This is an important function of universities, to grow the economy, lift the level of innovation and help understand social needs.

Learners enter higher education from a basic educational system in which the knowledge they learn to apply is approved and sanctioned by society. However, when learners leave higher education systems and apply the knowledge they have learned to real-life problems, they discover the difference between practice and theory. A universal of higher education is learning to question received knowledge and endlessly re-address it in search of a better way. According to Tiffin and Rajasingham (2003) without this process, knowledge becomes dogma and formulaic, and education becomes training.

The essence of teaching in higher education is to encourage questioning of the knowledge paradigm. It is why higher education should be linked to research and why a JITAiT could never replace a human teacher or professor. A JITAiT can respond to FAQs and assess assignments that already have answers, but it does so from within the logic of the paradigm. A JITAiT would not be able to deal with the contradictions that arise from problems that do not fit the knowledge paradigm. It requires a human with an open, critical mind to cope with the paradox in knowledge.

Will an institute of higher education in an e-learning environment that grows increasingly dependent on JITAiTs be able to cope with the questing nature of knowledge? If a JITAiT encounters a new question from a student that it cannot answer, it passes it on to a human teacher who, in effect, programs the JITAiT to answer such a question in the future. If, however, the human teacher cannot answer the question, then he or she passes it to the content specialist; and if the specialist cannot answer, there is a basis for research. Such a system would allow interesting questions of our times to emerge, and generates the need for further ongoing research.

CONCLUSION

Higher education takes place in a communication system where mature learners and teachers interact so learners can apply knowledge to problems and question what they are doing. The technology that makes this communications possible is changing, and will continue to change. What will not change is the interactive communication process of higher education, where we will continue to explain, demonstrate, question and set problems, and we will do this by talking and writing, as we have been doing since the days of Pythagoras, Socrates, Confucius and Buddha.

However, within the framework of the Sloan-C Five Pillars for Quality Online Education, it is argued that e-learning in higher education has the capability to make higher education more efficient, more cost effective and more accessible, and increase student and staff satisfaction, offering a paradigm shift beyond current norms and processes. But will it improve the way we learn and teach? Just as doctors seek to understand what causes disease, educators have yet to understand what causes learning. Until we have such knowledge, we need to continue the old way of doing things face to face that has worked since

classes were held in caves. E-learning in higher education will need to find an optimum mix of the old and new.

No matter how sophisticated and multimediated the virtual class, learners still strive for the soft touch of the tangibly real. Both HR and Croquet, and other technological applications yet to emerge, have the potential to signal a new paradigm of education that resonates with the Sloan-C Five Pillars for Quality Online Education for effective e-learning appropriate for the multicultural, networked global knowledge society of the 21st century.

This chapter is predicated on continued technological advances, particularly broadband infrastructures that, in many countries, are still some way into the future. But as Robert Austin and Stephen Bradley argue in their article in the Harvard Business Review, *The Broadband Explosion: Thinking about a Truly Interactive World* (2005), when true broadband arrives, everything will change – work, play and society. Education will not be an exception. The higher education paradigm has already begun to shift.

REFERENCES

- Austin, R., & Bradley, S. (2005). The broadband explosion: Thinking about a truly interactive world. *Harvard Business School Working Knowledge*, September 12.
- Bacsich, P. (1999, October 25-27). Planning and costing virtual universities. Proceedings of the Euro-Med Conference on Technology in Learning Environments, Tel Aviv.
- Bates, A. (1995). *Technology, open learning and distance education*. London: Routledge.
- Daniel, J. (1996). *Mega-universities and knowledge media: Technology strategies for Higher education*. London: Kogan Page.
- Daniel, J. (2003, November 7-9). *Mega-universities: Mega-impact on access, cost and quality*. First Summit of Mega-Universities, Shanghai, China. Retrieved September 11, 2005, from http://portal.unesco.org/education/en/ev.php-URL_ID=26277&URL_DO=DO_TOPIC&URL_SECTION=201.html
- Daniel, J. (2004, June 9). *The sustainable development of open and distance learning for sustainable development*. Proceedings of the Commonwealth of Learning Institute Strategies for Sustainable Open and Distance Learning, Canada. Retrieved September 9, 2005, from www.col.org
- Drexler, E. (1990). *Engines of creation*. London: Fourth Estate.
- Drucker, P. (1999). The shape of things to come. In F. Hesselbein & P. Cohen (Eds.), *Leader to leader: Enduring insights on leadership from the Drucker Foundation's award winning journal*. San Francisco: Josey-Bass.
- Drucker, P. (2000, May 15). Putting more into knowledge. *Forbes Magazine*, 165, 84-88.
- Encyclopedia Plus of World Problems and Human Potential* (4th ed.) [CD ROM]. (1996). Union of International Associations. Munchen; New Providence; London; Paris: K.G. Saur.
- Foucault, M. (1970). *The order of things*. New York: Pantheon House.
- Hanna, D. (2002). Building a vision for the future: Choices, challenges and leadership for universities. *Oxford Roundtable*. Oxford: Oxford University.
- Jewett, F., Finkelstein, M., Frances, C., & Scholz, B. (2000). *Estimating the cost of courses, interpreting the results, drawing conclusions*. American Council on Education: Oryx Press.
- Katz, R. N. (1999). Competitive strategies for higher education in the information age. In R.N.

- Katz & Associates (Ed.), *Dancing with the devil: Information technology and the new competition in higher education*. San Francisco: Josey Bass.
- Kelly, K. (1998). *New rules for the new economy: 10 radical strategies for a connected world*. New York: Penguin.
- Kuhn, T. S. (1962). *The structure of scientific revolutions*. Chicago: University of Chicago Press.
- Kuhn, T. S. (1977). Second thoughts on paradigms. In *The essential tension: Selected studies in scientific tradition and change*. Chicago: University of Chicago Press.
- Lanier, J. (2001). Virtually there. *Scientific American*, April 1.
- Ling, P., Inglis, A., & Webster, L. (1999). *Costing flexible learning*. Retrieved September 15, 2005, from www.celts.monash.edu.au/assets/other/costing-flexible-learning.pdf
- Liu, N.C. & Cheng, Y. (2005). *Academic ranking of world universities – Methodologies and problems*. Institute of Higher Education, Shanghai Jiao Tong University. Retrieved September 12, 2005, from <http://ed.sjtu.edu.cn/rank/file/ARWU-M&P.pdf>
- Lombardi, J. (2004, November 18). Croquet. Interview with author. Madison: University of Wisconsin, Information Technology Division. Retrieved December 1, 2004, from www.open-croquet.org
- Lorenzo, G., & Moore, J. (2002). *Five pillars of quality online education*. The Sloan Consortium Report to the Nation. Retrieved September 8, 2005, from www.sloan-c.org/effective/pillar-report1.pdf
- Mason, R. (1998). *Globalising education: Trends and applications*. London: Routledge.
- Newman, J. (G. Sampson, Ed.). (1902). *Newman's university sketches*. London: The Walter Scott Publishing Co. Ltd.
- Newman, J. (1996). *The idea of a university*. New Haven: Yale University Press.
- Peacock, A. (2001). How necessary are universities? In F. M. Turner (Ed.), *Journal of the Institute of Economic Affairs*, 21(3), 6-11.
- Poley, J. (2000). Global access to learning: Gender, poverty, and race. In D. Hanna (Ed.), *Higher education in an era of digital competition: Choices and challenges* (pp. 239-255). Madison: Atwood Publications.
- Poley, J. (2000). Leadership in the age of knowledge. In D. Hanna (Ed.), *Higher education in an era of digital competition: Choices and challenges* (pp. 165-181). Madison: Atwood Publications.
- Potashnik, M., & Capper, J. (1998). *Distance education: Growth and diversity*. Washington: World Bank. Retrieved June 12, 2004, from www.worldbank.org/fandd/english/0398/articles/0110398.htm
- Rayport, J., & Sviokla, J. (1994). Managing in the marketplace. *Harvard Business Review*, November-December, 141-150.
- Rumble, G. (1997). *The costs and economics of open and distance education*. London: Kogan Page. Retrieved September 15, 2005, from www.iec.ac.uk/resources/e_education_costs.pdf
- Terashima, N. (1993, December 10). *Telesensation – A new concept for telecommunications*. Proceedings of the TAO First International Conference on 3D Images and Communications Technologies, Tokyo.
- Terashima, N. (2001). Definition of HyperReality. In J. Tiffin & N. Terashima (Eds.), *HyperReality; Paradigm for the third millenium*. London: Routledge.
- Tiffin, J. (2004, November 17). *E-learning in higher education: Toward realizing the vision*. Keynote address to the National Institute of Multimedia Education (NIME), Tokyo.

Perspectives on 21st Century E-Learning in Higher Education

Tiffin, J., & Rajasingham, L. (2003). *The global virtual university*. London; New York: Routledge.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

This work was previously published in Integrating Information & Communications Technologies in the Classroom, edited by L. Tomei, pp. 289-306, copyright 2007 by Information Science Publishing (an imprint of IGI Global).

Chapter 8.8

RFID: New Technology on the Horizon for IT Majors

Eric Puffenbarger

James Madison University, USA

Faye P. Teer

James Madison University, USA

S. E. Kruck

James Madison University, USA

ABSTRACT

Educators have an ongoing challenge as they strive to stay up-to-date with new technology. One emerging technology, RFID (radio frequency identification) tags, has the potential to impact information systems in businesses as well as in our lives. Educators responsible for planning curriculum need to consider how to incorporate topics pertaining to RFID technology into a wide variety of technology courses. Therefore, one purpose of this manuscript is to give curriculum planners and teachers a summary of RFID by: presenting an overview of RFID technology; exploring RFID limitations and possible solutions; and examining the future outlook of RFID. An additional purpose further assists educators in

considering how to incorporate this new course topic into the curriculum by providing some teaching resources, objectives and suggestions pertaining to RFID.

INTRODUCTION

Today's educators need to have a fundamental knowledge of a wide variety of evolving technology. It has been stated that teachers need to "cross-fertilize ideas across technology and research domains" (Kalles & Papagelis, 2006). To accomplish this, educators need to continually scan the horizon for developing technology.

One such emerging technology is RFID (radio frequency identification) tags. RFID tags are

small, wireless devices that help identify objects, animals, and people.

RFID is just one part of the fast evolving telecommunications industry. Some educators have indicated that it is important for information technology students to learn more about the field of telecommunications (Choi, Teer, & Teer, 2005). As new course material is considered, either for introductory IT (information technology) courses or more specific upper level IT courses, it is important for educators to learn about RFID and determine if some course coverage should be devoted to RFID.

One purpose of this manuscript is to give curriculum planners and teachers a summary of RFID by: presenting an overview of RFID technology; exploring RFID limitations and possible solutions; and examining the future outlook of RFID. An additional purpose is to provide teaching resources, objectives, and suggestions pertaining to RFID. Hopefully, this will further assist educators as they consider how to incorporate this new course topic into the curriculum.

OVERVIEW OF RFID TECHNOLOGY

RFID is a type of automatic identification similar to bar codes. The difference between the two is that in RFID systems, an electronic device uses radio frequencies to communicate, whereas bar codes require line-of-sight scanning. For example, these tags can be used to track objects in supply chains and can even be found in the pockets, belongings, and bodies of consumers.

There are two types of RFID tags currently being used, UHF (ultra high frequency) and HF (high frequency). Tags can further be classified as active, semi-passive, and passive. Active tags are the most expensive and contain an internal power source; passive tags are powered by external radio signals; semi-passive can function either way. RFID tags are given a unique EPC

(electronic product code) and are installed with a transponder and digital memory chip. In addition to the EPC, the data contained within each tag may provide identification, location information, or product specifications.

The RFID system includes an electronic reader which enables data transmitted from tags to be read, stored, and eventually processed. The reader communicates with a host computer that runs software called middleware, which connects the data to specific applications. Readers are essentially a type of interrogator that use an antenna packaged with a transceiver and decoder. The reader sends out a signal that activates or “wakes up” a corresponding RFID tag which transmits its unique EPC code. Data can then be read from or written to the tag.

RFID tags are available in a variety of shapes and sizes, most of which are extremely small. RFID has made considerable progress recently with advancements in the technology, lower costs, and smaller tags. RFID systems have emerged as a practical auto-ID platform in industries as varied as automobile manufacturing, microchip fabrication, and even cattle herding (Weis, 2003). In some medical facilities, RFID tags are being used to double and triple check that the patient in the operating room is having the correct operation (Martin, 2005). RFID tags have also been used in disaster victim identification after the tsunami catastrophe in December 2004 (Meyer, Chansue, & Monticelli, 2006). Additional applications include the use of RFID to detect human activity. For example, an iGlove can track the objects grasped by the wearer. The iBracelet also tracks human activity and was found to be more aesthetically and ergonomically preferred to the glove (Smith et al., 2005). Current news articles indicate that RFID is being implemented in the areas of manufacturing and supply chain management (Loebbecke & Palmer, 2006). However, there are still several issues that are preventing RFID tags from becoming more prominent in today’s businesses and eventually replacing bar codes.

RFID: LIMITATIONS & POSSIBLE SOLUTIONS

Present limitations of RFID are primarily issues pertaining to security, privacy, and technology. In this section, these limitations will be explored and some possible solutions will be examined.

Security Issues

Security is one area of concern that is preventing the widespread adoption of RFID tags. Without the proper controls in place, private information could be stolen from products or other items containing RFID tags. Since most tags are passively powered and rely on wireless networks, they are open to attacks, which in some cases could be easier than picking someone's pocket. Security breaches to RFID tags could include physical attacks, counterfeiting, spoofing, eavesdropping, tracking, or denial of service (DoS). Any of these attacks would have a serious negative impact on a company as well as individual customers.

Security issues with RFID systems will first be analyzed by examining three main factors: availability, integrity, and confidentiality. These three pillars of security are referred to as the security triad (Glover & Bhatt, 2006).

Availability pertains to the system's uptime at the appropriate performance level or the amount of time that the system is available. Most system administrators would obviously prefer 100 percent availability, but there are various threats that negatively impact uptime. Poorly designed architectures are usually the most common reason for reductions in uptime. However, DoS attacks are another concern. This type of assault could occur when a criminal with the right tools and technology decides to send out a jamming radio signal in an RFID system that renders tags and readers useless.

Integrity addresses the accuracy and authenticity of the data transmitted. Some of the data transmitted via RFID usually includes a

company's product and shipping information as well as customer data. Threats to data integrity include both accidental and malicious modification of the data in a system. An example of this type of attack is spoofing, which could occur when someone swaps the tag data for Product A with Product B data to gain some type of advantage.

Confidentiality relates to limiting the access of information to authorized personnel only. Private data about customers or company information involving inventory and supply chains could potentially be read or stolen by intruders. This also relates to the issue of privacy, which will be discussed later. All three of the factors in the security triad can impact each component of an RFID system from the actual tags to the enterprise information system.

RFID tag security is vulnerable because currently the data stored is plain text or unencrypted. Adding encryption requires more space on the tag that results in higher costs, increased processing time, and a larger chip, all of which increase the size of the tag (Glover & Bhatt, 2006). Also, tags can be removed or replaced unless there is some type of physical supervision for RFID tagged items. RFID tags essentially listen and respond to a signal no matter where it comes from or to where it is being sent. To demonstrate the ease of retrieving information from a RFID tag, a Netherlands security firm successfully decrypted a RFID enabled passport in about two hours (White, 2006). The security firm was able to access a digitized fingerprint, photograph, and all other encrypted and plain text data on the passport by cracking a very predictable algorithm for the tag's password. Authorities in the United States had plans to implement a similar type of RFID tag in all American passports during the fall of 2006, but have now had to rethink the situation.

In a research study involving humans, an RFID tag called VeriChip was placed under the skin of Annalee Newitz. Applied Digital's VeriChip was approved by the FDA (Food and Drug Administration) on October 13, 2004, for

medical purposes such as tracking patients and storing medical information (Reynolds, 2004). All of the data on the chip was read and copied in approximately two hours, giving access to all of Newitz's medical records and as well as other private data (Kuchinskas, 2006). This VeriChip would be subject to all the same issues as a product RFID tag and more.

RFID readers are also susceptible to attacks due to the fact that they are normally connected to an internal ethernet using either wireless or wired connections. Again, data that travels from tags to the reader is not encrypted and the tags that are being read are not authenticated by the reader. For these reasons RFID readers are vulnerable to spoofing, DoS, and protocol attacks. Basically, anyone who is connected to the same network, has access to a wireless sniffer device, and possesses a basic knowledge of RFID reader protocols could carry out such an attack. Other problems exist when readers experience a collision. This can happen when the coverage areas of two different readers overlap causing interference with one another (Lahiri, 2005). Similarly, the presence of another wireless network in close proximity can interfere with RFID readers.

Potential solutions to the threats facing RFID readers include: (1) encrypting the data; (2) requiring authentication and authorization before allowing access to a reader's services; (3) establishing a proper authentication process between tags and readers; (4) setting up proper security at wireless access points; (5) strict physical access control to the company's buildings; (6) installing surveillance to monitor merchandise tagged with RFID, (7) using rewritable tags only when appropriate; and (8) installing protection from Internet attacks using firewalls, intrusion detection systems, network sniffers, and better anti-collision protocols. Collisions can also be somewhat solved with TDMA (time division multiple access) algorithms, which instructs each reader to read at different times or intervals (Lahiri, 2005). However, this would also require an intelligent

filtering system to prevent tags from being read more than once.

The RFID service bus is another area susceptible to attacks. The service bus contains all middleware components such as the object naming device, EPC event manager, EPCIS server, and the RFID integration server. Middleware essentially allows communication between the data being read and the corporate information system. Threats to this area would most likely be in the form of corporate spies, espionage agents, and intruders. With the right tools, they could gain access to key company information, trade secrets, and other private data that could potentially cause harm. To solve RFID service bus security problems, companies need to seriously consider controlling access to the network using firewalls, intrusion detection systems, and network sniffers. It would also be a good idea to set up a security infrastructure that will define which network users will be authenticated.

Additional help in providing the needed security infrastructure can be provided in the future by standards organizations. For example, EPCglobal, an international standards organization, maintains an EPC database, which identifies manufacturer, product, version, and serial number. Other functions performed by EPCglobal include providing middleware specifications for data exchange and administering the object name service for matching an EPC to information about the associated item. EPCglobal is currently working on specifications to secure EPCIS communications as well (Claburn & Hulme, 2004).

Finally, EIS (enterprise information system) security flaws have to be addressed. This system includes corporate assets such as the directory, identity management, access control, messaging systems, and a database that uses RFID data. RFID systems generate large amounts of transaction data. Companies utilizing RFID will be storing large volumes of potentially sensitive information that could overwhelm the existing network. As a result, this leaves the system open to intruders,

corporate spies, and pranksters. For example, if business sales and or inventory information was stolen it could result in huge financial losses. Plausible solutions include adequate network access control and physical access control to corporate premises. As RFID technology continues to improve, prices will probably drop allowing security methods to become more affordable.

Privacy Issues

Privacy is the right to be left alone when you want to be (Warren & Brandeis, 1890), to have control over you own personal possessions, and not to be observed without your consent (Haag, Baltsman, & Phillips, 2005). Certain types and uses of RFID tags definitely impact privacy (Peslak, 2005). The Pentagon, for example, plans to use RFID to track physical objects; such use raises relatively modest privacy concerns. The San Francisco Library would like to put RFID chips in its books, raising the specter of third parties being able to track our reading choices.

Even more troubling are proposals to put RFID chips into government issued identity documents (RFID Technology, 2004). The main concern is that this new technology will lead to the tracking of consumers and possible exposure of private information. Consumer information could be queried by marketers for the purpose of delivering personalized ads.

Further along the continuum of privacy concerns would be thieves using RFID technology to commit identity theft. Eventually, everyday products could be numbered, identified, cataloged, and tracked wherever readers are present (Flint, 2006). RFID tags could also end up inside many types of personal documents like driver's licenses, passports, diplomas, and similar documents (Granneman, 2003). Currently, there is no law requiring that product labels indicate the presence of an RFID tag. The current privacy gap with RFID tags exists because market penetration is moving faster than policy (Kuchinskas, 2006). Those who purchase RFID tagged merchandise, have RFID implants, or other tagged items could

Table 1. RFID privacy concerns (Glover & Bhatt, 2006, p 202)

| RFID Characteristic | Privacy Concerns |
|--|---|
| <ul style="list-style-type: none"> No line of sight RFID tag is read just by being in close proximity to reader | <ul style="list-style-type: none"> Unauthorized person can read your RFID-tagged items from safe distance Most consumers will not be aware of the tags or that the items are being tracked |
| <ul style="list-style-type: none"> Item-level tracking RFID tags have higher information storage capacities than most bar codes RFID tags may include a serial number Manufacturers and retailers can track items at an instance level Provides companies with a valuable tool for tracking and managing inventories, sales data, and other product information | <ul style="list-style-type: none"> Can potentially be used to identify unique individuals with the objects purchased The capability to track goods at item level, associate them with individuals, and then be able to automatically locate them in public places causes the most concern among privacy advocates |

be unknowingly exposed to readers, identified, and singled-out. Table 1 summarizes some RFID privacy concerns.

Many steps are being taken to protect consumer privacy. However, there is a delicate balance between satisfying the privacy-rights advocates and meeting the needs of the business world trying to fully benefit from RFID technology.

In the United States, government legislation regarding RFID privacy has been introduced in many states, but has failed in the majority of cases. Most of these bills will almost certainly be revised and reintroduced in the near future. Two notable bills were the RFID Right to Know Act of 2004, introduced by Missouri Senator Maida Coleman, and a California bill known as SB1834. The RFID Right to Know Act requires that any items with RFID tags have to be packaged with a clearly visible label notifying customers of the tag. SB1834 restricted the use of RFID tags and readers to relating only to product information; thus, customer identification is not utilized. SB1834 required that RFID be studied more carefully before being used in government issued ID cards (Torrieri, 2006).

The E.U. data protection laws require any data that can be directly identified to an individual be subject to Data Protection Directive (95/46). This directive includes several requirements: collection when only necessary and relevant; retention for only as long as necessary; and informed consent, which means a label must include details of how the information in the RFID tag will be used and instructions to the consumer how to disable or remove the tag. (Archer & Salazar, 2005).

There have also been numerous RFID privacy guidelines released by various organizations. For example EPCglobal has set the following guidelines (Glover & Bhatt, 2006, p 205-206):

- **Consumer Notice:** This guideline requires that consumers be given a clear notice of the

presence of EPC tags on products or their packaging. This notice will be given through the use of an EPC logo or identifier on the products or packaging.

- **Consumer Choice:** This guideline requires that consumers be informed of their choices to discard, remove, or disable EPC tags from the products they acquire. It is anticipated that for most products, the EPC tags will be part of disposable packaging or will otherwise be discardable.
- **Consumer Education:** Consumer education is key to dispelling some of the myths about RFID's benefits, capabilities, and limitations. EPCGlobal, working along with its member companies, will strive to provide consumers with the opportunity to obtain accurate information about RFID and its applications, as well as information about advances in the technology.
- **Record Use, Retention, and Security:** The EPC should not contain, collect, or store any personally identifying information. As with conventional bar code technology, data associated with an EPC will be collected, used, maintained, stored, and protected by the EPCGlobal member companies in compliance with applicable laws. Companies will publish, in compliance with all applicable laws, information on their policies regarding the retention, use, and protection of any personally identifying information associated with their use of EPC.

Dr. Garfinkel, of MIT, introduced a set of RFID privacy policies in 2002 to protect consumers, which he titled the "RFID Bill of Rights" (Glover & Bhatt, 2006). In the bill, he outlined several guidelines similar to those released by EPCglobal. Well-established organizations, such as CASPIAN (Consumers Against Supermarket Privacy Invasion), the ACLU (American Civil Liberties Union, Privacy International, METI (Ministry of Economy, Trade, and Industry), and

EPIC (Electronic Privacy Information Center), among others, have all played a part in attempting to enact legislation regarding RFID technology.

Measures to protect privacy can also be implemented by companies themselves by taking advantage of technological advancements. The simplest and most appealing way is to use kill commands or killer tags introduced by EPCglobal. They allow customers to request that RFID tags on purchased items be disabled or killed by the retailer before leaving the store or business location. Basically, a command is sent to the tag ordering it to render itself useless, thereby protecting consumers from unauthorized identification or tracking. On the other hand, this limits the usefulness of the technology to the point of sale and it could mean longer waiting times if customers decided to have all purchased items disabled. Another method is to use blocker tags developed by RSA Security. A blocker tag is a special type of RFID tag that prevents unwanted scanning of tags (Juels, 2005). Blocker tags work by passively jamming RFID readers, thus preventing other tags from being read. A potential drawback is that blocker tags could cause problems with individuals attempting to commit robberies by hiding products at check-out lines. Screaming tags could also be used by consumers which send out a strong signal burst to prevent other tags from being read.

Technology Issues

Several problems exist with the actual RFID technology. It is still an immature technology that is in the early adopters phase. Rapid upgrades are occurring, but this can also act as an inconvenience to businesses. Tags can be damaged or destroyed under current handling techniques; defective tag rates can be as high as 20 percent (Lahiri, 2005). RF-opaque and RF-absorbent materials can cause the technology to fail. For instance, if an RF-absorbent substance like water interferes with a tag or if an RF-opaque material, such as metal is tagged, a reader may fail to read the

tags. Radio frequencies also cannot pass through another human, which could create problems in high traffic areas. Another limitation for tags is they can easily be affected by environmental factors and surrounding conditions. If RFID tags get wet, they could be disabled or at least have their functionality damaged. UHF tags are currently being used mostly for warehouse supply-chain tracking and HF tags are used for item-level tracking (Schuman, 2006). UHF will start to replace HF tags at item-level, but if they continue to experience error rates a seesaw effect could be created between the usage rates of UHF and HF RFID tags.

RFID readers can be affected by the presence of an additional wireless network or by noise created from nearby electric motors. Incorrect hardware setup such as a wrong antenna placement could cause failure as well (Lahiri, 2005). Only a few tags can be read per second and, as mentioned earlier, readers can experience collisions. Universal RFID technology standards are not in place; therefore, you can have the same type of tags from different vendors perform differently. There does not seem to be a reliable timetable for when the standards issue will be resolved. It is a learning process and there are still not many RFID experts. Business owners should stay patient and when necessary, seek the guidance of consultants that have experience with RFID systems.

Presently, old-fashioned barcodes continue to provide greater stability to businesses. About five billion barcodes are scanned everyday and, with more than 50 existing standards, barcoding is the most widely deployed technology in the world (Lahiri, 2005). Furthermore barcodes cost less, have better accuracy rates, can be placed on almost any material, do not threaten privacy, and are secure. Nevertheless, as RFID technology continues to evolve, business people can research the benefits that an RFID system could provide and determine the technology that works best for a particular application.

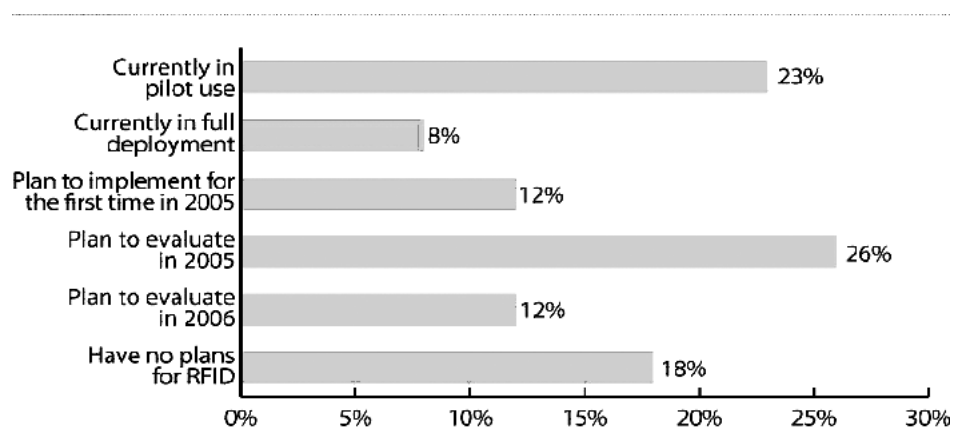
Cost is usually the most common reason cited for not using RFID technology. Tags are priced around 20 cents or more depending on the type and features. This price must drop below five cents and in most cases as low as one cent before most businesses will accept it. When comparing the cost of RFID with barcodes, there are many significant differences. Barcode readers generally cost less than \$400, while RFID readers can sometimes exceed \$800. Installing an RFID system would also involve the time consuming and costly tasks of restructuring the IT infrastructure, training personnel, and educating customers. A survey conducted by AMR Research has shown that RFID in 2005 had an average budget of more than \$548K and could increase to \$771K by 2007 (Reilly, 2005). Furthermore, RFID systems are very complex to design and implement. As RFID technology improves, prices should continue to drop. Business managers should set a price threshold at which RFID becomes a realistic technological solution; next, they should reevaluate the current situation when this price threshold is reached.

FUTURE OUTLOOK

The major push towards adopting RFID technology came when both Wal-Mart and the Department of Defense issued mandates requiring that their top 100 suppliers begin using RFID tags in shipments (Brewin, 2003). Wal-Mart underestimated many of the problems with RFID, such as the cost, and as a result deadlines were not met (Feder, 2004). Wal-Mart and other corporations continue to test various RFID tracking systems. Examples of these trials include Benetton tracking apparel, Gillette tracking consumer packaged goods, Michelin tracking tires, the European Central Bank tracking paper currency, hospitals tracking patients and personnel, and payment systems like Exxon Mobil's SpeedPass™ (Electronic Privacy Information Center, 2006). Ford Motor Company's use of RFID in their Dearborn plant was very successful. Ford is currently planning to implement RFID technology in four additional plants (Hamblen, 2006).

Eventually RFID tags will be placed in objects not just to store and track information, but to

Figure 1. RFID deployment survey (Reilly, 2005)



Q. Which of the following best describes your state of RFID technology deployment? (n=496)

make those objects smart, more useful, easier to maintain, and easier to recycle (Roberti, 2006b). Thus, as new applications for RFID are created, new business opportunities will flourish. These types of applications could be smart shelves that know all of their contents courtesy of internal RFID readers or smart refrigerators that work in a similar fashion.

Over the next year or two we can probably expect to see key advancements being made in RFID technology, falling prices, and agreeable standards and protocols being passed. As that happens, RFID's place in our society will start to take shape. Research has indicated that some companies are re-examining the use of barcodes and may implement RFID tags where they are cost-effective and make the most sense (Eschinger, 2005; Reilly, 2005; Roberti, 2006a). AMR Research surveyed 500 companies in order to assess the RFID market from 2005 through 2007 (Reilly, 2005). At the time of the AMR Research survey, 31 percent of the respondents were in full deployment or in pilot use of RFID. Twelve percent responded that their company planned to implement RFID in 2005; 26 percent said their company would evaluate RFID in 2005; and 12

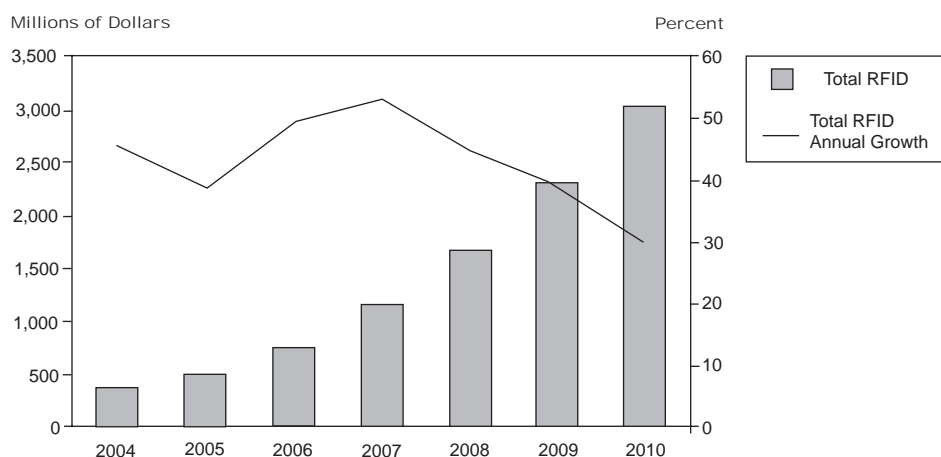
percent said their company would evaluate RFID in 2006. The results of the AMR Research survey are presented in Figure 1. A Gartner research reports states that in 2007 there will be a 50 percent annual growth in RFID sales (Eschinger, 2005). This is illustrated in Figure 2.

IMPLICATIONS FOR EDUCATORS

Because of the high cost of deployment and the impact on existing IT infrastructures, it seems that in the past users have been reluctant to adopt RFID (Webster, 2006). Even though RFID still has many limitations to be addressed, some have predicted that 2007 will be the year that RFID technology takes off (Eschinger, 2005b; Roberti, 2006).

Recently Comp TIA (Computer Technology Industry Association) announced a RFID certification in an effort to develop the workforce and provide the industry with a standard for measuring employee competency in RFID technology (Certification Magazine, 2006). IT certifications, such as RFID certification, typically developed and administered by a manufacturer or a profes-

Figure 2. RFID, worldwide size and growth (Eschinger, 2005)



sional organization can have numerous benefits. Some of advantages include: acquiring knowledge and skills that allow individuals to move into a new area; gaining exposure to the latest software or technology; increasing an individuals level of expertise; and gaining the ability to contact and network with world-wide top-performing professionals in the field (Al-Rawi, Lansari, & Bouslama, 2005).

One of the hardest things for IT educators to do is to it stay current with evolving technology. As we examine and develop our curriculum and course content, we may find that it is time to integrate topics pertaining to RFID technology within the various technology courses we teach. Some universities have incorporated RFID into their curriculum with support from business while others will need to do this on their own (SAP Gift to IU Kelley School of Business enables hands-on experiences, 2004). Some universities may want to develop a stand alone RFID course. Such courses could be centered on concepts such as RFID's use in the supply chain or RFID's application in manufacturing systems. If the curriculum does not have room for a stand alone course in RFID, these topics can be incorporated into such courses as the introductory or an intermediate computer information systems course or a telecom course.

Teaching Resources

Educators need to learn more about this technology and develop teaching materials. Currently most of the available teaching reference material for RFID is in the form of (1) professional organizations, (2) books, (3) journals, and (4) Internet resources.

- **Professional Organizations:** The Wireless Communications Alliance has a special interest group for those interested in RFID and is located at http://www.wca.org/RFID_info.htm. The Colorado RFID Alliance is a non-profit organization dedicated to bringing together the RFID community in the eastern part of Colorado and is located at <http://corfida.org/>.
- **Books:** Numerous books were found on the topic of RFID. Information on these books is given in Table 2.
- **Journals:** There is only one refereed journal, The International Journal of Radio Frequency Identification Technology and Applications, which began in 2007 according to Ulrich's Periodical Directory.
- **Internet Resources:** While one has to be cautious about the credibility of the Internet resources, there are some excellent Internet sources on RFID. They are primarily tar-

Table 2. Books relevant to RFID

| Authors | Title | Year | Publisher |
|---------------------------------------|--|------|-----------------------------|
| Bhuptani, Manish & Moradpour, Shahram | RFID Field Guide: Deploying Radio Frequency Identification Systems | 2005 | Prentice Hall |
| Glover, Bill & Bhatt, Himanshu | RFID Essentials (Theory in Practice) | 2006 | O'Reilly |
| Graafstra, Amal | RFID Toys: 11 Cool Projects for Home, Office and Entertainment | 2006 | ExtremeTech |
| Garfinkel, Simson & Rosenberg, Beth | RFID: Applications, Security, and Privacy | 2005 | Addison-Wesley Professional |
| Sweeney, Patrick J. | RFID for Dummies | 2005 | Wiley |

geted to business and industry professionals. Some of the more noteworthy are:

1. RFID Journal—<http://www.rfid-journal.com/>. Highlights of this online journal are useful in preparing to teach topics related to RFID. Those most notable for educators include: glossary of terms, global news articles, case studies, white papers, and Webinars. Numerous parts of the journal are open to non-subscribers; there are some items that are available only to fee paying subscribers.
2. RFID product news—<http://www.rfid-productnews.com/>. Includes feature articles, information on new products, whitepapers, information on current events, and case studies.
3. RFID directory, UK—<http://www.rfid.uk.com/>. Contains directories of RFID companies, manufacturers and suppliers.
4. RFID 101.com—Info guide to radio frequency identification (RFID) technology — <http://www.rfid-101.com/>. An online guide to selecting and purchasing RFID technology products.

Teaching Objectives and Suggestions

Lectures utilizing material obtained through professional organizations, books, journals, and the Internet can be utilized to assist in building a framework of understanding that will enhance the students' understanding of assigned readings and projects. The course syllabus should include the objectives and detailed assignment guidelines for course projects; a description of the course deliverables; and the course evaluation criteria. Some suggested course objectives include:

- Types of RFID technology
- How RFID is being utilized today

- Security and privacy issues with RFID
- Future of RFID technology

In addition to lectures, three specific course activities can be considered: (1) an individual research project; (2) a group research project; and (3) a hands-on project.

It is recommended that the performance of research projects be monitored by requiring the students to turn in two or three interim deliverables at predefined points in the research project. The deliverables from the research projects should be evaluated on content, format, style, and other predefined criteria.

- **Individual research project:** The instructor should provide the students with a list of possible research topics from which each student selects a topic of interest. These topics should coincide with current issues pertaining to RFID. To aid the undergraduate students in the literature search necessary for their research, it is suggested that a professional librarian from the university library be invited to class to provide a tutorial on utilizing research databases.
- **Group research project:** Group research projects can be assigned to groups of three or four students. The group research project will be useful in stimulating the students' learning of new and interdisciplinary concepts in the more flexible and comfortable learning environment of the peer education process. This will also provide students with experience in working in teams, a skill that they need to further develop and practice before entering the workplace.

It is recommended that the group research topic be based on a real world business utilizing RFID. Using real world cases in the group research projects will afford students the opportunity to experience first hand things such as realistic content, real world business objectives,

organizational impacts, social values, and ethical issues (Gendron & Jarmoszko, 2003; Hackney, McMaster, & Harris, 2003). The professor will need to guide the students in the selection of a real world case. The students can be asked to complete their group research project as follows:

1. Describe in detail a specific real world company's application of RFID.
2. Survey the existing literature regarding the specific company's application of RFID and summarize the literature related to that application.
3. If possible, describe the company's future plans regarding RFID.

At the completion of the projects, each group can present the results of their final group research project to the entire class. In addition to a class presentation utilizing presentation software such as Microsoft PowerPoint™, the students can provide the professor with a presentation file, a written project report, and a few test questions the group feels the class could answer after listening to the formal presentation. The questions collected from all the groups may be used on an exam to test the level of understanding of all students on all research project presentations. Such a procedure can be very useful in garnering student attentiveness during all group presentations. The instructor and all class members may evaluate each of the group research presentations based on pre-arranged guidelines.

- **Hands-on practice using RFID:** To enhance the students understanding of technology and its application in the real world, it is important to give students hands-on experience with technology in a lab environment (Greca, Cook, & Harris, 2004). Robert Yoder (2006) utilizes an inexpensive RFID reader and tags in a university lab setting to teach a variety of basic principles. Hands-on

practice opportunities, in which the students actually work with RFID components, will be beneficial in enhancing the students' understanding of the course's technical components. Depending upon the learning environment desired by the professor, the hands-on practice opportunities can be offered as lab sessions or as individual take-home assignments.

SUMMARY

Since RFID has the potential to have an impact on information systems in businesses as well as in our lives, it is important that we incorporate topics pertaining to RFID into existing courses and, where applicable, develop in-depth, stand-alone courses on RFID.

The overview of RFID and implications for teaching should be of interest to several groups of readers. Researchers in academic communities should be aware of the important role of RFID in industry and the resulting implications for needed IT research. Second, IT curriculum planners will find this information helpful as they strive to keep the curriculum in tune with the needs of business and industry. Third, IT professors need to be aware of the importance of RFID. Hopefully, IT professors can benefit from the teaching resources and teaching suggestions presented.

REFERENCES

- Al-Rawi, A., Lansari, A., & Bouslama, F. (2005). A holistic approach to develop IS curricula: Focusing on accreditation and IT certification. *Journal of Information Technology Education*, 4, 307-327.
- Archer, Q., & Salzar, G. (2005). RFID: a threat to privacy? *Computer Weekly*, April 5, 18.

- Brewin, B. (2003). Military orders suppliers to use RFID technology. *Computerworld*, Certification Magazine. (2006). Program updates. *Certification Magazine*, 8.
- Choi, Y.B., Teer, F.P., & Teer, H.B. (2005). Management of telecommunications services: A vital new content area and a course model for the college of business. *International Journal of Information Communication Technology Education*, 1(3), 60-73.
- Claburn, T., & Hulme, G. (2004). RFID's security challenge. *Information Week*. Retrieved February 10, 2006, from <http://www.informationweek.com/story/showArticle.jhtml?articleID=52601030&tid=13690>
- Electronic Privacy Information Center (2006). *Radio frequency identification (RFID) systems*. Retrieved February 10, 2006, from <http://www.epic.org/privacy/rfid/>
- Eschinger, C. (2005, November 2). Market share and forecast: Radio frequency identification, worldwide. *Gartner Research*, 2004-2010.
- Feder, B. (2004). Wal-mart hits snags in push to use radio tags to track goods. *New York Times*, Section C, Page 14, Column 5.
- Flint, D. (2006). RFID tags, security and the individual. *Computer Law & Security Report*, 22, 165-168.
- Gendron, M., & Jarmoszko, A.T. (2003). The integration of technology theory and business analysis: A pedagogical framework for the undergraduate MIS course in data communications and networking. *Journal of Information Systems Education*, 14(4), 361-371.
- Glover, B., & Bhatt, H. (2006). *RFID essentials*. Sebastopol, CA: O'Reilly Media.
- Granneman, S. (2003). RFID chips are here. *Security Focus*. Retrieved February 9, 2006, from <http://www.securityfocus.com/columnists/169>
- Greca, A.N., Cook, R.P. & Harris, J.K. (2004). Enhancing learning in a data communication and networking course with laboratory experiments. *The Journal of Computing in Small Colleges*, 19(3), 79-88.
- Haag, S., Baltzman, P., & Phillips, A. (2005). *Business driven technology*. New York: McGraw Hill.
- Hackney, R., McMaster, T., & Harris, A.J. (2003). Using cases as a teaching tool in IS education. *Journal of Information Systems Education*, 14(3), 229-234.
- Hamblen, M. (2006). RFID Successes highlighted at mobile & wireless world. *ComputerWorld*. Retrieved May 26, 2006, from <http://cwflyris.computerworld.com/t/553965/225881/20662/0/>
- Juels, A. (2005). *RFID security and privacy: A research survey*. RSA Laboratories. Retrieved February 11, 2006 from, http://www.rsasecurity.com/rsalabs/staff/bios/ajuels/publications/pdfs/rfid_survey_28_09_05.pdf
- Kalles, D., & Papagelis, A. (2006). Managing the decision tree life-cycle with components. *International Journal of Information Communication Technology Education*, 2(3), 1-13.
- Kuchinskas, S. (2006). The new chip-erati. *Internetnews.com*. Retrieved February 9, 2006, from <http://www.internetnews.com/security/article.php/3582971>
- Lahiri, S. (2005). *RFID sourcebook*. Westford, MA: IBM Press.
- Loebbecke, C., & Palmer, J. (2006). RFID in the fashion industry. *Management Information Systems Quarterly Executive*, 5(2), 15-25.
- Martin, Z. (2005). RFID tags help identify patients before surgery. *Health Data Management*, 13(7), 14-22.
- Meyer, H. J., Chansue, N., & Monticelli, F. (2006). Implantation of radio frequency identification

- device (RFID) microchip in disaster victim identification (DVI). *Forensic Sciences International*, 157, 168-171.
- Peslak, A. (2005). An ethical exploration of privacy and radio frequency identification. *Journal of Business Ethics*, 59, 327-345.
- Reilly, K. (2005). AMR research survey finds 69 percent of respondents plan to evaluate, pilot, or implement RFID in 2005. *AMR Research*, July. Retrieved May 17, 2006, from <http://www.amrresearch.com/Content/View.asp?pmillid=18470>
- Reynolds, M. (2004). RFID implants need better privacy protection. *Gartner Web*. Retrieved February 10, 2006, from the Gartner Web database.
- RFID Technology: What the Future Holds For Commerce, Security, and the Consumer*: Hearing Before the Subcommittee on Commerce, Trade, and Consumer Protection of the Committee on Energy and Commerce, United States House of Representatives, 108th Cong., 2nd sess. 1 (2004). Retrieved from the Computer & Information Systems Abstracts database.
- Roberti, M. (2006a). The bar code is back! *RFID Journal*. Retrieved February 10, 2006m from <http://www.rfidjournal.com/article/articleview/2123/1/128/>
- Roberti, M. (2006b). Forecasts for RFID in 2006. *RFID Journal*. Retrieved February 10, 2006m from <http://www.rfidjournal.com/article/articleview/2066/1/2/>
- SAP gift to IU Kelley School of Business enables hands-on experiences. (2004). Retrieved September 13, 2006m from <http://newsinfo.iu.edu/news/page/normal/1761.html>
- Schuman, E. (2006). Finding ways around RFID's errors. *Extreme Nano*. Retrieved February 11, 2006m from http://www.extremenano.com/article/Finding+Ways+Around+RFIDs+Errors/169743_2.aspx
- Smith, J. R., Fishkin, K. P., Jiang, B., Mamishev, A., Philipose, M., Rea, A. D., et al. (2005). RFID-based techniques for human-activity detection. *Communications of the ACM*, 48 (9), 39-44.
- Torrieri, M. (2006). California RFID bill holds as senator considers industry concerns. *RFID News*. Retrieved February 10, 2006, from <http://www.rfidnews.org/library/2006/02/01/california-rfid-bill-holds-as-senator-considers-industry-concerns/>
- Warren, S., & Brandeis L. (1890). The right to privacy. Originally published in *Harvard Law Review* 4 (5). Retrieved from http://www.lawrence.edu/fast/BOARDMAW/Privacy_brand_warr2.html
- Webster, J. (2006). Forecast 2006: RFID cost and complexity continue to block enterprise use. *Computer World*. Retrieved February 11, 2006 from <http://www.computerworld.com/management-topics/management/story/0,10801,107308,00.html?source=x2305>
- Weis, S. (2003). Security and privacy in radio-frequency identification devices. *Massachusetts Institute of Technology*. Retrieved February 9, 2006, from <http://theory.lcs.mit.edu/~cis/theses/weismasters.pdf#search='stephen%20august%20weis>
- White, D. (2006). Global RFID passport encryption standard cracked in 2 hours. *MobileMag*. Retrieved February 10, 2006, from <http://www.mobilemag.com/content/100/102/C6340/>
- Yoder, R. C. (2006). Using RFID in the classroom to teach information systems principles. *Journal of Computing Sciences in Colleges*, 21(6), 123-129.

This work was previously published in the International Journal of Information and Communication Technology Education, edited by L. Tomei, Volume 3, Issue 4, pp. 50-63, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 8.9

Games and Advertisement: Beyond Banners and Billboards

David B. Nieborg

University of Amsterdam, The Netherlands

ABSTRACT

The use of digital games for the promotion of goods and services is becoming more popular with the maturing and penetration of the medium. This chapter analyzes the use of advertisement in games and seeks to answer in which way brands are integrated in interactive play. The branding of virtual worlds offers a completely new range of opportunities for advertisers to create a web of brands, and it is the usage of marketing through games that differs considerably. This chapter offers a categorization of advergames and will address the use of advergames from a developmental perspective, differing between commercial games with in-game advertisement and dedicated advergames. Where TV commercials, print ads, and the World Wide Web rely on representation for the conveying of their message, advergames are able to add the extra dimension of simulation as a mode of representation, resulting in various interesting game designs.

INTRODUCTION

The increasing sociocultural and economic importance of digital games not only caught the attention of politicians, academics, and journalists but advertisers as well. Modern day gamers complement their use of the television screen with playing games, and use their PCs for Web browsing and buying books online as well as gaming. Marketers may have found their way around in the cinema and the television set; but the virtual world has yet to be fully explored. Slowly but steadily, the adaptive character of advertisement is spilling over to digital games. Besides money earned from the original purchase and subscriptions another revenue stream may become equally important for game publishers and developers. Why have digital games become such an interesting medium for advertisers? And in which way are brands integrated in interactive play? This chapter seeks an answer to both questions.

Digital play on its part can no longer be seen as child's play. The question is, if games ever have

been child's play. Due to the graphic nature, but also the complexity and sophistication of many contemporary PC games, children are not by default the primary target group of game publishers. As stated elsewhere in this volume, the average age of a gamer is not 13, not even 20, but 29, while 59% percent of the players are male. A significant number (43%) of all of all U.S. gamers play online and the gender breakdown of online players is similar to the overall demographics (ESA, 2004). And when gamers do play, they take their time. They have to, as contemporary console games for the big three—Xbox, PlayStation 2, and GameCube—as well as the majority of PC games, allow gamers to invest dozens of hours of their free time.

Single-player, narrative-driven role playing games such as the Final Fantasy series can take hours to complete, more open ended simulation games such as The Sims series or the Rollercoaster Tycoon series can grip the short attention span of Generation Y even longer, and online multi-player games can in theory be played indefinitely, for those considering playing games as an essential part of their lives. For the “hardcore” gamers, gaming is part of their lifestyle. The complex social worlds online multi-player games have become, makes playing such games even more rewarding from a sociocultural perspective, as discussed by Sal Humphreys elsewhere in this volume (Chapter IV). Spending 5 hours a day—on average—playing Counter-Strike with friends or clan mates, or playing 6 hours a day—role playing as a level 60 Night Elf Rogue in World of Warcraft with guild mates—is not an uncommon activity at all.

The Online Games White Paper 2003 by the International Game Developers Association (2003) estimates the U.S. market size of PC CD-based online games at less than 5 million gamers, and the PC Web-based category at 50 million (or more) gamers. The growing broadband penetration in the United States, Europe, and parts of Asia proves to be invaluable for the distribution of all sorts of digital content, and games are no exception to

these advancements. As game technology gets cheaper and more pervasive, the group of online PC gamers is projected to steadily grow over the coming years. The introduction of massive multiplayer online role playing game (MMORPG) such as World of Warcraft, showed the remarkable smooth distribution of a subscription-based game among millions. Only a month after the games' introduction on the Chinese market, the Warcraft population increased with 1 million new gamers, surpassing the 4 million player limit worldwide (Schiesel, 2005). Counter-Strike and Counter-Strike: Source, the most played, online first-person-shooter games, facilitate online game play for 2.4 million players every month.¹

As such, digital games are arguably the most influential product of contemporary computer technology. Many aspects of the omnipresent and growing cyber culture are surfacing in this new form of digital amusement and profound questions regarding the complex interplay of marketing, technology, and culture are yet to be addressed. Kline, Dyer-Witford, and de Peuter (2003) gave their take on the interaction among game technology, game culture, and marketing and argue that game culture has become part of “a web of synergistic advertising, branding and licensing practices spreading through contemporary popular culture” (p. 21). The commodification of digital play is commonplace and games as “the ideal commodity in the post-Fordist society” are natural inhabitants of this new high-technology capitalistic society. The post-Fordist society, also dubbed “post-industrial capitalism” and “information capitalism,” signals “changes in the workplace, in patterns of consumption, in media of communication and in the role of government” (Kline et al., p. 64). It is a move towards perpetual innovation, from material to experiential commodities and towards the development of media, information, and digitization. This society seems to welcome the synergy of advertisement and games with arms wide open.

The “eyeball” time of gamers is worth billions of dollars. Game technology enables developers to develop true-to-life simulations and as a result games steadily move outside their role of entertainment technology. Games are increasingly used for education, testing of (military) technology, and propaganda. Games have become more than just mere entertainment (Nieborg, 2004, 2005). And because of the interactive and configurative nature of game technology, advertisement in games can go far beyond static in-game banners, posters, and billboards.

Consider the horrifying First Person Shooter game *Doom 3*. The in-game personal digital assistant (PDA) of the player provides vital clues as how to navigate through the Mars base where the main character is trapped. During the game, dozens of e-mail messages become available on the PDA, some of which praise the fictive company Martian Buddy—“the latest interstellar marketing venture” (Martian Buddy, n.d.). As it turns out, investigative players, such as the author of this chapter, find out that surfing to martianbuddy.com provides a code to unlock a weapons locker. With an unforeseen wink to the subject matter at hand, the Web site explains its purpose: “Martian Buddy represents the best in direct marketing advertisements” (Martian Buddy, n.d.). The game developers are not far from the truth—the semi-annoying spam e-mails evidently did their work as the Martian Buddy Web site had more than 470,000 unique visits within 3 weeks after the release of the game. Naturally, the imaginary Martian Buddy brand is easily replaced by a global brand of choice.

The example of the fake Martian Buddy brand helps to pinpoint several essential elements in discussing games and advertising. The starting point of any analysis on games should always be the emphasis on its ludological nature, as games are systems “in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome” (Salen & Zimmerman,

2004, p. 80). Static in-game advertising may seem like a viable way to market a product or service, and in many ways it is, but games as rule-bound, interactive texts favor more than just an interpretive reading practice. Gaming is at the same time a configurative practice, combining “ends, means, rules, equipment and manipulative actions” (Eskelinen, 2001). The PDA in *Doom 3* is not merely encountered during a play session, it is operated by the player and a player cannot progress without using the device. Playing games involves engaging with the game’s simulation model in a creative fashion. In this way, the process of “reconfiguration,” creatively repurposing the rules of a game, could complement configurative gaming practices (Raessens, 2005, p. 380). It is my belief that the forward leaning (inter)active nature of game play, whether or not they enable a reconfigurative mode of participatory media culture, should always be considered by those including marketing messages in digital play.

Today, the implementation of branded game designs takes various forms and shapes. In the following section the distinction between different sorts of advergames will be fleshed out after which a detailed case study of the PC game *America’s Army*, will focus on the most elaborate form of advergaming, as it is wholly designed as a branded game experience.

UNDERSTANDING ADVERGAMES

The number as well as the sophistication and implementation of game-based advertisement (or advergames) are becoming more popular with the maturing and penetration of the medium. An advergame could be defined as the integration of advertising messages in an online game and is increasingly used as an integral part of Internet marketing and advertising strategies to promote goods and services to potential consumers (Buckner, Fang, & Qiao, 2002). Chen and Ringel (2001)

distinguish three ways in which messages can be incorporated in games. The first is associative advergaming, that is, driving brand awareness “by associating the product with the lifestyle or activity featured in the game” (p. 3), the second illustrative advergaming, in this way the product is heavily featured in the game, and a third way is demonstrative advergaming, featuring “the product or brand name in incidental ways” (p. 4). In addition, advergaming can also serve as online tracking tools. By both active and passive data gathering, advertisers can learn from customers and collect all sorts of demographic data, e-mail addresses, and data on online behavior. The topology of Chen and Ringel offers a starting point to discuss the use of games for marketing purposes. But as they ignore the interactive nature of games, a different categorization will be proposed to deepen the understanding of both games and advertisement.

As the various examples in this chapter will make clear, game technology enables developers to incorporate the modes discussed by Chen and Ringel (2001) in more than one way in a single game. This chapter offers a different categorization of advergaming and will address the use of advergaming from a developmental perspective. There are considerable differences between simple tennis games featuring a company’s logo and slogan, a high-profile commercial release developed for profit showing in-game ads, and state-of-the-art simulations offering immersive marketing experiences. In this chapter two main categories of advergaming are proposed based on the rationale of a game, that is, advertisement in commercial games, hereafter in-game advertisement, versus dedicated advergaming. The former category consists of commercially developed games, aimed to sell as many units as possible to profit both the developers and publisher. The latter category games are solely made to advertise. Both categories are inhabited by subcategories. These subcategories focus on the formal aspects of games, distinguishing be-

tween non-game-play integrated advertisement (logo’s, slogans, banners, and billboards) versus game-play integrated advertisement. This second subcategory consists of advertisement integrated into the game’s ruleset.

ADVERTISEMENT IN COMMERCIAL GAMES

The first category of games featuring in-game ads holds games containing some sort of brand placement. Similar to movies and television series, advertisers can insert praise for their goods in a commercial game in two ways. On the one hand, developers can choose to insert static advertisement, similar to a banner on a Web site or a billboard on the background in a movie or television series. The exploratory research of Chaney, Lin, and Chaney (2004) found that first-person-shooter players, regardless of their experience with the genre, did recall encountering static advertisement in the form of billboards during game play, but did not recall a brand’s name 15 minutes after. In this particular study, gamers were focused on playing the game, rather than paying attention to the (branded) environment.

On the other hand, developers can harness the interactive nature of games and blend an advertisement message into the game play. The moving picture equivalent of game-play integrated advertisement would be the cars of James Bond—for example, the BMW Z8 or the Aston Martin V12 Vanquish. Bond’s use of his specially prepared and luxurious cars, bear direct relevance to the movie’s plot. After all, a master spy needs a fast and powerful car to impress his opponents or in order to escape after a successful mission. It should be noted that the distinction between game play and non-game-play integrated ads is to a certain extent a theoretical one, many games have incorporated both mechanisms.

Let us now take a closer look as to how the two forms of in-game advertisement function in

today's for-profit games. The popular and much debated game *Grand Theft Auto: San Andreas* is an interesting example in this respect. Albeit the game has no real world in-game advertisement, it could be regarded as a proof of concept as to how to use interactive play for marketing purposes. As it happens, the game does show a great range of fake advertisement—ranging from promiscuous sex jokes to nods at previous games in the franchise. *Grand Theft Auto: San Andreas* is available for the PlayStation 2, Xbox, and the PC and is best described as an urban simulation game. The player navigates the Afro-American avatar Carl “CJ” Johnson through the state of San Andreas, modeled after the state of California. At the beginning of the game CJ arrives at his mother's home in the city of Los Santos, where he meets his old “homies” and the games' mission structure sets off. The player can freely explore the enormous virtual world of San Andreas by foot or by using various vehicles, for example, trains, planes, automobiles, golf carts, and forklifts.

The game space is modeled after three real world cities—Los Angeles, Las Vegas, and San Francisco with similar architecture and atmosphere. Because of its plentiful real world references, there are numerous opportunities to advertise various goods or services. It is likely that the controversial character of the game made many advertisers hesitant to put up a signpost in San Andreas. The inclusion of a brand without prior consent can lead to difficulties as shown in the PlayStation 2 game *The Getaway*. This game contains 50 square kilometers of virtual London where gamers have to fulfill all sorts of driving missions. The game pictured a scene where a criminal was dressed up as a British Telecom technician, after which British Telecom protested, resulting in the subsequent removal of the “advertisement” in future versions.

The easiest way to advertise goods in San Andreas is through the use of billboards alongside the road—a clear form of non-game-play integrated advertisement. To achieve missions in

the game, players have to cover great amounts of terrain and road signs, and billboards are already a natural part of the game space. However, gamers do not have to interact with the billboards in any way. For instance, the billboards do not offer any secret codes to unlock doors. An opportunity to add game-play integrated advertising would be branding clothing of the main character. It is possible to completely customize the appearance of CJ, ranging from various outfits (e.g., police uniforms, country or medic clothes), to watches and sun glasses. As new clothes make CJ look “cool” and improve his “appearance,” it also positively influences his “respect” and thus clothes become integrated into the overall game play. Designers could go as far as to let the computer-controlled characters make positive remarks about certain brands—encouraging a certain outfit.

Similarly, the game features various unbranded cars which will take the player to the gym to build muscles or to one of the fast food restaurants, such as Cluckin' Bell Happy Chicken (a Taco Bell/KFC parody) where the player can eat a Cluckin' Big Meal and have a glass of Sprunk (a parody of the soft drink Sprite). Nelson (2002) found that when brands are integrated into the game play: “for example, the car selection in a racing game—short term recall is enhanced” (p. 89). And while driving their randomly picked cars, the players of San Andreas can visit Well Stacked Pizza Co. or Burger Shot. Similar to the fake ads of Martian Buddy in *Doom 3*, Cluckin' Bell has a Web site at cluckinbellhappychicken.com, including the Cluckin' Bell Happy Chicken theme song and a list of the menus. Despite these various marketing opportunities, all these brands still are self-referential and they are part of the appeal of the game series—that is, the fake brands consist of typical *Grand Theft Auto* humor.

The games' soundtrack is one of the few in-game real world references in *Grand Theft Auto*. The moment the player gets into a (stolen) car, he can opt for one of the nine radio stations, ranging from a modern rock station to a country channel.

A month after the release of the PlayStation 2 version of the game, an 8-CD, stand-alone version of the soundtrack box set hit the market, featuring all in-game radio stations. The box is clearly primarily meant as a collector's item rather than a marketing opportunity. Games do however prove to be a valuable medium to market (new) music or bands. Rapper Snoop Dog for example, let his single Riders on the Storm debut in the race game Need For Speed Underground 2. The Need For Speed Underground 2 soundtrack is part of the EA TRAX initiative. The game industry's biggest publisher Electronic Arts (EA) teamed up with several record companies and started TRAX to promote new music in their sports games:

Record labels partner with EA because they understand videogames are a powerful channel for exposing new music to a large core of young opinion leaders. Record companies also realize the valuable demographics of gaming; its "cool" factor; the buzz and the size of the interactive entertainment industry have put videogames at the center of mainstream entertainment.²

In this way gamers might find their way to the latest hits via their games, rather than via their peers, p2p software, or the radio. In the same way that publishers put out press releases for movies and games, they put out independent press releases for a games' soundtrack.

For a long time, games have been part of the complex intertextual web of popular culture (cf. Marshall, 2002). Initial research points to the direction that gamers do not object to the use of in-game advertisement, arguing that (fake) advertisement makes the game space more "real" (Hernandez, Chapa, Minor, Maldonado, & Baranzuela, 2004; Molesworth, 2003; Nelson, 2002; Nelson, Keum, & Yaros, 2004;), whether this (perceived) additional realism is effective has yet to be seen (cf. Chaney et al., 2004). An expressive example of the "need" for advertisement and the idea it increases a virtual world's authenticity, is a

free downloadable user-made modification (mod) redecorating the virtual landscape of Grand Theft Auto III. The mod, ironically dubbed RealGTA3 (or RGTA), is assembled and partly developed by a Czech modder, and contains a collection of many Grand Theft Auto 3 modifications "trying to make GTA3 more realistic by adding real cars, buildings or advertisements all over Liberty City."³ The mod could as well be named the best of international brands mod with in-game advertisement for McDonalds, Pepsi, Coca-Cola, IKEA, Media Market, Pizza Hut, and the inevitable Czech beer brand Pilsner Urquell. The long list of mod developers from all over the world who contributed to RGTA suggests the willingness of amateur software developers to take part in the voluntarily act of branding virtual worlds.

FROM BANNERS TO POWER-UPS

The willingness to consume, to experience, or even to co-develop advertisement is shown in a number of today's persistent MMOGs, such as There and Second Life. These worlds as well show a mixture of both game-play and non-game-play integrated in-game advertising. In the virtual playgrounds, such the one of There, users are able to produce their own (noncorporate) brands and use the same branding techniques as clothing companies to market their goods. With the use of time, money, and technical skill, users are able to rival with corporate branded goods in regards of reputation within the virtual world (Book, 2004). Advertisement in MMOGs shows the active appropriation of brands used in the social and economic interests of gamers.

Some players actively choose to incorporate brands into their game experience to construct their online personae. In this way, the game world becomes an index of consumers rather than products, signifying consumers as cultural entities (Pennington, 2001). By a carefully constructed web of brands, consumers can market themselves

within chaotic online worlds deprived of the necessary signifiers to construct one's identity. That a personality can be defined by naming a number of brands shows the former Web site Branddating.nl. Here visitors associated themselves with several brands to distinguish themselves from other daters, in addition with their gender, age, and place of residence. Research into MMOGs suggests that younger age groups have a more positive attitude towards advertisement and branding in virtual worlds than adolescents and adults (Book, 2004). This fits with the demographics from the Branddating.nl Web site where a majority of the daters were fairly young as well.

As said, the technological and innovative character of game technology can open up a window of opportunity for innovative and daring marketers. The tactical first-person-shooter game SWAT 4 introduced customized in-game ads in their first (mandatory) patch. The marketing firm Massive Incorporated specializes in technology-linking ads with specific game audiences and already has some major game publishers among their clientele. When gamers play SWAT 4 they will randomly encounter in-game ads such as Coca-Cola or Gamefly.com posters and data is sent back to the Massive Incorporated ad servers detailing which ads are looked at by gamers and for how long. In this way the advertisers can specifically target online gamers with ads of their taste, thereby changing static, hard coded, in-game product placement into truly interactive dynamic advertisement, although still not game-play integrated. It is even possible, as is done in the MMOG Anarchy Online, to include full-motion video and audio ads.

Soft drink company Red Bull has integrated its product in the platform game Worms 3D where it serves as a power-up. A clever integration, oddly shaped power-ups with ever weirder results are part of all games in the Worms series. In the game a can of Red Bull serves as a powerful simulation of the Red Bull slogan "Red Bull gives you wings." In a similar way game publisher Ubisoft and Sony

Ericsson Mobile Communications made a deal to include the Sony Ericsson P900 and the T637 camera phone in the stealth game Tom Clancy's Splinter Cell Pandora Tomorrow. The phones are integrated in the game play, similar to Doom 3's PDA, as gamers have to use the mobile phone to receive messages from headquarters and to locate their position. And during hour-long single player game sessions, gamers are continually exposed to Sony Ericsson's technology up to a point where they have to make a photo of an opponent with the T637 camera phone.

Big corporations, such as McDonalds, already invest in branding online worlds. In The Sims Online users can purchase a McDonald's food kiosk, an element deliberately integrated into the game play. Book (2004, p. 13) demonstrates that the McDonald's food kiosks "function more as billboards than anything, they do not live up to their interactive potential." Pointing out that game-play integrated advertisement is not necessarily more successful than the non-game-play integrated subcategory. While both modes of in-game advertisement may become more ubiquitous, the sociocultural, political-economic, and technological characteristics of digital play facilitate yet another form of commodified game play, games focused on one product or service; the dedicated adverggame.

DEDICATED ADVERGAMES

The category of dedicated adverggames inhabits a wide array of games, ranging from simple Internet adverggames, mostly using Macromedia Flash technology, to sophisticated online worlds. A distinction can be made between three subcategories of dedicated adverggames. First, there consists a wide range of singular dedicated adverggames. Secondly, there are transferal dedicated adverggames, and thirdly there is the subcategory of experiential dedicated adverggames.

The first subcategory of simple nonpersistent advergaming are probably the widest employed subcategory of dedicated advergaming, for its low costs and simple development cycle. The notion of singularity derives from the games' focus on single-style game play. A singular advergame only has one core game-play element, such as games focusing on motor skills or (e.g., a race game), problem solving (e.g., a puzzle game). Many of these games are modeled on the classic games of yesteryear, such as Pacman or Tetris. A puzzle game with Tetris-style game play could be turned into a dedicated advergame by making it appear on a specific Web site in a pop-up window. Gamers who are interested can play the game on the spot or sometimes download it to play on a moment of choice. Other advergaming offer a new but familiar design. Car manufacturer Jaguar promoted their new S-type R model with a Flash game offering an online Urban Golf course.⁴ The car in the back of the game had nothing to do with the actual game play. A player has to finish a Golf course in central London and the hole is replaced by a red postbox. Players who supply their e-mail address can win golf lessons from a pro.

These simple advergaming arguably lack the game play to engender immersive play and are primarily used to raise brand awareness and direct visitors to the various Web sites for more information. The games have their own Web sites or may pop up when visiting a random Web site and cannot be saved to one's computer, thus the game becomes a random encounter and in many cases the nonpersistent achievements—that is, points—do not encourage gamers to play the game again. Making the game available off-line, on the other hand, can aid the viral distribution of a game and thus its marketing message. In the Jaguar advergame example, players may send the Web site's URL to their "mates" via the Web site and can compete to beat the top scores. The International Game Developers Association (IGDA) in their Online Games Whitepaper promote these kinds of advergaming as "a powerful and effective tool

for delivering branding and advertising messages" as these games tend to be "sticky," nonintrusive and able to generate various demographic data of consumers (2003, p. 35). As said, small PC Web-based advergaming can tap into a large group of 50 million U.S. gamers, whereas PC CD-based games, such as *The Sims* or *Rollercoaster Tycoon 3*, have a much smaller potential market of less than 5 million U.S. consumers.

A more sophisticated form of dedicated advergaming are games offering a transferring experience, or what Chen and Ringel (2001, p. 3) would call "associative advergaming." Here brand awareness is raised through lifestyle association. The subcategory of transferal advergaming may also feature the advertised product and thus can be seen as an illustrative advergame—offering as much in-game product exposure as possible. The sole intent of these kinds of advergaming is to put users into contact with its brand and harness a positive game experience within a controlled and branded (persistent) online world. The games in this subcategory may or may not contain any links to external Web sites of the advertised service or product and does not enable gamers to actually experience a particular product or service.

A successful example, in terms of the amount of visitors and time spent on the Web site is the online world of Coke Music, developed by order of Coca-Cola.⁵ Coke Music has all the elements of an MMOG and contains all kinds of simple social activities, which can be very time consuming, ranging from chat to the production of simple music compositions. The technology is completely Web based and gamers can only play online. Established in 2002, this Web site counted "over a million views a day, the number of new visitors increases monthly with 200,000, and people spend about 25 minutes on the site" (Van der Graaf, 2004). Additional gain for Coca-Cola is added through putting out surveys to collect various gamer data. The Coca-Cola brand is omnipresent and many ad campaigns in other media slip into Coke Music—and vice versa.

The example of the branded world of Coke Music shows how existing game genres can be repurposed to fit the advertisers need. Built upon the template of the commercial game/chat environment of Habbo Hotel, Coca-Cola successfully appropriated the game mechanics of a proven game concept and offers a free branded alternative. Habbo Hotel, developed by the Finnish company Sulake Labs, is a moderated, Web-based chat environment with many franchises all over the world. It is a huge success among young children and has 3 million unique users visiting virtual hotels within 16 countries on four continents. As both Habbo Hotel and Coke Music are free games, the choice between both games may be somewhat arbitrary and has a social dimension. In a way Coca-Cola's virtual world is more than a game; it is a social structure:

(...) based on the constant negotiation of cliques, inner circles, in-crowds and social drama that is enacted throughout a variety of settings. The corporate sponsor is just as likely to be completely ignored in the pursuit of these activities, especially when more powerful metaphors can be found. (Book, 2004, p. 21)

This observation shows that the complexity or sophistication of an advergaming does not equal (instant) success for the advertised product or service. There is always such a thing as good game design. A brand may be cleverly integrated into the game play or to put in the words of Hernandez et al. (2004) a brand may be congruent and thus less intrusive, creating meaningful play is an art in itself (cf. Salen & Zimmerman, 2004). Young gamers may freely wander through the branded world of Coke Music, whether or not they will associate their own lifestyle with the soft drink's brand is a question certainly worth further analysis. Next, the third subcategory of dedicated advergaming will be discussed—experiential advergaming.

EXPERIMENTAL MARKETING

Games add the representational mode of simulation to the marketing mix. In games, brands can be shown repeatedly and through carefully branded simulations, games enable consumers to “transfer meaning to themselves, defining themselves as cultural entities” (Pennington, 2001, p. 50). But the gift of interactivity adds a significant “bonus level,” through game-play products or services can be experienced. The intangible and arbitrary associations evoked by brands as symbols, become tangible, allowing gamers to experience what it is like to drive a car or being a soldier by immersing themselves into carefully constructed virtual simulations. Economists Pine and Gilmore (1999) offer a useful concept to understand this new marketing paradigm: “Cyberspace is a great place for escapist experiences” (p. 34) and the game can stage such memorable experiences, situating itself within existing community structures and design conventions in order to offer a “show.” This shift is in line with the notion of “the experience economy,” where the former offerings of the commodity economy are replaced by an economy relying on staging memorable and personal experiences.

The branding of virtual worlds offers a complete new range of opportunities for advertisers to create a web of brands. Brands get their meaning partly through opposition (Pennington, 2001) and the previous example of RealGTA shows the low technical, social, and virtual barriers of the branding of virtual worlds. Major global brands such as Microsoft, IBM, General Electric, and Intel do not have the advantage of being able to create experiential branded simulations. Computer software and hardware and consumer appliances seem to miss a central point to create meaningful play. Coca-Cola bypassed this problem by facilitating social interaction in a branded virtual world where teenagers can chat and come together within a branded community. Car manufacturers are

arguably one of the other few major brand holders being able to tap into existing game genres and develop engaging experiential simulations, that is, a racing game rather than a branded simulation, for example, a puzzle game sponsored by a car brand.

An interesting example of a successful experiential dedicated advergame, from an economic perspective, is the PC game *America's Army*.⁶ This game goes beyond a transferal experience as it is a game that relies mainly on the simulation of combat. The state-of-the-art game facilitates rich and immersive virtual experiences, showing consumers virtual insights in an interactive world previously not accessible to the general public. "By creating leads and traffic through *America's Army's* design and characteristics, the Army's brand is not about 'just a logo. It is much more, namely, it is the experience that occurs when a gamer comes into contact with the Army's game'" (Van der Graaf & Nieborg 2003, p. 329).

For most players *America's Army* is first and foremost an online multi-player-tactical, first-person-shooter PC game. Developed by the U.S. Army, the game is freely available on various Web sites and the game's design is inspired by other popular first-person-shooter games such as *Counter-Strike* and *Tom Clancy's Rainbow Six*. In *America's Army* the player takes the role of a U.S. Army soldier and engages in man-to-man combat against human opponents in authentic environments by using a range of real-life weaponry in order to complete a mission or objective. *America's Army* is primarily a multi-player game. The single player part entails several training missions, which need to be completed in order to unlock certain roles, such as a medic or a sniper.

America's Army could be seen as a simulation of the U.S. Army, many unrealistic elements from the first-person-shooter genre are changed. For realism's sake, the game play is much more structured and bound by the rules of physics and warfare. Players become soldiers with a persistent record. Shooting team members is ruled out and

maps, weapons, and roles cannot be changed. In *America's Army* you will always be put in the boots of a U.S. Army soldier. Through the use of a software trick every gamer sees himself and his team as U.S. soldiers and the other team as the *Opposing Forces (OpFor)* and vice versa.

America's Army is not the only advergame issued by the U.S. military to promote its services. There is the free downloadable real-time strategy game *Guard Force* to aid recruitment for the U.S. Army National Guard. While the U.S. Marine Corps was heavily involved in the development of the first-person-shooter, training tool spin-off *Close Combat: First to Fight*, this game is a commercial game with game-play integrated advertisement. Gamers have to buy the game and its primary goal is to sell as many copies as possible. The U.S. Navy issued the action game *Navy Training Exercise (NTE): Strike & Retrieve*. This game however is a transferal-dedicated advergame as the game play does not directly simulate the activities of Navy recruits. *America's Army* then is marketed as a combat experience, and by simulating U.S. Army values through a true-to-life infantry combat experience, the Army educates gamers about soldiering. How *America's Army* works as a dedicated advergame and an experiential marketing tool, will be explored more in depth in the following analysis.

MILITARY ADVERTISEMENT

With the end in 1973 of the mandatory military service, better known as the draft, the U.S. military had to rely on its recruiting efforts to enlist personnel for its new *All-Volunteer-Force*. Over three decades later, the U.S. military has to persuade more than 200,000 recruits annually to fill its ranks, but one of the biggest problems facing contemporary recruiting efforts still is its effectiveness. Today, the U.S. armed forces rely on three pillars for their recruiting efforts. First, there is a 15,000 strong force of recruiters. Second, various

(financial) incentives are available upon joining and in order to raise awareness, and third, to help recruiters reach their target groups, the military invests heavily in advertisement. From 1998-2003, the total advertising budget for military recruiting almost doubled from \$299-\$592 million while the total recruiting budget approached \$4 billion (General Accounting Office, 2003). In order to keep up with contemporary marketing, the U.S. Army created the “U.S. Army: An Army of One” brand.

As any other brand, the U.S. Army brand needs constant expansion—a process taking up enormous amounts of financial resources. To expand the Army brand, the U.S. Army sponsors a NASCAR (National Association for Stock Car Auto Racing) racing team, a NHRA (National Hot Rod Association) Top Fuel team, and a NHRA Pro Stock Bike team. And in line with the ubiquitous transgressive character of brands (Pennington, 2001), there are three (official) Web stores offering licensed material with the “U.S. Army of One” logo and slogan on it, ranging from clothing to mugs, playing cards to key rings, and other knickknacks.⁷ With half of the military advertising funding going to the Army and the constant need to reinvent and explore new advertisement platforms, there is room to experiment and try new initiatives to reach the core group of 18- to 24-year-olds. Probably the most high profile advertising experiment of all, could well be America’s Army.

It was the advergame dimension, the Army’s goal of attracting more recruits, that became at the conception of the project, the guiding design rationale. The U.S. Army does not label America’s Army as a recruiting tool or an advergame, but as a strategic communication tool (e.g., Davis, 2004). The goal of the game is to inform popular culture rather than to persuade and to raise awareness rather than directly recruit, which is done by U.S. Army recruiters. Raising both the awareness of the U.S. Army brand and the U.S. Army as a possible career are central to the design of the

game and its community. With less influencers, people with a positive attitude towards the Army and a willingness to communicate this attitude present in the U.S. society (e.g., former soldiers), the Army has to rely on other mechanisms to enter the “consideration set” of America’s youth. “So when a young person turns 18—17, 18—and they start to think about what their options are for the future, what does that list look like? Go to college? Get a job? Hang out with my friends? We want ‘join the Army’ to be one of those lists of options” (Department of Defense, 2001). With this statement, the former Secretary of the Army, Louis Caldera, articulated one of the main goals of the “Army of One” campaign.

What makes America’s Army fairly unique is that it could be considered one of the first multidimensional games (Nieborg, 2004, 2005). Analysis shows that the game has more than an advergame dimension. It is used to train U.S. Army soldiers as well as to educate gamers about the U.S. Army the edugame dimension. Through off-line PowerPoint lectures followed by multiple choice tests and through online game play, gamers may learn what it takes to be part of the “Army of One.” The games’ third dimension is its use as a test tool. New military technologies are carefully modeled in the game, allowing military experts and soldiers to test these future weapon systems in the virtual world, after which they can be easily incorporated into the edugame dimension. Gamers can be tested as well. Similar to off-line test tools, such as the Armed Services Vocational Aptitude Battery (ASVAB) freely available at U.S. high schools, the U.S. Army is able to virtually test the aptitude of potential Army recruits. The fourth and last dimension of America’s Army is its propaganda dimension. The game is both an example of a public affairs instrument, as an instrument of public diplomacy, as it shares many of the same goals and characteristic of both strategic communication tools. However, it is the role of America’s Army as a tool of public diplomacy that signals a shift away from the advergame di-

mension towards the propagame dimension. Both dimensions still interact and reinforce rather than replace each other. The initial goal of a recruitment aid and raising the brand awareness of the U.S. Army is partly bypassed when looked at the global use of the game, thereby giving way to the propagame dimension.

Encapsulated in the first-person-shooter genre are several key features ready to be appropriated for (successful) digital marketing. The U.S. Army as a brand transformed into the America's Army brand and appears able to tap seamlessly into existing game community frameworks. Kierzkowski, McQuade, Waitman, and Zeisser (1996) provide five distinct recommendations for success in digital marketing, all of which are present in the production, distribution, and consumption of the official U.S. Army game. First, there is the advertisement on and alliances with gaming Web sites such as GameSpy.com and Gigex.com. Second, providing participants with a stimulating and motivating game is evident in America's Army's much acclaimed realism. Third, participants are instantly rewarded and have the prospect of beating top scores. This is constructed by the extensive and persistent honor system which gives a gamer certain credits and acknowledgement among peers as well as goals to aim at (e.g., getting more honor points than a peer). Fourth is the identification of user preferences by providing choices within the game. In America's Army players can play in theatres of operation all over the (virtual) world, playing different rolls and familiarizing themselves with a plethora of weapons. And the fifth and final aspect is retaining users which is partly taken care of by the community, which consists of the official homepage with its message boards, several (semi-professional) affiliates and fan sites and several IRC channels. Game communities are known for their collaborative and peer-supporting character (Jenkins, 2002; Newman, 2004) and America's Army is no exception to this rule.

One of the questions asked by every journalist and academic unfamiliar with America's Army is: "is the game effective and do you have figures showing how many people joined?" Such figures are nonexistent and the design of both the game and the community are not set up in a way that such data can easily be obtained. One thing about America's Army as an advergaming is clear; the game is extremely cost effective. The game cost \$4 million a year from 2000-2003. With a breakdown of \$2 million in wages, \$300,000 for game engine costs, and \$1.5 million in operational costs (Zyda, Mayberry, McCree, & Davis, 2004). In the upcoming years, staffing costs and licensing fees are likely to grow. The \$20 million spent on the game pales into insignificance considering the following remark: "The Army estimates America's Army has the potential to save some \$700M-\$4B per year" (Zyda, 2002, p. 9).

CONCLUSION

In a society where even sand can be branded, the competition for attention is enormous (cf. Klein, 1999). Advertisement in our post-modern, media-saturated world is omnipresent but at the same time extremely fragmentary. The eyeball time of young people has become a commodity in itself, with every medium fighting for attention trying to sell audiences to a growing pool of companies and brand owners. Over the years and with the maturing of the medium, children's play has become heavily commodified (Kline et al., 2003). Product placement in digital games is ubiquitous and gamers seem to praise the efforts of game designers to include their favorite brands in a game to make the game space more "real." The console hardware developers have become established brands themselves, up to a point where gamers identify themselves with the hardware. Gamers even have names for such aficionados: "fanboys." As a result "The industry

has come full circle: conditions for its spectacular growth were set in existing youth-oriented media niches; now for gaming is itself poised to create marketing opportunities for other corporations that are seeking to target the youth audience” (Kline et al., 2003, p. 236). The multiple identities of gamers as both fans and consumers are not without consequences, the voluntary activity of play becomes intertwined with the discourses of a commodified game culture.

Where TV commercials, print ads, and the World Wide Web rely on representation for the conveying of their message, dedicated advergimes add the extra dimension of simulation. The ever-rising processing power of computer chips, doubling every 18 months according to Moore’s law, enables rich and immersive virtual experiences, showing consumers virtual insights in interactive worlds previously not accessible for the general public. It is the usage of marketing through games that differs considerably. Commercial games increasingly include some sort of marketing message. Increasingly, dedicated advergimes are used to advertise, varying from singular advergimes which may be freely distributed via popular Web sites or on a company’s homepage, to the more sophisticated experiential advergimes, which encompass elaborate, persistent, virtual worlds. As the early abstract games of Pong, Spacewar, and Tetris turned into lifelike and realistic simulations, developers are now able to turn their intertextual references into commercial representations and simulations. Games as one of the new intertextual commodities have to:

... posses the elasticity to incorporate the imaginary reconfigurations of its images, stories and products by users. Although corporations protect their trademarks and images, they have also developed sophisticated structures and architectures that allow certain images of their film or game to float freely across the Internet as promotional

sirens of their cultural commodity. (Marshall, 2002, p. 76)

America’s Army is a successful example of such a cultural commodity, marketed as a simulation of the U.S. Army. Game-play-integrated advertisement seems to be favored by gamers over non-game-play integrated forms—a cleverly integrated branded car of PDA adds flavor to a game and aids brand recall. Advergimes can move beyond in-game banners and billboards. However, while the goal of brand placement is raising brand awareness (Nelson, 2002), interactive entertainment is able to move beyond this marketing model as well. America’s Army shows that gamers are able to learn (U.S. Army) values, basic skills, and a considerable amount of knowledge and information, just by playing the game. Gamers willfully subject themselves to minute long PowerPoint lectures to advance in the game. A career in the U.S. Army is literally played out. In America’s Army, the U.S. Army brand is ubiquitous and encompasses all modes of advergaming.

The game constantly supports brand awareness, for the brand and its simulation are interchangeable. By using various new media technologies, the U.S. Army is able to directly reach their target group in an active and engaging manner that corresponds with the media use of today’s youth. Being able to simulate conflict by using existing game design conventions, the U.S. Army both redefines elements within the first-person-shooter genre and taps directly into the very fabric of popular culture. In a similar way Coke Music is based on the popular format of Habbo Hotel. The question would then be if the designers and publishers of future advergimes are willing to leave existing game genres behind and if, through innovative game design, they not only will profit from game technology and culture, but contribute to it as well.

REFERENCES

- Book, B. (2004). *These bodies are FREE, so get one NOW!: Advertising and branding in social virtual worlds*. Social Science Research Network. Retrieved August 25, 2004, from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=536422
- Buckner, K., Fang, H., Qiao, S. (2002). Advergaming: A new genre in Internet advertising. *SoCbytes Journal*, 2(1).
- Chaney, I., Lin, K., & Chaney, J. (2004). The effect of billboards within the gaming environment. *Journal of Interactive Advertising*, 5(1), 54-69.
- Chen, J., & Ringel, M. (2001). *Can advergaming be the future of interactive advertising?* Retrieved September 1, 2005, from <http://www.locz.com.br/loczgames/advergaming.pdf>
- Davis, M. (Ed.). (2004). *America's army pc game vision and realization*. San Francisco: U.S. Army and the Moves Institute.
- Department of Defense. (2001). *Army announces new advertising campaign*. Retrieved August 22, 2004, from http://www.defenselink.mil/transcripts/2001/t01102001_t110army.html
- Entertainment Software Association (ESA). (2004). *Top ten industry facts*. Retrieved December 10, 2004, from <http://www.theesa.com/pressroom.html>
- Eskelinen, M. (2001). The gaming situation. *Game Studies*, 1(1). Retrieved from <http://www.gamestudies.org/0101/eskelinen/>
- General Accounting Office. (2003). *Military recruiting: DOD needs to establish objectives and measures to better evaluate advertising's effectiveness*. Washington, DC: United States General Accounting Office.
- Hernandez, M. D., Chapa, S., Minor, M. S., Maldonado, C., & Barranzuela, F. (2004). Hispanic attitudes toward advergaming: A proposed model of their antecedents. *Journal of Interactive Advertising*, 5(1), 116-131.
- International Game Developers Association (IGDA) Online Games Committee. (2003). *IGDA Online Games White Paper*. San Francisco: IGDA.
- Jenkins, H. (2002). Interactive audiences? The collective intelligence of media fans. In D. Harries (Ed.), *The new media book*. London: BFI.
- Kierzkowski, A., McQuade, S., Waitman, R., & Zeisser, M. (1996). Marketing to the digital consumer. *The McKinsey Quarterly*, 32(3), 5-21.
- Klein, N. (1999). *No logo*. New York: Picador.
- Kline, S., Dyer-Witheyford, N., & de Peuter, G. (2003). *Digital play—The interaction of technology, culture, and marketing*. Montreal, Canada: McGill-Queen's University Press.
- Marshall, D. P. (2002). The new intertextual commodity. In D. Harries (Ed.), *The new media book*. London: BFI.
- Martian Buddy. (n.d.) *Homepage*. Retrieved May 16, 2006, from <http://www.martianbuddy.com>
- Molesworth, M. (2003, November, 4-6). *Encounters with consumption during computer-mediated play: The development of digital games as marketing communication media*. Paper presented at the Level Up: Digital Games Research Conference, Utrecht, Holland.
- Nelson, M. R. (2002). Recall of brand placement in computer/video games. *Journal of Advertising Research*, 42(2), 80-92.
- Nelson, M. R., Keum, H., & Yaros, R. A. (2004). Advertainment or adcreep? Game players' attitudes toward advertising and product placements in computer games. *Journal of Interactive Advertising*, 5(1), 3-30.

Newman, J. (2004). *Videogames*. London: Routledge.

Nieborg, D. B. (2004). *America's army: More than a game*. Paper presented at the Transforming Knowledge into Action through Gaming and Simulation, München, Germany.

Nieborg, D. B. (2005). *Changing the rules of engagement—Tapping into the popular culture of America's army, the official U.S. army computer game*. Unpublished masters thesis, Utrecht University. Retrieved September 1, 2005, from <http://gamespace.nl/thesis>

Pennington, R. (2001). Signs of marketing in virtual reality. *Journal of Interactive Advertising*, 2(1), 43-55.

Pine II, B. J., & Gilmore, J. H. (1999). *The experience economy: Work is theatre & every business a stage*. Boston: Harvard Business School Press.

Raessens, J. (2005). Computer games as participatory media culture. In J. Raessens & J. Goldstein (Eds.), *Handbook of computer game studies* (pp. 373-388). Cambridge, MA: MIT Press.

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. Cambridge, MA: MIT Press.

Schiesel, S. (2005, September 6). Conqueror in a war of virtual worlds. *The New York Times*, E1, column 4.

Van der Graaf, S. (2004). Viral experiences: Do you trust your friends? In S. Krishnamurthy (Ed.), *Contemporary research in e-marketing* (Vol. 1, pp. 166-185). Hershey, PA: Idea Group Publishing.

Van der Graaf, S., & Nieborg, D. B. (2003, November, 4-6). *Together we brand: America's army*. Paper presented at the Level Up: Digital Games Research Conference, Utrecht, Holland.

Zyda, M. (2002). *2002 In the MOVES Institute*. MOVES Institute. Retrieved August 14, 2004, from <http://www.movesinstitute.org/MOVES-activity2002.pdf>

Zyda, M., Mayberry, A., McCree, J., & Davis, M. (2004). *From Viz-Sim to VR to games: How we built a hit game-based simulation*. Monterey, CA: The MOVES Institute.

ENDNOTES

- ¹ Retrieved September 4, 2005 from <http://steampowered.com/status/status.html>
- ² Retrieved September 1, 2005 from <http://www.info.ea.com/downloads/eatrx.doc>
- ³ From the RGTA Web site General Info section located RealGTA.net. Retrieved August 23, 2004, from <http://www.doupal.cz/realgta/info.htm>.
- ⁴ Retrieved September 1, 2005 from <http://www.jaguarurbangolf.co.uk>
- ⁵ See: <http://www.cokemusic.com>
- ⁶ America's Army is continually updated and there is no finished version of the game. The first version, released July 4, 2002, was dubbed America's Army: Recon, followed by America's Army: Operations and America's Army: Special Forces. Each Special Forces update has its own label, for example, America's Army: Special Forces (Direct Action) v2.5, released October 13, 2005. During each update, content is added and the game's design differs constantly.
- ⁷ See for example: <http://www.armyproducts.com/default.aspx>, <http://shop.ipledge.com> and <http://armyofone.usptgear.com>. Retrieved August 22, 2004.

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 97-117, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 8.10

Believe It or Not: Virtual Religion in the 21st Century

Susan E. George

University of South Australia, Australia

ABSTRACT

This paper considers the development of virtual communities focusing upon virtual religion and its impact on humanity. It is important that religion is expressed communally and socially, and the Internet has provided a new community context for religiosity, linking people from geographically, socially, and culturally disparate backgrounds, facilitating interactivity as never before in an intriguing anthropological development. We find examples of “online religion” that are already occurring and see technology as playing a crucial positive role in humanity in the 21st century. While there are limitations with virtual interaction compared to face-to-face engagement, there are benefits, primarily that such technology starts to answer the deeper philosophical questions associated with technology, especially the question of how technology cannot rob people of the essence of what it is to be human. By facilitating virtual religion, technology assists the uniquely human pursuit of religiosity, and merely provides a new “meeting place” for exchange.

INTRODUCTION

The Internet has created new human communities linking people from geographically, socially, culturally, and otherwise disparate backgrounds. Such virtual communities may be defined as

a collection of people sharing common interests, ideas, and feelings over the Internet or other collaborative networks. Web-based virtual communities have been defined as social aggregations that emerge from the Net when enough people carry on public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace. These communities are becoming increasing[ly] important forums for individuals and groups that share a professional interest or share common activities. (call for papers for the forthcoming Encyclopaedia of Virtual Communities and Technologies, editor Subhasish Dasgupta, Idea Group Reference)

Virtual communities may be considered an outcome of the recent developments in com-

munications technologies and a natural anthropological consequence for humanity embracing communications technology. They are found in realms as diverse as education and health, recreation and science.

One of the most important human realms in which virtual communities are found is that of religion. The technology underlying “virtual religion” is essentially the communication technology provided by computer science through the Internet. While the original computer networks were never designed as a human communication medium, they have come to penetrate society for communication purposes in many ways — from mobile phones to Internet banking, handheld computers to “intelligent” agents and voice recognition at human-machine interfaces. The Internet has particularly brought people together from all over the world in various online communities and virtual worlds in the new “meeting place” of cyberspace.

The remainder of this paper explores the development of virtual religion and its impact on humanity. First we consider the nature of religion and note that a social and communal expression is vital. As humanity embraces new modes of interaction, we recognize virtual religion as an anthropological consequence of the new technologies. Second, we explore ways that technology is facilitating religious expression, noting it is both supporting conventional practice and enabling new. We pose some questions that have been raised about the validity of virtual religious expression and consider who is interacting in this forum and why.

Third, we move to consider technology in context, noting how it is ideally the application of science for the benefit of humanity, although many people have identified negatives of technology including its power to rob humanity of the essence of what it is to be human. One of the key questions of the generation is how technology can have a positive role in lives. In conclusion, the development of virtual religion is seen as the means

by which technology may play a positive role in lives, facilitating as it does virtual communities and religious expression in a new anthropological context, and promoting, not stifling, the questions that are at the essence of what it is to be human.

RELIGION: REAL AND VIRTUAL

Religion has proved very hard to define. Definitions of religion are often too narrow and exclude many of the belief systems which most people will agree are religious, or they are too vague and ambiguous, leading one to conclude that just about any and everything is actually a religion. Some of the more successful attempts identify a set of markers such as practical and ritual, experiential and emotional, narrative and mythical, doctrinal and philosophical, ethical and legal, social and institutional, and the material (Smart, 1992). The more markers present, the more “religious-like” the belief system is. Sometimes religion is regarded as subjective, designating the feelings and acts of people that specifically relate to God and is distinguished from theology. From this subjective perspective, religion may be defined by the benefits it offers: the inclusion in a social community, the accompanying rights and responsibilities, personal fulfillment, spiritual and emotional benefits from that, and other assets.

One important element of religion is its communal and social expression. In fact, religion is often distinguished from spirituality, which is used to refer to devotional aspects of faith and interior individual experiences (McGrath, 2001). In a Christian context, the “body of believers” has a special significance as the church. The faithful are invited to gather and not cease to meet together, whether that is in a physical church building, or other! The synagogue as a Jewish place of worship literally means a meeting place where people would come together. For Islam, one of the five pillars entails the giving of alms as if all are brother and sister in the same family. For

these major world religions, and for many others, the social dimension may be regarded as one of its distinguishing marks, and meeting together is a crucial component.

When we use the term virtual religion, we are speaking of interactions within cyberspace. Many theorists have divided communications history into three main epochs: the oral tradition, the literary tradition, and the visual tradition (Postman, 1985). Each of these traditions provides ways of knowing what is true and what is not. Summitt (1993) suggests that society is entering a fourth tradition, that of interactivity where the locus of interaction is cyberspace. This is where virtual religion is happening. The interactivity facilitated by the Internet means that those in geographically or otherwise isolated areas may (in some capacity) participate in corporate expression of religion, cutting across cultural, social, economic, linguistic, and other borders in a way never previously possible. Importantly, there is a two-way communication in the interaction — in the exchange that makes virtual religion so unique and a very real component of life at the start of the 21st century.

The anthropological implications of such a society are fascinating. That component of anthropology that is interested in the different environments in which people are found, the social relationships and the language within them, their evolution, and customs will find Internet religious-expression fascinating. Some branches of anthropology being particularly concerned with the nature and substance of people from a religious perspective (<http://mountainretreat.org/glossary.html>) and some religions, such as Christianity, may argue that the human can only be understood in the context of God. Virtual religion certainly provides a stimulus for anthropological study in the online, interactive, global, virtual communities that have come into being with communications technologies.

We find virtual religion a natural anthropological consequence for humanity as it utilizes this

enabling technology — in a way unimagined by its inventors. Hurd (2001) sees technology itself as a consequence of humanity; the act of creating and using tools for present and future use is part of what it is to be human. Taking that a step further, having created those tools, humanity will naturally use them to further its own quest. The deepest questions that humanity asks are philosophical and religious: questions about identity, significance, and purpose. A part of what it is to be human will be to continue to ask those questions through the technologies that emerge as consequences of humanity.

TECHNOLOGY AND RELIGIOUS EXPRESSION

Supporting the Old, Facilitating the New

George (2004) examines the information technology (IT) revolution in the specific context of technology applied to Western Christianity, discussing how technology has supported conventional church life and mission through church management and administration. There are excellent study resources and a wealth of electronic aids and software resources, often interactive in nature, engaging the learner; worship can also be supported with technology and made relevant to a multimedia-experience generation. Such IT systems undoubtedly (at the best of times) benefit church life with improved efficiency, accuracy, ease of communicating information, reliability, and so forth. Drawbacks are obvious when the system fails and when IT detracts more subtly from the relational community of a church.

In terms of facilitating the new in religiosity, George Barna (1998), in his book *The Second Coming of the Church*, argues that most Christian churches are operating on outdated models of authority, leadership, and congregational structure, failing to meet the needs of a changing culture.

He believes that in this decade “millions of people will never travel physically to a church, but will instead roam the Internet in search of meaningful spiritual experiences.” Using a computer for online religious activity could become the dominant form of religion and religious experience. Soukup (2000) also believes that it is vital to understand the media in reaching the culture with natural implications for the religious expression in online communities.

However, online communities are not the prerogative of the religious. Online learning is another forum where face-to-face gatherings are replaced by electronic interaction. Many students still prefer face-to-face learning situations compared to online collaboration, often because online interaction is used when it is inappropriate for the learning objectives and there is a mismatch that hinders rather than supports the educational purpose. See, for example, Carnegie Mellon’s guidelines for facilitating online collaborative learning and interaction (<http://www.cmu.edu/teaching/technology/collab.html>). Also, for many religious adherents, a remote community would be a poor substitute for a physical gathering, yet it is certainly gaining some adherents as will be discussed shortly.

Internet church is essentially an online community that includes the normal components of church in an electronic forum. There may be archived addresses, liturgies, prayers, and meditations, even video and audio recordings of actual gatherings. A bulletin board may be used for prayer or as a discussion forum to enable members to engage with each other. Members may keep in touch with electronic mailing lists and/or SMS messages and mobile phones. All manners of Internet churches have sprung up with this form of alternative worship originating in the UK in the late 1980s.

Wilson (2000) describes Internet church as an opportunity to change the history of Christianity, comparing the information superhighway to the Roman roads built almost two millennia ago that

facilitated the spread of Christianity. For example, one initiative in virtual church recognizes that younger people are attracted to online communities through games (e.g., <http://www.waltemathe.org/virtkirch/>) and a gaming strategy may be the way that inhabitants of cyberspace are drawn into deeper discussions in the marketplace. A UK-based organisation has recently (May 2004) developed a three-month Web-based pilot of a 3D virtual church (<http://shipoffools.com/church/>). It consists of a chat room with participants embodied as characters in the space; there is a virtual building where religious expression can be made and online services complete with a religious message and music.

Brenda Brasher’s book *Give me that Online Religion* (2001) broadens from Christianity to describe online religious communities and practices in general. It is one of the earliest sources that address the practical outworkings of religion through technology. Bell (2004) observes that new technologies, “technologies of enlightenment,” are delivering religious experiences in new mediums and creating new possibilities and opportunities for spiritual and religious life — everything from cyber seders, the papal SMS service, Mecca finding mobile phones, Buddhist blessings of the Internet, and the ngonli almanac online. While examples of online religion can be found, the question remains of just how they relate to the conventional expression of religion.

Virtual Religion in Question

The Catholic Church has faced particular questions relating to its worship and liturgy in light of virtual and remote communication possibilities. In particular, it has had to address the question of whether sacraments can be administered over the Internet where normally the celebration depends “on the physical presence of the gathered faithful.” The ruling of the U.S. bishops’ secretariat for the liturgy was that no sacrament can be received by electronic communication. The same ruling

was found for the ritual involving “adoration of the cross,” which was not permitted to be done via a Webcam without physically being in the church building (<http://www.monksofadoration.org/webadore.html>). This has implications for all remote links—live telecast, Internet transmissions, Webcams, and video links — since technology cannot replace the physical presence among gathered people.

Theological rulings are not the only reasons why online communities are not desirable. If people engage solely in online social groups, friendships and other intimates in the real world can be put on hold. The technology can be adopted uncritically without discerning the options and setting appropriate limits. A new sort of addiction can grow among those who have tasted the Internet and replace the real-world interactions with a virtual world. While examples of online communities can be found, some questions that remains are who uses them, how, when, why, and where.

Who is Interacting and How

The Internet shrouds the user in anonymity, and some of Goffman’s (1982) principles for face-to-face interaction just do not hold. Goffman’s theory provides an explanation on how people interact with one another in day-to-day life. He sees two regions in which people perform. The first is the front region where our activities embody certain standards, such as politeness, where the individual is socially accepted within society. In contrast, the backstage or back region is where suppressed feelings make an appearance and contradict the actions carried out in the front region. When analyzing Goffman’s theory relative to cyberspace communication, we see that the lines between the front stage and backstage are blurred through anonymity, creating issues in “flaming” (insulting or argumentative replies), all the while keeping privacy.

In terms of using computer technology, there are some trends already observable. Gender has for a long time been recognized as a factor influencing interest (or disinterest) in computer science, with the female traditionally being adverse to using the technology. At the start of the IT revolution, age was traditionally a factor influencing uptake, but not so much as the decades pass. When natural communication needs to be and can be supported because of disability, there may also be a gravitation towards the use of technology. Personality may also be a factor in uptake of online communities, where in accordance with Goffman’s interactive principles, the normal rules of communication face to face are broken with the anonymity that Internet technology affords.

Careaga (1999) reports that “one out of every four Internet users has sought religious or spiritual information at one point or another in their virtual travels, and on a daily basis, more people use the Internet for spiritual purposes than for gambling, banking, finding a date, trading stocks, or buying and selling at web auction sites like eBay combined.” Cyberspace is regarded as a new marketplace where people meet together, and hand in hand with everyday business, will discuss politics, religion, and philosophy, and ask those questions that traditional religion has conventionally answered in churches, synagogues, mosques, and other religious meeting places. People are going to the Internet more than they are to any organized religious meeting place.

This paper finds the interactivity of online environments to be the place where virtual religion is happening. The About forum is just one discussion group (<http://forums.about.com>) where atheists and agnostics, Islamics, Christians, and many others from all over the world are meeting 24 hours a day, seven days a week, and engaging in the deepest religious and philosophical questions ever asked. The interactions occurring in such online environments may be labeled virtual religion, just as real as any debate that might take

place in the actual world in forums more recognizably identified as religious. Using technology to continue the religious quest of humanity is seen as a natural anthropological consequence for humanity at the threshold of the 21st century, given communications technology has enabled such interactivity and repositories of information in every language, in various media, unparalleled in human history. Virtual religion is a natural anthropological consequence for humanity.

TECHNOLOGICAL DEVELOPMENT IN CONTEXT

Science Applied to Benefit Daily Life

It is surprising how many definitions see technology as not only the application of science, but an application designed to benefit humanity. However, clearly, the ramifications of a certain piece of technology in terms of benefit or harm may not always be apparent at the outset. For example, definitions include, “the application of scientific advances to benefit humanity” (<http://sln.fi.edu/franklin/glossary.html>), and, “The creation of products and processes for the purpose of improving human chances for survival, comfort level, and quality of life” ([http://www.geog.ouc.bc.ca/conted/online courses/enviroglos/t.html](http://www.geog.ouc.bc.ca/conted/online%20courses/enviroglos/t.html)). In terms of benefits to humanity, we may look to how technology might be applied to clinical health care practice (Gastmans, 2002), how to develop (and fund) more technologies that will serve social human needs (Steffan, 2004), or how technology intersects with social enterprise (Fruchterman, 2004). We may consider how technology has benefited and served humanity in what many would regard as one of its deepest and most distinguishing capacities, that is, in its capacity for religiosity.

Other definitions of technology also embody expectations that technology will influence every aspect of existence—from education to

health care, recreation to international politics. Technology is science applied to daily life, with applications as diverse as genetically modified food and intelligent washing machines. Many definitions focus particularly upon commerce or industry (“the practical application of science to commerce or industry”; <http://www.cogsci.princeton.edu/cgi-bin/webwn>), or engineering (“The practical application of knowledge, especially in a particular area such as engineering”; <http://www.projectauditors.com/Dictionary/T.html>). And while definitions may emphasize a certain component of daily life, technology undeniably touches every facet and excludes none, not even religiosity.

Since technology does apply science to daily life, a need is found for monitoring the ethical questions and vital issues of the use of technology to judge whether it is good or bad. Science in its purest form is not concerned with moral judgment, or with purpose or teleology (and while social sciences may ask why about a particular phenomenon, they still remain silent on the deepest questions of human existence). Groups that do monitor the application of science typically have a religious affiliation. For example, the Institute for Religion, Technology, and Culture (<http://www.religion-research.org/irtc/irtc.htm>) aims to promote discussion and reflection on technology from a theological and philosophical perspective. They see technology as impinging upon how people understand themselves, the world, and God. The science, religion, and technology group of the Church of Scotland (<http://www.srtp.org.uk/srtpage3.shtml>) was set up to monitor unexpected risks and side effects, unintended social consequences, and changes in moral outlook arising from technology. Sometimes these groups are seen in negative terms, representing people who are resistant to change, reinforcing the false dichotomy of science versus religion rather than presenting a body reflecting upon the application of science.

The Uptake of Technology

The Western Judeo-Christian culture of the previous century has shown an extraordinary obsession with technology in its application of science to daily life. While a residual of technophobia can be found, the widespread uptake of technology is largely continuing unabated in the Western world. In some instances, technology and its products are rejected; for example, the increased interest in “natural” products is seen as an example of shunning technology (Carson, 2002). Yet, largely, the Western world embraces technology. Noble (1977) finds the theme of transcendence as explanation for technological obsession in a Judeo-Christian culture; both science and religion promise to transcend mortal life — nature, our bodies, humanity, and the world.

Yet at the same time the Western world embraces technology, Western culture enters into a post-Christian society, rejecting the Judeo-Christian culture of the past two millennia. In particular, it witnesses the end of Christendom (Hall, 2002). An increase in technology has apparently occurred hand in hand with a decrease in religiosity — at least a decline in the participation in organized, traditional religion. Whether people are any less religious remains a question. The Closer to Truth forum discusses this question, noting the intriguing paradox that as the world becomes more scientific, extreme religions are gaining ground (Kuhn Foundation, 2003). Others point out that technology has replaced religion and become a god of society (Strong, 1991).

Technology: Negative or Positive?

Many have reflected on technology in its most general terms and found it both changing humanity and having some negative consequences. Shelly’s *Frankenstein* is a fictional story meant as a cautionary tale to warn us that technology could eventually destroy us. Technological disas-

ters undoubtedly occur. Works such as *Inviting Disasters: Lessons from the Edge of Technology* (Chiles, 2002) discuss major accidents from space exploration to aircraft- and chemical-processing plants, seeking to determine why they happen. Yet the primary difficulties of technology are more profound than simple catastrophes.

The philosopher Heidegger (1977b) finds that technology is changing society and is relentlessly overtaking and transforming the entire world into raw materials mobilized in technical processes. Heidegger (1977a) explained that “[o]nly a god can save us” from the juggernaut of progress. The issue is not that machines are evil or that they have taken over, but that in constantly choosing to use them over every other alternative, we make many other unwitting choices that confuses our nature. Heidegger’s goal is to find a way of living with technology that does not allow it to “warp, confuse, and lay waste our nature.”

Other philosophers such as Borgmann (1993) also see technology (in a modern and postmodern world) to include a waning recognition of the possibility of any substantial spiritual existence. It is as if technology destroys that component of humanity. Dreyfus and Spinoza (1997) ask how we can relate ourselves to technology in a way that not only resists this devastation, but that also gives it a positive role in our lives. This is marked as the key question for our generation.

Other negatives of technology have been identified from a specifically religious perspective. The education and training accompanying science and technology has been directly linked to a decline in participation of organized religion. While education is obviously not wrong in itself, the underlying rationalism placing reason over faith has been identified as a factor increasing religious scepticism and atheism (Lecky & Edward, 1946). In fact, education now explicitly recommends that atheism be taught as part of the religious education curriculum in British schools (Cassidy, 2004), reflecting a society that values

rationalism, inclusiveness of all worldviews, and postmodern correctness over values of a previously Christian Western society.

From a religious perspective, there is also the observation that technology breeds a sense of empowerment and self-sufficiency. With appropriate technology, the human can control many facets of the world, removing the need for God, at least fostering a reliance on technology rather than anything supernatural. A Catholic religious address half a century ago warns of the dangers of technology in terms of “exalting technology” and “blinding intelligence” (Pius, 1953/2000). The address points out that technology can beautifully reveal God, but also cause humanity to once again sink itself into the first sin of self-sufficiency and independence. Berger’s *The Precarious Vision* (1961) is one of the earliest works that describe why it is difficult for a fully contemporary person to maintain a Christian view of reality that is not in some way precarious, once again pointing to the way technology — from a religious perspective — may be having a negative impact.

CONCLUSION

Going back to the key question of our generation asked by Dreyfus and Spinoza (1997) — that of how we can relate ourselves to technology in a way that resists its devastation and also gives it a positive role in our lives — it would seem natural to relate the answer, or at least a component of the answer, to the observations made previously about virtual religion: that humanity is utilizing technology for the purposes of furthering answers to its own deepest questions. Far from stifling this exploration and investigation, technology is facilitating a renaissance in interactivity, enquiry, and communication among people from all walks of life in virtual communities. There may be drawbacks in the depth of interaction possible, for example, that could be seen as negative for human-

ity in contrast to face-to-face communal religious expression, yet, in that it facilitates communities that promote and do not stifle the questions that are at the essence of what it is to be human, virtual religion makes one of the most positive contributions to that key question: How can technology play a positive role in humanity?

REFERENCES

- Barna, G. (1998). *The second coming of the church*. Word Publishing.
- Bell, G. (2004). *Technologies of enlightenment? Religion and ubiquitous computing at Intel and beyond*. Retrieved February 15, 2004, from <http://www.sbs.ox.ac.uk/downloads/scitechseminar20040310.pdf>
- Berger, P. (1961). *The precarious vision: A sociologist looks at social fictions and Christian faith*. Greenwood Publishing Group.
- Borgmann, A. (1993). *Crossing the postmodern divide*. Chicago: The University of Chicago Press.
- Brasher, B. (2001). *Give me that online religion*. John Wiley and Sons.
- Careaga, A (1999). *E-vangelism*. Retrieved from http://www.e-vangelism.com/e-v_intro.html
- Carson, J. (2002). *Technology and humanity*. Retrieved from http://www.applelust.com/alust/oped/All_Mac_Considered/Archives/carson_humaneity.shtml
- Cassidy, S. (2004). *Atheism lessons planned for schools*. Retrieved from <http://education.independent.co.uk/news/story.jsp?story=491532>
- Chiles, J. (2002). *Inviting disasters: Lessons from the edge of technology*. HarperCollins Publishers.

Believe It or Not

- Dreyfus, H. L., & Spinoza, C. (1997). *Highway bridges and feasts: Heidegger and Borgmann on how to affirm technology*. Retrieved from <http://www.focusing.org/dreyfus.html>
- Fruchterman, J. (2004, March 31). *Ubiquity*, 5(5). Retrieved from <http://www.acm.org/ubiquity/>
- Gastmans, C. (2002). *Between technology and humanity: The impact of technology on health care ethics*. Leuven University Press.
- George, S. E. (in press). *The church and the IT revolution, Travelling EMU, Uniting Church in Australia*.
- Goffman, E. (1982). *Interaction ritual*. Pantheon Books.
- Hall, D. J. (2002). *The end of Christendom and the future of Christianity*. Trinity Press International.
- Heidegger, M. (1977a). Only a god can save us now (D. Schendler, Trans.). *Graduate Faculty Philosophy Journal*, 6(1).
- Heidegger, M. (1977b). *The question concerning technology* (W. Lovitt, Trans.). New York: Harper and Row.
- Hurd, M. (2001). Technology vs. humanity. *Capitalism Magazine*. Retrieved from <http://www.capmag.com/article.asp?ID=152>
- Kuhn Foundation, The. (2003). *Can religion withstand technology? Closer to truth*. Retrieved from http://www.pbs.org/kcet/closetotruth/explore/show_14.html
- Lecky, H., & Edward, W. (1946). *History of the rise and influence of the spirit of rationalism in Europe*. London: Watts & Co.
- McGrath, A. (2001). *Christian theology: An introduction*. Blackwell.
- Noble, D. F. (1977). *America by Design: Science, technology and the rise of corporate capitalism*. New York: Alfred A. Knopf.
- Pius. (2000). 1953 Christmas Message of Pope Pius XII (December 4, 1953). *The Angelus*, XXIII(4). Retrieved from http://sspx.ca/Angelus/2000_April/On_Modern_Technology_and_Peace.htm
- Postman, N. (1985). *Amusing ourselves to death: Public discourse in the age of show business*. New York: Penguin Books.
- Smart, N. (1992). *The world's religions*. Cambridge University Press.
- Soukup, P. A. (2000). *Media, culture and Catholicism*. Rowman & Littlefield
- Steffan, A. (2004). *Technology benefiting humanity: The tech bloom—Collaborative and emergent technologies*. Retrieved from <http://www.world-changing.com/archives/000520.html>
- Strong, D. (1991). The promise of technology versus God's promise in Job. *Theology Today*, 48(2). Retrieved from <http://theologytoday.ptsem.edu/jul1991/v48-2-article4.htm>
- Summitt, P. M. (1993). *My world and welcome to it: A look at the construction of social reality in virtual reality*. Unpublished manuscript.
- Wilson, W. P. (2000). *The Internet church*. Word Publishing.

This work was previously published in the International Journal of Technology and Human Interaction, edited by B. C. Stahl, Volume 1, Issue 1, pp. 62-71, copyright 2005 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 8.11

Changing Technological Trends in the Travel Behaviour of Older Tourists

Ian Patterson

University of Queensland, Australia

ABSTRACT

This chapter examines the growth in usage of information technology and the Internet by older adults. We are becoming an ageing society with seniors and baby boomers now responsible for a larger share of all holiday spending. The Internet provides a perfect vehicle for the travel industry however, many seniors are still fearful about using the Internet, and perceived problems still exist with credit card security, quality control and privacy issues. In the future, Internet travel bookings are likely to increase with the growth in baby boomers who generally prefer to use the Internet. This will further encourage the use of discount fares however it will place increased pressure on the future role of the travel agent. Furthermore the authors hope that through an understanding of the technological needs of older

adults, it will inform tourism providers about the best ways to attract older people to use Internet sites for all aspects of their travel needs.

INTRODUCTION

We are becoming an ageing society. The United Nations has recognised the fact that the older generation are growing rapidly, and has estimated that over two billion people will be aged 60 years and over by the year 2050, and this will account for 22% (or one out of five) of the world's population compared to 10% in 2000. These demographic shifts will be seen across all continents (United Nations, 2000). For example, McNeil (1991) stated that, "... as amazing as it seems, over one-third of all Americans were born between 1946 and 1964" (p. 22). Australia's ageing population also is

increasing, from around 12% in 1999 to between 24% and 26% by 2051, or one in four people (Australian Bureau of Statistics, 1999).

On a global scale, the world is becoming increasingly aware of the significant impact that older adults (and in particular, baby boomers) will have on the tourism industry in the decades ahead (Goeldner, 1992). The direct consequence of this ageing pattern is that in the future, seniors will be responsible for a larger share of all holiday spending. For example, in 1999 over 593 million international travellers were aged 60 years and over. This accounted for around a third of all holiday spending by this segment. By 2050 this figure is projected to be greater than 2 billion trips (World Tourism Organisation, 2001).

As a result of this change in the demographic profile, the tourism and leisure industry is increasingly targeting the 65 years and over market because older adults generally are regarded as having greater amounts of free time and discretionary income to spend on travel, and as a result have become a significant growth market (Javalgi, Thomas, & Rao, 1992). This is because many baby boomers perceive themselves to be younger in age and in outlook, more in control of their lives, and increasingly more self-reliant. Baby boomers typically feel a decade younger (average of 10.2 years) than what their actual age is, and as a result often prefer to spend their holiday activities with younger people (Clever & Muller, 2002). They often seek out new and different leisure experiences that are often challenging and soft adventure activities, as well as being skillful and knowledgeable consumers that are generally satisfied with their lives (Patterson, 2002).

Today, the Internet has provided a perfect vehicle for the travel industry, as online travel Web sites have allowed consumers to have increased power over their travel planning, as well as providing them with a quick, easy and cheaper way of booking holiday travel. Traditionally, older consumers have been slower to embrace new technologies such as computers and the Internet in comparison

to younger people. Many seniors are still fearful of using the Internet, and a widespread belief exists that information and communication technologies (ICT) are only for the young. This attitude is slowly changing as more baby boomers are approaching the retirement age.

AIMS OF THE CHAPTER

This chapter will discuss the use of information technology and the Internet by older adults, to assist them in making more informed decisions about future tourist destinations, and provide cheaper travel bookings. Some of the important research questions that will be asked in this chapter are:

1. Are older adults still reliant on travel agents to help make travel decisions for them?
2. Do older adults feel confident that they can use computers and the Internet to gather travel information?
3. In the future, will older adults use the Internet to plan and make their own travel bookings?

THE TRADITIONAL ROLE OF TRAVEL AGENTS

In the past, travel agents have served as both information providers and planning/booking providers for a large number of travellers, particularly when planning international overseas travel (Oppermann, 1997). In the 1990s travel agencies emerged as one of the top three information sources used by tourists for overseas travel, as well as the means to arrange travel to destinations that people had not previously visited (Duke & Persia, 1993; Mihalik, Uysal, & Pan, 1995).

The first serious attempts at research focussing on the role of the travel agent began in the 1980s. These studies set out to discover how consum-

ers perceived the role of the travel agent, and the reasons why people chose a specific agency to make travel bookings. Bitner and Booms (1982) were quick to predict that the role of the travel agent needed to change in the future—from the traditional role of a clerk, to a salesperson, and ultimately to a travel councillor. They suggested that if travel agents were to survive in the future, they needed to adopt the following radical changes to the way they do business:

- To use more aggressive marketing techniques to segment the market and to better communicate with their clients
- To have a better command of product line and profitability analysis
- To expand their use of highly sophisticated information systems and equipment
- To gain a thorough knowledge of travel destinations and requirements for each of the market segments
- To develop an understanding of how to interact and to successfully negotiate with suppliers

Sheldon (1986) examined the role of the travel agent from an economic perspective. The author affirmed that the main function of a travel agent was to reduce the time and money spent on information and transaction costs for consumers, as well as providing promotional expenditure for suppliers. Sheldon found that basic package tours provided a bigger discount to the consumer (15%) than all-inclusive tours (-3%) in his study.

Kendall and Booms (1989) investigated the way that consumers chose, used, and reacted to communications from retail travel agencies. They administered a questionnaire to 660 respondents in the Seattle region using a random digit dialling technique, as well as conducting several focus group workshops to discuss issues that were associated with people's views about travel agencies. The authors found that word of mouth communication was heavily relied upon,

and as a result many travel agencies developed many loyal clients. The researchers found that consumers will sometimes call a travel agency that is listed in an advertisement to compare basic information and prices, but will always go back to their regular agency for the actual bookings and payments.

Kendall and Booms (1989) concluded that if travel agents were to survive, they needed to develop greater knowledge about the specific needs and expectations of their clients. This included information about the types of restaurants they preferred; local attractions or side trips they wanted to go on; leisure activities that they liked to participate in; and the destinations and types of hotels, resorts, and transportation they preferred. Consumers rated the importance of gaining knowledge from all types of information sources higher than their own physical comfort when visiting an agency. In regard to their physical needs, some clients were particularly attracted by the specific location of the retail travel agency operation and the pleasantness of the office décor, while others preferred to use the telephone when dealing with the agency. Kendall and Booms (1989) concluded that travel agents needed to develop more sophisticated marketing techniques and to have a thorough understanding of consumer needs so as they could effectively compete in the travel marketplace.

Richards (1995) was interested in discovering whether travel agents were able to provide customers with travel information by helping them to bridge the information gap. This was because many consumers were becoming more skilled in accessing specialised product knowledge through their own sources, and as a result were increasingly becoming more advanced in their means of information retrieval than travel agents themselves. With this in mind, Oppermann (1997) focused his research on resident's perceptions of travel agency service attributes and compared them to travel agents beliefs about what customers found to be important. He collected responses from 266

travel agencies and 400 New Zealand residents, and found that there was a wide gap between resident's perceptions and the travel agent's actual beliefs. He argued that travel agents needed to be more aware of their client needs in order to remain competitive, and thereby to ensure long-term viability. Oppermann (1997) concluded that travel agents needed to lift their current performance because they were being placed under increasing pressure from other competitors in the travel industry. For example, the increased availability of tourist information on the Internet combined with direct booking and payment facilities were now seen as detrimental to travel agencies.

Oppermann cited several authors who also had forecast the demise of travel agencies because of the increasing competition from the Internet. Lewis, Semeijn, and Talalayevsky (1998) for example, expressed concern about the future of travel agents, given the increased trend toward information technology. The researchers noted that there had been a significant reduction in agency commissions paid by airlines to travel agencies, due to the increasing use of the Internet by consumers that had enabled them to obtain current travel information and to make direct airline reservations more easily. Because of these changing customer demands and travel patterns of senior customers, this has resulted in increased expectations in relation to value and convenience, as well as the emergence of increasingly knowledgeable consumers who were quickly becoming more proficient users of information technology.

As noted previously, the traditional travel industry structure consisted of a huge network of travel agencies that had a complete monopoly on information, prices and bookings. However, this is now changing and increasingly being challenged by travel providers who have direct access to customers through Web sites provided through the Internet. This has particularly become evident in the airline industry where carriers such as Virgin Airlines in Australia and Southwest Airlines in the U.S. sell most of their cheaper tickets on the

Internet without the use of travel agents. Even the established airlines such as American and United are now using direct channels such as line services, the Internet, and toll-free telephone numbers to reach their customers. Eliminating the human aspect has minimised costs for the airlines and as a result they can now offer discount fares that are exclusively available to online users as well as promoting the use of electronic ticketing (Lewis et al., 1998).

However, although they are increasingly becoming under threat from new technological advances, travel agents are still performing many important services for their travel consumers. Some still act as information brokers by passing on information from suppliers of travel products to consumers. They process transactions of printing tickets or forwarding money and often act as advisers to travellers. Aspects such as trust and social contact are still important to some consumers particularly when planning leisure travel, as well as face-to-face communication with an agent at a physical retail location is still seen as important for many older travellers. In the future, the highly competitive nature of the travel industry and the declining commissions paid by airlines may lead to the widespread consolidation of some smaller travel agencies. The success of travel agents will depend entirely on their ability to, "... capture the market's loyalty, ensure access to travel information while providing value-added services, and develop winning product strategies supported by information technology" (Lewis et al., 1998, p. 25).

In Scotland, one travel agency, Stewart Travel Centre, has responded to Internet travel companies cutting into their business by refocusing their strategic direction (Edry & Sennott, 2004). Stewart had noticed that there was a large number of cruise ships launched in the 1990s and decided to concentrate on advertising cruise packages. By 1999, he had created Scotland's Cruise Centre which became the largest in the country with nearly half of his 5,000 annual customers book-

ing cruises. Stewart also has moved into other profitable niche areas such as gay and senior travel, adventure vacations, and even pet travel. In the future he felt that travel agents needed to embrace the Internet more, and help customers to sort through the information overload on the Web. Although the Internet may be cheaper and easier for simple trips, travel agents are still needed to sort out difficult itineraries and complex long-haul travel. Their skills and experience will still be needed to sort out such problems as arranging connecting flights, and to inform travellers about the plethora of rules and regulations that apply to travel within different overseas countries. Many older clients in particular like to spend time talking over their travel plans in person, therefore they prefer to book through a travel agent rather than through the Internet (Edry & Sennott, 2004).

THE USE OF COMPUTERS AND THE INTERNET BY OLDER PEOPLE

In the later part of the 20th century, a technological revolution began to occur with the development and mass production of the personal computer (PC), video games, cable TV, and mobile telephones. In addition, the Internet soon became available and started to form a link between the multiple forms of information and communication technologies (ICT).

In the 21st century, increasingly larger numbers of older people are learning to use a computer and the Internet. For example, only about 30% of Americans aged 55 and over owned a computer in 1996. By 2001 these figures had increased to 37.1% (Adler, 2002). However, the majority of older people aged 65 years and older still do not have any Internet access. In the United Kingdom, although there has been a huge increase in the use of the Internet to 62% of the British population, the usage rate dropped to 33% for the 55 to 64 year age group, and to just 6% for those over 75

years of age (National Statistics Survey, 2003). This has been attributed to the lack of adequate training, unfamiliarity with computer technology, or uncertainty about how the Internet can be used as a useful resource for them. Others are disadvantaged because of their low income, poorer education and/or lower social class status (Castells, 1998). As a result, Internet usage is mainly concentrated in the younger end of the over 50 age group. However, baby boomers who are presently aged between 42 and 60 years of age will rapidly increase the percentage of computer users as they become older. This is because many baby boomers are well educated and wealthy and because of this, have favourable attitudes toward the use of computers (Kawamoto, 2003).

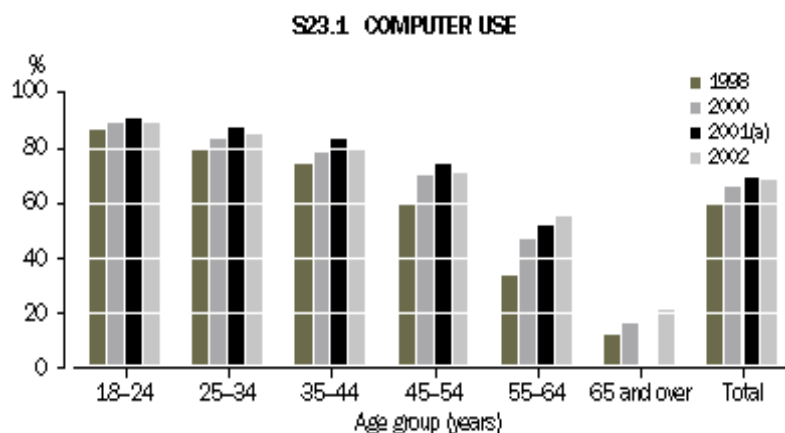
In Australia, the Australian Bureau of Statistics (2002) found that around one in five older people used a computer in 2002 which is slightly lower than the American figures (ABS, 2002). That is, only 21% of older people aged 65 years and older used a computer compared to 89% of persons aged 18 to 24 years (see Figure 1).

Older people who use computers were more likely to use them at home for personal and private purposes (92%). Other uses were for educational purposes (19%), work or business (16%) and voluntary or community work (13%). Only 13% of older people aged 65 years and older used the Internet, with 4% using it to pay their bills such as their car registration or local government rate payments. Over a third of older people (36%) stated that they had no need to order goods and services via the Internet, or had not bothered to try.

A recent study in the United States by the Kaiser Family Foundation (2004) specifically looked at the use of the Internet for informing decisions about health and health care options. The foundation found that less than a third (31%) of Americans aged 65 years and older had used the Internet. However, they noted that 70% of the next generation of seniors who are presently aged 50 to 64 year age group were regular users of the Internet. These differences in usage figures

Changing Technological Trends in the Travel Behaviour of Older Tourists

Figure 1. Computer usage across different age groups between 1998-2002 (Source: Household Use of Information Technology, Australia [8146.0])



Note: (a) Data for 2001 not available for persons aged 65 years and over

were quite striking with only 21% of older adults going online to access health resources compared to 53% of the 50 to 64 year olds. The foundation concluded that there was a “digital divide” between the two age groups and this placed older people who were most in need with limited access to information on which to base important health care decisions.

A report titled “Older Americans and the Internet” reinforced the findings of the Kaiser Foundation. They stated that despite the significant gains among seniors, “... most Americans aged 65 and older live lives far removed from the Internet, know few people who use e-mail or surf the Web, and cannot imagine why they would spend money and time learning how to use the computer” (AScribe Health News Services, 2004, p. 2). However this is quickly changing as a growing group of younger baby boomers in the 50 to 60 year age group have become significantly more attached to the Internet. Lee Rainie, the author of this report, concluded, “Internet users are gaining momentum. Internet users in their 50’s

who work, shop, and keep in touch with friends and family online will age into, and transform the wired senior population” (AScribe Health News Services, 2004, p. 2).

Several studies have investigated the benefits of computer usage for older adults. A study by White, McConnell, Clipp, and Bynum (1999) at Duke University concluded that teaching older adults to use computers to access the Internet and e-mail has resulted in a trend toward reduced loneliness. White et al. (1999) found that computers had a beneficial effect on older people’s psychosocial wellbeing as well as expanding their social support network. White and his colleagues also noted that involvement in a network of online support and chat groups, helped older people to feel connected to society, and was a strong predictor of lower levels of perceived life stress. The Kaiser Foundation (2004) reinforced this, with their study findings that 34% of seniors considered e-mail and the Internet as an important part of their lives that they did not want to do without. Furthermore, over half (56%) of seniors who used

e-mail stated that it made it a lot easier for them to stay in touch with family and friends.

The importance of social support networks has been emphasised in other studies of older adults. Wright (2000) found that older adults were able to meet a diverse group of individuals not only from the same cohort group but also to make intergenerational contacts. Wright concluded that these online support groups helped older adults to feel more connected to society, as sharing one's life with others helps to validate their experiences as human beings. This is especially true for individuals who spend a great deal of time on the Internet, and generally results in relatively strong relationships beginning to form. For a number of people, their relationships with Internet friends were regarded as similar to a surrogate family, even though they had met online and were complete strangers beforehand. Furthermore, Antonucci (1990) and Wright (2000) noted that greater involvement with Internet support networks was a better predictive of lower perceived life stress than age or the number of hours per week communicating on the Internet.

Morrell, Mayhorn, and Bennett (2000) conducted a study to document the use of the World Wide Web among a sample of 381 (151 men and 230 women) in different age groups in South Eastern Michigan. The breakdown in age groups were 108 middle-aged (aged 40-59), 181 were young-old adults (aged 60-74), and 92 were old-older adults (aged 75-92). Two versions of a World Wide Web questionnaire were mailed to respondents, one directed at current users of the Web while the other directed at nonusers. The researchers found that only nine of the 92 old-older adults indicated that they were current Web users. Users were found to be younger, better educated, more likely to own a computer, have a higher household income, and lived with someone who was a nonuser. The authors concluded that age was a good predictor of Web use, and the reason that the old-older age group did not use the Web was because of a lack of computer access and knowledge.

Sourbati (2002) conducted focus group and individual interviews with 18 older tenants and six care staff in sheltered accommodation schemes in North London. This accommodation service employed care staff on a 24-hour basis and provided a communal Internet facility and free Internet sessions. Sourbati (2002) wanted to ascertain what benefits were provided by Internet access for older people living in sheltered accommodation. Firstly, she found that encouragement that was provided by family, social networks, and care staff generated a lot of interest about using the Internet among older people. Several saw it as a way of providing opportunities to engage in constructive leisure activities and hobbies, find companionship, communicate with others, and keep in contact with modern society.

One retired tenant stated "... I would love to be able to use the Internet. Because that's tomorrow, I mean if I had a few bob and I wanted to buy something I'd buy the Internet ... I'd use it for entertainment, I could tap into information, companionship" (Sourbati, 2002, p. 2).

Secondly, she found that there were barriers and obstacles to their use of the Internet. These included physical disabilities such as arthritis, dexterity problems, or declining vision had caused problems. Lack of technical support and assistance by community support officers who also lacked basic Internet skills were issues that also needed to be dealt with. Such computer devices as the mouse could cause difficulties for older adults when performing such skills such as dragging, clicking, or fine positioning. "The only thing I find hard now which I have only ever used once is what do you call it ... the mouse, you know, it kept going here, there and everywhere" (Sourbati, 2002, p. 2). Older adults also may become confused and frustrated by the unfriendliness of interface designs such as small font sizes, using pull-up or drop-down menus, or having a poor colour contrast background (Lee, Godbey, & Sawyer, 2003). Although these barriers exist, several organisations such as the University of

the Third Age, ElderHostel, and SeniorNet are helping older adults to gain computer knowledge through a wide range of educational programs and training.

Elderhostel (www.elderhostel.org)

In 1999, Elderhostel was one of the Internet winners at the annual CIO Web Business Magazine awards. Elderhostel began with a very basic site in 1995 however in 1997, the president of Elderhostel, Bill Berkeley, decided to expand of this site as one of his major objectives. Among the changes that occurred, the customer mailing list was expanded by 25% and online registrations were encouraged. This saved the organisation \$87,000 as Elderhostel promoted an appeal to save the environment resulted in a growing number of clients who no longer received paper catalogues. Instead, regular customers received e-mail notification when a new catalogue went online. The online catalogue was improved by including details about accommodations and information of special interest to those with physical limitations. The site allows customers to register, check their status, cancel or transfer courses, go on a mailing list, change their information, send e-mails, and make donations. In fact, online donations have outpaced mail contributions, and the average gift has been 30% higher than donations that are made through the mail. The site also supported meaningful surveys and experimental programs. Future plans include peer program reviews and a discussion forum. Elderhostel has attributed their success to design that is tailored to suit over 55-year olds, such as readable print, minimal graphics and allowance for small screens (www.cio.com/archive/Web-business/070199_interwinners.html).

SeniorNet as an Educational Provider (www.seniornet.org)

SeniorNet was established to provide education for older adults so as to enable them to gain greater

access to computer technology (Grotsky & Gilbert, 1998). SeniorNet began in 1986 as a research study that was aimed at encouraging seniors to use a computer. The study found that under the right conditions, older adults adapted well to using digital technology. Over time, SeniorNet soon established an infrastructure of learning centres specifically designed to cater for older adults which has now grown into a national network of 128 learning centres covering 35 states in the United States. Adults who are 50 years and older can enrol in an inexpensive eight week class ranging from an introduction to computers, to creating your own Web page. These classes are peer taught by more than 1800 older adult volunteers who have previously taught more than 120,000 older adults to use computers and the Internet.

The mission of SeniorNet is centred on inclusion and independence, and classes are places where comfort and community are stressed, and older students are encouraged to ask questions and work at their own pace. By going online, older adults can also locate new friends and gain support in difficult times. For example, SeniorNet has established a grief support discussion group where people can find comfort and support when necessary. Other intergenerational projects such as "Living Archives" were launched in 1993 and this has enabled school students to electronically connect and interact with seniors, and at the same time to encourage participation by older adults in this form of electronic classroom. The project focuses on such specific topics as World War II, the 1950s, the civil rights movement, space travel, and women's liberation. This has enabled a high school student in Alabama for example, to communicate with a Holocaust survivor in Arizona, or a senior citizen who marched with Dr Martin Luther King Jr. to share that experience with students across the country (Grotsky & Gilbert, 1998).

Adler (2002) stated that in the future, the widespread availability of broadband networks will play a major role in supporting and enhancing

the lives of older adults. High-speed broadband networks offer several important advantages over slower narrowband networks: first, they make it possible to add high-quality two-way video to today's voice and text communications. Second, they provide instant access to rich multimedia content. Third, broadband's "always on" feature makes communications more convenient and supports a broad range of continuous, unobtrusive monitoring services. Finally, once broadband networks, both wired and wireless, become ubiquitous, users will be able to access any content from anywhere at any time.

While broadband applications will be of value to many segments of society, some applications will be of special importance to seniors. Among the key benefits that ubiquitous broadband networks offer to older adults are:

- **Enhancing communications with family and friends:** High-speed, always-on networks will dramatically enhance the ways in which people communicate and share their lives on an on-going basis. High quality video will be added to today's voice and text communications providing opportunities for richer interactions.
- **Expanding opportunities for lifelong learning:** Current experiments with "e-learning" have demonstrated the potential of online education for older adults, particularly for those with limited mobility. Online "classrooms without walls" will bring engaging educational experiences to seniors at home, and will help prolong the careers of older workers by providing instant access to continued training in the workplace.
- **Improving the delivery of health care services:** Broadband technology may have the greatest impact on the lives of seniors in the area of health. As people get older, the cost of the medical services they use also increases. One promising approach to improving health care delivery is a greater

use of "tele-medicine" services. Broadband networks will make it possible to deliver high quality medical services to older adults, including remote diagnoses and continuous health monitoring in ways that are convenient for both patients and providers.

- **Supporting independent living:** One of the most innovative uses of broadband networks will be to help people remain independent as they age and become more frail. Research is currently underway to develop an "aware home" that will unobtrusively track the behaviour of residents, automatically provide needed services, and call for help when needed.
- **Creating new options for entertainment:** As broadband access grows, so will the range of entertainment options available to everyone, including older adults. Greater bandwidth will expand the opportunities to provide content designed for specific audiences and give individuals the ability to customise the programming available to them.

For these benefits to be realised, a number of barriers will have to be overcome. These include ensuring that new services are easy for older adults to learn and use, guaranteeing that online applications are private and secure, and creating a legal and regulatory environment favourable to the rapid deployment of broadband networks (Adler, 2002).

Adler (2002) presents the following future scenario of Madge Gunderson, 88 years old, and the year is 2012:

Madge is able to keep in close contact with her family thanks to a constant stream of communication back and forth. As she sits down to breakfast she picks up a wireless tablet about the size of a pad of paper and scans a list of half a dozen messages that have arrived overnight. She sees that a video e-mail message has arrived from her 21-year old grandson who is teaching

English in Japan. She could play the message on her handheld tablet, but she decides to watch it on a larger flat screen that hangs on the wall of in her kitchen. The screen is in fact a normal digital television set containing some additional circuitry that allows it to connect to and interact with other systems through a wireless home network. Using her tablet as a remote control, Madge turns on the wall screen and calls up the message. Madge is amused to see that the grandson wants to introduce one of his students named Toshio who wants to practice his English skills. His English is less than perfect, but she is able to follow his description of a kite-flying festival he had participated in. The message then cuts to a few seconds of video of brilliantly coloured kites flying in a clear blue sky. Madge likes the image of the kites so much that she replays this segment. She freezes the video of the kites and sends the image to an electronic picture frame that sits on the kitchen counter, replacing another picture that had been in the frame for the last few months. At the end of the message, Toshio asks Madge if she would be kind enough to send him a message back. She considers using a digital video camera in the room to create a video response, but decides that she doesn't look good enough at this hour of the day to be seen, even in an online message. So she records a short audio message politely thanking Toshio for his message and telling him how she enjoyed seeing the kites. When she is finished, she sends the message to her grandson for delivery to his student. As she scans the rest of her message list on her tablet, she sees one from her physical therapist who explains that he has some new exercises that he'd like Madge to try and asks her to schedule an appointment. She links to a calendar showing the therapist's schedule and sees that he has an open slot at the end of the morning. She taps on that time on the tablet's touch sensitive screen, and her name is automatically entered (the system recognises that it is Madge who is calling and knows that she is one on the therapist's patients). After going through her messages, Madge shifts to a display

of the front page of the *Washington Post* which remains a daily habit, even though she rarely reads the printed version of the paper. She scans the headlines and reads a few stories, then calls up a calendar of her activities for the day. She sees that she is scheduled to meet a friend for afternoon tea then tutor a group of second graders in a local after-school program which she does every week ... Since Madge no longer drives a car, her calendar automatically reserves a ride to her appointments through a local para-taxi ... As Madge drives to town she gets a call from her granddaughter in Boston who is eager to show her a drawing that she made that morning at school. As Madge only has her handheld phone with a small video display, she tells her granddaughter that she will look at the picture when she gets home where she will be able to see it on the big screen. As Madge arrives at the school she decides to turn off her pocket phone. All of this technology is helpful, she thinks, but sometimes it's a good idea not to be too connected! (pp. 8-9)

THE USE OF INTERNET TECHNOLOGY FOR TRAVEL BY OLDER ADULTS

The Internet is a technological innovation which is having a profound influence on all aspects of people's lives. The Internet is gaining rapidly on other forms of media such as television and newspapers in terms of time spent on these types of media (Heichler, 1997). The travel industry in particular has consistently been identified as one of the main industries that is most likely to be affected by the growth of the Internet. Machlis (1997) stated that travel was the single largest revenue generator among consumers on the Internet, totalling US\$800 million in 1997.

In 2005 the Travel and Tourism Industry (TIA) estimated that 56% of the 216.1 million adults in the U.S. currently use the Internet. This translates to over 120 million adults of which 84% state that

they are travellers, meaning that they have taken at least one trip of 50 miles or more away from their home in the past year. This translates to a market of 101.3 million online travellers. More frequent travellers who state that they have undertaken five or more trips annually, have an even greater likelihood of using the Internet with 75% indicating that they use it (Green & Cook, 2005).

Several studies have looked at the increased growth in Internet purchases for travel by older people. Age has been found to be an important demographic variable in terms of the likelihood of older adults using the Internet for a browsing search for travel information, purchasing, and perceptions about security. A study by GTRC (1998) found that mature individuals were less likely to use search engines to reach an Internet site than by traditional means such as through reading magazines and newspapers. This study also found a significant relationship between a traveller's age and the likelihood of making purchases over the Internet. This is because as people age, they appear to be more suspicious about the quality of products that are available, with almost 50% of potential travellers over 50 years of age citing the quality of the goods as a problem when making purchases over the Internet. Mature individuals also were less likely to admit that they would use their credit card over the Internet (GTRC, 1998).

Weber and Roehl (1999) provided a profile of consumers who purchased travel via the Internet. These researchers at Georgia Tech conducted a WWW survey in 1997 to track the growth and changes of the Web user base. The survey was conducted online with participants completing questionnaires that were posted on the Web. Their study found that age and education were significant variables, and that people who were younger (25 years or younger), or older (over 55 years of age) were less likely to purchase travel arrangements online than people in other age groups. Furthermore, respondents with four-year college degrees or postgraduate qualifications were more likely

to purchase travel online than people with lower educational levels. Travel purchasers also were more likely to have previously been online for a period of four or more years. The most frequently cited reasons for *not* purchasing products online were credit card fraud, no assessment of product quality, privacy issues, and the preference to purchase locally. The researchers concluded that the major challenges facing online travel retailers were to address the issues of credit card security and data access. They concluded that consumers must feel confident that the information being provided was safe and could be used ethically and appropriately (Weber & Roehl, 1999).

In a further study by Bonn, Furr and Hausman (2000), they interviewed a sample of almost 14,000 travellers during a recent trip to Tampa, Florida. The researchers divided the sample population into three representative age groups: Generation X'ers, Baby Boomers, and Mature Travellers. A small number of travellers from England, Canada, Germany, and Brazil (11.2%) completed the questionnaire, while 88.8 % of the total sample was residents of the United States. The authors found that the U.S. respondents, particularly Generation X'ers and Baby Boomers consistently stated that they were the most likely users of Internet services for travel purposes. Mature travellers were less likely to make use of the Internet to book a trip as the trend line in their study indicated nearly flat growth until 1999. However, future growth in Internet usage among mature travellers is likely to increase as a result of the continuing maturation of the baby boomer population, rather than any change in behaviour patterns of present-day mature travellers.

These latest figures are encouraging, with seniors who now use the Internet increasing by 47% between 2000 and 2004. In February 2004, a survey found that 22% of Americans aged 65 years or older had access to the Internet and this has increased from 15% in 2000. This translates to about 8 million Americans who are aged 65 years or older that presently use the Internet.

By contrast, 58% of Americans aged 50 to 64 years, 75% of 30 to 49-year-olds, and 77% 18 to 29-year-olds currently go online. In particular, 41% of the older age group 65 years and older have made travel reservations online at the end of 2003. This is a 16% increase since 2000 and showed a growth rate of 64% (AScribe Health News and Services, 2004).

Why is the Internet Becoming More Popular for Travel Bookings by Older Adults?

Several reasons have been suggested:

- Allows customers to shop around for the lowest fares for trips and accommodations
- Provides a more personalised service with large amounts of useful information available
- Helps consumers to better understand the products by using multimedia, such as fantasy vacations and 360 degree virtual tours
- Saving money in a paperless environment
- Increases the convenience of obtaining information at home, and supporting a customer focussed strategy
- The Web dramatically decreases the time it takes to make travel reservations and plans. (Turban, 2004)

Examples of Successful Travel Web Sites for Use by Older People

Travelocity (<http://www.travelocity.com>)

Regarded as the leader in the category of mega-travel sites, this is the third largest Web site on the Internet. This site provides consumers with a myriad of services, ranging from car rentals, train bookings, hotel reservations, and information on every conceivable destination and complete vacation packages. It maintains a user friendly

interface over which transactions are processed. The site is simple to use, and a consumer can literally book an airline ticket with 3 clicks. It also continues to add value to the site by introducing new personalised services to customers.

Wal-Mart (<http://www.walmart.com>)

Wal-Mart has moved into the booming and profitable world of Internet travel sites. In 2000 it launched its new site which offers airline tickets, car rentals, and hotel reservations to customers. The site is extremely simplistic and provides nothing other than the basics and is easy to use for older travellers.

United Airlines
(<http://www.shopzilla.com>)

In July 1999, United Airlines and Buy.com announced a strategic alliance between the two which capitalised on the booming online travel industry. Specifically, it was a strategic business move to get into the mega-travel site sector which had become very profitable. This site offers the typical array of hotel, car, and planning services. This idea was later modified to target college students CollegeTravelNetwork.com. In January 2000, United announced a partnership with Delta Airlines, Northwest Airlines, and Continental Airlines to develop a site devoted to airline travel that will offer fares that can be only found on the Internet.

REI Adventure Travel
(<http://www.rei.com>)

REI.com is one of the growing sites that specialises in adventure travel. REI has experienced a 22% increase in sales since 1998, and now offers around 4,000 trips each year. Adventure Travel has bought out Adventure Travel and this has allowed them to provide a dynamic Web wizard search engine that enables customers to plan an adventure trip

by searching its database based on parameters of destination and activity, and then narrows it down by price, and so on. REI also is the sole provider of adventure gear and other paraphernalia.

Suggestions for successful travel sites for older travellers:

- Focus on customer service.
- Keep the site as simple as possible and use larger print to make it easier to read for older people.
- Provide as many services as possible to create a one-stop shopping site for travel without sacrificing simplicity.
- Utilise java script and intelligent agents to further personalise the site for older visitors.
- Attempt to form strategic alliances with other companies with complimentary core competencies.
- Look to move into regions that are untapped and have a huge market potential such as Asia.

CONCLUSION

In 1998, people who were over 50 years of age and who were intent on travelling were more likely to use the traditional advertising media such as through travel agents, magazines, and/or newspapers. Travel agents in particular have, and still are providing an important service for older travellers especially if they are travelling overseas. Many older adults still prefer word of mouth communications with their travel agent, many of which have built up a loyal clientele of older people over the years that still rely on them for travel information, advice and personalised booking services. Several academics have challenged the traditional role of the travel agent stating that they need to change their mode of operations from a salesperson and clerical worker, to become a travel councillor if they want to remain competi-

tive with online booking and Internet services, especially in the airline and hospitality industries. That is, a good travel agent needs to develop more sophisticated marketing techniques and detailed information about travel destinations, as well as an understanding the specific travel needs of different segments of the older adult market if they wish to stay in business.

Many older people still lack knowledge about, and access to computers while others do not feel confident about using the Internet. However, there are many benefits of using the Internet such as developing an increased social support network, and improved contacts with friends, relatives, and family members through e-mail services. Furthermore, surfing the Web can increase a person's knowledge and skills and help to re-establish and maintain an older adult's sense of empowerment and confidence. Finally, cognitive improvements through the learning of new technologies also have been noted, and studies have shown that older adults have substantially increased their ability to feel mentally alert, challenged, and useful (Lee et al, 2003).

Recently, through such organisations as Senior Net and the University of the Third Age, older people are learning how to use computers in relaxed and comfortable settings close to their homes. This has encouraged the use of intergenerational projects with schoolchildren, who can now instantaneously interact with seniors through the use of electronic classrooms. Adler (2002) also stated that the widespread availability of broadband networks will play a major role in supporting and enhancing the lives of older adults. These benefits include enhancing communications with family and friends, expanding opportunities for lifelong learning, improving the delivery of health care services, supporting independent living, and creating new options for entertainment. For these benefits to be realised, a number of barriers will have to be overcome. These include ensuring that new services are easy for older adults to learn and use, guaranteeing that online applications

Changing Technological Trends in the Travel Behaviour of Older Tourists

are private and secure, and creating a legal and regulatory environment favourable to the rapid deployment of broadband networks.

Although younger consumers are more likely to make online bookings for travel purposes, older people are becoming increasingly more confident in the use of this form of information technology. Perceived problems still exist with such aspects as credit card security, quality control and privacy issues. However, the numbers of people aged 65 years and older in the United States who are using the Internet has increased from 15% in 2000, to 22% in 2004, an increase of eight million Americans. This will further increase with the growth in the number of baby boomers who are generally proficient in their use of the Internet, and prefer to take advantage of its services in relation to online purchases. This has encouraged the use of discount fares for international travel however it places greater pressure on the future role of the travel agent, as it may eventually eliminate them as a broker for travel transactions.

REFERENCES

- ABS (Australian Bureau of Statistics). (1999). *Older people: Australia, A social report* (Cat. No. 4109.0). Canberra, ACT: AGPS.
- ABS (Australian Bureau of Statistics). (2002). *Household use of information technology, Australia* (Cat. No. 8146.0). Canberra, ACT: AGPS.
- Adler, R. P. (2002). *The age wave meets the technology wave: Broadband and older Americans*. Retrieved 30 June, 2006 from <http://www.seniornet.org/downloads/broadband.pdf>
- Antonucci, T. C. (1990). Social supports and social relationships. In R. H. Binstock & L. K. George (Eds.), *Handbook of aging and the social sciences* (pp. 206-226). San Diego, CA: Academic Press.
- AScribe Health News Services. (2004, March 25). *22 percent of Americans age 65 and older go online: Many more are shopping, doing health research, making travel reservations* (pp. 1-2).
- Bitner, M. J., & Booms, B. H. (1982). Trends in travel and tourism marketing: The changing structure of distribution channels. *Journal of Travel Research*, 21, 39-44.
- Bonn, M. A., Furr, H. L., & Hausman, A. (2000). Employing Internet technology to investigate and purchase travel services: A comparison of X'ers, boomers and mature market segments. *Tourism Analysis*, 5, 137-143.
- Castells, M. (1998). *The information age. Volume 3: End of the millennium*. Oxford, UK: Blackwell.
- Cleaver, M., & Muller, T. E. (2002). The socially aware baby boomer: Gaining a lifestyle based understanding of the new wave of ecotourists. *Journal of Sustainable Tourism*, 10, 173-190.
- Duke, C. R., & Persia, M. A. (1993). Effects of distribution channel level on tour purchasing attributes and information sources. *Journal of Travel and Tourism Marketing*, 2, 37-56.
- Edry, S. L., & Sennott, S. (2004, April 19). Cruising for customers: Contrary to popular belief, the Internet hasn't killed off travel agents. It's turned them into savvy specialists. *Newsweek International*, p. 58.
- Green, C. E., & Cook, S. D. (2005). *Travelers' use of the Internet* (2005 ed.). Washington DC: Travel Industry Association of America.
- Goeldner, C. R. (1992). Trends in North American tourism. *American Behaviouralist Scientist*, 36, 144-154.
- Grodsky, T., & Gilbert, G. C. (1998). Seniors travel the information superhighway. *Parks and Recreation*, 33, 70-74.
- GTRC. (1998). *GVU's 10th WWW user survey*. Atlanta, GA: Georgia State University Press.

- Heichler, E. (1997). Internet lacks content for women. *Computerworld*, 31, 64.
- Javalgi, R. G., Thomas, E. G., & Rao, S. R. (1992). Consumer behavior in the US travel marketplace: An analysis of senior and non-senior travellers. *Journal of Travel Research*, 31, 14-19.
- Kaiser Family Foundation. (2004). *E-health and the elderly: How seniors use the Internet for health*. Retrieved June 30, 2006 from <http://www.kff.org>
- Kawamoto, K. (2003, November-December). Older adults and the Internet. *Interface: The Journal for Education, Community and Values*.
- Kendall, K., & Booms, B. (1989). Consumer perceptions of travel agents: Communications, images, needs, and expectations. *Journal of Travel Research*, 33, 29-37.
- Lee, B., Godbey, G., & Sawyer, S. (2003). The changing roles of computers and Internet in the leisure lives of older adults. *Parks and Recreation*, 38, 22-25.
- Lewis, I., Semeijn, J., & Talalayevsky, A. (1998). The impact of information technology on travel agents. *Transportation Journal*, 37, 20-25.
- McNeil, R. D. (1991, September/October). The recreation profession and the age revolution: Times they are a 'chargin'. *Illinois Parks and Recreation*, 22, 22-24.
- Machlis, S. (1997). Profits eludes travel sites. *Computerworld*, 32, 53-54.
- Mihalik, B. J., Uysal, M., & Pan, M.-C. (1995). A comparison of information sources used by vacationing Germans and Japanese. *Hospitality Research Journal* 18/19, 39- 46.
- Morrell, R. W., Mayhorn, C. B., & Bennett, J. (2000). A survey of World Wide Web use in middle-aged and older adults. *Human Factors*, 42, 175-184.
- National Statistics Survey. (2003). Retrieved June 5, 2006 at <http://www.statistics.gov.uk>
- Oppermann, M. (1997). Service attributes of travel agencies: A comparative perspective of users and providers. *Journal of Vacation Marketing*, 4, 265-281.
- Patterson, I. R. (2002). Baby boomers and adventure tourism: The importance of marketing the leisure experience. *World Leisure Journal*, 44(2), 4-10.
- Richards, G. (1995). Retailing travel products: Bridging the information gap. *Progress in Tourism and Hospitality Research*, 1, 17-19.
- Sheldon, P. J. (1986). The tour operator industry: An analysis. *Annals of Tourism Research*, 13, 349-365.
- Sourbati, M. (2002). *Internet use in sheltered housing: Older people's access to the new media and online service delivery*. Joseph Roundtree Foundation: Digital Age series.
- Turban, E. (2004). *Electronic commerce: A managerial perspective*. New Jersey: Pearson/Prentice Hall.
- United Nations, Division for Social Policy and Development, Department of Economic and Social Affairs (2000). *The sex and age distribution of the world populations: 1998 revision*. Retrieved June 30, 2006: <http://www.un.org/esa/population/publications/ageing/Graph.pdf>
- Weber, K., & Roehl, W.S. (1999). Profiling people searching for and purchasing travel products on the World Wide Web. *Journal of Travel Research*, 37, 291-298.
- White, H., McConnell, E., Clipp, E., & Bynum, L. (1999). Surfing the net in later life: A review of the literature and pilot study of computer use and quality of life. *Journal of Applied Gerontology*, 8, 358-378.

Changing Technological Trends in the Travel Behaviour of Older Tourists

Wright, K. (2000). Computer-mediated social support, older adults, and coping. *Journal of Communication*, 50(3), 100-118.

World Tourism Organisation. (2001). *Tourism 2020 vision: Global forecasts and profiles of market segments*, 7. Madrid, Spain: World Tourism Organization.

This work was previously published in Information and Communication Technologies in Support of the Tourism Industry, edited by W. Pease, M. Rowe, & M. Cooper, pp. 339-359, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 8.12

New ICTs for Conflict Prevention and Management

Ángela-Jo Medina
ConcienciAcción.org, USA

ABSTRACT

This chapter introduces the impact of new information and communication technologies (nICTs), specifically the Internet, on national and international conflict prevention and management. This analysis provides case studies of the use and examples of the prospective use of nICTs to counteract conflict as it undermines social and economic structures and hinders regional development. This study reviews the specific application of nICT-related initiatives at the different phases of the conflict cycle: from addressing the root causes of conflict as a tool for prevention and management, through the reconciliation and reconstruction phase. The author intends this analysis to illustrate and contribute to the discussion of how the social and development-related application of nICTs can compliment existing conflict prevention and management reduction strategies.

INTRODUCTION

According to the United Nation's Development Program's Human Development Report the greater part of countries with limited human development, 22 of 32, have experienced violent conflict since 1990 (2005, pp. 149-179). Conflict undermines social and economic structures: public healthcare, education systems, employment, and so forth. Regional development is also one of its victims.

This chapter outlines the uses of new Information and Communication Technologies (nICTs) for the prevention and management of active and latent national and international conflicts. It will demonstrate the application and potential of nICTs to complement activities that are already being carried out in the field to address the root causes of conflict, its prevention and management, as well as the fomentation of reconstruction and reconciliation.

Some of the uses given within the structure of this analysis are the creation of a medium of coherent manifestation, the establishment of a basis for transparent governance, and the development of generic platforms of common interest. Case studies illustrate the actual and prospective use of nICTs in the different phases of the conflict cycle.

The term nICTs is used to designate the Internet individually and/or its conversion with other types of information communication technologies like community radios, television, mobile telephony, and so forth. In this case, however, for the most part, the Internet will be the focus. Nevertheless, later in the chapter, mobile telephony, another very important nICT, will be considered.

BACKGROUND

Differences of opinion are commonplace and conflict is natural; neither of them is necessarily negative. The crux of the issue is finding and applying methods to prevent and manage these conflicts in a peaceful manner.

Today's intra and inter state conflicts¹ are difficult to analyze, thus difficult to solve. Since the end of the Cold War, the nature of global conflicts has significantly changed². The ethno-political, structural, and social factors that cause and transform conflict constitute a complex, ever-changing web. The weakening and/or disintegration of state authority, the existence of third parties that benefit from strife and the many cases in which civilians are the target of violence are constants within this framework. As indicated by Timothy Shaw, "Prospects for regional development recede as conflicts both escalate and proliferate and 'off-budget' incomes and expenditures become priorities for regimes and leaders alike" (2003, p.7).

Society's evolution has expanded the variety of sources and scenarios of conflict and simultaneously increased the number of tools available to deal with them. New information and

communication technologies are among these. To date, non-military studies about the impact of nICTs on conflict situations have been few³. This possibility results from the Internet which evolved from ARPANET, a military command and control center dating back to the 1960s (Sequeira Bolaño, 2001).

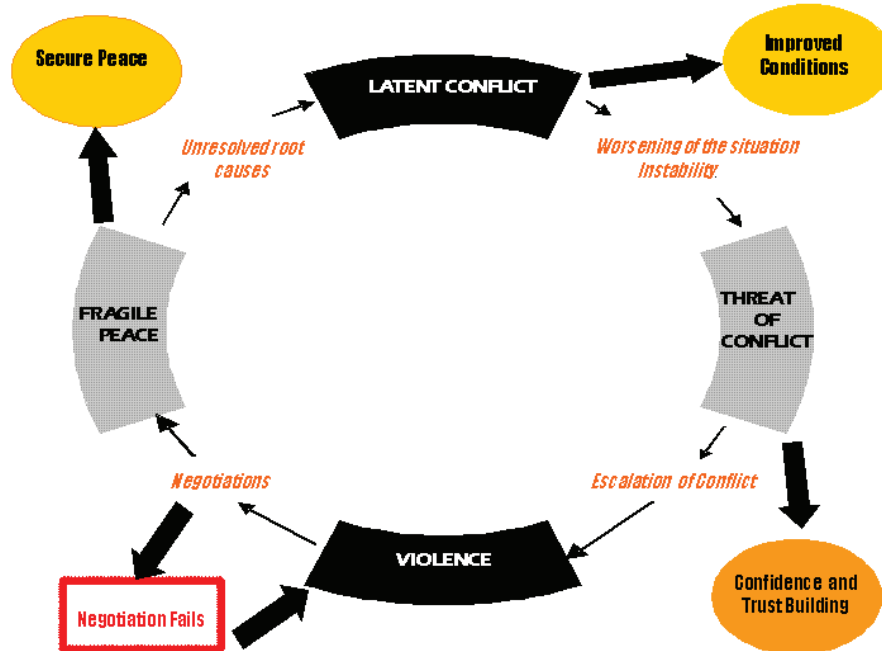
The public eye is quick to hone in on the dangers of the Internet: identity theft, digital crimes, child exploitation and pornography, as well as it being a potential virtual breeding ground for terrorists and insurgents, to name a few. Paradoxically, non-governmental organizations that address human rights, conflict transformation, governance, and development issues, however, have also been quick to adopt nICTs to support their work in the field (Naughton, 2001, pp. 147-168). Similarly, governments are increasingly sensitive to the possible importance of nICTs in official and grassroots interventions directed at preventing and managing ethno-political conflicts. Tony Rutkowsky, former senior Telecommunication Union Executive, has emphasized the potential of the Internet to compensate for many of the structural deficiencies within national and international governing bodies (1997). The Internet creates a common border-free information space where equality is inherent⁴.

ISSUES

For Carment and Schnabel (2003) conflict prevention includes, "institutional mechanisms that prevent tensions from escalating into violent conflict, to employ early warning mechanisms that allow the international community to monitor relations between and within states, and to facilitate capacity building within conflict-prone societies" (p. 1).

Conflict by nature is non-linear, yet in theory, the line between conflict prevention and conflict management is very distinct. In practice, however, and faithful to the fluctuating nature of conflict

Figure 1. The conflict cycle



itself, this distinction becomes blurred. Figure 1 depicts this reality through an illustration of the conflict cycle. The possibility of diffusing conflict is present at every stage, as is the possibility of escalation.

This difference is even more distorted in the case of the relationship between nICTs and conflict. The problems, actors, and interests change over time because of society’s changing dynamics, economies and policies (Vayrynen, 1991, p. 1-25). nICTs to be used in to assist both in the prevention of conflict as well as post-conflict reconstruction and reconciliation. The room for action for nICTs spans every nuance that affects the conflict cycle and its potential outcome. As Jan Berting notes, information systems penetrate modern societies in all spheres of life (Berting, 1990, pp. 33-36). The line between social structures and technological systems has become increasingly difficult to define.

Conflict Prevention

According to the European Commission, conflict prevention spans from initiatives directed at reacting rapidly to emerging conflicts to those aimed at projecting long-term stability. International cooperation and development initiatives, institution building, and rapid-reaction mechanisms fall under this category. Identifying and addressing the presence of factors that are a breeding ground for conflict—undemocratic political systems, ethnic, cultural and religious tensions, the presence of refugees, a weak or non-existent welfare state, and unequal distribution of resources—in a timely manner is essential.

nICTs are useful in responding to some of these structural—governmental, social, and economic—deficiencies because they serve as a bridge between developed and developing countries. They provide alternative solutions to existing

realities, act as a catalyst for social and economic change, and defy geographical limitations. The strategic use of nICTs can encourage existing relationships, foster subtle changes in existing paradigms and mobilize society to reinforce the social perspective towards a community goal or ideal. This approach enables opportunities for early alerts, and pre-emptive measures to deal with the potential sources of conflict.

Difficult socioeconomic conditions are among the root causes of conflict. UN Secretary General Kofi Annan has recognized that “peace and development remain inextricably linked—one feeding on the other, enabling the other and securing the other. The renunciation of violence as a means of gaining and holding power is only the beginning. Then must follow a renewed commitment to national development founded on sober, sound, and uncorrupted economic policies” (United Nations, 1998). The Secretary General says the proposal in his report on Africa requires new ways of thinking, of acting (1998, p. 3). The facts speak for themselves: 50% of the 45 poorest countries in the world have seen their social and economic foundations eroded by wars and other forms of violence (“Breaking the Conflict Trap,” 2003). Poverty itself does not generate conflict, but it does generate pressure for change in countries in which there is an unequal distribution of resources. Because of this, the Swedish Cooperation Agency has noted that when development is lacking, countries become more susceptible to conflict.

According to Nobel Prize winner, Amartya Sen, poverty is not limited to lack of income, but includes the lack of skills or capabilities needed to be more productive and obtain higher income (2000). Some of these are basic education, health services, food security, and so forth. nICTs are useful in the development process because they supplement existing development initiatives. They also open new routes to address inequities and existing sources of structural violence. Electronic

commerce (e-commerce) contributes to addressing these issues in many ways.

The Internet offers many possibilities for establishment of small and medium-sized businesses. The benefits it offers are immense, as it provides any business an avenue to enter into the global markets. Size and location have become issues of little relevance in finding markets that are receptive to the goods from any business (Heeks, 2002).

Ecosandals.com⁵, a cooperative based in the shantytown of Korogocho in Nairobi, Kenya, is a successful example of the use of e-commerce in poverty and violence-stricken areas. This international business is the product of the Wikyo Akala Project, which educates, trains, and provides employment for the inhabitants of Kogorocho. They do this through the production and sale of sandals made from recycled tires that are sold throughout the world from the project’s Web site.

PeopLink⁶, and Mercado Global⁷ are two nonprofit organizations that also seek to foment development and fair trade by helping artisans from remote areas around the world to sell their products via the Internet.

In these examples, e-commerce has dramatically reduced transaction costs, allowed artisans to reach larger numbers of customers, provided a means to build capacities in local communities and ensured the long-term sustainability of the projects. This approach has provided holistic solutions to development and poverty related dilemmas. Unfortunately, the digital divide related problems, such as infrastructure, access, and training (Bastos Tigre & O’Connor, 2002) as well as a lack of regulatory and legal frameworks have made banks and financial institutions reticent to assume a more active role in promoting e-commerce. Their participation, however, remains primordial in many countries to extend the reach and attractiveness of e-commerce and avoid fraud.

Another variable in the solution to the poverty problem is agriculture. It generates earnings for

governments by raising the per capita income, foments a more equal growth and, if necessary, provides reparations for the less-fortunate segments of the population particularly when dealing with issues relating to agricultural reform and access to natural resources (Addison, 2005).

Regardless of location, farmers need access to certain types of information to maximize productivity and comprehend and take advantage of market trends. The Food and Agriculture Organization (FAO) of the United Nations' Global Information and Early Warning System⁸ provides timely information on production, trade, stocks, food consumption, food aid requirements and the status thereof from each sub-region in the world. This enables governments, the international community, and other organizations to tailor their actions to existing situations and avoid potential crises.

Research has shown that wages increased by a worldwide average of 10% per year of schooling, and educated parents are more likely to have educated children. Education is an important key in breaking the inter-generational poverty cycle. Worldwide, there are one billion youth between the ages of 15-24, and 85% of them live in developing countries. Their unemployment and under-employment rates tend to be much higher than that of the average population. Young people with limited education and employment opportunities fall prey to groups involved in violent conflict that seek to increase their numbers. This is particularly disturbing since, according to UNESCO, over 27 million children and youth that are in the midst of, or recovering from, conflict lack access to formal schooling (Roberts, 2005). In this situation, e-learning can be found very useful in providing learning opportunities for young people because of its flexible delivery method and can be easily adapted to the demands of their day to day lives. In rural areas, lacking formal educational centers, ICT and nICTs have been proven successful in facilitating the educational process. Such is the

case of the African Virtual University⁹ (AVU) based in Nairobi, Kenya.

AVU has over 34 learning centers in 17 African countries. It educates and supports economic development through the network of African institutions that work with internationally recognized universities. Learning is done via online materials, CD-ROMs, DVDs, and realtime chat sessions. The exchange between student and instructor takes place, for the most part, by e-mail and online discussions forums.

The use of nICTs provides the combination of distance education with traditional learning methods and allows access to high quality teaching materials that support and/or substitute poorly qualified teachers. Furthermore, initiatives of this nature not only train future employees, but also create human capital that is prepared to contribute to and take a leadership role in the development process.

In these contexts, legitimate institutions, strong civil society, and good governance have been found to play a central role in conflict prevention. States in danger of, or affected by, conflict tend to suffer crisis of legitimacy. Then the state gradually adopts an oppressive and predatory attitude vis-à-vis society and is undermined by strife and its gradual inability to carry out its duties. Faced with "failed" statehood, governments cannot respond to the needs and demands of its citizens, and violence becomes almost inevitable. nICTs can be used to intervene in this dynamic and aid in the correction of these deficiencies.

Through e-government and e-governance initiatives, nICTs contribute to the relationship between government institutions and citizens. The Gyandoot Project—implemented in India, and winner of the Stockholm Challenge IT Award in Public Services and Democracy in 2000 (Stockholm, 2000)—for example, has established kiosks throughout the rural, poverty-stricken area of Madhya Pradesh. This has been done to facilitate access to information pertaining to agricultural

transactions, municipal affairs—such as the filing of complaints, registries and land titles—and governmental transparency¹⁰. The use of electronic media to complete public transactions has eliminated many of the economic, physical, and time constraints of traditional bureaucracy. Easy access to information and knowledge regarding political processes, services, and so forth, allows citizens to play a more active role in government, thus increasing government accountability, and promoting the open communication needed for state legitimacy. These are the mechanisms of democracy.

The manner in which the use of nICTs empowers citizens makes them a means for the poor, marginalized and disenfranchised to find their voice, organize grassroots movements, and demand governmental accountability. Such is the case of the ex-Yugoslavia in which local non-governmental organizations (NGOs) and student groups used the Internet and mailing lists to organize and overthrow Slobodan Milosevic (Cronnauer, 2004). Mailing lists of this nature often satisfy the psychological need for support that many individuals and groups who feel traditional media fails to provide. Through the movement's use of the Internet, they realized that they were not alone and that there were people throughout the country and world that shared their messages. These forms of large-scale virtual mobilizations often manage to gather traditional media attention, and influence public institutions through public opinion.

nICTs allow timely monitoring of conflict indicators and adoption of measures to address the root causes of conflicts. Human rights violations, for example, are not only indicators of the imminent threat of conflict and the possibility of violence, but also a root cause of conflict. Thereby, human rights violations lead to massive refugee movements, which, in turn, increase the socio-political tensions that ultimately result in the long-term threat of the eruption of violence.

The World Organization Against Torture (OMCT) is the largest coalition of NGOs fighting against all forms of malicious and demeaning treatment for the protection of human rights. It became fully active in February 1997, resulting from the need for more effective action and efficient means of transmitting information in cases of possible violations. The SOS Torture network has 250 NGOs at its disposal as sources of information and urgent intervention. Through these networks, urgent actions reach over 90,000 state and non-state institutions, associations, and pressure groups. Since the rapid transmission of information is essential, the OMCT counts on over 90,000 correspondents ready to intervene if required. This permits the network-based monitoring of information pertaining to existing and potential human rights violations. Simultaneously, the analysis of the information might be used to predict and prevent human rights violations that may aggravate already tense situations and result in further violence.

In "Information Technology and Human Rights," Metz (1996) emphasized the transnational nature of the relationship between human rights and the Internet by characterizing it as "having enormous consequences for the human rights movement as an aid to its efforts to collect, interpret, and disseminate information and to push for appropriate action in response to violations"¹¹ (p. 179). Here, digital technology plays a crucial role in developing issue networks that compel state and international actors to take action. In this way, digital networks remove national intermediary players that might otherwise hinder, censor, or conceal certain invaluable information. The Internet offers local occurrences and local groups the opportunity to gain the attention of the international transcendence that might have otherwise been denied. This often acts as a vital catalyst for action and essential to the spirit of their message. On Friday, March 9, 2001, Amnesty International¹² won the Revolution 2001 Award

for the best use of e-mail and the Internet for Stoptorture.org, (Amnesty International, 2001) which went live on Wednesday, October 18, 2000, to mark the launch of its global campaign against torture. The site received over 10,000 hits from people in 146 countries in the 48 hours following its publishing (Amnesty International, 2000).

Amnesty International has harnessed the power of the Internet to improve its traditional letter writing method of campaigning. Among these improvements one finds increased momentum in human rights emergencies. The (Amnesty International Urgent Action) network activates rapid action for those who are in imminent danger of grave human rights violations. Urgent Actions circulate by e-mail and fax to Amnesty International sections worldwide who then distribute them to members of the UA network asking them to send appeals through the fastest channels available. It has been found that e-mail through the UA network has facilitated networking at an international level, and each case sometimes generates between 3,000 and 5,000 appeals.

In any type of democracy, the Internet offers citizens and civil society an alternate source to obtain political legitimacy and at the same time strengthens the legitimacy of the system in which they operate. These opportunities are essential conduits for democracy and become vital when the plurality of opinions that circulate in a society can be channelled in a productive manner. However, their function and success are based on the normative commitment of the stakeholders towards the transformation of the existing system (Flichy, 2001).

Conflict Management

The independence of media from private and political interests is one of the important parameters among the European Commission's indicators for the prevention of conflict. This is clearly because they play an important role in the search

for freedom of speech, human development, and movements for peace. They are important tools for shaping public thought and perceptions. Media has the ability to polarize communities or unite them; consequently, nICTs harbour great potential in moments of crisis.

When used properly, the Internet is a tool that can offer a panoramic and simultaneous view of situations in conflict. The methodology used by the human rights organization, Equipo Nizkor¹³, facilitates this. The Vigía del Fuerte cases in Colombia demonstrates this perfectly (Equipo Nizkor, 2002).

As Diaz Dionis (2002) remarks on the FARC church incident that killed 90 people in which, official versions of the event omitted the action was intended to provoke the massive displacement of the population (p. 95). Twenty-four hours after the incident contact was re-established with clerics from the affected area through a religious group in Panama. They, in turn, transmitted information via the Internet every six hours. The official communiqués of the Archbishopship of Quibdo denouncing the incident were disseminated online in Spanish and English to over 18,000 human rights organizations, 5,000 activists and 40 list-serves, including a closed discussion list for jurists specialized in international tribunals. The information ultimately also reached 200 legal experts and the parliaments of 11 countries (Dionis, 2002, p. 96). The massive dissemination of information that Nizkor carried out, de-legitimized the official government version (Oficina en Colombia del Alto Comisionado de las Naciones Unidas para los Derechos Humanos, 2002) and forced the Colombian government to change from its position. Additionally, it enabled the application of the II Additional Protocol to the Geneva Conventions Relating to the Protection of Victims of Non-International Armed Conflicts ("Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of Non-International

Armed Conflicts [Protocol II]”). Therefore, the documental treatment of information pertaining to human rights issues and the monitoring of the situation in a particular locality via the Internet can help manage an existing crisis.

Modern conflicts articulate themselves in the communicative realm. The “Internet, War, and Peace in Colombia,” project notes that “The narratives of war are strategies of the war itself, they are inscribed in its logic: lies and cover-ups are basic tactics to bring down the contenders” (Barón Porrás, Corredor & Mancera, 2002, pp. 6-7). The use of symbolic language, the environment, and the media produce the narrative of the war and create the discourse of public reality. During Colombia’s 40 years of strife, the war has not only taken place in rural and urban settings, it has been fought in the collective imagery of the population. Colombian media were critical at various levels of the conflict. It became yet another actor, responsible for the polarization of society and in many cases the escalation of conflict (Barón Porrás, et al., 2002).

In the past 10 years, along with the expansion of the use of nICTs around the country, “the citizen movement for peace,” organized by civil society, has emerged. This group uses new and old ICTs to reach its goals (Barón Porrás). Their use has had such a deep impact on the dynamics of the Colombian conflict that the belligerent parties—the government and the FARC—have favored nICTs to disseminate information, educate about the conflict, and involve civil society (Porrás, 2002). Web sites open the way for public discourse and allow the parties involved to create meaning for their actions and reality. The Internet is playing vital role in their legitimacy. It has opened direct channels of communication with the national and international public. The actors engage in the negotiation process through their participation in the narration of the Colombian people’s collective reality (Porrás, 2002). Contextualizing the conflict gives it a political meaning and supplies information that enables

actors to make informed decisions and join the peace process (Barón Porrás).

Similarly, electronic conferences allow users to share their points of view, publications, or commentaries so that other users can read them and respond. The first recorded electronic conference organized to seek a solution to a war took place in 1991 during the war in the former Yugoslavia. Sponsored by the Swedish Association for Peace and Arbitration and the Association for Progressive Communications, it contained 5,000 messages, ideas, opinions, calls for action, and information on disappearances. As the cyber-Balkan communication center with messages from Switzerland, United States, Croatia, the Netherlands, Australia, Bosnia-Herzegovina, Germany, Finland, and so forth, it was also used to coordinate the aid received (Walch, 1999).

nICTs permit the immediate dissemination of local information and provide informational and communicative infrastructure services to millions of users and organizations worldwide. These types of networks facilitate an exchange of information that is otherwise impossible through traditional media. In fact, traditional media strictly regulates the fixed roles of the content providers and audience. On the other hand, the roles adopted by participants in a virtual environment are more fluid and involve participants from any corner of the earth, in a variety of capacities. Online publications are a resource for journalists that attract a readership of millions, but refuse to conform to the constraints of mass media. These are the authentic voices of cyberspace.

The blog¹⁴ phenomenon which began circa 1994 is a recent, concrete example of this. Simply put, a blog is a journal that is updated periodically and is available on the Web. As Andrew Sullivan from *Wired Magazine* notes, “Blogs do two things that Web magazines like *Slate* and *Salon* simply cannot. First off, blogs are personal. Almost all of them are imbued with the temper of their writer. This personal touch is much more in tune with our current sensibility than were the

opinionated magazines and newsarticles of old” (2005). The impact of blogging is such that Reporters without Borders (2005) recently released a Handbook for Bloggers and Cyberdissidents, arguing that, “Bloggers are often the only real journalists in countries where the mainstream media is censored or under pressure” (Create your own blog, 2005).

nICTs form a decentralized system that can mobilize any amount of information in web-like fashion. This can be used to strengthen the articulation of networks and interest groups. Technology 4 Peace¹⁵ began its work in 1996 as a virtual based organization whose primary goal was to inform and recruit expatriate Greek and Turkish Cypriots to complement the need for structured, organized, and long lasting dialogue between the belligerent parties. As a focal point for information and peace-related activities, it fomented workshops, coordinated events, marches, and meetings between different bi-communal groups. In this context, the project designed and created a holistic infrastructure for individuals and groups interested in promoting peace.

Burmanet¹⁶ and the Free Burma Coalition¹⁷ have found nICTs to be the most important campaigning tool available. Thanks to the collaboration of international activists, they are able to coordinate activities beyond their national borders. Using the Internet, its members have created a virtual community that uses cyber diplomacy to pressure the State Law and Order Restoration Council peacefully. The Internet’s role was essential in getting legislation passed in the state of Massachusetts condemning companies that do business with or within Burma. This is particularly the case since Massachusetts does not have a large Burmese electorate. This illustrates how the Internet can be a peaceful alternative to the violent transformation of repressive regimes through the search for consensus and public debate, regardless of where it takes place.

Electoral violence biases and shapes the ethno-political factors that contribute to violent conflict.

In Sri Lanka, the Center for Monitoring Election Violence (CMEV) uses the Internet to hinder initiatives that intend to undermine the peaceful transformation of the conflict in Sri Lanka (Liyanaarachchi, 2003). It does this by releasing numerous updated reports daily on its Web site that publicly expose existing political violence and naming its perpetrators.

nICTs inform of events instantly as they occur. In May 19, 2002, Fiji suffered a *coup d’état* that brought on a political crisis. The Internet became an essential source of information during that crisis. Fijilive.com Web site was the first source to release news of the coup internationally (Baghwan Rolls, 2002). In fact, the BBC began its coverage of the event with a picture of the Web site because that was the only image available at that time.

Thus, the Internet empowers its users to partake in informational processes and the creation of public consciousness. It introduces new messages into the dominant message flow and creates alternative, horizontal means to reach people at large. It mobilizes the mind of the world.

Post-Conflict Reconstruction and Reconciliation

Although reconstruction may occur at different points during and after conflict, in general terms, it is characterized as taking place between the cessation of violent conflict and the return to normalization. Reconstruction provides an initial response as a tool for transformation, and fosters long-term sustainability through addressing the following issues: security; justice/reconciliation; social/economic well-being; and governance/participation (Center for Strategic and International Studies (CSIS) and the Association of the United States Army (AUSA), 2002).

Most of the time, violent confrontation destroys physical and social infrastructures, hinders development, and exacerbates already existing precarious conditions. Once violence

has ceased, unaddressed, unmanaged, unresolved conflicts continue to be fertile ground for future confrontations. Therefore, certain measures and conditions become imperative to establish the foundations necessary to move beyond conflict. These include, but are not limited to, measures involving the:

- Protection of victims and survivors
- Reform of political and legal institutions
- Revitalization, restructuring of social and economic structures
- Management and return of refugees and internally displaced persons
- Promotion of reconciliation and facilitation of political participation

As mentioned earlier, initiatives like addressing the reform of political and legal institutions, social and economic revitalization, and promoting political participation become invaluable in reconstruction and reconciliation processes. Addison (2001) argues that, “conflict resolution and prevention require economic reform— independently of the need for reform to raise growth, reduce poverty and safeguard the environment. And infrastructure reconstruction (e.g. in rural areas) is ineffective if policies that depress its values to livelihood are retained” (p. 2).

On the other hand, long-term solutions are required to avoid relapses. They must aim to heal (Øberg, 1996) the:

- Bodies and psyches of the victims
- Social and economic structures
- Environment
- Loss of trust

These are the reasons for using nICTs in the prevention of conflict and at the same time are equally applicable for post-conflict reconstruction and reconciliation.

Similarly, the concept of *human security* recognizes the notions of conflict, health and

their interdependence. It refers to the safety of individuals and groups to be freed from acts of violence. This includes human rights violations and terrorism, and non-violent threats, such as environmental degradation, economic crisis, infectious diseases, and natural disasters (Commission on Human Security, 2003). Apart from these, illnesses like tuberculosis, malaria, HIV/AIDS, and other sexually transmitted diseases affect and threaten the reality of the poverty and conflict-stricken.

Furthermore, extended periods of conflict not only undermine economic development, but also worsen the lack of sanitary measures. Humanitarian organizations often attempt to supplement this deficit with an influx of aid. In general, the main recipients of these services and goods are refugees, whose presence involuntarily increases the existing tensions in that area. The resentment of local residents may arise under these circumstances, but in situations like this, health services can mitigate the displacement of population (Bunde-Birouste, Eisenbruch, Grove, Humphrey, Silove, Waller, & Zwi, 2004).

More importantly, in times of peace the use of nICTs can provide indications for its potential uses in post-conflict scenarios.

E-health¹⁸ telemedicine and tele-health have an important impact on the supply of health services, knowledge sharing, access to medical information and research and training. Through an easy-access, combination of e-mail communication and Web-based medical databases can be made available to practitioners worldwide¹⁹. The India Health Project (Graves & Reddy, 2000) facilitates the work of rural health care providers by using nICTs to improve prevention programs and provide timely information to monitor, analyze, and plan urgent responses. Midwives, who are the primary care providers in India²⁰, use PDAs to process patient data, collect information, generate schedules, and so forth. Telemedicine is used in Ethiopia to connect rural clinics with the central hospital in Addis Ababa, and the Tigray

regional hospital with a mobile physician. This aids the decision making process by allowing medical professionals in remote areas access to the knowledge and experience of urban doctors through interactive audiovisual and data applications (Lemma, Atnaf & Kassegne, 2004).

Tools of this nature when applied to conflict-ridden or conflict-prone areas could ease the load of medical personnel, while improving the health of the general population.

In “Towards Conflict Transformation and a Just Peace,” Clements (2004) remarks that stable peace requires a deep analysis of the structural causes that underlie conflict. Determining the commonalities between traditional and budding social sources of power are complicated tasks, and that if not approached from an organic perspective they will worsen existing conditions or will create new confrontations. Thus, the task of promoting reconciliation is a multidimensional and extremely difficult challenge. This challenge can only be met if the warring factions can be moved beyond the confines of the reasoning and realities that led to the positions they adopted at the beginning of the conflict. Information and communication can act here as an essential element for dialogue initiation and confidence building.

Internet has minimized the distance factor and, despite the technological component, relationships do not cease to be human. According to Aguirre (1999), “behavioral sciences and, especially, psychological schools,” have demonstrated that “the initial ‘distance’ Internet places between people, enables individuals to know that there are others with similar affinities in a faster, simpler way than in normal relationships.”

Info-Share²¹ is interactive software developed by a group of peace promoters in response to the September 2003 dwindling of the Sri Lankan peace process. Its purpose is to develop networks between the stakeholders of the peace process, so that instant communication —via messenger or chat—is available at all times. The project, which is sponsored by Groove Networks, USAID and the

Academy for Educational Development, among others, is designed to be a platform that offers support for the creation of “shared spaces” in the public and private domain. V. Anandasangaree, the leader of the Tamil United Liberation Front commented that lapses in communication were extremely pernicious to the evolution of the peace process (Liyanaarachchi, 2003). Info-Share has bridged the communication gaps between the parties involved. For example, the tools available have assisted in finding the most appropriate strategic responses for the dissemination of information through early alert systems and other more appropriate networks. Info-Share’s Hattotuwa (2004) claims that the process of conflict transformation and management as well as peace-building are strengthened if the entities involved are connected through multi-sectoral networks and have open access to stored knowledge. The creation of this type of networks makes the positive impact of nICTs plausible and possible.

The importance of human contact in conflict transformation and peacebuilding should not be overlooked. It is essential to strengthen relationships and foment cooperation. The combinations of interpersonal communication and daily collaboration, however, have been proven to be the most appropriate and successful formal methods to reduce tension (Huntington, 1993).

Although the Israeli-Palestinian conflict has reached a new peak in terms of ethnic tensions and violence, the Project for Arab-Jewish Dialogue has made positive contributions to peace-building efforts in that area. Under the sponsorship of the Program in Conflict Resolution at Bar-Ilan University and its Palestinian counterpart, Al-Quds University in East Jerusalem, the project has organized virtual encounters between Israeli and Palestinian students. These virtual meetings are dialogues that revolve around finding the commonalities between Islam and Judaism. This is important because the religious element, considering the social structure of the communities involved, is essential to the characteriza-

tion of these collectives. These similarities are intended to be the basis of future relationships (Mollov & Lavie, 2000). This platform helps to establish bonds of trust that are favorable to the implementation of the political agreements that arise from formal negotiations. It helps advance beyond the stereotypes and labels to identify with the “other.”

A follow-up of these activities demonstrated that when face-to-face contact was complemented with virtual contact, it increased the level of intimacy and trust between both groups. It levelled the terrain for interaction on equal terms because both groups perceived they have something to teach and learn from each other. The success this project has had in meeting the objective of changing the perceptions and improving the quality of relationships between the groups indicates that the large scale implementation of these types of initiatives can facilitate negotiation, reconstruction, and reconciliation processes. The type of interpersonal exchanges and cultural respect promoted in this context is vital to reach a long-lasting peace.

RECOMMENDATIONS

Suggestions on the use of nICTs for conflict management and prevention in the future must first be pre-empted with a disclaimer of sorts regarding nICTs and their implications within the discourse of conflict. nICTs are by no means the end-all, be-all of conflict prevention and management.

The Internet offers the advantages of decentralization and participation, it merges the local with the global; it is a means to communicate and transmit information and empowers individuals who have access to it. Nevertheless, and due to great part of these same factors, the other side of the coin is as dangerous as the first one is full of advantages. Francisco Marín Calahorro (2004) notes both in times of peace and conflict the

dissemination of content is free, which is why the presence of information on crises, conflicts, subversive groups, and other types of national and international activities have proliferated (pp. 341-349). As per sociologist, Sherry Turkle, “the Internet is an ‘ideal medium’ to recruit small groups of people” (Guzman, 1997). Although this chapter has focused on the positive facets of nICTs in conflict situations, it is important to realize that in the same way that they empower citizens and assist in the promotion of the universal ideals of peace, human rights, equality, and social justice, Neo-Nazi and terrorist groups, like Al-Qaeda, also make use of nICTs to network, disseminate, and legitimize their messages.

From the communicative and informational perspective, the flux and immediacy of information through nICTs facilitates the transmission of reality as it occurs. One of the dangers or problems that arise when dealing with conflicts in a virtual setting is, however, the very characteristics of the medium itself: it is virtual and text-based. The lack of non-verbal cues might inhibit “speakers” from understanding the totality of the message being transmitted²². On one level, cyberspace requires a straightforward communicative style to determine the degree to which parties agree or disagree to avoid lapses and misunderstandings. On that same note, however, lack of tact or sensitivity could be lethal to the dialogue process. Since the Internet is a discursive medium, it is important to take into account the cultural and social context of the individuals who are communicating. This helps minimize the effect of the personal backgrounds of the negotiators or dialoguing parties that may contribute to the interaction. The goal is to avoid misunderstandings and maintain the fluidity and openness of the exchange.

Censorship and governmental monitoring are also issues that arise when discussing the application of nICTs for conflict prevention and management. Countries like China frequently restrict access to Web sites that are critical of

their government, speak of human rights abuses, or denounce corrupt behaviour²³. This content is considered subversive and illegal and is automatically blocked by governmental Internet filters (Zittrain & Edelman, 2003). These types of limitations inhibit the extent to which nICTs can be of use in many of the scenarios mentioned earlier in this chapter.

Additionally, the benefits that might arise from the use of nICTs are greatly hindered by the existence of the digital divide (The Economist, 2005). It is essential to realize that the advantages of the Internet can only be seen as such if one presupposes that this chapter relates specifically to individuals, populations, and countries that do not suffer, or suffer a lesser version of the digital divide. According to the Digital Divide Network, access to digital technology hinges on numerous factors: telecommunications infrastructure, national poverty index, the cost of the necessary technology, literacy rates and basic education. The digital divide and the development divide are practically the same. As Cynthia Hewitt de Alcántara (2001) notes:

The digital divide is an integral part of a much broader and more intractable development divide. The likelihood that people in low-income countries can improve their life chances is often sharply limited not only by their lack of access to modern means of communication and sources of information, but also by a complex network of constraints ranging from unresolved problems of poverty and injustice in their own societies to the structure and dynamics of the global economic system. (pp. 7, 30)

Populations that are on the losing end of the development divide will continue to have problems when it comes to using digital technology to improve their realities.

Furthermore, problems arise regarding the legal, fiscal, and regulatory frameworks of the

political and policy environments in which nICTs are used²⁴. It is because of this, that the role of nICTs in conflict is only complementary to other measures taken to prevent, manage, and bring conflict to a conclusion.

However, it is important to recognize that there are no solutions to the issue of the impact of nICTs on conflict prevention and management, but there are realities. Of those realities, only some of them, those relating to access, technology, infrastructure, and expertise can be addressed in a straightforward manner through policy and concrete national and international initiatives. For the other realities, which hinge on the nature of the medium itself and the content communicated, there are no quick fixes or easy solutions. They require an increased general awareness on the exchange of ideas and the potential for dialogue of the Internet, as well as knowledge to discern the quality and legitimacy of the information available.

In concluding this segment, in spite of limitations outlined, it is important for institutions addressing conflict prevention and management to incorporate the use of nICTs into the breadth of their work. Only then they will be able to take full advantage of the benefits and assistance they could afford from this technology.

FUTURE TRENDS

The opportunities that technology affords can be practically endless. In the same way that software can search databases worldwide to predict the number of military war casualties (The Economist, 2005), it may well be used to project and find ways to avoid loss of civilian life.

The future for the use of nICTs in conflict prevention and management does not limit itself to the evolution of the realities and possibilities outlined above, but encompasses a variety of other scenarios and uses. Governments, international

organizations, and financial institutions might consider investing increased time and funds in further studying their effects within this context. Also, it is important to extend research and foment the use of related indigenous innovations.

Unlike computer-based Internet and other more traditional ICTs, mobile telephony has the advantage that their use neither requires literacy nor a permanent electricity supply. Both on its own and merged with the Internet—mobile data services—mobile telephony has proven to be a useful political tool in the cases of Spain, the Philippines, the United States, India, and Hong Kong (Standage, 2001). In all these situations short message services have served as mediums to mobilize voters (Adelman, 2004). Furthermore, in terms of development, efforts such as the Grameen Bank's "telephone ladies" have proven their usefulness to the development cause (Buerk, 2005). Results in this respect have been such that it has been estimated that "that an extra ten phones per 100 people in a typical developing country increases GDP growth by 0.6 percentage points" (Bishop, 2005).

Attention should also be given to the use of nICTs to prevent the loss of life in road accidents, militia fights, kidnappings, ambushes, and so forth. The informational vacuum that exists between life in urban and rural areas, which often requires unprotected citizens to travel long distances on precarious roads, could be filled by providing information and news via mobile short message services, mobile data services and digital networks, where available. These tools would help maintain a functioning alternative back-end media infrastructure at times when traditional media collapses.

It would be extremely useful to compile information and centralize data repositories on the implementation of these mechanisms within different conflict contexts to determine typologies for action.

CONCLUSION

Conflict is a global phenomenon. Thanks to new and old ICTs, conflict now reaches beyond its immediate physical location and travels around the globe as information in the blink of an eye. The purpose of this article has been to explore the methods via which the nICTs can help to prevent and manage the globalized conflict. Within this framework, nICTs have been used to provide punctual specific, incidental sources of income generation and economic empowerment that compensate for deficits in social services, like health and education, and assist in local capacity building. Through initiatives and projects of this nature, international organizations, civil society, and governments can use nICTs to contribute to the correction of structural flaws that produce or aggravate some of the root causes of conflict.

From the communicative and informational perspective, nICTs can play as facilitators and catalysers of dialogue²⁵ is certain. Virtual communities have become one of the central axis of social mobilization in the information society. This confirms Wellman's affirmation regarding how computer networks unite individuals as much as they do machines and the manner in which this coincides with the emergence of social networks (1996). They emerge and develop in an environment that is very different from every day life: cyberspace (Tirado & Gálvez, 2002). Furthermore, they continue to be a forum for complete interaction. They create bridges between the parties involved in the conflict that complement the activities and negotiations taking place in situ. Foremost, they are important in the reconstruction of the communal concept of the "other" to overcome stereotypes and false assumptions.

These technologies have also proven valuable to:

- Predict and manage crises

- Create and manage solidarity of action networks
- Disseminate information.
- Plan and coordinate activities
- Mobilize citizens

In many cases, particularly relating to conflict management, one might argue that rather than offering any tangible support, messages are introduced into the flow of public discourse through the Internet. This newly integrated information then becomes a means to act on the imaginary collective of the conflict. Therefore, the communication process demands a collective course of action, but at the same time should invoke individual decision-making and enable contributions to the formation and revision of opinions.

In conclusion, it can be stated that the ultimate enduring success and sustainability of the effects of these initiatives are linked to the complementary use of nICTs processes that are already taking place in the field. They are meant to be another, but no less important, component of the holistic solutions that conflict—its causes and consequences—may require.

REFERENCES

- Addison, T. (2001). *Discussion article 2001/16 from conflict to reconstruction*. Retrieved June 17, 2006, from <http://www.wider.unu.edu/publications/dps/dp2001-16.pdf> .nsf/c2fab74f3f54c22ca256afc00097c53/ddc68095c9ab62b8ca256f6300760289/\$FILE/Issue_Article_I.pdf
- Addison, T. (2005). *Agricultural development for peace*. Retrieved June 17, 2006, from <http://www.wider.unu.edu/publications/rps/rps2005/rp2005-07addison.pdf>
- Adelman, J. (2004, July 12). U say u want a revolution. *TIME Asia Magazine*, 164(2). Retrieved June 17, 2006, from <http://www.time.com/time/asia/magazine/article/0,13673,501040712-660984,00.html>
- Aguirre, A. (1999). *Relaciones humanas telematizadas (Telematic Human Relationships)*. Retrieved June 17, 2006, from http://www.fun-redes.org/mistica/castellano/ciberoteca/participantes/docupart/esp_doc
- Amnesty International. (2000). *Torture campaign: Electronic activism an outstanding success*. Retrieved June 17, 2006, from AI Index ACT 40/037/2000, <http://www.amnesty.org>
- Amnesty International. (2001). *UK Amnesty International wins award for innovative campaigning*. Retrieved June 17, 2006, from AI Index EUR 45/005/2001, <http://www.amnesty.org>
- Amnesty International Urgent Actions Saves lives; sign up today!(n.d.) Retrieved June 15, 2001, <http://webamnesty.org/pages/uaindex-eng>
- And now forecast war. (2005). *The Economist Technology Quarterly*, 376(8444), 22-23.
- Barón Porras, L. F. (n. d.). *Guerra, drama y victimización: Conclusiones y alternativas. (War, drama and victimisation: Conclusions and alternatives)*. Retrieved June 17, 2006, from <http://ntci.cinep.org.co/conclusiones/con6.htm>
- Barón Porras, L. F. (n. d.). *Proyecto de Investigación: NTCI y Paz de la paz en Colombia. (Research Project: NICT and Peace in Colombia)*. Retrieved June 17, 2006, from <http://ntci.cinep.org.co/presentacion/nuestroproyecto.pdf>
- Barón Porras, L. F., Valencia Corredor, M., & Bedoya Mancera, A. (2002, October). *Noticias de guerra: la “extraña lógica” de la guerra y la paz en Colombia en prácticas de consumo de noticieros. (News of war: The “strange logic” of war and peace in Colombia and practices in the consumption of news broadcasts)*. Retrieved June 17, 2006, from <http://ntci.cinep.org.co/presentacion/notiguerra.pdf>

- Bastos Tigre, P., & O'Connor, D. (2002, April). *Policies and Institutions for E-Commerce Readiness: What can developing countries learn from OECD Experience?* Retrieved October 28, 2006, <http://www.ideas.repec.org/p/oec/devaaa/189-en.html>
- Berting, J. (1990). Technological impacts on human rights: Models of development, science and technology, and human rights. In C. Weeramantry (Ed.), *The impact of technology on human rights* (pp. 33-36). New York: United Nations University Press.
- Bhagwan Rolls, S. (2002, November 15). *The impact of new information communication technology on the media: A community media perspective from the Pacific Island Region of women*. Paper presented at the United Nations Division for the Advancement of Women (DAW) Expert Group Meeting on Participation and Access of Women to the Media, and the Impact of Media on, and Its Use As an Instrument for the Advancement and Empowerment of Women, Beirut, Lebanon.
- Bishop, M. (2005). Loose talk saves lives. *The International Development Magazine*, 31. Retrieved June 17, 2006, from <http://www.developments.org.uk/data/issue31/loose-talk.htm>
- Blog. (2005, September 15). *Wikipedia: The free encyclopedia*. Retrieved June 17, 2006, from <http://en.wikipedia.org/wiki/Weblogging>
- Boltz, L.C. (2002). *Information technology and peace support operations relationship for the new millennium*. Retrieved June 17, 2006 from Information Technology and Peace Support Operations: Publications: Virtual Diplomacy Initiative at <http://www.usip.org/virtualdiplomacy/publications/reports/13.html>
- Buerk, R. (2005). *Telephone ladies connect Bangladesh*. Retrieved June 17, 2006 from http://news.bbc.co.uk/go/pr/fr/-/1/hi/world/south_asia/4471348.stm
- Bunde-Birouste, A., Eisenbruch, M., Grove, N., Humphrey, M., Silove, D., & Zwi, A. (2004, December). *Health and Peacebuilding: Securing the Future*. Retrieved March 9, 2005, from The University of New South Wales Health and Conflict Project Web site: <http://humansecurity-chs.org/finalreport/index.html>
- Carment, D., & Schnabel, A. (2003). *Conflict prevention: Path to peace or grand illusion*. Tokyo: United Nations University Press.
- Center for Strategic and International Studies (CSIS) and the Association of the United States Army (AUSA) (2002, May). Retrieved October 28, 2006, from CSIS Reports: Post-Conflict Reconstruction Task Framework Report Web site: <http://www.csis.org/media/csis/pubs/framework.pdf>
- Clements, K. (2004). *Towards conflict transformation and a just peace*. Retrieved December 12, 2004, from Berghof Handbook for Conflict Transformation Web site: http://www.berghof-handbook.net/uploads/download/clements_handbook.pdf
- Commission on Human Security (2003, May 1). *Human Security Now*. Retrieved July 4, 2003, from Final Report of the Commission on Human Security Web site: <http://www.humansecurity-chs.org/finalreport/index.html>
- Cronauer, K. (2004, April 4). Activism and the Internet: Recommendations for uses of electronic mailing lists. Retrieved October 28, 2004, from Activism and the Internet: Using electronic mailing lists for mobilization Web site: <http://cs.ubc.ca/spider/cronauer/>
- Diaz Dionis, G. (2002). El Activismo de los derechos humanos y el control politico-social a traves de las nuevas tecnologías. (Human rights activism and socio-political control through new technologies) In M. Agúndez Basterra (Ed.), *Derechos Humanos y Nuevas Tecnologías: Colección "Jornadas sobre Derechos Humanos"* (pp. 78-99). San Sebastian, Spain: Ararteko.

Equipo Nizkor. (2002, May). *Crisis humanitaria de Vigía de Fuerte* (Mayo de 2002). Retrieved June 30, 2002, from Colombia-Derechos Humanos-Informes Web site: <http://www.derechos.org/nizkor/colombia/informes.html>

Flichy, P. (2001). *L'imaginaire de l'Internet. (The imaginary of Internet)*. Paris: La Découverte.

Fromkin, V., & Rodman, J. (1983). *An introduction to language*. New York: CBS College Publishing.

Guzman, D. (1997). *Racism and racial discrimination on the Internet*. Retrieved June 17, 2006, from Seminar on the Role of the Internet with Regard to the Provisions of the Internet Convention on the Elimination of All Forms of Discrimination at <http://www.unhchr.ch/html/menu2/10/c/racism/guzman.htm>

Graves, M., & Reddy, N.K. (2000). *Electronic support for rural healthcare workers*. Retrieved June 17, 2006, from <http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN019013.pdf>

Hattotuwa, S. (2004). *Untying the Gordian knot: ICT for conflict transformation and peace building*. Retrieved June 17, 2006, from http://www.masternewmedia.org/news/2004/06/13/untying_the_gordian_knot_ict.htm

Heeks, R. (2002, June). *iDevelopment not e-development: ICTs and micro-/small enterprise. Development Gateway*. Interview with Richard Heeks. Retrieved June 17, 2006, from <http://www.developmentgateway.org/node/133831/sdm/docview?docid=254666>

Hewitt de Alcántara, C. (2001). *The development divide in a digital age: An issue article*. United Nations Research Institute for Social Development (UNRISD). Retrieved June 17, 2006, from <http://www.unrisd.org/>

Huntington, S. P. (1993). The clash of civilizations. *Foreign Affairs*, 72(3), 49.

Lemma, F., Atnaf, S., & Kassegne, S. K. (2004). *Survey of current efforts and potential in application of telemedicine in Ethiopia*. Retrieved June 17, 2006, from Survey of Current Efforts and Potentials in Application of Telemedicine in Ethiopia, http://www.digitaladdis.com/sk/Tele-Medicine_Ethiopia_Article1.pdf

Liyanaarachchi, Champika (2003, November 18). *Sri Lanka: As Peace Falters, Activists Turn to ICT to Build Bridges*. Retrieved December 1, 2003, from One World South Asia Home/In Depth/War and Peace/Conflict Resolution/Sri Lanka Web site: <http://southasia.oneworld.net/article/view/73045/1/975>

Marin Calahorro, F. (2004). Nuevas tecnologías y conflictos en la era multimedia. (New technologies and conflicts in the multimedia era). In F.R. Contreras & F. Sierra (Eds.), *Culturas de Guerra: Medios de información y violencia simbólica* (pp. 341-349). Fuenlabrada, Madrid: Ediciones Cátedra (Grupo Anaya, S.A.).

Metzl, J. F. (1996). Information technology and human rights. *Human Rights Quarterly*, 18(4), 719.

Mollov, B., & Lavie, C. (2000). *Culture, dialogue and perception change in the Israeli-Palestinian conflict*. Retrieved June 17, 2006, from Culture, Dialogue and Perception Change In the Israeli-Palestinian Conflict, <http://faculty.biu.ac.il/~steing/conflict/Articles/israelipalestiniandialogue.pdf>

Naughton, J. (2001). Contested space: The Internet and global civil society. In H. Anheier, M. Glasius, & M. Kaldor (Eds.), *Global civil society 2001* (pp. 147-168). New York: Oxford University Press.

Øberg, J. (1996). *Conflict mitigation in reconstruction and development*. Retrieved June 17, 2006, from <http://www.gmu.edu/academic/pcs/oberg.htm>

Oficina en Colombia del Alto Comisionado de Naciones Unidas para los Derechos Humanos.

(2002). *Informe sobre la misión de observación en el Medio Atrato*. Bogota.

The real digital divide. (2005, March 10). *The Economist Technology Quarterly*. Retrieved June 17, 2006, from http://www.economist.com/opinion/displayStory.cfm?story_id=3742817

Reporters without Borders. (2005). *Create your own blog, remain anonymous, and get round censorship!* Retrieved June 17, 2006, from http://www.rsf.org/article.php3?id_article=15083

Reporters without Borders. (2005). *Handbook for bloggers and cyberdissidents*. Retrieved June 17, 2006, from Handbook for Bloggers and Cyberdissidents, http://www.rsf.org/rubrique.php3?id_rubrique=542

Rutkowski, T. (1997). *Seminar on the role of Internet with regard to the provisions of the International Convention on the Elimination of All Forms of Racial Discrimination, Item VI: Elements relating to conduct and good practices for Internet based materials*. Retrieved June 17, 2006, from <http://www.unhcr.ch/html/menu2/10/c/racism.rutkowsl.htm>

Sen, A. (2000). *Desarrollo y libertad. (Development as Freedom)*. Barcelona, Spain: Editorial Planeta.

Sequeira Bolaño, C. R., & de Santana Vasconcelos, D. (2001). Internet y la economía de la comunicación. (Internet and the communication economy). *Voces y Culturas*, 18, 73.

Shaw, T. (2003). *Conflict and peace-building in Africa: The regional dimensions*. Retrieved June 17, 2006, from <http://www.wider.unu.edu/publications/dps/dps2003/dp2003-10.pdf>

Standage, T. (2001, October 11). *The Internet, untethered*. Retrieved June 17, 2006, from The Economist http://www.economist.com/displayStory.cfm?Story_id=811934

Stauffacher, Daniel (Ed.) (2005). *Information and communication technology for peace: The role of ICT in preventing, responding to and recovering from conflict*. NY: United Nations Publications.

Stockholm Challenge. (n.d.). *Ecosandals.com: Wikyo Akala Project of Korogocho, Kenya*. Retrieved June 17, 2006, from Stockholm Challenge, http://www.stockholmchallenge.se/search_view.asp?IdNr=4303

Sullivan, A. (2005, May 10). *The blogging revolution*. Retrieved June 17, 2006, from Wired Magazine, <http://www.wired.com/wired/archive/10.05/mustread.html?pg=2>

Tirado, F.J., & Gálvez, A. (2002). *Comunidades virtuales, ciborgs y redes sociotécnicas: nuevas formas para la interacción social. (Virtual communities, ciborgs and socio-technical networks: New forms for social interaction)*. Retrieved June 17, 2006, from Francisco Javier Tirado, Anna Gálvez - Comunidades virtuales, ciborgs y redes sociotécnicas: nuevas formas para la interacción social, <http://www.uoc.edu/humfil/articles/esp/tiradogalvez0302/tiradogalvez0302.html>

United Nations Development Program (UNDP) Human Development Report Office. (2005). *Human development report 2005: International cooperation at a crossroads*. New York: UNDP and Oxford University Press.

United Nations. (1998). *Secretary General says proposals in his report on Africa require new ways of thinking, of acting* (Press Release SG/SM/6524 SC/6503). New York: United Nations Information Service.

Roberts, B. (2005, March). *New minimum standards for education in emergencies aim at giving 50 million children a chance to learn*. Retrieved October 28, 2006, from Education Today Newsletter, July-September 2003-Saving lives, saving minds Web site: <http://portal.unesco.org/educa->

tion/en/ev.php-URL_ID=38521&URL_DO=DO_TOPIC&URL_SECTION=201.html

United Nations High Commission for Human Rights (UNHCHR). (1997). *Protocol additional to the Geneva Conventions of 12 August 1949, and relating to the protection of victims of non-international armed conflicts* (Protocol II). Retrieved October 28, from the Higher Commissioner for Human Rights Web site: 2006, from <http://www.unhchr.ch/html/menu3/b/94.htm>

United Nations Press Service. (1998, April 16). *Secretary-General says proposal in his report on Africa requires new ways of thinking, of acting*. Retrieved June 17, 2006, from Press Release SG/SM/6524, <http://www.un.org/News/Press/docs/1998/19980416.SGSM6524.html>

Vayrynen, R. (1991). To settle or to transform? Perspective on the resolution of national and international conflicts. In R. Vayrynen (Ed.), *New directions in conflict theory: Conflict resolution and conflict transformation* (pp. 1-25). London: Sage.

Walch, J. (1999). *CMC under fire: The case of former Yugoslavia*. Retrieved June 17, 2006, from <http://www.lhs.se/~jwalch/cmconf.rtf>

Wellman B., Salaff, J., Dimitrova, D., Garton, L., Gulia, M., & Haythornwaite, C. (1996). Computer networks as social networks: Collaborative work, telework, and virtual community. *Annual Review of Sociology*, 22, 213-238.

Zittrain, J., & Edelman, B. (2003). *Empirical analysis of Internet filtering in China*. Retrieved June 17, 2006, from <http://cyber.law.harvard.edu/filtering/china/>

ENDNOTES

¹ The most common types of armed conflicts over the past 50 years have been liberation

wars, civil wars, minority conflicts (ethnic groups seek to end oppression), and border disputes.

² Of the 106 armed conflicts in the world that took place from 1989-1996, only six occurred between states. The remaining 86 were internal conflicts where over 80% of the directly affected populations were civilians.

³ For information regarding military studies see Boltz (2002). Since this chapter was written, the UNICTS Task force has also published *Information and Communication Technologies for Peace: The Role of ICT in Preventing, Responding to and Recovering from Conflict* by Stauffacher, Drake, Curriion, and Steinberger (2005).

⁴ Reference is made to equality as the right to access available information once the technology is available.

⁵ Ecosandals.com, <http://www.ecosandals.com>.

⁶ PeopLink at <http://www.peoplink.org>.

⁷ Mercado Global at <http://www.mercadoglobal.org>.

⁸ Sistema Mundial de Información y Alerta, Food and Agriculture Organization at <http://www.fao.org/WAICENT/faoinfo/economic/giews/spanish/index.htm>.

⁹ African Virtual University at <http://www.avu.org/>.

¹⁰ The literacy threshold of the citizens in the area may, nevertheless, still be an important caveat to the total success of the Gyandoot Project as it may enable old gatekeepers to stay in control. The Organization for Economic Cooperation and Development's study on "Literacy in the Information Age" divides literacy into five levels. Level 1 (very easy text only) is the usual definition of literacy. Level 3 is needed to function within the Information Society, which includes the Internet. Level 3 approximately matches the skills acquired by completing second-

- ary education. This research evaluated the literacy of individuals ranging from ages 16-65 in industrialized countries, and found an astonishing amount of population below level 3, for example, more than 40% in the USA, and 85% in Chile. OECD (Literacy in the Information Age, 2001).
- ¹¹ nICTs are the tool of choice for disseminating information regarding human rights violations, torture, arbitrary detention, etc., that does not reach corporate media outlets.
- ¹² Amnesty International, <http://www.amnesty.org>
- ¹³ <http://www.derechos.org/nizkor/>
- ¹⁴ Blogs can belong to individuals, groups of writers, corporations, media and political campaigns, and so forth. According to Wikipedia, “A Weblog, Web log or simply a blog, is a Web application which contains periodic posts on a common webpage. These posts are often but not necessarily in reverse chronological order. Such a website would typically be accessible to any Internet user. The term ‘blog’ came into common use as a way of avoiding confusion with the term server log” (Blog, 2005).
- ¹⁵ Tech4Peace at <http://www.tech4peace.org>.
- ¹⁶ <http://www.ibiblio.org/freeburma/bnn/bnn.html>. This is an e-mail-based newsgroup.
- ¹⁷ This is an activist network that includes Web pages, chats, news, grassroots campaigns, policy initiatives, and so forth. <http://www.freeburmacoalition.org>
- ¹⁸ This term refers to the use of computing, the creation of networks and communication as support mechanisms for medicine, nursing, pharmacology, and dentistry.
- ¹⁹ USAID financed, Managers Electronic Resource Center, exemplifies this.
- ²⁰ The median is 5000 patients per midwife.
- ²¹ Info Share, <http://www.info-share.org/>.
- ²² Fromkin and Rodman (1983) claim that up to 90% of the meaning of a message is transmitted non verbally.
- ²³ Dissident/democracy sites. Blocked sites include sites about democracy and human rights generally and sites specific to China. Of the top 100 sites returned by Google in response to a search for “democracy china,” 40 were found to be blocked, while 37 “dissident china” sites were blocked, 32 were blocked for “freedom china,” and 30 for “justice china.” Specific blocked sites included Amnesty International, Human Rights Watch, the Hong Kong Voice of Democracy, the Direct Democracy Center, and dozens of Falun Gong and Falun Dafa sites.
- ²⁴ This makes reference to regulation concerning industry standards.
- ²⁵ Dialogue facilitators are neutral; their participation is limited to the fact that they maintain the flow of communication and channel information.

This work was previously published in Information and Communication Technologies for Economic and Regional Developments, edited by H. Rahman, pp. 56-78, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 8.13

Crossing the Digital Divide and Putting ICT to Work to Improve People's Lives

Teresa Peters

Bridges.org, South Africa

INTRODUCTION

Information and communications technology (ICT) is a key weapon in the war against world poverty. When used effectively, it offers huge potential to empower people in developing countries to overcome development obstacles, address the most important social problems they face, and strengthen communities, democratic institutions, a free press, and local economies. But, a “digital divide” separates those who can access and use ICT to gain these benefits, and those who do not have access to technology or cannot use it for one reason or another.

Governments can play a fundamental role in creating an environment that will foster technology use and encourage investment in ICT infrastructure, development, and a skilled workforce. Government action is also important in spreading the benefits of technology throughout society, and governments have the power and mandate to balance the needs of their citizens for long-term

economic growth and social prosperity. However, translating a vision into practical steps that fit the local context is not a simple matter. Leaders need to have a realistic appreciation for what ICT can—and cannot—do for their countries and communities, and they must lead effectively and bolster public confidence in the path they take.

The digital divide is a complex problem, presenting both practical and policy challenges. And it is apparent that solutions, which work in developed countries, cannot simply be transplanted to developing country environments: solutions must be based on an understanding of local needs and conditions.

GOVERNMENT POLICY CAN HINDER EFFORTS TO TACKLE DIGITAL DIVIDES

A range of projects are underway in developing countries to integrate ICT in a number of critical

areas, including education, healthcare, government, trade, and small business support. However, these projects frequently encounter obstacles that directly or indirectly relate to the country's policy environment. One example involves projects that rely on technology or infrastructure use that is limited by current laws or regulations, such as laws that control or ban the use of satellite, wireless, or Voice over Internet Protocol (VoIP) technologies. Another example involves ICT projects that are hindered by a general law or regulation, such as fiscal or customs policies that limit cross-border trade in computing technologies. Another involves projects working in a particular subject area (such as healthcare) where current laws or regulations do not cover ICT use (such as privacy and data protection laws governing the handling of electronic health data).

To cross the digital divide and put ICT to effective use to improve people's lives, countries and communities must be "e-ready" in terms of infrastructure, access to ICT, training, and a legal and regulatory framework that will foster ICT use. If the digital divide is to be narrowed, these issues must be addressed in a coherent, achievable strategy that is tailored to meet local needs.

Many national leaders have embraced ICT and are ready to promote a legal and regulatory environment that will enable its widespread use. However, at the working level, many government officials do not understand the implications of existing policies that may hinder ICT use, nor the changes they need to create a more favourable environment. Although the development aid industry generates a tremendous volume of reports, advice, and analysis aimed at helping developing countries in the policy area, developing country governments frequently report that such recommendations do not show sufficient understanding of local needs and conditions. Some governments have subscribed to e-strategies promulgated by outsiders, but at a practical level they lack the political will to drive change because they do not enjoy widespread public support for

an ICT-focused approach. Often this is because government officials fail to engage stakeholders in framing the e-strategies, so they do not have public buy-in for their long-term plans. In some cases the government has partnered with the country's business and civil society sectors to promote ICT-enabled development at the ground level, but the various stakeholder groups lack the experience and resources to give effective input.

CITY OF CAPE TOWN: AN EXAMPLE OF BEST PRACTICE AT CITY LEVEL

Many of the policy issues related to ICT use are at the national level and include issues such as legal and regulatory frameworks and macro-economic policies. But there are other issues where city governments have a key role to play.

The City of Cape Town is an example of a local government committed to putting ICT to work for social and economic development, and driving the changes necessary to ensure ICT is used effectively. Cape Town's leaders have recognised that ICT is a powerful tool for transforming the way that people do business, communicate with each other, access information and, if used effectively, can help the City achieve its goals.

In January 2002, the City Council commissioned Bridges.org to undertake a pioneering assessment of the digital divide in Cape Town, in order to get a view of where its citizens, communities, and organisations stood in terms of current ICT use and the potential benefits of ICT use in the City. The study examined the access, use, and need for ICT in Cape Town, with a special focus on the millions of people who live in disadvantaged communities within the greater metropolitan area. The study helped City leaders to measure ICT integration, plan for expansion, focus their internal efforts, and to identify areas where external support was required. The study also provided benchmarks for external comparison and gauging

internal progress. Finally, the study served as a valuable part of a greater process to bring a wide range of stakeholders into the discussion about ICT and development in Cape Town.

National-level assessments of this nature commonly study e-readiness by compiling information from government agencies, big companies, business associations, and other secondary sources. This study started with such an approach. However, it then went further to collect direct input from communities, small businesses, and community organisations, to gauge the need for ICT service in the community and depict the real-life constraints—and opportunities—that people and institutions face as they work to harness ICT for local benefit. At the same time, the study assessed the interest and capacity of the City's communities, businesses, academic institutions, and government agencies to help 'bridge the divide'. Such an approach allowed this study to look ahead to the social appropriation of ICT for local benefit, so that practical options and recommendations could be framed to guide the City Council as it developed its own plans. Further, the processes used in the study helped the City better connect with its people and to gain widespread support for the e-strategies the process developed.

As a result, several public and private sector initiatives commenced in Cape Town with the related goals of (1) fostering the budding ICT sector and using ICT as an enabler for broader economic growth, and (2) tackling the problems of

the "digital divide" to maximise digital inclusion. Perhaps the most notable example was the City of Cape Town's Smart City Strategy, which won the African ICT Achievers Award for e-Government in 2002. This strategy aimed to put ICT to work in ways that would enable the government to transform itself to deliver more effective and efficient service to citizens. It also aimed to empower citizens to deal more effectively with the growing digital economy. The city envisions "a smart city populated by informed people, connected to the world and each other by the technology of the information age."

ABOUT BRIDGES.ORG

Bridges.org (<http://www.bridges.org>) is an international non-profit organisation based in South Africa with a mission to promote the effective use of ICT in developing countries to improve people's lives. One area of focus is in informing policy decisions that affect people's access to and use of ICT. Bridges.org also conducts technology research and provides social consulting services to ground level projects using ICT, helping with project planning and evaluation and relaying lessons learned. It brings an entrepreneurial attitude to its social mission, and is committed to working with, instead of against, government agencies and the business community.

*This work was previously published in *Encyclopedia of Developing Regional Communities with Information and Communication Technology*, edited by S. Marshall, W. Taylor, & X. Yu, pp. 144-145, copyright 2006 by Information Science Reference, formerly known as Idea Group Reference (an imprint of IGI Global).*

Chapter 8.14

Creative London?

Investigating New Modalities of Work in the Cultural Industries

David Lee

Goldsmiths College, University of London, UK

ABSTRACT

This chapter considers the emergence of the discourse of creativity in contemporary economic, political, and social life, and the characteristics of emerging labour markets in the cultural industries. In particular it is concerned with analysing the working experiences of a number of individuals working in the cultural industries in London. Using a critical theoretical framework of understanding, it examines the importance of cultural capital, subjectivisation, governmentality, network sociality, and individualization as key concepts for understanding the experience of labour in the creative economy. This chapter considers how creative individuals negotiate the precarious, largely freelance, deregulated and de-unionised terrain of contemporary work. As the economic becomes increasingly inflected by the cultural in contemporary social life, the terrain of experience of individuals working in these expanding sectors has been neglected in cultural studies. This chapter seeks to critically intervene

in this area, arguing that the “creative” turn in contemporary discourse can be seen to mask emergent inequalities and exploitative practices in the post-industrial employment landscape.

INTRODUCTION

Everywhere we turn in contemporary society, we are being encouraged to be creative. In today’s “knowledge economy,” where we are told we are “living on thin air” (Leadbeater, 1999) the imperative to be creative has taken on the ideological force of a moral edict: something that we should all aspire to. Influential political literature tells us that we are living in the “Creative Age” (Bentley & Seltzer, 1999), commentators speak of the rise of the “creative class” (Florida, 2002) and businesses are told to display “creative leadership” (Guntern, 1998). Indeed creativity is no longer presented as a choice in such discourse; it becomes compulsory if one is to survive the vicissitudes of global capitalism. A vast plethora of books from

self-help literature to popular psychological literature as well as an extensive range of discursive political activity seeks to assure us that creativity is something that we can all achieve, if only we try. As Osborne (2003) argues, “in psychological vocabularies, in economic life, in education and beyond, the values of creativity have taken on the force of a moral agenda” (p. 507).

Creativity, as a key structural necessity of cultural production, has come to be seen as a constitutive element of the contemporary economy. One of the defining features of our times is the ever-increasing fusion of the cultural with the economic within society (see Jameson, 1991; Lash & Urry, 1994). Ours is an economy of “signs and spaces,” increasingly dominated by the media, by brands, by advertising, in short by signifying practices. As Lash and Urry (1994) argue “[e]conomic and symbolic processes are more than ever interlaced and interarticulated; that is...the economy is increasingly culturally inflected and ... culture is more and more economically inflected” (p. 64). The structural needs of late capitalism demand creative workers in a wide range of areas. The huge growth in the creative industries is concomitant with the emergence of the notion of the creative economy. As such, Wang (2004) claims that “[c]reativity’ is redefined as an enterprise sector, intrinsic, not external, to the contemporary technologically-accented knowledge economy” (p. 11). In contemporary society creativity becomes a central element of the discursive regime of the new economy, in which the demands on the individual to demonstrate flexibility, entrepreneurship, and innovation have taken on the hegemonic power of ideology.

In the United Kingdom, the ethos of creativity has become an integral part of the New Labour government. The overt fusion of culture with politics can be seen both as a rebranding exercise as evident in the Cool Britannia project and as a vital component of the bid to transform Britain into a leading global knowledge economy.¹ Yet the

creativity explosion is not one that emanates purely from the heavy hand of the state, it also becomes a matter of governmentality, in the Foucauldian sense,² one that encourages the development of techniques of the self,³ and is a discursive process that has become embedded within our very subjectivity. Subsequently, we live in a society where everyone not only wants to be creative but is told and believes that they can be.

This chapter considers the working experiences of a small group of cultural producers working in London’s creative economy as a way of exploring the sociological significance of the cultural economy within the context of late modernity. It investigates why creativity has become such a central component of the discourse of everyday life, and how it has become entwined with the social, the political, and the economic. Exploring the importance of identity, reflexivity, and individualization for these “cultural intermediaries,”⁴ I argue that the precarious routes that they are obliged to take through the spheres of employment within the creative economy are indicative of a radically transformed world of work. As the relationship between the cultural and the economic becomes ever more entwined in modern society, the question of how these cultural producers negotiate the terrain of the new economy is vital. The new modalities of work in the cultural industries, which are largely freelance, flexible, and entrepreneurial, can be seen as templates for how we are all increasingly having to negotiate our working lives in a state that is “permanently transitional” (McRobbie, 2004).

As today’s cultural producers make highly individualized pathways through their working lives, and as the notion of the “portfolio career” becomes more common place, we can see how the traditional notion of a career is radically altering; no longer a “job for life,” work becomes transitional and insecure. The increased individualization of late modern social life means that these knowledge workers must “seek personal solutions to systemic

contradictions” (Beck & Beck-Gernsheim, 2002, p. 22): they must live with the ever-present possibility of “the breakdown biography” (p. 3). It is clear from my research that the working lives of cultural producers are increasingly precarious. At the same time culture has been appropriated by the state and by transnational corporations for neo-liberal, free-market purposes. With this in mind, the fundamental and underlying questions driving my research for this chapter are: what purposes does the “creative turn” serve within contemporary society, and what are the subjective experiences of those individuals who are working inside the creative economy?

Structurally, the argument that follows is split into two key sections. The first section is a theoretical discussion that seeks to contextualize the cultural economy within the larger historical and social framework of late modernity. This will examine the key literature both in terms of theorizing the cultural economy and also more specifically the research that is available into the study of cultural production and the sociology of work. Through an examination of recent academic and political literature I will attempt to define the scope of the creative economy, and its political significance. Then I will explore the increasingly cultural nature of economic life, followed by an analysis of the inherent reflexivity and individualization in contemporary society and the significance of this for my research. This will be followed by a review of the literature within both media and cultural studies and sociology that helps us to understand the working lives of cultural producers, assessing the importance of subjectivity, discourse, and governmentality.

The second section is an analysis of interviews carried out between July and August 2004 with four individuals working within the creative industries in London. I will attempt to ground the theoretical discussion of the essay in the actual lived and situated experiences of these individuals. The subjects of this analysis come

from a variety of backgrounds and ages. All are working within the creative industries as defined by the Department of Culture Media and Sport (DCMS).⁵ They have a personal investment with the notion of being “creative” in terms of what they do. As such they fit the criteria of subjects for whom being creative is a deeply important aspect of their lives, and for whom, as Rose (1990) would suggest, “[w]ork is a essential element in the path to self-fulfilment” (p. 118).

THEORIZING THE CULTURAL ECONOMY

Worldwide, the creative industries sector has been among the fastest growing sectors of the global economy. (Cunningham, 2004, p. 110)

First let us turn to a consideration of what the creative industries actually are, and how we can assess their social, economic, and political significance. The cultural workers inside the creative economy are employed in a huge variety of different roles, within a rapidly transforming area. In recent years, creative industries have become the subject of intense promotion within political and economic discourse. In 1998 the British government defined the creative industries as being comprised of music, performing arts, publishing, software, TV and radio, film, designer fashion, advertising, arts and antiques, crafts, design, architecture, and interactive leisure software (DCMS, 1998). They are defined as “those industries which have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property” (DCMS, 2001, p. 5).

Concomitantly, in recent years creativity has been put at the top of the political and economic agenda on a global basis. Leadbeater (1999) has declared that “the real assets of the modern econ-

omy come out of our heads not out of the ground: ideas, knowledge, skills, talent and creativity” (p. 18). In the U.S., Florida (2002) has announced that there is a dominant new social group in society that he calls the “Creative Class”:

[i]f you are a scientist or engineer, an architect or designer, a writer, artist or musician, or if you use your creativity as a key factor in your work of business, education, health care, law or some other profession, you are a member. With 38 million members, more than 30 per cent of the nation’s workforce, the Creative Class has shaped and will continue to shape deep and profound shifts in the ways we work, in our values and desires, and in the very fabric of our everyday lives. (p. 9)

On the more local level that I am describing in London, creative industries have become central to regional policy to promote economic growth. A recent report on London’s creative industries, Creative London, shows the scale of growth of this sector in recent years (London Development Agency, 2004). According to this research, the creative industries contribute £21 billion to London’s gross domestic product; one in every five new jobs created in London is in the creative industries, and the sector as a whole now accounts for more than 500,000 jobs in the capital (London Development Agency, 2004). This makes the creative economy second only to financial services in terms of its economic significance in the capital.

CULTURAL CAPITALISM

The structural demands of late capitalism mean that increasing numbers of people are now making a living within the creative industries. Jameson (1984) detected the centrality of cultural production to the workings of advanced capitalist economies, asserting that post-modernism, both as a historical condition and as a new cultural

aesthetic marked by pastiche, irony, depthlessness, and heterogeneity, needs to be understood from a material, economic basis. Post-modernism occurs in a society where culture has become inextricably connected with the economy and where: “aesthetic production ... has become integrated into commodity production generally: the frantic economic urgency of producing fresh waves of ever more novel-seeming goods at ever greater rates of turnover, now assigns an increasingly essential structural function and position to aesthetic innovation and experimentation” (Jameson, 1991, pp. 4-5). This shift is also one away from an industrial society into a so-called post-industrial society, where services rather than manufacturing and industry have become the economic dominant (Bell, 1973). This supposedly “weightless” economy creates an increased need for cultural producers. In our consumer society, goods have a built in obsolescence and advertising and marketing become crucial. As such, culture becomes not only a major aesthetic consideration, but is also the major driving economic force within society.

More recently Lash and Urry (1994) have argued that we live in an economy of “signs and spaces.” By this they mean that business processes have become increasingly acculturated in modern social life, so that the value of a commodity, for example, is indissociable from the power and symbolic capital attached to its “brand.” As they note, “[w]hat is increasingly being produced are not material objects, but signs.” In this process, “goods often take on the properties of sign-value through the process of ‘branding,’ in which marketers and advertisers attach images to goods” (Lash & Urry, 1994, p. 15). Structurally, this means there are ever-greater numbers of people working to produce symbolic content. As Lash and Urry (1994) assert: “[w]e thus live in increasingly individuated and symbol-saturated societies in which the advanced-services middle class plays an increasing role in the accumulation process.

This class assumes a critical mass in the present restructuration: as symbol-processing producers and as consumers of processed symbols working and living in certain towns and cities” (p. 222).

REFLEXIVE MODERNIZATION

As the cultural has become fused with the economic, the ongoing processes of individualization and reflexive modernization provide a theoretical framework for understanding the new modalities of work for cultural producers. A number of commentators have examined the processes of detraditionalization that have occurred through modernization, and the impact of this on the individual where subjects become increasingly “reflexive” and are compelled to seek structure and meaning to their lives through a plethora of personal lifestyle choices (see Beck, Giddens, & Lash, 1994). Individualization has become a key trend in contemporary social life, occurring as people are disembedded from traditional social ties of kinship, class, and geography and become more fluid and mobile in their social relationships. As Lash (2002) writes, “individualism is a result of the retreat of the classic institutions: state, class, nuclear family, ethnic group” (pp. 9-10).

This process has profound consequences for the individual. Subjects in individualized societies must take responsibility for themselves. If things go wrong, the answer lies not with society, but with their own personal failings. Indeed, “‘individualization’ consists in transforming human ‘identity’ from a ‘given’ into a ‘task’—and charging the actors with the responsibility for performing that task and for the consequences (also the side-effects) of their performance” (Bauman, 2002, p. 15).

Explaining this dynamic, Giddens (1992) argues: “[t]he self today is for everyone a reflexive project—a more or less continuous interrogation of past, present and future. It is a project carried

on amid a profusion of reflexive resources: therapy and self-help manuals of all kinds, television programmes and magazine articles” (p. 30). This is certainly evident for my interviewees, who are self-monitoring and order their identities through personal narratives which present themselves as life choices. The “creative” turn which I have described can be seen as a key element of the ongoing process of individualization within late modernity, something for the self to aspire to, that which will bring self-fulfillment. As such it becomes part of the “lifestyle” culture of contemporary society, an individual route to potentially transform one’s domestic life, relationship—even one’s identity.

RESEARCHING CONTEMPORARY CULTURAL PRODUCTION: THE MISSING LINK

Why has the study into the working lives of cultural producers been so neglected in recent years by academics? Firstly, such work is “production heavy,” and “requires intense periods of immersion in the field of study” (Schudson, 2000, p. 257). Access is also a central issue. Although academics have some contact with media professionals and cultural intermediaries, in order to do valid research in this field one needs to have very strong contacts, as gaining access to busy media and creative professionals is a painstaking and time-consuming process. Furthermore, production research has been seen by some as overly celebratory of the industries it studies, in that it “succumbs to the superficial glamour” of the world it attempts to study (Garnham, 1990, p. 11). Critics have also questioned the validity of the methodology of ethnographic research in media and cultural studies, claiming that the interview technique misses the larger questions of power, decision making, and economics within media organizations (Garnham, 1990).

THEORIZING WORK IN THE NEW CULTURAL ECONOMY

In recent years, however, a number of writers have attempted to make sense of the transformed working landscape of contemporary cultural producers. For example, McRobbie's (2000) engagement with recent social theories of reflexivity, network cultures, governmentality, and individualization has produced some crucial insights into modalities of work within the cultural economy. Addressing Garnham's (1990) point, she acknowledges that there is always the fear that "this kind of work can often convey the field of study as being more autonomous and more cut off from the network of powerful institutions that are its conditions of existence" (McRobbie, 2000, p. 258). However, drawing on the insights of theorists such as Rose (1990, 1999), she argues that the self-promotional strategies used by creative workers that emphasize the glamour of what they do are in fact critical factors in the study of this field: "I would propose that it is precisely the creative dimension, the dynamics of self-promotion and also the sociological nature of 'the glamour' that now ought to be the focus of attention in studies of cultural workers" (McRobbie, 2000, p. 258). Of course, such rewards are only available to a tiny elite of cultural workers, and following this path comes at the expense of job security, decent pay, and a whole array of worker's rights, which are sacrificed on the altar of creativity.

Discourse analysis also provides a convincing means of understanding the role of creativity as a loaded signifier involved in the formation of work-based identities. For example, Du Gay's research (1996, 1997) investigates how workers come to identity with beliefs that closely echo the needs and normative demands imposed on them by capitalism and by the companies that they work for. Du Gay's research exposes the centrality of culture within the contemporary workplace. His insights are essential for understanding the

discursive power of creativity for those employed within the cultural industries, as a way of creating "better" contemporary workers. Du Gay suggests that there is a clear reason for this turn to culture in the workplace—profit—in which, "[c]ulture' is accorded a privileged position ... because it is seen to structure the way people think, feel and act in organizations. The aim is to produce the sort of meanings that will enable people to make the right and necessary contribution to the success of the organization for which they work" (1996, p. 41). Equally, Miller and Rose (1990) argue that economic governance operates through subjects, and so needs to connect with an individual's subjectivity in order to be effective. As they explain, there is an economic rationale for this process: "[g]overnment ... is a 'personal' matter, and many programmes have sought the key to their effectiveness in enrolling individuals as allies in the pursuit of political, economic and social objectives" (Miller & Rose, 1990, pp. 327-328). The promotion of creativity can be interpreted as a fundamental part of economic discourse and governmentality, one in which the creative lifestyle as an individual choice has a wider economic and political purpose. As they suggest: "[o]rganizations are to get the most out of their employees ... by releasing the psychological strivings of individuals for autonomy and creativity and channelling them into the search of the firm for excellence and success" (Miller & Rose, 1990, p. 330). These processes play a vital role in the formation of identity for cultural producers, as we shall now see.

THE CULTURAL PRODUCERS

I have chosen to separate the analysis of my interviews into three central themes. Firstly, I will examine the economic realities of making a living in the cultural industries. Secondly, I will explore the importance of creativity to my interviewees.

Creative London?

Finally, I will analyse the emergence of cultural individualization within the creative economy, through my participants' experiences. Work for these individuals has become a site of intense flux, compelling them to be entrepreneurial and to sell themselves on the labour market on a constant basis. This has had a negative impact on their personal lives in some cases. Yet for all this, these cultural producers loved their work, and the "freedom" that their creative labour gave them. As such, work for them has become a terrain of great risk but also of opportunity and great satisfaction. In the pages that follow I will try to make sense of the complex and often contradictory evidence that I have amassed from my research.

A RISKY BUSINESS: MAKING A LIVING IN THE CULTURAL ECONOMY

The working lives that I describe illustrate a shift in which the traditional notion of a career or job for life is disappearing; instead people are more likely to be in a state of semi-employment or multi-activity work. As Beck (2000) argues: "[t]he normal work situation ... has begun to break down, and a political economy of insecurity and differentiation has developed in place of an economy of state-guaranteed social security" (p. 53). For growing numbers of people the "portfolio career" is emerging, filling the vacuum left by the permanent job. This is certainly the pattern of work as experienced by my interviewees. For example, Mark (personal communication, August 2004), the co-founder of a small advertising firm, described the lack of security that he experiences in work:

It's not particularly secure. I mean we constantly have conversations about it, will we be able to continue, have we got enough money? It's hard to say, I've only ever got about 30 days where I'm certain [of work].

Similarly, Catherine (personal communication, August 2004), a television producer/director working in the independent television sector, finds her working life highly precarious at times. When asked about the average length of a contract, Catherine replied:

I've got a long one at the moment, 8 months. But I've had a weekly contract before ... that's about as bad as it gets! Three months is very common for a documentary. I've never had anything longer than 8 months.

Catherine described the tension between managing a creative career in a self-entrepreneurial way and the impact that it can have on your emotional life:

At times I feel incredibly insecure ... The positive way of trying to look at the career is always looking for new skills and new challenges and just keeping moving, taking the work that comes my way. But the actual feeling, what it's actually like to work really, really hard and be off to Africa one week talking your way into a jail cell and then fly back and the project is over and you're unemployed again and all your contacts say that there is no work about, can be very harsh really. Hard on yourself.

Daniela is an established freelance journalist, who has worked for a large number of national newspapers and magazines over the course of her career. Because of this, she has very good contacts in the business, and finds work more easily than most in her field. But she is still prone to the fluctuations of fashion and of the market, and has experienced the insecurity of creative work the hard way. When working for a national newspaper she told me how suddenly they terminated her contract when it became financially necessary:

When they had a budget overspend they had to get rid of me and bring the job in-house because that's

how they were going to save £11,000 a year ... they just phoned up and said 'Could you file your copy? Oh and by the way we don't need you any more.' (personal communication, August 2004)

“DUCKING AND DIVING”: THE PORTFOLIO CAREER

A significant trend that my analysis shows is the emerging “portfolio career” pattern for those employed in cultural production. As the “job-for-life” disappears, and the insecurity of project-based work increases, subjects in the cultural economy are compelled to find a number of ways to make a living. It quickly became clear that in addition to the attendant insecurity of creative work, my participants have to juggle any number of different projects at a given time. They are forced to become highly entrepreneurial, commodifying themselves on the labour market, always on the lookout for the next project. According to Catharine:

As a researcher or assistant producer most people spend the last few weeks of their contract looking around for work, because when people want to hire you they want you the next Monday.

Daniela provided particularly telling evidence of the portfolio career pattern.

When the Internet came up British Airways head-hunted me, At this point I was working at The Times two days a week, I was doing my television critic stuff for the Daily Mail and I was doing other freelance stuff—so I had like an office job a steady contract and other bits and pieces, and then British Airways wanted me to set up their internet site ... so I've got a little portfolio. Then I've got this rock festival that I'm setting up in Nebraska which is something completely different.

Daniela is performing a juggling act to ensure a steady flow of capital. She was an exemplary

case study of a creative worker for whom “[t]he norm now is a kind of middle class ‘ducking and diving’” (McRobbie, 2002a, p. 525).

Ellie also finds it necessary to combine a number of jobs to make a living as an artist. Insecurity and transition form a staple feature of her working life. She makes very little money from her artistic practice and sees it as an investment in her future career. In order to survive she teaches sculpture part-time on an art foundation course and does occasional telesales work to supplement her income. She has little security in her teaching work and no formal contract in her telesales work.

NETWORKING: A CLUB CULTURE

To survive in such a precarious, flexible situation, where one goes from project to project at a dizzying pace, the ability to network becomes crucial. Daniela states:

I think you do have to network and I think a lot of people do it and I think there's a lot of brown-nosing going on. You have to rely on contacts, you have your favourite commissioning editors who you actually socialize with ... you become friends with the people who commission you and you almost expect them to hand you pieces like you're their favourite pet.

How can we understand the emergence of the network as the dominant paradigm of contemporary social and economic life? Castells (1996) argues that fundamental changes in communications technology, most importantly the development of the Internet and instantaneous global communications systems, mean that we have entered the age of the “network society.” In this emergent society, labour markets have undergone intense changes. As Castells (1996) suggests: “[c]apitalism itself has undergone a process of profound restructuring, characterized

Creative London?

by greater flexibility in management; decentralization and networking of firms both internally and in their relationships to other firms; considerable empowering of capital vis-à-vis labour, with the concomitant decline of influence of the labor movement; increasing individualization and diversification of working relationships” (p. 1). As creative workers are increasingly freelance, mobile, and have no fixed stable workplace, the network becomes increasingly important in terms of finding work, socializing, sharing information, and learning new skills.

Taking this into account, interestingly my analysis shows that most of my participants had an ambivalent relationship to the networking culture that they operated in. While admitting its centrality to success, it was also seen as something potentially vulgar, not something that they overtly associated themselves with doing. It seemed that there was a code to “correct” networking.

THE CENTRALITY OF “CULTURAL CAPITAL”

If networking is the new paradigm for finding work and maintaining a career in the new cultural economy, then a critical question arises: who has the skills to get on in this “club culture” and who does not? Clearly, successful networking in London’s creative economy can be seen to take place in a rigid hierarchy of taste, with definite social codes and norms. Navigating this terrain successfully requires high levels of “cultural capital” in order to facilitate access to the network and to provide an individual with the communicative and cognitive skills to succeed in this environment (Bourdieu, 1984).

All of my interviewees can be said to possess high levels of cultural capital. Middle-class, university-educated, they epitomize Bourdieu’s definition of “cultural intermediary,” a group that: “comes into its own in all the occupations involving presentation and representation (sales,

marketing, advertising, public relations, fashion, decoration and so forth) and in all the institutions providing symbolic goods and services. These include the various jobs ... in cultural production and organization which have expanded considerably in recent years” (Bourdieu, 1984, p. 359). My interviewees instinctively knew how to behave in the closed worlds of their professions and how to work the cultural economy to their advantage, where networking is so vital. Evidence of their skills can be seen in these comments:

Mark: You’ve got to have the interpersonal skills—they are the most important things. (personal communication, August 2004)

Catherine: How do I network? Just pop an e-mail, make a call, be charming. (personal communication, August 2004)

The networked economy becomes increasingly discriminatory in terms of who has access and who does not while hard-fought battles over workers’ rights and antidiscrimination laws are sidelined. As McRobbie (2002) argues, networked labour markets in the creative industries are far more open to subtle forms of discrimination and exclusion: “[w]hat we see ... is the emergence of working practices which reproduce older patterns of marginalization (of women and people from different ethnic backgrounds), while also disallowing any space or time for such issues to reach articulation. In this case the club culture question of ‘are you on the guest list?’ is extended to recruitment and personnel, so that getting an interview for contract creative work depends on informal knowledge and contacts, often friendships” (p. 533).

CULTURAL INDIVIDUALIZATION

The working lives of this group of cultural producers are acted out against the backdrop of an ac-

celerated individualization within contemporary society. My analysis suggests that the creative economy is peopled by atomized workers, who connect through networks but have lost a wider sense of workplace politics and labor solidarity. Because they have no fixed communal workplace, their experience of work is innately individual, as they move with such speed from project to project and place to place. For Daniela, modern technology exacerbates the atomizing process:

When you're freelance you've got the Internet and everything, you can do your shopping on the Internet there becomes very little reason for you to walk out of your front door. I could be here for a whole week and never go out.

FINDING "PLEASURE IN WORK"

Despite the pains that they feel at such precarious working lives, my participants were all at pains to stress how much they love their jobs, and the sense of freedom and fulfillment it gives them. They expressed a deep ambivalence towards their working lives. As seen previously, they were open about their concerns at the insecurities and the stresses of individualization, of living and working in a culture requiring constant risk taking. Yet at the same time they emphasized their great personal satisfaction in being creative, and in the pleasure they derive from their work. In central ways, "creativity" acted as a panacea for the structural pains of making a living under such pressures:

Daniela: I love the fact that I can come up with an idea, and have the freedom to turn it into a story that lots of people then enjoy reading. I'm lucky to have that, so many jobs are really boring.

Mark: It's a way of expressing yourself, of doing work that doesn't necessarily feel like work, you know?

In particular, my participants all stressed the satisfaction they derived from "doing their own thing," and of escaping the dull confines of a nine-to-five office job, which they associated with tradition and a lack of autonomy and fulfillment.

Ellie: I think it's about freedom maybe, having freedom about choices I make, in terms of what I do and what I think about.

Daniela: I know for a fact that I really need to believe in what I'm doing. I can't just do it for the money.

As Ursell (2000) suggests, for creative workers "pleasure derives from the scope they are finding for aesthetic self-expression" (p. 819). This helps to explain why contemporary cultural producers actively choose their occupations and sometimes work for very little money or even for nothing, even though they experience insecurity and exploitation. The pleasure and satisfaction that these workers derive from their jobs, even in the face of deeply (self) exploitative working practices, serves a structural function that legitimizes the workings of late capitalism. The individualized pleasure in work that my participants feel can be understood in terms of how the discourse of creativity has a disciplinary effect on workers. In a culture where creativity is prized as an "inner quality" that will bring self-fulfillment, it becomes a discursive regime: "regimes of power all the more effective since they are connected with freedom and self-realization" (McRobbie, 2002b, p. 104). As Ursell (2000) suggests, in the creative economy, "one constructs one's self with a view to marketability and value-adding propensities" (p. 810). Thus commercial consumption regimes and lifestyle politics so evident in contemporary society act as potent technologies of the self, creating individuals who are "seeking identity in work, whose subjective desires for self-actualiza-

Creative London?

tion are to be harnessed to the firm's aspiration for productivity" (Rose, 1990, p. 244).

CONCLUSION

My research into the rapidly evolving and amorphous creative industries signals a number of trends, each of which would provide fertile ground for further research. In examining the personal implications of the creative economy focusing on the experiences of my respondents, I have only been able to sketch out some preliminary and tentative shifts. However, the results are striking, and if they can be said to be indicative of wider developments in this field, and indeed in the economy at large, they signal a significant transition in contemporary labour markets.

My analysis suggests that creative workers are compelled to find new ways of managing their careers in increasingly individualized ways; in the absence of a job-for-life, and with the need to juggle a variety of projects in their attempts to work the cultural economy, these knowledge workers are having to find complex pathways through their working lives, routes which insist that they become reflexive, adaptive, and in the absence of workplace politics that they become their own support structures. They are truly "entrepreneurs of the self" (Du Gay, 1997, pp. 301-303).

Creative workers are at the vanguard of the new economy model of work in terms of how they experience flexible capitalism, freelance economies, networking, and work that is defined by mobility, atomisation, rapid deskilling, self-exploitation, multiple sites, insecurity, entrepreneurialism, and flux. In their biographies we can begin to understand the logical progression of neo-liberal values, the fusion of the cultural with the economic and the impact of the network society on work in the age of "soft capitalism." Cast adrift in the flows of the creative economy, my interviewees all exist in a constant state of risk at work, yet the rewards are deeply uncertain for as Sennett

(1998) argues, "new market conditions oblige large numbers of people to take quite demanding risks even though the gamblers know the possibilities of reward are slight" (p. 88).

A future world of work characterized by semi-employment, risk, and insecurity is the logical conclusion of the neo-liberal winner-take-all market. Such a breakdown of certainty and meaning can be glimpsed in my participants' working lives. As Sennett (1998) asks, "How can long-term purposes be pursued in a short-term society? How can durable social relationships be sustained? How can a human being develop a narrative of identity and life history in a society composed of episodes and fragments?" (pp. 26-27). This is the dilemma for my participants working in the creative economy of London. And as Beck (2000) suggests, it may be one that will face us all: "[t]he high-wire balancing act is becoming the paradigm for individual biography and social normality. Become a life-artist or go under: such is the alternative that is posed everywhere" (p. 118).

REFERENCES

- Bauman, Z. (2002). Individually together. In U. Beck & E. Beck-Gernsheim (Eds.), *Individualization*. London: Sage Publications.
- Beck, U. (2000). *The brave new world of work*. Cambridge, UK: Polity Press.
- Beck, U., & Beck-Gernsheim, E. (2002). *Individualization*. London: Sage Publications.
- Beck, U., Giddens, A., & Lash, S. (1994). *Reflexive modernization: Politics, tradition and aesthetics in the modern social order*. Cambridge, UK: Polity Press.
- Bell, D. (1973). *The coming of post-industrial society: A venture in social forecasting*. New York: Basic Books.

- Bentley, T., & Seltzer, K. (1999). *The creative age: Knowledge and skills for the new economy*. London: Design Council/Demos.
- Bourdieu, P. (1984). *Distinction: A social critique of the judgement of taste*. London: Routledge.
- Burchell, G., Gordon, C., & Miller, P. (Eds.). (1991). *The foucault effect: Studies in governmentality*. London: Harvester Wheatsheaf.
- Castells, M. (1996). *The information age: Economy, society and culture (Vol. 1). The rise of the network society*. Oxford, UK: Blackwell.
- Cunningham, S. (2004). The creative industries after cultural policy. A genealogy and some possible preferred futures. *International Journal of Cultural Studies*, 7(1), 105-115.
- Department of Culture Media and Sport (DCMS). (1998). *Creative industries mapping document*. London: DCMS.
- Department of Culture Media and Sport (DCMS). (2001). *Creative industries mapping document*. London: DCMS.
- Donzelot, J. (1991). Pleasure in work. In Burchell et al. (Eds.), *The foucault effect: Studies in governmentality*. Hemel Hempstead, UK: Harvester Wheatsheaf.
- Du Gay, P. (1996). *Consumption and identity at work*. London: Sage Publications.
- Du Gay, P. (Ed.). (1997). *Production of culture/cultures of production*. London: Sage Publications.
- Florida, R. (2002). *The rise of the creative class, and how it's transforming work, leisure, community and everyday life*. New York: Basic Books.
- Foucault, M. (1988). Technologies of the self. In H. Luther et al. (Eds.), *Technologies of the self: A seminar with Michel Foucault* (pp. 16-49). Cambridge: University of Massachusetts Press.
- Garnham, N. (1990). *Capitalism and communication: Global culture and the economics of information*. London: Sage Publications.
- Giddens, A. (1992). *The transformation of intimacy: Sexuality, love and eroticism in modern societies*. Cambridge, UK: Polity Press.
- Guntern, G. (Ed.). (1998). *Risk-taking and creative leadership*. London: Shephard-Walwyn.
- Jameson, F. (1991). *Postmodernism, or, the cultural logic of late capitalism*. London: Verso.
- Lash, S. (2002). Individualization in a non-linear mode. In U. Beck & E. Beck-Gernsheim (Eds.), *Individualization*. London: Sage Publications.
- Lash, S., & Urry, J. (1994). *Economies of signs and spaces*. London: Sage Publications.
- Leadbeater, C. (1999). *Living on thin air: The new economy*. London: Viking.
- London Development Agency (LDA). (2004). *Creative London*. London: LDA.
- McRobbie, A. (1999). *In the culture society: Art, fashion and popular music*. London: Routledge.
- McRobbie, A. (2000). The return to cultural production case study: Fashion journalism. In J. Curran & M. Gurevitch (Eds.), *Mass media and society* (pp. 255-267). London: Arnold.
- McRobbie, A. (2002a). Clubs to companies: Notes on the decline of political culture in speeded up creative worlds. *Cultural Studies*, 16(4), 516-531.
- McRobbie, A. (2002b). From Holloway to Hollywood: Happiness at work in the new cultural economy? In P. Du Gay & M. Pryke (Eds.), *Cultural economy* (pp. 97-114). London: Sage Publications.
- McRobbie, A. (2004). Everyone is creative? Artists as pioneers of the new economy. In E. B. Silva & T. Bennett (Eds.), *Contemporary culture*

Creative London?

and everyday life (pp. 184-210). Durham, UK: Sociology Press.

Miller, P., & Rose, N. (1990). Governing economic life. *Economy and society*, 19(1). In P. Du Gay (Ed.), *Production of culture/cultures of production*. London: Sage Publications.

Osborne, T. (2003). Against 'creativity': A philistine rant. *Economy and Society*, 32(4), 507-525.

Rose, N. (1990). *Governing the soul: The shaping of the private self*. London: Routledge.

Rose, N. (1999). *Powers of freedom: Reframing political thought*. Cambridge University Press.

Schudson, M. (2000). The sociology of news production revisited (again). In J. Curran & M. Gurevitch (Eds.), *Mass media and society* (pp. 175-200). London: Arnold.

Sennett, R. (1998). *The corrosion of character: The personal consequences of work in the new capitalism*. New York: Norton.

Ursell, G. (2000). Television production: Issues of exploitation, commodification and subjectivity in UK television labour markets. *Media, Culture and Society*, 22(6), 805-827.

Wang, J. (2004). The global reach of a new discourse: How far can 'creative industries' travel? *International Journal of Cultural Studies*, 7(1), 9-19.

ENDNOTES

- 1 "Cool Britannia" was New Labour's strategy on coming to power in 1997 to promote the UK as a cultural powerhouse and as a world leader in the creative industries.
- 2 "Governmentality" relates to Michel Foucault's theory of power. The term refers to the techniques that exist to encourage individuals to act upon themselves in ways that serve particular ends (see Burchell, Gordon, & Miller, 1991).
- 3 Techniques of the self are those practices which "permit individuals to effect by their own means or with the help of others, a certain number of operations on their own bodies and souls, thoughts, conduct and ways of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection or immortality" (Foucault, 1988, p. 18).
- 4 The notion of the "cultural intermediary" derives from the work of French sociologist Pierre Bourdieu. Bourdieu (1984) argues that the cultural intermediaries are a new economic class, who work in the culture industries, serving the needs of an economy characterized by a massive expansion of the cultural sphere.
- 5 The DCMS definition of the creative industries includes music, performing arts, publishing, software, TV and radio, film, designer fashion, advertising, arts and antiques, crafts, design, architecture (DCMS, 2001).

This work was previously published in Information Communication Technologies and Emerging Business Strategies, edited by S. van der Graaf, pp. 140-159, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Chapter 8.15

Information–Communications Systems Convergence Paradigm: Invisible E–Culture and E–Technologies

Fjodor Ruzic

Institute for Informatics, Croatia

ABSTRACT

This chapter is on cultural aspects of information-communications systems embedded into new media environment and invisible e-technologies, and on a new age of social responsibility for information technology professionals. Besides the key issues in information technology development that create smart environment and ambient intelligence, the chapter also discusses digital e-culture and the new media role in cultural heritage. From the viewpoint of information technology, the current information-communications systems converge with media. This convergence is about tools-services-content triangle. Thus, we are confronted with a new form of media mostly presented with the term digital, reshaping not only media industry but also a cultural milieu of an entire nation on a regional and global basis. The discussion follows on the World Library idea that

is rebuilding with new form of World Memory (World Brain), the shift from visible culture domination to the domination of invisible culture in the world of e-technologies predominance. From this scenario, information technology professionals coping with information systems projects, e-services development, and e-content design have more cultural responsibility than in the past when they worked within closer and inner cultural horizons and when their misuse of technologies had no influence on culture as a whole.

INTRODUCTORY REMARKS

The information society is, above all, an economic concept but with important social and cultural implications. The new forms of direct access to information and knowledge create new forms of e-culture. E-culture is a part of a culture. It not

only concerns users but the community of information professionals as well. When one speaks of information technology, it is always from the Western point of view, whereas e-technology (especially its applications) takes place throughout the world, and every culture has a different understanding of it. The shift to an e-culture at the level of society in general is translated to the individual level, enabling cultural change to be described empirically. The term *e-culture* refers to the diffusion of new technology, its application for various purposes (especially information and communication), and shifts in related attitudes, values, and norms. E-technology may not be gnawing at the roots of our culture, but those roots are gradually absorbing it. As with all innovation, cultural or otherwise, this technology will reinvigorate, transform, and inspire older cultural forms. We are living in the era of globalization, the information economy, with borderless communities and multiple citizenships. E-culture literacy and attainment will require serious attention to new infrastructure, to the building blocks and platforms for e-culture. These are critical issues for the pursuit of information professionals' excellence, for creativity in an information society, as well as for fundamental imperatives for commerce and trade in a new media environment.

The main notion of the following text is on cultural aspects of information-communications systems embedded into a new media environment, on invisible technologies, and on a new age of cultural responsibility for information technology professionals. The key issues in information technology development that create invisible e-technologies and smart environments are under e-culture influence. From the viewpoint of information technology, the current information-communications systems converge with media. This convergence is about tools-services-content triangle. Thus, we are accepting a new form of media mostly presented with the term *digital*, reshaping not only media industry but also a cul-

tural milieu of an entire nation on a regional and global basis. The discussion follows on the new e-technology and information-communications systems convergence as the basis for defining pervasive computing and positive e-technologies. The findings at the end of this chapter explain the process of a fundamental cultural shift from the computer-based information technology to the computerless (invisible) e-technologies in which the e-culture is the essential factor of the success. The discussion section is about the role of information technology professionals coping with information systems projects, e-services development, and e-content design. They have more social responsibility than in the past when they worked within closer and inner cultural horizons and when their misuse of technologies had no influence on culture as a whole.

BACKGROUND ON INFORMATION COMMUNICATIONS SYSTEMS AND NEW MEDIA

One of the most valuable and essential processes that humanity can engage in and which is, therefore, essential to look at in terms of information technologies, is the process of self-determination. The principal of self-determination of people was embodied as a central purpose of the United Nations in its 1945 charter. The purposes of the United Nations are to develop friendly relations among nations based on respect for the principle of equal rights and self-determination of nations, and to take other appropriate measures to strengthen universal peace. Resolution 1514 (XV) of December 14, 1960, containing the Declaration on the Granting of Independence to Colonial Countries and Peoples, stated that all nations have the right to self-determination; by virtue of that right, they freely determine their political status and freely pursue their economic, social, and cultural development (United Nations, 1960). In the 1990s,

these issues continued to be highly relevant as numerous people around the world strove for the fulfillment of this basic right of self-determination. The UN General Assembly in 1995 again adopted a resolution regarding the universal realization of the right of nations to self-determination. Thus, the General Assembly reaffirmed the importance for the effective guarantee and observance of human rights and of the universal realization of the right of nations to self-determination (United Nations, 1995). By this, we see that self-determination is tied to all aspects of life: political, economic, social, and cultural. It is ultimately about how we choose to live and allow others to live together on this planet. Furthermore, information technology plays a key role in current economic and social affairs, so the information technology specialists/professionals have much more social responsibility than other professions. Information and communication technologies and networking infrastructures are playing an expanding role in supporting the self-determination of people and emergent nations. Access to information and the facilitation of communication provides new and enhanced opportunities for participation in the process of self-determination. It gives the potential to enhance political, economic, social, educational, and cultural advancement beyond the scope of traditional institutions and forms of governance.

The next step in recognizing cultural and social dimensions of information technology on the international scene is regarding the Council of Europe document, Declaration of the Committee of Ministers on human rights and the rule of law in the information society (Council of Europe, 2005). The Declaration recognizes that information and communication technologies are a driving force in building the information society with the convergence of different communication media. It also stressed that building societies should be based on the values of human rights, democracy, rule of law, social cohesion, respect for cultural

diversity, and trust between individuals and between nations, and their determination to continue honoring this commitment as their countries enter the Information Age.

Vannevar Bush (1945) predicted that the advanced arithmetical machines of the future would be (a) electrical in nature, (b) far more versatile than accounting machines, (c) readily adapted for a wide variety of operations, (d) controlled by instructions, (e) exceedingly fast in complex computation, and (f) capable of recording results in reusable form. The new computer devices as smart devices, linked through communications systems, are creating new forms of information-communications systems. Thus, the new form of information appliances and ubiquitous information technology creates the basis for the concept of an information-processing utility. Based on interactive and ubiquitous carriers of information, the first generation of new information systems evolved to provide easy communication over time and space barriers. Thus, the new information systems are media. They are virtual communication spaces for communities of agents interested in the exchange of goods and knowledge in a global environment. Further promising technologies are pervasive computing and augmented reality. The vision of pervasive computing is, to some extent, a projection of the future fusion of two phenomena of today: the Internet and mobile telephony. The emergence of large networks of communicating smart devices means that computing no longer will be performed by just traditional computers but rather by all manners of smart devices. From these notions, it is evident that information-communications systems open the way to information society development. The information society is based on the new (digital) media that provides vast opportunities for information/content networking. New organizational networks are built, cutting across national borders and interests. The networks themselves increasingly may take precedence over nation-states as the driving factor

in domestic and foreign affairs. At the same time, native communities have been actively engaged in creating and utilizing such networks with increasing participation and sophistication.

We are entering the era of new media. New media are tools that transform our perception of the world and, in turn, render it invisible or visible. Information technology (IT) professionals must understand new problems, considering the role of e-technologies in the integration and interaction between cultures. It is apparently true with tera architecture of the sensor networks that will transform business, healthcare, media, and e-culture itself. A new form of information-communications systems boosts intelligent networks with the majority of computers that are invisible and disposable. The IT professionals have the challenge in turning all that data into useful and meaningful information and in resolving cultural and privacy issues that accompany pervasive networked computing and ambient intelligence. IT professionals are confronted with the stage when e-technologies extract analytic values from social networks turning information issued by sensors and other data sources into knowledge management systems.

Defining new media is hard work. If we begin to use voice or books in an innovative fashion, we have just made old media into new media. Whatever we define as new media now would be old media as soon as we add innovations. We cannot define new media strictly based on the use of new technology for distance communication, since technology is always changing. What is new media today will be passé tomorrow. If we try to define new media by process rather than by structure, we are still in trouble. Whatever we define new media as today no longer will be valid tomorrow as technology changes the structures and processes. Trying to define the limits of change is a futile effort due to the very nature of change. This means that the regulation of new media is also an exercise in utility. The experiences with first-generation media platforms showed that in order

to take advantage of the potentials and chances offered by new media, we need to explore their features and learn how to use them effectively and to build them efficiently. In short, we need to develop innovative concepts, frameworks, and methodologies for the design, realization, and management of the new media. The new media offer unprecedented opportunities and potentials for positively changing almost any aspect of our lives. The growing importance of new media and the demand for appropriate platforms have given rise to the development of innovative technologies and components for such media. Consequently, we can now observe the first generation of media platforms and the first management approaches for such platforms.

The evolution in convenient, high-capacity storage of digital information is one of the enabling technologies for new media. Disk drives that allow local storage, retrieval, and manipulation of digital content are increasing in capacity and falling in price. The current TV experience will evolve into a highly personalized process. Consumers have access to content from a wide variety of sources tailored to their needs and personal preferences. New business models and opportunities for the various providers in the value chain will evolve in an organic market focused on addressing individuals directly with new services. This will allow content providers to respond more effectively to audience needs. Digital media and the emerging communication technologies have created an overabundance of programs and information available from which each consumer can choose. The consumer will need new solutions enabling smart and active decision making over viewing preferences, such as a personal filter for the multitude of choices, dynamically adapting to changing needs and preferences.

Communications technology is available for the support of highly complex interenterprise service networks that support new services (Nergoponte, 1996). Altogether, this creates a new view on the product, emphasizing the utility of

the package (product and services) instead of the product itself. Analyzing the lifecycle of a product is crucial for synthesizing and specifying new types of benefits for a customer. Therefore, modern manufacturers have to provide benefits to customers. Questions are what could be the benefits and what kind of utility may be beneficial for the customer. Based on that exercise, they have to come up with appropriate business concepts based on new media e-culture.

THE CULTURE AND INVISIBLE CULTURE

To cope with the new culture space in the context of information-communications systems embedded into new media environment, there is a need for basic definitions on culture, new media, and digital e-technologies. The great advances in culture come not when people tried to impose the values of one culture to the exclusion of all others, but rather when modern individuals try to create structures that are more exciting by combining elements from different cultures. The current information technology is capable of recording universal standards and particulars around the world, and it opens new ways and sources for creativity and global cultural heritage. Hence, information technology must reflect the full range of human existence, the values, the culture, and the entire knowledge. At the same time, the new e-culture is born interacting with e-technologies, and it exists in new cultural ecology. This new cultural ecology stimulates the development of a new trio (triple convergence) consisting of e-technologies, e-culture, and e-society.

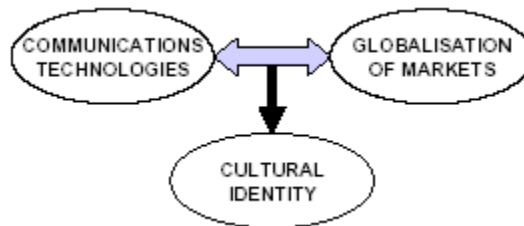
The culture is a shared set of manifest and latent beliefs and values (Sackmann, 1991). It helps people to categorize and predict their world by teaching them about habits, rules, and expectations from the behaviors of others. Culture also molds the way people think—what their motivations are, how they categorize things, what inference

and decision procedures they use, and the basis on which they evaluate themselves. Most of other definitions are too narrow. Sociologists have focused on behaviorist definitions of culture as the ultimate system of social control. In this system, people act appropriately and monitor their own standards and behaviors. Thus, the culture consists of the learned ways of group living and group responses to various stimuli; sociologists describe the content of the culture as the values, attitudes, beliefs, and customs of a society. Media theorists have explored the interplay of culture and technology, which has led to an emphasis on some aspects of culture. The new approaches are considering cultural ecology as consisting of new media in which various types of media are translated into a common digital form that is accessible within a single framework.

Today's networked media allow each user to participate actively in the creation of cultural expressions, which we perceive simultaneously and with immediate proximity. The new culture is emerging due to the use of digital technology (e-technology). At the same time, there is a strong relation between values promoted by the new digital e-culture and the traditional moral values created by the major world cultures. These notions open the new contextual approaches on culture in the information society. The culture related to the information society is about three contextual elements (Figure 1).

The forces of globalization and technology development are paradoxical by nature, offering both threats and opportunities for cultural diversity. Yet, the information society is currently perceived only as an economic imperative in a new environment shaped by rapid information technology developments, based on visions shaped primarily by technologist and business concerns and priorities. The prevailing options embedded in these visions, such as globalization based on cultural homogenization, are questionable not only from a political and social standpoint but also in economic terms. Citizens around the world

Figure 1. Triple context of culture in information society



are becoming increasingly concerned about the way accelerating processes of globalization and technological innovation are leading to cultural homogenization and immense concentrations of financial power. Globalization generally is seen to be a phenomenon driven primarily by economic interests. As such, it has neither moral content nor values. Therefore, it could be independent from culture.

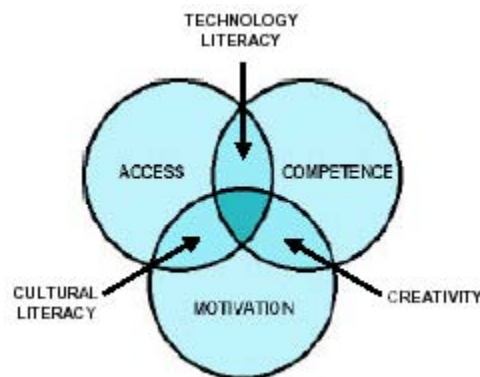
Cultural Diversity and the Information Society

Cultural diversity potentially can become a key asset in the information society, despite the fact that the culture could be defined as an obstacle. It is clear from the previous discussion on glo-

balization that the economic forces of globalization pose a serious threat to cultural identity. Information technologies are not only the tools that accelerate the pace of globalization, but they are also becoming the key means of access to any good or service. One could thus argue that cultural diversity is an obstacle. Cultural diversity is essentially a question of communication, both internally to one's own culture and externally with distributed cultures. Thus, one of the central issues is not only access to new e-technologies but also the capability of manipulating new media in order to participate actively in communicational exchanges.

Technology literacy is needed to operate IT effectively. Cultural literacy refers to the ability of an individual (or community) to relate to the

Figure 2. Tools-services-content triangle as the basis for information society



services made by one's own cultural heritage and with access to another culture in a positive way. This means learning from both similarities and differences, being able to reject some aspects, and accepting others. Cultural literacy thus lies at the heart of the possibility of communication in a context of cultural diversity. Content is about Creativity. Creativity is the factor lying at the intersection of motivation and competence, and it covers both the individual and the collective levels. Collective creativity is of greater importance if we are aiming for a shift toward an information society in which a given community will depend on the collective creativity of its social and economic individuals and organizations (with accepting collective memory and brain).

Visible Culture

Western culture has had a strong bias toward the so-called fine arts, such as painting and sculpture. These expressions of culture, which are continuously visible, were more significant than the performance arts (theatre, film, music), which are only visible when they are being played. One of the key elements of great visible culture is uniqueness. Thus, the challenge of universal standards has brought the question of uniqueness back to the fore. To communicate internationally, we need global standards that bring the risk of reducing everything to one mode of expression.

The world of telephony offers an interesting case in point. We clearly need standards and uniform rules for telephones, yet every conversation on those telephones still can be different (Veltman, 1997). In this imperative to record the particular as well as the universal, creativity is only one essential element. The major cultures of the world owe much of their greatness to the fact that they have a recorded tradition, which stabilizes the corpus but also ensures the possibility of a cumulative dimension, which is reflected in terms such as cultural heritage. Even so, there

are many skills in the craft tradition relating to culture that remain oral and invisible.

Invisible Culture

Many people favor material culture because it is visible and easily recognized. Culture is about more than objects in visible and tangible places. For example, many computer users are accustomed to thinking of computers as tools for answering questions. We need to think of them as tools for helping us to understand which questions can be asked, to learn about contexts when and where questions are not asked, of knowing that there are very different ways of asking the same thing. If software continues to be dominated by one country and if the so-called wizards of those programs all rely on the questions of that single country, then many potential users of computers inevitably will be offended, and it is likely that they will not use the programs.

The base assumption is that culture for us is invisible (invisible culture). As workers do not know that they are participants accepting entire organization values, the culture of an organization is invisible (Cooke & Lafferty, 1989). Yet, it is all-powerful. Therefore, this assumption is important for invisible e-culture. We are working in organizations that actually drive our behavior and performance in a way that most of the time is not visible to us. A definition of culture includes the way we do things.

A way to look at culture is actually to have some outside expert or outside person come in and question the way things are going, which can begin to give some insight to the people inside the organization about their own culture (Cleary & Packard, 1992). However, the culture is also considering exchange of ideas, thoughts, and beliefs, and it helps people realize that things can be done differently somewhere else. The success in one culture does not mean success in another culture, and there are actually many ways to suc-

ceed, change, and live. People realize that they can act on some other level of culture and act on their own culture.

E-Culture

We could define culture as the beliefs, behaviors, languages, and entire way of life of a particular time or group of people. Culture includes customs, ceremonies, art, inventions, technology, and traditions. The term also may have a more specific aesthetic definition and can describe the intellectual and artistic achievements of a society. The new world economy develops in e-culture and characterizes with the fast, open access to information and the ability to communicate directly with nearly anyone anywhere (Kanter, 2001). This sets e-culture apart from traditional environments.

In a first approximation, one could say that an e-culture is emerging from the convergence of communication and computing along with globalization and the penetration of e-technology in the smallest corners of our lives. The advent of information and communication technology goes hand in hand with changes in attitudes, skills, and behaviors that play a central role in daily life. The advent of an e-culture is correlated with terms of a broad definition of culture. This concerns the culture of a society with both invisible and material characteristics. E-technology as a part of the cultural information may be classified as e-invisible culture, but the outputs of that technology (information appliances) may range among the material (visible) cultural products.

The shift to an e-culture at the level of society is translated to the individual level enabling cultural change to be empirically described. The term *e-culture* refers to the diffusion of new technology; its application for various purposes (especially information and communication); and shifts in related attitudes, values, and norms. The human thinking and behavior are changing gradually by

information and communication technology. E-technology may not be gnawing at the roots of our culture, but those roots gradually are absorbing it. As with all innovation, cultural or otherwise, this technology will reinvigorate, transform, and inspire older cultural forms. We are living in the era of globalization, the information economy, with borderless communities and multiple residencies. E-culture literacy and attainment will require serious attention to new infrastructure and to the building blocks and platforms for e-culture. These are critical issues for the pursuit of information professionals' excellence, for creativity in an information society, as well as for fundamental imperatives for commerce and trade in new media environments.

E-TECHNOLOGIES AND UBIQUITOUS INFORMATION (DIGITAL) APPLIANCES

The Internet is without precedent because of two key features: its interactive and communicative natures. It is not a commodity in the sense that you can go out and buy a TV. You cannot go out and buy a net. The key word here is interactivity. Interactivity implies a dialogue of some kind, a changing response based on changing stimuli. There is much talk of interactive Web sites, but even the best of these choose from a preprogrammed set of possibilities in order to give the illusion of being interactive. You have interactivity over the telephone, and you have interactivity in a face-to-face dialogue. However, you do not have interactivity in traditional analogue television. The prosperity of the net is that it permits simultaneous interactivity with thousands and, perhaps, millions of people worldwide. This is a first in the history of humankind.

With the new and upcoming information-communications systems with pervasive and personal appliances, there will be a huge number

Figure 3. Scenario of universal personal information appliance



of networked intelligent devices and information appliances functioning as self-organizing and managed networks (Figure 3).

In the near future, information communications systems with invisible networked devices, sensors, and appliances will transform businesses, public administration, public services, and the way we communicate within digital networks. Digital networks through the new form of information transport by ultra wideband and WiMax technologies will boost the intelligent networks development around the entire globe. The computer is becoming invisible and everywhere simultaneously. This is the beginning of the invisible computer era.

Parallel to this development is that of networking, which conceivably could result in all the invisible computers in the world being networked into a single virtual computer. This would lead to the evolution of a computer that

would be everywhere and nowhere at the same time. Technology itself and on its own is not a cultural determinant. Technology is the invention of a particular culture—a cultural expression. The relationship between culture and technology is not linear and monodirectional but rather multidimensional and hyperspatial. Ten years from now, the computer as we know it today will be an anachronism, a device consigned to museums. Instead, the digital information and services once delivered via conventional computers will be available through almost everything we touch. At the heart of this next generation of computing is the network. It will be pervasive and personal. Looking out a decade or two, every person and thing could be instrumented with sensors that feed data into the content base and take actions on behalf of the client.

The new term, *speckled computing*, goes in that way. It offers a radically new concept in

information technology that has the potential to revolutionize the way we communicate and exchange information (Arvind, 2005). Computing with Specknets will enable linkages between the material and digital worlds, and it is the beginning of truly ubiquitous computing. As the once-separate worlds of computing and wireless communications collide, a new class of information appliances will emerge. Where once they are used regularly, the post-modern equivalent might not be explicit after all. Rather, data sensing and information processing capabilities will fragment and disappear into everyday objects and the living environment. At present, there are sharp dislocations in information processing capability—the computer on a desk, the PDA/laptop, the mobile phone, smart cards, and smart appliances. However, Speckled Computing, the sensing and processing of information, will be highly diffused. The person, the artifacts, and the surrounding space become computational resources and interfaces to those resources. Surfaces, walls, floors, ceilings, articles, and clothes will be invested with a computational activity for rich interactions with the computational resources.

The information appliance is the natural outcome in the evolution of information processing. That is why they were foreseen a long time ago. Digital computers started out as expensive mainframes accessible to a few. The next step was the personal computer that individuals could own, and it was incorporated into everyday human activities. Thus, it was essential to have as much functionality in the personal computer as possible. Information technology is making feasible small and inexpensive devices that are smart. This helps to push intelligence closer to the people, the ultimate customers of information technology that accept some of the hidden cultural attributes of the entire community.

In a smart environment, the interaction endpoints simply could not be cognitively or physically visible. In essence, the user may have no idea that they are engaging in a computer-mediated

communication. A smart environment is a composite space made from many individual objects. These objects are either fixed or mobile. The term *invisible* means that a technology has become so natural (common) and so comfortable that we use it all the time without ever thinking of it as a technology or a number of linked technologies. These invisible technologies are taken for granted. Since they are no longer technological, we can afford to think of them as customary, as the day-to-day workings of our world. As it continues to become more acceptable and as people come into the any-information system more proficient with these new tools, computer technologies will become increasingly invisible.

The exact example of the ubiquitous e-technologies environment is under way through the ubiquitous city in South Korea. New Songdo City (U-city), being built on a manmade island, will feature pervasive computer technology throughout, driven by RFID tags and CDMA wireless communication. Although many Western observers would find the lack of privacy disquieting, Asian countries are more interested in the technological potential of such environments. U-life will become its own brand, its own lifestyle. Residents will enjoy full videoconferencing calls between neighbors, video on demand, and wireless access to their digital content and property from anywhere in Songdo. At the same time, privacy is also encountered: all information services will be anonymous, and they will not be linked to user identity.

INVISIBLE E-TECHNOLOGIES' INTERACTION WITH INVISIBLE E-CULTURE

Our relationship with the manmade world is dominated by the paradigm of the device. This paradigm creates an illusory separation between the technological means (the machinery, the medium) and the technological ends (the commodity,

the message). Technological progress generally is devoted to increasing the availability of technological goods, to make them everywhere available instantly without risk or hassle. At the same time, we want the machinery to become invisible. For various reasons, we repress ourselves from seeing the machinery and our dependence upon it. Our conscious awareness focuses on the message, and we refuse to acknowledge the medium (Pribram, 1971). Our perception of the world and our place in it are inextricably mediated through technology and the device paradigm. Our discovery of ourselves (identity through self-determination) is technical and complicated.

We are entering a new era of computing, often referred to as ubiquitous or pervasive computing. Ubiquitous computing consists of information appliances, specialized and easy-to-use devices that avoid the complexity of the computer. The future belongs to information appliances. When technology changes rapidly, greater ease of use serves to attract more users and developers, creating new frustrations. The most we can do is ameliorate the spread of the information appliance products and services. To do this, it appears necessary to recognize that flexibility and ease of use are in an unavoidable conflict and that the optimal balance between those two factors differs among users. Therefore, systems should be designed to have degrees of flexibility that can be customized for different people. Information appliances will be popular, since they will provide many new services for which the desktop computer is ill-suited and will do so in user-friendly ways. However, they will introduce their own complexity, and the level of frustration with information technology will not decrease. This is a result of the conflict between usability and flexibility. The information appliance market will be anything but mature for a long time to come. The emphasis in information processing has been and is likely to continue to be on development of novel applications. When the available information is stored on computers, it is important

for information management applications to be able to model users' interpretations of their data and to capture the possibly different meanings, semantics links, and relationships with which users associate the information units available. This is in correlation to one's personal culture. For this purpose, various Personal Information Management tools are being developed to assist the user with navigation/browsing over various forms of personal digital data. As an example of capturing, organization, and archiving new media content, the MyLifeBits project is very explanatory. MyLifeBits has the aim to store in digital form everything related to the activities of an individual, providing full-text search, text and media annotations, and hyperlinks to personal data (Gemmell, Aris, & Lueder, 2005).

Information technology should mature to the humane technology of appliances in which the technology of the computer disappears behind the scenes into task-specific devices that maintain all the power without the difficulties. This could be explained by the technology of radio. Thus, computers should evolve the way radio receivers did (Norman, 1998). However, there is a problem of motivation, beliefs, knowledge, and frustration dealing with the information technology. This is considering culture (dominantly invisible culture). The problem is that with information appliances and by invisible technologies, we are confronted with the services that must be well-understood and stable. We will not see this scenario with information appliances, not for a long time. In a world with a huge potential in services, content, and navigation, we cannot know how people will want to use information appliances.

Careful design that is focused on human factors and incorporates powerful processors and software can provide information appliances that are a delight to use. However, once the number of devices to be connected increases and wireless communication with WiFi networks expands, the difficulties will increase. Building complicated systems that work is hard. Building ones

that work and are user-friendly is much harder. Further, it is necessary to balance the demand for user friendliness with the demand for more features. A tradeoff between flexibility and ease of use is unavoidable. The problem is that we should not be thinking just of individual information appliances. We have to be concerned with the whole system, which is likely to be complex. The problem is also how to balance flexibility and ease of use in a way that can be customized for people with different needs. This problem is especially focused on multimedia home systems. The home information appliance environment is likely to be more complicated than the office environment today. In addition, many users will be less knowledgeable about information technology than the typical office worker will (Ronfeldt, 1992). Therefore, it will be essential to outsource the setup and maintenance of home computing and electronics to experts. This notion opens new ways for information technology professionals that are accessing information appliances environment (this environment asks for new interface design, navigation methods, and computational power over networked appliances). Hence, there is convergence of culture and technology in use, be they visible or invisible.

Positive E-Technologies

Rheingold (2000) argues that the technology that makes virtual communities possible has the potential to empower ordinary citizens at a relatively small cost. E-technology potentially can provide citizens and professionals advantage and power, which is intellectual, social, commercial, and political. At the same time, civil and informed people must understand the advantages that e-technology provides. They must learn to use it wisely and constructively, as it cannot fulfill its positive potential by itself. Thus, the positive e-technologies should be developed as reduction technologies that make target behaviors easier by

reducing a complex activity to a few simple steps. One of the most explicit theories that attempts to describe our natural inclination to do a cost/benefit assessment is expectancy theory. This theory posits that behavior results from expectations about what alternatives will maximize pleasure and minimize pain. E-technologies also should be self-monitoring technologies to perform tedious calculations or measurements, helping people achieve goals or outcomes. Ideally, these technologies work in real time, giving users immediate feedback on a performance or status. When people can take immediate action on a persuasive message, psychologists have found the message more persuasive than when presented at other times. The recent effort on real-time speech translation is an obvious example of these notions. Researchers from the International Center for Advanced Communication Technologies (interACT), a joint venture of Carnegie Mellon and the University of Karlsruhe, have developed a wearable system that allows real-time speech translation. The system consists of sensors that detect mouth muscle movements, translates that to a spoken language, and then retranslates that into other languages. It will make communication and cultural learning more likely, since people using this technology will be empowered to come together when they otherwise would not interact.

Culture is omnipresent in all technological advancements over the course of history, whether it is the result of intrinsic societal dynamics or the extrinsic factors of the environment. As history clearly documents, whenever technology changes, some pressing force of culture has had an effect on it. Moreover, there is a sort of invisible complimentary system between culture and technology; that is, whenever technology changes, the culture will adapt its way of life to fit the technology. For example, with the invention of the technology necessary for agriculture, cultures worldwide changed their hunting and gathering way of life in order to use the new technology

and expand its horizons. This would be expected with the information technology, too. In essence, culture indeed influences human technology, but technology also simultaneously molds the way in which cultures function.

PERSUASIVE AGENDA

Like human persuaders, persuasive interactive technologies can bring about positive changes in many domains, including health, business, safety, and education (Dillard & Pfau, 2002). With such ends in mind, the new area of information technology development is created under the term *captology*. Captology focuses on the design, research, and analysis of interactive computing products created for the purpose of changing people's attitudes and behaviors. The fact that people respond socially to computer products has significant implications for persuasion. It opens the door for computers to apply a host of persuasion dynamics that are described collectively as social influence. These dynamics include normative influence and social comparison as well as less familiar dynamics such as group polarization and social facilitation.

Just as the term *software* shifts the emphasis from media/text to the user, the term *information behavior* also can help us to think about the dimensions of cultural communication, which previously went unnoticed. These dimensions always have been there, but in an information society, they have rapidly become prominent in our lives and, thus, intellectually visible. Today, our daily life consists of information activities in the most literal way: checking e-mail and responding to e-mail, checking phone messages, organizing computer files, using search engines, and so forth. In the simplest way, the particular way people organize their computer files, use search engines, or interact on the phone can be thought of as information behavior. Of course,

according to a cognitive science paradigm, human perception and cognition, in general, can be thought of as information processing. While every act of visual perception or memory recall can be understood in information processing terms, today there is much more to see, filter, recall, sort through, prioritize, and plan. In other words, in our society, daily life and work largely revolve around new types of behavior activities that involve seeking, extracting, processing, and communicating large amounts of information. Information behaviors of an individual form an essential part of individual identity. They are particular tactics adopted by an individual or a group to survive in information society. Just as our nervous system has evolved to filter information existing in the environment in a particular way that is suitable for information capacity of a human brain, so we evolve particular information behaviors in order to survive and prosper in an information society. In today's world of information, people suddenly are shifting their attention to the Web for their computing needs.

Levy (1998) contends that communication in the virtual world can cultivate collective intelligence, which can encourage the development of intelligent communities. He states that sharing of information, knowledge, and expertise in e-communities can promote a kind of dynamic, collective intelligence, which can affect all spheres of our lives. He contends that the virtual world can foster positive connections, cooperation, bonds, and civil interactions. In e-groups or e-communities, which are flexible, democratic, reciprocal, respectful, and civil, this collective intelligence can be enhanced continually. Researchers in science, education, business, and industry are pooling their collective intelligence, knowledge, and data in collaborative memories. These are virtual centers in which people in different locations work together in real time, as if they were all in the same place. Science, education, commerce, and industry have become increasingly global.

Collaboration, which is efficient, maximizing, and timesaving among distance researchers in these fields, has become more critical.

This new e-culture paradigm within the Web users' community opens the ways for Web 2.0 e-technologies platform comprising the set of principles and practices based dominantly on the user behavior and cultural values of collaboration. Most users find that Web 2.0 sites are extremely useful, because they are always available (whenever they need it and anywhere they go) with their information. Web 2.0 is the network as platform, spanning all connected devices. Web 2.0 applications are those that make the most of the intrinsic advantages of that platform:

- Delivering software as a continually updated service that gets better, the more people use it.
- Consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others.
- Creating network effects through architecture of participation.
- Going beyond the page metaphor of Web 1.0 to deliver rich user experiences.

One of the key aspects of Web 2.0 is that it connects people so that they can participate effortlessly in fluid conversations and dynamic information sharing. At the same time, information appliances and computing devices are giving people permappresence on the Web. Before now, the user consciously had to go to cyberspace by sitting at a desktop computer and looking at it through a display. Web 2.0 applications will become invisible as they become more popular, and there also would not be such a phrase as "going on the Web." Moreover, if the network is omnipresent and invisible, we do not need the term *cyberspace* anymore. Web 2.0 is also more human and a social one labeled with social interactions like

conversation, sharing, collaboration, publishing, which could be supported by the corresponding processes (blogging, tagging, sharing, publishing, networking) and content formats (blogs, wikis, podcasts, folksonomies, social software). In addition, Johnson and Kaye (2004) stated that the Web would become a trustworthy place and the users would take it with much more reliance and credibility.

Computers Influence our Thoughts and Actions

Although culture is mostly learned, it is bound by necessity to a particular setting or context of its behavioral and material articulation. Culture is both conservative and adaptable. Culture is articulated symbolically and has the function of symbolically integrating the diverse moments and spaces of culture into a coherent sense of order. This format is emerging throughout the social field as a format of technology (the point-to-point Internet, file sharing, grid computing, blogs), and as a third mode of production producing hardware, software (often called open sources software) and intellectual and cultural resources (wetware) that are of great value to humanity (GNU/Linux, Wikipedia).

Cognitive scientist Clark (2003) believes that we are liberating our minds, thanks to our penchant for inventing tools that extend our abilities to think and communicate, starting with the basics of pen and paper and moving on to ever more sophisticated forms of computers and e-technologies. He declares that we are, in fact, human-technology symbionts, or natural-born cyborgs, always seeking ways to enhance our biological mental capacities through technology. The persuasive e-technologies are in front of us to solve the problem of difficulties in utilization of the computer, which complexity is fundamental to its nature. We have to start over again to develop information appliances that fit people's

needs and lives (Norman, 1998). In order to do this, companies must change the way they develop information system products. They need to start with an understanding of people: user needs first, technology last. Companies need a human-centered development process, even if it means reorganizing the entire company.

People are more readily persuaded by computing technology products that are similar to them in some way (Fogg, 2003). Although people respond socially to computer products that convey social cues, in order to be effective in persuasion, hardware and software designers must understand the appropriate use of those cues. If they succeed, they make a more powerful positive impact. If they fail, they make users irritated or angry. With that in mind, when is it appropriate to make the social quality of the product more explicit? In general, it is appropriate to enhance social cues in leisure, entertainment, and educational products, especially with smart mobile devices (Rheingold, 2002). Users of such applications are more likely to indulge, accept, and perhaps even embrace an explicit cyber social actor. When perceived as social actors, computer products can leverage these principles of social influence to motivate and persuade.

DISCUSSION ON NEW FORMS OF CULTURAL RESPONSIBILITY OF IT PROFESSIONALS

Culture and ethics are a very important part of our everyday life in information society. The invention of new e-technologies tends to bring many different dilemmas into the lives of the creators and the people who use them. Some technologies have been created without choice, and we must make sure we fully understand how to use them properly. The introduction and use of new technologies require a check against the moral structure of the society and the ethical beliefs of

the individuals that will feel the effects of such an addition to their lives (Postman, 1992). This belief should be the foundation of innovation so that members of the society can have a strong, viable, and ethical solution to satisfy their wants and needs and to extend their capabilities. Ubiquitous computing and smart environments will be characterized by massive numbers of almost invisible miniature sensing devices that potentially can observe and store information about our most personal and intimate experiences. The new forms of direct access to information and knowledge create new forms of e-culture. It concerns not only users but the community of information professionals as well.

Technology can be a powerful tool for change, especially when used responsibly. Responsible IT management should be an important part of any socially responsible enterprise's strategies, policies, and practices. Users should have information technology choices that can and should reflect organizational, community, and national values and social responsibility. These notions are considering IT professionals' activities; they should create applications that guarantee accessibility. Accessibility to information via the information-communications systems should not be inhibited by disability or resource limitations, and the design solutions should be for the user experience. Usability of information technology solutions requires attention to the needs of the user (information consumer). The information-communications systems create new psychological demands from human. They ask us to bring a greater capacity for innovation, self-management, and personal responsibility. They also demand social responsibility of information technology professionals. Information technology is the wave of today and the future. Society must adapt to it by creating responsible rules, norms, ethics, and knowledge workers that will enhance its rapid growth.

Many firms acting on the global scene via information-communications systems are committed to incorporating socially responsible projects into their policies and activities. Corporate social responsibility is a development that is here to stay for the long term as a part of corporate policy influencing the company's involvement in the well being or development of local as well as global communities (Furnham & Gunter, 1993). Information technology firms are in a unique position to distribute their high-tech expertise and cultural values in development projects. The new information society environment poses a new relation between values promoted by the new digital civilization and the traditional moral and cultural values created by the major world civilizations. Computer technology and ethical egoism are the products of secular research within a free market capitalist society. The majority of non-Western societies and some Western, as well, follow ethical rules created within traditional culture. These rules are centered on guiding the individual in properly fulfilling his or her role within the society, which means the superiority of the society over the individual. The changes that information technology is bringing to people's lives are revolutionary, and one of the features of every revolution is that it is at the same time both a process of creation and of destruction. The revolutionary process itself is a very rapid one, which means that there is little or no time for a methodical and deep reflection on it while the process is actually in progress. These points ask for more attention from information technology professionals to cope with the culture exposed through the visible objects. They also should implement invisible culture elements when designing new information services. One possible way of minimizing the harm could be through incorporating the experiences of the process of intercultural dialogue into the process of creating a global e-culture of the information society.

REFERENCES

- Arvind, D. K. (2005). Speckled computing. In *Proceedings of Nanotech 2005, Anaheim, CA* (Vol. 3, pp. 351-354). Cambridge, MA: Nano Science and Technology Institute.
- Bush, V. (1945). As we may think. *The Atlantic Monthly*, 176(1), 101-108.
- Clark, A. (2003). *Natural-born cyborgs: Minds, technologies, and the future of human intelligence*. Oxford, UK: Oxford University Press.
- Cleary, C., & Packard, T. (1992). The use of metaphors in organizational assessment and change. *Group and Organizational Management*, 17, 229-241.
- Cooke, R., & Lafferty, J. (1989). *Organizational culture*. Plymouth, MI: Human Synergistics.
- Council of Europe. (2005). *Declaration of the committee of ministers on human rights and the rule of law in the information society*. Strasbourg, France: Office of Publications.
- Dillard, J. P., & Pfau, M. (2002). *The persuasion handbook: Developments in theory and practice*. London: Sage Publications.
- Fogg, B. J. (2003). *Persuasive technology: Using computers to change what we think and do*. San Francisco: Morgan Kaufmann Publishers.
- Furnham, A., & Gunter, B. (1993). Corporate culture: Definition, diagnosis, and change. *International Review of Industrial and Organizational Psychology*, 8, 233-261.
- Gemmell, J., Aris, A., & Lueder, R. (2005). Telling stories with MyLifeBits. In *Proceedings of the IEEE International Conference on Multimedia 2005*, Amsterdam, The Netherlands (pp. 1536-1539). Piscataway, NJ: IEEE Publications.
- Johnson, T. J., & Kaye, B. K. (2004). For whom the Web toils: How Internet experience predicts

Web reliance and credibility. *Atlantic Journal of Communication*, 12(1), 19-45.

Kanter, R. M. (2001). *Evolve: Succeeding in the digital culture of tomorrow*. Boston: Harvard Business School Press.

Levy, P. (1998). *Becoming virtual: Reality in the digital age*. New York: Plenum Publishing.

Negroponte, N. (1996). *Being digital*. London: Coronet.

Norman, D. (1998). *The invisible computer: Why good products can fail, the personal computer is so complex, and information appliances are the solution*. Cambridge, MA: MIT Press.

Postman, N. (1992). *Technopoly: The surrender of culture to technology*. New York: Alfred A. Knopf.

Pribram, K. (1971). *Languages of the brain*. Englewood Cliffs, NJ: Prentice-Hall.

Rheingold, H. (2000). *The virtual community: Homesteading on the electronic frontier*. Cambridge, MA: MIT Press.

Rheingold, H. (2002). *Smart mobs: The next social revolution*. Cambridge, MA: Perseus Publishing.

Ronfeldt, D. (1992). *Cyberocracy is coming*. London: Taylor & Francis.

Sackmann, S. A. (1991). Uncovering culture in organizations. *Journal of Applied Behavioral Science*, 27, 295-317.

United Nations. (1960). *General assembly resolution 1514 (XV), declaration on the granting of independence to colonial countries and peoples*. 947th Plenary Meeting. New York: UN Publishing Office.

United Nations. (1995). *General Assembly resolution 49/148, universal realization of the right of peoples to self-determination*. Forty-Ninth Session. New York: UN Publishing Office.

Veltman, K. H. (1997). Why culture is important in a world of new technologies. In *Proceedings of the Panel on Cultural Ecology, 28th Annual International Institute of Communications Conference*, Sydney, Australia. Sydney: International Institute of Communications.

This work was previously published in Information Resources Management: Global Challenges, edited by W. Law, pp. 54-74, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).

Index

A

- Abacus 262
- abject poverty 2630
- absolute poverty 2618
- abuse 1314
- academic Web portfolios 1658
- Accelerated Development Plan (ADP) 1977
- Access Barriers 765
- access index (DAI) 3, 17
- access point (SAP) 972, 976, 986
- Access to ICT within Latin American Countries 2569
- achievement-task orientation 2641
- action research methods 3112
- active information transfer 191
- active learning 2094
- active learning 2708
- active prosumer 1852
- ActiveSWF 946
- actor-network theory (ANT) 535, 540-542, 3405
- Ad Hoc Networks 2957
- adaptive hypermedia 414
- Addiction Disorder (IAD) 1313
- Adult & Community Education (ACE) 186
- adult literacy programs 2504
- adult literacy training 2504
- adult students, characteristics 1165
- advanced distributed learning (ADL) 944
- advanced economies 2587
- Advanced Placement (AP) 1937, 1942
- Advanced Research Project Agency (ARPA) 240, 1307
- advanced wireless network security & management - CIT 499 1126
- advanced wireless networking - CIT 581 1127
- Advertisement in Commercial Games 3747
- advisory service 2186
- aeroplane flight system 3460
- Africa Competitiveness Report 2004 2590
- African Information Society Initiative (AISII) 1291
- African Information Society Initiative (AISII) 2588
- African SchoolNet movement 1284
- African SchoolNet tool kit 1293
- AFTA WebMAIL 915
- agent-based architecture of a distributed laboratory system 1130–1142
- agents of change 478
- AHLE systems 415
- AIDS 1368, 1369, 1371
- airline line control (ALC) 257
- airlineTariff Publishing Company (ATPCO) 259, 274
- All Pakistan Women Association (APWA) 127
- Altéa Customer Management Solution (CMS) 273
- Amadeus 262, 272

- amplification theory 2687
 analytical dualism 3405
 Anglophone 1936
 anthropology 1756
 anticipatory ICT standardizing 536–573
 AOL (AIM), 1668
 application program interface (API) 274, 3004
 application service provider (ASP) 977
 application services 1527
 Arab values 154
 Arab world 151
 Aravind Eye Care System (AECS) 1013
 Arizona Coalition against Domestic Violence 2691
 artificial intelligence (AI) 3326
 Asia Pacific Economic Cooperation 2975
 Asia Pacific Network Information Centre (APNIC) 128
 Asian sex tourism market 1366
 Asia-Pacific Advanced Networks (APAN) 127
 Asia-Pacific Development Information Program (APDIP) 1384
 Asia-Pacific Program of Education for All (AP-PEAL) 209
 associate stage 2016
 Association for Computing Machinery (ACM) 2639
 Association for Progressive Communications (APC) 213
 Association for the Prevention of Torture (APT) 2686
 Association of South East Asian Nations 1999
 asynchronous chat 1206
 asynchronous collaboration 1191
 asynchronous discussion 1466, 1467
 asynchronous engagement 2091
 Asynchronous learning networks (ALN) 3718
 attributes, negative and positive 1616
 audio blogging 2692
 audiovision 1823
 AuSTO 926, 927
 AuSTO ontology 934
 Australian Creative Resources Online (ACRO) 1390
 Australian Federation of Travel Agents (AFTA) 1890
 Australian sustainable tourism ontology (AuSTO) 923, 934
 Australian Tourism Data Warehouse (ATDW) 916, 947
 AustralianHotels Association (AHA) 996
 automated methods for integrating systems (AMIS) 1801
 automatic teller machine (ATM) 123
 autostrada 245
 avatar 1903
 Avex records 1810
- B**
- baby boomers 3769, 3772, 3778
 backdoor attack 1798
 balancing leadership and collaborative management 336
 Bangladesh Advanced Education Research & Information Network (BAERIN) 127
 Bangladesh Research and Educational Network (BERNET) 127
 Bangladesh Telecommunications Regulatory Commission (BTRC) 121
 bargaining power 2970
 Bario community 826
 Base Consulting Group (BCG) 3043
 Beer, Stafford 619
 behavior modeling approach 2398
 behavioral trust 2271
 behaviorism 431
 behaviorism, theories 432, 435
 behaviourist learning 1068
 Beijing Platform for Action (BPFA) 502
 benevolence-based trust 2272
 best practice 513, 515, 517, 533
 biobanking 3681, 3686
 biobanking enterprises 3682
 biographical interviews 474, 478
 Biopiracy 3688
 biotechnology 2235
 black box testing 3046
 Blackboard 1666
 Blair Witch project 1823
 blended learning 1202–1215
 blended model 1216–1224
 blog 801, 1383, 1671, 1885
 bloggers 585
 Blue IQ initiative 2015
 bluebug attack 1798
 bluejacking 1798
 Bluetooth 956, 957, 964, 1782
 BMB experience 2352
 BMI-TechKnowledge 3329
 body area networks (BAN) 1760
 bottom-up approach 204
 Boundary Work 3528
 Bovine Spongiform Encephalopathy (BSE) epidemic 2376

Index

- brainstorming 662, 666, 667, 669
British culture 2240
Broadband Advisory Group (BAG) 57
broadband communication technology 62
broadband content 1389
broadband infrastructure 1380
broadband Internet 449
broadband network 1381
broadband satellite system (GBSS) 1518–1529
broadband services 56
brokerage network 2517
Bruner's three-form theory 434
BSVD classrooms 2518
BSVD network 2518
Building a Simulation Game 1449
Building Digital Opportunities Program 2631
BUIS Project 2676
bulletin board 1370
bureaucracy-driven networks 2504
bureaucratic cybercontrolled society 2697
Bursa urban information systems (BUIS) 2675
business collaboration 2972
business community 3806
Business Entry Point 916
business intelligence (BI) 618
business logic layer (BLL) 925, 927
Business networks 2969
business process outsourcing (BPO) 125, 210
Business Registration and Licensing Agency (BRELA) 1546
business system 3330
business-to-business (B2B) 978, 985, 2971, 3140
business-to-consumer (B2C) 978, 985, 2970, 2971
Buyer Search Costs 1993
- C**
- calculus process 2271
call centers 210
CanalDigitaal 1851
capability maturity model (CMM) 864
capacity building 678, 900, 2969
Cape IT Initiative 2014
Caribbean businesses 1987
carriage facilities (rainbow model layer) 2499
case study 658, 663, 665, 666, 668
case-based reasoning (CBR) 1574
Catholic Organization for Relief and Development (CORDAID) 1545
causal-loop diagram (CLD) 2982, 2984
CawdNet 2003
c-commerce 988, 989, 990, 991, 992, 993, 994, 995, 997, 998
cellular phone 1872
central conflationism 3408
centralized knowledge 2506
Certification Magazine 2719
Chaku-melo 1810
challenges in the formation phase 331
Challenging Existing Textualities 2090
channel access protocol 1729
Channel Disintermediation 1990
chat room 1370
chemical reaction model (CRM) 1131
chief executive officer (CEO) 3119
chief information officer (CIO) 3001
chief privacy officer (CPO) 3003
Child Rights Information Network 2685
child-rights movement 2684
CHIPS (Clearing House Interbank Payment System) 229
Christian Social Services Commission (CSSC) 1544
CI professionals 1446
CIT 346 - wireless networking 1125
Citizen Engagement 678
citizen-led e-democracy, definition 2449
civic education 3306
civic interest 842
civic Web forum 842
Civic Web Genres 853
civil society 206
civil society organizations (CSOs) 206, 216
civilian GPS satellite signal 959
Civilization 1649
clarify targets 3018
Class participation patterns by gender 3546
Clearing House Interbank Payment System (CHIPS) 229
Clement and Shade's rainbow model 2499
client/server model definition 1135
closed circuit television camera (CCTV) 3325
closed educational environment 1943
closed source 1420
Club Culture 3814
coach environment 1700
coalition of space Internet providers (COSIP) model 1513–1529
codes of ethics 2649
coercive power 3024
cognitive apprenticeship, definition 2355
cognitive flexibility theory 436

- cognitive orientations 545–550
 cognitive skills 1190
 cognitive tools 1192
 cognitivism, theories 433
 cognitivist learning 1068
 Cold War 238
 collaboration challenges 326
 collaboration challenges for users 337
 collaboration challenges in community telecommunication networks 323–344
 collaborative agent system architecture (CASA) 1131
 collaborative business networks 3634
 collaborative IOR 997
 collaborative learning 1191, 1256
 collaborative network outcomes 2972
 collaborative peer tutoring in teaching Java 1712–1725
 collaborative task 1153
 collaborative writing 3356
 collaborative-filtering recommender system 940
 collectively mobile heterogenous network (CMHN) 280
 Colloquial usage 802
 Colombo Stock Exchange (CSE) 2045
 commercial logic. 844
 Commercialization of High-Tech Sector 3684
 commercialization of research 3684
 Commission for Science and Technology (COSTECH) 212
 Commission of Sustainable Development (CSD) 23
 Committee for Democracy in Information Technology (CDI) 2577
 Committees for the protection of human subjects (CPHS) 1020
 Commons Deed 1388
 Communication and Interaction between Partners 2955
 Communication Centres 1979
 Communication Channel Enactment 3491
 communication infrastructure 2552
 communication networks 2496
 communication networks for smart organizations 1771
 communication paradox 3482
 communication technology (ICT) 1329, 1591, 1666
 communications technologies 3717
 Communicative Action Theory 3491
 communities of practice (CoPs) 1085
 communities of practice, and apprenticeship 1086
 Community advisory boards (CABs) 1020
 community computer centre (telecentre) 1328
 community consultation 778–792
 community empowerment 2282
 community health 1016
 community ICT access 905
 community ICT initiatives 2289
 community informatics 55
 community informatics researchers 63
 Community Information Centres (CIC) 67, 126
 Community Interaction 1468
 community needs consultation model 780
 community network, phases of development 327
 community of practice 2084
 community ownership 2579
 community participation 2576
 community sensitization 1962
 community services approach 2288
 community technology centers 889
 Community Technology Centres 183
 community telecenters 2573
 community-based ICT 904
 community-based organizations (CBOs) 206
 Community-based participatory research (CBPR) 1020
 community-based system 206
 community-based training 904
 comparative advantage 120, 204
 competence-based trust 2272
 competitive advantage 2104, 2108, 2115, 2516
 competitive co-evolution 2969
 competitive intelligence (CI) 618, 1414, 1423, 1437, 1445
 Competitive Intelligence as a Process 1419
 Competitive Intelligence as a Product 1418
 competitor intelligence 1423
 complexity theory 3695
 compound annual growth rate 9–13
 computer access and knowledge 3774
 computer aided-learning (CAL) 1696
 computer aided-learning (CAL) engineering tools 1696
 computer assisted communication media 3489
 computer assisted learning 2304
 computer assisted software engineering (CASE) 1091
 Computer Information Systems (CIS) 1692
 computer kiosks 163
 computer literacy 931, 1310, 1547
 computer programming, misconceptions 3341
 computer reservation system (CRS) 256, 258, 268, 277, 280

Index

- computer science teaching 3340
- Computer Security Institute (CSI) 1786
- computer supported intentional learning environments (CSILE) 1111
- Computer Systems Policy Project (CSPP) 798
- computer-aided design (CAD) 2669
- computer-assisted education (CAE) 457
- computer-assisted instruction (CAI) 457
- computer-assisted learning (CAL) 457
- computer-based game 1647
- computer-based information technology 3821
- computerization index (CI) 3037, 3130
- computer-mediated communications 2305
- computer-mediated instruction 1619
- computer-mediated learning 446
- computers in the classroom 2312
- computer-supported collaborative learning (CSCL) 1111
- computer-supported collaborative work 2269
- computing and ICT literacy 3338
- computing curricula 1270–1283, 2001
- computing literacy 3340, 3344
- computing tablet 1873
- computing teaching, Italian experience 3341
- concept of place 1495
- conceptual training 2846
- concur task tree environment (CTTE) 930
- confidentiality, integrity, and availability (CIA) 2796
- conflict between face-to-face and online literacy 2100
- conflict cycle 3785, 3786
- conflict prevention 3785, 3786, 3796
- conflict transformation 3794
- Connected Lives Project, Canada 3230
- connecting business processes 1245
- construction as Carnival 1753
- constructivist e-learning environment (CEE) 1109, 1111, 1112, 1114
- constructivist e-learning influence 1109–1121
- constructivist e-learning system (CES) 1109
- constructivist learning theory 1110, 1256
- constructivist portfolios 1057
- consumer creativity 2360
- consumer preferences 312
- consumer products 3039
- consumer rights 2357
- consumer-generated innovation 640
- contemporary globalized economy 2032
- contemporary instructional technologies 2118
- content management 1383, 2653
- content management system (CMS) 967, 1255
- content object repository discovery and registration/resolution architecture (CORDRA) 944, 945, 947, 949
- content of formation 329
- content provider (CP) 976
- content-based recommender system 940
- context of formation 328
- context of performance 333
- contextual approach 473
- contiguity (contact) 1753
- contingent improvisation 2516, 2517, 2525
- continuous learning 406
- Contribution of Competitive Intelligence 1417
- cooperative IOR 993
- cooperative learning 1256
- cooperative learning theory 435
- cooperative marketing 2972
- cooperative method of instruction 1938
- coordinating actors (GCA) 1525–1527
- copyright 1383, 1386, 1387, 1388, 1389
- core indicators (CIs) 86
- cost efficiency 2108
- cost factor 1771
- Council for Economic Planning and Development 1997
- Council for Scientific and Industrial Research (CSIR) 212
- counterterrorist activities 2697
- country assistance plan (CAP) 2605
- country assistance strategies (CASs) 2587
- country assistance strategies of the World Bank 2586
- country cooperation framework (CCF) 2605
- course design 1052
- Cox regression analysis, results 395
- Creating a Development Dynamic: Final Report of the Digital Opportunity Initiative 2588
- creation of technology (component of technological innovation) 285
- Creative Commons (CC) 1386, 1388, 1389, 1390
- creative commons copyright license 1379
- Creative Commons license 1387, 1388
- Creative Content e-Platform (UNESCO) 1384
- creative development of culture 1391
- Creative Environment 663
- creative labor processes 1382
- Creative London 3807
- creative user workshop 665, 666, 667, 668
- creativity 656, 657, 658, 661, 662, 663, 664, 665, 667, 668, 669

creativity framework 656, 657, 658, 663, 664, 668, 669

critical media studies 842

critical realism 3407, 3411

critical success factor (CSF) 3010

cross cultural profile 175

cross-cultural differences 3194

cross-culture Internet marketing 2881, 2882

cross-licensing 373

CT-supported development 1495

cultural aspects of ICT 2918

cultural background 2191, 3313

cultural barriers 490

Cultural Capital 3815

cultural colonization 3313

cultural differences 2880

cultural diversity 3192, 3825

cultural expression 1384, 3828

cultural homogenization 3825

cultural impact 1968

Cultural Industries 3807

cultural innovation 1382

cultural knowledge management 1380

cultural knowledge management system 1379

cultural literacy 3825

cultural materials 1380

cultural norms, Arab world and IT 154

cultural preferences 805

cultural preservation 2654

cultural production 1385

Cultural Production 3811

cultural shift 3821

cultural tradition 1384

cultural tradition 3313, 3315

culture in information society 3825

culture, definition of 153

custom logic (CL) 925

customer relationship management (CRM) 1245, 1249, 1572, 3326

customer-citizen 583

cutting-edge technologies 2495

cyber café 141, 2047

cyber cafes (telecenters) 799

cyber crimes, threats and trends 1786

cyber kiosks 447

cybercell 1947

cyber-crime 1314

cyberdemocratic model 592

cyberidentity 2096

cybermediation 2903

cyberspace 48, 52

cybervoyeur 1361

D

Danish business environment 607

data analysis 1336

data conversion (DC) 2960

data entry 165

data protection law 2043

data switching exchange (DSE) 52

Data transfer rate 1382

data warehouse 1437

DBV-t 1851

d-cinema 1833

death of distance 1497

Decipher 916

Decipher ICT system 2029

decision support system (DSS) 1572

declarative knowledge 2735

Dedicated Advergates 3750

dedicated development centre 868

dedicated hosting 1885

dedicated Internet connection 2035

deep learning 1048, 1049, 1055

Defining Place 1495

degradation 104

degree level (S1) 2060

demand factor 1519

demand of mobility 1767

demand side innovation 640

demand-side model 1899

democracy 840

democracy in organizational research 3174

democratic development 238

democratic ideals 3306

Demographics 673

Denial Of Service (DOS) 1533

dense closed networks 2516

Department of Computer Science and Engineering (CSE) 2035

Department of Defense (DoD) 944

design-reality gap 516

desktop virtual reality (DVR) 1704, 1706

destination marketing organization (DMO) 2878

deterrence-based trust 2271

deutero decision-learning 1074

developing countries 115, 120

developing societies 116

developing world 47

development 92, 101, 817, 897

development awareness (DA) 1029

development company (SDC) 862, 863

Index

- development of human skills (component of technological innovation) 285
devices (rainbow model layer) 2499
DG Information Society 602
dictatorship of the proletariat 824
didactic methods 1286
didactical materials 2350
diffusion of educational technology 2130
diffusion of innovation 2516, 2517
diffusion of Innovation theory (IDT) 1036
diffusion of old innovations (component of technological innovation) 285
diffusion of recent innovations (component of technological innovation) 285
diffusion of technology 2518
diffusion theory 646
Digital Access 764
Digital “Have-Nots” 767
Digital Agenda 2572
digital and equipments dependencies 2647
digital archive 1380
digital broadband environment 1380
digital broadband production environment 1389
digital business portfolio 1581
digital business portfolios 1582
digital cinema as disruptive technology 1832–1845
digital cinema incentive (DCI) 1834
digital collaboration 446
digital cultural production 1388
digital cultural production mode 1380
digital divide 54, 56, 74, 128, 145, 161, 192, 207, 443, 449, 489, 764, 890, 897, 904, 1251, 1289, 2622, 2786, 3300, 3787, 3796, 3805, 3806
digital division 77
digital economy 1766
digital e-culture 3820
digital gap 76
digital heart 3422
digital inclusion 3806
digital inclusion 516
digital inequality 76
digital information 3823
digital libraries 1011
digital media 2378, 3823
digital music content market, Japan 1810
digital music content markets, Japan and U.S. 1811
Digital Opportunity Task Force (DOT Force) 79
digital petri dishes 2372
digital portfolios, types of 1583
digital production technology 1385
digital space 1573
digital technology 3789
digital television (DTV) 1820
Digital Video Broadcasting (DVB) 1612
digital-divide reduction 83
digital-inequality 83
direct sequence 1760
Direction Stage 1455
Directorate Generale (DG) 602
disadvantaged groups 897
discursive environment 1256
discussion forums 1459, 1460, 1466, 3196
Discussion Group 2013
discussion threads 3540
disease burden 1024
disease surveillance 1002, 1003
disease-control programmes 2212
disruptive innovation 1835
disruptive technology 1835, 1838
dissemination of information 3790
dissemination of knowledge 799
dissemination strategy 1935
distance communication, 3823
distance education 413, 414, 1153, 1459, 3788
distance learning 3542
distraction (abstractedness) 1754
distributed knowledge 48
distributed laboratory system 1130–1142
distributed leadership 3697
distributed learning model 408
distributed production network 2357
distribution channel 2970
distribution manager (DM) 274
distribution-oriented strategy 1542
Domain Name Server (DNS) 2041
domestic digital divide 79
double-loop decision-learning 1073
draft ITIEM model 3027
DSE (data switching exchange) 52
DSL (digital subscriber line) 85
Dual Barrier Partnerships 3606, 3613
dual-coding theory 439
dyadic collaboration 1713
dynamic packaging system 924
dynamic tourism information repository 947
- ## **E**
- EAF (Euro Access Frankfurt) 229
EBA (Euro Banking Association) 229
e-brochure 1902
ebXML standard 366

- e-catalogue 1902
 ECB (European Central Bank) 228
 ECMA 985
 ecologically sustainable future 1496
 e-commerce 55, 123, 192, 938, 941, 1848, 1901
 economic and regional development (ERD) 793
 Economic and Social Council [ECOSOC] 76
 economic deprivation 2633
 economic development 193
 Economic Development of Ethnic Minorities 3683
 Economic globalization 165
 economic growth 3806
 Economic Monetary Union (EMU) 228
 economic poverty 2623
 economic rationalism 1494
 economy 98, 100, 664, 665
 economy index (KEI) 2
 e-culture 3821, 3827
 e-culture literacy 3821
 EDI Action Plan 603
 EDI Council 606
 education 84, 1002
 education (e-learning) 192
 education and competence orientation 2640
 education policy 578
 education reform 2130
 education systems 1293
 Educational Dimension 466
 educational systems 2570
 educational technology 1217
 eEurope 882, 887
 eEurope program 882
 effectiveness (brokerage) networks 2517
 Efficient Market 3633
 Efficient Markets Hypothesis 3623, 3625
 e-ForAll 208
 ego orientation 2640
 eGov 52
 e-government 123, 192, 886, 3788
 e-health 192
 e-Knowledge 2779
 elaboration theory 435
 Elderhostel 3775
 e-learning 444, 447, 452, 453, 458, 809, 944,
 1048, 1286, 3344
 electrical and electronics (E&E) 2660
 electromagnetic compatibility (EMC) 392
 Electronic Arts' The Sims 1649
 electronic booking 1038
 electronic civil disobedience 2691
 Electronic Classroom of Tomorrow (ECOT)
 1226–1229, 1231
 electronic commerce capabilities, in Arab World
 152
 electronic data interchange (EDI) 990
 Electronic Data Interchange Network 2043
 electronic democracy 841
 electronic funds transfer (EFT) 990
 electronic government (e-government) 886
 electronic mail 2688
 electronic newsletter 2690
 electronic patient record (EPR) 1910
 Electronic Privacy Information Centre (EPIC) 2999
 electronic scrapbook (e-scrapbook) 943
 electronic-mediated learning 447
 e-management 2782
 embedded collaborative systems (ECS) 1254, 1256
 emotional digitalization 3417
 employee effectiveness 3193
 Employer Recruitment 773
 empowerment agenda, definition 3149
 EMU (Economic Monetary Union) 228
 End Child Prostitution in Asian Tourism (EPCAT)
 1361
 end user licence agreements (EULA) 2358
 end user requirements 1795
 endogenous growth theory 92
 Energeco 619
 E-News 1468
 English as a foreign language (EFL) 795
 English as a second language (L2) 800, 806
 English language 1310, 1322
 enhanced communication 2105
 enhanced-observed time difference (E-OTD)
 960, 985
 enterprise capability model 2984, 2986
 enterprise system instruction 1248
 enterprise systems (ES) 1245
 entrepreneurship education 3208, 3214
 environment 657, 659, 660, 661, 663, 664, 670
 epidemic 1373
 e-portfolio 1047, 1048, 1059
 equal access 47
 Equal Opportunities Commission (EOC), definition
 3157
 equal-level perspective 52
 e-ready 3805
 eRunway 2045
 e-services 961
 e-Sri Lanka 124
 e-strategies 1–35, 2597

Index

- e-technology 3821
EtheKwini Municipality Area (EMA) 2821
Ethical, Legal and Social Issues (ELSI) in Genetic Research 3686
ethnic citizenship 1968
ethnic minorities 3685
ethnic populations 3682
ethno-nationalism 1972
ethno-political conflicts 3785
ethno-political factors 3792
e-tourism 924, 952
e-tourism application 924
e-tourism application generator architecture (e-TAGA) 924
e-transformation 2779, 2786, 2788
ETSI 884, 887, 958
EU research and development programs in ICT 887
EU research programs 883
Euro Access Frankfurt (EAF) 229
European Central Bank (ECB) 228
European Co-ordination Committee on Human Rights Documentation [ECCHRD] 2695
European Mediterranean Partnership (MEDA) 2781
European patent landscape 356
European Union (EU) 75, 227, 882
evaluation techniques 3045
event grammar 549–551
evidence-based practice (EBP) 2236
Evolution of Microcredit 3660
evolutionary psychology (EP) 3483
executive information system (EIS) 2818
existing infrastructure 1334
expectations 2191
experience-centred design 712, 728, 729
expert workshop 664, 666, 667, 669
expertise (tacit knowledge) 797
explanatory factors 586
explanatory variables 586
explicit knowledge 795, 796
Expression of Interest (EOI) 185
eXtensible Markup Language (XML) 275, 921
eXtensible Stylesheet Language (XSL) 953
External Degree of Bachelor of Information Technology (BIT) 2039
external source 1420, 2118
external stakeholder 2521
externalization 795, 1564
extranet 446
extreme poverty 2629
Eye Care 1013
- F**
- F2F Behavior Modeling 2407
Facebook 1870
face-to-face to online instruction transition 1179–1189
factor 1519
faculty autonomy 3698–3699
Faculty of Medical Sciences (FMS) 2009
failure in the use of technology in learning 2087
failure of ICT-enhanced curricula 2087
Fair Access to Internet Report (FAIR) 145
Falun Gong 2687
Family Health Information Management System (FHIMS) 2211
Family Welfare Department (FWD) 2213
fanboy 1857
fantasy journey 665, 667
Far East cultures 155
fare management system (FMS) 274
FareLogix 274
far-transfer task 2847
Federal Trade Commission v. Dell Computer Corp. (1995) 365
Federal Trade Commission v. Rambus, Inc 365
feedback 899
feedback loop 2981
Felder-Silverman model 416
female students 1401
feminist technoscience 47, 48
Fiankoma 1029
Fiankoma project 1030
fiber optic networks 2034
field dependent/field independent model 416
file transfer protocol (FTP) 1309
film industry 1840
film industry, current structure 1839
filtering 1312
final ITIEM methodology/model 3027
finance (balanced scorecard perspective) 2105
financial barriers 491
Financial Intermediary 3633
Financial Structure 3633
Finnish ICT industry 3142
firewall security policy 2807
firewalls 1788
First National Bank (FNB) 863, 3123
Five-Year Socioeconomic Development Plan (SEDP) 207
fixed line telephone networks 1515
fixed-satellite services (FSS) 1519

- flexibility and adjustment orientation 2640
flexible peer 1153
Flickr 1870, 1877
Flow Theory 3492
focal awareness 795
focus group 830
foreign direct investment (FDI) 2, 2660, 3210
forgent networks 367
Formal Education 768
Formation of Enterprise (CEFE) Network 2525
formative evaluation 1963
Foundation for Credit Community Assistance (FOC-CAS) 3672
Foundation for Intelligent Physical Agents (FIPA) compliant platforms 923
Foundation for International Community Assistance [FINCA] 3671
Frame Relay (FR) circuits 2041
Fraunhofer Institute (AIS) 1630
free and open-source software (FOSS) 2696
freedom of expression 2684
free-market practice 3306
frequency hopping 1761
frequency of design theories utilized by online instructors 438
frequent flyer programmes (FFP) 266
Front Line 2691
front-end communication processor (FECP) 258
full time staff equivalent figures (FTSE) 995
fun-pleasure orientation 2641
Future Airline Core Environment (FACE) 276
future style of digital music listening 1812
fuzzy logic 2986
- G**
- G8 502
Gagne's conditions of learning 436
Galileo 262
Galileo system 959
game engine 2362
game mod 1647
game play 2362
garbage in, garbage out (GIGO) 797
GARMIN 958
gateway/SAP session 976
GBSS Association 1520
GDS 916
geek 1857
gender 47
gender and online communication 3540
gender as performance 473
Gender Communication Style Differences 3568
gender divide 1286
gender equality 480
gender gap 897
gender imbalance 472, 478, 897
Gender Imbalance in ICT 3520
gender pay gap 3151
Gender Script 3528
gender-based stereotyping, definition 3149
gender-effective user interfaces 3578
General Agreement of Trade in Services (GATS) 126, 1287
general packet radio services (GPRS) 955, 957, 964, 985
general" audience 844
general-purpose technology (GPT) 91
Genetic Information Management 3688
genetic sampling 3681
genomic biobanks 3682
genre 1383
Genuine Progress Indicator (GPI) 58
geographic information system (GIS) 926, 963, 985, 1010, 1570, 1688, 2653
German Development Bank (KfW) 1022
German Federal Ministry of Education and Sciences (BMBF) 1630
Ghana 1029
GIGO 797
girls' interest in sciences, mathematics and technology 1630
GIS course objectives 1692
glaucoma 1013
global access to ICT 3300
global audience 801
global burden of disease (GBD) 1024
Global Civilization 238
global communication 802
global distribution networks 1381
global distribution system (GDS) 258, 261, 262, 263, 264, 265, 270, 272, 273, 274, 275, 277, 281, 990
global distribution system (GDS) supplier 263, 271, 273
global economic system 3796
global economy 1495
Global English 793, 801, 802, 804, 810
Global English speaker 807
global information infrastructure 1245
global knowledge economy 2496
Global Knowledge Partnership (GKP) 497
global language 800

Index

- global learning 3695
 - global market 3787
 - global perspective 799
 - global positioning system (GPS)
 - 958, 959, 961, 963, 972, 985
 - global positioning system (GPS) device 959, 964
 - global positioning system (GPS) receiver 957
 - global regime 2685
 - global settings 1216
 - global system for mobile telecommunications (GMT) 954
 - global time coordination 1769
 - Global Village Energy Partnership (GVEP) 213
 - Global Voices Online 2689
 - globalization 142, 284, 808, 971
 - globalizing world 117, 118
 - GNP [gross national product] 590
 - GOARN network 1009
 - Google Talk 1887
 - governance 142
 - governance (rainbow model layer) 2499
 - Government communication 844
 - government involvement 2190
 - government prioritization of software and IT services 576
 - government procurement ICT 3137
 - government procurement markets 3137
 - government procurement systems 3138
 - Government Web Portal 1353
 - governmental transparency 3789
 - government-funding 185
 - government-led e-democracy, definition 2449
 - government-to-business (G2B) 3140
 - GPRS (general packet radio service) 1009
 - Grameen Foundation USA (GFUSA) 3675
 - Grameen Telecom of Bangladesh (GTC) 3674
 - Grameen Telecom Village Phone program 3674
 - Grameen Village Phone Model 3675
 - GrameenPhone Ltd (GP) 3674
 - grant information packs 185
 - graphic elements 2372
 - graphical user interface (GUI) 277, 925
 - graphical user interface (GUI) layer (GUIL) 925
 - grassroots 1380
 - grassroots citizen group 842
 - grassroots consultation 2501, 2503, 2509, 2510
 - grassroots content development 2501
 - grassroots creativity 1381
 - grassroots ICT applications 2504
 - grassroots involvement 2507
 - grass-roots journalism 1469
 - grassroots production efforts 1383
 - grassroots stakeholder participation 793
 - grassroots support 2519
 - grassroots-based infomediaries 525
 - gravity equation 289, 293, 296
 - gravity model 289
 - Great 8 (G8) 82
 - green paper 884
 - grid computing 1774
 - gross domestic product (GDP) 58, 92, 2535, 2587
 - group accomplishments 1196
 - group discussion 2268, 2272
 - group dynamics 1196
 - group process 2268, 2269
 - group work 2268
 - groupware 1447, 1571, 3197
 - groupware applications 1437
 - GSM (Global System for Mobile Communications)
 - 957, 959, 963, 958, 1010
 - GSM mobile terminals 964
 - guest-host interrelation scheme 2880
 - guide dog strategies 2040
 - guided meditation 665
 - Gulf Savannah region 672
 - Gundam 1858
 - GUTU World Links Telecenter 1956
 - Gyandoot Dotcom 163
 - gyroscope 962
- ## **H**
- hacking 1314
 - half-life of knowledge 444
 - harmonize ontology 923
 - HDR (see Human Development Report) 511
 - HDTV 1820, 1821
 - HDTV, reviving in a digital context 1827
 - HDTV, the end? 1826
 - health care 658, 663, 665
 - health education 1003
 - health informatics 2237
 - health information systems (HISs) 2210, 2228
 - Health Insurance Portability and Accountability Act (HIPAA) 1022
 - health literacy through ICTs 2434
 - health literacy, definition 2440
 - health promotion 2324, 2326, 2331, 2334
 - Health worker education 1016
 - healthcare 2330
 - health-care delivery 1002
 - HEI 2108, 2112, 2115
 - heterarchy 200

- hierarchy 200
 high and low context 3196
 higher education institution (HEI) 2104
 higher education organizations 2118
 higher education paradigm 3716
 higher education portfolios 1056
 high-level security 1771
 high-quality multimedia production 1381
 high-speed circuit switched data (HSCSD)
 955, 985
 high-speed downlink packet access (HSDPA)
 955, 985
 Himba 1952
 HIS 2211
 Hispano-American Health Link program (EHAS)
 2576
 history of the Internet 238
 HIV programmes 2211
 HIV/AIDS 1288, 1289, 1367, 1369, 2011
 HIV/AIDS HIS 2211
 hold up problem 1840
 Holistic Initiatives 773
 Home Commerce Business Networks 3641
 Homosocial Reproduction 3520
 Honey and Mumford's model 416
 hospitality 911
 hotel 995
 household mechanics 3234
 HTML 965, 985
 HTML specification 368
 HTTP 971, 975, 976, 985
 human computer interaction (HCI) 3695
 human contact 3794
 Human Development Index (HDI) 58, 502
 Human Development Report (HDR) 511
 Human Development Survey (HDS) 2215
 human factor 2730
 human flourishing 3303
 human genomics projects 3690
 human infrastructure 797
 human potential 3304
 Human Resource 2663, 2669
 human resource development (HRD) 122, 123
 Human Rights 2682
 Human Rights Education Associates (HREA) 2693
 Human Rights Internet 2692
 Human rights NGO 2705
 human rights violations 3789
 Human Rights Watch 2689, 2697
 human security 142, 3793
 human-computer interaction (HCI) 656, 1910
 humanism 432
 humanism, theories 434
 humanist learning 1068
 human-machine interface 3327
 hurdles 2178
 hybrid ITIEM methodology 3022, 3025, 3027
 hyper text markup language (HTML) 1309, 1773
 hyper text transfer protocol (HTTP) 1773
 HyperText Markup Language (HTML) 805, 1221,
 2728
- I**
- ICT (Information and Communication Technology)
 46, 117, 120, 228, 672, 1437, 1540, 1543,
 1544, 1547, 3682
 ICT access 2566
 ICT and culture 2248
 ICT and profitability 2507
 ICT and the Efficient Markets Hypothesis 3623
 ICT application 2579
 ICT as a production sector 120
 ICT as a teaching tool 3349
 ICT as an enabler of socioeconomic development
 120
 ICT categories 2590
 ICT development 209, 583, 656, 657, 664, 668,
 2599
 ICT diffusion 160, 162, 601
 ICT diffusion index (ICTDI) 3
 ICT dissemination 2501
 ICT fluency 764, 765
 ICT for competitive intelligence 1416, 1424
 ICT for development 2248, 2250
 ICT for human development 2572
 ICT generations 2319
 ICT Growth 160
 ICT impact on learning agency and seamless learn-
 ing 405–412
 ICT implementation 208
 ICT improvement 444
 ICT in a globalized world 2495
 ICT in education 2010
 ICT in learning processes 445
 ICT in schools 3348
 ICT in the Classroom 1599
 ICT in the new economy 304–322
 ICT indicators 2784
 ICT Industry 3520
 ICT infrastructure 2557, 3501
 ICT infrastructure 443, 576
 ICT initiatives 208, 589

Index

- ICT Intermediaries 2579
ICT literacy, computing 3338
ICT literature 583
ICT media 589
ICT networks 2972
ICT networks in rural regions 2508
ICT on learning 2317
ICT penetration 128
ICT perceptions 3386
ICT policy 47, 883, 2568, 2598
ICT Production 3504
ICT professions 472, 478, 2038, 2040
ICT projects 257, 2567, 2573, 2576, 2580
ICT sector 882, 2557
ICT sector, patents and standards 345–382
ICT service 2575
ICT skills 1059
ICT Stories Project 798
ICT strategies 2586
ICT systems 2022
ICT to Work 3804
ICT usage 2282
ICT use narratives 2341
ICT value hierarchy 3352
ICT, democracy 2441
ICT, evolution 3368
ICT, knowledge construction 3368
ICT, why it is important 3348
ICT, work organisations 3273
ICT-based channels 589
ICT-based development projects 2248, 2250
ICT-based education 446
ICT-based information seeking 2968
ICT-based learning 445, 446
ICT-based mass learning 453
ICT-based network 2973
ICT-based strategies 589
ICT-driven sector 2971
ICT-enabled changes 3172
ICT-enabled education 1284
ICT-enhanced education 2496
ICT-mediated learning 445, 447
ICT-related regional development 57, 59, 62
ICT-rich learning environments 1049
ICTs as a basic need 2032
ICTs for Conflict Prevention 3784
ICTs for development 513, 514, 515
ICTs for management 3784
ICTs in participatory theory 2452
ICTs in Secondary Education and Teachers Training colleges (TTCs) 1544
ICTs in socioeconomic development 193
ICTs integrated into existing approaches 1050
ICTs, implementation of 55
ICT-sector development 2607
ID tag 962
identification of persons 1789
Identity 876
IDR cycle 2903
IDRC (International Development Research Centre) 1292
illegal immigration 1369
illiteracy 47
ILMS 2523
image-based geographical interface 1897
imagination 1090
IMAX 1902
impact of ICTs on regional development 63
implementation 2056
implementation strategy 2041
importance of connectivity 1516–1518
improved learning 2086
incoming tourism 2880
Incubation 662
incubation phase 2016
independent variables 586
India 2209, 2252
India Health Care (IHC) 2211
Indian government 868
Indian IT Export Scenario 166
Indian Ministry of Environment and Forests (MoEF) 2518, 2519
India's education and research network (ERNET-India) 127
indicator 85, 2561
Indigenous Communication Rights 1973
indigenous creativity 1951
Indigenous ICT practices 1966
indigenous knowledge (IK) 798
indigenous knowledge, definition 2491
Indigenous people 3682
indigenous people, definition 2491
indigenous persons 2652
individual accomplishments 1196
individualism 2255
individualism index 2254
industrial marketing and purchasing group (IMP) 3636
industrial model 1251
Industrial Network Theory 3636
industrial policy 882, 888
industries 1367

- industry 1364, 1365, 1369, 1370, 1373
 industry clustering 2969
 inequality 79
 inference engine (IE) 925
 inference rules 553–555
 in-flight entertainment and communication system (IECS) 280
 InfoDev 213
 infomediaries 525
 infomediary 207
 informatics 2234
 information 1311
 information age 2054
 information and communications technologies (ICT) 54, 116, 144, 160, 174, 190, 191, 228, 254, 267, 268, 270, 277, 278, 280, 513, 514, 533, 600, 618, 656, 764, 794, 825, 841, 890, 985, 990, 1029, 1416, 1437, 1468, 1538, 1633, 2040, 2104, 2233, 2272, 2282, 2297, 2350, 2491, 2495
 information appliance 3829
 information beggars 3310
 information behavior 3832
 information channels 2968
 information distribution 2968
 information economy 1495, 3827
 information engineering (IE) 740
 information inequality 76
 information infrastructure 210
 information kiosks 2501
 information literacy 889, 1547
 information literate person 1547
 information management (IM) 444, 797, 2037, 2039
 information marginalization 1969
 information model 1251
 information networking 192
 information overload 1416, 2695
 information paradigm 1968
 information privileged 3310
 Information Processing Techniques Office (IPTO) 243
 information processing theories 3489
 information quality 3387
 Information Resources Development 1437
 Information Resources Management Association/ Data Administration Managers Association International (IRMA/DAMA) 1274
 information retention 2709
 information revolution 825
 information sharing 518
 information society 86, 444, 825, 873, 883, 897, 1969, 2054, 2076, 2349, 2556
 Information Society and Development (ISAD) 1291
 information society technologies (IST) 887
 Information Stratification 1356
 information systems (IS) 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 750, 985, 2356, 2515, 2518
 Information Systems Audit and Control Association (ISACA) 1275
 Information Systems Centric Curriculum (ISCC99) 1275
 information systems development (ISD) 734, 735, 736, 737, 738, 739, 740, 744, 745, 746, 748, 749
 information systems failure 2515
 information technology (IT) 76, 795, 920, 953, 985, 989, 991, 992, 995, 996, 997, 998, 1038, 2708, 2718, 2845, 3820
 Information Technology Agreement (ITA-1) 126
 Information Technology Education Resource Centre (ITERC) 2037
 information technology intervention 2519
 information technology services (ITS) 125
 information utility (LIU) 1513–1529
 information value chain 530
 informational capital, definition 2492
 information-based economy 254
 infrastructure 1381, 1386, 1389, 2190, 2495
 inhuman treatment 2693
 Innis 646
 innovating audiovisual media 1822
 innovation 621, 2516
 Innovation and Diffusion Theory 1040
 Innovation Hub 2014
 innovative assessment 1202
 Insight 662
 instant messaging (IM) 1666, 1668, 1886
 instant messaging tools 2372
 instantaneity (immediacy) 1755
 Institute for Didactics of Natural Sciences (IDN) 1630
 Institute of Computer Technology (ICT) 2040
 Institute of Electrical and Electronics Engineers (IEEE) 944, 985
 Institute of Electrical and Electronics Engineers (IEEE) 802.15 (Bluetooth) 956
 institutional actor (LIA) 1525
 Institutional Discourse 600
 institutional portfolios 1057
 institutional review boards (IRBs) 1020

Index

- Instructional Computer Use 1601
instructional design 420
instructional system 2119
Instructional Systems Design 2119
instructor 2177
integrated development environment 2847
integrated digital services network (ISDN) 804
integrated financial-management information systems (IFMISs) 2600
Integrated Health Information Management Systems (IHIMS) 2209, 2211
integrated library management system (ILMS) 2523
integration of HIS 2211
intellectual capital (IC)
intellectual property (IP) 1388, 2357, 3211
intellectual property rights (IPRs) 2048, 3141
intellectual technology 1251
Intelligence 621
intelligence collection network 1420
intelligence cycle 1415
intelligence infrastructure 1417
intelligent agents 414
intelligent application 924
intelligent computer-assisted instruction (ICAI) systems 457
intelligent e-tourism tools 920, 923
intelligent networks 3823
intelligent topic manager (ITM) 923
intelligent tutoring systems (ITSs) 457
intelligent v 952
Intention-based models 1039
interaction 1180
interaction in online education 1165
interactive environment 2360
interactive television 1846, 1847, 1848, 1852
Interactivity 1476
intercultural MNE communication matrix 3161
interdependence orientation 2640
interface knowledge management (extra-MNE) 3159
Interface Message Processor 244
Interim Poverty reduction Strategy chapter (IPRSP) 211
internal competencies 2517
internal digital divide 2569
internal processes 2105, 2111, 2114
internal source 1420
internal structure 2119
internalization 1564
internalization 795
international Air Transport Association (IATA) 259
International Association of Science Parks (IASP) 2015
International Centre for Integrated Mountain Development (ICIMOD) 127
International Communications Association (ICA) 500
international community 2496
international competitiveness 883
international development 513, 533
international digital divide 79, 160, 2569
International Institute for Communication and Development (IICD) 798, 1545
international master's program 1216
International Monetary Fund (IMF) 211
international non-governmental organization (INGO) 213
International Pharmaceutical Abstracts (IPA) 2009
international politics in technological innovation 1823
International Private Leased Circuits (IPLCs) 2041
International Public Sector Accounting Standards (IPSAS) 2044
International Telecommunication Union (ITU) 76, 888
international trade 284, 285
internationalization 800, 802, 805, 2107
Internet 142, 238, 246, 899, 1031, 1472, 1540, 2047, 2325
Internet access 766
Internet as a Tool 1425
Internet backbone 52
Internet Leased Lines (ILLs) 2041
Internet method of instruction 1938
Internet penetration 80
Internet protocol (IP) 275, 960, 975, 985
Internet service provider (ISP) 49, 121, 146, 2034
Internet systems 1006
Internet usage 80, 2561
Internet World Stats 80
Internet-accessible creative production 1390
Internet-based communities 585
Internet-based gateways 1545
Internet-based protocols 968
interoperability in smart organizations 1799
inter-organisational system (IOS) 990, 995, 997
interpersonal networks 2968
interteaching 1715
inter-village connectivity and empowerment initiative (Thailand) 2508
intranet 446
intranet applications 1437

IOR 993
 IP (Internet protocol) 2546
 IP rights frameworks 1381
 iPod 1809, 1887
 IQ academies 1226–1228, 1231
 IR 985
 IR scanner 957
 IRC 2524
 Iron Curtain 238
 IS design, knowing as a challenge 1087
 ISDN (integrated services digital network) 78
 isolation 827
 ISP (Internet service provider) 49
 ISPs 2034, 2041
 issues arising 787
 IST (see information society technologies) 887
 IS-user relationship 735, 741, 745, 746, 747
 IT 2035
 IT education 2035, 2038
 IT enabled services (ITeS) 125
 interpersonal trust 2271
 ITU (see International Telecommunications Union)
 888, 986

J

Japan 1855
 JASPER 1728
 Java tutor 1714
 Jena 928
 John Keells Computer Services (JKCS) 2045
 John Keells Holdings (JKH) 2045
 joint venture 2113
 Journalism 849, 1468
 JPEG 986
 JPEG standard 367
 J-Phone 1402

K

K-12 learning applications 2154
 key currency 227
 Key Symbol 3528
 kiosk 77, 2501
 knowledge 84, 2553
 knowledge and organizational networks 2951
 knowledge construction 3368
 knowledge construction process 1192
 knowledge divide 513
 knowledge interchange format (KIF) 1801
 knowledge management (KM) 514,
 795, 797, 798, 799, 805, 1539, 2077

knowledge management systems (KMS) 2350
 knowledge network 1352, 2076
 knowledge objects 798
 knowledge society 407, 410, 3301
 Knowledge Space 3476
 knowledge-based economy 446, 882, 1286
 knowledge-based infrastructure 2969
 knowledge-based society 1285
 knowledge-based trust 2271
 knowledge-economy strategy 1543
 knowledge-intensive services (KIS) 165
 koyal 1401, 1857
 Kolb's model 416
 KPN (Royal Dutch Post) 1850

L

labor force 2104
 LAN 986
 LAN Designer 1726, 1741
 LAN-Designer description 1728
 LAN-Designer in practice 1730
 LAN-Designer on students' performance 1747
 LAN-Designer, benefits 1732, 1744
 LAN-Designer, impact on students' performance
 1737
 LAN-Designer, teaching and learning context 1744
 LAN-Designer, test results 1732
 landing rights 1521
 landscape scenario 665, 666, 667, 668, 669
 language 1310
 language accommodation 3200
 Language Acquisition Device (LAD) 3483
 language barrier 490
 language preservation 2509
 Lanka Educational Academic and Research Network
 (LEARN) 2035
 Lanka Educational And Research Network
 (LEARN) 127
 LAN-map 1729
 laptop computers 1640
 laptop initiative 1639
 larger scale development 868
 Laser Printer 68
 Latin paleography 2350
 leapfrogging 106
 leapfrogging development 1995
 learner-centered multimedia learning 448
 learning 2111, 2114, 2177, 2304
 learning (balanced scorecard perspective) 2105
 learning agency 408, 409
 Learning Architecture 2090

Index

- learning by choice 1506
 - learning by doing 794
 - learning center 3788
 - learning communities 406
 - learning community building 1185
 - Learning Design 2090
 - learning environments 406
 - learning management systems (LMS) 947, 1459, 1460, 1461, 1462, 1466, 2350
 - learning object databases 1267
 - learning outcome 2253
 - learning process 1153, 1154
 - Learning Resource Centers (LRCs) 2523
 - learning strategy 2119
 - learning styles 413, 415, 459
 - learning technologies 444
 - learning theorists 1647
 - learning-based decision making 1071
 - Learning-In and Learning-Through Technology 2092
 - least developed countries (LDCs) 3302
 - least developed country (LDC) 106, 192
 - lecture activities 2708
 - lecture attendance 2710
 - lecture notes 2711
 - lecture setting 2708
 - lecturer 2712
 - led training 2179
 - legal framework 577
 - legitimate power 3024
 - legitimizing identity 872
 - LegoMindstorms 1630
 - less developed countries 3314
 - less-developed countries (LDCs) 2248
 - lexical mapping theory (LMT) 3430
 - LexisNexis Total Research database 1368
 - liberalism 2240
 - Liberation Tigers of Tamil Eelam (LTTE) 2033
 - license refusal 370
 - licensing 349
 - licensing practices in the ICT sector 358
 - LIF 986
 - life cycle phase 665, 666
 - life stages 1398
 - life story (biographical) patterns 474, 478
 - life themes 474, 479
 - lifelong learner 2504
 - lifetime of telecommunication and IT standards 383–404
 - Limitations on ICT 2925
 - LISA 801, 805
 - Lisbon process 888
 - Lisbon strategy 882
 - Listserv 2013
 - literacy 83, 2555
 - Literacy Level 831
 - literacy, definition 2449
 - literacy/social facilitation (rainbow model layer) 2499
 - Literature on the Internal Digital Divide 2567
 - LiveJournal 2372
 - LiveJournal icons 2375
 - LiveJournal user icons 2372
 - local adaptation 2525
 - local area network (LAN) 78, 1937, 2523
 - local area network (LAN) design 1726–1740
 - local community 56, 2105, 2497, 2510
 - local community group 2517
 - local condition 2521
 - local connection 2521
 - local context 2518
 - local contingency 2521
 - local governance 842
 - local government 2521
 - local knowledge 2497, 2498
 - Local Politics 3310
 - local stakeholders 805
 - Localised Networks 2062
 - localization 793, 799, 810
 - Localization Industry Standards Association (LISA) 799
 - localized knowledge 2506
 - location Interoperability Forum (LIF) 963
 - location measurement unit (LMU) 986
 - locational patterns 2014
 - location-aware tourism-related services 952
 - location-based services (LBS) 952, 956, 986
 - location-based services (LBS) domain 953
 - logic layer 922
 - Longitudinal Studies 1991
 - long-term orientation 2255
 - long-term vs. short-term orientation 3191
 - Looking After Children Electronic System (LACES) 212
 - Low e-Literacy Level 1983
 - low-income communities 120
 - low-income populations 890
 - low-level thinking 3351
- ## **M**
- M&E measure performance 2580
 - M.S. Swaminathan Research Foundation 127

- machine-to-machine (M2M) 1760
 macroeconomic environment 577
 MAGNET project 657, 658, 663, 664, 668
 mail 1571
 maintaining the model 1446
 Malatestiana Library in Cesena, Italy 2352
 male-centric technology 902
 managed learning environments 1617
 Managed Private Leased Circuit (MPLC) 2042
 Management 914
 management (ICM) 1561
 management (KM) 1561, 1577
 Management Capability 832
 management for development results (MfDR) 207
 management information system (MIS) 2674, 3660
 management skill sets 3025
 Manse Forum 849
 mapping 1010
 marginal communities 192, 527
 marginalization 901
 Market Channel 2975
 Market Creation Partnerships 3604
 marketing intelligence 1423
 marketing research 2972
 MarketReality™ Monitor 1396
 Martyrology of Arpino 2352
 masculinity 2254
 masculinity dimension 155
 masculinity index 2254
 Mass networking 2077
 mass storage 1883
 massively multiplayer online games (MMOGs) 2357
 Mass-Mediated Public Sphere 843
 master itinerary (MI) 274
 mastery learning 432
 matching hypothesis 418
 matchmaking engine 1370
 mathematical network theory 199
 McCarty's model 416
 m-commerce 1779
 MDGs (see Millennium Development Goals) 504
 mean square error (MSE) 2993
 meaningful learning 2847
 Means for Development 3302
 measurement managed companies 2108
 MedCarib 2013
 media 1468
 media analysis framework 646
 media bias 646
 Media communication 844
 media determinis 646
 media environment 1383
 media industry 843
 Media Life Cycle 643
 Media Richness Theory 3490
 media strategy 3554
 media utilisation 1474
 mediated learning approach (MLA) 1050
 mediated learning environment 1050
 Medical education 2009
 Medical Sciences Library (MSL) 2009
 meditation 665
 MEDLINE 2010, 2013
 Membership of the Global Village 3309
 Memorandums of Understanding (MOUs) 185, 2057
 men family university 1399
 mental schemes 459
 Me-Print™ 941, 949
 Merrill's instructional transaction theory 436
 mesh topology 1729
 message passage interference (MPI) 1137
 meta-cognition 418
 methodological individualism 3408
 Methodology for Capturing Student Feedback 2092
 metropolitan area networks (MAN) 1760, 1779
 Mexican Communities 889
 Micro Edition of the Java 2 Platform (J2ME) 969
 Microcredit and Microfinance 3662
 Microdevelopment Finance Team (MFT) 3672
 microfinance institutions (MFIs) 3658, 3659
 Microsoft .NET Compact Framework 969
 Middle Ages 2351
 Middle Ages, women and written culture 2351
 Millennium Development Goals (MDGs) 145, 192, 487, 504, 2587, 2619, 3568
 Millennium Information Technologies (MIT) 2045
 Ministry of Economic Development (MED) 209
 Ministry of Education and Vocational Training (MEVT) 1544
 Ministry of Energy, Communications, and Multimedia (MECM) 2661
 minitel system 1370
 minority serving institution (MSI) 1139
 minzu classification system 3692
 MIS manager 3130
 Mixed Objective and Subjective Lens 2344
 MLP 986
 MMOG 2357, 2358
 MMOG, proprietary community of 2357
 MMS 954, 964, 986

Index

- MNE knowledge management 3158
mning tool 1568
mobile communication 3476
Mobile Communication Paradox 3475
mobile equipment (ME) 975, 986
mobile ICT 1752–1757
mobile location center (GMLC) 963
mobile location protocol (MLP) 953, 963
mobile network operator (MNO) 953, 976, 986
mobile network operator (MNO) infrastructure 976
mobile phone 280, 638
mobile platform 279
mobile positioning center (MPC) 963, 986
mobile positioning protocol (MPP) 953, 964, 986
mobile security 1794
mobile social capital 2517
Mobile Switching System (MTX) 555–557
mobile system development 658, 659, 660
mobile telephones 1516
Mobile Telephones 1979
mobile tourism services 954, 963
mobility 898
moblogs 2692
mode 2 knowledge production 50, 52
Model Curriculum for Information Systems 1274–1275
model of best practice 2522
model of e-democracy 582
model-building stage 1449
model-view-controller design pattern 966
modernism 2240
modernization 2499
MONDECA 923
Money Matters Institute, Inc 58
monitoring 1446
Monquest survey 1205
monthly music spending 1813
Moore's Law 1868, 1869
Moore's theory of transactional distance 434
morality 2233
Movement for the Survival of the Ogoni People (MOSOP) 2685
MovingAlps Project 177
MPEG 986
MPHS data 2216
MSC 972
MSID 986
Mtandao Afrika program 1298
m-teachers (mediating teachers) 1944, 1945
m-teams 1945
M-time culture 2256
MTN Uganda 3676
Multi-Dimension eXpression (MDX) 2961
multimedia authoring tools 1258
multimedia clips 2653
Multimedia Super Corridor (MSC) 210
multi-national companies (MNCs) 117, 165, 3684
multinational enterprises (MNEs) 3158
Multiple layering of digital informatio 1472
multiple sclerosis (MS) 1909–1924
Multipurpose Community Telecenters (MCT) 207
Multipurpose Household Survey (MPHS) 2214
Municipal consulting 1359
municipal democracy. 842
music ownership formats 1814
mutual constitution 3405
My personal Adaptive Global Net" (MAGNET 657
- ## **N**
- name-based system 2215
nanotechnology 2235
narratives 1058
national 1969
National Association of Theater Owners (NATO) 1833
National Biodiversity Information Center (NBIC) 3685
national broadband strategies 885
National Care Record System (NCRS) 1038
National Communications Authority (NCA) 1977
National Council for Science and Technology (NCST) 212
National Council for Scientific Research (NCSR) 212
national culture 307, 2254
National Development Strategy (NDS) 211
National Examination Council of Tanzania 1546
National Growth and Poverty Eradication Strategy (NGPES) 207
National Health Service (NHS) 1036, 1037
National ICT Policy 1539, 2598
National Informatics Centre (NIC) 68
National information policy 1359
National Information Technology Agenda (NITA) 2661
National Information Technology Council (NITC) 2661
National Institute of Education (NIE) 2037
National Learning Infrastructure Initiative (NLII) 1056
national marketing companies (NMC) 262

- National Policy on Information Technology in School Education (NAPITSE) 2035, 2036
- National Poverty Eradication Strategy (NPES) 1540
- national poverty-reduction strategies 2586
- National Program for the Information Society 2573
- National Programme for Information Technology (Npfit) 1038
- National Regulatory Agency in Telecommunications and Information (NRATI) 2546
- National Rural Health Mission 2212
- National Science Foundation (NSF) 2518
- National Small Business Act (NSBA) 2792
- National Strategy for Socioeconomic Development (NSSED) 211
- National Telecommunication Corporation (NTC) 123
- National Telecommunications and Information Administration (NTIA) 76
- national tourism organization (NTO) 1369
- national tourism organization (NTO) 2886
- native speakers 801
- near-transfer task 2847
- neo-corporatist 592
- network analysis 2516
- network building 2968
- network closure 2517
- network control protocol (NCP) 1307
- network engineering technology programs 1122–1129
- network formation 2969
- network linkages 2518, 2521
- network project 2105
- network security 1792
- networked environments 1791
- Networked Information and Communication Literacy Skills (NICLS) 2297
- networked literacy 2305, 2318
- Networked Readiness Index (NRI) 2590
- networked world 2510
- networks 2054
- networks of independent operators 2111
- Neural Data Mining System (Ndms) 2959
- neural network (NN) 2960
- neutral culture 2256
- new communications technology 1370
- new digital deal 1838
- new discoveries 2626
- new information and communication technologies (nICTs) 3784
- new media 2357
- New National Networking Service (N3) 1038
- New Partnership for Africa's Development (NEPAD) 212, 1284, 1292, 1300, 2588
- new screens, implementing 1824
- New Tactics in Human Rights project 2691
- new technologies 2568, 2620
- New York colleges and universities 1655
- news genre 843
- news industry text format (NITF) 965
- News Markup Language (NewsML) 965
- N-Form Organization 200
- NGO Gender Strategies Working Group 503
- Non-Formal Education 771
- non-government organisations (NGOs) 2518, 2525, 2526
- non-governmental organizations 2787
- non-governmental organizations (NGOs) 211, 215, 216, 513
- nongovernmental organizations (NGOs) 793, 3662, 3789
- nonhierarchical structure 2687
- non-line of sight (NLOS) applications 1780
- non-metropolitan Australia 1496
- nonnative speakers 801
- non-persisters, characteristics 1169
- nonprofit organization 3787
- nontraditional education sectors 2693
- Non-Zero Sum Variables 3721
- Nortel Networks Ltd, 1552
- NRATI 2548
- ns-2 1727
- NTT DoCoMo 1862
- O**
- OAL environment 2400
- object imagery 1902
- objective, definition 2349
- observability (attribute of innovation) 2516
- ODA (see official development aid) 210, 509
- OECD (Organization for Economic Cooperation and Development) 1289
- OEMs 2043
- of planned behavior 2324
- of reasoned action 2324
- Office of Technology Assessment (OTA) 2177, 2183
- Official Airline Guide (OAG) 259
- official development aid (ODA) 509
- organizational trust 2271
- Oke-Ogun Community Development Network 2003
- Okinawa Charter on Global Information Society 213

Index

- OMA 986
On Tour 924
One-Stop-Shop (OSS) 207
onion models 681, 683, 684, 685, 686, 687, 688
690, 691, 692, 693, 694, 698, 700, 701,
702, 703, 704, 705, 706, 707, 708, 710
online action- research 462
Online analytical processing (OLAP) 2960
online asynchronous learning (OAL) environments
2398
Online Asynchronous Mediums for Behavior Mod-
eling 2400
online behavior modeling 2399
online community 3540
online database, definition 2356
online discussion 1153
online economy 1848, 1850, 1851, 1852
online education 1459, 2709
online education, student persistence 1163
online group collaboration, framework application
1146
online group collaborative learning 1143–
1152, 1190
online group collaborative learning, findings 1148
online information security class example 1185
online learning 1191, 1207, 2268, 2272
online learning applications 2154
online learning environments 1202
online learning resources 1053
online multi-player games 3745
online network 2973
Online newspapers 1472
online privacy policy (OPP) 3000
online publishing system 2373
online religion 3759
online teaching methods 1616
OntoEdit 925
ontolingua 925
ontological aspects 925
ontology 920, 921, 922, 926
ontology capture mechanism 926
Ontology Language (OWL) 927
ontology layer (OL) 925
ontology vocabulary 922
OPAC (online public access catalogue) 2011
Open Catalogue of Manuscripts 2351
open content 1299
open copyright arrangements 1386
open education resources 1297
open educational environment 1943
open model of teaching and learning 1935
open parliament 585
open schools 1947
open source 1420
open source software 124
open source tools 1459, 1466
open sources software 3833
open systems architectures (OSA) 1772
open systems interconnection (OSI) 394
Open Travel Alliance (OTA) specifications 923
Open University of Sri Lanka (OUSL) 2035
OpenGIS location services (OGS) 963
OpenLS 963, 986
open-source software licensing 1387
operating expense ratio (OPEX) 3124, 3133
Operative Integration 2927
OPNET Modeler 1728
optical fiber network 2034
Optimality-Theoretic Lexical Mapping Theory
3428
Orang Asli 2656
Organisation for Economic Co-operation and De-
velop 2010
organization 1182
Organization for Economic Cooperation and Devel-
opment (OECD) 2586
Organization for Economic Cooperation and Devel-
opment (OECD) 76, 92, 119, 193, 213,
584
organization in its environment 1446
organization of work 2119
organizational 2177
Organizational and End User Information Systems
(OEIS) 1275
organizational culture 3386
organizational e-democracy 3171
Organizational learning 3193
Organizational Structure 3697
organized crime 1365
orthogonal frequency division multiplexing
(OFDM) 1760
otaku 1401, 1857
outlocation services 125
Outsourcing” Collection Activities 1426
overview of COSIP model 1523–1528
own development unit 868
- P**
- package interchange file (PIF) 945
packet switching protocols 2249
Pakistan Educational Research Network (PERN)
127

- Pakistan Telecommunication Company Limited (PTCL) 123
 paleography 2352, 2356
 Pan Asia Networking (PAN) 127
 panic 1368, 1374
 pan-Indigenous discourse 1967
 panography 1906
 paradigm 2057
 Paris Integrated Settlement (PIS) 229
 Paris Net Settlement (PNS) 229
 Parliamentary Online Information System (POLIS) 1545
 participation in political decisions 585
 Participatory 3D Modelling (P3DM) 1926
 participatory action research approach 842
 participatory approaches, definition 2463
 participatory design 656, 657, 658, 660, 663, 664, 665, 667, 668, 669
 participatory design model 2518
 participatory learning in action (PLA), definition 2463
 participatory rural appraisal (PRA), definition 2463
 participatory rural appraisals (PRAs) 2576
 participatory solutions 516
 particularism 2255
 Partner 2053
 partner actor (TPA) 1525
 Partners in Smart Organizations 2958
 partnership 2053, 2285
 partnerships, cross-sectoral 2285
 partnerships, public/private sector 2285
 partnerships, tripartite 2286
 passband 1519
 passenger name record (PNR) 259
 passive information transfer 191
 patent policies 361
 patent problems, risk 368
 patent strategies 354
 patent strategies, avoiding infringement 363
 patient-relation management (PRM) 1909
 patriarchal 902
 pay discrimination, definition 3157
 Pay Phones 1978
 pedagogical framework 1244
 pedagogical functions 1946
 pedagogical practices 2497
 Pedagogical Praxis 3706
 pedagogical strategies 1202
 pedagogy 414, 444
 pedophilia 1368, 1369, 1370
 peer relationships 1194
 peer-to-peer linkages (cohesive networks) 2519
 people in models 1449
 Peoples Movement for Human Rights Education 2694
 people-track approach 803
 PePP 2054
 perceived usefulness (PU) 1041
 performance phase, challenges 336
 Perinorm database analysis 383–404
 Peripheral Sub-Alpine Regions 175
 Peripheral workers, 767
 permeation stage 2236
 persists, characteristics 1169
 personal area network (PAN) 1760
 Personal Computer Use 1601
 personal computer (PC) 78, 1516, 2568, 2590
 personal digital assistant (PDA) 117, 280, 924, 957, 964, 986, 3198, 3746
 personal distributed environments 657
 personal networks 657, 663
 personal trusted device 1790
 pesantren 2056
 phenomenal field theory 437
 phenomenography 736, 738, 747
 physical features 2191
 physical infrastructure 117
 physical topology 1729
 Piaget 1190
 PIAPs 2556
 PICO 916
 picture stimulation 662, 669
 pilot project 868
 PIS (Paris Integrated Settlement) 229
 plagiarism 1313, 1314
 plagiarism 2175
 plain old telephone systems (POTS) 1531
 Planning 2053
 Platform for Privacy Preferences (P3P) 1883
 players, chaotic unruliness of 2367
 plazas comunitarias 889
 Pleasure In Work 3816
 pluricentricity 808
 PNR 265
 PNS (Paris Net Settlement) 229
 podcasts 1666
 Poetics of Information 1970
 Point of sale (POS) 3664
 points-of-presence (POPs) 2041
 Polarization of the Workforce 766
 policies and procedures (P&P) 996
 Political Advocacy 1972

Index

- Political Opportunity Structure (POS) 587
political uses of ICTs 582
political will 84, 2556
Pondok Pesantren Pabelan 2053
pooling assumption testing 294
poor countries 3311, 3319
popular culture 2372
popular culture, LiveJournal 2381
popular culture, predigital era 2377
popular culture, transformation of 2378
population health 1002
Population Profiles 3687
pornography 1315, 1368, 1370
porosity (screening) 1754
portable document file (PDF) 1220
portable storage 1882
portal framework 2653
portal, definition 3118
portfolio artifacts 1584
Portfolio Career 3814
portfolio software 1587
Poschiavo Project 176
positioning 959, 961
Positive E-Technologies 3831
positive peer support, spiritually and emotionally 1150
positivist portfolios 1057
postcolonial 46, 47, 52
Post-Conflict Reconstruction 3792
post-industrial society 871
postings by gender 3547
post-secondary (K12) education 445
Post-Test method 2732
poverty 143, 1541, 2053
poverty alleviation 2626
Poverty Monitoring Master Plan (PMMP) 1541
poverty reduction 2623
poverty reduction (PR) 191, 194, 195, 208
poverty reduction and economic growth 2587
Poverty Reduction Strategy 2596
poverty reduction strategy article (PRSP) 207, 527, 1541, 2587
poverty-reduction support credits 2586
Poverty-Reduction Tools 3662
power distance 3191
power distance index 2254
predigital era, popular culture 2377
pre-incubation phase 2016
Preparation 662
Prescription Pricing Authority (PPA) 1038
presence 1180
Pre-Test method 2732
primary and secondary schools 2507
primary health care 2211
primary health centres (PHCs) 2212
Primary Market 3633
primary public education 2504
primary source 1420
privacy 1315, 2189
privacy cost 311
privacy issues 1881
private information exchanges (PIX) 1527
private sector 1546, 2773
private sector entrepreneurs 2787
problem solving 1154
problem-based activities 2113
problem-based learning (PBL) 2009, 2013
Problems in Internet Use 3307
procedural knowledge 2735
procedural training 2846
process interchange format (PIF) 1801
process of formation 331
process of performance 335
procurement planning 3138
Prodem FFP (Bolivia) 3671
Prodem Private Financial Fund (Prodem FFP) 2578
Producer of meaning 3524
product and service delivery 2971
Product Distribution 914
production-oriented growth strategy 1542
productive pedagogies 1049
product-market-technology combination 619
professional development (PD) modules 2193
profit impact of marketing strategy (PIMS) 3130
profitable markets 3306
Program of Economic Growth and Struggle Against Poverty 2550
programmed airline reservation system (PARS) 257
project based learning approach 1143–1152
project identity 872
project management perspective 2515
project planning 522
project-based online group collaborative learning 1190–1201
Prometheus (project) 444
promoting interaction and presence online 1181
Promotion 914
proof and trust layers 922
property management system (PMS) 990
property rights 312
proprietary worlds 2357
prostitution 1363, 1364, 1365, 1367

- prosumer 1847, 1852, 1876
 Protégé 2000 925
 prototyping 660, 665
 PRSP 1546
 psychological trust 2271
 P-time culture 2256
 Ptolemy project 1003
 public communication 841, 844
 public debate 842
 public discussion 842
 Public Distribution System (PDS) 69
 public education 2504
 public health 1024
 public infrastructure 2502
 public interaction 842
 public life 842
 Public Participation GIS 1926
 public policy 101
 public television networks 1382
 Public/Private Sector Partnerships 2285
 PubMed 2013
 Pure Objective Lens 2343
 push technology 1567
- Q**
- qualitative research 474
 quality 1592
 quality assurance (QA) 275
 quality of life 3300, 3315
 quality of service (QoS) 954, 970, 986, 1124,
 1531
 Quattro Pro Version 4.0 3131
 Quechua 1952
 questionnaire 664
 queuing 1312
- R**
- RACE program 883
 Radio 1980
 radio frequency identification technology (RFID)
 117, 1781
 Rambus, Inc v. Infineon Technologies AG (Fed. Cir.
 2003) 365
 RAND-licensing 371
 random access memory drums 256
 Randomized control trials (RCTs) 1019
 RAW format 1876
 realistic technologies 524
 reasoner 928
 reasons why 1313
 recommender system 938, 939, 941, 949
 reflective portfolios 1055
 Reflexive Modernization 3811
 reframing information system design 1083–1101
 regional areas 55
 regional Australia 1495
 Regional Communications Infrastructure Program
 (RCIP) 2595
 regional communities 191, 1495, 3137
 regional development (RD) 193, 194, 1495, 2495
 Regional Development Agencies Network 1354
 regional development, educational benefits 2495
 regional development, ICTs 2495
 regional groupings 2517
 Regional Partnership Program (RPP) 209
 regional planning 2772
 regional programs 778–792
 regional specialization 2969
 regionally-based tourism SMEs 2970
 registered sex offenders 1370
 regression analysis 3131
 REI Adventure Travel 3779
 reintermediation 1993, 2903, 2911
 relative advantage (attribute of innovation) 2516
 relay chat (IRC) 1309, 1527
 relevance 48
 Relevance of Gender 2096
 religio-psychical orientation 2640
 Remote 1495
 remote access policy 2807
 remote communities 2511
 remote consultation 1012
 remote diagnosis 1014
 Remote Transaction System 3671
 remoteness 827
 repatriation of IT skills of expatriates 2039
 repositories 1568
 repository access 947
 Republic of Moldova (RM) 2532
 requery hopping 1760
 request for proposal (RFP) 3044, 3051
 requirements elicitation 679, 681, 682, 698, 710
 requirements specification 658, 666, 668
 research 1002, 1968
 research and development (R&D) 2660
 Research ICT Africa (RIA) 3330
 Research ICT Africa (RIA) network 145
 reservation system (CRS) 990
 resistance identity 872
 resource description framework (RDF) 922, 986
 resource-based view (RBV) 3637

Index

- revised (v.2) cultural adaptation process (CAP)
 model 2252
REVPAR 996, 997
RF 986
RF tags 957
RFID (radio frequency identification) tags 3730
RFID deployment survey 3737
RFID security 1798
rights and empowerment strategy 1542
Robert Morris University (RMU) 1235–1243
Roberta Project, the 1631
robotics 1630
robotics technology 1633
role of ICTs on regional areas 55
room nights occupied (RNO) 2986, 2992
round trip time (RTT) 960, 986
Royal Dutch Post 1850
royalty-free licensing 369
RTGS 228
RTGSPlus 229
Rural 1495
rural areas 1539, 1540
rural areas 2041
rural centers 2511
rural communities 2501
rural community 826, 1029
rural community telecenter 1955
Rural Searchlight (RUSEL) 2003
rural sector 2039
- S**
- SAARC Agricultural Information Centre (SAIC)
 127
safety (cohesive) networks 2517
safety drivers 2517, 2519
sales force automation (SFA) 1572
SALT 2549
Sarawak 826
Sarvodaya Shramadana Movement 127
satellite
satellite technology 1611
scale mapping 1925
scanners 2104
Scenario Building 1451
scenario construction 657, 660, 663, 664, 668
scenarios 656, 657, 663, 664, 665, 666, 668, 6
 69
school district digital Intranet 1936, 1942
SchoolNet 1937
SchoolSat1 1611
science and engineering (S&E) 483
Science Panel on Interactive Communication and
 Health (SciPICH) 2325
science parks 2113
SciPICH 2336
screening in high standard 1820–1831
Scripted Behavior Modeling 2406
seamless learning 407
search engine 1426, 1567
secondary source 1420
second-level feedback 1076
Sector Partnership Fund (SPF) 2017
sector reform 884
security in smart organizations 1785
SED 195, 209
self-actualization theory 437
self-determination 1969
self-efficacy 2848
self-representation 1969
Semantic Web 921, 967
Semantic Web application 920
semi-automated business environment research
 (SABER) 256, 258, 260, 262
SeniorNet 3775
Service Level Agreements 2924
service/access provision (rainbow model layer)
 2499
service-oriented approach 953
service-oriented architecture (SOA)
 953, 968, 972, 986
services and commerce 1312
set top box 1850, 1852
severe acute respiratory syndrome [SARS] 1008
sexual subculture 1371
SGML 965
Sha-Mail 1402
sharable content object (SCO) 944, 945, 947
sharable content object (SCO)reference model
 (SCORM) 944, 946, 947, 949
shared hosting 1885
sharing 1571
Sharing with Other People Network (SWOPNet)
 1544
short text messages (SMS) 1871
short text messages (SMS) 954, 960, 964, 986
short-term memory 2847
short-term milestones 2115
SIG (Special Interest Group) 2005
simple mail transfer protocol (SMTP) 1309
simple object access protocol (SOAP) 275, 986
Simulation-Games 1445
Simulations and interactions 2091

- Single Barrier Partnerships 3605, 3607
 single standard vs. consumer market 1835
 single-loop decision-learning 1072
 SITAR 263
 site 2333
 situation 2064
 situational trust 2271
 sketch mapping 1925
 Skills Gap Among ICT-Literate Adults 2316
 Skills Gap Between Parents and Children 2316
 Skills Gap Between Teachers and Students 2315
 Skype 1887
 Sloan-C Five Pillars of Quality Online Education
 3716, 3718
 small and medium enterprise (SME) 123, 207, 214,
 215, 989, 992, 1546, 2039, 2911, 3121
 small and medium tourism enterprise (SMTE) 989,
 2976, 2978, 2979, 2980
 Small Enterprise Development Agency (SEDA)
 2793
 Small Island Developing States Network (SIDSNet)
 212
 smart cards 1789, 3658
 smart phone 924
 Smithsonian Institute 863
 smooth interpersonal relationship orientation 2640
 SMS (short messaging service) 643, 1010
 snarf attack 1798
 SO Partners 2962
 social and situational learning 1068
 social aspects of ICT 2918
 social capital 92, 101, 102, 191, 205, 672, 2070
 Social Capital Networks 676
 social cognitive theory 2324
 social connectedness, definition 2440
 Social Construction of Technology (SCOT)
 535, 540–542
 social constructivism 1470
 social content 206
 social development 193
 Social Dimension 466
 social identity theory (SIT) 994, 3172
 social learning 1085
 social learning model 1096
 social modernization 1353
 social movement 2682
 social network analysis 2516
 social network theory 993
 social networking sites 2372
 social networks 2516
 social presence 2398
 social problem 82
 social responsibility 3820
 social shaping of technology 825
 social, technical, economic, environmental, and
 political (STEEP) 1546
 social-cultural model of learning 432
 socialization, externalization, combination, and
 internalization (SECI) model 795
 socially constructive learning tools
 1459, 1463, 1466
 socially disadvantaged 898
 societal development strategies 127
 socio-cultural identity 174
 socio-cultural systems 2248
 socio-demographic factors 55
 socioeconomic development (SED) 126, 190, 194,
 208, 210, 211, 212, 446
 socio-economic development goals 2248
 socioeconomic environment 191
 socioeconomic factors 2775
 Socioeconomic Features 673
 socioeconomic gains 208
 Socioeconomic transformation 2771
 socioeconomics 446
 sociolinguistic theory 3566
 Socio-Technical Environment 1600
 software 1055, 1059
 Software Engineering Institute (SEI) 1275
 Software Technology Parks (STP) 169
 software tools (rainbow model layer) 2499
 -source software (OSS) 1331
 South Asia on the Human Development Index 124
 South Asian Association for Regional Cooperation
 (SAARC) 127
 South Asian Network Operators Group (SANOG)
 127
 South East Asia 1996
 Southern Education and Research Alliance (SERA)
 2015
 Soviet Union 239
 space 1573
 Space Odyssey 3326
 spam 1881
 spatial and temporal distances 179
 Spearman Rank Correlation Test 3131
 speckled computing 3828
 spread spectrum 1760
 Sri Lanka Institute of Information Technology
 (SLIIT) 2036
 Sri Lanka Telecom (SLT) 2041, 2042, 2047
 Sri Lanka Telecom Corporation (SLT) 2034

Index

- Sri Lanka Telecommunications Authority (SLTA) 2042
- stages-of-change model 2324
- Stakeholder Assessment Model (SAM) 2526
- stakeholder group identification and needs 784
- stakeholder groups 801
- stakeholder identification 682
- stakeholder networks 2526
- stakeholders 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 695, 696, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 2039, 2046, 2105, 2518
- standardization 360
- standardization 884, 887
- standardization and patents in general 346
- START 261
- State Information Technology Agency (SITA) 1331
- state of lack 2618
- State Office of Public Prosecutor (SOPP) 2550
- State Planning Organization (SPO) 2773
- state support 2556
- State support 83
- State Tourism Authority (STA) 2979
- State Wide Area Network (SWAN) 126
- statement of work (SOW) 3045
- state-wide area network (SWAN) 163
- static economic model 94, 99
- static information sources 920
- stationary social capital 2517
- STEEP 664
- STEEP methodology 664
- Steganography 2957
- STEM-Net 1937
- STI/HIV/AIDS programme 2211
- Sticky Policy Paradigm 3003
- strain syndrome 3328
- strategic initiative 2115
- strategic management 2107
- strategic path 2115
- strategic planning 2105
- strategic success 2115
- strategic theme 2109
- strategies to avoid plagiarism 1314
- strategy formulation 617, 618
- strategy map 2105, 2113, 2114, 2116
- Strom 592
- strong ties 2517
- structural convergence 2248
- structural holes 2516
- structured topic 1153
- student anxiety 2154
- student attitudes to interaction 1172
- student enjoyment 2154
- student involvement 3540
- student learning portfolios 1057
- student motivation 2154
- student persistence in online education 1163–1178
- student portfolio 1656
- student training 2189
- student-centered learning 419, 1257
- Studio approach, 1471
- study skills 2176
- style of using songs 1814
- subcentres (SCs) 2212
- subject matter experts 2254
- subject matter skills 2176
- subjective, definition 2349
- submarine patenting, legal changes and tactics 352
- submarine patents 348
- submarine patents today 353
- submarine patents, case studies 364
- submarine patents, origins 351
- sub-Saharan Africa (SSA) 2587
- subscriber line (DSL) 18
- subscription-based games 2363
- subsidiary awareness 795
- successful ICT outcomes 787
- Sudan Virtual Engineering Library—Sustainability Network (SudVEL-SKN) 2506
- super-passenger name record (super-PNR) 274
- supply chain management (SCM) 1249
- support 2177
- support (brokerage) networks 2523
- support and training 1527
- support infrastructure 2523
- support network 2517, 2521
- surrogacy 679, 680, 681, 689, 690, 704, 705, 706
- surveillance 1002
- survival times of standards 395
- sustainable development initiatives 2506
- Sustainable Development Networking Program (SDNP) 127
- sustainable livelihoods approach 1542
- sustainable livelihoods, definition 2492
- sustainable tourism cooperative research centre (STCRC) 2977, 2982, 2995
- Sveiby 796
- swift trust 2271
- swingers 1363, 1371
- Swiss Regional Development 176

Synchronized Multimedia Integration Language (SMIL) 946
 synchronous chat 1206
 synergies 2112
 system 1314
 System Development Corporation (SDC) 241
 system task model 929
 systems of innovation (SOI) 2022
 systems theory 1257

T

tacit knowledge 120, 794, 795, 796, 810
 Takeuchi 796, 797
 Talea 924
 talking head lecture 2709
 TALPA 1851
 Tanzania 48
 Tanzania Global Development Learning Center (TGDL) 1546
 target group specific content 2883
 task-oriented online discussion 1153–1162
 Tasmanian 1495
 taxonomy 679, 681, 682, 687, 688, 690, 693, 698, 700, 702, 704, 708
 TD-SCDMA 1552
 teacher education curriculum 1216
 teacher training programs 1297
 teacher-directed learning environment 1050
 Teachers' Attitudes 1597
 Teachers' Knowledge of Computer Software 1596
 teaching and learning 1311
 teaching environments 2118
 teaching methods 2118
 teaching portfolios 1057
 teaching with ICTs, new and old problems 459
 teaching-learning process 3338
 Team Work 661
 technical infrastructure 1527, 2782
 technical literacy 2496
 technical quality 2883
 technical skills 2176
 techno-fetishism 2500
 technological advancements 3831
 technological convergence 825, 2249
 technological determinism 1494
 TECHNOLOGICAL DETERMINISM 817
 technological determinism 817, 825
 technological differences 293
 technological innovation 285, 297
 technological intelligence 1423
 technological knowledge 192
 technological revolution 2622
 Technological Trends 3768
 technological trust 2271
 technology 656, 657, 659, 661, 663, 664, 669, 2177
 Technology acceptance model (TAM) 1036
 technology achievement index (TAI) 3–4
 Technology and Religious Expression 3761
 Technology as Culture 3524
 technology diffusion program 2517, 2519
 technology integration 2130
 technology licensing practices 354
 technology management 3695
 technology partner actor (STP) 1525
 technology, integrating into curriculum 1234–1243
 technology-induced improvement 830
 technoscience 52
 techno-whizzos 2978
 techspeak 801
 telecenter 207, 2033, 2495, 2496, 2501, 2507
 telecenter networks 2501
 Telecenter Users 889
 telecenters 122, 447, 889
 telecenters, private sector 2507
 telecentre 518, 2053
 telecom sector 883
 telecom sector reform 888
 telecommunication 56, 491
 telecommunication bandwidth 2045
 telecommunication infrastructure 2047
 telecommunication networks 256
 telecommunication networks, example of collaboration 324
 Telecommunication Problems 877
 telecommunications 2033, 2034, 2042
 telecommunications channel 2519
 telecommunications infrastructure 1495
 Telecommunications Regulatory Commission of Sri Lanka (TRCSL) 2035
 Telecommunications Revolution 675
 teledensity 2568
 telehealth 1007
 tele-learning (e-learning) 1934
 TeleManagement Forum 3262
 Telemanagement Network 3260
 telemedicine 1007
 telemedicine 3793
 Telephone Organization of Thailand 1999
 telepresence 1827
 teletext 1822

Index

- template 679, 682, 689, 701, 703, 704, 705, 710
terms of service (TOS) 2358
terrestrial digital broadcasting (DBV-t) 1850, 1851
tertiary educational sector 2507
tertiary students 1202–1215
The Digital Divide 87
The Food and Agricultural Organization of the United Nations 1554
The Mindset Network 1289
The United Nations Conference on Trade and Development 1986
The United Nations Development Program (UNDP) 123
theoretical framework 534
theories used by online instructors 432
theory of immediacy and social presence 434
theory of morality 2233
theory of multiple representations 433
ThinkQuest Africa (TQA) 1298
third-level feedback 1077
third-party patents 363
third-party submariners, case studies 367
threatened intermediaries hypothesis 2902
TIM 2025
time division multiple access (TDMA) 986
time of arrival (TOA) 960, 986
timing advance (TA) 960
TiVo 1850
tools-services-content triangle 3820, 3821
top-down / bottom-up perspective 53
top-down projects 516
total immersion environment 1898
tour operator (TO) 2901
tourism 1360, 1361, 1362, 1363, 1365, 1367, 1368, 1369, 1370, 1372
Tourism 911
tourism networks 2972
tourism ontology 920
tourism recommendation using image-based planning (TRIP) 943, 945, 946
tourist information centers 2970
tourist market 1371
tourists 1369
traceable communication 1769
traditional learning methods 3788
traditional methods of communications and teaching 2503
traditional portfolios 1055
trafficking 1369
tragedy of the commons 2982
trainer-of-trainers model 2518
transaction processing facility (TPF) 257
transferred trust 2271
transformation 48
transformation model 1102–1108
transformation model, research and theory 1103
transformation model, stages explored 1104
transformation phase 1450
translation difficulties 2178
transnational network 2684
transparent governance 3785
transport control protocol (TCP) 971, 975, 986
transport infrastructure 297
travel agent (TA) 941, 986
travel agent (TA) game in Agentcities (TAGA) 923
travel intermediaries 270
travel recommender system (TRS) 939, 941, 942, 947
Treatment Action Campaign (TAC) 2685
trialability (attribute of innovation) 2516
Triandis theory of interpersonal behaviour (TIB) 1036
tribal 898
Trinidad and Tobago 2009
Tripartite Collaboration 2286
Tripartite Partnerships 2286
Triple Barrier Partnerships 3606, 3615
triple convergence 3824
triple helix 52
triple helix model 50
TripleHop's Trip Matcher™ 941
triple-play 1850
TripMatcher 949
trunk telecommunications networks 2034
trust 2271
Trust Building 2270, 2953
trust in networked organizations 1785
trust in smart organizations 1783
Trust Maintenance 2955
trusting relationships 2268
tutoring system 1713
TWISTER (Terrestrial Wireless Infrastructure Integrated with Satellite Telecommunications for E-Rural) 85
two-way knowledge sharing 525, 526
two-way-communication 1846
TZ-MDGs 1539
- ## **U**
- U.N. Millennium Development Goals (MDGs) 1539

- U.S. Agency for International Development (USAID) 2519
- U.S. dollar 228
- U.S. patent landscape 355
- ubiquitous e-technologies environment 3829
- ubiquitous tourism 952
- Uganda Business Information Network (UBIN) 207
- Uganda Finance Trust (UFT) 3676
- Uganda Microfinance Union (UMU) 3672
- Ukrainian Internet 1352
- ultra wide band (UWB) 1760
- UMTS 85
- UN (see United Nations) 504
- UN Millennium Development Goals (MDGs) 1538
- uncertainty 2236
- uncertainty avoidance 3191, 3196
- uncertainty avoidance index 2255
- UNDAW (see United Nations Division for the Advance) 511
- UNDP 2548, 2550
- UNDP (see United Nations Development Program) 79, 152, 210, 211, 511
- UNESCO 1951
- UNESCO 213
- unicode 921
- UNIFEM (see United Nations Fund for Women) 511
- Unified Modeling Language, UML 664
- uniform resource identifier (URI) 921, 986
- uniform resource locator (URL) 1309, 1773
- uninominal 589
- United Kingdom 1037
- United Nations (UN) 76, 496, 504, 514, 590
- United Nations Commission on the Status of Women (UNCSSW) 511
- United Nations Development Program 2053, 2555
- United Nations Development Program (UNDP) 58, 76, 511, 1288, 2053, 2535
- United Nations Division for the Advancement of Women 511
- United Nations Education and Scientific and Cultural Organization (UNESCO) 76, 119, 212, 1288, 2496
- United Nations Fund for Women (UNIFEM) 511
- United Nations Institute for Training and Research (UNITAR) 1384
- United Nations Millennium Summit 2587
- United Nations Universal Declaration of Human Rights 506
- universal access to ICT 2573
- Universal Declaration of Human Rights 1290
- Universal Declaration of Human Rights 497
- universal description, discovery, and integration (UDDI) 275, 955, 957, 973, 986
- Universal of Higher Education 3719
- Universal Participation 2287
- universal personal information appliance 3828
- universal service 2573
- universalism 2255
- universities 2118
- university education 2507
- University of Bremen, Digitale Media in Education (DiMeB) 1630
- University of the Third Age (U3A) 186
- university resistance 2174
- UN-MDGs 1539
- UPC digital television 1851
- urban areas 1540
- urban information systems 2673
- urban/regional divide 1497
- URL 986
- usability aspect 925
- usability engineering (UE) 2742
- USB flash-memory music players 1812
- use cases 1002
- use classes 1024
- USE IT 1909–1924
- Use of Computers 3772
- Use of Internet Technology 3777
- Use of IT in education 2036
- Use of IT in management of the education system 2036
- user experience 712, 713, 715, 716, 720, 727, 728, 729, 730, 731
- user experience, analysis framework for 712, 713, 716, 717, 720, 721, 722, 725, 726, 727, 728, 729, 730, 731, 733
- user icons 2372
- user needs and requirements 659, 660, 664, 666, 668
- user requirements 657, 663, 665
- user satisfaction 2845
- user scenarios 666, 668
- user task model 929
- user-centered design (UCD) 2742
- user-centred design 656, 657, 660
- users' self-efficacy 2845
- Uses of ICT 1970
- Using the Simulation Game 1451
- utilitarianism 2240

Index

V

value 1592
value-added networks 2971
value-based practice (VBP) 2236
value-concept 2235
variation theory 1202
VBP (see value-based practice) 2236
VEEM (Victorian E-Commerce Early Movers) 2521
verification 662, 2190
very small aperture terminals (VSAT) 121, 1531
viability 618
Viable System Model 619
viable system perspective 619
video advocacy 2692
video-compression technology 1553
videoconferencing 3198
videoconferencing 899
video-over IP 3203
Videotaped Behavior Modeling 2406
viewpoint 687, 688, 692, 693, 700, 705, 708
viewpoint-oriented requirements development (VORD) 688
village heads (kepala desa) 2056
village information kiosks 2501
Village Phone Uganda 3676
viral marketing 469
virtual classroom 446
Virtual communities 2350, 2356, 3759
virtual computer 3828
virtual environments 3578
virtual fare store (VFS) 274
Virtual I.D.E.A.L. (IDEAL) 1228
virtual leaning 2273
Virtual Networking 3500
virtual organization 2105, 2111
virtual private network (VPN) 280, 1535, 1796, 2041
virtual reality (VR) 1704, 2168
virtual reality in mechanical engineering 1696–1711
Virtual Religion 3759
virtual schools 1225
Virtual Souk 798
virtual teaching 1934
virtual worlds 3579
virus 1315
virus defense 1788
visible Culture 3826
Vista School District Digital Intranet project 1937
visual spatial tasks 3578

visual travel recommender system (V-TRS) 939, 942, 943, 947, 949
visual travel recommender system (V-TRS) Web portal 947
Viva Favela 2576
VLR 972
voice communication devices 3497
voice over Internet protocol (VoIP) 146, 1530, 1542, 1776, 1887, 2249, 3203
VoIP technology 1776
Volere template 682, 704, 705
Voluntary Service Overseas (VSO) 2004
Voxiva 1018
voyeur community 1372
VSAT 68, 826
Vygotsky 1190

W

WAG 986
WAN (wide area network) 1023
WAP 2043, 2547
war 238
war against world poverty 3804
warehouse 1568
Washington Assessment of Student Learning (WASL) 2130
wasta 153
weak ties 2516, 2517
Wealth of Nations Triangle Index 58
Web
Web 2043
Web portal 2689
Web portfolio 1655
Web searching capacity 1475
Web services 968
Web services Description Language (WSDL) 275
Web services resource framework 987
Web site development 1053, 1055
Web sites 2047
Web technologies 2972
Web tools 585
Web-based application 2372
Web-based blogging 2372
Web-based course 1941
Web-based course portals/enhancements 1666
web-based education 420
Web-based e-learning technology 944
Web-based instruction 2143
Web-based knowledge dissemination 805
Web-based learning 445
Web-based publicness 842

- WebCT 1617, 1666, 1204, 1205, 1217, 1218, 1255
 Weblog 2705
 Weblogs (blogs) 1666
 Web-mounted materials and experiences 2091
 WebQuests 2154
 well-being, definition 2492
 Western cultures 2252
 Westernization 1856
 wide area network (WAN) 986, 1760
 wide screen ratio 1822
 wideband CDMA (WCDMA) 960, 987
 WiFi (wireless fidelity) 85
 wiki 1383, 1666, 1676
 Wikipedia 1677
 wilderness operators 2978
 -WiMax technology 1522–1523
 wire-based telecommunications infrastructures 1879
 wired network security 1792
 wireless access protocol (WAP) 964, 986, 1778, 2043, 2820, 2821
 wireless application gateway (WAG) 967
 Wireless artifact 3494
 wireless communication networks 1777
 wireless data network 951
 Wireless Device Usage 3489
 wireless fidelity (WiFi) 955, 957, 987
 wireless LAN (WLAN) 960, 961, 963, 987
 wireless loop-line (WLL) telephone 899
 wireless medium 952
 wireless metropolitan area network (WMAN) 1780
 wireless networking courses 1125–1127
 wireless networking curriculum model 1122–1129
 wireless networks, types of 1777
 wireless technology 48, 52, 3489
 wireless technology innovation 1758–1764
 WLL (wireless local loop) 1023
 WML 987
 Women in ICT 3514
 Women's Electronic Village Hall (WEVH) 904
 women's group (PKK) 2057
 worker 1363, 1365
 work-from-home scenarios 3229
 workgroup software 1571
 working at home 3229
 Working Group (INWG) 1307
 Working Group on Internet Governance (WGIG) 496
 workshops 657, 658, 661, 663, 664, 665, 666, 667, 668, 669
 Worksite Internet Nutrition (WIN) 2335
 World Bank and the Consultative Group to Assist the Poor (CGAP) 3662
 World Conferences on Women 487
 World Health Organization (WHO) 1003
 World Links for Development Program 1299
 World Organisation against Torture 2686
 World Organization Against Torture (OMCT) 3789
 world poverty 3804
 World Summit on Sustainable Development (WSSD) 213
 World Summit on the Information Society (WSIS) 76, 487, 496, 503, 1967, 2588, 2684
 World Tourism Organization (WTO) 126, 923, 1551, 2978
 World War II 239
 World Wide Web (WWW) 906, 948, 972, 2249
 worldwide human-rights movement 2682
 writing across the curriculum 3246
 writing assignment 3252
 writing in the disciplines (WID) 3249
 WSIS 511
 WSIS Declaration of Principles 496, 503, 511
 WSIS Gender Caucus 503
 WSIS Plan of Action 496
- X**
- xDSL 2548
 XLS 987
 XML 945, 949, 953, 965, 968, 976, 987
 XSL 963, 965, 976, 987
 XSL Transformation (XSLT) 953
 XSL-FO 987
 XSLT 965, 976, 987
 xxML 971
- Y**
- Yahoo! 1886